E6582062①

TOSHIBA

Industrial Inverter

(For 3-phase motors)

Instruction Manual

High-performance inverter

TOSVERT VF-AS3

3-phase 240V class 0.4 to 55kW 3-phase 480V class 0.4 to 280kW

Notice

- 1. Make sure that this instruction manual is delivered to the end user of the inverter unit.
- 2. Read this manual before installing or operating the inverter unit, and store it in a safe place for reference.

Safety precautions

Read first

Introduction

Installation and wiring

[Basic operation] Operation panel and screen display

[Basic operation] Operation methods of

[Fundamental operation] How to use parameters

[Advanced] How to use parameters

Operating using external signals

Monitoring operation status

Measures to satisfy standards

Selection and installation of peripheral devices

Table of parameters

Specifications

Trip information and measures

Maintenance and inspection

Warranty

Disposal

6

10

Ι

Safety precautions

The items described in the instruction manual and on the inverter itself are very important so that you can use safely the inverter, prevent injury to yourself and other people around you as well as to prevent damage to property in the area. Thoroughly familiarize yourself with the symbols and indications shown below and then continue to read the manual. Make sure that you observe all warnings given.

Explanation of markings

| Marking | | Meaning of marking |
|---------|------------------|--|
| | MARNING | Indicates that errors in operation will lead to death or serious injury. |
| | A CAUTION | Indicates that errors in operation will lead to injury ^{*1} to people or that these errors will cause damage to physical property ^{*2} . |

^{*1} Such things as injury, burns or electric shock that will not require hospitalization or long periods of outpatient treatment.

Meanings of symbols

| Marking | Meaning of marking | | |
|-------------|--|--|--|
| \Diamond | Indicates an inhibition (Don't do it). Detailed information on the inhibition is described in illustration and text in or near the symbol. | | |
| 0 | Indicates a mandatory action that must be followed. Detailed information on the mandatory action is described in illustration and text in or near the symbol. | | |
| \triangle | Indicates a warning or caution. Detailed information on the warning or caution is described in illustration and text in or near the symbol. | | |

T2

16

^{*2} Physical property damage refers to wide-ranging damage to assets and materials.

■ Limits in purpose

This inverter is used for controlling speeds of three-phase motors in general industrial use.

The single-phase input inverter performs three-phase output and cannot drive a single-phase motor.

⚠ SAFETY PRECAUTIONS

- This product is intended for general purpose uses in industrial application. It cannot be used for application which will cause big impact on public and require special quality control, such as power plant and railway, and equipment in which failure and operational errors of this product can endanger human life or harm a human body, such as equipment for nuclear power control, aviation, space flight control, traffic, medical, safety device, and amusement. However, it is possible to verify the application propriety under the condition that purpose is limited and special quality control is not required. Please contact your Toshiba distributor if you wish to use this product for a specific purpose.
- Please use our product for application which will not cause serious accident or damage even if the product
 has failure, or please use our product in environment where a backup circuit, device is provided as a system
 outside the product or a safety device functions.
- Please do not use our product for any load other than three-phase motors in general industrial use. Use in other than proper three-phase motors can cause an accident.
 - The single-phase input model inverter performs three-phase output and cannot drive a single-phase motor.

Handling

WARNING Never disassemble, modify or repair. This can result in electric shock, fire and other injury. Please call your Toshiba distributor for Disassembly inhibited · Never remove the front cover when the power is on. The unit contains high voltage parts and contact with them will result in electric shock. Do not stick your fingers into openings such as cable wiring holes and cooling fan covers. The unit contains high voltage parts and contact with them will result in electric shock. Do not place or insert any kind of object (electrical wire cuttings, rods, wires etc.) inside the inverter. Prohibited This will cause a short circuit and result in electric shock or fire. Do not allow water or any other fluids to come in contact with the inverter. This will cause a short circuit and result in electric shock or fire. · Turn the power on only after attaching the front cover. If you turn the power on without attaching the front cover, this will result in electric shock or other injury. Immediately turn the power off if the inverter begins to emit smoke or an unusual odor, or unusual sounds. Continuous use of the inverter in such a state will cause fire. If the inverter is left to be turned on Mandatory in that state, it can cause fire. Please call your Toshiba distributor for repairs. Always turn the power off if the inverter is not used for long time. · The inverter will have failure due to leakage current caused by dust and other material. If the

inverter's power is left to be turned on in that state, it can cause fire.

⚠ CAUTION



inhibited

Do not touch heat radiating fins or discharge resistors.
 These devices get high temperature, and you will get burned if you touch them.

■ Transportation & installation

WARNING



• Do not install and operate the inverter if it is damaged or any of its components is missing. This will result in electric shock or fire. Please call your Toshiba distributor for repairs.

• Do not place any inflammable object near the inverter.

If flame is emitted due to failure in the inverter, this will lead to fire.

- Do not install the inverter in any location where the inverter could come into contact with water or other fluids.
- · This will result in electric shock or fire.
- Operate under the environmental conditions prescribed in the instruction manual.
 Operations under any other conditions will result in failure.
- Mount the inverter on a metal plate.

The rear panel will get high temperature. Do not mount the inverter on an inflammable object, this will result in fire.

• Do not operate the inverter with the front cover removed.

The unit contains high voltage parts and contact with them will result in electric shock.



Mandatory action

 An emergency stop device must be installed that is configured in accordance with the system specifications.

If such an emergency stop device that can activate mechanical brake by shutting off power supply is not installed, operation cannot be stopped immediately by the inverter alone, thus resulting in an accident or injury.

- · All options to be used must be those specified by Toshiba.
 - The use of options other than those specified by Toshiba will result in an accident.
- In using a power distribution device and options for the inverter, they must be installed in a cabinet.

When they are not installed in the cabinet, this will result in electric shock.

⚠ CAUTION



• For transporting or carrying the inverter, do not hold by the front cover.

The cover will come off and the unit will drop, resulting in injury.

Do not install the inverter in any place with large vibration.
 The unit will fall due to the vibration, resulting in injury.

 Carry the inverter by two people or more when the inverter is the model mass 20kg or more (VFAS3-2110P - 2370P, VFAS3-4220PC - 4750PC).

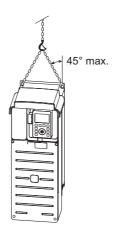
If you carry the inverter alone, this will result in injury.

 Transport a large-capacity inverter (VFAS3-2450P, 2550P, VFAS3-4900PC - 4280KPC) by a crane.

If you transport a heavy load by hand, this will result in injury.

Please take the utmost care for the operator's safety, and please handle the inverter carefully in order not to damage the product.

For lifting the inverter, hang the inverter with wire ropes via hanging bolts (hanging holes) provided at upper part or lower part of the inverter as shown below.





- Please make sure that the inverter is hanged by two wire ropes in a balanced manner, and please be careful that the inverter does not receive excessive force during the hanging operation.
- Do not carry the inverter with the cover attached, hold nor put the hand in the wiring holes during the transportation.

You can have your hands pinched and injured.

- Transport the operation panel in accordance with law.
 - Please transport the operation panel by airplane or ship in accordance with law as a lithium battery is used in the operation panel.
- Install the inverter at a place which can support the unit's mass.
 - If you install the inverter at a place which does not support the unit's mass, the unit will fall, resulting in injury.
- · Install the mechanical brake when it is necessary to hold a motor shaft.
 - A brake function of the inverter cannot perform mechanical hold, and it results in injury.
- When ambient temperature is above 50°C, use the operation panel by detaching it from the unit.

There is a risk that heat can rise up and flame can be emitted in the lithium battery used in the operation panel. When ambient temperature is above 50°C, use the operation panel by detaching the panel from the unit and extending the panel.

Wiring

Prohibited

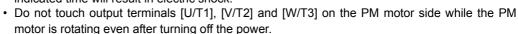
WARNING

- Do not connect power supply to the output (motor side) terminals [U/T1], [V/T2] and [W/T3]. Connecting power supply to the output will damage the inverter and result in fire.
- Do not insert a braking resistor between DC terminals [PA/+] and [PC/-] or [PO] and [PC/-]. This will result in fire.

Please connect the braking resistor in accordance with the instruction manual.

• Do not touch wires of equipment (e.g. MCCB) that is connected to the inverter power side at least 15 minutes after turning off the power.

If an electric charge remains in a capacitor in the inverter, touching the wires before the indicated time will result in electric shock.



While the PM motor is rotating even after the power is turned off, as a high voltage is generated in the output terminals [U/T1], [V/T2] and [W/T3] on the PM motor side, touching the output terminals will result in electric shock. Please perform wiring after verifying that the PM motor is stopped.

When using this 480V class inverter with a power supply system that is grounded in other than
the neutral point (e.g. when the power supply has delta connection with single phase
grounding), the grounding capacitor should not be grounded (or the capacity of the grounding
capacitor should not be increased).

Otherwise, it will result in failure or fire.

· Electrical construction work must be done by a qualified expert.

Erroneous connection of power supply by someone who does not have that expert knowledge will result in fire or electric shock.

• Connect output terminals (motor side) correctly.

If the phase sequence is incorrect, the motor will operate in reverse and that can result in injury.

Wiring must be done after installation.

If you perform wiring prior to installation, this will result in electric shock or other injury. Verify that the power is turned off and the charge lamp is off before starting wiring. If you perform wiring without verification, this will result in electric shock.

• Tighten the screws on the terminal block to specified torque.

If the screws are not tightened sufficiently to the specified torque, this will result in fire.

Verify that the power supply voltage is within +10% and -15% (±10% when the load is 100% in continuous operation) of the applied power supply voltage written on the name plate.
 If you do not use the appropriate power supply voltage, this will result in failure or fire.



Mandatory

action

The grounding wire must be connected securely.
 If the grounding wire is not securely connected, when the inverter has failure or earth leakage, this will result in electric shock or fire.

⚠ CAUTION

• Do not attach devices with built-in capacitors (such as noise reduction filters or surge absorbers) to the output terminals (motor side).

Heat rises up and this could cause a fire.

Do not switch only one of two grounding capacitor switch screws in the same form.
 The inverter will have failure due to insufficient switching. Please switch two grounding capacitor switch screws in the same form.

• Do not detach the operation panel from the unit when the power is ON.

This will result in failure. Please detach the operation panel after turning the power off.

 When you connect a USB cable to the operation panel, do not perform the connection while the operation panel is attached to the unit.

This will result in failure. Please connect the USB cable to the operation panel after detaching the operation panel from the unit.

• Do not connect Ethernet to the RS485 communication connector.

Erroneous connection will result in failure.

Do not connect RS485 communication to the Ethernet connector.

Erroneous connection will result in failure.

Verify that the power is OFF before detaching the front cover.
 If you detach the front cover while the power is ON, this will result in electric shock or other injury.

· Mount the front cover after wiring.

If you turn the power on without attaching the front cover, this will result in electric shock or other injury.

Please be careful that if you press too hard the front cover by a screwdriver for attachment, it will damage the inverter unit.

Mount the attached DC reactor (DCL) for VFAS3-4160KPC - 4280KPC.
 If you do not mount the attached DC reactor (DCL), it will result in failure. Mount the DC reactor (DCL) between [PA/+] and [PO].

Supply AC power supply to cooling fans if you use VFAS3-4160KPC - 4280KPC with DC input.
 If you do not supply AC power supply, the cooling fans do not operate, and this will result in overheat trip.





Operations

A WARNING

• Do not touch terminals when the inverter's power is on even if the motor is stopped. Touching the terminals while voltage is applied will result in electric shock.

• Do not touch switches when the hands are wet and do not try to clean the inverter with a damp cloth. This will result in electric shock.

Prohibited

• Do not touch terminals or motor of the inverter while performing auto tuning.

Touching the terminals or motor while voltage is applied to the terminals and motor may result in electric shock, even if the motor is stopped.

After setting offline auto-tuning (F400 = $^{"}2"$), execute the auto tuning at first start of the inverter. The auto tuning takes several seconds and the motor is stopped meanwhile, but voltage is applied to the terminals and motor. The motor may also generate a sound during the auto tuning, but this is not malfunction.

· Turn the power on only after mounting the front cover.

When you use the inverter housed in the cabinet with the front cover removed, always close the cabinet doors first and then turn the power on. If you turn the power on with the front cover or the cabinet doors open, this will result in electric shock.

Make sure to set the setup menu correctly.

If you set the setup menu incorrectly, this will damage the inverter or cause the inverter to perform unexpected movement.



· Make sure to set the parameter correctly.

If you set the parameter incorrectly, this will damage the inverter or cause the inverter to perform unexpected movement. When you write the parameter in the inverter via a parameter writer, please transmit correct data.

- Make sure that operation instructions are off before resetting the inverter after malfunction.
 If the inverter is reset while the operation instructions are on, the motor will restart suddenly, resulting in injury.
- Install circuit protection such as the mechanical brake in the crane.
 If there is no sufficient circuit protection installed in the crane, insufficient motor torque while auto tuning will cause the machine stalling/falling.

A CAUTION

Observe all allowable operating ranges of motors and machines in use.

Not observing these ranges will result in damage to motors and machines and injury. Please use motors and machines within their respective allowable operating ranges by referring to their respective instruction manuals.



• Do not set the stall prevention level parameters (F601 and F185) extremely low.

If the stall prevention level parameters (F601 and F185) are set at or below the motor no-load

current, the stall preventive function will be always enabled and increase the frequency when it judges that regenerative braking is taking place.

Do not set the stall prevention level parameters (F601 and F185) at 30% or less under normal use conditions.



Mandatory action

• Use the inverter that conforms to specifications of the power supply and the three-phase motor to be operated.

If you use the inappropriate inverter, not only will the three-phase motor not rotate correctly, but it will cause serious accidents such as overheating and burning out.

· Take countermeasures against leakage current.

The leakage current through the stray capacitance of the input/output power wires of inverter and motor can affect peripheral devices. In that case, please take countermeasures such as reducing the carrier frequency or shortening the length of input/output power wires. When the total wire length (total length between an inverter and motors) is more than 100m, if the trip occurs with the motor no-load current, make enough space between phase wires or insert the filter (MSF: motor-end surge voltage suppression filter).

When operation by communication or extension panel is selected

WARNING



Mandatory action

- Set the parameter Communication time-out.
- If the parameter is not properly set, the inverter cannot be stopped immediately and this will result in injury and accidents.
- Install an emergency stop device and an interlock that are configured in accordance with the system specifications.

If the inverter cannot be stopped immediately via communication or the extension panel, this will result in injury and accidents.

When auto-restart after momentary stop function is selected

A CAUTION



Mandatory

- When the auto-restart after momentary stop function is selected, stand clear of motors and machines at momentary power failure.
 - The motors and machines which have stopped due to momentary power failure will restart suddenly after power is restored, and this will result in injury.
- Attach caution labels indicating functions programmed for Auto restart, on inverters, motors and machines.

Please prevent accidents with the caution labels.

■ When retry function is selected

A CAUTION



Mandatory action

- When the retry function is selected, stand clear of motors and machines at tripping stop.

 The motors and machines which have attended due to tripping attended and an extent added.
 - The motors and machines which have stopped due to tripping stop will restart suddenly, and this will result in injury.
 - Take measures for securing safety even if the motor restarts unexpectedly, such as attaching a cover to the motor.
- Attach caution labels indicating functions programmed for Retry, on inverters, motors and machines.

Please prevent accidents with the caution labels.

Maintenance and inspection

▲ WARNING



Do not replace parts.

This will result in electric shock, fire and other injury. Please call your Toshiba distributor for repairs and replacement of expendable parts.

- Perform daily inspection and periodic inspection on equipment.
 - If the equipment is not inspected and maintained, faults and malfunctions cannot be discovered and that mat result in accidents.
- · Before inspection, perform the following steps.



Mandatory action

- (1) Turn off the power to the inverter.
- (2) Wait at least 15 minutes and verify that the charge lamp is no longer lit.
- (3) Use a tester that can measure DC voltages (800 VDC or more), and verify that the voltage to the DC main circuits between [PA/+] and [PC/-] is 45V or less.

Performing inspection without carrying out these steps can lead to electric shock.

When using the PM motor, please verify that the PM motor is stopped. While the PM motor is rotating even after the power is turned off, as a high voltage is generated in the output terminals [U/T1], [V/T2] and [W/T3] on the PM motor side, touching the output terminals will result in electric shock.

Disposal

⚠ CAUTION



Mandatory action

- If you dispose of the inverter, have it done by a specialist in industry waste disposal*1.
 If you dispose of the inverter by yourself, this can result in explosion of capacitor or production of noxious gases, resulting in injury.
- When you dispose of the operation panel, insulate the terminals of the lithium battery by wrapping the terminals with tapes.
- If the terminals contact with other metal or batteries, this will result in heat rising up, explosion, and fire.

Sterilization, insect removal processing for wooden packaging material

⚠ CAUTION



Mandatory

- If wooden packaging materials require sterilization, insect removal processing, make sure to employ methods other than fumigation.
 - The fumigation processing may damage electronic parts by generated gas and steam. Especially halogen disinfectants, such as fluorine, chlorine, bromine and iodine cause corrosion inside the capacitors.

Attach caution labels

Shown here are examples of caution labels for preventing accidents that are to be attached to inverters, motors and other equipment.

^{*1} Persons who specialize in the processing of waste and known as "industrial waste product collectors and transporters" or "industrial waste disposal persons". Please observe any applicable law, regulation, rule or ordinance for industrial waste disposal.

Be sure to attach the caution labels where it is easily visible when selecting the auto-restart function or the retry function.

(Example of caution label)

A CAUTION

(Functions programmed for Auto restart)

Do not go near motors and equipment.

Motors and machines that have stopped temporarily due to momentary power failure will restart suddenly after power is restored.

⚠ CAUTION

(Functions programmed for Retry)

Do not go near motors and equipment.

Motors and machines that have stopped temporarily due to tripping stop will restart suddenly after the specified time has Thank you for purchasing Toshiba's industrial inverter.

To handle TOSVERT VF-AS3 correctly, this instruction manual explains how to install and wire the inverter, operation procedure, how to run the motor, measures for protective functions (when an alarm/trip occurs), etc.

It is for the "Ver. 100" and later CPU versions of the inverter.

Please be informed that the specifications described in the instruction manual and technical data, and the CPU version may be changed without notice.

CONTENTS

| I | Safety precautions | I-1 |
|----|--|--------------|
| II | Introduction | II-1 |
| 1 | Read first | 1-1 |
| | 1. 1 Check product purchase | |
| | 1. 2 Multi-rating | |
| | 1. 3 Indication of product type | 1-5 |
| | 1. 4 Structure of equipment | |
| | 1. 5 Operation procedure | 1-14 |
| 2 | Installation and wiring | |
| | 2. 1 Installation | |
| | 2. 2 How to remove covers of inverter | |
| | 3 Wiring 4 Cautions for application | |
| 3 | [Basic operation] Operation panel and screen display | 3-1 |
| Ŭ | 3. 1 Basic of operation panel | |
| | 3. 2 Normal/emergency screen display | |
| 4 | [Basic operation] Operation methods of motor | 4-1 |
| | 4. 1 To run/stop motor | |
| | 4. 2 Basic setting methods of parameters | |
| | 4. 3 Basic panel run methods | |
| | 4. 4 Basic terminal run methods | 4-26 |
| 5 | [Fundamental operation] How to use parameters | |
| | 5. 1 Settings of main parameters | |
| | 5. 3 Setting of extended parameters that are especially important | |
| 6 | [Advanced] How to use parameters | 6-1 |
| | 6. 1 Output signals from the control terminals | |
| | 6. 2 Input signals to the control terminals | |
| | 6. 3 Selecting terminal functions | |
| | 6. 4 Switching two to four types of motor characteristics | |
| | 6. 5 V/f 5-point setting | |
| | 6. 6 Setting the frequency commands | |
| | 6. 7 Setting the start and end frequencies | |
| | 6. 8 DC braking | 6-36 |
| | 6. 9 Automatic stop when run continues at the lower limit frequency (sleep function) | 0-42 6.44 |
| | 6. 11 Jumping the frequency to avoid the resonant frequency | |
| | 6. 12 Setting the preset-speed operation frequency | |
| | 6. 13 Bumpless operation | |
| | 6. 14 Changing carrier frequency to reduce noise and magnetic noise | |
| | 6. 15 Avoiding trips | |
| | 6. 16 Single load sharing by multiple inverters (droop control) | 6-69 |
| | 6. 17 High-speed operation with light load on cranes | 6-72 |
| | 6. 18 Brake sequence | |
| | 6. 19 Constant speed run with Acc/Dec suspended (dwell operation) | |
| | 6. 20 Switching to commercial power run | |
| | 6. 21 PID control | |
| | 6. 22 Retaining the stop position | |
| | 6. 23 Setting of motor parameters | |
| | 6. 25 Torque limits | |
| | 6. 26 Adjusting current and speed control gain | |
| | 6. 27 Switching multiple acceleration/deceleration | |
| | 6. 28 Pattern operation | |
| | | |

| | 6. 29 Shock monitoring function | 6-118 |
|------------|---|-------|
| | 6. 30 Setting the protection functions | |
| | 6. 31 Forced run control in emergency | |
| | 6. 32 Frequency adjustment using external input (override function) | |
| | 6. 33 Adjustment parameters | |
| | 6. 34 Setting functions of operation panel | |
| | 6. 35 Trace function | |
| | 6. 36 Store cumulative power | |
| | 6. 37 Select EASY key function | |
| | 6. 38 Communication functions | |
| | 6. 39 Step-out detection of PM motor | |
| | 6. 40 Traverse function | |
| | 6. 41 My function | 6-194 |
| 7 | Operating using external signals | 7-1 |
| • | 7. 1 How to externally operate the inverter | |
| | 7. 2 Applied operation by I/O signals | |
| | 7. 3 Frequency commands by the analog signals | |
| | | |
| 8 | Monitoring operation status | |
| | 8. 1 Screen display of [Monitor mode] | |
| | 8. 2 Screen display at trip occurrence | 8-11 |
| 9 | Measures to satisfy standards | 0.1 |
| 9 | 9. 1 How to deal with CE marking | |
| | 9. 2 Compliance with UL/CSA Standards | |
| | 9. 3 Compliance with objects standards | |
| | 9. 3 Compliance with safety standards | 9-13 |
| 10 | Selection and installation of peripheral devices | 10-1 |
| | 10. 1 Selection of wire size | |
| | 10. 2 Selection of a wiring device | 10-4 |
| | 10. 3 External options | 10-10 |
| | 10. 4 Insert type options | 10-14 |
| | - 11 - 6 - 1 | |
| 11 | Table of parameters | |
| | 11. 1 Frequency setting parameter | |
| | 11. 2 Basic parameter | |
| | 11. 4 Advanced parameter | |
| | 11. 5 Communication parameter | |
| | 11. 6 Parameter setting range and default setting depending on capacity | |
| | 11. 7 Analog output/Monitor output function | |
| | 11. 8 Input terminal function | |
| | 11. 9 Output terminal function | |
| | 11. 10 Setup menu | |
| | 11. 11 Guidance function | |
| | | |
| 12 | Specifications | |
| | 12. 1 Model and main standard specification | |
| | 12. 2 Outside and Mass | 12-7 |
| 12 | Trip information and measures | 12.1 |
| 13 | 13. 1 Description of trip and alarm information and measures | |
| | 13. 2 How to reset trip | |
| | 13. 3 How to determine causes of other problems. | |
| | 10. 0 1.0.7 to dotominio oddodo di otrici probicilio | 10-10 |
| 14 | Maintenance and inspection | 14-1 |
| | 14. 1 Daily inspection and cleaning | |
| | 14. 2 Periodical inspection | |
| | 14. 3 In case of a failure | |
| | 14. 4 Cautions for storage | 14-6 |
| <i>.</i> - | Managark | 4= 4 |
| 15 | Warranty | 15-1 |
| 16 | Disposal | 16_1 |
| . 0 | Dioposa | |

Read first

This chapter explains check items when you receive the inverter, names of parts of the inverter, and the flow of basic procedures before operation.

1. 1 Check product purchase

A CAUTION



 Use the inverter that conforms to specifications of the power supply and the three-phase motor to be operated.

If you use the inappropriate inverter, not only will the three-phase motor not rotate correctly, but it will cause serious accidents such as overheating and burning out.

Before using the product you have purchased, check to make sure that it is exactly what you ordered. Check the contents of packing and accessories for damage.

Ι

П

1

2

3

4

5

)

/

5

LU

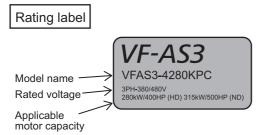
12

13

14

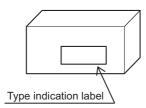
15

16



* Refer to [1. 3] for (HD) and (ND).





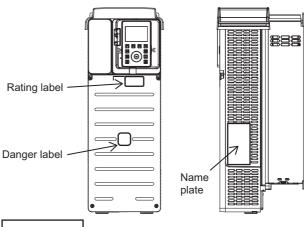
Danger label



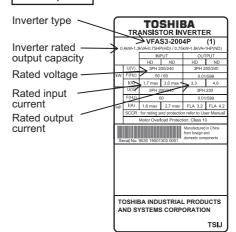
Risk of injury, electric shock or fire.

•Read the instruction manual.
•Do not open the cover while power is applied or 15 minutes after power has been removed.
•Ensure proper earth connection.

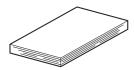
Inverter main unit







Quick start



CD-ROM

Instruction manual is included as electronic data.



DC reactor

Only for frame size A7 and A8.

Danger label kit

Danger labels in 6 languages for sticking

⚠ DANGER`

Risque de blessure, d'électrocution ou d'incendie.

- · Lire le manuel d'instruction. Avant d'intervenir dans le variateur couper la puissance et attendre 15 minutes avant d'ouvrir le couvercle.
- Assurer un raccordement approprié à la terre

⚠GEFAHR

Gefahr von Verletzungen elektrischem Schlag oder Brand.

- Lesen Sie die Bedienungsanleitung. Vor öffnen der Abdeckung Gerät vom Netz trennen und 15 Minuten warten. Sorgen Sie für eine fachgerechte Erdung.

Rischio di lesioni, scosse elettriche o incendi.

Leggere le instruzioni del manuale.

⚠ PERICOLO

- Togliere tensione e attender 15 minuti prima di aprire il coperchio
- Garantire un adeguato collegamento a terra.

1 PERIGRO

Riesgo de daños, descarga electrica o fuego.

- · Lea el manual de instrucciones.
- Antes de retirar la cubierta Antes de retirar la cubierta corte la alimentación y esper 15 minutos.

 Asegure una correcta conexion a tierra.

けが、感電、火災のおそれ

・取扱説明書の注意事項を読むこと

・通電中及び電源遮断後15分以内

は端子台カバーを開けないこと。

確実に接地を行うこと。



有受伤、触电、发生火 灾的危险。

•请详细阅读使用说明书。 在运行中或切断电源 15分钟之内,请勿揭开盖板。 务必切实地进行接地。







があります。

- French
- German
- · Italian
- Spanish
- Chinese
- Japanese

· Labels for communication option Affix to lower side of communication indicator.



Important

• When you have purchased VFAS3-4160KPC to VFAS3-4280KPC (frame size A7 or A8), the DC reactor is packed together with the unit.

1. 2 Multi-rating

This inverter has multi-rating.

Select rating with the parameter <AUL: Multi-rating select> according to the characteristics of the load to be applied.

- <AUL>="2: ND rating (120%-60s) (0 after execution)"
- Select it to apply equipment with variable torque characteristic.
- Example) Fans, pumps, blowers, etc.
- <AUL>="3: HD rating (150%-60s) (0 after execution)"
- Select it to apply equipment with constant torque characteristic.
- Example) Conveyors, load transporting machinery, cranes, mixers, compressors, making machines, machine tools, etc.

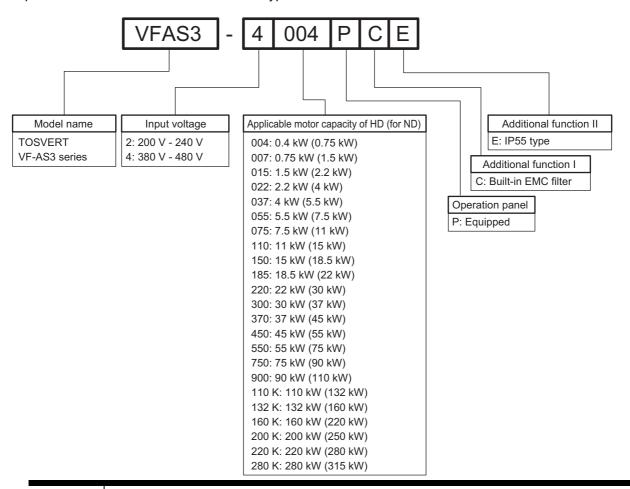
Both of them return to "0" after setting.

For details, refer to [5. 2. 2].

This instruction manual describes the motor capacity based on HD rating. In the case of ND rating, it is described with parentheses like (ND: **kW).

1. 3 Indication of product type

Explanation of the indication of the inverter type.





- Always shut power off first then check the ratings label of inverter held in a cabinet.
- This inverter has multi-rating. The motor capacity is described based on HD rating. In the case of ND rating, it is described with parentheses like (ND: **kW).

Type and frame size

This inverter has eight types of units with frame size A1 to A8 according to the voltage class and the capacity. The following table shows the relationships between the types and the frame sizes.

| Frame size | Type-Form | | |
|------------|----------------------|------------------------|--|
| | 240V | 480V | |
| A1 | VFAS3-2004P to 2022P | VFAS3-4004PC to 4037PC | |
| A2 | VFAS3-2037P | VFAS3-4055PC, 4075PC | |
| A3 | VFAS3-2055P, 2075P | VFAS3-4110PC to 4185PC | |
| A4 | VFAS3-2110P to 2185P | VFAS3-4220PC to 4370PC | |
| A5 | VFAS3-2220P to 2370P | VFAS3-4450PC to 4750PC | |

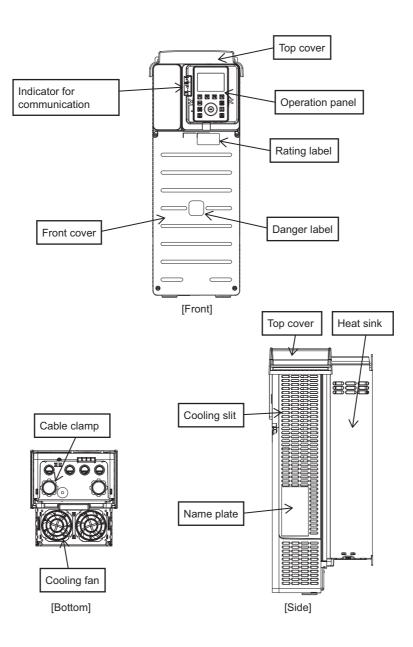
| Frame size | Type-Form | | |
|------------|--------------------|--------------------------|--|
| | 240V | 480V | |
| A6 | VFAS3-2450P, 2550P | VFAS3-4900PC to 4132KPC | |
| A7 | - | VFAS3-4160KPC | |
| A8 | - | VFAS3-4200KPC to 4280KPC | |

1. 4 Structure of equipment

The following is brief explanation of the names and functions of parts that compose the inverter.

1. 4. 1 Outside view

This inverter has eight types of units with frame size A1 to A8 (made of resin or metal) according to the voltage class and the capacity. For details of outside dimensions, refer to [12. 2].



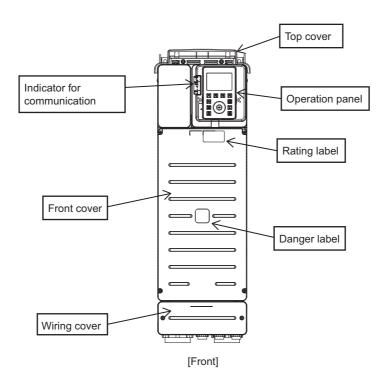
• Front cover

A cover for the terminal blocks (power circuit/control circuit). This cover should be removed for wiring to the power terminal block or the control terminal block, using the connector for communication and the option slot, switching the grounding capacitor, or checking the charge lamp. For how to remove, refer to [2. 2].

Top cover

A cover to protect the top of the inverter, which is attached to models with frame size A1 to A5. Remove this cover to install inverters side by side or in a location with ambient temperature above 50°C for heat discharge. For how to remove, refer to [2. 2].

With frame size A4 or A5 VFAS3-2110P to 2370P, VFAS3-4220PC to 4750PC

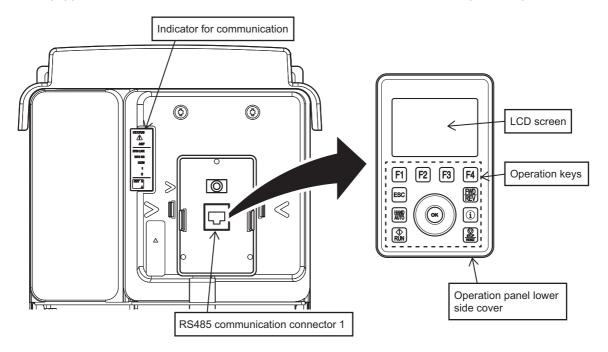


Wiring cover

The models with frame size A4 or A5 have a cover for wiring beneath the front cover. This cover should be removed to wire to the power terminal block or control terminal block. For how to remove, refer to [2. 2. 2] (frame size A4) or [2. 2. 3] (frame size A5).

1. 4. 2 Operation panel and peripherals

The operation panel of the inverter is directly connected to RS485 communication connector 1. It is equipped with some indicators for communication on the left side of the operation panel.



Operation panel

The operation panel is equipped with a LCD screen and operation keys on the front side and two types of connectors (operation panel female connector and USB-miniB connector) on the bottom surface.

It is directly connected to the unit with the operation panel male connector on the back side but can be removed. It can be also used for remote control with an exclusive extension cable (optional).

LCD screen

The operation panel is equipped with a multilingual (8 languages) LCD that displays the frequency, parameters and their set values and the operation status according to the display mode of the inverter. For details, refer to [3. 1. 1].

Operation keys

There are an [ESC] key, [HAND/AUTO] key, [RUN] key, [FWD/REV] key, [i] key, [STOP/RESET] key, [F1] to [F4] keys, touch wheel, and [OK] key.

The [F1] to [F4] keys execute functions according to the indication on the lower side of the LCD screen.

With the touch wheel, you can change the menu items and values on the screen by touching it by your finger to rotate to the right or left or touching its upper side or lower side lightly.

For details of the operation keys, refer to [3. 1. 1].

· Operation panel lower side cover

This cover protects two connectors on the right of the lower side of the operation panel and the slot for battery on the left. The right side/left side of the cover can be opened respectively.

· Operation panel female connector

For remote control, connect the operation panel to this female connector with a cable. To mount the operation panel on the cabinet, use the door mount kit (optional).

USB-miniB connector

Used only by manufacturer.

· Slot for battery

A lithium battery is inserted to this slot for internal real time clock of the operation panel (equipped as standard at the time of shipping). For how to replace the battery, please consult your Toshiba distributor. For the time of battery replacement, refer to [14. 2. 3].

■ RS485 communication connector 1

Normally, this connector is used for connection of the operation panel. For remote control, connect the operation panel with an exclusive extension cable (optional).

Indicators for communication

The upper three LEDs indicate the operation status, trip status, and STO (Safe Torque Off) respectively from the top.

STATUS (Green LED)

- On: Stopped
- Fast blinking: Run command ON, frequency command 0
- Slow blinking: During run
- Off: Power OFF

(Red LED)

- Blinking: A trip has occurred
- Off: In normal condition

ASF (Yellow LED)

- On: STO
- Off: In normal condition

Other seven LEDs indicate the communication status.

1. 4. 3 Terminal blocks

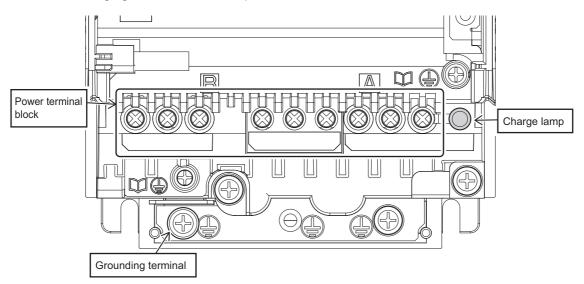
This inverter is equipped with a power terminal block and a control terminal block. To the power terminal block, connect the power supply and the motor. To the control terminal block, connect external control signals.

Both terminal blocks are equipped in the unit and wiring and the connection state cannot be checked during run.

Power terminal block

The power terminal block to which the power supply and the motor are connected has different shapes and arrangements depending on the type of the inverter.

The following figure shows an example of frame size A1.



· Power terminal block

A cage-type or screw-type terminal block to which the power supply and motor, braking resistor, etc. are connected.

For details of the terminal types and functions, refer to [2. 3. 3].

· Grounding terminal

Exclusive terminal to wire a grounding wire.

Charge lamp

While the charge lamp is on, voltage is applied, or high voltage remains in the inverter.

The location of the charge lamp varies depending on the type (frame size).

For details, refer to [2. 2. 5].

Memo

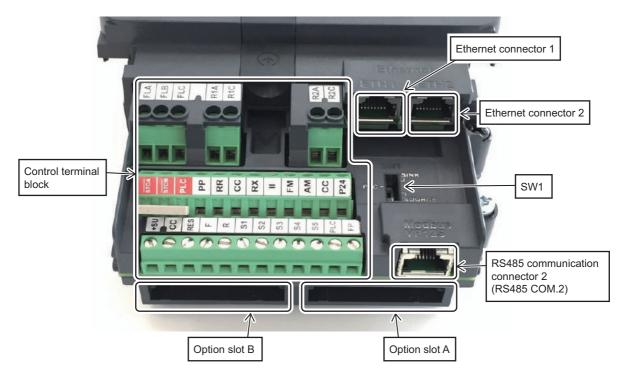
• For the layout and shape of power terminal block of each type, refer to [2, 3, 3].

Control terminal block

The control terminal block is common to all the types and is located on the lower side of the operation panel.

It connects wiring between the inverter and an external control device.

Control terminal block is detachable.



Control terminal block

A cage-type terminal block.

For details of the terminal types and functions, refer to [2. 3. 5].

SW1

A switch to switch between the sink logic, source logic and external power supply sink logic of the input terminal.

The default setting is PLC (external power supply) side. For details, refer to [2. 3. 5].

RS485 communication connector 2 (RS485 COM.2)

An RJ45 connector for RS485 communication.

For details, refer to [2. 3. 6].

• Ethernet connector 1, 2

Two RJ45 connectors for Ethernet are equipped.

For details, refer to [2. 3. 7].

· Option slot A, B

Two slots are equipped in the back of the control terminal block.

The right one is slot A and the left one is slot B.

Furthermore, an option 3 slot adapter can be added between the operation panel and the unit.

For details, refer to [10. 4. 3].



• Connection of Ethernet to the RS485 communication connectors may result in a malfunction.

1. 4. 4 Features of inverter

This inverter has the following features.

(1) A detachable LCD operation panel is equipped as standard

- A touch wheel is adopted for excellent environment resistance.
- With the LCD display (240 x 160 dots), the operation panel has excellent visibility compared with an 7-segment LED display, allowing easy setting of parameters. Furthermore, it supports multiple languages.
- It is equipped with Real time clock that allows to calendar operation.
- Indication of QR Code[®] allows easy access from a smartphone to our website.
- An option to attach a door with IP65 water-proof and dust-proof performance is also provided.

(2) Built-in communication function for Ethernet to allow remote monitoring

 The inverter is equipped with RJ45 connectors for Ethernet and for RS485 communication, two for each of them.

(3) Full filling options can be installed to two slots (up to three slots)

• Cassette-type options for network (DeviceNet™, PROFIBUS, PROFINET, etc.), extended terminal block, encoder feedback, and safety function can be added easily.

(4) High environmental friendliness and enhanced environment resistance

- A DC reactor built in as standard suppresses generation of harmonics to comply with IEC61000-3-12.
- An EMC noise filter is built in as standard to comply with C2/C3 (480 V class) of IEC61800-3.
- Comply with the chemicals (3C3)/dust (3S3) standards of IEC60721-3-3. (Frame size A6 or smaller)
- Can be used at an altitude of up to 4800 m. (TN/TT system) (Frame size A6 or smaller)
- A built-in Nema type 1 kit. (Frame size A5 or smaller)
- The inverter is operable at an ambient temperature of -15 to +60°C.
- The design expectancy life time of the cooling fan, smoothing aluminum electrolytic capacitor for power circuit, and aluminum electrolytic capacitor for control circuit are ten years. (Frame size A6 or smaller)

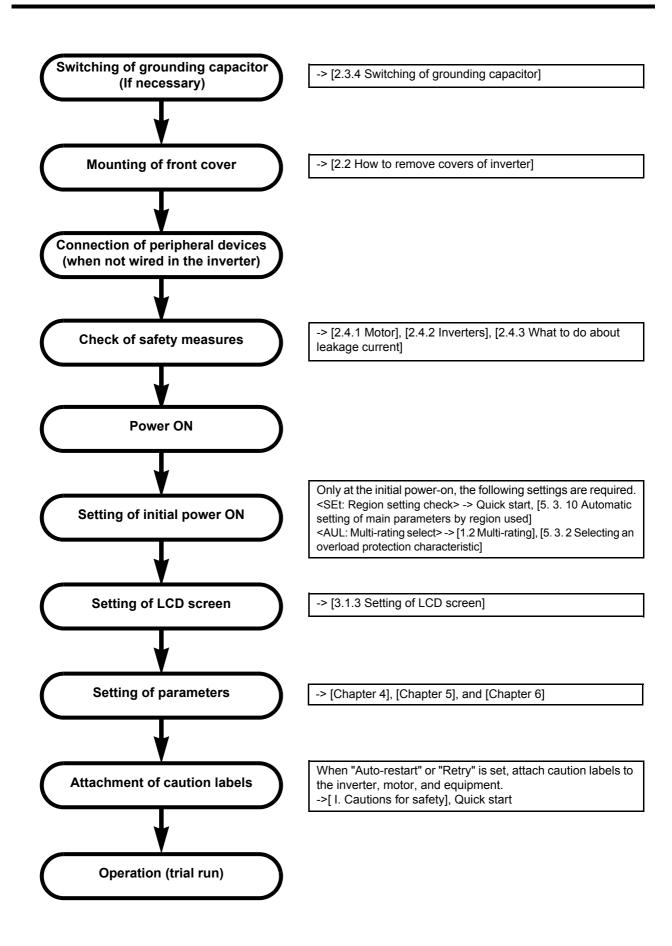
(5) High control performance is realized

- With its dual rating, the inverter is usable for a wide range of applications with light load (120% for 1 min) and heavy load (150% for 1 min).
- It is also usable for a PM motor.
- Auto tuning is possible.
- High frequency operation up to 590 Hz is possible.
- · High-accuracy motor control is possible.

1. 5 Operation procedure

The basic procedure to operate a motor with the inverter is as follows.

Reference -> [1.1 Check product purchase] Check of packed items -> [2.1.1 Installation environment] Check of installation site Carrying-in to installation site -> [2.1.2 How to install] Installation Removal of top cover -> [2.2 How to remove covers of inverter] Removal of front cover -> [2.2 How to remove covers of inverter] Selection between sink logic/ -> [2.3.5 Control terminals] source logic Installation of insert type options ->[10. 4 Selection of built-in options] (If necessary) Power terminal block -> [2.3.2 Standard connection method, 2.3.3 Power terminal] Mounting of DC reactor -> [2.3.8 Mounting of DC reactor] Wiring Control terminal block -> [2.3.2 Standard connection method], [2.3.5 Control terminal] Connection of communication cables -> [2.3.6 RS485 RS485 communication connectors], [2.3.7 Ethernet connectors] Other wiring work in the inverter - Wiring of built-in options -> [10. 4 Selection of built-in options] - Connection change of cooling fan power supply (when a DC power supply is used) -> [10. 5 Using DC power supply] Connection of peripheral devices -> [Chapter 10]



2

Installation and wiring

⚠ WARNING



Disassembly prohibited Never disassemble, modify or repair.
 This can result in electric shock, fire and other injury. Please call your Toshiba distributor for repairs.



• Do not stick your fingers into openings such as cable wiring holes and cooling fan covers. The unit contains high voltage parts and contact with them will result in electric shock.

• Do not place or insert any kind of object (electrical wire cuttings, rods, wires etc.) inside the inverter.

This will cause a short circuit and result in electric shock or fire.

• Do not allow water or any other fluids to come in contact with the inverter. This will cause a short circuit and result in electric shock or fire.

A CAUTION



• For transporting or carrying the inverter, do not hold by the front cover. The cover will come off and the unit will drop, resulting in injury.



Mandatory action

 Carry the inverter by two people or more when the inverter is the model mass 20kg or more (VFAS3-2110P - 2370P, VFAS3-4220PC - 4750PC).
 If you carry the inverter alone, this will result in injury.

This chapter explains installation of the inverter, how to remove the covers, how to wire to the power supply and the motor, connection of the control circuit, and functions of terminals and connectors for communication.

I

П

Л

5

6

7

8

11

12

13

L4

15

16

2. 1 Installation

Take special care with the installation environment of the inverter. Install the inverter in a location that secures space for ventilation and heat emitting (in the cabinet, etc.), considering heat generation and occurrence of noise.

2. 1. 1 Installation environment

Prohibited • Do not place any inflammable object near the inverter. If flame is emitted due to failure in the inverter, this will lead to fire. • Do not install the inverter in any location where the inverter could come into contact with water or other fluids. This will result in electric shock or fire. • Operate under the environmental conditions prescribed in the instruction manual. Operations under any other conditions will result in failure.





• Do not install the inverter in any place with large vibration. The unit will fall due to the vibration, resulting in injury.

This inverter is an electronic control instrument. Take full consideration to install it in the proper operating environment as follows.

(1) Do not install in any location of high temperature, high humidity, moisture condensation and freezing and avoid locations where there is exposure to water and/or where there may be large amounts of dust, metallic fragments and oil mist.



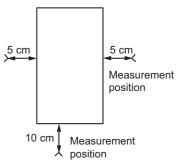
- (2) Do not install in any location where corrosive gases or grinding fluids are present.
- (3) Operate in areas where ambient temperature ranges from -10°C to +60°C.
 - When using the inverter in locations with temperatures above 50°C, remove the top cover and operation panel of the inverter to use it.

For details of how to remove the top cover, refer to [2. 2].

- The inverter is a heat-emitting body. Make sure proper space and ventilation are provided when installing in the cabinet.
- Measure the ambient temperature in the positions shown in the figure on the right.



Position for measuring ambient temperature



(4) Do not touch the heat sink as it may have a high temperature.



- (5) Do not install in any location subject to large amounts of vibration.
 - If the inverter is installed in a location that is subject to vibration, anti-vibration measures are required. Please consult with your Toshiba distributor about these measures.

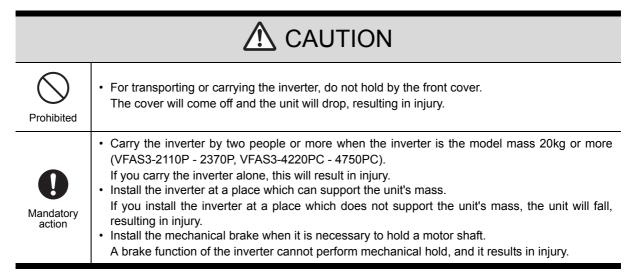


- (6) If the inverter is installed near any of the equipment listed below, provide measures to insure against errors in operation.
 - · Solenoids: Attach a surge suppressor on the coil.
 - · Brakes: Mount a surge absorber on the coil.
 - Magnetic contactors: Mount a surge absorber on the coil
 - Resistors: Place far away from the inverter.



2. 1. 2 How to install

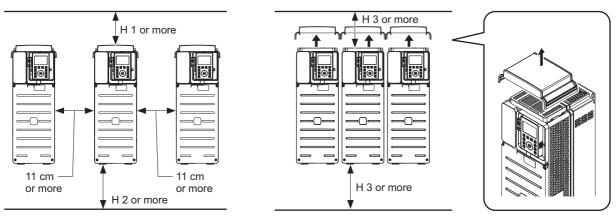
MARNING Do not install and operate the inverter if it is damaged or any of its components is missing. This will result in electric shock or fire. Please call your Toshiba distributor for repairs. Prohibited · Mount the inverter on a metal plate. The rear panel will get high temperature. Do not mount the inverter on an inflammable object, this will result in fire. Do not operate the inverter with the front cover removed. The unit contains high voltage parts and contact with them will result in electric shock. An emergency stop device must be installed that is configured in accordance with the system specifications. Mandatory If such an emergency stop device that can activate mechanical brake by shutting off power supply is not installed, operation cannot be stopped immediately by the inverter alone, thus resulting in an accident or injury. · All options to be used must be those specified by Toshiba. The use of options other than those specified by Toshiba will result in an accident.



Select an indoor location with good ventilation, and then install the inverter upright on a flat metal plate. For the positions and sizes of the mounting holes, refer to [12. 2].

If multiple inverters are installed

To install multiple inverters in one location, either normal basic installation or side-by-side installation (to align inverters side-by-side horizontally with no space) can be adopted.



| Туре | H1(cm) | H2(cm) | H3(cm) |
|--|--------|--------|--------|
| VFAS3-2004P - 2370P VFAS3-4004PC - 4750PC | 10 | 10 | 10 |
| VFAS3-2450P, 2550P VFAS3-4900PC - 4132KPC | 25 | 25 | 25 |
| VFAS3-4160KPC | 15 | 15 | 25 |
| VFAS3-4200KPC - 4280KPC | 20 | 15 | 25 |

1) Basic installation

When installing multiple inverters, leave at least 11 cm or more of space between each inverter and install them aligned horizontally.

When using the inverter in locations with temperatures above 50°C, remove the top cover and operation panel of the inverter (refer to [2. 2]) and use the inverter with the output current reduced (refer to "Instruction manual for load reduction").

2) Side-by-side installation

To align the inverters side-by-side horizontally with no space, remove the top cover of the inverter before use (refer to [2. 2]). When using the inverter in locations with temperatures above 50°C, use the inverter with the operation panel removed and use the inverter with the output current reduced (refer to "Instruction manual for load reduction").

The space shown in the figure above is the minimum allowable space. Because the inverter has cooling fans built in on the top or bottom surfaces, make the space on top and bottom as large as possible to allow for air passage.



• Do not install in any location with high humidity or high temperatures and where there are large amounts of dust, metallic fragments and oil mist.

Memo

• We also provide models with IP55 protective construction for adverse environments.

■ Current reduction curve

The current value of the inverter that can be output continuously varies depending on the installation method, ambient temperature, and the setting of carrier frequency.

For details, refer to "Instruction manual for load reduction".

■ Calorific values of inverter and required ventilation

Approximately 5% of the rated power of the inverter will be lost as a result of conversion from AC to DC or from DC to AC. In order to suppress the rise in temperature inside the cabinet when this loss becomes heat loss, the interior of the cabinet must be ventilated and cooled.

The amount of forcible air-cooling ventilation required and the necessary heat discharge surface quantity when operating in a sealed cabinet depending on motor capacity are as follows. <ND rating>

| Input voltage Class | Applicable motor capacity (kW) | Inverter | type-form | Frame size | Inverter calorific value (W) *1 | Inner side calorific value (W) *1 | Forced air-cooled Required ventilation amount (m ³ /min) | Sealeded cabinet Necessary heat discharge surface quantity (m ²) |
|---------------------------|--------------------------------|----------|-----------|---------------|---------------------------------------|---|--|---|
| | 0.75 | | 2004P | | 65 | 27 | 0.37 | 1.30 |
| | 1.5 | 2007P | A1 | 92 | 29 | 0.52 | 1.83 | |
| | 2.2 | | 2015P | 015P | 115 | 32 | 0.65 | 2.31 |
| | 4.0 | | 2022P | | 189 | 38 | 1.07 | 3.79 |
| | 5.5 | 20 | 2037P | A2 | 243 | 47 | 1.38 | 4.85 |
| | 7.5 | | 2055P | A3 | 392 | 53 | 2.22 | 7.84 |
| | 11 | | 2075P | | 544 | 62 | 3.09 | 10.87 |
| 3-phase 240 V | 15 | VFAS3- | 2110P | | 625 | 90 | 3.55 | 12.51 |
| | 18.5 | | 2150P | A4 | 750 | 101 | 4.26 | 15.01 |
| | 22 | | 2185P | | 874 | 112 | 4.96 | 17.49 |
| | 30 | | 2220P | | 1084 | 136 | 6.15 | 21.68 |
| | 37 | | 2300P | A5 | 1384 | 163 | 7.86 | 27.68 |
| | 45 | | 2370P | | 1631 | 184 | 9.26 | 32.63 |
| | 55 | | 2450P | A6 | 2466 | 278 | 14.00 | 49.33 |
| | 75 | | 2550P | Ab | 3432 | 359 | 19.48 | 68.64 |

^{*1} Case of 100% load ND continuous operation. The heat loss for the optional external devices (input reactor, radio noise reduction filters, etc.) is not included in the calorific values in the table.

| Input voltage Class | Applicable motor capacity (kW) | Inverter type-form | | Frame size | Inverter calorific value (W) *1 | Inner side calorific value (W) *1 | Forced air-cooled Required ventilation amount (m ³ /min) | Sealeded cabinet Necessary heat discharge surface quantity (m ²) |
|---------------------------|--------------------------------|--|---------|---------------|---------------------------------------|---|---|---|
| | 0.75 | | 4004PC | | 56 | 26 | 0.32 | 1.13 |
| | 1.5 | | 4007PC | A1 | 79 | 28 | 0.45 | 1.58 |
| | 2.2 | | 4015PC | | 100 | 30 | 0.57 | 2.00 |
| | 4.0 | | 4022PC | | 140 | 33 | 0.79 | 2.80 |
| | 5.5 | 7.5 44 11 44 15 4 18.5 4 22 4 30 43 | 4037PC | | 192 | 37 | 1.09 | 3.83 |
| | 7.5 | | 4055PC | A2 | 233 | 45 | 1.32 | 4.66 |
| | 11 | | 4075PC | | 323 | 53 | 1.84 | 6.47 |
| | 15 | | 4110PC | A3 | 455 | 62 | 2.58 | 9.10 |
| | 18.5 | | 4150PC | | 557 | 70 | 3.16 | 11.14 |
| | 22 | | 4185PC | | 603 | 71 | 3.42 | 12.06 |
| | 30 | | 4220PC | | 770 | 94 | 4.37 | 15.40 |
| 3-phase 480 V | 37 | | 4300PC | A4 | 939 | 107 | 5.33 | 18.78 |
| | 45 | | 4370PC | | 1101 | 123 | 6.25 | 22.02 |
| | 55 | | 4450PC | | 1094 | 132 | 6.21 | 21.88 |
| | 75 | | 4550PC | A5 | 1589 | 175 | 9.02 | 31.78 |
| | 90 | | 4750PC | - | 1827 | 199 | 10.37 | 36.54 |
| | 110 | | 4900PC | A6 | 2920 | 309 | 16.58 | 58.40 |
| | 132 | | 4110KPC | | 3457 | 358 | 19.62 | 69.13 |
| | 160 | 160 | 4132KPC | | 4013 | 405 | 22.78 | 80.26 |
| | 220 | | 4160KPC | A7 | 5404 | 452 | 30.68 | 108.08 |
| | 250 | | 4220KPC | | 6279 | 606 | 35.64 | 125.58 |
| | 280 | | 4250KPC | A8 | 6743 | 769 | 38.28 | 134.86 |
| | 315 | | 4280KPC | | 7749 | 769 | 43.99 | 154.98 |

^{*1} Case of 100% load ND continuous operation. The heat loss for the optional external devices (input reactor, radio noise reduction filters, etc.) is not included in the calorific values in the table.

Panel designing in consideration of effects of noise

The inverter generates high frequency noise. When designing the control panel, consideration must begiven to that noise.

Examples of measures are given below.

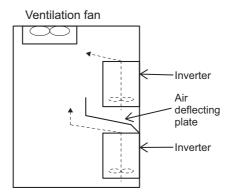
- Wire so that the power connections and the control connections are separated. Do not place them in the same conduit, do not run them in parallel, and do not bundle them.
- Provide shielding and twisted wires for control connection.
- Separate the input (power) and output (motor) wires of the power circuit. Do not place them in the same conduit, do not run them in parallel, and do not bundle them.
- · Be sure to ground the inverter grounding terminals.
- Install a surge absorber on any magnetic contactor and relay coils used around the inverter.
- · Install radio noise reduction filters if necessary.

■ When more than one inverter are installed in one cabinet

When two or more inverters are installed in one cabinet, pay attention to the followings.

- Ensure a space of at least 20 cm or more on the top and bottom of the inverters.
- Install an air deflecting plate so that the heat rising up from the inverter on the bottom does not affect the inverter on the top.
- Inverters may be installed side by side with each other with no space left between them. When installing inverters side by side, remove the top cover of the inverter. For how to remove, refer to [2. 2].

When using the inverter in locations with temperatures above 50°C, use the inverter with the operation panel removed and the output current reduced.



How to remove covers of inverter

WARNING



· Never remove the front cover when the power is on. The unit contains high voltage parts and contact with them will result in electric shock.

!\ CAUTION



screwdriver, be sure not to scratch your hand as these results in injury. • Turn the power off when removing the front cover and the wiring cover.

· When removing and mounting the front cover, wiring cover or the power terminal block with a



action

- If the power is on, it can result in electric shock or injury. Do not press too hard with the screwdriver. It can scratch the inverter unit.
- After wiring is complete, be sure to replace the front cover and the wiring cover. Otherwise, it can result in electric shock or fire.

In the following cases, covers of the inverter should be removed.

- Wiring of the power circuit/control terminal block (refer to [2. 3. 2])
- Switching of the control terminal block (refer to [2. 3. 5])
- Switching of the grounding capacitor (refer to [2. 3. 4])
- Mounting of the DC reactor attached with frame size A7 and A8 (refer to [2. 3. 7])
- Mounting of insert type options (refer to [10. 4])
- · Connection change of the cooling fan power supply when a DC power supply is used.
- · Heat discharge measures in the case of high ambient temperature, side-by-side installation of multiple inverters, etc. (refer to [2. 1. 2])
- Removal of installed inverters with frame sizes A1 to A5

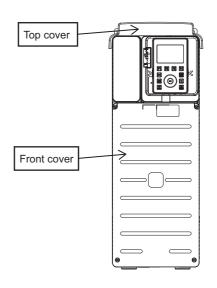
Use the procedure and corresponding figure for each type, shown in following pages, to remove portions such as covers.

2. 2. 1 With frame size A1, A2, or A3 VFAS3-2004P to 2075P, VFAS3-4004PC to 4185PC

The parts to be removed are as follows.

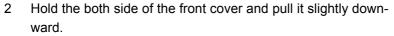
- Front cover on the lower side of the front surface (resin)
- Top cover on the top surface (resin)

Each cover can be removed separately.



■ Front cover

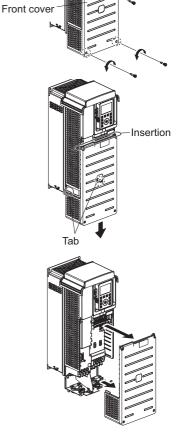
1 Loosen four screws of the front cover.
Since the screws are of falling prevention type, they do not come off the front cover even if loosened.



The inserted part of the upper side of the front cover comes off.

The tab shown in the figure on the right also come off.

- 3 Pull the front cover toward you and remove it from the unit.
- 4 Mount the front cover in the reverse procedure.
 Pay attention to engagement of the tab and insertion of the upper side of the cover.



■ Top cover

1 Put your fingers in the clearance in the back from the upper side of the top cover, and pull the cover toward you while lifting it upward.

The tab shown in the figure on the right comes off.



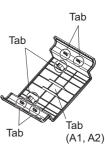


Since the tab is engaged stiffly, removing the top cover can result in injury. Pay enough attention

2 Remove the top cover from the unit.



When mounting the top cover, put it on the top of the unit, adjust the position of the tab, push the cover to fit in.

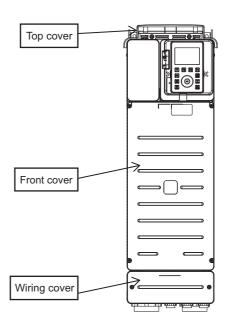


2. 2. 2 With frame size A4 VFAS3-2110P to 2185P, VFAS3-4220PC to 4370PC

The parts to be removed are as follows.

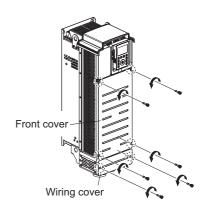
- Front cover in the middle of the front surface (resin)
- Wiring cover on the lower side of the front surface (resin)
- Top cover on the top surface (resin)

Each cover can be removed separately.



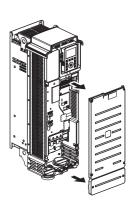
■ Front cover

- 1 Loosen four screws of the front cover.
 Since the screws are of falling prevention type, they do not come off the front cover even if loosened.
- Remove the front cover from the unit.The upper part of the front cover has no inserted part.
- 3 Mount the front cover in the reverse procedure.



Wiring cover

- Loosen two screws of the wiring cover.
 Since the screws are of falling prevention type, they do not come off the wiring cover even if loosened.
- 2 Remove the wiring cover from the unit.
- 3 Mount the wiring cover in the reverse procedure.

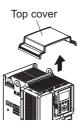


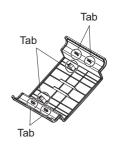
■ Top cover

1 Put your fingers in the clearance in the back from the upper side of the top cover, and pull the cover toward you to remove it.

The tab shown in the figure on the right comes off.







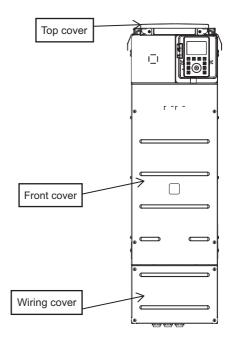
2 Mount the top cover in the reverse procedure.

2. 2. 3 With frame size A5 VFAS3-2220P to 2370P, VFAS3-4450PC to 4750PC

The parts to be removed are as follows.

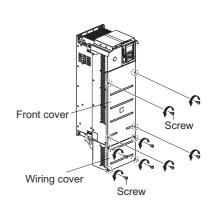
- Front cover in the middle of the front surface (metal)
- Wiring cover on the lower side of the front surface (metal)
- Top cover on the top surface (metal)

Each cover can be removed separately.



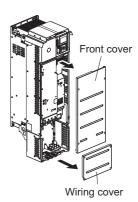
Front cover

- Remove four screws of the front cover.
 Store the removed screws so as not to be lost.
- 2 Remove the front cover from the unit.
- 3 Mount the front cover in the reverse procedure.



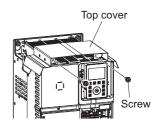
Wiring cover

- Remove four screws of the wiring cover.
 Store the removed screws so as not to be lost.
- 2 Remove the wiring cover from the unit.
- 3 Mount the wiring cover in the reverse procedure.

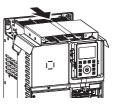


■ Top cover

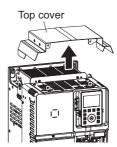
Remove two screws of the top cover.
 Store the removed screws so as not to be lost.



Pull the top cover slightly toward you.The tab shown in the figure on the right comes off.



3 Lift the top cover upward and remove it from the unit.



4 Mount the top cover in the reverse procedure.

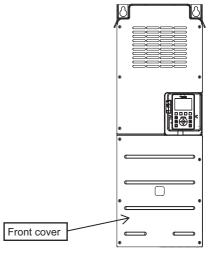


2. 2. 4 With frame size A6 VFAS3-2450P, 2550P, VFAS3-4900PC to 4132KPC

The parts to be removed are as follows.

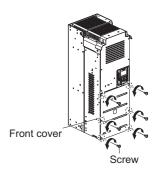
- Front cover on the lower side of the front surface (metal)
- Transparent cover inside the front cover above (transparent resin)
- Wiring duct inside the front cover above (black resin)

The top cover is never removed.



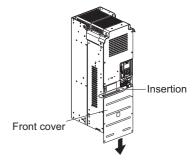
■ Front cover

Remove six screws of the front cover.
 Store the removed screws so as not to be lost.



2 Lift the bottom end of the front cover, pull the entire cover downward and remove it from the unit.

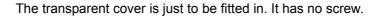
Since the upper part of the front cover has an inserted part, the cover cannot be removed just by lifting it.

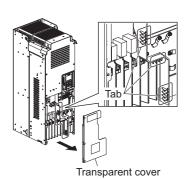


3 Mount the front cover in the reverse procedure.

■ Transparent cover

- Remove the front cover.
 Refer to the procedure above.
- 2 Remove the tab that holds down the transparent cover, lift the transparent cover and remove it from the unit.



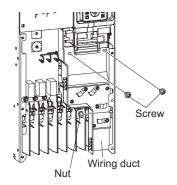


3 Mount the transparent cover in the reverse procedure.

Wiring duct

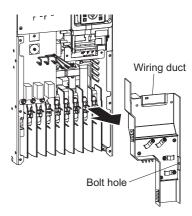
1 Remove the front cover and the transparent cover. Refer to the procedure above.

- 2 Remove two screws of the wiring duct. Store the removed screws so as not to be lost.
- 3 Remove one nut.
 Store the removed nut so as not to be lost.



4 Lift the left side of the wiring duct first and remove it from the unit.

Be careful that the bolt from which the nut has been removed does not get caught in the bolt hole.



Mount the wiring duct in the reverse procedure.
 First, adjust the bolt hole to the position of the bolt.
 Be sure to mount the wiring duct before the transparent cover.

2. 2. 5 Charge lamp

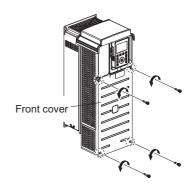
While the charge lamp is on (red), voltage is applied, or high voltage remains in the inverter. The location of the charge lamp varies depending on the type.

■ With frame size A1 to A5 VFAS3-2004P to 2370P, VFAS3-4004PC to 4750PC

The charge lamp is inside the front cover.

In the case of frame size A1, check the charge lamp in the following procedure. Also for other models, remove the front cover by referring to [2. 2] and check the charge lamp.

1 Loosen four screws of the front cover. Since the screws are of falling prevention type, they do not come off the front cover even if loosened.

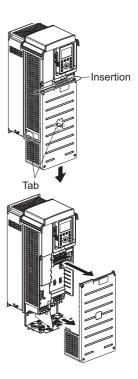


2 Hold the both side of the front cover and pull it slightly downward.

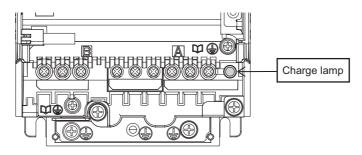
The inserted part of the upper side of the front cover comes off.

The tab shown in the figure on the right also come off.

3 Pull the front cover toward you and remove it from the unit.

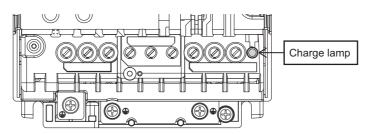


4 Check that the charge lamp is on/off.

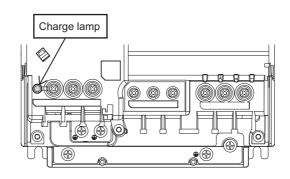


Mount the front cover in the reverse procedure.Pay attention to engagement of the tab and insertion of the upper side of the cover.

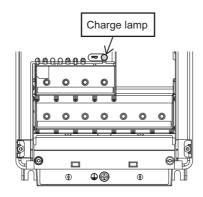
Frame size A2 VFAS3-2037P, VFAS3-4055PC, 4075PC



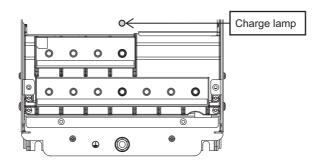
Frame size A3 VFAS3-2055P, 2075P, VFAS3-4110PC to 4185PC



Frame size A4 VFAS3-2110P to 2185P, VFAS3-4220PC to 4370PC

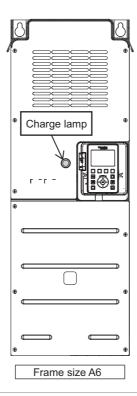


Frame size A5 VFAS3-2220P to 2370P, VFAS3-4450PC to 4750PC



■ With frame size A6 to A8 VFAS3-2450P, 2550P, VFAS3-4900PC to 4280KPC

You can check the charge lamp without opening the cover. When removing the front cover, be sure to check that the charge lamp is off.



2.3 Wiring

↑ WARNING Never disassemble, modify or repair. This can result in electric shock, fire and other injury. Please call your Toshiba distributor for Disassemrepairs. bly prohib-ited • Do not stick your fingers into openings such as cable wiring holes and cooling fan covers. The unit contains high voltage parts and contact with them will result in electric shock. Do not place or insert any kind of object (electrical wire cuttings, rods, wires etc.) inside the This will cause a short circuit and result in electric shock or fire. Prohibited Do not allow water or any other fluids to come in contact with the inverter. This will cause a short circuit and result in electric shock or fire. • All options to be used must be those specified by Toshiba. The use of options other than those specified by Toshiba will result in an accident. In using a power distribution device and options for the inverter, they must be installed in a cab-Mandatory action When they are not installed in the cabinet, this will result in electric shock.

This section explains cautions for wiring, how to connect to the power supply, motor, and control equipment, functions of the terminal blocks/connectors for communication, and how to switch the grounding capacitor, etc.

2. 3. 1 Cautions for wiring

WARNING Never remove the front cover when the power is on. The unit contains high voltage parts and contact with them will result in electric shock. Prohibited · Mount the front cover after wiring. If you turn the power on without attaching the front cover, this will result in electric shock or other injury. Electrical construction work must be done by a qualified expert. Erroneous connection of power supply by someone who does not have that expert knowledge will result in fire or electric shock. Connect output terminals (motor side) correctly. If the phase sequence is incorrect, the motor will operate in reverse and that can result in injury. Wiring must be done after installation. If you perform wiring prior to installation, this will result in electric shock or other injury. Mandatory Verify that the power is turned off and the charge lamp is off before starting wiring. If you perform wiring without verification, this will result in electric shock. Tighten the screws on the terminal block to specified torque. If the screws are not tightened sufficiently to the specified torque, this will result in fire. Verify that the power supply voltage is within +10% and -15% (±10% when the load is 100% in continuous operation) of the applied power supply voltage written on the name plate. If you do not use the appropriate power supply voltage, this will result in failure or fire. The grounding wire must be connected securely. If the grounding wire is not securely connected, when the inverter has failure or earth leakage, this will result in electric shock or fire. grounded





Do not attach devices with built-in capacitors (such as noise reduction filters or surge absorbers) to the output terminals (motor side).
 Heat rises up and this could cause a fire.

Pay attention to the following when wiring.

Measures for noise

To prevent electrical interference due to high-frequency noise generated by the inverter, separately bundle wires to the power circuit's power side terminals ([R/L1], [S/L2], [T/L3]) and wires to the motor side terminals ([U/T1], [V/T2], [W/T3]).

Control power supply

The control power of this inverter is supplied inside from the power circuit power supply. Therefore, if a malfunction or trip causes the power circuit to be shut off, control power will also be shut off.

• To check the cause of the malfunction or trip, set <F602: Trip record retention> to "1: Retain at power off."

• To make the control circuit continuously operate even if the power circuit is shut off due to malfunction or tripping, use an optional control power supply unit and supply power to the control circuit.

Wiring

- For power terminals, use ferrules with insulation sleeve terminal and crimp-style terminal with insulation sleeve. Connect the terminals so that adjacent terminals do not touch each other.
- For the sizes of electric wires used in the power circuit, refer to the table in [10. 1].
- The length of each wire is assumed to be 30 m or less. If the wire length is over 30 m, the wire size (diameter) must be increased.
- For grounding terminal, use wires of the size that is equivalent to or larger than those given in table [10. 1] and always ground the inverter.
- Wire the grounding wire as close as possible to the inverter.
- To ground the inverter unit, connect it to an exclusive grounding terminal. Do not use screws of the case, chassis, etc.
- Tighten the screws of the power terminal block and the control terminal block to the recommended tightening torque shown in the table [2. 3. 3] and [2. 3. 5] respectively.

2. 3. 2 Standard connection method

A WARNING

Prohibited

Be grounded

- Do not connect power supply to the output (motor side) terminals [U/T1], [V/T2] and [W/T3]. Connecting power supply to the output will damage the inverter and result in fire.
- Do not insert a braking resistor between DC terminals [PA/+] and [PC/-] or [PO] and [PC/-]. This will result in fire.
- Please connect the braking resistor in accordance with the instruction manual.
- Do not touch wires of equipment (e.g. MCCB) that is connected to the inverter power side at least 15 minutes after turning off the power.
 - If an electric charge remains in a capacitor in the inverter, touching the wires before the indicated time will result in electric shock.

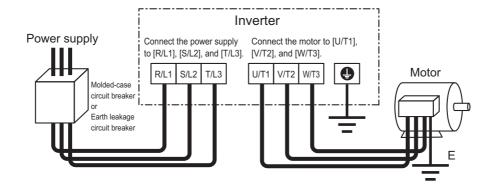
The grounding wire must be connected securely.
 If the grounding wire is not securely connected, when the inverter has failure or earth leakage, this will result in electric shock or fire.

The wiring of the power supply and motor is connected to the power terminal block and the wiring of external control equipment such as control signals to the control terminal block.

Connection to power supply and motor

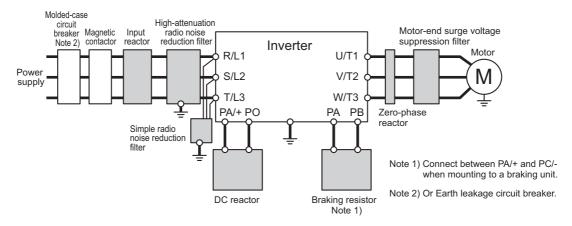
This diagram shows a standard wiring of the power circuit.

Connection to the power supply and motor wiring is common to all the types.



Connection to peripheral devices

This diagram shows an example of connection to peripheral devices.



For details of the peripheral devices, refer to [Chapter 10].

- · An noise filter is built in all the types as standard.
- A DC reactor is built in as standard or attached (frame size A7, A8).

Braking resistor

- To VFAS3-2004P to 2370P, VFAS3-4004PC to 4750PC, and VFAS3-4160KPC, connect only the braking resistor (optional) because a dynamic braking circuit is built in them as standard.
- When a braking resistor (optional) is installed for VFAS3-4900PC to 4132KPC and VFAS3-4200KPC to 4280KPC, a braking unit (optional) is also required.

For details, refer to [10. 3. 4].

DC input

- To input DC power, connect the inverter between terminals [PA/+] and [PC/-].
- When the inverter is used with a DC power supply, a circuit to suppress an inrush current may be required. Please contact your Toshiba distributor for information.
- When the inverter is used with a DC power supply, three-phase power input for cooling fan driving may be required separately.

■ Connection procedure of power circuit wiring

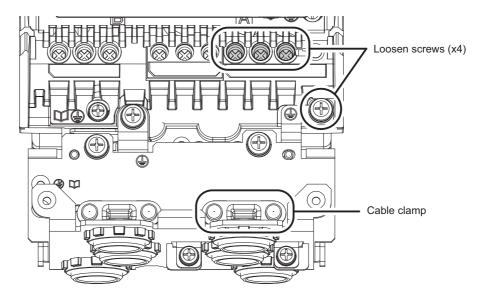
The following is the connection procedure of the power connection, with frame size A1 as an example.

Connect other sizes in the same way.

- 1 Remove the front cover.

 For how to remove, refer to [2. 2. 1].
- 2 Loosen the screws of the grounding terminal for inverter case. Mount the grounding wire to the screws of grounding terminal. Switch the grounding capacitor when needed. For details of how to switch, refer to [2, 3, 4].
- 3 Loosen the screws of the terminals [U/T1], [V/T2], and [W/T3] and a terminal [PE] of the power terminal block.

The terminal [PE] exists only in frame size A4 to A6.

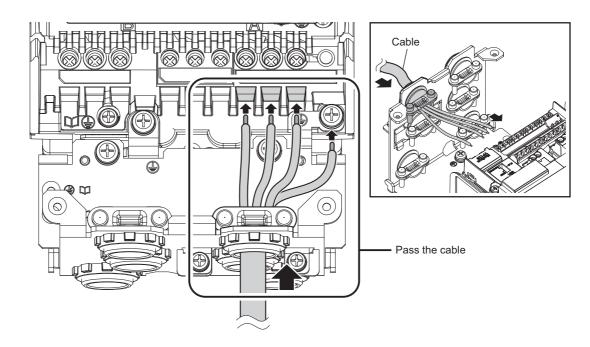


- 4 Pass the motor wiring through the cable clamp.

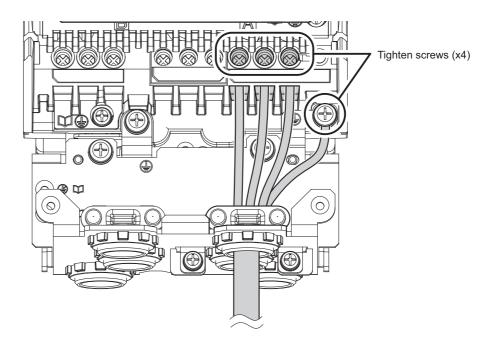
 The cable clamp exists only in frame size A1 to A5.
- 5 Mount the motor wiring to the screw of each corresponding terminal.

 Mount ferrules with insulation sleeve terminal and crimp-style terminal with insulation sleeve to the end of each wire of the motor in advance. For cautions, refer to "

 Wiring" of [2. 3. 1].

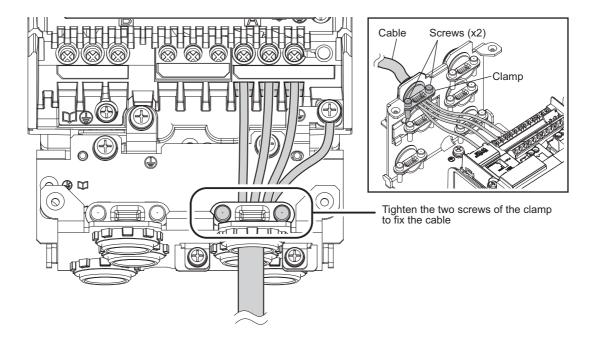


Tighten the screws of the terminals [U/T1], [V/T2], and [W/T3] and a terminal [PE]. For the recommended tightening torque, refer to "■Recommended tightening torque of power terminal screws" of [2. 3. 3].



7 Tighten two screws of the cable clamp and fix the motor wiring (four wires) with the cable clamp.

The cable clamp exists only in frame size A1 to A5.

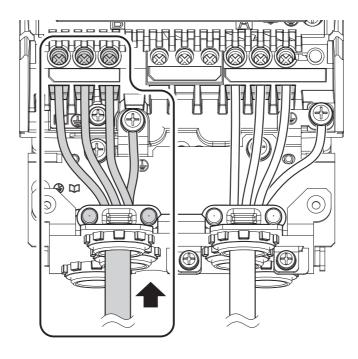


8 Similarly, mount the power supply wiring to the terminals [R/L1], [S/L2], and [T/L3] and a terminal [PE] after passing it through other cable clamp.

For the recommended tightening torque of the screws, refer to "Recommended tightening torque of power terminal screws" of [2. 3. 3].

Also fix the power supply wiring with the cable clamp.

The cable clamp exists only in frame size A1 to A5.



When connection is complete, mount the front cover. For how to mount, refer to [2. 2. 1].

Memo

- For the layout and shape of power terminal block of each frame size, refer to [2. 3. 3].
- The cable clamp exists only in frame size A1 to A5.
- Covers to be removed at the time of wiring vary depending on the frame size. For details, refer to [2. 2].

Connection of control circuit

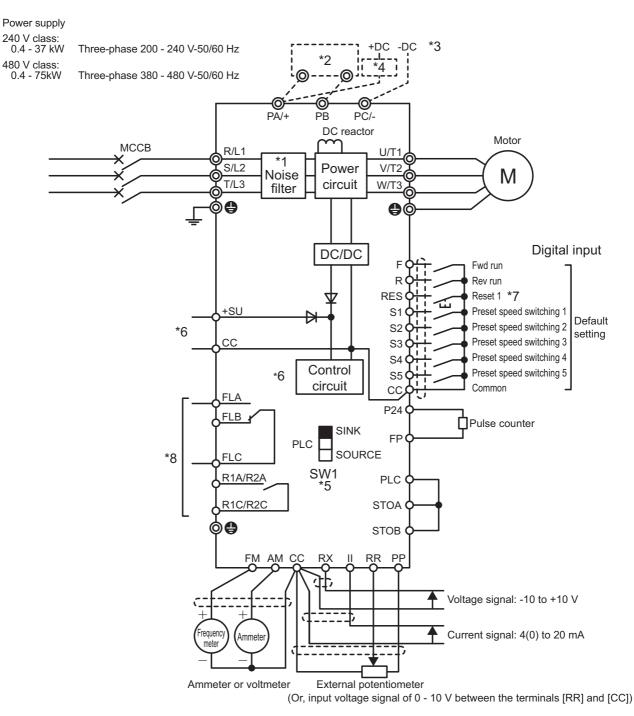
- The input/output of the control circuit consist of digital input x 8 points, analog input x 3 points, analog output x 2 points, relay contact output x 3 points, etc. In many cases, the function of input/output can be switched with parameter setting.
- For the function and electrical specification of each terminal, refer to [2. 3. 5].
- For details of how to operate with terminal input, refer to [4. 4].

For an example of wiring of the control circuit, refer to the "Standard connection diagram".

■ Standard connection diagram

This diagram shows a standard wiring of the power circuit and control circuit.

This diagram shows an example of a standard connection for 240 V class, 0.4 to 37kW and 480 V class, 0.4 to 75kW (frame size A1 to A5).

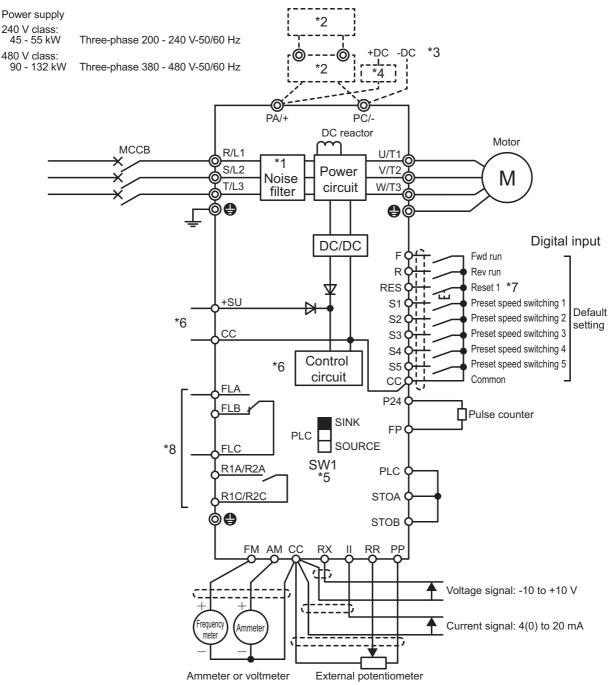


- *1 EMC filter is built in 480 V class.
- *2 External braking resistor (option).
- *3 To input DC power, connect the inverter between the terminals [PA/+] and [PC/-].
- *4 If your inverter is 240 V with 11kW or more, or 480 V with 22kW or more, and please contact your Toshiba distributor for information.when using it with a DC power supply, a circuit to suppress an inrush current is required.
- *5 For the switch function, refer to [2. 3. 5].
- *6 To supply control power from an external power supply for backing up the control power supplied from the inverter, an optional control power supply unit (CPS002Z) is required. In this case, it is used in conjunction with the inverter internal power supply.

 Set <F647: Control power option failure detection> to back up the control power supply.

 For details, refer to [6, 30, 20].
- *7 The reset signal is activated by ON→OFF trigger input.
- *8 Connect to power to comply with OVC2 (Over Voltage Category 2). Isolation transformer is necessary when connecting to power supply (OVC3).

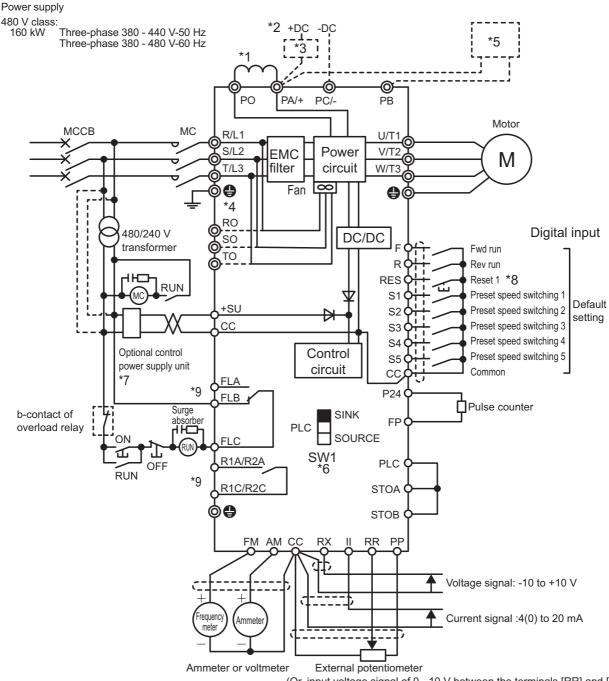
This diagram shows an example of a standard connection for 240 V class, 45 - 55 kW and 480 V class, 90 - 132 kW (frame size A6).



(Or, input voltage signal of 0 - 10 V between the terminals [RR] and [CC]) $\,$

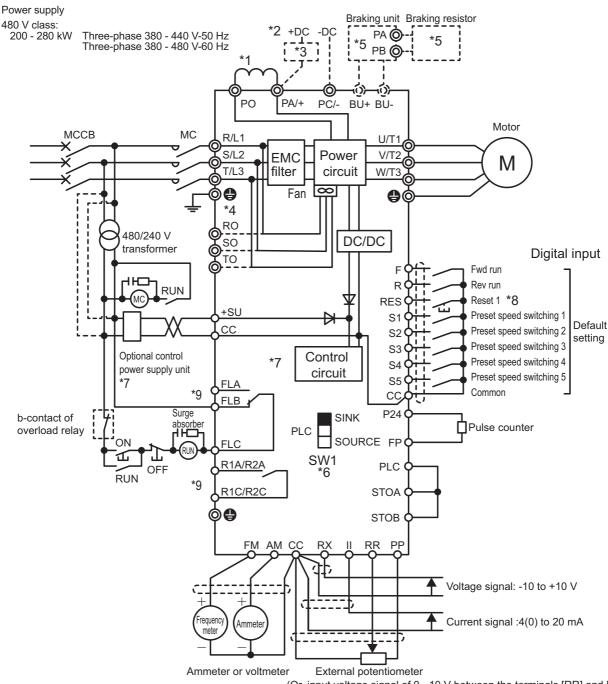
- *1 EMC filter is built in 480 V class.
- *2 When a braking resistor (optional) is mounted, a braking unit (optional) is also required.
- *3 To input DC power, connect the inverter between the terminals [PA/+] and [PC/-].
- *4 When the inverter is used with a DC power supply, a circuit to suppress an inrush current may be required. Please contact your Toshiba distributor for information.
- *5 For the switch function, refer to [2. 3. 5].
- *6 To supply control power from an external power supply for backing up the control power supplied from the inverter, an optional control power supply unit (CPS002Z) is required. In this case, it is used in conjunction with the inverter internal power supply.
 Set <F647: Control power option failure detection> to back up the control power supply.
 For details, refer to [6. 30. 20].
- *7 The reset signal is activated by ON→OFF trigger input.
- *8 Connect to power to comply with OVC2 (Over Voltage Category 2). Isolation transformer is necessary when connecting to power supply (OVC3).

This diagram shows an example of a standard connection for 480 V class, 160 kW (frame size A7).



- (Or, input voltage signal of 0 10 V between the terminals [RR] and [CC])
- Be sure to mount the DC reactor. A circuit between the terminals [PA/+] and [PO] is not short circuited (at the time of shipping).
- *2 To input DC power, connect the inverter between the terminals [PA/+] and [PC/-].
- When the inverter is used with a DC power, a circuit to suppress an inrush current may be required. Please contact your Toshiba distributor for *3 information.
- *4 When the inverter is used with a DC power supply, three-phase power input for cooling fan driving is required separately..
- *5 External braking resistor (option)
- *6 For the switch function, refer to [2. 3. 5].
- *7 To supply control power from an external power supply for backing up the control power supplied from the inverter, an optional control power supply unit (CPS002Z) is required. In this case, it is used in conjunction with the inverter internal power supply. Set <F647: Control power option failure detection> to back up the control power supply. For details, refer to [6. 30. 20].
- *8 The reset signal is activated by ON→OFF trigger input.
- Connect to power to comply with OVC2 (Over Voltage Category 2). Isolation transformer is necessary when connecting to power supply (OVC3).

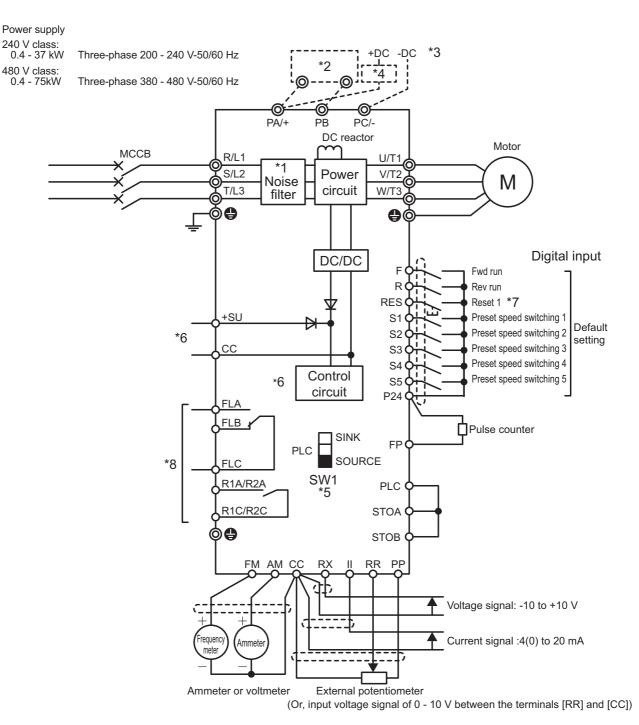
This diagram shows an example of a standard connection for 480 V class, 200 to 280 kW (frame size A8).



(Or, input voltage signal of 0 - 10 V between the terminals [RR] and [CC])

- *1 Be sure to mount the DC reactor. It is not required for DC power input terminal. A circuit between the terminals [PA/+] and [PO] is not short circuited (at the time of shipping).
- *2 To input DC power, connect the inverter between the terminals [PA/+] and [PC/-]. It is not used in conjunction with the DC reactor option DCL1.
- *3 When the inverter is used with a DC power supply, a circuit to suppress an inrush current is required. Please contact your Toshiba distributor for information.
- *4 When the inverter is used with a DC power supply, three-phase power input for cooling fan driving is required separately.
- *5 When a braking resistor (optional) is mounted, a braking unit (optional) is also required.
- *6 For the switch function, refer to [2. 3. 5].
- *7 To supply control power from an external power supply for backing up the control power supplied from the inverter, an optional control power supply unit (CPS002Z) is required. In this case, it is used in conjunction with the inverter internal power supply.
 - Set <F647: Control power option failure detection> to back up the control power supply.
 - For details, refer to [6. 30. 20].
- *8 The reset signal is activated by ON→OFF trigger input.
- *9 Connect to power to comply with OVC2 (Over Voltage Category 2). Isolation transformer is necessary when connecting to power supply (OVC3).

This diagram shows an example of a standard connection for 240 V class, 0.4 to 37 kW and 480 V class, 0.4 to 75 kW (frame size A1 to A5).



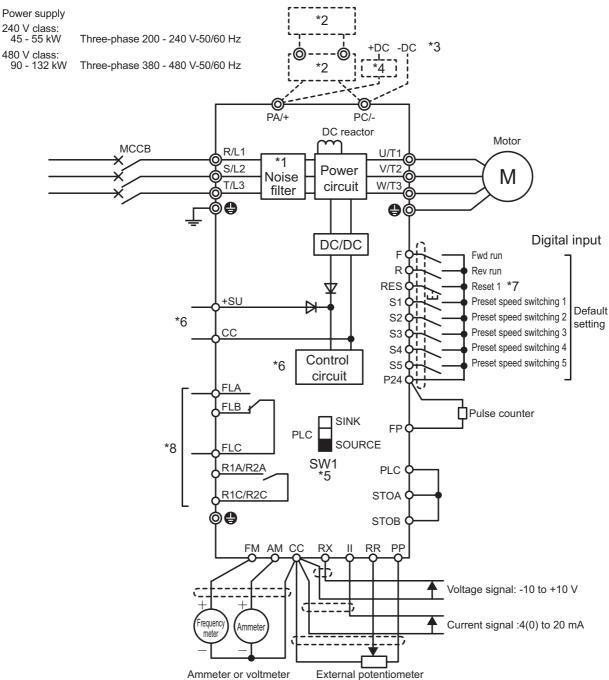
- *1 EMC filter is built in 480 V class.
- *2 External braking resistor (option).
- *3 To input DC power, connect the inverter between the terminals [PA/+] and [PC/-].

 When your inverter is 240 V with 11kW or more, or 480 V with 22kW or more, and please contact your Toshiba distributor for information.when using it with a DC power supply, a circuit to suppress an inrush current is required.
- *5 For the switch function, refer to [].
- *6 To supply control power from an external power supply for backing up the control power supplied from the inverter, an optional control power supply unit (CPS002Z) is required. In this case, it is used in conjunction with the inverter internal power supply.

 Set <F647: Control power option failure detection> to back up the control power supply.

 For details, refer to [6, 30, 20].
- *7 The reset signal is activated by ON→OFF trigger input.
- *8 Connect to power to comply with OVC2 (Over Voltage Category 2). Isolation transformer is necessary when connecting to power supply (OVC3).

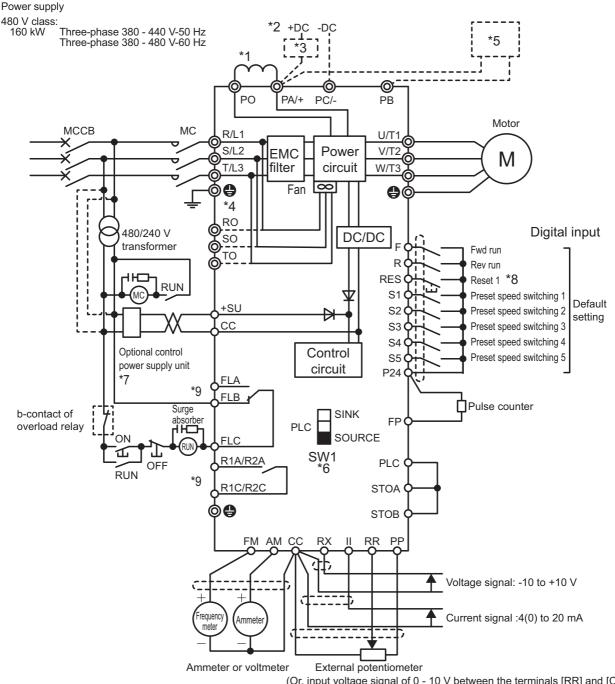
This diagram shows an example of a standard connection for 240 V class, 45 to 55 kW and 480 V class, 90 to 132 kW (frame size A6).



(Or, input voltage signal of 0 - 10 V between the terminals [RR] and [CC])

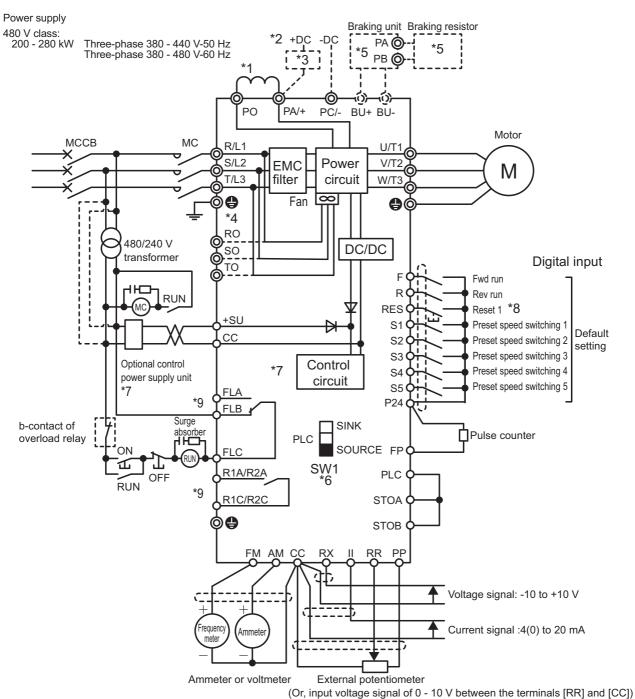
- *1 EMC filter is built in 480 V class.
- *2 When a braking resistor (optional) is mounted, a braking unit (optional) is also required.
- $^{\star}3$ To input DC power, connect the inverter between the terminals [PA/+] and [PC/-].
- *4 When the inverter is used with a DC power supply, a circuit to suppress an inrush current may be required. Please contact your Toshiba distributor for information.
- *5 For the switch function, refer to [2. 3. 5].
- *6 To supply control power from an external power supply for backing up the control power supplied from the inverter, an optional control power supply unit (CPS002Z) is required. In this case, it is used in conjunction with the inverter internal power supply.
 Set <F647: Control power option failure detection> to back up the control power supply.
 For details, refer to [6. 30. 20].
- *7 The reset signal is activated by ON→OFF trigger input.
- *8 Connect to power to comply with OVC2 (Over Voltage Category 2). Isolation transformer is necessary when connecting to power supply (OVC3).

This diagram shows an example of a standard connection for 480 V class, 160 kW (frame size A7).



- (Or, input voltage signal of 0 10 V between the terminals [RR] and [CC])
- Be sure to mount the DC reactor. A circuit between the terminals [PA/+] and [PO] is not short circuited (at the time of shipping).
- To input DC power, connect the inverter between the terminals [PA/+] and [PC/-].
- When the inverter is used with a DC power, a circuit to suppress an inrush current may be required. Please contact your Toshiba distributor for infor-*3 mation.
- *4 When the inverter is used with a DC power supply, three-phase power input for cooling fan driving is required separately.
- *5 External braking resistor (option)
- *6 For the switch function, refer to [2. 3. 5].
- To supply control power from an external power supply for backing up the control power supplied from the inverter, an optional control power supply unit (CPS002Z) is required. In this case, it is used in conjunction with the inverter internal power supply. Set <F647: Control power option failure detection> to back up the control power supply. For details, refer to [6. 30. 20].
- *8 The reset signal is activated by ON→OFF trigger input.
- *9 Connect to power to comply with OVC2 (Over Voltage Category 2). Isolation transformer is necessary when connecting to power supply (OVC3).

This diagram shows an example of a standard connection for 480 V class, 200 to 280 kW (frame size A8).



- *1 Be sure to mount the DC reactor. It is not required for DC power input terminal. A circuit between the terminals [PA/+] and [PO] is not short circuited
- *2 To input DC power, connect the inverter between the terminals [PA/+] and [PC/-]. It is not used in conjunction with the DC reactor option DCL1.
- *3 When the inverter is used with a DC power supply, a circuit to suppress an inrush current is required. Please contact your Toshiba distributor for information
- *4 When the inverter is used with a DC power supply, three-phase power input for cooling fan driving is required separately.
- *5 If a braking resistor (optional) is mounted, a braking unit (optional) is also required.
- *6 For the switch function, refer to [2. 3. 5].

(at the time of shipping).

- *7 To supply control power from an external power supply for backing up the control power supplied from the inverter, an optional control power supply unit (CPS002Z) is required. In this case, it is used in conjunction with the inverter internal power supply.
- *8 The reset signal is activated by ON→OFF trigger input.
- *9 Connect to power to comply with OVC2 (Over Voltage Category 2). Isolation transformer is necessary when connecting to power supply (OVC3).

2. 3. 3 Power terminals

The power terminals are connected to the power supply (primary side) and the motor (secondary side).

■ Functions of power terminals

| Terminal symbol | Function | Applicable frame size |
|----------------------------|--|---------------------------------------|
| • | Grounding terminal for inverter case. There are 3 terminals in cooling fin or mounting part of EMC plate. | All frame sizes |
| [PE] | Grounding terminal. | Frame size A4, A5, and A6 |
| [R/L1] [S/L2] [T/L3] | Connected to an AC power supply. 240 V class: Three-phase 200 - 240 V-50/60 Hz 480 V class: VFAS3-4004PC to 4132KPC : | All frame sizes |
| [U/T1] [V/T2] [W/T3] | Connected to a three-phase motor. | All frame sizes |
| [PA/+] [PB] | Connected to a braking resistor. Change the parameters <f304: braking,="" dynamic="" olr="" trip="">, <f308: braking="" resistance="">, and <f309: braking="" capacity="" resistor=""> if necessary.</f309:></f308:></f304:> | Frame size A1, A2, A3, A4, A5, and A7 |
| [BU+] [BU-] | Inside the inverter. Connected to a braking unit (optional). Braking resistor (optional) is connected to a braking unit terminals [PA] and [PB]. | Frame size A8 |
| [PA/+] [PC/-] | A DC power can be input. For models of VFAS3-2110P to 2550P and VFAS3-4220PC to 4280KPC, a rush current suppression circuit (optional) is required. Connected to a braking unit (Optional) for frame size A6. | All frame sizes |
| [PA/+] [P0] | Be sure to connect the attached DC reactor. | Frame sizes A7 and A8 |

Memo

• The arrangement of the terminals varies depending on the type. See the figures on the next page and after.

■ Recommended tightening torque of power terminal screws Power terminal torque and wire strip length

| Screw size | Frame size | Tor | Strip length | |
|------------|------------|---------|--------------|------|
| | | (N • m) | (lb · in) | (mm) |
| M4 | A1 | 1.3 | 11.5 | 10 |
| | A2 | 1.5 | 13.3 | 10 |
| M5 | A3 | 2.6 | 23 | 18 |

| Screw size | Frame size | Tor | Strip length | |
|------------|------------|---------|--------------|------|
| | | (N • m) | (lb · in) | (mm) |
| M8 | A4 | 10 | 88.5 | 28 |
| M10 | A6 | 27 | 239 | - |
| M12 | A5 | 18 | 159 | 35 |

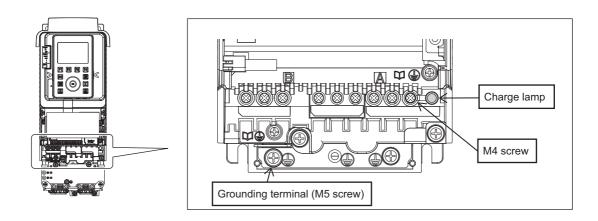
Grounding terminal torque

| Screw size | Frame size | Tor | Strip length | |
|------------|------------|---------|--------------|------|
| | | (N • m) | (lb · in) | (mm) |
| M5 | A1,A2,A3 | 2.6 | 23 | - |
| M6 | A4 | 4.4 | 38.9 | - |
| M8 | A4 | 10 | 88.5 | 28 |
| M8 | A5,A6 | 11.8 | 104 | - |
| M10 | A6 | 27 | 239 | - |
| M12 | A5 | 18 | 159 | 35 |

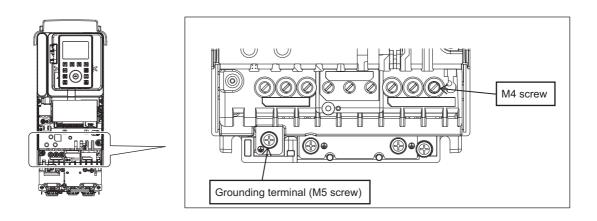
Note) $1(N \cdot m) = 8.850(lb \cdot in)$

■ Arrangement of power terminals

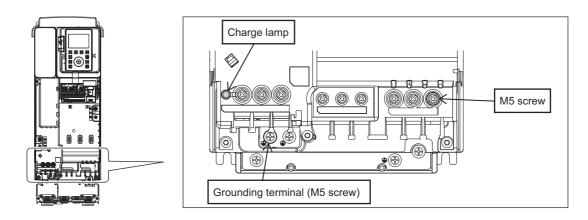
1) Frame size A1 VFAS3-2004P to 2022P, VFAS3-4004PC to 4037PC



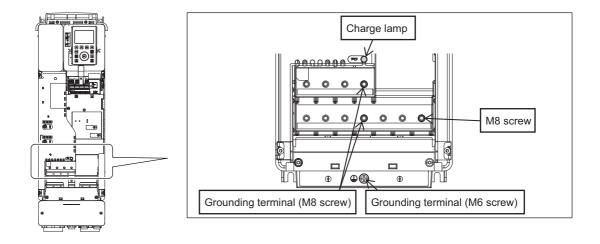
2) Frame size A2 VFAS3-2037P,VFAS3-4055PC, 4075PC



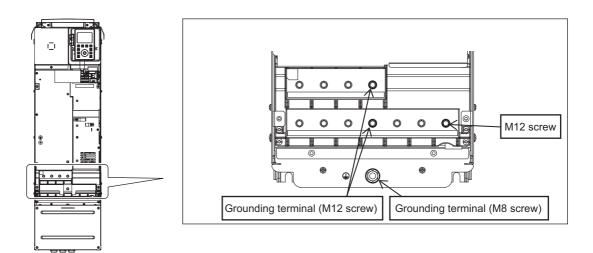
3) Frame size A3 VFAS3-2055P, 2075P, VFAS3-4110PC to 4185PC



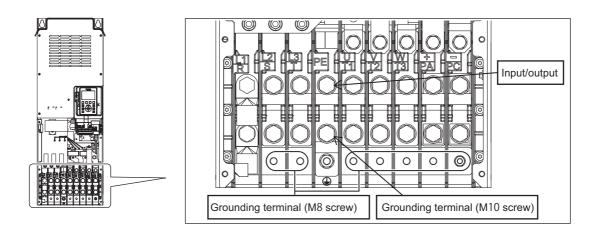
4) Frame size A4 VFAS3-2110P to 2185P, VFAS3-4220PC to 4370PC



5) Frame size A5 VFAS3-2220P to 2370P, VFAS3-4450PC to 4750PC



6) Frame size A6 VFAS3-2220P to 2370P, VFAS3-4450PC to 4750PC



2. 3. 4 Switching of grounding capacitor

WARNING



Prohibited

When using this 480V class inverter with a power supply system that is grounded in other than
the neutral point (e.g. when the power supply has delta connection with single phase grounding), the grounding capacitor should not be grounded (or the capacity of the grounding capacitor should not be increased).

Otherwise, it will result in failure or fire.

This inverter has a built-in noise filter (EMC noise filter for 480V class) and the inverter input power supply is grounded via the capacitor. By switching this grounding capacitor, the leakage current from the inverter can be reduced.

It is switched by changing the position of the exclusive switching screw(s) that varies depending on the type. For some types, the grounding capacitor is completely disconnected (frame size A1to A5). For others, the capacitor capacity is reduced (frame size A6 to A8).

For the details of the influence of the leakage current and measures, refer to [2. 4. 3].



- Note that when the grounding capacitor is switched, the inverter unit no longer comply with the EMC directive.
- · Be sure to switch with the power off.
- For models with two switching screws, be sure to set both screws to the same side.

Switch the grounding capacitor in the following procedure given for each type. At the time of shipping, the grounding capacitor is grounded or its capacity is large.

With frame size A1 VFAS3-2004P to 2022P, VFAS3-4004PC to 4037PC

- 1 Remove the front cover. For how to remove, refer to [2. 2. 1].
- 2 Remove two screws for switching of grounding capacitor.

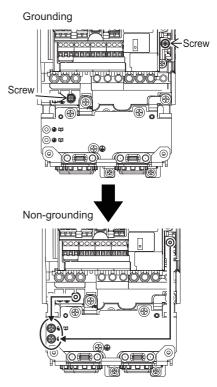
The grounding capacitor is disconnected. Mount the removed screws to the positions shown in the figure on the right and tighten them.

3 To recover the shipping state, mount the two screws for switching of grounding capacitor and

The grounding capacitor is connected and grounded.

4 After switching, mount the front cover. For how to mount, refer to [2. 2. 1].

tighten them.





• For models with two switching screws, be sure to set both screws to the same side.

With frame size A2 VFAS3-2037P, VFAS3-4055PC, 4075PC

1 Remove the front cover. For how to remove, refer to [2. 2. 1].

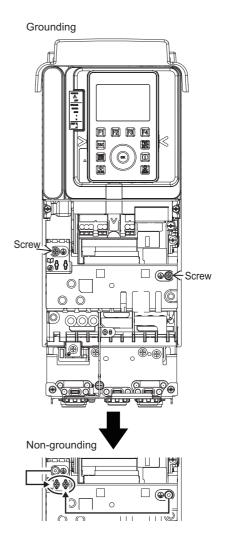
2 Remove two screws for switching of grounding capacitor.

The grounding capacitor is disconnected. Insert the removed screws to the positions shown in the figure on the right.

3 To recover the shipping state, mount the two screws for switching of grounding capacitor and tighten them.

The grounding capacitor is connected and grounded.

4 After switching, mount the front cover. For how to mount, refer to [2. 2. 1].



2. Installation and wiring



• For models with two switching screws, be sure to set both screws to the same side.

With frame size A3 VFAS3-2055P, 2075P, VFAS3-4110PC to 4185PC

1 Remove the front cover. For how to remove, refer to [2. 2. 1].

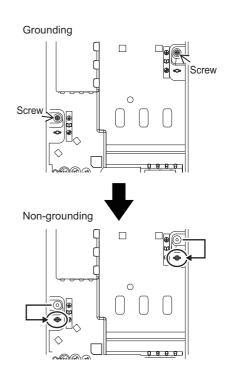
2 Remove two screws for switching of grounding capacitor.

The grounding capacitor is disconnected. Insert the removed screws to the positions shown in the figure on the right.

3 To recover the shipping state, mount the two screws for switching of grounding capacitor and tighten them.

The grounding capacitor is connected and grounded.

4 After switching, mount the front cover. For how to mount, refer to [2. 2. 1].





• For models with two switching screws, be sure to set both screws to the same side.

With frame size A4 VFAS3-2110P to 2185P, VFAS3-4220PC to 4370PC

1 Remove the front cover. For how to remove, refer to [2. 2. 2].

2 Remove the screw(s) for switching of grounding capacitor from the position of the grounding mark and insert it/them into the position of the non-grounding mark.

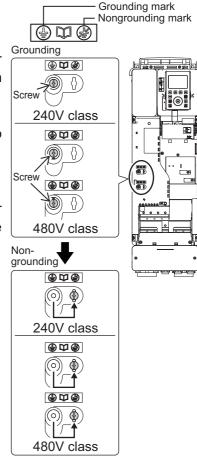
The 240 V class has one screw.

The 480 V class has two screws. Remove both of two screws.

The grounding capacitor is disconnected.

- 3 To recover the shipping state, remove the screw(s) for switching of grounding capacitor and tighten it/them to the screw hole in the position of the grounding mark. The grounding capacitor is connected and grounded.
 - After switching, mount the front cover.

For how to mount, refer to [2. 2. 2].





• For models with two switching screws, be sure to set both screws to the same side.

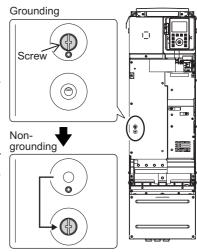
■ With frame size A5 VFAS3-2220P to 2370P, VFAS3-4450PC to 4750PC

- 1 Remove the front cover. For how to remove, refer to [2. 2. 3].
- 2 Remove the screw for switching of grounding capacitor from the position of the grounding mark and tighten it to the position of the non-grounding mark.

The grounding capacitor is disconnected.

3 To recover the shipping state, remove the screw(s) for switching of grounding capacitor and tighten it/them to the screw hole in the position of the grounding mark.

The grounding capacitor is connected and grounded.



4 After switching, mount the front cover. For how to mount, refer to [2. 2. 3].

With frame size A6 VFAS3-2450P, 2550P, VFAS3-4900PC to 4132KPC

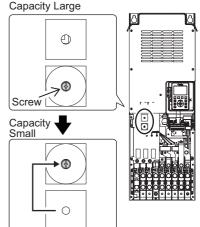
1 Remove the front cover and the transparent cover inside Capacity Large (transparent resin).

For how to remove, refer to [2. 2. 4].

2 Remove the screw for switching of grounding capacitor from the position of the grounding mark and tighten it to the position of the non-grounding mark.

The grounding capacitor's capacity is reduced.

3 To recover the shipping state, remove the screw(s) for switching of grounding capacitor and tighten it/them to the screw hole in the position of the grounding mark. The grounding capacitor's capacity is increased.



4 After switching, mount the transparent cover and the front cover in this order. For how to mount, refer to [2. 2. 4].

2. 3. 5 Control terminals

The control terminals are connected to external control equipment to control operation of the inverter and motor and monitor the state externally.

■ Functions of control terminals

The control terminal block is common to all the models.



| Termi- nal symbol | Input/ output | Function | Electrical specifications | Internal circuit |
|-------------------------|------------------|---|---|------------------------------------|
| F | Input | Multifunction programmable digital input. In the default setting, forward run is performed with ON and deceleration stop with OFF. | | |
| R | Input | Multifunction programmable digital input. In the default setting, reverse run is performed with ON and deceleration stop with OFF. | Digital input. • 24 Vdc-5 mA or less | |
| RES | Input | Multifunction programmable digital input. In the default setting, this inverter protective function is reset by ON→OFF. It has no effect when the inverter is in a normal condition. | Compliant with IEC61131-2 logic type 1 • Sink logic: ON < 10 V, 16 V < OFF • Source logic: | R RES S1 1 |
| S1 | Input | Multifunction programmable digital input. In the default setting, preset speed operation is performed with ON | OFF < 5 V, 11 V < ON Sink logic and | SW1 SURCE SOURCE |
| S2 | Input | Multifunction programmable digital input. In the default setting, preset speed operation is performed with ON | source logic can be switched with the slide switch [SW1] | |
| S3 | Input | Multifunction programmable digital input. In the default setting, preset speed operation is performed with ON | | |
| S4 | Input | Multifunction programmable digital input. In the default setting, preset speed operation is performed with ON With <f146: input="" s4="" select="" terminal="">, digital input, pulse train input, and PG input can be switched.</f146:> | Digital input. • 24 Vdc-5 mA or less Compliant with IEC61131-2 logic type 1 | |
| S5 | Input | Multifunction programmable digital input. In the default setting, preset speed operation is performed with ON. With <f147: input="" s5="" select="" terminal="">, digital input, pulse train input, and PG input can be switched.</f147:> | Sink logic: ON < 10 V, 16 V < OFF Source logic: OFF < 5 V, 11 V < ON Sink logic and source logic can be switched with the slide switch [SW1] Pulse train input Up to 30 kpps (duty 50%) | 54 S5 2.2k 980 980 980 |

| Termi- nal symbol | Input/ output | Function | Electrical specifications | Internal circuit |
|-------------------------|------------------------------------|--|--|---|
| CC | Com- mon to input/ output | An equipotential terminal of the control circuit. It is allocated in three positions. | - | CC |
| PP | Output | 10 Vdc power output for analog input setting. | 10 Vdc (allowable load current: 10 mAdc) | Voltage Regulator |
| FP | Output | Multifunction programmable digital/pulse train output. With <f669: fp="" switching="" terminal="">, digital output and pulse train output can be switched.</f669:> | Digital output • 24 Vdc-50 mA Pulse train output • Up to 30 kpps (duty 50%) | +24V FP PTC |
| RR | Input | Analog input with 0 - 10 Vdc. It can be switched to PTC input, etc. with <f108: input="" rr="" select="" terminal="">.</f108:> | 0 - 10 Vdc (internal imped- ance: 31.5 kΩ) | 21.5k +3V 10k |
| RX | Input | Analog input with -10 to +10 Vdc. With <f107: input="" rx="" select="" terminal="" voltage="">, it can be swtiched to 0 - 10 Vdc.</f107:> | -10 to +10 Vdc (internal imped- ance: 31.5 kΩ) | 21.5k +3V |
| II | Input | Analog current input with 0 - 20 mAdc. The current can be changed to 4 - 20 mA, etc. with setting of the parameter. | 0 - 20 mAdc (internal imped- ance: 250 Ω) | 21.5k +3V 250 37.4k 7 |

| Termi- nal symbol | Input/ output | Function | Electrical specifications | Internal circuit |
|-------------------------|------------------|---|--|-------------------------|
| FM | Output | Multifunction programmable analog output. 0 - 10 Vdc output with default setting. With <f681: fm="" switching="" terminal="">, meter option (0 - 1 mA), current (0 - 20 mA) output, and voltage (0 - 10 V) output can be switched.</f681:> | 0 - 10 Vdc (allowable load resistance: 1 kΩ or more) 4 - 20 mAdc | FM +24V 0~10V +24V |
| AM | Output | Multifunction programmable analog output. 0 - 20 mAdc output with default setting. With <f686: am="" switching="" terminal="">, meter option (0 - 1 mA), current (0 - 20 mA) output, and voltage (0 - 10 V) output can be switched.</f686:> | (0 - 20 mAdc) (allowable load resistance: 500 kΩ or less) | 0-20mA 68 |
| PLC | Output | When the slide switch [SW1] is set to the sink side or source side, it can be used as 24 Vdc power output. | 24 Vdc-200 mA (200 mA in total with P24) Compliant with IEC61131-2 | ! EXT |
| | Input | When the slide switch [SW1] is set to the PLC side, it can be used as a common terminal for digital input terminal. | - | PLC Current limiter SW1 |
| P24 | Output | 24 Vdc power output. | 24 Vdc-200 mA (200 mA in total with PLC) Compliant with IEC61131-2 | |
| +SU | Input | DC power input to operate the control circuit. Connect a control power supply option or 24 Vdc power supply between [+SU] and [CC]. | 24 Vdc- current 1A or more | +24V +SU |
| STOA | Input | At the time of shipping, the terminals [STOA]-[STOB]-[PLC] are shorted by the shorting bar. This is a terminal with STO function that complies with the safety standard | Refer to Safety Function Manual. Compliant with IEC61131-2 logic type 1 | |
| STOB Input | | IEC61800-5-2. For details, refer to Safety Function Manual. This terminal is not programmable digital input. | Activate < 5 V, 11 V < DeactivateNot coast stop | |

| Termi- nal symbol | Input/ output | Function | Electrical specifications | Internal circuit |
|-------------------------|------------------|--|--|--------------------------|
| FLA | | Multifunction programmable relay contact output. Operation of the | Maximum contact | FLA FLA |
| FLB | Output | protection function of the inverter is detected in the default setting. | capacity 250 Vac-2 A (cosφ=1) 30 Vdc-2 A (at resistive load) | +24V |
| FLC | | during protection function operation. | 250 Vac-1 A (cosφ=0.4) 30 Vdc-1A | FLC |
| R1A | Output | Multifunction programmable relay contact output. A low-speed | (L/R=7 ms) Minimum contact | R1A R2A I +24V |
| R1C | Catput | signal is output in the default setting. | capacity • 24 Vdc-5 mA | |
| R2A | Output | Multifunction programmable relay contact output. It is not assigned in the default partiag. The function | Life • 100000 times | R1Ci |
| R2C | Juiput | in the default setting. The function can be set with <f134: function="" r2="" terminal="">.</f134:> | | R2C |



With relay contact output, chattering (momentary ON/OFF of contact) is generated by external
factors of the vibration and the impact, etc. In particular, please set a filter of 10 ms or more, or
timer for measures when connecting it directly to the input unit of the programmable controller.

Reference

- To change the function of the terminals [F], [R], [RES], and [S1] [S5] \rightarrow Refer to [6. 3. 2]
- To change the function of the terminals [FP], [FL], [R1], and [R2] \rightarrow Refer to [6. 3. 3]
- To change the function of the terminals [RR] and [RX] \rightarrow Refer to [6. 2]
- To change the function of the terminals [FM] and [AM] \rightarrow Refer to [5. 1. 6]

■ Recommended tightening torque of control terminal screws Control terminal torque and wire strip length

| | Screw size | Torque | | Strip length | Screwdriver size | |
|--------------------|------------|---------|-----------|--------------|------------------|-----------|
| | Sciew Size | (N · m) | (lb · in) | (mm) | Width (mm) | Thickness |
| Relay | M3 | 0.5 | 4.4 | 11 | 3.5 | 0.5 |
| Except Relay (2nd) | M3 | 0.5 | 4.4 | 6 or 7 | 3.5 | 0.5 |
| Except Relay (1st) | М3 | 0.5 | 4.4 | 6 | 3.5 | 0.5 |

Wire size

| | Conductor | Using one wire | | Using two wires | | Using two wires with twin ferule | |
|--------------------|---------------|-------------------------|-------|--------------------|-------|----------------------------------|-------|
| | | (mm ²) | AWG | (mm ²) | AWG | (mm ²) | AWG |
| Relay | Solid wire | 0.14-2.5 | 26-14 | 2x0.14 to 2x0.75 | 26-18 | - | - |
| Relay | Stranded wire | 0.14-2.5 | 26-14 | 2x0.14 to 2x0.75 | 26-18 | 2x0.5 to 2x1.5 | 20-16 |
| Except Relay | Solid wire | 0.14-2.5 | 26-14 | 2x0.14 to 2x1.0 | 26-18 | - | - |
| (2nd) | Stranded wire | 0.14-1.5mm ² | 26-16 | 2x0.14 to 2x0.75 | 26-18 | 2x0.5 to 2x1.0 | 20-18 |
| Except Relay (1st) | Solid wire | 0.14-1.5mm ² | 26-16 | 2x0.14 to 2x0.75 | 26-18 | - | - |
| | Stranded wire | 0.14-1.5mm ² | 26-16 | 2x0.14 to 2x0.75 | 26-18 | 2x0.5 to 2x1.0 | 20-18 |

Switching of slide switch of control terminal block

With the slide switch [SW1] of the control terminal block, the setting of sink logic, source logic and external power supply sink logic of the digital input terminals [F], [R], [RES], and [S1] - [S5] is switched.

For details of sink/source logic, refer to the following "■Sink logic and source logic."

- The slide switch [SW1] is set to the PLC side in the default setting. This is the setting when the inverter external power supply is used
- To use as sink logic, set the slide switch [SW1] to the SINK side.
- To use as source logic, set the slide switch [SW1] to the SOURCE side.



Important

- · Switch the logic before turning on the power supply.
- After confirming that the sink/source setting is correct, turn on the power supply.

Sink logic and source logic

In Japan and the U.S., current flowing out turns digital input terminals on. This is called sink logic. The method generally used in Europe is source logic in which current flowing into digital input terminals turns them on.

Each digital input terminal is supplied with electricity from either the inverter's internal power supply or an external power supply, and its connections vary depending on the power supply used.

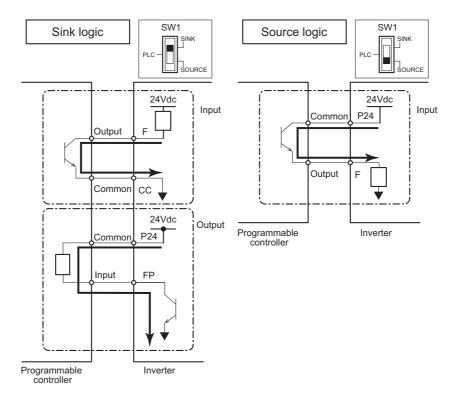
Memo

 Sink logic is sometimes referred to as negative logic, and source logic is referred to as positive logic.

1) When the inverter internal power supply is used

When the internal power supply of the inverter is used to supply electricity to digital input terminals, the connection is as shown in the diagram below.

Sink/source logic is set by the slide switch [SW1]. Refer to "■Switching of slide switch of control terminal block."

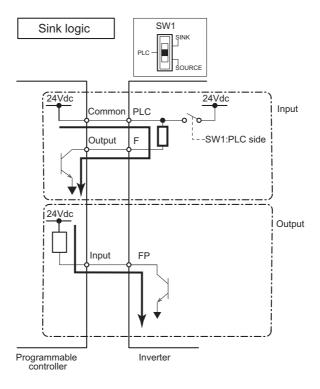


2) When an external power supply is used

The terminal [PLC] is used to connect to an external power supply or to separate a terminal from other input or output terminals.

Sink/source logic is set by the slide switch [SW1].

Refer to "■Switching of slide switch of control terminal block."

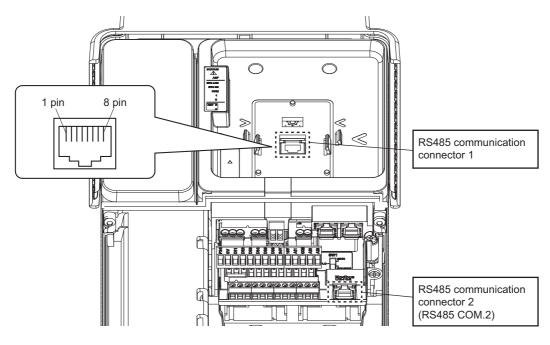


2. 3. 6 RS485 communication connectors

This inverter is equipped with two RS485 communication connectors in the positions in the figure below.

RS485 communication connector 1 is 2-wire RS485 communication and is used for connection to the operation panel, extended panel, etc. For RS485 communication connector 2, 2-wire/4-wire can be switched with <F829: RS485 (2) wiring type>.

For the operation panel, extended panel, etc., set it to 2-wire. In network communication, set it according to the network specification.



Memo

- To use RS485 communication connector 1, remove the operation panel.
- The operation panel and the extension panel cannot be used simultaneously.

■ Pin arrangements of connectors

Both of the RS485 communication connectors are 8-pin RJ45 connectors and the pin arrangements are as shown in the tables below.

- The signal names are the ones based on the inverter side.
- Do not connect to pins that are not on the table.



• Connection of Ethernet to the RS485 communication connectors may result in a malfunction.

1) RS485 communication connector 1

| Signal name | Pin arrangement | Description |
|-------------|-----------------|--------------------|
| DA | 4 | Non-inverting data |
| DB | 5 | Inverting data |
| SG | 8 | Signal ground |

2) RS485 communication connector 2

| Signal name | Pin arrangement | Description |
|-------------|-----------------|--------------------------------|
| RXA | 4 | Non-inverting received data |
| RXB | 5 | Inverting received data |
| TXA | 3 | Non-inverting transmitted data |
| TXB | 6 | Inverting transmitted data |
| SG | 8 | Signal ground |

■ Wiring of RS485 communication

For details, refer to "RS485 Communication Function Instruction Manual".

2. 3. 7 Ethernet connectors

This inverter is equipped with two Ethernet connectors in the positions in the figure below. To use Ethernet, refer to "Ethernet Function Instruction Manual".



• Connection of RS485 communication connectors to Ethernet may result in a malfunction.

2. 4 Cautions for application

This section introduces cautions for use of the motor and inverter, influence of leakage current on peripheral devices, and measures against it.

2. 4. 1 Motor



 Use the inverter that conforms to specifications of the power supply and the three-phase motor to be operated.

If you use the inappropriate inverter, not only will the three-phase motor not rotate correctly, but it will cause serious accidents such as overheating and burning out.

When this inverter and the motor are used in conjunction, pay attention to the following items.

Comparison with commercial power supply operation

This inverter employs the sinusoidal PWM control. However, the output voltage and output current are not perfect sine waves. They have a distorted wave that is close to sinusoidal waveform. This is why there will be a slight increase in motor temperature, noise and vibration, compared to operation with a commercial power supply.

Operation in low-speed range

When running continuously at low speed in conjunction with a general purpose motor, there may be a decline in that motor's cooling effect. If this happens, operate with the output lower than the rated-load.

To carry out low-speed operation continuously at the rated torque, use a constant torque motor. In this case, select "constant torque motor" of "4" -"7" in <OLM: Motor overload protection characteristic>.

For details, refer to [5. 1. 5].

Adjusting motor overload protection level

This inverter has a built-in electronic thermal for motor overload protection. The electronic thermal's reference current is set to the inverter's rated current in default setting, so adjust it in linewith the rated current of the motor being used in combination before operation.

For how to set, refer to [5. 1. 5].

■ High speed operation over 60 Hz

Operating at frequencies over 60 Hz will increase noise and vibration. This may exceed the motor's mechanical strength limits and the bearing limits so you should inquire to the motor's manufacturer about such operation.

Lubricating mechanisms

Operating an oil-lubricated reduction gear and gear motor in the low-speed range will worsen the lubricating effect. Check with the manufacturer of the reduction gear to find out about operable gearing area.

Occurrence of instability (abnormal vibrations and overcurrent trips)

Unstable phenomena such as abnormal vibrations and overcurrent trips may occur depending on combinations of the inverter and motor, and load.

- 1) In the following cases, lower the settings of inverter carrier frequency.
 - · Combined with a motor that is extremely below applicable motor ratings for the inverter
 - Combined with light load with a load factor of 50% or less
 - · Combined with load whose inertial moment is very small
 - · Combined with special motors

For details, refer to [6, 14].

- 2) In the following case, set the S-pattern acceleration/deceleration function (refer to [6. 27. 1]). When vector control is selected, adjust the load moment of inertia ratio (refer to [6. 23. 1] or switch to V/f constant mode (refer to [5. 2. 4]).
 - · Combined with couplings between load devices and motors with high backlash
- 3) When vector control is selected, adjust the load moment of inertia ratio (refer to [6. 23. 1] or switch to V/f constant control (refer to [5. 2. 4]) in the following case.
 - Combined with loads that have sharp fluctuations in rotation such as piston movements

Braking motor when turning off power supply

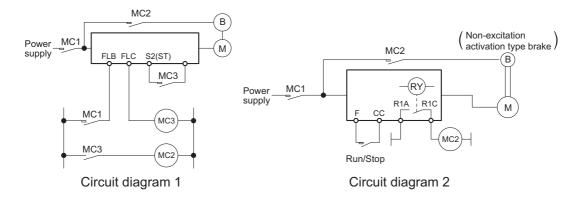
A motor with its power turn off goes into coasting state, and does not stop immediately. To stop the motor quickly as soon as the power is turn off, install an auxiliary brake. There are different kinds of brake devices, both electrical and mechanical. Select the brake that is best for the system.

Load that produces regenerative torque

When combined with a load that produces regenerative torque, the overvoltage or overcurrent protection function may be activated to trip the inverter. Install a braking resistor to deal with it. For details of the braking resistor, refer to [10. 3. 4].

Motors with brake

When motors with a brake are directly connected to the inverter's output, the brake cannot be released at startup because of low voltage. Wire the brake circuit separately from the power circuit.



Circuit diagram 1 is an example in which the standby function is assigned to the terminal [S2]. This circuit can be applied to a machine that mainly operates horizontally. Set the terminal [S2] to "Open" to turn off output of the inverter and have the motor in coasting state. Then, operate the brake. If the brake is operated with inverter output, the inverter may trip due to bound current. Note that when it is applied to a machine with vertical movements, the motor may fall when it is in coasting state.

Circuit diagram 2 is an example in which low-speed signals are assigned to the terminals [R1A]-[R1C]. This circuit can be applied also to a machine with vertical movements. At the time of start, output is made from the inverter while the brake is operating. When the output frequency reaches <F100: Low-speed signal output frequency>, the brake is released by the signal output from the terminals [R1A]-[R1C]. When the machine stops, the inverter comes to deceleration stop. When the output frequency decreases under <F100>, the output signal from the terminals [R1A]-[R1C] becomes off and the brake operates.

Measures to protect motors against surge voltages

In a system in which a 480 V class inverter is used to control the operation of a motor, very high surge voltages may be produced depending on the wire length, wire routing and types of wires used. If such surge voltages are applied repeatedly for a long time, it may cause deterioration of insulation of motor coils.

Here are some examples of measures against surge voltages.

- Decrease <F300: Carrier frequency> of the inverter.
- With 75 kW or less and long wiring (approx. 20 to 100 m) between the inverter and motor, set <F300: Carrier frequency> of the inverter to 4 kHz or less and set <F316: Carrier frequency control> to "2: No decrease, 480 V class" or "3: Valid decrease, 480 V class."
- · Use a motor with high insulation strength.
- Insert an AC reactor or a motor-end surge voltage suppression filter between the inverter and the motor.

2. 4. 2 Inverters

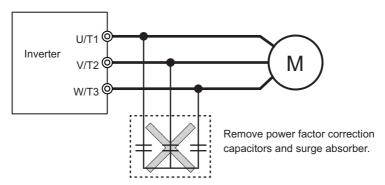
For the inverters to be used, pay attention to the following items.

Inverter capacity

Do not operate a motor whose capacity is larger than the inverter (e.g. a 45 kW motor with a 30 kW inverter), no matter how light the load is. Current ripple will raise the output peak current, making it easier to set off the overcurrent trip.

Power factor correction capacitor

Power factor correction capacitors cannot be installed on the output side of the inverter. To operate a motor with a power factor correction capacitor attached, remove the capacitor. Otherwise, it may cause an inverter malfunction and capacitor destruction.



Power factor correction capacitor

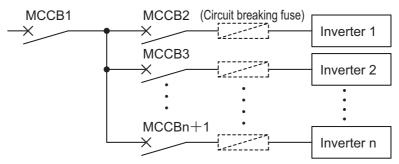
Operating at other than rated voltage

Connections to voltages other than the rated voltage described in the rating label cannot be made. If a connection must be made to a power supply other than one with rated voltage, use a transformer to raise or lower the voltage to the rated voltage.

Selective circuit breaking when two or more inverters are used on the same power line

There is no fuse in the inverter's power circuit. Thus, as the diagram below shows, when more than one inverter is used on the same power line, you must select interrupting characteristics so that only MCCB (MCCB2 to MCCBn+1 in the diagram) install in each inverter will trip and the common MCCB (MCCB1 in the diagram) will not trip when a short occurs in one inverter.

When you cannot select the proper characteristics, install a circuit interrupting fuse on the secondary side of MCCB2 to MCCBn+1.



Selective circuit breaking of inverters

If power supply distortion is not negligible

If the power supply distortion is not negligible because the inverter shares a power distribution line with other systems causing distorted waves, such as systems with thyristors or large-capacity inverters, install an input reactor to improve the input power factor, to reduce higher harmonics, or to suppress external surges.

For details, refer to [10. 3. 1].

■ If multiple inverters are connected with common DC bus link

When inverters are fed by AC power supply and connected with common DC bus link, step-out is generated and ground fault trip may occur. In this case, set <F636: Ground fault trip> = "0: Disabled".

^{*} MCCB: Molded-case circuit breaker

For details, refer to [6. 30. 10].

■ Disposal

To dispose the inverter, refer to [Chapter 16].

2. 4. 3 What to do about leakage current

A CAUTION

· Take countermeasures against leakage current.



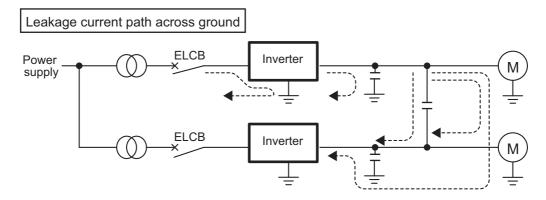
The leakage current through the stray capacitance of the input/output power wires of inverter and motor can affect peripheral devices. In that case, please take countermeasures such as reducing the carrier frequency or shortening the length of input/output power wires. When the total wire length (total length between an inverter and motors) is more than 100m, if the trip occurs with the motor no-load current, make enough space between phase wires or insert the filter (MSF: motor-end surge voltage suppression filter).

Pay attention to the cable length
 In case the total cable length (total of length between an inverter and motors) is 100 m or more,
 a trip can occur even with no-load current. Make enough space among each phase cable or
 install the filter (MSF) as countermeasure.

Measures should be taken for leakage current across ground and leakage current between wires because they may cause a malfunction of peripheral device.

■ Influence of leakage current across ground

Leakage current may flow not just through the inverter system but also through grounding wires to other systems. This leakage current will cause earth leakage breakers (ELCB), leakage current relays, ground relays, fire alarms and sensors to operate improperly, and it will cause superimposed noise on the TV screen or display of incorrect current detection with the CT.



Here are some examples of measures against leakage current across ground.

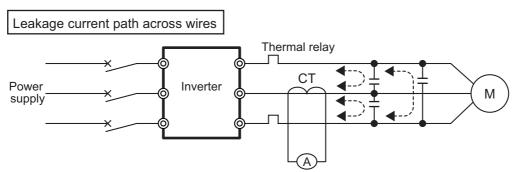
- When there is no radio-noise interference or similar problem, detach the grounding capacitor of the EMC noise filter.
 - For how to switch the grounding capacitor, refer to [2. 3. 4]. In this case, be sure to set <F300: Carrier frequency> to 4 kHz or less for some capacity. If it is over 4kHz, the internal parts of the inverter may be damaged.
- Decrease <F300: Carrier frequency>.
 - For details, refer to [6. 14].
 - However, when a low carrier frequency cannot be set because of increase in magnetic noise from the motor, you can also adopt earth leakage breakers with enhanced measures for inverter. Pleased contact your Toshiba distributor for details.
- Use high frequency remedial products for earth leakage breakers.
 When further measures are required with long wire length, etc., decrease <F300: Carrier frequency>.

Built-in noise filter

The 480 V models of this inverter has a built-in EMC noise filter, so the leakage current value in the delta connection (single-phase grounding) power supply may become greater.

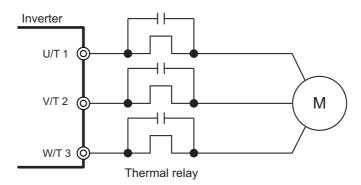
Influence of leakage current across lines (in case of thermal relays)

The high frequency component of current leaking into electrostatic capacity between inverter output wires will increase the effective current values and make externally connected thermal relays operate unnecessarily. When the wires are long (50 m or more) or in case of models with motors of low rated current (several A (ampere) or less), especially the 480 V class low capacity (4.0 kW or less, 5.5 kW or less with ND) models, it will be easy for the external thermal relay to activate unnecessarily, because the ratio of leakage current against the motor rating will increase.



Here are some examples of measures against leakage current across lines.

- Use the electronic thermal of the inverter.
 The setting of the electronic thermal is done with <tHrA: Motor overload protection current 1>. For details, refer to [5. 1. 5].
- Decrease <F300: Carrier frequency>.
 However, note that the motor magnetic noise is increased.
 For details, refer to [6, 14].
- Install 0.1 to 0.5μF 1000 V film capacitor to the input/output terminals of each phase in the thermal relay.



Influence of leakage current across lines (in case of CT and ammeter)

If a CT and ammeter are connected externally to detect inverter output current, the leak current's high frequency component may destroy the ammeter. If the wires are long (50 m or more) or in case of models with motors of low rated current (several A (ampere) or less), especially the 480 V class low capacity (4.0 kW or less, 5.5 kW or less with ND) models, it will be easy for the high frequency component to pass through the externally connected CT and be superimposed on and burn the ammeter, because the ratio of leakage current against the motor's rated current will increase.

Here are some examples of measures against leakage current across lines.

• Connect the ammeter to the terminal [FM] and terminal [AM] of the inverter.

For how to connect the meter and how to set parameters, refer to [5. 2. 6].

- Check the current value with the monitor function. For details, refer to [8. 1. 1].
- Set <F300: Carrier frequency> to 5 kHz or less.
 However, this may increase noise on the motor side.
 For details, refer to [6. 14].

3

[Basic operation] Operation panel and screen display

This chapter introduces the functions of the operation keys on the operation panel and screen display and explains how to operate them.

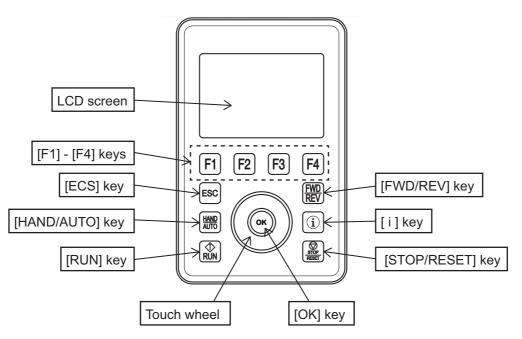
Memo

• The specifications and operation procedure of the operation panel are common to all the types of this inverter.

3. 1 Basic of operation panel

The operation panel allows you to set parameters and monitor the status. This section explains how to operate the operation panel and how to switch four types of display modes.

3. 1. 1 LCD screen and operation keys



LCD screen

This screen displays [Standard mode], [Setting mode], [Monitor mode], and [Easy mode] according to the purpose. When an error occurs, an alarm, trip, etc. are displayed. For details, refer to [3. 1. 2]. Normally, the backlight color is white, but it turns red when a trip occurs. You can adjust the contrast and set screen settings such as automatic off time. For details, refer to [3. 1. 3].

• [F1] - [F4] keys

They are keys to execute functions displayed on the screen.

For details, refer to [■[F1] - [F4] keys] described later in this subsection.

• [ECS] key

This key switches the display mode.

It is also used to return to the previous item of the hierarchy of the screen.

• [HAND/AUTO] key

This key switches between hand (operation panel)/remote (remote control).

It is used to operate the inverter temporarily at hand (operation panel) while performing terminal operation (remote control) normally.

To enable this key, set the parameter <F750: EASY key function>.

For details, refer to [6. 37].

• [RUN] key

This key is used for a run command from the operation panel.

To enable this key, set "1" to the parameter <CMOd: Run command select>.

For details, refer to [5. 1. 1].

• [FWD/REV] key

This key switches between forward run and reverse run of the motor during panel run.

It is enabled when the parameter <CMOd: Run command select> is "1" and <Fr: Panel Fwd/Rev run select> is "2" or "3".

For details, refer to [5. 2. 9].

• [i] key

This key displays information.

Normally, model information is displayed.

- Type
- Multi-rating
- Rated voltage
- Rated output capacity
- Rated output current
- CPU 1 version
- CPU 2 version
- Serial number
- Setting by region

Necessary information is displayed when a trip occurs.

[STOP/RESET] key

This key is used for a stop command from the operation panel.

To enable the stop command by this key, set "1" to the parameter <CMOd: Run command select>.

For details, refer to [5. 1. 1].

Emergency off can be applied to the inverter except when it is operated by the operation panel. When you press this key, **EOFF** blinks. When you press it again, "E" is displayed and the emergency off is applied.

For details, refer to [3. 2. 3].

It is also used as a reset key when a trip occurs. The inverter can be reset by pressing this key twice in succession when a trip occurs.

3-2

For details, refer to [3. 2. 4].

Touch wheel

Slide your finger in a circular motion to change the menu items and values on the screen.

Turning clockwise: To move to the next item or increase the value.

Turning counterclockwise: To move to the previous item or decrease the value.

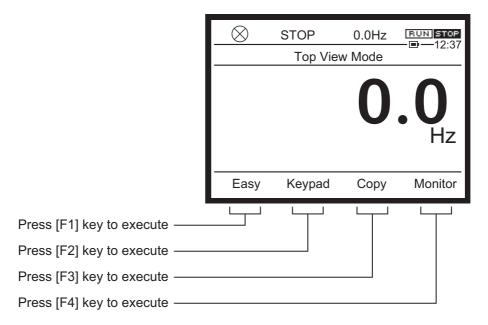
When you lightly touch the top or bottom of the circle, you can move to that direction by one item. For example, if you touch the top of the circle continuously, it works similarly to turning clockwise.

• [OK] key

This key is used to confirm the menu items and values on the screen.

■ [F1] - [F4] keys

The [F1] - [F4] keys are used to execute the items (text, symbol, icon, etc.) displayed on the lower side of the LCD screen.



The [F1] - [F4] keys corresponding to the screen display are as follows.

| Screen display | | n display | | | |
|----------------|----------------------------|-----------|---|------------|--|
| Key | Displayed position Display | | Function | Reference | |
| | | Easy | Displays the screen for [Easy mode] | [3. 1. 2] | |
| | | Тор | Displays the screen for [Standard mode] | [3. 1. 2] | |
| [F1] | Left end | Clear | Clears the monitor peak and minimum hold | [6. 34. 7] | |
| ניין | Leit end | F9 to F8 | Displays parameters of previous hundreds (F900s to F800s) | [4. 2. 1] | |
| | | C9 to C8 | Displays parameters of previous hundreds (C900s to C800s) | [4. 2. 1] | |
| | | X1000 | Sets the far left number | [4. 2. 3] | |

| | Scree | n display | | |
|------|--------------------|-------------|--|------------------------|
| Key | Displayed position | Display | Function | Reference |
| | | Screen | Sets the LCD screen | [3. 1. 3] |
| | | <u>;</u> ģ; | Inverts the backlight color (white or red) | [3. 2. 2] |
| | | Language | Displays the screen for language selection | [3. 1. 3] |
| 1501 | NA: -l-II - I - # | < | Move setting to left | [3. 1. 3] [4. 2. 1] |
| [F2] | Middle left | ♠ | Page up (If there are more than six choices) | - |
| | | Easy | Displays the screen for [Easy mode] | [3. 1. 2] |
| | | Return | Same as [ESC] key (Return to the screen of [Setting mode]) | - |
| | | Change | Displays the setting screen of related parameters | [8. 1. 1] |
| | | X100 | Sets the number second from the left | [4. 2. 3] |
| | | <u>;</u> ġ; | Inverts the backlight color (white or red) | [3. 1. 3] |
| | Middle right | > | Move setting to right | [3. 1. 3] [4. 2. 1] |
| [F3] | | ₩ | Page down (If there are more than six choices) | - |
| [F3] | | R (Back) | Searches backward | [4. 2. 1] |
| | | Setting | Displays the screen for [Setting mode] | [3. 1. 2] |
| | | Return | Same as [ESC] key (Return to the screen of [Monitor mode]) | - |
| | | X10 | Sets the number third from the left | [4. 2. 3] |
| | | Jog | The inverter performs jog run while the key is pressed | [6. 10] |
| | | Monitor | Displays the secreen for [Monitor mode] | [3. 1. 2] |
| | | F2 to F1 | Displays parameters of next hundreds (F200s to F100s) | [4. 2. 1] |
| [F4] | Right end | C1 to C0 | Displays parameters of next hundreds (C100s to C000s) | [4. 2. 1] |
| | | ® | Displays details monitor | [8. 1. 1] |
| | | F (Next) | Searches forward | [4. 2. 1] |
| | | X1 | Sets the far right number | [4. 2. 3] |

3. 1. 2 Display mode

This inverter has four types of display modes.

The display modes can be switched in the following two ways.

- Press the [ESC] key.
- Press any of the [F1] [F4] keys to which the applicable display mode is assigned.

(1) [Standard mode]

- This is the mode that is displayed first power on.
- The operation status (output frequency of the inverter, etc) is always displayed and alarms and trips when they occur.
 - In the default setting, the output frequency is displayed. The display contents can be selected with <F710: Standard mode display>.
- Setting of the panel operation frequency, EASY key function operation, language selection, and screen setting are also made in [Standard mode].

(2) [Setting mode]

- · Parameters are set in this mode.
- · All the parameters are displayed.
- [Easy mode] is also available in which only the registered parameters are displayed.

(3) [Easy mode]

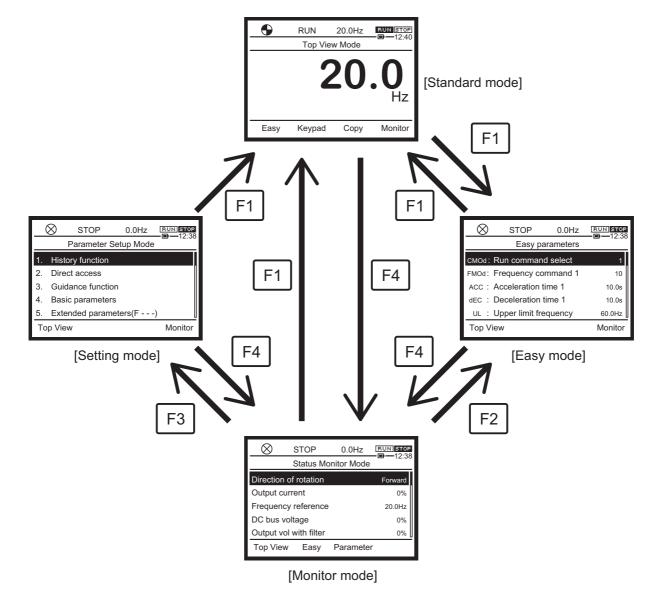
- · Parameters are set in this mode.
- In this mode, only the registered parameters are displayed.

(4) [Monitor mode]

• You can check the status such as the operation status of the inverter and terminal information.

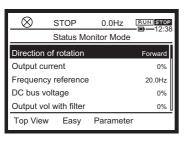
The following are the top screen of each mode and how to switch between them.

When switching with the [F1] - [F4] keys

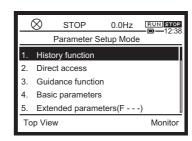


When switching with the [ESC] key



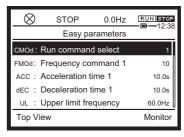


[Monitor mode]



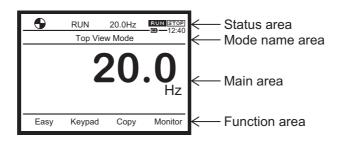
[Setting mode]





[Easy mode]

■ Screen structure

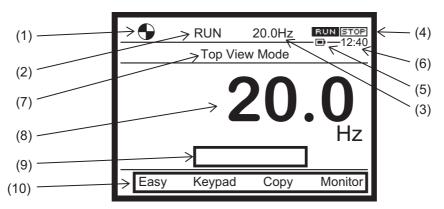


3-6

Screen display of [Standard mode]

This is the normal display mode of the inverter.

(1) - (6) are display contents common to [Standard mode], [Setting mode], [Easy mode], and [Monitor mode].



- (1) The operation status is displayed with the following symbols.
 - (Rotating): In operation (clockwise for forward run, counterclockwise for reverse run)
 - (X): Stop

EUFF(Blinking): Waiting for emergency off applied with the [STOP/RESET] key (when you press the [STOP/RESET] key again while the symbol is blinking, the motor comes to an emergency off)

(2) The operation status is displayed with the following text.

"RUN": During run
"STOP": Stopped

"Trip": Trip has occurred

"JOG": In jog run

(3) The output frequency (default setting) is displayed in Hz. Set the display contents with <F723: Status area display of operation panel>.

For details, refer to [5. 3. 3].

(4) The run commands are displayed with icons.

RUN STOP: Run
RUN STOP: Stop

- (5) The remaining capacity of the battery (■ yes/ □ no) is displayed with icons.
- (6) The current time ("hour/minute") is displayed.
- (7) Current display mode

[Standard mode] is displayed.

(8) Normally, the output frequency (default setting) is displayed. Set the display contents with <F710: Standard mode display>. For details, refer to [5. 3. 3].

When an alarm or trip occurs, its contents are displayed.

- (9) When an alarm or trip occurs, the name of the alarm and a message are also displayed here.
- (10) The functions assigned to the [F1] [F4] keys are displayed.

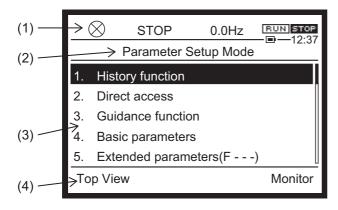
For details, refer to [3. 1. 1].

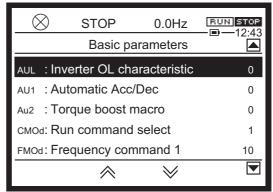
Memo

• When emergency off, alarm, or trip has occurred, refer to [3. 2] and [Chapter 13].

Screen display of [Setting mode]

This is a display mode to set parameters.





Top screen of [Setting mode]

Setting screen of basic parameters

- (1) From the operation status to the current time, this mode has the same display as [Standard mode].
- (2) The current display mode [Setting mode] is displayed.
- (3) The setting items are displayed. One screen can display up to five items.

 Select an item with the touch wheel and press the [OK] key. Then the setting screen is displayed.

 Setting screen of basic parameter>

"Left end": Title

"Middle": Parameter name "Right end": Setting value

(4) The functions assigned to the [F1] - [F4] keys are displayed. For details, refer to [3. 1. 1].

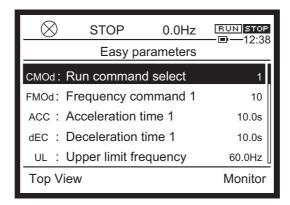
■ Screen display of [Easy mode]

This is a display mode to set parameters easily.

It is displayed in the following cases.

- When "Easy" of the [F1] [F3] keys is pressed in [Standard mode] and [Monitor mode]
- · When [Easy mode] is set in <PSEL: Parameter mode select>

Only the parameters set in <F751: Easy setting 1> - <F782: Easy setting 32>. For details, refer to [5. 1. 8].

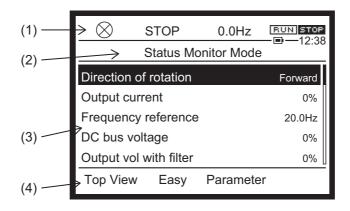


Memo

• For details of how to set parameters, refer to [4. 2. 3].

Screen display of [Monitor mode]

This is a display mode to monitor the inverter status (output current, input voltage, terminal information, etc.).



- (1) From the operation status to the current time, this mode has the same display as [Standard mode].
- (2) The current display mode [Monitor mode] is displayed.
- (3) The monitor items are displayed. One screen can display up to five items.

"Left end": Monitor item name

"Right end": Value, status

Furthermore, if is displayed in the [F4] key when selecting an item with the touch wheel, detailed information is displayed when you press the [OK] key.

(4) The functions assigned to the [F1] - [F4] keys are displayed. For details, refer to [3. 1. 1].

Memo

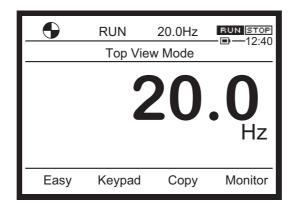
• For details of [Monitor mode], refer to [Chapter 8].

3. 1. 3 Setting of LCD screen



 Note that if power off or a power failure occurs while the setting of the LCD screen is being changed, the LCD screen information is lost, and you may not be able to use the operation panel.

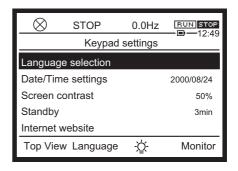
When you press the [F2] key ("Screen") in [Standard mode], the LCD setting screen is displayed. This screen allows various settings of the LCD screen such as selection of display language, setting of current date/time, link to the website, adjustment of contrast, and automatic off time.



LCD screen

The following five items can be set.

- · Selection of display language
- Setting of current date/time (date is displayed at the right end)
- Contrast adjustment of LCD screen (unit: %)
- Automatic off time setting of LCD screen backlight (unit: min)
- · Link to website



Language selection

Select a language to be displayed from the list.

You can select among English, German, Italian, Spanish, Portuguese, Chinese (simplified). (French and Russian are in preparation.)

The default setting is English.

A check mark is display to the right end of the selected language.



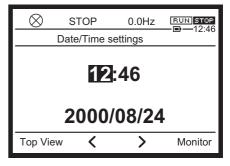
Date/time setting

Set the date and the time.

The time is represented in HH:MM and the date in YYYY/MM/DD.

Set the current time.

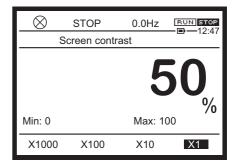
The digits that can be changed are highlighted. Press the [F2] key or [F3] key to shift the highlighted digits. Increase or decrease the value and press the [OK] key.



■ Contrast adjustment

The contrast can be adjusted in the range of 30 -70%. The default setting is 50%.

If you touch the touch wheel, the value in the middle is highlighted. Increase or decrease the value and press the [OK] key.

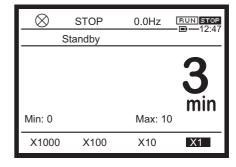


■ Automatic off time

The off time of the backlight can be set in the range of 0 min (always on) - 10 min (off after 10 minutes).

The default setting is 3 min.

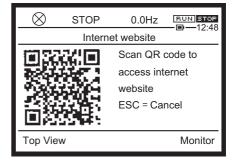
If you touch the touch wheel, the value in the middle is highlighted. Increase or decrease the value and press the [OK] key.



■ Website

Information is displayed.

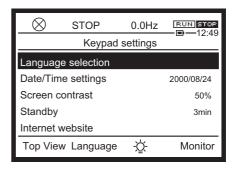
For example, you can access easily from your smartphone to our website by displaying the QR code.



Switching of backlight color

When you press the [F3] key (\tilde{

The color is switched every time you press the key.



Memo

• The LCD screen can be set regardless of the setting of inhibition of parameter change with <F700: Parameter reading&writing access lockout>.

3. 2 Normal/emergency screen display

This section explains the screen display of the operation panel.

When operation such as parameter setting is not performed, the top screen of [Standard mode] is displayed. During run, output frequency, etc. are displayed, and the status of alarm and trip is displayed when an error occurs.

3. 2. 1 Normal display

When the inverter is stopped, the screen on the right is displayed.

Status area

- 🛇 at the left end is stopped
- · As status, "STOP" is displayed.
- The output frequency "0.0 Hz" is displayed (<F723: Status area display of operation panel> = "0: Output frequency")

STOP 0.0Hz FUN STOR 12:37 Top View Mode O O Hz Easy Keypad Copy Monitor

Main area

• The output frequency "0.0 Hz" is displayed

During run of the motor, the screen shown on the right is displayed.

Status area

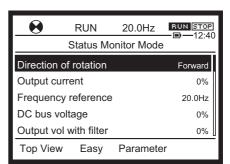
- 🗶 at the left end rotates
- · As status, "RUN" is displayed
- The output frequency ("20.0Hz" in the example on the right) is displayed (<F723: Status area display of operation panel> = "0: Output frequency")

RUN 20.0Hz Top View Mode 20.0Hz Top View Mode 20.0Hz Top View Mode Copy Monitor

Main area

· The output frequency "20.0Hz" is displayed

Even if [Standard mode] is switched to other display mode, you can grasp the operation status from the display in the status area.



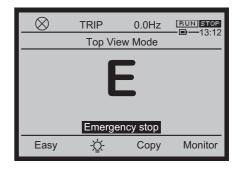
Reference

- When the LCD screen is dark -> Refer to [3. 1. 3]
- To check the output current, input/output voltage, etc. -> Refer to [3. 1. 2], [8. 1. 1]
- To check the setting value of the parameter -> Refer to [3. 1. 2], [4. 2]

3. 2. 2 Display at the time of trip

When a trip occurs, the trip title and trip name blink, and the backlight of the LCD screen turns red to inform you of a trip. Check the cause of the trip and eliminate it.

When you press the [i] key, necessary information is displayed.



Memo

• If you want to return only the backlight from red to white, press the [F2] key.

Reference

- To reset from the operation panel -> Refer to [3. 2. 4]
- To know details of the display at the time of alarm/trip, causes, and measures -> Refer to [Chapter 13]

3. 2. 3 Emergency off

To apply emergency off from the operation panel except when the inverter is operated by the operation panel, follow the procedure below.

For how to apply emergency off by other than the operation panel (digital input, etc.), refer to [6. 30. 4].

1 Press the [STOP/RESET] key.

EOFF blinks at the left end of the status area. In [Standard mode], "Emergency off? (STOP) key" is displayed on the lower side in the main areas. In the cases of "Setting mode" and "Monitor mode," just **EOFF** blinks.



- 2 If you press the [STOP/RESET] key again while EUFF is blinking, the inverter comes to emergency off.
 - The backlight turns red, and "E" blinks.
 - "Trip" is displayed in the second position from the left of the status area.
 - · "Emergency off" is displayed in the main area.



Memo

- The blinking **EOFF** returns to the original display status after few seconds if no operation is performed.. The inverter comes to emergency off only if you press the [STOP/RESET] key while **EOFF** is blinking.
- If you want to return only the backlight from red to white, press the [F2] key.

3. 2. 4 How to reset trip

If a trip occurs, you can reset it with panel operation.

For how to reset a trip by other than the operation panel (digital input, etc.), refer to [13. 1].

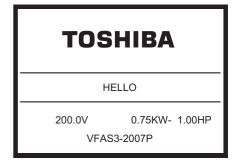
- 1 Press the [STOP/RESET] key with the trip displayed.
 "CLr" blinks in the main area, and "Reset? (STOP) key" is displayed on the lower side.
 - The backlight is red.
 It is white when the setting of the backlight is changed.



2 If you press the [STOP/RESET] key again while "CLr" is blinking, the trip is reset.

The display on the screen once disappears, and the screen immediately after power on is displayed.

The backlight returns to while.





Important

- If the cause of the trip is not eliminated, a trip occurs again even after reset.
- If the trip is caused by overload protection or overheat or when pre-alarm occurs, the trip cannot be reset.
 For details, refer to [13. 1].

Memo

- The blinking "CLr" returns to the trip display after few seconds if no operation is performed. The trip is reset only if you press the [STOP/RESET] key while "CLr" is blinking.
- If you press keys other than the [STOP/RESET], it is considered that reset will not be done, and the screen returns to trip display.

4

[Basic operation] Operation methods of motor

...

П

1

2

3

7

8

1

12

13

14

15

16

A WARNING

- Do not touch terminals when the inverter's power is on even if the motor is stopped. Touching the terminals while voltage is applied will result in electric shock.
- Do not touch switches when the hands are wet and do not try to clean the inverter with a damp cloth

This will result in electric shock.

- When the retry function is selected, stand clear of motors and machines at tripping stop.
- The motors and machines which have stopped due to tripping stop will restart suddenly, and this will result in injury.

Take measures for securing safety even if the motor restarts unexpectedly, such as attaching a cover to the motor.

Do not touch terminals or motor of the inverter while performing auto tuning.

Touching the terminals or motor while voltage is applied to the terminals and motor may result in electric shock, even if the motor is stopped.

After setting offline auto-tuning (F400 = "2"), execute the auto tuning at first start of the inverter. The auto tuning takes several seconds and the motor is stopped meanwhile, but voltage is applied to the terminals and motor. The motor may also generate a sound during the auto tuning, but this is not malfunction.

Do not set the stall prevention level parameters (F601 and F185) extremely low.

If the stall prevention level parameters (F601 and F185) are set at an adjusting the stall prevention level parameters (F601 and F185) are set at an adjusting the stall prevention level parameters (F601 and F185) are set at an adjusting the stall prevention level parameters (F601 and F185) are set at an adjusting the stall prevention level parameters (F601 and F185) are set at an adjusting the stall prevention level parameters (F601 and F185) are set at an adjusting the stall prevention level parameters (F601 and F185) are set at an adjusting the stall prevention level parameters (F601 and F185) are set at an adjusting the stall prevention level parameters (F601 and F185) are set at an adjusting the stall prevention level parameters (F601 and F185) are set at an adjusting the stall prevention level parameters (F601 and F185) are set at an adjusting the stall prevention level parameters (F601 and F185) are set at an adjusting the stall prevention level parameters (F601 and F185) are set at an adjusting the stall prevention level parameters (F601 and F185) are set at a stall prevention level parameters (F601 and F185) are set at a stall prevention level parameters (F601 and F185) are set at a stall prevention level parameters (F601 and F185) are set at a stall prevention level parameters (F601 and F185) are set at a stall prevention level parameters (F601 and F185) are set at a stall prevention level parameters (F601 and F185) are set at a stall prevention level parameters (F601 and F185) are set at a stall prevention level parameters (F601 and F185) are set at a stall prevention level parameters (F601 and F185) are set at a stall prevention level parameters (F601 and F185) are set at a stall prevention level parameters (F601 and F185) are set at a stall prevention level parameters (F601 and F185) are set at a stall prevention level parameters (F601 and F185) are set at a stall prevention level parameters (F601 and F185) are set

If the stall prevention level parameters (F601 and F185) are set at or below the motor no-load current, the stall preventive function will be always enabled and increase the frequency when it judges that regenerative braking is taking place.

Do not set the stall prevention level parameters (F601 and F185) at 30% or less under normal use conditions.

· Turn the power on only after mounting the front cover.

When you use the inverter housed in the cabinet with the front cover removed, always close the cabinet doors first and then turn the power on. If you turn the power on with the front cover or the cabinet doors open, this will result in electric shock.

Make sure that operation instructions are off before resetting the inverter after malfunction.



action

Prohibited

If the inverter is reset while the operation instructions are on, the motor will restart suddenly, resulting in injury.

· Make sure to set the setup menu correctly.

If you set the setup menu incorrectly, this will damage the inverter or cause the inverter to perform unexpected movement.

• Install circuit protection such as the mechanical brake in the crane.

If there is no sufficient circuit protection installed in the crane, insufficient motor torque while auto tuning will cause the machine stalling/falling.

A CAUTION



Observe all allowable operating ranges of motors and machines in use.

Not observing these ranges will result in damage to motors and machines and injury. Please use motors and machines within their respective allowable operating ranges by referring to their respective instruction manuals.

• Use the inverter that conforms to specifications of the power supply and the three-phase motor to be operated.

If you use the inappropriate inverter, not only will the three-phase motor not rotate correctly, but it will cause serious accidents such as overheating and burning out.



· Take countermeasures against leakage current.

The leakage current through the stray capacitance of the input/output power wires of inverter and motor can affect peripheral devices. In that case, please take countermeasures such as reducing the carrier frequency or shortening the length of input/output power wires. When the total wire length (total length between an inverter and motors) is more than 100m, if the trip occurs with the motor no-load current, make enough space between phase wires or insert the filter (MSF: motor-end surge voltage suppression filter).

The operation methods of the motor are panel run, terminal run, and communication run. In any case, parameters should be set in advance.

This chapter explains how to set parameters that are basic of motor operation.

In addition, the basic operation methods for panel run and terminal run are introduced, using examples.

4. 1 To run/stop motor

To run/stop the motor, the following operations are required.

- · Input a run command.
- Input a frequency command (motor speed).
- · Input a stop command.

The operation methods of the motor are panel run, terminal run, and communication run.

To change the motor speed, control the output frequency of the inverter.

With this inverter, the run/stop command and the frequency command can be set individually.

- Set the input method of run/stop (run command) with the parameter <CMOd: Run command select>.
- Set the input method of the frequency command with the parameter <FMOd: Frequency command select 1>.

Set the method to input each command and operate with that method.



• For reasons of safety, some parameters cannot be changed while the inverter is running. For details, refer to [11. 1], [11. 3].

Panel run

On the operation panel, input run/stop (run command) and frequency command.

When you press the [RUN] key on the operation panel, the motor starts running. When you press the [STOP/RESET] key, it is stopped. Set the frequency command with the touch wheel and register it as a setting value of the parameter.

Memo

• For how to switch other operation method to panel run, refer to [4. 3], [5. 1. 1].

Terminal run

The motor is operated with an external signal.

Run/stop the motor with an ON/OFF signal to a digital input terminal. Also, input the frequency command with potentiometer/voltage/current signals to analog input terminals.

Memo

• For how to switch other operation methods to terminal run, refer to [4. 4], [5. 1. 1].

■ Communication run

The motor can be operated with an RS485 communication or Ethernet. Connect cables to RS485 communication connector 1 and 2 for the RS485 communication or to Ethernet connector 1 and 2 for the Ethernet communication. By inserting cassette options (PROFINET, etc.) to optional slots A and B, other communication run is also made possible.

For details, refer to "Communication Function Instruction Manual".

4. 2 Basic setting methods of parameters

This inverter has four kinds of display modes as described in [3. 1. 2]. Switch to [Setting mode] (or [Easy mode]) and set parameters.

On the setting screen of a parameter, the title, name, and setting value of the parameter are displayed. Each parameter has a 4-digit communication number assigned separately from the title.

4. 2. 1 [Setting mode] and [Easy mode]

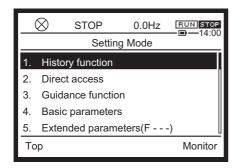
Two parameter setting methods are provided.

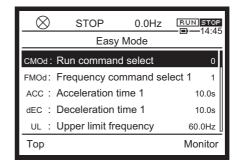
[Easy mode]

- Only ten basic parameters most frequently used are displayed.
- Up to 32 parameters can be registered to be displayed.
- To set parameters not displayed in [Easy mode], set to [Setting mode] to read them out.
- Since parameters registered in [Easy mode] are directly displayed on the [Easy mode] screen, you can check or change them easily.

[Setting mode]

- · This is a mode to set parameters of the inverter.
- All the basic parameters, extended parameters, and other parameters are displayed.





How to switch [Setting mode]/[Easy mode]

To switch between [Setting mode] and [Easy mode], switch to [Standard mode] or [Monitor mode] first.

[Setting mode] -> [Easy mode]

- Switch to [Standard mode] and press the [F1] key ("Easy").
- · Switch to [Monitor mode] and press the [F2] key ("Easy").

[Easy mode] -> [Setting mode]

- · Switch to [Standard mode] and press the [ESC] key.
- · Switch to [Monitor mode] and press the [F3] key ("Setting").

■ [Setting mode]

On the [Setting mode] screen, the following eight items are displayed.

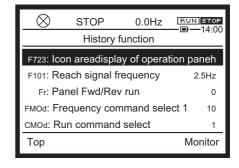
1) History function <AUH>

The history of changed parameters is displayed.

The latest five parameters whose settings have been changed on the operation panel can be searched automatically.

It is a convenient function to immediately change parameters that have been once set or to adjust parameters by changing the setting values little by little.

The changed parameters are displayed regardless of the difference from the default setting values.



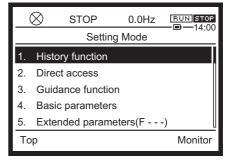
Read the history in the following procedure.

1 Select "1. History function" on the [Setting mode] screen and press the [OK] key.

The history function screen is displayed.

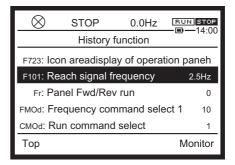
Up to five latest parameters that have been set or changed recently are displayed.

For each parameter, the tile, parameter name, and setting value are displayed in one line.

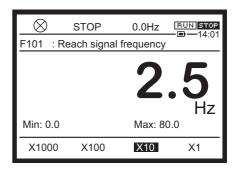


2 Select a parameter you want to change and press the [OK] key.

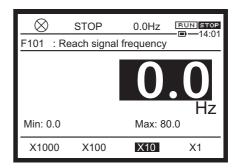
In the example on the right, <F101: Reach signal specified frequency> is selected.



The setting screen of that parameter is opened.

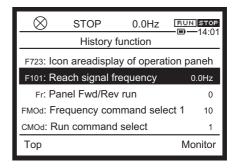


3 Change the setting of the selected parameter and press the [OK] key.



The history function screen is displayed.

When you select the history function next time, the parameter changed most recently is displayed on the top.



4 Press the [ESC] key.

The screen returns to the [Setting mode] screen.

Memo

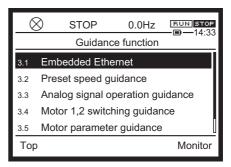
- The following parameters are not displayed in the history function.
 - <FC: Panel run frequency>
 - <AUF: Guidance function>
 - <AUA: Application easy setting>
 - <AUL: Multi-rating select>
 - <AU1: Automatic Acc/Dec>
 - <AU2: Torque boost macro>
 - <SEt: Region setting check>
 - <tyP: Default setting>
 - <F699: Trip for test>
 - <F700: Parameter reading&writing access lockout>
 - <F737: Panel keys lockout>
 - <F738: Password setting>
 - <F739: Password verification>
 - <F899: Communication option reset>

2) Guidance function <AUF>

Parameters required for a special purpose can be displayed as a group and set collectively.

You can set necessary parameters easily by setting parameter groups in turn that are automatically formed for special purposes.

Purpose-specific guidance such as Embedded Ethernet setting, Preset speed operation, Motor 1,2 switching, and Motor parameter is provided.



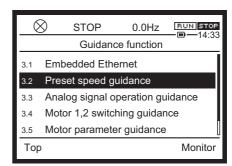
Parameter setting

| Title | Parameter name | Adjustment range | Default setting |
|-------|-------------------|---|--------------------|
| AUF | Guidance function | 0: - 1: Embedded Ethernet setting 2: Preset speed operation 3: Analog frequency command 4: Motor 1,2 switching 5: Motor parameter 6: PM motor parameter | 0 |

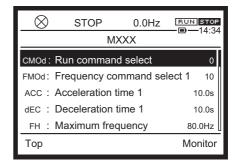
How to use

For example, set preset speed operation in the following procedure.

1 Select Guidance function "2: Preset speed operation" and press the [OK] key.

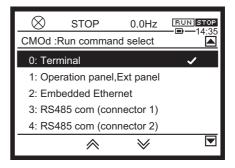


Parameters required for preset speed operation are displayed as a group.



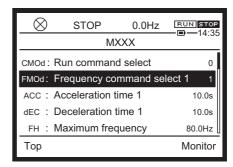
2 Press the [OK] key with <CMOd: Run command select> on the top of the preset speed parameter group screen selected.

The selection screen of <CMOd> is displayed.



When you select <CMOd> and press the [OK] key, the screen returns to the preset speed parameter group screen. Select the next parameter <FMOd: Frequency command select 1> and press the [OK] key.

By setting parameter groups similarly in turn, you can set necessary parameters easily.



List of parameters changeable by guidance function

| Em | Embedded Ethernet setting | | | | |
|------------------------|--|--|--|--|--|
| | <auf>=1</auf> | | | | |
| C081-C096 | Device name 1-16 | | | | |
| C610 | Emb Eth. IP setting mode | | | | |
| C611-C614 | Emb Eth. IP address setting value | | | | |
| C615-C618 | Emb Eth. Subnet mask setting value | | | | |
| C619-C622 | Emb Eth. Default gateway setting value | | | | |
| C629-C632 | Emb Eth. IP address monitor | | | | |
| C633-C636 | Emb Eth. Subnet mask monitor | | | | |
| C637-C640 | Emb Eth. Default gateway monitor | | | | |
| Preset speed operation | | | | | |
| | <auf>=2</auf> | | | | |
| CMOd | Run command select | | | | |
| FMOd | Frequency command select 1 | | | | |
| ACC | Acceleration time 1 | | | | |
| dEC | Deceleration time 1 | | | | |
| FH | Maximum frequency | | | | |
| UL | Upper limit frequency | | | | |
| Sr1-Sr7 | Preset speed 1-7 | | | | |
| F111-F116 | Terminal xx function | | | | |
| F287-F294 | Preset speed 8-15 | | | | |
| Ana | alog frequency command | | | | |
| | <auf>=3</auf> | | | | |
| CMOd | Run command select | | | | |
| FMOd | Frequency command select 1 | | | | |
| ACC | Acceleration time 1 | | | | |
| dEC | Deceleration time 1 | | | | |
| FH | Maximum frequency | | | | |
| UL | Upper limit frequency | | | | |
| LL | Lower limit frequency | | | | |
| F201 | RR point 1 input value | | | | |
| F202 | RR point 1 frequency | | | | |
| F203 | RR point 2 input value | | | | |
| F204 | RR point 2 frequency | | | | |
| F216 | II point 1 input value | | | | |
| F217 | II point 1 frequency | | | | |
| F218 | II point 2 input value | | | | |
| F219 | II point 2 frequency | | | | |

| | Motor 1,2 switching | |
|-----------|---|--|
| | <auf>=4</auf> | |
| vL | Base frequency 1 | |
| vLv | Base frequency voltage 1 | |
| vb | Manual torque boost 1 | |
| tHrA | Motor overload protection current 1 | |
| ACC | Acceleration time 1 | |
| dEC | Deceleration time 1 | |
| F111-F116 | Terminal xx function | |
| F170 | Base frequency 2 | |
| F171 | Base frequency voltage 2 | |
| F172 | Manual torque boost 2 | |
| F182 | - | |
| F185 | Motor overload protection current 2 | |
| F415 | Stall prevention level 2 Motor rated current | |
| F500 | | |
| | Acceleration time 2 | |
| F501 | Deceleration time 2 | |
| F601 | Stall prevention level 1 | |
| | Motor parameter | |
| ř | <auf>=5</auf> | |
| Pt . | V/f pattern | |
| vL | Base frequency | |
| vLv | Base frequency voltage 1 | |
| F405 | Motor rated capacity | |
| F415 | Motor rated current | |
| F417 | Motor rated speed | |
| F400 | Offline auto-tuning | |
| | PM motor parameter | |
| | <auf>=6</auf> | |
| Pt | V/f pattern | |
| vL | Base frequency 1 | |
| vLv | Base frequency voltage 1 | |
| F402 | Automatic torque boost | |
| F405 | Motor rated capacity | |
| F415 | Motor rated current | |
| F417 | Motor rated speed | |
| F458 | Current control response | |
| F460 | Speed control response 1 | |
| F461 | Speed control stabilization coefficient 1 | |
| F462 | Speed reference filter coefficient 1 | |
| F910 | PM step-out detection current level | |
| F911 | PM step-out detection time | |
| F912 | PM q-axis inductance | |
| F913 | PM d-axis inductance | |
| F914 | Parameter for manufacturer | |
| F915 | PM control method | |
| F916 | PM starting current | |
| F917 | IPM maximum torque control | |
| F918 | IPM current phase adjustment | |
| F919 | Parameter for manufacturer | |
| F400 | Offline auto-tuning | |
| . 100 | Chimic date taring | |

3) Basic parameter

Basic parameters for inverter operation are displayed.

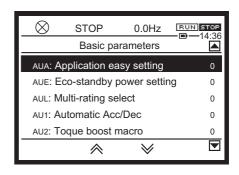
For details, refer to [5. 2], [5. 3], [11. 2].

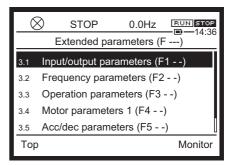
4) Extended parameter (F---)

Extended parameters used for complicated operation, detailed setting, and special applications, etc. are displayed.

Extended parameters are represented as "F" and a 3-digit number.

For details, refer to [5. 3], [Chapter 6], [11. 3].





5) Advanced parameter (A---)

Parameters of My function, etc. that allows simplified programming are displayed.

Advanced parameters are represented as "A" and a 3-digit number.

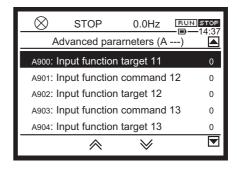
For details, refer to [11. 4].

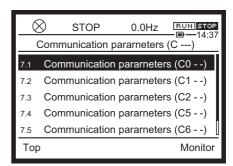
6) Communication parameter (C---)

Parameters with communication function are displayed.

Communication parameters are represented as "C" and a 3-digit number.

For details, refer to [11. 5].

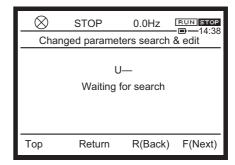




7) Changed parameters search & edit <GrU>

Parameters with values different from the default setting are searched, and the titles and setting values of such parameters are displayed.

The setting values of parameters can be set during search.

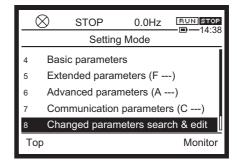


Memo

- Since all the parameters are compared with the default setting values, it may take a few seconds until parameters are displayed.
- · To cancel parameter search, press the [ESC] key.

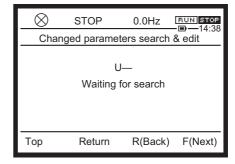
Read the changed parameter in the following procedure.

1 Select "8. Changed parameters search & edit" on the [Setting mode] screen and press the [OK] key.



The Changed parameters search & edit screen is displayed.

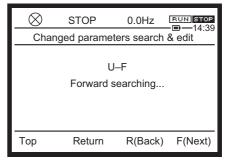
"U--- Waiting for search" is displayed in the main area.



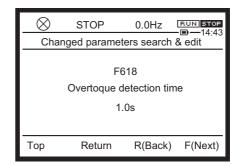
2 Press the [F4] key ("F(Next)"). During search, "U--F Forward searching..." is displayed.

Among the changed parameters, the one with the smallest 4-digit communication number is displayed.

The tile, parameter name, and setting value of the parameter are displayed.

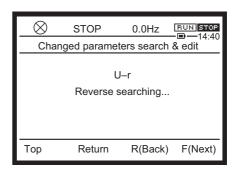


When you press the [F4] key ("F(Next)") repeatedly, the changed parameters are displayed one by one.

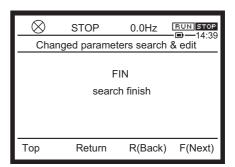


4 When you press the [F3] key ("R(Back)"), the changed parameters are displayed one by one from the one with the biggest communication number.

During search, "U--r Reverse searching..." is displayed.

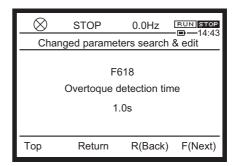


When the parameters have been searched to the last (first) one, "FIN search finish" is displayed.

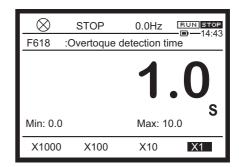


5 Press the [OK] key on the screen of the parameter you want to change.

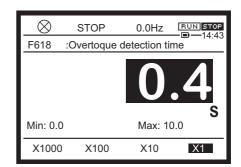
In the example on the right, <F618: Overtorque detection time> is selected.



The setting screen of the parameter is opened.

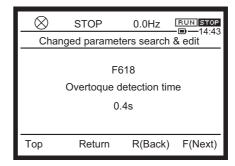


6 Change the setting of the selected parameter and press the [OK] key.



The Changed parameters search & edit screen is displayed. You can check that the parameter has been changed.

You can perform forward/reverse search continuously.



7 Press the [ESC] key or [F2] key ("Return").
The screen returns to the [Setting mode] screen.

Memo

• Even if the value is changed, when it is reset to the value same as the default setting, it is not displayed in Changed parameters search & edit.

• If "3" is set in <tyP: Default setting>, the parameters are all reset to the default setting. However, the values of some parameters are designed not to return to the default setting, considering maintainability. These parameters are not displayed in Changed parameters search & edit. For details of <tyP: Default setting>, refer to [5. 1. 9].



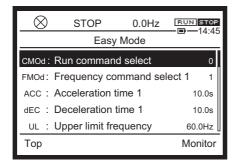
Important

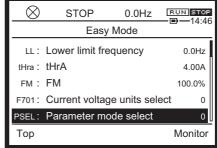
• For reasons of safety, some parameters cannot be changed during run. For details, refer to [11. 2], [11. 3].

■ [Easy mode]

In [Easy mode], basic ten (default setting) parameters are displayed.

Up to 32 parameters can be registered to be displayed.





<CMOd: Run command select>

Set inputs (operation panel, terminal, communication) that give a run command to the inverter. For details, refer to [5. 1. 1].

<FMOd: Frequency command select 1>

Set inputs (operation panel, terminal, communication) that give a frequency command to the inverter.

For details, refer to [5. 1. 1].

<ACC: Acceleration time 1>

Set the time that the output frequency of the inverter takes to reach <FH: Maximum frequency> from 0 Hz.

For details, refer to [5. 1. 4].

<dEC: Deceleration time 1>

Set the time that the output frequency of the inverter takes to decrease to 0 Hz from <FH: Maximum frequency>.

For details, refer to [5. 1. 4].

<UL: Upper limit frequency>

Set the upper limit of the output frequency.

For details, refer to [5. 1. 3].

<LL: Lower limit frequency>

Set the lower limit of the output frequency.

For details, refer to [5. 1. 3].

<tHrA: Motor overload protection current 1>

Set the reference current for protection with electronic thermal.

For details, refer to [5. 1. 5].

<FM: Terminal FM adjustment>

Adjust the scale of the meter connected to the terminal [FM].

For details, refer to [5. 1. 6].

<F701: Current, voltage units select>

Select the unit of current/voltage displayed on the operation panel among % or A (ampere)/V (volt). For details, refer to [5. 1. 7].

<PSEL: Parameter mode select>

Select the parameter mode between [Setting mode] and [Easy mode]. For details, refer to [5. 1. 8].

4. 2. 2 Basic parameters and extended parameters

This inverter has basic parameters and other three types (with F, A, and C) of parameters.

Basic parameter

Basic parameters for inverter operation.

Extended parameter

Parameters used for complicated operation and detailed setting. They are represented as "F" and a 3-digit number.

Advanced parameter

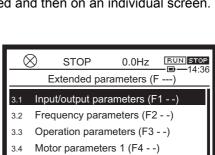
Parameters used for My function, etc. that allows simplified programming. They are represented as "A" and a 3-digit number.

Communication parameter

Parameters to set communication function. They are represented as "C" and a 3-digit number.

Since <F---> and <C---> types includes many parameters, select them on a screen that displays parameters by the hundred and then on an individual screen.

On the selection screen of parameters, titles, parameter names, and setting values (right end) of the parameters are displayed.



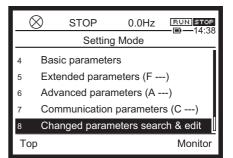
Acc/dec parameters (F5 - -)

Top

4. 2. 3 Basic operation of parameter setting

Set parameters in the following procedure.

Select an item for some parameters and set a value for others.



Monitor

Setting of parameter for which an item should be selected

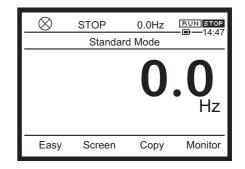
For an example, here is a procedure to set an extended parameter <F710: Standard mode display>.

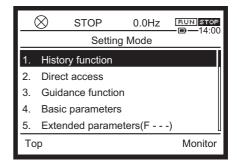
1 Press the [ESC] key to change from [Standard mode] to [Setting mode].

In the example on the right, the operation panel is in [Standard mode], and the output frequency is displayed in the middle of the screen.

- To switch from [Monitor mode], press the [F3] key ("Setting").
- Switch from [Easy mode] to [Standard mode] or [Monitor mode]. For details of switching of display modes, refer to [3. 1. 2].

The [Setting mode] screen is displayed.

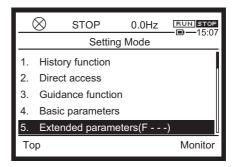




Memo

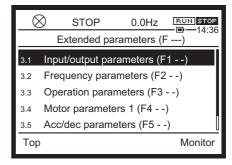
- If [Setting mode] is not displayed on the screen even after the above operation, check the <PSEL: Parameter mode select> setting. When "2: Easy mode only" is set, change the setting. For details, refer to [5. 1. 8].
- 2 Select "5. Extended parameter (F---)" with the touch wheel.

The selected item is highlighted.

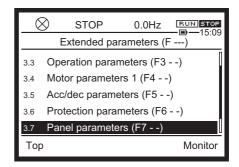


3 Press the [OK] key.

The extended parameter screen is displayed. The screen showing the list of each category with 100 parameters is displayed.

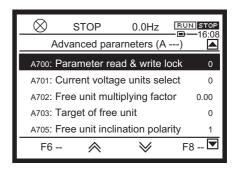


4 Select "3.7. Panel parameter (F7--)" with the touch wheel.



5 Press the [OK] key.

The top screen of the parameters is displayed, starting with <F700: Parameter reading&writing access lockout>.



6 With the [F3] key ₩ and the touch wheel, select <F710: Standard mode display>.

The [F2] key ∧ scrolls up the screen that displays five parameters at a time page by page.

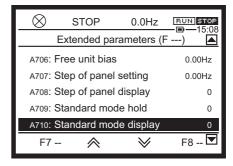
The number displayed at the right end of each item is the current setting value.

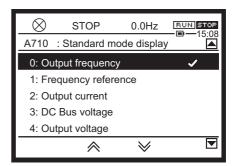
7 Press the [OK] key.

The setting screen of <F710: Standard mode display> is displayed.

The current setting value is highlighted, and a check mark is displayed at the right end.

In the example on the right, "0: Output frequency" is the current setting value.

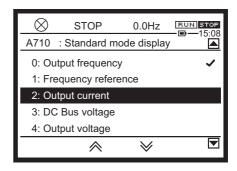




8 Select a new setting value.

Select it by using the touch wheel, the [F2] key \wedge , and the [F3] key \vee .

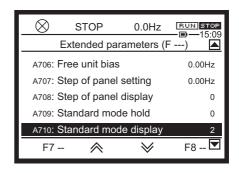
In the example on the right, the setting value is changed to "2: Output current."



9 Press the [OK] key.

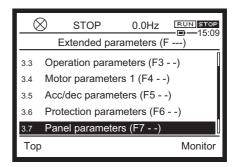
The setting value is changed. The screen display returns to the previous screen (previous one in the hierarchy), and the screen of the panel parameter is displayed.

Check that the number displayed at the right end of the item <F710: Standard mode display> has been changed ("0" -> "2" in the example on the right).



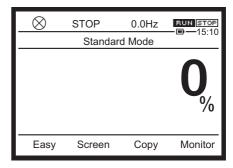
10 Press the [ESC] key.

The screen display returns to the previous one, and the extended parameter screen is displayed.



11 Press the [F1] key ("Standard") and return to [Standard mode].

In the example on the right, the display in [Standard mode] has been changed to output current (displayed in %). When you press the [F4] key/[ESC] key, the mode is switched to [Monitor mode].



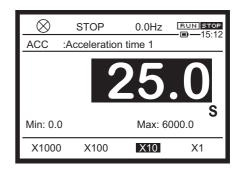
Memo

• For details of the function and adjustment range of <F710: Standard mode display>, refer to [5. 3. 3].

■ With parameters for which a value should be set

For an example, here is a procedure to set the basic parameter <ACC: Acceleration time 1>. At that time, the current setting value, unit, setting lower limit (Min:), and setting upper limit (Max:) are displayed.

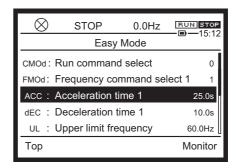
1 Change the value with the touch wheel. When you touch the touch wheel, the value is highlighted, and you can change setting. When highlighted, the setting value is being changed. With the [F1] to [F4] keys, the following digits are changed.



| Key | Display | Meaning | Digit to be changed in this example |
|-----|---------|---|-------------------------------------|
| F1 | x 1000 | Change the digit that is the minimum digit x 1000 | 100 sec |
| F2 | x 100 | Change the digit that is the minimum digit x 100 | 10 sec |
| F3 | x 10 | Change the digit that is the minimum digit x 10 | 1 sec |
| F4 | x 1 | Change the minimum digit of the value displayed | 0.1 sec |

2 Press the [OK] key.

The setting value is changed, and the screen display returns to the previous one.



Memo

• For details of the function and adjustment range of <ACC: Acceleration time 1>, refer to [5. 1. 4].

4-18

4. 3 Basic panel run methods

This section introduces panel run methods with basic examples. Input a run command and a frequency command from the operation panel.

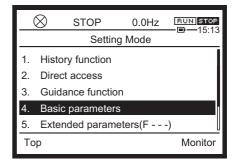
4. 3. 1 [Operation example 1] Operating with [RUN] key/ [STOP] key on operation panel

Operate only with the operation panel.

- First, make setting so that a run command and a frequency command can be input from the operation panel.
- Then, set a frequency command on the operation panel. The motor will rotate with this frequency.
- After setting the above, operate by using the keys on the operation panel.
- The parameters to be set are <CMOd: Run command select> and <FMOd: Frequency command select 1>.

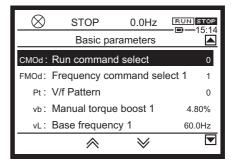
Reference

- How to switch the display mode of the operation panel -> Refer to [3. 1. 2]
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details of <CMOd: Run command select>, and <FMOd: Frequency command select 1> -> Refer to [5. 1]
- To set parameters, switch to [Setting mode].
 Select "4. Basic parameter" and press the [OK] key. The basic parameter screen is displayed.



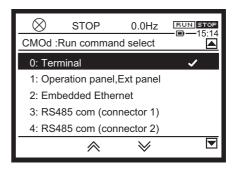
2 Select <CMOd: Run command select> and press the [OK] key.

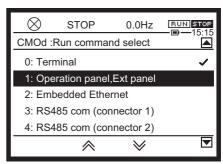
You can also select <CMOd: Run command select> on the [Easy mode] screen.



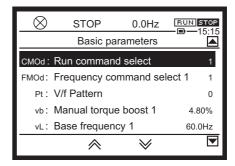
The setting screen is displayed.

3 Select "1: Operation panel, Extension panel" and press the [OK] key.

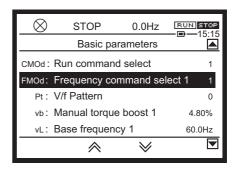




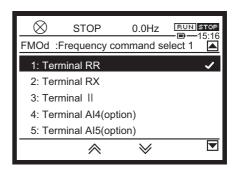
The basic parameter screen is displayed. Check that the setting value of <CMOd: Run command select> is "1."



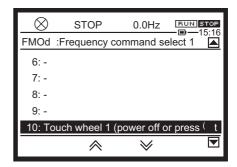
4 Select <FMOd: Frequency command select 1> and press the [OK] key.



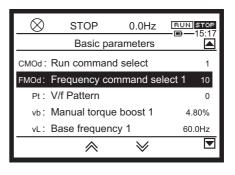
The setting screen is displayed.



5 Select "10: Touch wheel 1 (power off or press OK to save)" and press the [OK] key.

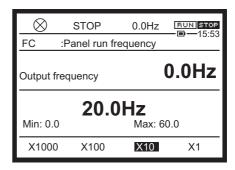


The basic parameter screen is displayed. Check that the setting value of <FMOd: Frequency command select 1> is "10".



- 6 Press the [ESC] key or [F1] to [F4] keys to switch to the [Standard mode] screen.
- 7 In [Standard mode], press the [OK] key. The setting screen of <FC: Panel run frequency> is displayed.

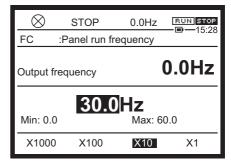
If you leave this setting screen as it is, the screen returns to the [Standard mode] screen for a few seconds later.



8 Change the frequency command value with the touch wheel.

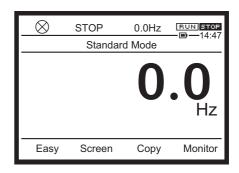
When the setting value is changed, the value on the lower side of the screen is highlighted.

In the example on the right, it is set to 30.0 Hz. This becomes the frequency command value.



9 Press the [OK] key.

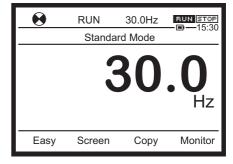
The screen returns to the [Standard mode] screen.



10 When you press the [RUN] key, the motor starts running.

In the main area of the [Standard mode] screen, the output frequency is displayed.

The motor accelerates according to the setting of <ACC: Acceleration time 1>, and its frequency changes to the frequency command value set with <FC: Panel run frequency> and becomes stable. In the example on the right, it is 30.0 Hz.



The following are always displayed in the status area on the upper side of the screen regardless of display mode.

(From the left)

- The icon is rotating
- · Operation status "RUN"
- Output frequency (display contents vary depending on the setting of the parameter)
- Run command icon RUN STOP

Memo

- You can change the frequency command value by pressing the [OK] key in [Standard mode] and displaying the setting screen of <FC: Panel run frequency> during run.
- When you change the frequency command value with the touch wheel, the output frequency changes accordingly.
- 11 To stop the motor, press the [STOP] key.
 The motor decelerates according to the setting of <dEC: Deceleration time 1> and stops.

4. 3. 2 [Operation example 2] Switching forward/reverse run with [FWD/REV] key during panel run

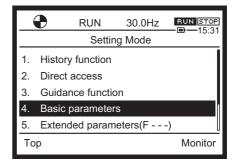
Switch the direction of rotation of the motor during run only by the operation panel.

- Make setting so that forward run/reverse run can be input from the operation panel.
- The parameter to be set is <Fr: Panel Fwd/Rev run select>.

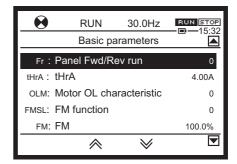
Reference

- How to switch the display mode of the operation panel -> Refer to [3. 1. 2]
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details of <Fr: Panel Fwd/Rev run select> -> Refer to [5. 2. 9]
- 1 Operate the motor with the operation panel according to [4. 3. 1].
- 2 Switch to [Setting mode].
- 3 Select "4. Basic parameter" and press the [OK] kev.

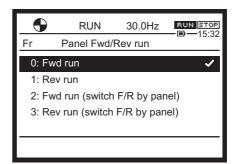
The basic parameter screen is displayed.



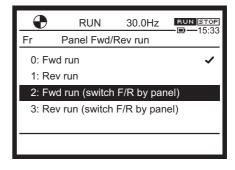
4 Select <Fr: Panel Fwd/Rev run select> and press the [OK] key.



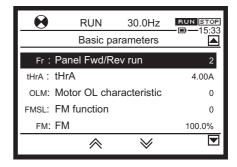
The setting screen is displayed.



5 Select "2: Fwd run (switchable F/R by panel)" and press the [OK] key.



The basic parameter screen is displayed. Check that the setting value of <Fr: Panel Fwd/Rev run select> is "2."



Memo

- · When you select "1: Rev run" and press the [OK] key, the motor decelerates and starts reverse run. [FWD/REV] key operation is not possible.
- Press the [ESC] key or [F1] to [F4] keys to switch to the [Standard mode] screen.
 - Icon of direction of rotation FEV

Only when the [FWD]/[REV] key is enabled, REV



REV is displayed in the mode name area in the upper right of the screen.

When the motor is running forward, REV is



highlighted. When it is running reversely, REV is highlighted.



The following are always displayed in the status area on the upper side of the screen regardless of display mode. (From the left)

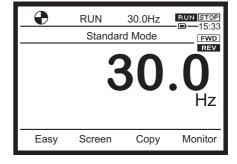
- The icon is rotating (clockwise for forward run)
- · Operation status "RUN"
- · Output frequency (display contents vary depending on the setting of the parameter)
- Run command icon BUN STOP

Memo

- · You can also check the direction of rotation of the motor on the [Monitor mode] screen. For details, refer to [8. 1. 1].
- When you press the [FWD/REV] key, the direction of rotation of the motor is switched to reverse run. The motor decelerates and shows 0.0 Hz once. Then, it accelerates to the frequency command value set with <FC: Panel run frequency> and becomes stable.

You can check the direction of rotation of the motor with the following display.

The icon is rotating counterclockwise



- Icon of direction of rotation REV
- 8 When you press the [FWD/REV] key again, the direction of rotation of the motor is switched to forward run.

The motor decelerates and shows 0.0 Hz once. Then, it accelerates to the value set with <FC: Panel run frequency> and becomes stable.

4. 4 Basic terminal run methods

WARNING



• Do not touch terminals when the inverter's power is on even if the motor is stopped. Touching the terminals while voltage is applied will result in electric shock.

cloth.
This will result in electric shock.

Prohibited



action

• Turn the power on only after mounting the front cover.

When you use the inverter housed in the cabinet with the front cover removed, always close the cabinet doors first and then turn the power on. If you turn the power on with the front cover or the cabinet doors open, this will result in electric shock.

Do not touch switches when the hands are wet and do not try to clean the inverter with a damp

This section introduces terminal run methods with basic examples.

Input a run command and a frequency command from a digital signal (switch/relay, etc.) or analog signal (voltage/current) from the external.

4. 4. 1 [Operation example 1] Run/stop with external signal (frequency command with operation panel)

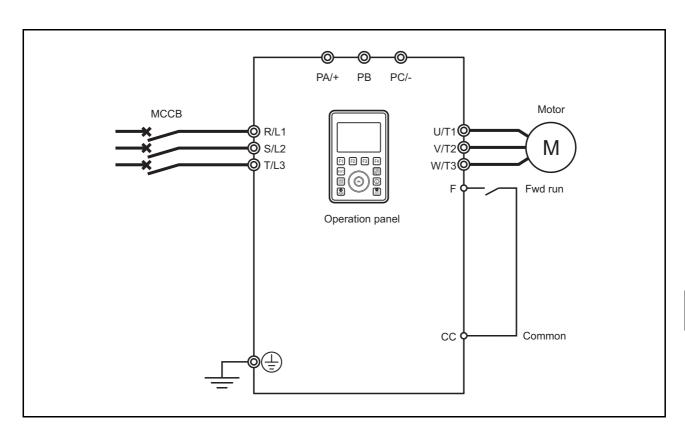
Input a run command externally and a frequency command from the operation panel.

- First, check connection from external contacts such as switch/relays to the control terminal. Here is a case where the operation is controlled by a switch.
- Next, make setting so that a run command can be input externally (terminal) and a frequency command from the operation panel.
- Then, set a frequency command on the operation panel. The motor will run with this frequency.
- After setting the above, operate the motor by using an external switch.
- The parameters to be set are <CMOd: Run command select> and <FMOd: Frequency command select 1>.
- Control connection is explained in the case of sink logic.

Reference

- How to switch the display mode of the operation panel -> Refer to [3. 1. 2]
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details of <CMOd: Run command select>, and <FMOd: Frequency command select 1> -> Refer to [5. 1. 1]
- Difference of connection between sink logic and source logic -> Refer to [2. 3. 5]
- Details of operation by external signals -> Refer to [Chapter 7]

VF-AS3



- 1 Turn off the power of the inverter.
- 2 Remove the covers of the control terminal block and parts required for connection. Covers to be removed vary depending on the type of the inverter.

 For details of how to remove the covers, refer to [2. 2].
- 3 Check that the slide switch [SW1] is on the SINK side.

If it is set to PLC/SOURCE side, set it to the SINK side.

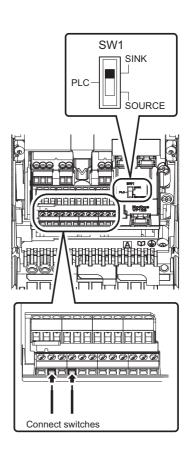
For details of the slide switch, refer to [2. 3. 5].

4 Check connection between the terminal [F] and terminal [CC] of the control terminal block.

The terminal [F] is used for a forward run command in the default setting.

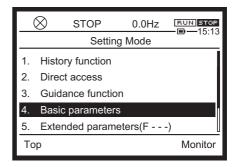
For details of positions of the control terminal block and terminals, refer to [2. 3. 5].

- Mount the covers.For how to mount them, refer to [2. 2].
- 6 Turn on the power of the inverter.



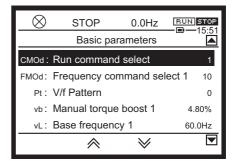
7 Switch to [Setting mode].

Select "4. Basic parameter" and press the [OK] key. The basic parameter screen is displayed.

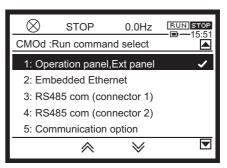


8 Select <CMOd: Run command select> and press the [OK] key.

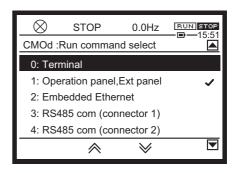
You can also select <CMOd: Run command select> on the [Easy mode] screen.



The setting screen is displayed.



9 Select "0: Terminal" and press the [OK] key.

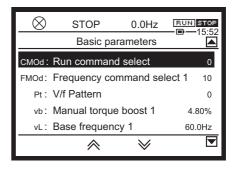


The basic parameter screen is displayed.

Check that the setting value of <CMOd: Run command select> is "0."

10 Select <FMOd: Frequency command select 1> and press the [OK] key.

The setting screen is displayed.



11 Select "10: Touch wheel 1 (power off or press OK to save)" and press the [OK] key.

The basic parameter screen is displayed.

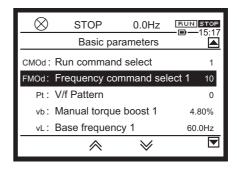
Check that the setting value of <FMOd: Frequency command select 1> is "10".

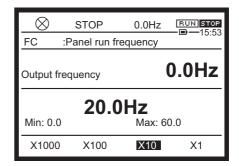
- 12 Press the [ESC] key or [F1] to [F4] keys to switch to the [Standard mode] screen.
- 13 In [Standard mode], press the [OK] key.

 The setting screen of <FC: Panel run frequence.

The setting screen of <FC: Panel run frequency> is displayed.

If you leave this setting screen as it is, the screen returns to the [Standard mode] screen for a few seconds later.

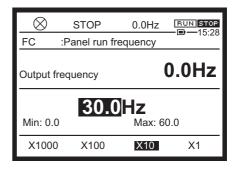




14 Change the frequency command value with the touch wheel.

When the setting value is changed, the value on the lower side of the screen is highlighted.

In the example on the right, it is set to 30.0 Hz. This becomes the frequency command value.



15 Press the [OK] key.

The screen returns to the [Standard mode] screen.



Monitor

16 When you turn on the external switch, the motor starts running.

In the main area of the [Standard mode] screen, the output frequency is displayed.

The motor accelerates according to the setting of <ACC: Acceleration time 1>, and its frequency changes to the frequency command value set with <FC: Panel run frequency> and becomes stable. In the example on the right, it is 30.0 Hz.

The following are always displayed in the status

area on the upper side of the screen regardless of display mode. (From the left)

- The icon is rotating
- Operation status "RUN"
- Output frequency (display contents vary depending on the setting of the parameter)
- Run command icon RUN STOP
- 17 To stop the motor, turn off the external switch.

The motor decelerates according to <dEC: Deceleration time 1> and stops.

Memo

• Reverse run of the motor can be performed by connecting an external contact (switch/relay, etc.) between the terminal [R] and terminal [CC] similarly to the procedure above. For details, refer to [Chapter 7].

A

Fasy

RUN

Screen

30.0Hz

Conv

Standard Mode

4. 4. 2 [Operation example 2] Setting frequency with external potentiometer/analog signal

Input both run command and frequency command externally.

Set the frequency command with a potentiometer connected to outside or a voltage/current signal from outside.

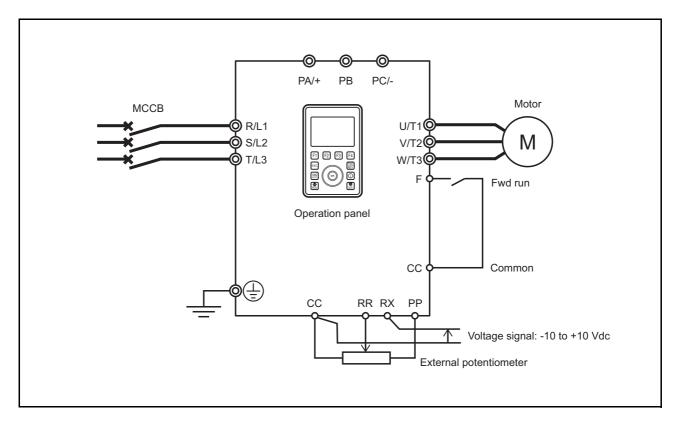
- First, check connection from external contacts such as switch/relays to the control terminal.
- Here is a case where run/stop is input with a switch and a frequency command is input with a potentiometer (1 $10 \text{ k}\Omega$, 1/4 W) or voltage (0 10 Vdc, -10 to +10 Vdc).
- Next, make setting so that a run command and a frequency command can be input externally (terminal).
- After setting the above, operate the motor by using the external switch/potentiometer or voltage signal.
- The parameters to be set are <CMOd: Run command select> and <FMOd: Frequency command select 1>.
- · Control connection is explained in the case of sink logic.

• How to switch the display mode of the operation panel -> Refer to [3. 1. 2]

• Procedure to change parameter setting -> Refer to [4. 2. 3]

Reference

- Details of <CMOd: Run command select>, and <FMOd: Frequency command select 1> -> Refer to [5. 1. 1]
- Difference of connection between sink logic and source logic -> Refer to [2. 3. 5]
- Details of operation by external signals -> Refer to [Chapter 7]



- 1 Turn off the power of the inverter.
- 2 Remove the covers of the control terminal block and parts required for connection. Covers to be removed vary depending on the type of the inverter.

 For details of how to remove the covers, refer to [2. 2].

3 Check that the slide switch [SW1] is on the SINK side

If it is set to PLC/SOURCE side, set it to the SINK side.

For details of the slide switch, refer to [2. 3. 5].

4 Check connection of the terminals to be used on the control terminal block.

For details of positions of the control terminal block and terminals, refer to [2. 3. 5].

Digital input terminals [F], [CC]

 Connect the switch and execute forward run of the motor.

Potentiometer input terminals [PP], [RR], [CC]

 Connect both ends of the potentiometer to the terminal [PP] and terminal [CC], and the sliding terminal to the terminal [RR]. Rotate the potentiometer to change the frequency command.

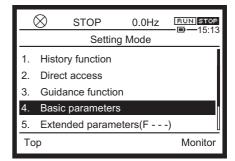
The terminal [PP] is used for a 10 Vdc power supply for analog input.

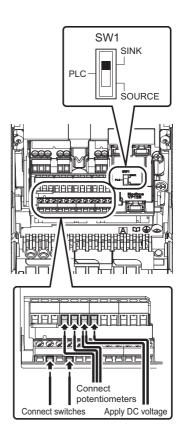
Analog input terminals [RX], [CC]

- Input 0 10 Vdc or -10 to +10 Vdc as a frequency command signal between the terminal [RX] and terminal [CC].
- 5 Mount the covers.

For how to mount them, refer to [2. 2].

- 6 Turn on the power of the inverter.
- 7 Switch to [Setting mode].
 Select "4. Basic parameter" and press the [OK] key. The basic parameter screen is displayed.

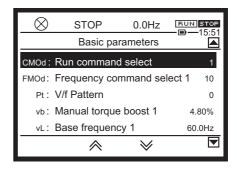


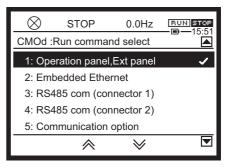


8 Select <CMOd: Run command select> and press the [OK] key.

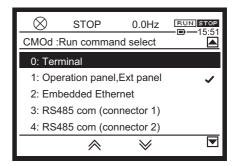
You can also select <CMOd: Run command select> on the [Easy mode] screen.

The setting screen is displayed.

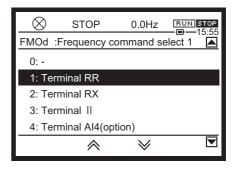




9 Select "0: Terminal" and press the [OK] key. The basic parameter screen is displayed. Check that the setting value of <CMOd: Run command select> is "0."



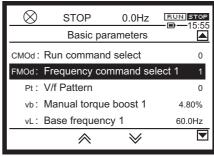
- 10 Select <FMOd: Frequency command select 1> and press the [OK] key. The setting screen is displayed.
- 11 Select "1: Terminal RR" and press the [OK] key.



The basic parameter screen is displayed.

Check that the setting value of <FMOd: Frequency command select 1> is "1."

In this setting, the voltage signal input to the terminal [RR] should be the frequency command. Here, the voltage input to the terminal [RR] is adjusted with the potentiometer.



12 Press the [ESC] key or [F1] to [F4] keys to switch to the [Standard mode] screen.

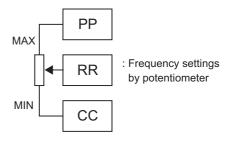
In the main area of the [Standard mode] screen, the output frequency (0.0 Hz) is displayed.

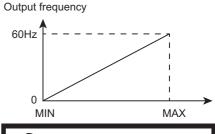
13 Turn on the external switch.

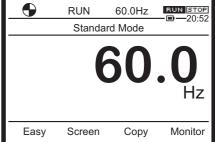
14 When you rotate the potentiometer, the frequency command value increases, and the motor starts running.

The following are always displayed in the status area on the upper side of the screen regardless of display mode. (From the left)

- The icon is rotating
- · Operation status "RUN"
- Output frequency (display contents vary depending on the setting of the parameter)
- Run command icon BUN STOP







Memo

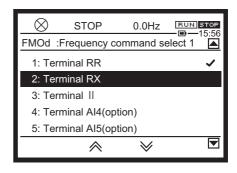
• In some cases, for example, when the potentiometer is set to the maximum/minimum, you can set the two frequency command points. The default setting is 0.0 Hz/60.0 Hz. For details, refer to [7. 3. 2].

15 When you turn off the external switch, the motor decelerates and stops.

16 In [Setting mode], change the setting value of <FMOd: Frequency command select 1> to "2: Terminal RX."

In this setting, set the frequency command with the voltage signal (0 - 10 Vdc or -10 to +10 Vdc) connected to the terminal [RX].

Even if the potentiometer is connected to the terminal [RR], a frequency command by the potentiometer is disabled.

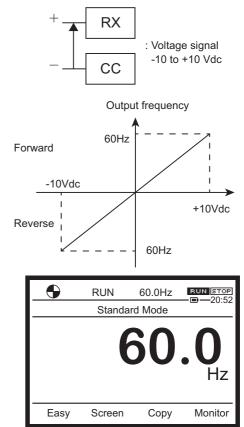


- 17 In [Standard mode], turn on the external switch.
- 18 When the voltage signal is increased from 0 V, the frequency command is increased, and the motor starts running.

By inputting a positive/negative voltage signal, forward run/reverse run can be switched.

The following are always displayed in the status area on the upper side of the screen regardless of display mode. (From the left)

- The 🔊 icon is rotating
- · Operation status "RUN"
- Output frequency (display contents vary depending on the setting of the parameter)
- Run command icon BUN STOP



Memo

 In some cases, for example, when the voltage is set to the minimum (0 V)/maximum (+10 V), you can set the two frequency command points. The default setting is 0 V: 0.0 Hz, 10 V: 60.0 Hz.

For details, refer to [7. 3. 4].

Set the input voltage to the terminal [RX] to "0: 0 - +10 V" or "1: -10 to +10 V" with <F107: Terminal RX input voltage select>.

19 When you turn off the external switch, the motor decelerates and stops.

Memo

• You can also change the input specification of the terminal [RR] to PTC input, etc. For details, refer to [6. 2. 3].

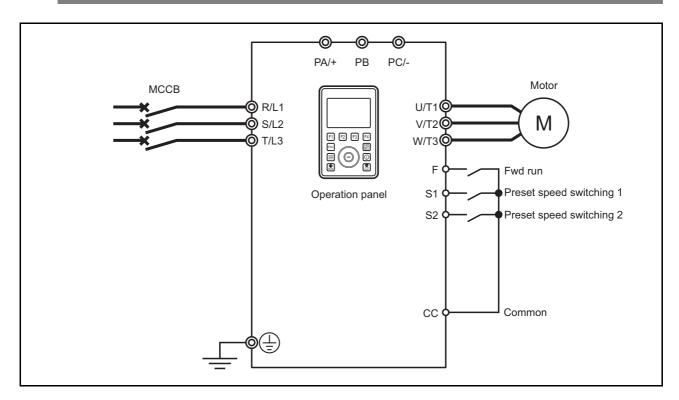
4. 4. 3 [Operation example 3] Switching run/stop and frequency with external switch

Digital input both a run command and a frequency command externally.

- First, check connection from external contacts such as switch/relays to the control terminal. Here is a case where run/stop is input by a switch and a frequency command is operated by 3-speed operation (controlled with two relays).
- Next, make setting so that a run command and a frequency command can be input externally (terminal).
- After setting the above, operate the motor by using the external switch or external signal.
- The parameters to be set are <CMOd: Run command select>, <Sr1: Preset speed 1>, <Sr2: Preset speed 2>, and <Sr3: Preset speed 3>.
- Control connection is explained in the case of sink logic.

Reference

- How to switch the display mode of the operation panel -> Refer to [3. 1. 2]
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details of <CMOd: Run command select> -> Refer to [5. 1. 1]
- Difference of connection between sink logic and source logic -> Refer to [2. 3. 5]
- Details of operation by external signals -> Refer to [Chapter 7]



- 1 Turn off the power of the inverter.
- Remove the covers of the control terminal block and parts required for connection. Covers to be removed vary depending on the type of the inverter.

 For details of how to remove the covers, refer to [2. 2].

3 Check that the slide switch [SW1] is on the SINK side.

If it is set to PLC/SOURCE side, set it to the SINK side.

For details of the slide switch, refer to [2. 3. 5].

4 Check connection of the terminals to be used on the control terminal block.

For details of positions of the control terminal block and terminals, refer to [2. 3. 5].

Digital input terminals [F], [CC]

 Connect the switch and execute forward run of the motor.

Digital input terminals [S1], [CC]

• Connect relay 1 to perform preset speed operation.

Digital input terminals [S2], [CC]

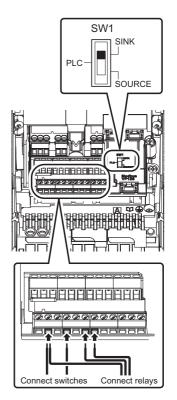
• Connect relay 2 to perform preset speed operation.



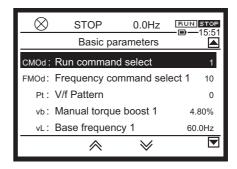
- With combination of relay 1 ON, relay 2 ON, and both relay 1 and relay 2 ON, you can set three types of frequency command values.
- 5 Mount the covers.

For how to mount them, refer to [2. 2].

- 6 Turn on the power of the inverter.
- 7 Switch to [Setting mode].
- 8 Select "4. Basic parameter" and press the [OK] key. The basic parameter screen is displayed.

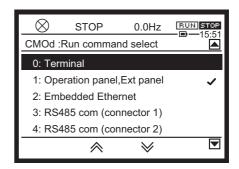


9 Select <CMOd: Run command select> and press the [OK] key.



The setting screen is displayed.

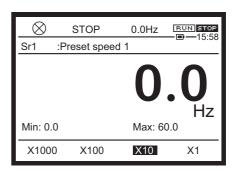
10 Select "0: Terminal" and press the [OK] key. The basic parameter screen is displayed. Check that the setting value of <CMOd: Run command select> is "0."



11 Select <Sr1: Preset speed 1> and press the [OK] key.

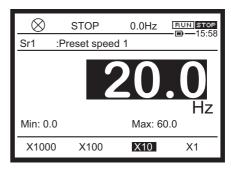
The setting screen is displayed.

The default setting is 0.0 Hz.



12 Change the setting value with the touch wheel. When the setting value is changed, the value on the screen is highlighted.

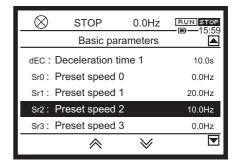
In the example on the right, it is set to 20.0Hz. This is the frequency command value of Preset speed 1.



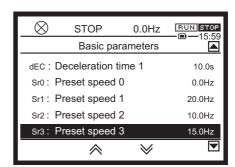
13 Press the [OK] key.

The screen returns to the basic parameter screen.

14 Similarly, select <Sr2: Preset speed 2> and <Sr3: Preset speed 3> and change the setting values.



In the example on the right, <Sr2: Preset speed 2> is set to 10.0 Hz and <Sr3: Preset speed 3> to 15.0 Hz.



- 15 Press the [OK] key to return to the basic parameter screen.
- 16 Turn on the external switch. Leave the two relays off.
- 17 When you turn on relay 1, the frequency command value of <Sr1> is enabled, and the motor starts running.

In the main area of the [Standard mode] screen, the output frequency is displayed.

The output frequency changes to the frequency command value set with <Sr1: Preset speed 1> and becomes stable.

In the example on the right, it is 20.0 Hz.

RUN 20.0Hz
Standard Mode

20.0Hz
P-20:51

Standard Mode

Authorization

Easy Screen Copy Monitor

Output frequency

<Sr1>

The following are always displayed in the status area on the upper side of the screen regardless of display mode. (From the left)

- The 🛣 icon is rotating
- · Operation status "RUN"
- Output frequency (display contents vary depending on the setting of the parameter)
- Run command icon BUN STOP

18 When you turn on relay 2 with relay 1 on, the frequency command value of <Sr3> is enabled, and the output frequency changes.

0 Time

[F]-[CC] ON OFF

[S1]-[CC] ON OFF

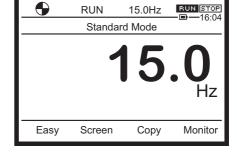
[S2]-[CC] ON OFF

<Sr3>

The output frequency changes to the frequency command value set with <Sr3: Preset speed 3> and becomes stable.

In the example on the right, it is 15.0 Hz.

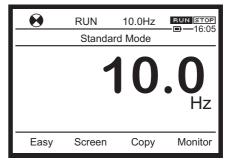
19 When you turn off relay 1 with relay 2 on, the frequency command value of <Sr2> is enabled, and the output frequency changes.



The output frequency changes to the frequency command value set with <Sr2: Preset speed 2> and becomes stable.

In the example on the right, it is 10.0 Hz.

20 When you turn off the external switch, the motor decelerates and stops.



Memo

• For details of preset speed operation, refer to [5. 2. 7].

5

[Fundamental operation] How to use parameters

Frequently set parameters include default 10 parameters in [Easy mode] and basic parameters. This chapter describes these parameters.

5. 1 Settings of main parameters

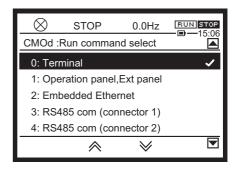
This section describes how to select run and frequency commands required for operating the motor, how to limit the output frequency, how to set acceleration/deceleration time, how to set the electronic thermal for motor protection, and how to adjust the meter.

5. 1. 1 Selecting how to input run and frequency commands

(1) Selecting how to input run/stop

<CMOd: Run command select>





Function

Select where to input a run command to the inverter.

■ Parameter setting

| Title | Parameter name | Adjustment range | Default setting |
|-------|--------------------|--|--------------------|
| CMOd | Run command select | O: Terminal 1: Operation panel, Extension panel 2: Embedded Ethernet 3: RS485 communication (connector 1) 4: RS485 communication (connector 2) 5: Communication option | 0 |

Selecting a setting value

0: Terminal

Run/stop the inverter with an external ON/OFF signal.

For how to set terminals and parameters to be used, refer to [4.4].

Π

3

4

5

7

8

9

12

13

14

15

16

For details of operation by external signals, refer to [Chapter 7].

1: Operation panel, Extension panel

Press the [RUN], [STOP] key on the operation panel to run/stop the inverter.

You can do it even on the optional extension panel.

For how to set this value, refer to [4. 3].

2: Embedded Ethernet

Connect a communication cable to the Ethernet connector 1 or 2, and run/stop the inverter through the Ethernet communication.

For details, refer to "Communication Function Instruction Manual".

3: RS485 communication (connector 1)

This has the operation panel mounted when shipped from the factory. Remove the operation panel and connect a communication cable, and you can run/stop the inverter through the RS485 communication.

For details, refer to [0].

4: RS485 communication (connector 2)

Connect a communication cable to the RS485 communication connector 2 next to the control terminal block. Then, you can run/stop the inverter through the RS485 communication. For details, refer to [6, 38].

5: Communication option

Run/stop the inverter with a communication option command.

For details, refer to "Communication Function Instruction Manual".

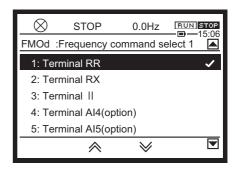
Memo

- Assign the input terminal function "108: Terminal operation priority" to an unused input terminal.
 When the input terminal is ON, run command is terminal run.
 - For details, refer to the table of input terminal functions in [7. 2. 1] or [11. 8].
- The priority command from the communication or terminal precedes the command set with <CMOd: Run command select>.

(2) Selecting how to input a frequency command

<FMOd: Frequency command select 1>





■ Function

Select where to input a frequency command to the inverter.

Parameter setting

| Title | Parameter name | Adjustment range | Default setting |
|-------|----------------------------|--|--------------------|
| FMOd | Frequency command select 1 | 0: - 1: Terminal RR 2: Terminal RX 3: Terminal II 4: Terminal Al4 (option) 5: Terminal Al5 (option) 6 - 9: - 10: Touch wheel 1 (power off or press OK to save) 11: Touch wheel 2 (press OK to save) 12: Sr0 13, 14: - 15: Terminal Up/Down frequency 16: Pulse train 17: High resolution pulse train (option) 18, 19: - 20: Embedded Ethernet 21: RS485 communication (connector 1) 22: RS485 communication (connector 2) 23: Communication option | 1 |

Selecting a setting value

1: Terminal RR

Analog signal: Input a frequency command with 0 - 10 Vdc.

For details of the control terminal, refer to [2. 3. 5].

For details of operation by external signals, refer to "Chapter 7".

2: Terminal RX

Analog signal: Input a frequency command with -10 to +10Vdc.

For details of the control terminal, refer to [2. 3. 5].

For details of operation by external signals, refer to "Chapter 7".

3: Terminal II

Analog signal: Input a frequency command with 4 - 20 mAdc (0 - 20 mAdc).

For details of the control terminal, refer to [2. 3. 5].

For details of operation by external signals, refer to "Chapter 7".

4: Terminal Al4 (option)

The terminal [Al4] is included in the cassette option. Input a frequency command with an analog signal.

For details of the optional terminal [Al4], refer to [10. 4. 1].

5: Terminal Al5 (option)

The terminal [Al5] is included in the cassette option. Input a frequency command with an analog signal. For details of the optional terminal [Al5], refer to [10. 4. 1].

10: Touch wheel 1 (power off or press OK to save)

Use the touch wheel on the operation panel to input a frequency command.

Even if you turn off the power supply without pressing the [OK] key, a frequency command value will be saved.

On the extension panel, use the up and down arrow keys to input a frequency command.

Even if you turn off the power supply without pressing the [ENT] key, a frequency command value will be saved.

For how to set this value, refer to [4. 3. 1] and [4. 4. 1].

11: Touch wheel 2 (press OK to save)

Use the touch wheel on the operation panel to input a frequency command.

Press the [OK] key, and a frequency command value will be saved.

On the extension panel, use the up and down arrow keys to input a frequency command.

Press the [ENT] key, a frequency command value will be saved.

For how to set this value, refer to [4. 3. 1] and [4. 4. 1].

12: Sr0

Set the value of the parameter <Sr0: Preset speed 0> as a setting value of a frequency command. For details of <Sr0: Preset speed 0>, refer to [5. 2. 7].

15: Terminal Up/Down frequency

Input a frequency command with an Up/Down command to the input terminal.

For details of how to set parameters and terminals, refer to [6. 6. 5].

16: Pulse train

Input a frequency command with a pulse train signal (up to 30 kpps) to the terminals [S4] and [S5]. For how to set this value, refer to [6. 6. 4].

17: High resolution pulse train (option)

Input a frequency command with a high resolution pulse train signal to the input terminal.

20: Embedded Ethernet

Connect a communication cable to the Ethernet connector 1 or 2, and input a frequency command through the Ethernet communication.

For details, refer to "Communication Function Instruction Manual".

21: RS485 communication (connector 1)

Remove the operation panel, connect a communication cable, and input a frequency command through the RS485 communication.

For details, refer to [6. 38].

22: RS485 communication (connector 2)

Connect a communication cable to the RS485 communication connector 2 next to the control terminal block, and input a frequency command through the RS485 communication.

For details, refer to [6. 38].

23: Communication option

Input a frequency command with a communication option command.

For details, refer to "Communication Function Instruction Manual".

- The following functions set for the input terminal are always enabled regardless of the settings of <CMOd: Run command select> and <FMOd: Frequency command select 1>.
 - Reset (enabled at trip only)
 - Standby
 - External thermal trip
 - Coast stop command
- Set <CMOd: Run command select> and <FMOd: Frequency command select 1> after stopping the inverter.

You cannot set them during run.

However, when <F736: CMOd/FMOd change lockout during run> is set to "0: Unlocked", you can change them during run. For details, refer to [6. 34. 1].

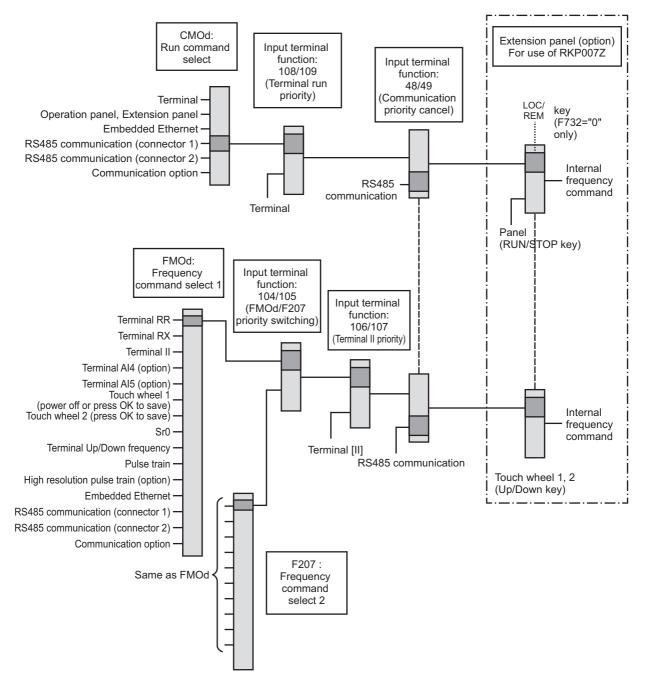
- The priority command from the communication or terminal precedes the setting of <FMOd: Frequency command selection 1>.
- <F207: Frequency command select 2> is provided.

Use <FMOd: Frequency command select 1> in the default setting. However, you can switch between two frequency command selections. For details, refer to [5. 3. 1].

Memo

(3) Example of switching run and frequency commands

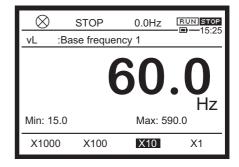
The figure below shows an example of switching run and frequency commands.



5. 1. 2 Setting rated frequency and rated voltage of motor

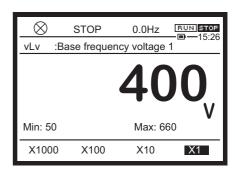
<vL: Base frequency 1>

Basic parameter



<vLv: Base frequency voltage 1>

Basic parameter



■ Function

These parameters are used to set the rated frequency and rated voltage of the motor according to machinery. They are important parameters to decide the control range of the inverter.

Parameter setting

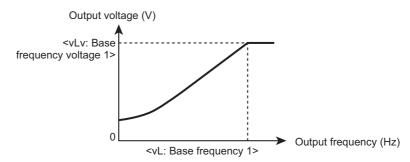
| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|--------------------------|--|------|-----------------|
| vL | Base frequency 1 | 15.0 - 590.0 | Hz | 50.0/60.0 *1 |
| vLv | Base frequency voltage 1 | 240V class: 50-330 480V class: 50-660 | V | *1 |

^{*1} Depending on the setup menu. Refer to [5. 2. 10].

■ Reference of setting

Set the rated frequency (50 Hz, 60 Hz, etc.) and rated voltage (200 V, 220 V, etc.) of the motor according to the specifications of machinery.

The inverter is controlled based on the rating of the motor specified with these parameters.



Memo

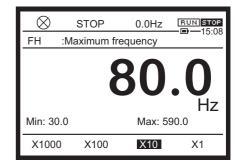
• You can set four types of motor rating. For details including <F170: Base frequency 2>, refer to [6. 4].

5. 1. 3 Setting the output frequency limit

(1) Setting the maximum frequency of the inverter

<FH: Maximum frequency>

Basic parameter



■ Function

Set the maximum value of the frequency output from the inverter. This frequency is also the criteria of acceleration and deceleration time.

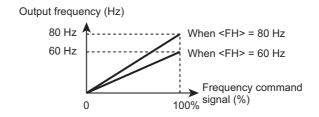
Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|-------------------|------------------|------|--------------------|
| FH | Maximum frequency | 30.0 - 590.0 | Hz | 80.0 *1 |

^{*1} Depending on the setup menu. Refer to [5. 2. 10].

Guideline for the setting

Set the maximum frequency suited for the rating of the motor and load.

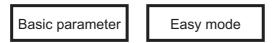


Memo

- Set <FH: Maximum frequency> after stopping the inverter. You cannot set it during run.
- When increasing the value of <FH: Maximum frequency>, you should also set the corresponding value of <UL: Upper limit frequency> as required. --> Refer to the following "Setting the upper and lower limits of the output frequency".

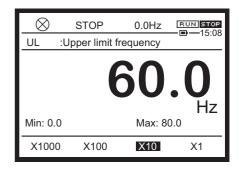
(2) Setting the upper and lower limits of the output frequency

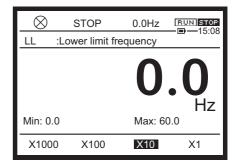
<UL: Upper limit frequency>



<LL: Lower limit frequency>







■ Function

Set the upper limit frequency to decide the upper limit of the output frequency and the lower limit frequency to decide the lower limit.

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|-----------------------|------------------|------|--------------------|
| UL | Upper limit frequency | 0.0 - FH | Hz | 50.0/60.0 *1 |
| LL | Lower limit frequency | 0.0 - UL | Hz | 0.0 |

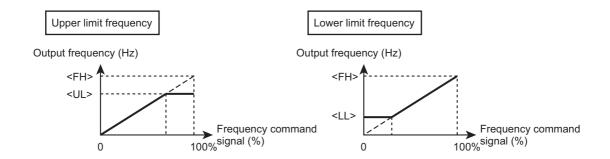
^{*1} Depending on the setup menu. Refer to [5. 2. 10].

Guideline for the setting

Set <UL: Upper limit frequency> to a value which is ten times or less the values of <vL: Base frequency 1>.

If a value exceeding this limit is set, the "A-05" alarm will appear, and the value of the output frequency will be limited to a value which is 10 times the value of <vL: Base frequency 1>.

The same holds for Base frequency 2 - 4. (Refer to [6. 4].)



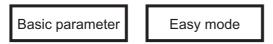
Memo

• Frequencies under the setting value of <F240: Start frequency> are not output. --> Refer to [6. 7. 1].

• During operation of the stall prevention, the inverter may run at the frequency exceeding the value of <UL: Upper limit frequency> or the frequency under the value of <LL: Lower limit frequency>.

5. 1. 4 Setting acceleration/deceleration time

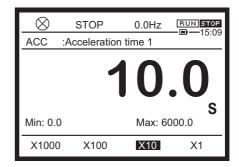
<ACC: Acceleration time 1>

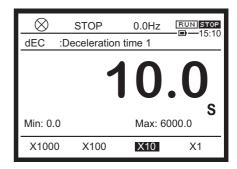


<dEC: Deceleration time 1>

Basic parameter

Easy mode





■ Function

Set a time for acceleration and deceleration.

In <ACC: Acceleration time 1>, set a time before the output frequency of the inverter reaches the value of <FH: Maximum frequency> from 0.0 Hz.

In <dEC: Deceleration time 1>, set a time before the output frequency of the inverter decreases to 0.0 Hz from the value of <FH: Maximum frequency>.

Unit for a setting time is selected with <F519: Unit of Acc/Dec time>.

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|---------------------|--------------------|------|-----------------|
| ACC | Acceleration time 1 | 0.0 - 6000 (600.0) | S | *1 |
| dEC | Deceleration time 1 | 0.0 - 6000 (600.0) | S | *1 |

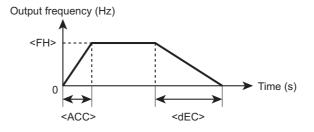
^{*1} The default is 10.0/30.0/60.0 (s) depending on the capacity. Refer to [11. 6].

| Title | Parameter name | Adjustment range | Default setting |
|-------|----------------------|---|--------------------|
| F519 | Unit of Acc/Dec time | 0: - 1: 0.01s unit (0 after execution) 2: 0.1s unit (0 after execution) | 0 |

■ Guideline for the setting

The criteria of acceleration time and deceleration time is the value of <FH: Maximum frequency>. Note that it is not the value of <UL: Upper limit frequency>.

You can use <F519: Unit of Acc/Dec time> to switch the unit of setting time between 0.1s and 0.01s. With acceleration/deceleration time set to 0.0 second, the unit of 0.05 second is used internally for <F519> is "2: 0.1s unit" (default setting), and the unit of 0.01 second for <F519> is "1: 0.01s unit".



 When you set a time shorter than the optimum acceleration/deceleration time determined by the load condition, the stall prevention action may cause the acceleration/deceleration time to be longer than the setting value.

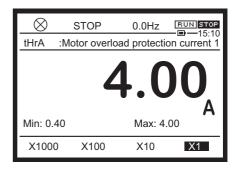
Memo

- If you set a further shorter acceleration/deceleration time, the inverter may stop due to an overcurrent trip or overvoltage trip for protection. For details, refer to "Chapter 13".
- The stop methods of the motor are the deceleration stop by <dEC: Deceleration time 1> or the coast stop. For details, refer to [6. 3. 1].
- You can set four types of options for each acceleration and deceleration time. For Acceleration time 2 through 4 and Deceleration time 2 through 4, refer to [6. 27. 2].

5. 1. 5 Protecting the motor from overload

<tHrA: Motor overload protection current 1>

Basic parameter Easy mode



■ Function

Set a protection characteristic of the electronic thermal suited for the rating and characteristic of the motor. The electronic thermal operates based on the set current value, and any trip occurs. This will protect the motor.

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|-------------------------------------|--------------------------|------|-----------------|
| tHrA | Motor overload protection current 1 | Depending on capacity *1 | Α | *1 |

^{*1} Depending on the capacity. Refer to [11. 6].

Reference of setting

Set <tHrA> suited for the motor rated current. Set necessary parameters for the used motor or operation.

■ Selecting a motor type and protective function: <OLM: Motor overload protection characteristic>, <F606: Motor overload reduction frequency threshold>

Select a motor type and whether the motor overload trip "OL2" and overload stall are enabled or disabled.

The inverter overload trip "OL1" is always detected to protect the inverter.

| Title | Parameter name | Adjustment range Unit | | Default setting |
|-------|--|---|----|--------------------|
| OLM | Motor overload protection characteristic | 0: Standard motor, OL2, No stall 1: Standard motor, OL2, Stall 2: Standard motor, No OL2 trip, No stall 3: Standard motor, No OL2 trip, Stall 4: Constant torque motor, OL2, No stall 5: Constant torque motor, OL2, Stall 6: Constant torque motor, No OL2 trip, No stall 7: Constant torque motor, No OL2 trip, Stall | | 0 |
| F606 | Motor overload reduction frequency threshold | 0.0 - 60.0 | Hz | 6.0 |

What is overload stall?

Memo

• The overload stall function can apply to variable torque characteristic load where a lower frequency reduces load current, such as a fan, pump, and blower.

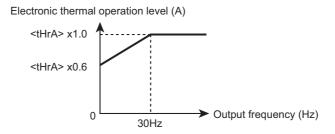
When the inverter detects overload, this function automatically lowers the output frequency before the motor overload trip "OL2" occurs. This function enables you to run the inverter at the frequency where load current balances. As a result, the inverter can continue to run without trip.

• Do not apply the overload stall function to constant torque characteristic load (load with constant load current regardless of the frequency, for example, in a conveyor).

1) When the general purpose motor is used

When the motor runs at low speed (low frequency), its cooling effect will degrade. To prevent overheat of the motor caused by this problem, the inverter starts to detect overload earlier than usual when using the general purpose motor.

<OLM: Motor overload protection characteristic> = "0" to "3"



The reduction start frequency of the electronic thermal is fixed to 30 Hz.

2) When the constant-torque motor is used

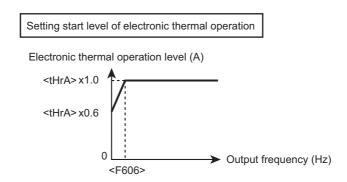
The constant-torque motor can run at constant torque at lower speed (lower frequency) compared to the general purpose motor. However, an extremely low speed will cause the cooling effect of the motor to decrease.

Set the value of <F606: Motor overload reduction frequency threshold> suited for the motor characteristic.

<OLM: Motor overload protection characteristic> = "4" to "7"

Setting of <F606: Motor overload reduction frequency threshold>

We recommend the estimation of across 6 Hz (default setting) (refer to the following figure).



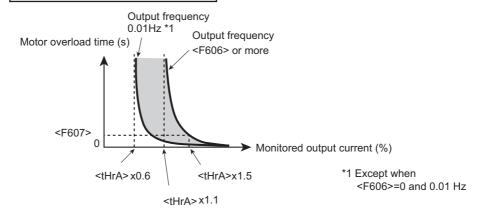
Setting a time before the trip of the electronic thermal occurs: <F607: Motor overload time>

Setting a time before the trip of the electronic thermal occurs: <F607: Motor overload time> Set a time before the overload trip "OL2" occurs at the motor overload of 150%.

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|---------------------|------------------|------|--------------------|
| F607 | Motor overload time | 10 - 2400 | S | 300 |

| | utput current %) | Motor overload time (s) (Outline data) | | | |
|----------|---------------------|--|---------|-----------------|----------|
| | | F607=600 is set | | F607=30 | 0 is set |
| tHrA=100 | tHrA=50 | F606 or more | 0.01 Hz | F606 or more | 0.01 Hz |
| 68 | 34 | - | 7200 | - | 3600 |
| 70 | 35 | - | 3600 | - | 1800 |
| 80 | 40 | - | 1000 | - | 500 |
| 90 | 45 | - | 600 | - | 300 |
| 100 | 50 | - | 420 | - | 210 |
| 112 | 56 | 12000 | 310 | 6000 | 155 |
| 120 | 60 | 2400 | 270 | 1200 | 135 |
| 130 | 65 | 1200 | 230 | 600 | 115 |
| 140 | 70 | 800 | 190 | 400 | 95 |
| 150 | 75 | 600 | 170 | 300 | 85 |
| 200 | 100 | 270 | 110 | 135 | 55 |

Motor overload protection characteristics



Selecting how to detect inverter overload: <F631: Inverter overload detection>

This function enables to automatically increase the continuous output current and the inverter overload capacity when the ambient temperature is low.

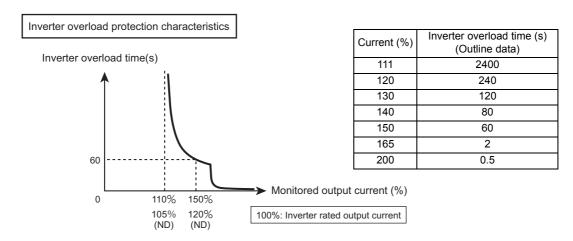
| Title | Parameter name | Adjustment range | Default setting |
|-------|-----------------------------|---|-----------------|
| F631 | Inverter overload detection | HD 0: 150%-60s 1: Temperature estimation ND 0: 120%-60s 1: Temperature estimation | 10 |

Set <F631: Inverter overload detection> to "1: Temperature estimation".

- If the inverter overload trip "OL1" occurs, you can clear it by decreasing the value of <F601: Stall prevention level 1> or setting <ACC: Acceleration time 1> or <dEC: Deceleration time 1> to a longer value.
- To protect the inverter unit, you cannot turn off inverter overload detection.

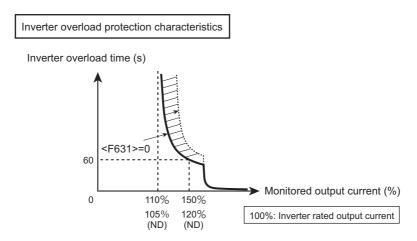
0: 150%-60s (HD rating) or 0: 120%-60s (ND rating)

The inverter is protected with the uniform overload curve of 150%-60s (120%-60s for ND rating), regardless of temperature.



1: Temperature estimation

Estimate inverter internal temperature rise and automatically adjust overload protection characteristics (the diagonally shaded area in the following figure).



 When the output frequency is 0.1 Hz or less, or when the output current is 150% or more, the overload trip "OL1" or overcurrent trips "OC1 through OC3" may occur in shorter time to protect the inverter.

- In the default setting, when inverter overload occurs, the inverter is designed to suppress the overload trip "OL1" or overcurrent trips "OC1 through OC3" by automatically decrease the carrier frequency. A lower value of the carrier frequency increases the acoustic noise from the motor but does not affect the performance. When you do not want to lower the value of the carrier frequency, set <F316: Carrier frequency control> to "0: No decrease". (Refer to [6. 14].)
- The overload detection level depends on the output frequency or carrier frequency.

Saving an overload integral value at power off : <F632: Electronic thermal memory target>

Set a target to reset the integral value of overload at power off. It applies to both the motor electronic thermal and overload detection for inverter protection.

| Title | Parameter name | Adjustment range | Default setting |
|-------|----------------------------------|---|-----------------|
| F632 | Electronic thermal memory target | 0: No.1 to 4 motor, memory disabled 1: No.1 to 4 motor, memory enabled 2: No.1 motor, memory disabled 3: No.1 motor, memory enabled | 0 |

0: No.1 to 4 motor, memory disabled

2: No.1 motor, memory disabled

Reset the integral value. "0" applies to No.1 to 4 motors and "2" to the No.1 motor only.

1: No.1 to 4 motor, memory enabled

3: No.1 motor, memory enabled

For memory enabled, the overload integral values of the motor and inverter are saved at power off. When power supply is ON again, the calculation process is resumed from the state when it is powered off.

However, with the RTC enabled (with operation panel), the subtraction process is performed according to virtual cooling curves, regardless of the setting.

Overload pre-alarm output

When the motor overload level reaches the setting value (%) of <F657: Overload alarm level> for the overload trip "OL2" integral value, "L" appears. Also, an overload pre-alarm signal can be output from the output terminal. For details, refer to [7. 2. 2].

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|----------------------|------------------|------|--------------------|
| F657 | Overload alarm level | 10 - 100 | % | 50 |

5. 1. 6 Adjusting the meter connected to the inverter

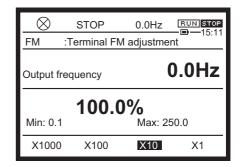
<FM: Terminal FM adjustment>

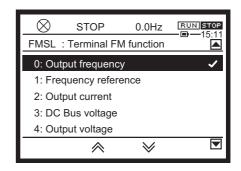
Basic parameter Easy mode

< FMSL: Terminal FM function>

Basic parameter

<F671: Terminal AM adjustment> <F670: Terminal AM function>





■ Function

To indicate the output frequency and output current of the inverter in the meter, connect the meter to the terminal [FM] or [AM].

After connecting them, you should adjust the scale of the meter.

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|------------------------|------------------|------|-----------------|
| FM | Terminal FM adjustment | 0.1 - 250.0 | % | 100.0 |
| F671 | Terminal AM adjustment | 0.1 - 250.0 | % | 100.0 |

Select the content to be indicated in the meter by <FMSL: Terminal FM function> and <F670: Terminal AM function>.

| Title | Parameter name | Adjustment range | Default setting |
|-------|----------------------|--|--------------------|
| FMSL | Terminal FM function | O: Output frequency 1: Frequency command value 2: Output current 3: Input voltage (DC detection) 4: Output voltage 5: Stator frequency 6: Speed feedback frequency (real time) 7: Speed feedback frequency (1-second filter) 8: Torque 9: Torque command | 0 |

| Title | Parameter name | Adjustment range | Default |
|-------|----------------|---|---------|
| | | 10: Output fragues of during and Fragues and | setting |
| | | 10: Output frequency during run. Frequency command value during stop. | |
| | | 11: Torque current | |
| | | 12: Exciting current | |
| | | 13: PID feedback value | |
| | | 14: Motor overload factor (OL2 data) | |
| | | 15: Inverter overload factor (OL1 data) | |
| | | 16: Braking resistor overload factor (OLr data) | |
| | | 17: Braking resistor load factor (%ED) | |
| | | 18: Input power | |
| | | 19: Output power | |
| | | 20: Input cumulative power | |
| | | 21: Output cumulative power | |
| | | 22: Fixed output 1 | |
| | | 23: Fixed output 2 | |
| | | 24: Terminal RR input value | |
| | | 25: Terminal IX input value | |
| | | 26: Terminal II input value27: Motor speed command | |
| | | 28: Terminal FM output value | |
| | | 29: Terminal AM output value | |
| | | 30: - | |
| | | 31: Communication data output | |
| | | 32 - 33: - | |
| | | 34: Motor load factor | |
| | | 35: Inverter load factor | |
| | | 36 - 40: - | |
| | | 41: Terminal FP pulse train output value | |
| | | 42: - | |
| | | 43: Terminal FM/AM gain setting value | |
| | | 44: Terminal Al4 input value | |
| | | 45: Terminal AI5 input value | |
| | | 46 - 49: My function monitor output 1 - 4 | |
| | | 50 - 61: - | |
| | | 62: PID result frequency | |
| | | 63: PID set value | |
| | | 64: Light-load high-speed switching load | |
| | | torque 65: Light-load high-speed torque during | |
| | | constant speed run | |
| | | 66 - 70: - | |
| | | 71: Motor speed (estimated value) | |
| | | 72 - 75: - | |
| | | 76: Terminal S4/S5 pulse train input value | |
| | | 77 - 78: - | |
| | | 79: Dancer control PID result frequency |] |
| | | 80 - 119: - |] |
| | | 120: Internal temperature 1 | |
| | | 121 - 123: - | |
| | | 124: Power circuit board temperature | |
| | | 125 - 129: - | |

| Title | Parameter name | Adjustment range | Default setting |
|-------|----------------------|--|--------------------|
| | | 130: External PID3 set value | |
| | | 131: External PID3 feedback value | |
| | | 132: External PID3 result value | |
| | | 133: External PID4 set value | |
| | | 134: External PID4 feedback value | |
| | | 135: External PID4 result value | |
| | | 136 - 149: - | |
| | | 150: Signed output frequency | |
| | | 151: Signed frequency command value | |
| | | 152: Signed stator frequency | |
| | | 153: Signed speed feedback frequency (real time) | |
| | | 154: Signed speed feedback frequency (1-second filter) | |
| | | 155: Signed torque | |
| | | 156: Signed torque command | |
| | | 157: - | |
| | | 158: Signed torque current | |
| | | 159: Signed PID feedback value | |
| | | 160: Signed terminal RX input value | |
| | | 161: Signed terminal Al4 input value | |
| | | 162: Signed terminal AI5 input value | |
| F670 | Terminal AM function | Same as <fmsl></fmsl> | 2 |

■ How to adjust the scale of the meter with the inverter run

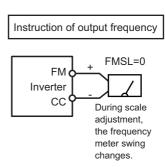
As an example, this section describes how to adjust the scale of the frequency meter connected to the terminal [FM].

Use the adjustment screw of the meter to set a zero point in advance.

This method can apply to the meter connected to the terminal [AM] as well.

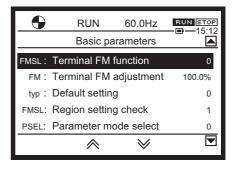
1 Connect the frequency meter as shown in the figure below.

For how to connect it to the control terminal block, refer to [2. 3. 5] and [4. 4].



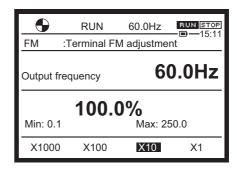
2 In the basic parameters of [Setting mode], set <FMSL: Terminal FM function> to "0: Output frequency".

The default setting of <FMSL> is "0".



3 In the basic parameters of [Setting mode], select <FM: Terminal FM adjustment> and press the [OK] key.

The output frequency of the inverter is displayed in the upper part of the screen, and the output level (%) of the terminal [FM] in the lower part.



4 Turning the touch wheel will change the indication of the meter and the output level (%) of the terminal [FM] in the lower field of the screen. Adjust the scale so that the indication of the meter matches the output frequency.



5 Press the [OK] key to complete the adjustment of the meter.

How to adjust the scale of the meter with the inverter stopped

You can adjust the scale of the meter even at the inverter stop state.

When <FMSL: Terminal FM adjustment> and <F670: Terminal AM adjustment> are set "22", signal value is fixed at the following values.

<FMSL>/<F670>

0, 1, 5, 6, 7, 10, 13, 62, 63, 79, 130, 131, 132, 133, 134, 135, 150, 151, 152, 153, 154, 159

: Maximum frequency (FH)

: 200% of rated current

: 150% of rated voltage

: 250% of rated torque

: Maximum value of OL counter

: %ED value of braking resistor

: 200% of rated power

: 1000 x F749

• 2, 11, 12, 108

• 3, 4

8, 9, 64, 65, 155, 156

• 14, 15, 16, 34, 35

• 17

18, 19

20, 21

• 24, 25, 26, 28, 29, 31, 41, 44, 45, 74, 75, 76, 160, 161, 162 : Maximum value

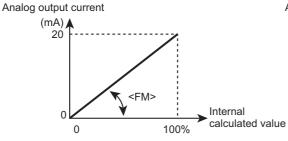
• 27, 71 : FH x 60/F856

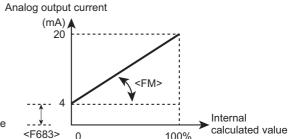
46, 4748, 4956535232767

• 120, 124 : 200°C

When <FMSL: Terminal FM adjustment> and <F670: Terminal AM adjustment> are set "23", signal value is fixed at half of the above values.

■ For 4 - 20 mA output





This is when <F682: Terminal FM inclination polarity> is "1: Positive inclination (upward slope)" and <F683: Terminal FM bias> is "0". When<F682> is set to "0: Negative inclination (downward slope)", the inclination becomes negative.

This is when <F682> is "1" and <F683: Terminal FM bias> is "20". 20% value (4mA) of the full scale output current (20 mA in this case) will be the output current at internal calculated value of 0%.

Adjust the values of <F682: Terminal FM inclination polarity> and <F683: Terminal FM bias> for 4 - 20 mA output.

For details, refer to [6. 33. 3].

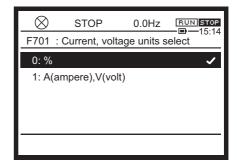
Memo

- The maximum resolution is 1/1024 for both the terminals [FM] and [AM].
- To use the terminals [FM] and [AM] for current output, set external load resistance to 600Ω or less.
- To use the terminals [FM] and [AM] for voltage output, set external load resistance to $1k\Omega$ or more.

5. 1. 7 Selecting the display units for current and voltage

<F701: Current, voltage units select>

Easy mode



■ Function

Select the display units of parameters and monitors represented in current and voltage.

Parameter setting

| Title | Parameter name | Adjustment range | Default setting |
|-------|-------------------------------|---------------------------------|--------------------|
| F701 | Current, voltage units select | 0: % 1: A (ampere), V (volt) | 0 |

Applicable parameters and monitors

The following list shows parameters and monitors whose display units can be changed with <F701: Current, voltage units select>.

Displayed in A (amperes)

Parameter

<F251: DC braking current>

<F601: Stall prevention level 1>, <F185: Stall prevention level 2>

<F326: Brake release undercurrent threshold>

<F611: Undercurrent detection level>

• Monitor

Output current

Torque current

Exciting current

Displayed in V (volts)

Parameter

<F191: V/f 5-point VF1 voltage>

<F193: V/f 5-point VF2 voltage>

<F195: V/f 5-point VF3 voltage>

<F197: V/f 5-point VF4 voltage>

<F199: V/f 5-point VF5 voltage>

Monitor

Input voltage

Output voltage

<vLv: Base frequency voltage 1>, <F171: Base frequency voltage 2>, <F175: Base frequency voltage 3>, and <F179: Base frequency voltage 4> are always displayed in V (volts). You cannot change it.

Selecting a setting value

0: %

Current and voltage are displayed in percent.

For current (A), 100% means the rated current of the inverter.

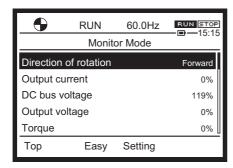
For voltage (V), 100% with 200 V for 240 V class and 400 V for 480 V class.

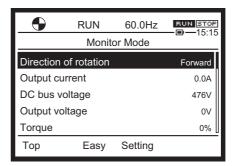
1: A (ampere), V (volt)

Current is displayed in A (amperes) and voltage in V (volts).

■ Setting example

While a model with a rated current of ●● A is used at the rated load (100% load), the monitor mode is displayed as follows:

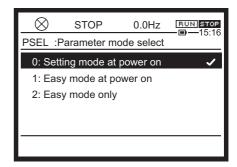




5. 1. 8 Selecting the parameter mode between [Setting mode] and [Easy mode]

<PSEL: Parameter mode select>





Function

Select the display mode of parameter settings between [Setting mode] and [Easy mode]. You can select a mode at power on and use the operation key to switch it or see only [Easy mode]. How to read parameters depends on a mode.

[Easy mode]

- Register frequently set parameters as [Easy mode] parameters in advance. Only the registered parameters (up to 32) appear.
- Ten parameters are selected in the default setting. You can change them as required.

[Setting mode]

You can read all parameters in the standard [Setting mode].

Parameter setting

| Title | Parameter name | Adjustment range | Default setting |
|-------|-----------------------|---|-----------------|
| PSEL | Parameter mode select | Setting mode at power on Easy mode at power on Easy mode only | 0 |

Selecting a setting value

0: Setting mode at power on

The parameter mode is set to [Setting mode] at power on.

You can use the operation key to switch between [Setting mode] and [Easy mode].

- Operation panel: [ESC] key or [F1] key For details, refer to [3. 1. 2].
- Extension panel: [EASY] key (if any)

1: Easy mode at power on

The parameter mode is set to [Easy mode] at power on.

You can use the operation key to switch between [Setting mode] and [Easy mode].

- Operation panel: [ESC] key or [F1] key For details, refer to [3. 1. 2].
- Extension panel: [EASY] key (if any)

2: Easy mode only

The parameter mode is always [Easy mode].

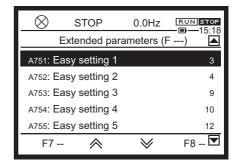
You cannot see the [Setting mode] screen.

■ Setting parameters in [Easy mode]

Up to 32 parameters are displayed in [Easy mode]. Set among <F751: Easy setting 1> through <F782: Easy setting 32>.

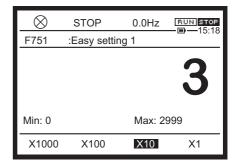
| Title | Parameter name | Adjustment range | Default setting |
|-------------|---|------------------|----------------------|
| F751 | Easy setting 1 | 0 - 2999 | 3 <cmod></cmod> |
| F752 | Easy setting 2 | 0 - 2999 | 4 <fmod></fmod> |
| F753 | Easy setting 3 | 0 - 2999 | 9 <acc></acc> |
| F754 | Easy setting 4 | 0 - 2999 | 10 <dec></dec> |
| F755 | Easy setting 5 | 0 - 2999 | 12 |
| F756 | Easy setting 6 | 0 - 2999 | 13 <ll></ll> |
| F757 | Easy setting 7 | 0 - 2999 | 31 <thra></thra> |
| F758 | Easy setting 8 | 0 - 2999 | 6 <fm></fm> |
| F759 - F780 | Easy setting 9 through Easy setting 30 | 0 - 2999 | 999 (No function) |
| F781 | Easy setting 31 | 0 - 2999 | 701 <f701></f701> |
| F782 | Easy setting 32 | 0 - 2999 | 50 <psel></psel> |

In [Easy mode], only parameters registered with <F751: Easy setting 1> through <F782: Easy setting 32> appear in the order of registration.



Set communication numbers of registered parameters for <F751: Easy setting 1> through <F782: Easy setting 32>.

For communication numbers, refer to [11. 2] - [11. 5].



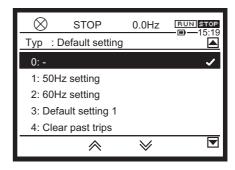
Memo

• When no parameter should be registered, set <F751: Easy setting 1> through <F782: Easy setting 32> to "999".

5. 1. 9 Returning parameters to their default settings Clearing each history

<tyP: Default setting>





■ Function

You can return parameters to their default settings at a time, clear run times, and store/rewrite parameters specified by users.

Parameter setting

| Title | Parameter name | Adjustment range | Default setting |
|-------|-----------------|---|--------------------|
| tyP | Default setting | 0: - 1: 50Hz setting 2: 60Hz setting 3: Default setting 1 4: Clear past trips 5: Clear cumulative run time 6: Initialize typeform 7: Store user settings 8: Rewrite user settings 9: Clear cumulative fan run time 10, 11: - 12: Clear number of starting 13: Default setting 2 (complete initialization) 14: Clear number of external equipment starting | 0 |

Note) The setting value becomes 0 after execution, but a check mark is added to the previous setting value.

■ Selecting a setting value

1: 50Hz setting

The following parameters are set for the base frequency 50 Hz.

Setting values of other parameters are not changed.

When you select a parameter and press the [OK] key, nothing appears momentarily, the same content displayed at power on appears, and the mode enters [Standard mode].

| <fh: frequency="" maximum=""></fh:> | 50Hz |
|--|--------------|
| <ul: frequency="" limit="" upper=""></ul:> | *1 % display |
| <vl: 1="" base="" frequency=""></vl:> | |
| <f170: 2="" base="" frequency=""></f170:> | |
| <f174: 3="" base="" frequency=""></f174:> | |
| <f178: 4="" base="" frequency=""></f178:> | |
| <f204: 2="" frequency="" point="" rr=""></f204:> | |
| <f213: 2="" frequency="" point="" rx=""></f213:> | |
| <f219: 2="" frequency="" il="" point=""></f219:> | |
| <f225: 2="" al4="" frequency="" point=""></f225:> | |
| <f231: 2="" al5="" frequency="" point=""></f231:> | |
| <f237: 2="" frequency="" input="" point="" pulse="" s4="" s5="" train=""></f237:> | |
| <a316: deviation="" pid2="" upper-limit=""></a316:> | |
| <a317: deviation="" lower-limit="" pid2=""></a317:> | |
| <a319: pid2="" set="" upper-limit="" value=""></a319:> | |
| <a322: output="" pid2="" upper-limit=""></a322:> | |
| <f330: automatic="" frequency="" high-speed="" light-load="" operation=""></f330:> | |
| <a346: deviation="" pid3="" upper-limit="">*1</a346:> | |
| <a347: deviation="" lower-limit="" pid3="">*1</a347:> | |
| <a349: pid3="" set="" upper-limit="" value="">*1</a349:> | |
| <a352: output="" pid3="" upper-limit=""></a352:> | |
| <f355: commercial="" power="" switching=""></f355:> | |
| <f364: deviation="" pid1="" upper-limit=""></f364:> | |
| <f365: deviation="" lower-limit="" pid1=""></f365:> | |
| <f367: pid1="" set="" upper-limit="" value=""></f367:> | |
| <f370: output="" pid1="" upper-limit=""></f370:> | |
| <a376: deviation="" pid4="" upper-limit="">*1</a376:> | |
| <a379: pid4="" set="" upper-limit="" value="">*1</a379:> | |
| <a382: output="" pid4="" upper-limit=""></a382:> | |
| <f426: fwd="" level="" limit="" speed=""></f426:> | |

| <f428: level="" limit="" rev="" speed=""></f428:> | |
|---|--|
| <f814: 2="" communication="" frequency="" point=""></f814:> | |
| <f417: motor="" rated="" speed=""></f417:> | 1400 - 1480min ⁻¹ (Depending on capacity) |

2: 60Hz setting

The following parameters are set for the base frequency 60Hz.

Setting values of other parameters are not changed.

When you select a parameter and press the [OK] key, nothing appears momentarily, the same content displayed at power on appears, and the mode enters [Standard mode].

| <fh: frequency="" maximum=""></fh:> | 60Hz |
|--|--------------|
| <ul: frequency="" limit="" upper=""></ul:> | *1 % display |
| <vl: 1="" base="" frequency=""></vl:> | |
| <f170: 2="" base="" frequency=""></f170:> | |
| <f174: 3="" base="" frequency=""></f174:> | |
| <f178: 4="" base="" frequency=""></f178:> | |
| <f204: 2="" frequency="" point="" rr=""></f204:> | |
| <f213: 2="" frequency="" point="" rx=""></f213:> | |
| <f219: 2="" frequency="" ii="" point=""></f219:> | |
| <f225: 2="" al4="" frequency="" point=""></f225:> | |
| <f231: 2="" al5="" frequency="" point=""></f231:> | |
| <f237: 2="" frequency="" input="" point="" pulse="" s4="" s5="" train=""></f237:> | |
| <a316: deviation="" pid2="" upper-limit=""></a316:> | |
| <a317: deviation="" lower-limit="" pid2=""></a317:> | |
| <a319: pid2="" set="" upper-limit="" value=""></a319:> | |
| <a322: output="" pid2="" upper-limit=""></a322:> | |
| <f330: automatic="" frequency="" high-speed="" light-load="" operation=""></f330:> | |
| <a346: deviation="" pid3="" upper-limit="">*1</a346:> | |
| <a347: deviation="" lower-limit="" pid3="">*1</a347:> | |
| <a349: pid3="" set="" upper-limit="" value="">*1</a349:> | |
| <a352: output="" pid3="" upper-limit=""></a352:> | |
| <f355: commercial="" power="" switching=""></f355:> | |
| <f364: deviation="" pid1="" upper-limit=""></f364:> | |
| <f365: deviation="" lower-limit="" pid1=""></f365:> | |
| <f367: pid1="" set="" upper-limit="" value=""></f367:> | |
| <f370: output="" pid1="" upper-limit=""></f370:> | |
| <a376: deviation="" pid4="" upper-limit="">*1</a376:> | |
| <a379: pid4="" set="" upper-limit="" value="">*1</a379:> | |
| <a382: output="" pid4="" upper-limit=""></a382:> | |
| <f426: fwd="" level="" limit="" speed=""></f426:> | |
| <f428: level="" limit="" rev="" speed=""></f428:> | |

| <f814: 2="" communication="" frequency="" point=""></f814:> | |
|---|--|
| <f417: motor="" rated="" speed=""></f417:> | 1680 - 1775min ⁻¹ (Depending on capacity) |

3: Default setting 1

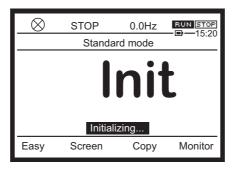
Return parameters except for some ones to their default settings.

When you select the setting and press the [OK] key, "Init" blinks in the main area and "Initializing" appears under it for a while.

They disappear momentarily, the same content displayed at power on appears, and the mode enters [Standard mode].

The history of past trip data is cleared.

To initialize all parameters, set <tyP: Default setting> to "13".



 The values of the following parameters are designed not to return to their default settings, considering maintainability.

Also, these parameters do not appear in the <Changed parameters search & edit> even if they are set to values different from default settings.

- <FMSL: Terminal FM function>
- <FM: Terminal FM adjustment>
- <SEt: Region setting check>
- <F107: Terminal RX input voltage select>
- <F148: Terminal Al4 input select>
- <F149: Terminal AI5 input select>
- <F379: PG option voltage>
- <F470: RR input bias>
- <F471: RR input gain>
- <F472: RX input bias>
- <F473: RX input gain>

to

Memo

- <F479: Al5 input gain>
- <F669: Terminal FP switching>
- <F670: Terminal AM function>
- <F671: Terminal AM adjustment>
- <F681: Terminal FM switching>
- <F682: Terminal FM inclination polarity>
- <F683: Terminal FM bias>
- <F686: Terminal AM switching>
- <F687: Terminal AM inclination polarity>
- <F688: Terminal AM bias>
- <F690: Terminal AM upper-limit level>
- <F699: Trip for test>
- <F750: EASY key function>
- <F790: Panel display at power on>
- <F791: 1st and 2nd characters of F790> <F798: 15th and 16th characters of F790>
- <F809: Operation panel connection priority>
- <F880: Free memorandum>



4: Clear past trips

Initialize (clear) the history information of eight past trips.

No parameter is changed.

When you select the setting and press the [OK] key, nothing appears momentarily, the same content displayed at power on appears, and the mode enters [Standard mode].

5: Clear cumulative run time

Clear cumulative run time to 0.

When you select the setting and press the [OK] key, nothing appears momentarily, the same content displayed at power on appears, and the mode enters [Standard mode].

6: Initialize typeform

Clear a trip if the type error "EtyP" occurs.

However, if it occurs, contact your Toshiba distributor.

When you select the setting and press the [OK] key, nothing appears momentarily, the same content displayed at power on appears, and the mode enters [Standard mode].

7: Store user settings

Store the setting values of all current parameters.

8: Rewrite user settings

Rewrite the setting values of the parameters stored in "7: Store user settings" to the inverter.

You can use parameter initial settings specific for users with "7: Store user settings" and "8: Rewrite user settings."

9: Clear cumulative fan run time

Clear cumulative fan run time to 0.

Set it, for example, when you have replaced the cooling fan.

When you select the setting and press the [OK] key, nothing appears momentarily, the same content displayed at power on appears, and the mode enters [Standard mode].

12: Clear number of starting

Clear the values on the monitor to 0 for the number of starting, the number of forward starting, and the number of reverse starting.

When you select the setting and press the [OK] key, nothing appears momentarily, the same content displayed at power on appears, and the mode enters [Standard mode].

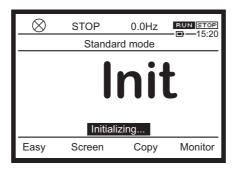
13: Default setting 2 (complete initialization)

Return all parameters to their default settings at a time.

When you select the setting and press the [OK] key, "Init" blinks in the main area and "Initializing" appears under it for a while.

They disappear momentarily, the same content displayed at power on appears, and the mode enters [Standard mode].

All parameters are returned to their default settings, and the history data of past trips is also cleared.



Memo

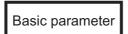
• Set <tyP: Default setting> after stopping the inverter. You cannot set it during run.

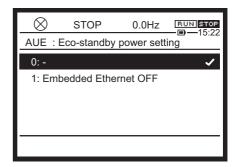
5. 2 Setting other basic parameters

This section describes basic parameters not included in [5.2]. Set any parameter in the [Setting mode].

5. 2. 1 Setting energy savings

<AUE: Eco-standby power setting>





■ Function

Turn off the unused function to reduce standby electricity.

Parameter setting

| Title | Parameter name | Adjustment range | Default setting |
|-------|---------------------------|----------------------------------|--------------------|
| AUE | Eco-standby power setting | 0: - 1: Embedded Ethernet OFF | 0 |

Note) The setting value becomes 0 after execution, but a check mark is added to the previous setting value.

■ Selecting a setting value

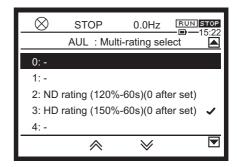
1: Embedded Ethernet OFF

Standby electricity can be reduced when you do not use the embedded Ethernet.

5. 2. 2 Selecting an overload protection characteristic

<AUL: Multi-rating select>

Basic parameter



■ Function

Select an inverter overload protection characteristic suited for the torque characteristic of the machine.

Parameter setting

| Title | Parameter name | Adjustment range | Default setting |
|-------|---------------------|---|--------------------|
| AUL | Multi-rating select | 0,1: - 2: ND rating (120%-60s) (0 after execution) 3: HD rating (150%-60s) (0 after execution) 4 - 7: - | 3 |

Note) The setting value becomes 0 after execution, but a check mark is added to the previous setting value.

Selecting a setting value

2: ND rating (120%-60s) (0 after execution)

Select this value when applying the machine with variable torque characteristic. Example) Fan, pump, blower, etc.

3: HD rating (150%-60s) (0 after execution)

Select this value when applying the machine with constant torque characteristics.

Example) Conveyor, load transporting machinery, crane, concrete mixer, compressor, making machine, machine tool, etc.

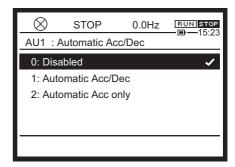
Memo

• The default setting of some parameters are different between HD rating and ND rating. Refer to [11. 6].

5. 2. 3 Acceleration/deceleration time adjustment automatically according to load

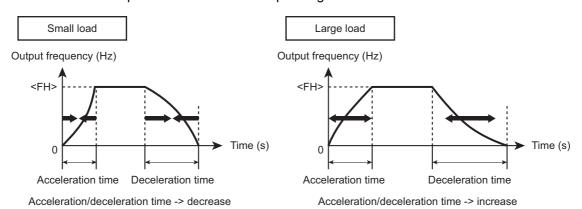
<AU1: Automatic Acc/Dec>

Basic parameter



Function

This is a parameter that automatically adjusts the acceleration/deceleration time according to the load condition to prevent an overcurrent trip during acceleration/deceleration.



Parameter setting

| Title | Parameter name | Adjustment range | Default setting |
|-------|-------------------|--|--------------------|
| AU1 | Automatic Acc/Dec | 0: Disabled 1: Automatic Acc/Dec 2: Automatic Acc only | 1 |

■ Selecting a setting value

1: Automatic Acc/Dec

The acceleration/deceleration time is adjusted automatically in the range in which the output current does not exceed the rated current of the inverter. The adjustment range is 1/8 to 8 times as long as the time set with <ACC: Acceleration time 1> and <dEC: Deceleration time 1>. If you set suitable values for the average load with <ACC: Acceleration 1> and <dEC: Deceleration 1> in advance, it will be easy to deal with load fluctuation.

2: Automatic Acc only

Only the acceleration time is adjusted automatically. The speed is decelerated according to the setting of <dEC: Deceleration time 1>.



Important

- Use this parameter with the motor connected.
- When the inverter is used with a load that fluctuates considerably, it may fail to adjust the acceleration or deceleration time in time, and therefore may be tripped.
- When using the optional braking resistor or braking unit, do not set <AU1: Automatic Acc/Dec>
 to "1". Otherwise, braking resistor overload may occur during deceleration.

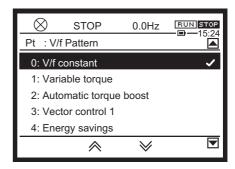
Memo

When the acceleration/deceleration time is automatically set, the acceleration/deceleration time
is always changed according to the load. For machinery that requires constant acceleration/
deceleration time, accelerate or decelerate with the setting time of <ACC: Acceleration time 1>
and <dEC: Deceleration time 1> instead of using this function. For details, refer to [5. 1. 4].

5. 2. 4 Selecting motor control method

<Pt: V/f Pattern>

Basic parameter



■ Function

This is a parameter to select the motor control method according to the characteristics and application of the machinery.

Memo

With <AU2: Torque boost macro>, you can set <Pt> of this parameter to "2: Automatic torque boost", "3: Vector control 1", and "4: Energy savings" and <F400: Offline auto-tuning > to "2" simultaneously.

Parameter setting

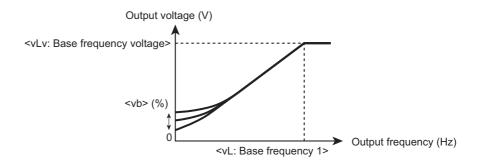
| Title | Parameter name | Adjustment range | Default setting |
|-------|----------------|--|--------------------|
| Pt | V/f Pattern | 0: V/f constant 1: Variable torque 2: Automatic torque boost 3: Vector control 1 4: Energy savings 5: Dynamic energy savings (for fan and pump) 6: PM motor control 7: V/f 5-point setting 8: - 9: Vector control 2 (speed / torque) 10: PG feedback control 11: PG feedback vector control (speed / torque) 12: - | 0 |

Selecting a setting value

0: V/f constant

This is a typical control method of an inverter, and the inverter is controlled so that the ratio of the output frequency (f) and the output voltage (V) becomes almost constant.

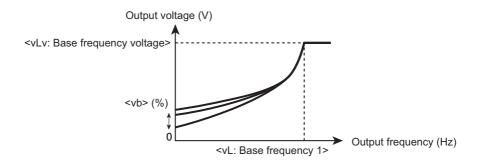
It is applied to loads with equipment like conveyors that requires the same torque at low speeds as at rated speeds.



To increase the torque at low speeds, increase the setting value of <vb: Manual torque boost 1>. For details, refer to [5. 2. 6].

1: Variable torque

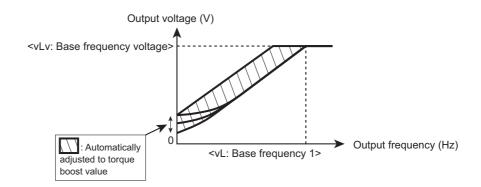
This is applied to loads such as fans, pumps and blowers in which the torque is proportional to the square of load motor speed.



2: Automatic torque boost

The load current in the speed range from startup to base frequency is detected and the output voltage (torque boost) from the inverter is automatically adjusted. This gives steady torque for stable operation.

It is applied to loads that require torque.



Operation may become unstable depending on loads. In this case, set Pt = 0: V/f constant and increase the value of vb: Manual torque boost 1>.

Setting of motor parameters

When <Pt> is "2", setting of motor parameters is required.

When the motor you are using is a 4P Toshiba general motor which has the same capacity as the inverter, there is basically no need to set the parameters.

First, look at the motor name plate and set the following parameters.

- <vL: Base frequency 1> (Rated frequency)
- <vLv: Base frequency voltage 1> (Rated voltage)
- <F405: Motor rated capacity>
- <F415: Motor rated current>
- <F417: Motor rated speed>

Next, perform auto-tuning. Two parameter setting methods are provided.

1) Setting with <AU2: Torque boost macro>

Set <AU2: Torque boost macro> to "1". Set <Pt> to "2: Automatic torque boost" and <F400: Offline auto-tuning> to "2" simultaneously.

For details, refer to [5. 2. 5].

2) Setting with <F400: Offline auto-tuning>

Set <F400: Offline auto-tuning> to "5".

For details, refer to [6. 23. 1].

* If an auto-tuning error occurs, set motor parameters individually by referring to [6. 23. 1]

"

Setting method 4: Manually setting motor parameter".

3: Vector control 1

High-torque and high-precision stable operation is realized in the speed range from startup to base frequency.

It is applied to load transporting machinery and elevators that require high torque and machine tools that require high precision.

- · High starting torque can be obtained.
- It is effective when smooth stable operation from a low speed is required.
- The change of motor speed caused by load fluctuation is suppressed to realize high-precision operation.

When <Pt> is "3", setting of motor parameters is required.

When the motor you are using is a 4P Toshiba general motor which has the same capacity as the inverter, there is basically no need to set the parameters.

In other cases, look at the motor name plate and set the following parameters.

- <vL: Base frequency 1> (Rated frequency)
- <vLv: Base frequency voltage 1> (Rated voltage)
- <F405: Motor rated capacity>
- <F415: Motor rated current>
- <F417: Motor rated speed>

Three parameter setting methods are provided.

1) Setting with <AU2: Torque boost macro>

Set <AU2: Torque boost macro> to "2". Set <Pt> to "3: Vector control 1" and <F400: Offline auto-tuning> to "2" simultaneously.

For details, refer to [5. 2. 5].

2) Setting with <F400: Offline auto-tuning>

Set <F400: Offline auto-tuning> to "5".

For details, refer to [6. 23. 1].

* If an auto-tuning error occurs, set motor parameters individually by referring to [6. 23. 1] "Setting method 4: Manually setting motor parameter".

3) Manual setting

Set each motor constant.

For details, refer to [6. 23. 1].

4: Energy savings

Energy can be saved in all speed ranges by detecting load current and flowing the optimum current that fits the load.

When <Pt> is "4", setting of motor parameters is required.

When the motor you are using is a 4P Toshiba general motor which has the same capacity as the inverter, there is basically no need to set the parameters.

In other cases, look at the motor name plate and set the following parameters.

- <vL: Base frequency 1> (Rated frequency)
- <vLv: Base frequency voltage 1> (Rated voltage)
- · <F405: Motor rated capacity>
- <F415: Motor rated current>
- <F417: Motor rated speed>

Three parameter setting methods are provided.

1) Setting with <AU2: Torque boost macro>

Set <AU2: Torque boost macro> to "3". Set <Pt> to "4: Energy savings" and <F400: Offline auto-tuning> to "2" simultaneously.

For details, refer to [5. 2. 5].

2) Setting with <F400: Offline auto-tuning>

Set <F400: Offline auto-tuning> to "5".

For details, refer to [6. 23. 1].

* If an auto-tuning error occurs, set motor parameters individually by referring to [6. 23. 1] "Setting method 4: Manually setting motor parameter".

3) Manual setting

Set each motor constant.

For details, refer to [6. 23. 1].

5: Dynamic energy savings (for fan and pump)

Energy can be saved in all speed ranges by detecting load current and flowing the optimum current that fits the load. Even in a low-speed range with especially decreased efficiency, more substantial energy savings than those provided when <Pt> is "4: Energy savings" can be achieved by controlling to maximize the efficiency.

The inverter cannot respond to rapid load fluctuations, so this setting should be used only for loads, such as fans and pumps that have less load fluctuations.

When <Pt> is "5", setting of motor parameters is required.

When the motor you are using is a 4P Toshiba general motor which has the same capacity as the inverter, there is basically no need to set the parameters.

In other cases, look at the motor name plate and set the following parameters.

- <vL: Base frequency 1> (Rated frequency)
- <vLv: Base frequency voltage 1> (Rated voltage)

- <F405: Motor rated capacity>
- <F415: Motor rated current>
- <F417: Motor rated speed>

Two parameter setting methods are provided.

1) Setting with <F400: Offline auto-tuning>

Set <F400: Offline auto-tuning> to "5".

For details, refer to [6. 23. 1].

* If an auto-tuning error occurs, set motor parameters individually by referring to [6. 23. 1]

"

Setting method 4: Manually setting motor parameter".

2) Manual setting

Set each motor constant.

For details, refer to [6. 23. 1].

6: PM motor control

Permanent magnet motors (PM motors) that are highly efficient can be operated in sensor-less operation.

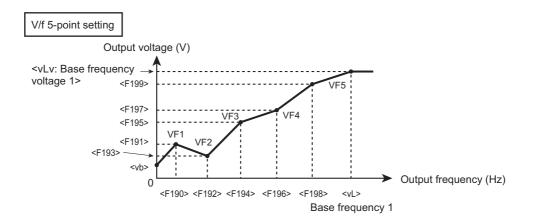
Setting of parameters for PM motor is required. For details, refer to [6. 23. 2].

7: V/f 5-point setting

V/f control characteristics can be created according to machinery. Set frequency and voltage in five points and run the inverter with V/f control characteristics derived by connecting these points. Set five points from VF1 to VF5 with the following parameters <F190> to <F199>.

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|---------------------------|------------------|------|-----------------|
| F190 | V/f 5-point VF1 frequency | 0.0 - FH | Hz | 0.0 |
| F191 | V/f 5-point VF1 voltage | 0.0 - 125.0 | % *1 | 0.0 |
| F192 | V/f 5-point VF2 frequency | 0.0 - FH | Hz | 0.0 |
| F193 | V/f 5-point VF2 voltage | 0.0 - 125.0 | % *1 | 0.0 |
| F194 | V/f 5-point VF3 frequency | 0.0 - FH | Hz | 0.0 |
| F195 | V/f 5-point VF3 voltage | 0.0 - 125.0 | % *1 | 0.0 |
| F196 | V/f 5-point VF4 frequency | 0.0 - FH | Hz | 0.0 |
| F197 | V/f 5-point VF4 voltage | 0.0 - 125.0 | % *1 | 0.0 |
| F198 | V/f 5-point VF5 frequency | 0.0 - FH | Hz | 0.0 |
| F199 | V/f 5-point VF5 voltage | 0.0 - 125.0 | % *1 | 0.0 |

^{*1 100%} with 200 V for 240 V class and 400 V for 480 V class.





- Set <vb: Manual torque boost 1> to approximately 0 to 3% of the base frequency voltage. If the setting value is too large, it may impair the linearity between points.
- If the inclination of the set V/f is above 8.25%/Hz, Points setting alarm 2 "A-02" occurs.

9: Vector control 2 (speed / torque)

It is applied to torque control.

Vector control realize high-torque and high-precision stable operation in the speed range from startup to base frequency.

It is applied to load transporting machinery and elevators that require high torque and machine tools that require high precision.

- · High starting torque can be obtained.
- It is effective when smooth stable operation from a low speed is required.
- The change of motor speed caused by load fluctuation is suppressed to realize high-precision operation.

When <Pt> is "9", setting of motor parameters is required.

When the motor you are using is a 4P Toshiba general motor which has the same capacity as the inverter, there is basically no need to set the parameters.

In other cases, look at the motor name plate and set the following parameters.

- <vL: Base frequency 1> (Rated frequency)
- <vLv: Base frequency voltage 1> (Rated voltage)
- <F405: Motor rated capacity>
- <F415: Motor rated current>
- <F417: Motor rated speed>

Two parameter setting methods are provided.

1) Setting with <F400: Offline auto-tuning>

Set <F400: Offline auto-tuning> to "5".

For details, refer to [6. 23. 1].

- * If an auto-tuning error occurs, set motor parameters individually by referring to [6. 23. 1]
- "Setting method 4: Manually setting motor parameter".

2) Manual setting

Set each motor constant.

For details, refer to [6. 23. 1].

10: PG feedback control

Vector control is performed by using speed feedback signals from the motor.

Attach the PG feedback option to the inverter. Use a motor with speed sensor (encoder) and connect signals from the encoder to the PG feedback option.

In the following cases, use <Pt> = "11: PG feedback vector control (speed / torque)"

- To perform torque control
- · To perform speed control that requires high precision
- · When low-speed operation (with motor slip frequency or less) of regeneration is required

When <Pt> is "10", setting of motor parameters is required.

Look at the motor name plate and set the following parameters first.

- <vL: Base frequency 1> (Rated frequency)
- <vLv: Base frequency voltage 1> (Rated voltage)
- <F405: Motor rated capacity>
- <F415: Motor rated current>
- <F417: Motor rated speed>

Two parameter setting methods are provided.

1) Automatic setting with auto-tuning

Set <F400: Offline auto-tuning> to "5".

For details, refer to [6. 23. 1].

2) Manual setting

Set each motor constant.

For details, refer to "PG Feedback Function Instruction Manual".

11: PG feedback vector control (speed / torque)

Vector control is performed by using feedback signals from the motor. It is applied to high-precision speed control and torque control.

Attach the PG feedback option to the inverter. Use a motor with speed sensor (encoder) and connect signals from the encoder to the PG feedback option.

Torque control is performed based on the torque command, so the motor speed depends on the relationship between the load torque and the motor generated torque.

When <Pt> is "11", setting of motor parameters is required.

Look at the motor name plate and set the following parameters first.

- <vL: Base frequency 1> (Rated frequency)
- <vLv: Base frequency voltage 1> (Rated voltage)
- <F405: Motor rated capacity>
- <F415: Motor rated current>
- <F417: Motor rated speed>

Two parameter setting methods are provided.

1) Automatic setting with auto-tuning

Set <F400: Offline auto-tuning> to "5".

For details, refer to [6. 23. 1].

2) Manual setting

Set each motor constant.

For details, refer to "PG Feedback Function Instruction Manual".

Cautions for automatic torque boost and vector control

- Look at the motor name plate and be sure to set the following parameters.
 - <vL: Base frequency 1> (Rated frequency)
 - <vLv: Base frequency voltage 1> (Rated voltage)
 - <F405: Motor rated capacity>
 - <F415: Motor rated current>
 - <F417: Motor rated speed>
- The vector control exerts its characteristics effectively within the speed range of <vL: Base frequency 1>. The same characteristics will not be obtained in speed ranges over the base frequency.
- When using vector control, set <vL: Base frequency 1> in the range of 40 to 120 Hz.
- Use a three-phase motor with a capacity that is the same as the inverter's rated capacity or one rank below. The minimum applicable motor capacity is 0.1 kW.
- Use a motor that has 2 to 16 P.
- Operate one motor in combination with one inverter. Vector control cannot be used when one
 inverter is operated with more than one motor. When using a combination of several motors, set
 <Pt> to "0: V/f constant".
- The maximum length of wires between the inverter and motor is 30 m. If the wires are longer than 30 m, be sure to perform offline auto-tuning with the wires connected. However, the effects of voltage drop due to resistance of wiring cause motor-generated torque in the vicinity of base frequency to be somewhat lower.
- When a reactor or motor-end surge voltage suppression filter is connected between the inverter
 and a motor, the motor's generated torque may fall. Performing offline auto-tuning may also cause
 a trip "Etn1". When a trip has occurred, connect the inverter and the motor directly to perform
 offline auto-tuning, or set motor parameters by referring to the test record of the motor.
- Attach the speed sensor used for PG feedback control directly to the motor. If it is attached via a gear, etc., rigidity is not ensured, causing hunting of the motor or a trip of the inverter.
- If the motor is not connected or a motor with extremely small capacity is connected for operation for the purpose of operation check of the inverter, etc., set <Pt> to "0: V/f constant" temporarily. If it is set to Automatic torque boost or Vector control, normal operation may not be possible.

Memo

- <Pt: V/f Pattern> is valid only with No.1 motor.
- If it is switched to No.2 to 4 motor, V/f constant control is applied regardless of the setting of <Pt>.

Cautions for PM motor control

• If the motor is not connected or a motor with extremely small capacity is connected for operation for the purpose of operation check of the inverter, etc., set <Pt> to "0: V/f constant" temporarily. If it is set to PM motor control, normal operation may not be possible.

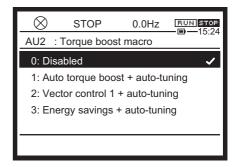
Cautions for motor control

- Set the upper limit for frequency command to a value which is three or four times the value of <vl>
- The value of run frequency is limited to a value which is ten times or less the values of <vL>, and the alarm "A-05" will appear when it is exceeded.
- If the inclination of the set V/f is over 8.25%/Hz, the alarm "A-02" will appear.

5. 2. 5 Setting parameters for torque boost and energy saving easily

<AU2: Torque boost macro>

Basic parameter

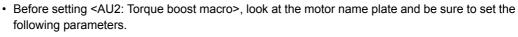


Function

This parameter is used to set V/f Pattern of the inverter and offline auto-tuning of motor parameters simultaneously for machinery that requires torque boost and energy saving.

Parameter setting

| Title | Parameter name | Adjustment range | Default setting |
|-------|--------------------|--|--------------------|
| AU2 | Torque boost macro | Disabled Automatic torque boost + offline auto-tuning Vector control 1 + offline auto- tuning Energy savings + offline auto-tuning | 0 |





Important

- <vL: Base frequency 1> (Rated frequency)
- <vLv: Base frequency voltage 1> (Rated voltage)
- <F405: Motor rated capacity>
- <F415: Motor rated current>
- <F417: Motor rated speed>

Set other motor parameters as necessary.

Selection of setting value

1: Automatic torque boost + offline auto-tuning

This is applied to loads that require torque.

The load current in the speed range from startup to base frequency is detected and the output voltage (torque boost) from the inverter is automatically adjusted. This gives steady torque for stable operation.

- When <AU2: Torque boost macro> is set to "1", <Pt: V/f Pattern> is set to "2" automatically.
- The same characteristics can be obtained by setting <Pt> to "2: Automatic torque boost" and <F400: Offline auto-tuning> to "2: Auto-tuning at run command (0 after execution)". For details, refer to [6. 23. 1].

2: Vector control 1 + offline auto-tuning

This is applied to load transporting machinery and elevators that require high torque and machine tools that require high precision.

High-torque and high-precision stable operation is realized in the speed range from startup to base frequency.

- When <AU2: Torque boost macro> is set to "2", <Pt: V/f Pattern> is set to "3" automatically.
- The same characteristics can be obtained by setting <Pt> to "3: Vector control 1" and <F400: Offline auto-tuning> to "2: Auto-tuning at run command (0 after execution)". For details, refer to [6. 23. 1].

3: Energy savings + offline auto-tuning

This is applied to machinery such as fans and pumps that requires energy saving.

Energy can be saved in all speed ranges by detecting load current and flowing the optimum current that fits the load.

- When <AU2: Torque boost macro> is set to "3", <Pt: V/f Pattern> is set to "4" automatically.
- The same characteristics can be obtained by setting <Pt> to "4: Energy savings" and <F400: Offline auto-tuning> to "2: Auto-tuning at run command (0 after execution)". For details, refer to [6. 23. 1].

If vector control cannot be set

First read the precautions about vector control in [5. 2. 4]. If the desired torque cannot be obtained, refer to [6. 23], [6. 24]. If auto-tuning error "Etn1" appears, refer to [6. 23. 1], [6. 23. 2].

■ Parameters set simultaneously with <AU2: Torque boost macro>

<aU2: Torque boost macro> is a parameter to set <Pt: V/f Pattern> and <F400: Offline auto-tuning> simultaneously.

Therefore, if <AU2> is changed, the following relevant parameters are changed automatically.

| | | | Automatically set parameters | | |
|---|--|---|---------------------------------------|---|-----------------------------|
| | <au2></au2> | | <pt></pt> | | <f400></f400> |
| 0 | 0 is displayed after resetting it | - | Check the setting value of <pt>.</pt> | - | - |
| 1 | Automatic torque boost + offline auto-tuning | 2 | Automatic torque boost | 2 | Execute (0 after execution) |
| 2 | Vector control + offline auto-tuning | 3 | Vector control 1 | 2 | Execute (0 after execution) |
| 3 | Energy savings + offline auto- tuning | 4 | Energy savings | 2 | Execute (0 after execution) |

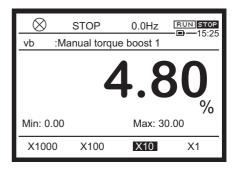
Memo

• For details of offline auto-tuning, refer to [6. 23. 1].

5. 2. 6 Increasing starting torque

<vb: Manual torque boost 1>

Basic parameter



■ Function

The starting torque is increased by increasing the setting value when starting torque is required. It is valid when the setting value of <Pt: V/f Pattern> is "0: V/f constant", "1: Variable torque", or "7: V/f 5-point setting".

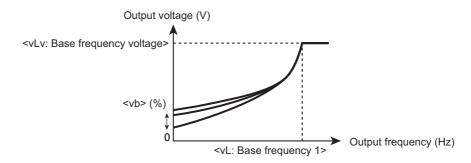
Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|-----------------------|------------------|------|-----------------|
| vb | Manual torque boost 1 | 0.00 - 30.00 | % | *1 |

^{*1} Depending on the capacity. Refer to [11. 6].

■ Reference of setting

100% is based on the base frequency voltage. Set the value within +2% of the default setting.





- The optimum value is programmed for each inverter capacity by default setting. When a value larger than the reference value is set, an overcurrent trip may occur at startup.
- Repeated operation with excessive torque boost may cause failure of IGBT in the power circuit. When larger stating torque is required, consider using vector control. For details, refer to [5. 2. 4].

VF-AS3

5. 2. 7 Operating by switching frequency command with external logic signal

Basic parameter

<F287: Preset speed 8> to <F294: Preset speed 15> <F964: Preset speed 16> to <F979: Preset speed 31>

| \otimes | STOP | 0.0Hz | RUN STOP |
|-----------|--------------|---------|------------|
| Sr1 | :Preset spee | ed 1 | 10.20 |
| | | 0 | . 0 |
| Min: 0.0 |) | Max: 60 | 0.0 |
| X1000 |) X100 | X10 | X1 |

Function

The frequency commands are switched with external logic signals. For example, high speed and low speed are switched with 1-speed and 2-speed. Up to 31-speed can be set.

They can be used as interruption frequency commands because they have priority over other frequency commands.

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|--------------|----------------------|------------------|------|-----------------|
| Sr0 | Preset speed 0 | LL - UL | Hz | 0.0 |
| Sr1 to Sr7 | Preset speed 1 - 7 | LL - UL | Hz | 0.0 |
| F287 to F294 | Preset speed 8 - 15 | LL - UL | Hz | 0.0 |
| F964 to F979 | Preset speed 16 - 31 | LL - UL | Hz | 0.0 |



Important

- They are valid in the case of run/stop with terminals. Set <CMOd: Run command select> to "0". For details, refer to [5. 1. 1].
- Preset speed 16 to 31 are set only by terminal input. They cannot be set via communication.
- Preset speed 16 to 31 do not support preset speed with the functions. If these functions are required, select preset speed 1 to 15.

Reference of setting

Set the frequency to be used for preset speed 1 to 31 with <Sr1: Preset speed 1> to <F979: Preset speed 31>.

When the preset speed command (external logic signal) is off, the frequency command set with <FMOd: Frequency command select 1> is valid. When <FMOd: Frequency command select 1> is "12: Sr0", the setting value of <Sr0: Preset speed 0> becomes the frequency command.

Memo

• The preset speed command is always given priority when other frequency commands are input at the same time.

Setting example of preset speed frequency

Here is a case of sink logic (when the slide switch [SW1] is set to SINK).

| СС | Termi- | | | | | | Pre | eset s | peed o | opera | tion | | | | | |
|--------|--------|---|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| | nal | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| S1 | [S1] | ✓ | - | ✓ | - | ✓ | | ✓ | - | √ | - | ✓ | - | ✓ | - | √ |
| S2 | [S2] | - | ✓ | √ | - | - | √ | √ | - | - | ✓ | √ | - | - | ✓ | ✓ |
| S3 | [S3] | - | - | - | ✓ | √ | ✓ | ✓ | - | - | - | - | √ | √ | √ | √ |
| S4 | [S4] | - | - | - | - | - | - | - | √ | ✓ | ✓ | ✓ | √ | √ | √ | √ |
| S5 | [S5] | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

| СС | Termi- | | | | | | | Prese | t spec | d ope | eration | 1 | | | | | |
|------------|--------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| | nal | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |
| \$1 \$2 | [S1] | - | ✓ | ı | ✓ | - | √ | - | ✓ |
| | [S2] | - | - | ✓ | ✓ | - | - | ✓ | ✓ | - | - | ✓ | ✓ | - | - | ✓ | ✓ |
| S3 | [S3] | - | - | - | - | ✓ | ✓ | ✓ | ✓ | - | - | - | - | ✓ | ✓ | ✓ | √ |
| S4 | [S4] | - | - | - | - | - | ı | - | ı | √ | \ | \ | ✓ | \ | \ | \ | √ |
| S5 | [S5] | √ |

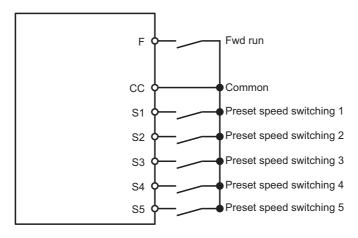
✓: ON, -: OFF (When it is all OFF, then frequency command other than Preset speed operation is enabled.)

Set the input terminal functions as follows.

- <F114: Terminal S1 function 1> = "10: Preset speed switching 1"
- <F115: Terminal S2 function> = "12: Preset speed switching 2"
- <F116: Terminal S3 function> = "14: Preset speed switching 3"
- <F117: Terminal S4 function> = "16: Preset speed switching 4"
- <F118: Terminal S5 function> = "118: Preset speed switching 5"

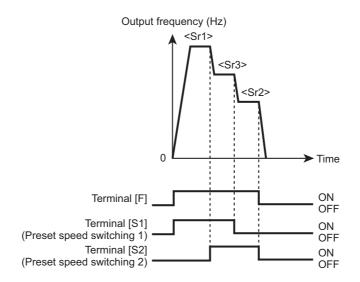
Connect them as shown in the digram below.

In case of sink logic



The following is an operation example of preset speed 1 - 3. In this case, set <Sr1: Preset speed 1> to <Sr3: Preset speed 3>.

VF-AS3



■ When changing frequency command during run

The frequency command can be changed during run with preset speed command.

Set <F724: Frequency setting target by touch wheel> to "1: FC + Preset speed". When you operate the touch wheel during run with preset speed command, the frequency command can be changed. When you press the [OK] key, the setting value of the preset speed frequency can be changed.

| Title | Parameter name | Adjustment range | Default setting |
|-------|---|--|-----------------|
| F724 | Frequency setting target by touch wheel | 0: Panel run frequency command (FC) 1: FC + Preset speed | 0 |

0: Panel run frequency command (FC)

Sets the frequency command from the operation panel.

1: FC + Preset speed

Sets the frequency command from the operation panel during run with the preset speed command.

Memo

While the frequency command is being adjusted, the frequency for running is switched if other
preset speed command is input. However, the screen display and the adjustment target of the
touch wheel are not switched. When you press the [OK] key, the display is switched to the
current frequency for running.

■ Setting of operation function

For preset speed frequency commands of 1-speed to 15-speed, functions such as direction of rotation, acceleration/deceleration time, V/f control, and torque limit can be set.

After setting <F560: Preset speed operation style> to "1: With function", set functions with <F561 Preset speed 1> to <F576: Preset speed 15>.

| Title | Parameter name | Adjustment range | Default setting |
|-------|------------------------------|----------------------------------|-----------------|
| F560 | Preset speed operation style | Frequency only With function | 0 |

0: Frequency only

Only the frequency command is valid.

1: With function

For each preset speed commands of 1-speed to 15-speed, direction of rotation, acceleration/ deceleration time, V/f control, and torque limit can be set.

In this case, the direction of rotation of the motor is as set with <F561: Operation function (1-speed)> to <F576: Operation function (0-speed)>, not as the input of terminal [F] or terminal [R].

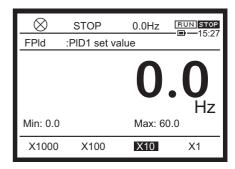
| Title | Parameter name | Adjustment range | Default setting |
|-------------|--|---|-----------------|
| F561 - F575 | Operation function (1- speed) to Operation function (15-speed) | 0: Fwd run +1: Rev run +2: Acc/Dec switching signal 1 | 0 |
| F576 | Operation function (0-speed) | +4: Acc/Dec switching signal 2 +8: V/f switching signal 1 +16: V/f switching signal 2 +32: Torque limit switching signal 1 +64: Torque limit switching signal 2 | |

Add the values of the functions to be used for setting. For example, when using the functions of Rev run (+1) and Acc/Dec switching signal 1 (+2), set "3" (+1+2=+3).

5. 2. 8 Setting PID control

<FPId: PID1 set value>

Basic parameter



■ Function

This parameter is applied to process control including keeping airflow, pressure, and the amount of flow constant

The set value and the feedback signal (4 - 20 mA, 0 - 10 V) from the detector are compared, and the frequency is changed toward the set value.

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|----------------|------------------|------|-----------------|
| FPId | PID1 set value | F368 to F367 | Hz | 0 |

Reference of setting

1) Selecting set value and feedback input

Set the set value of PID control with <F389: PID1 set value select> and the feedback input value with <F360: PID1 feedback input select>.

- For <F389>, do not set the signal used for <F360>.
- When the feedback value and the set value match, the signal can be output. Assign function "144: PID 1, 2 frequency command agreement" to the output terminals.

| Title | Parameter name | Adjustment range | Default setting |
|-------|----------------------------|---|--------------------|
| F389 | PID1 set value select | 0: selected by FMOd/F207 1: Terminal RR 2: Terminal RX 3: Terminal II 4: Terminal Al4 (option) 5: Terminal Al5 (option) 6 - 11: - 12: FPId 13, 14: - 15: Terminal Up/Down frequency 16: Pulse train 17: High resolution pulse train (option) 18, 19: - 20: Embedded Ethernet 21: RS485 communication (connector 1) 22: RS485 communication (connector 2) 23: Communication option | 0 |
| F360 | PID1 feedback input select | 0: - 1: Terminal RR 2: Terminal RX 3: Terminal II 4: Terminal Al4 (option) 5: Terminal Al5 (option) 6 - 16: - 17: High resolution pulse train (option) | 0 |

2) Setting contents of PID control

Set <F359: PID control 1> to "1: Process PID control".

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|--------------------------------|---|------|--------------------|
| F359 | PID control 1 | 0: Disabled 1: Process PID control 2: Speed PID control 3: Easy positioning P control 4: Dancer control 5 - 10: - 11: Minus Process PID control 12: Minus Speed PID control 13: Minus Easy positioning P control 14: Minus Dancer control | | 0 |
| F367 | PID1 set value upper- limit | 0.0 - FH | Hz | 50.0/60.0 |
| F368 | PID1 set value lower-limit | 0.0 - F367 | Hz | 0.0 |

Set <ACC: Acceleration time 1> and <dEC: Deceleration time 1> to the time that is suitable for the system. Refer to [5. 1. 4].

To limit the setting values, set the following parameters.

- To limit the set value: <F367: PID1 set value upper-limit>, <F368: PID1 set value lower-limit >
- To limit the output frequency: <UL: Upper limit frequency>, <LL: Lower limit frequency> (Refer to [5. 1. 3].)

Memo

 PID control can be temporarily turned off with an external signal. Assign "36: PID control OFF" to an input terminal.

3) Adjusting PID control gain level

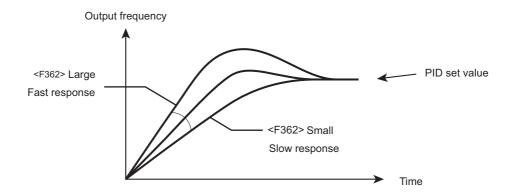
Adjust the PID control gain level according to the set values, the feedback signals, and the object to be controlled.

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|------------------------|------------------|-----------------|--------------------|
| F362 | PID1 proportional gain | 0.01 - 100.0 | - | 0.30 |
| F363 | PID1 integral gain | 0.01 - 100.0 | s ⁻¹ | 0.20 |
| F366 | PID1 differential gain | 0.00 - 2.55 | S | 0.00 |

<F362: PID1 proportional gain>

This parameter adjusts the proportional gain level of PID control. A correction value proportional to the particular deviation (the difference between the set value and the feedback value) is obtained by multiplying this deviation by the parameter setting.

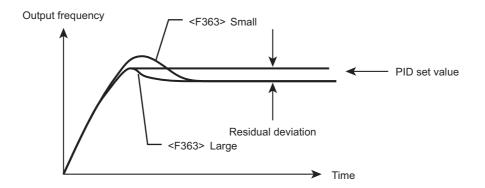
A larger P-gain adjustment value gives faster response. Too large an adjustment value, however, results in an unstable event such as hunting.



<F363: PID1 integral gain>

This parameter adjusts the integral gain level of PID control. Any remaining deviations (residual deviation offset) during proportional action are cleared to zero.

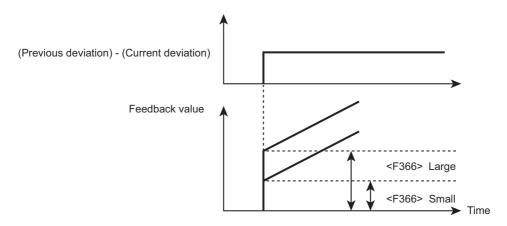
A larger I-gain adjustment value reduces residual deviations. Too large an adjustment value, however, results in an unstable event such as hunting.



The integral/derivative amount of PID control can be reset with an external signal. Assign function number "52: PID differential/integral reset" to an input terminal.

<F366: PID1 differential gain>

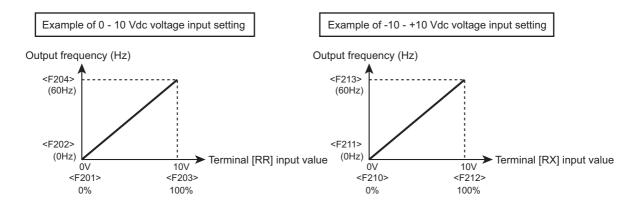
This parameter adjusts the differential gain level of PID control. This gain increases the speed of response to a rapid change in deviation (difference between the set value and the feedback value). Note that setting the gain beyond necessity may cause fluctuations in output frequency, and thus operation to become unstable.



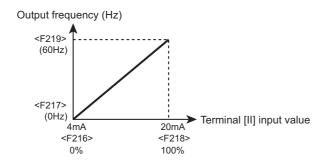
The integral/derivative amount of PID control can be reset with an external signal. Assign "52: PID differential/integral reset" to an input terminal.

4) Adjusting feedback input

Make adjustment by converting input level of the feedback value into frequency. Refer to [6. 6. 2].



Example of 4 - 20 mAdc current input setting



5) Setting the time elapsed before PID control starts

Waiting time until starting PID control system can be set to avoid PID control until the control system becomes stable at power on.

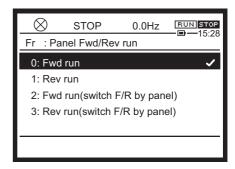
The inverter ignores feedback input signals and runs at the frequency determined by the frequency command value for the period of time set with <F369: PID1 start wait time>, and enters PID control after the elapsed time.

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|-----------------------------|------------------|------|-----------------|
| F369 | PID control start wait time | 0 - 2400 | s | 0 |

5. 2. 9 Switching direction of rotation during panel run

<Fr: Panel Fwd/Rev run select>

Basic parameter



Function

This parameter is used to select the direction of rotation of the motor during panel run.

The direction of rotation can be changed during run by using the [FWD/REV] key on the operation panel.

Parameter setting

| Title | Parameter name | Adjustment range | Default setting |
|-------|-----------------------------|---|--------------------|
| Fr | Panel Fwd/Rev run select | 0: Fwd run1: Rev run2: Fwd run (switchable F/R by panel)3: Rev run (switchable F/R by panel) | 0 |

Selecting a setting value

0: Fwd run

When you press the [RUN] key on the operation panel, the motor runs forward.

Forward run/reverse run cannot be switched.

1: Rev run

When you press the [RUN] key on the operation panel, the motor runs reversely.

Forward run/reverse run cannot be switched.

2: Fwd run (switchable F/R by panel)

When you press the [RUN] key on the operation panel, the motor runs forward.

When you press the [FWD/REV] key during forward run, the motor starts running reversely. When you press the [FWD/REV] key again, the motor starts running forward.

The command given before "MOFF" display is remained at the power off.

3: Rev run (switchable F/R by panel)

When you press the [RUN] key on the operation panel, the motor runs reversely.

When you press the [FWD/REV] key during reverse run, the motor starts running forward. When you press the [FWD/REV] key again, the motor starts running reversely.

The command given before "MOFF" display is remained at the power off.

Direction of rotation of motor

You can check the direction of rotation of the motor with the following display.

- FWD / FWD display of the rotation direction icon.
- · Direction of rotation of the rotating icon
- "Forward"/"Reverse" display of the direction of rotation in [Monitor mode].

When the [FWD]/[REV] key is valid, FWD is displayed at the upper right of the LCD screen.

highlighted.

When the motor is running forward, REV is highlighted. When it is running reversely, is



Memo

• This function is valid when the motor is run/stopped from the operation panel or extension panel (<CMOd: Run command select> = "1").

• In the case of terminal run, setting with <Fr: Panel Fwd/Rev run select> is invalid. Switch forward/reverse run with the terminal [F] and the terminal [R].

Terminal [F]: Fwd run Terminal [R]: Rev run

For details of terminal run, refer to "Chapter 7".

5. 2. 10 Automatic setting of main parameters by region used

A WARNING



· Make sure to set the setup menu correctly.

If you set the setup menu incorrectly, this will damage the inverter or cause the inverter to perform unexpected movement.

<SEt: Region setting check>





Function

When you select a region using in the setup menu at initial Power on, parameters such as the base frequency of the motor is set automatically according to the selected region.

You can check the region that has been set or reset it by starting the setup menu.

Parameter setting

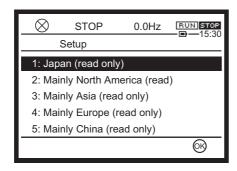
| Title | Parameter name | Adjustment range | Default setting |
|-------|----------------------|--|--------------------|
| SEt | Region setting check | Setup menu starting Japan (read only) Mainly North America (read only) Mainly Asia (read only) Mainly Europe (read only) Mainly China (read only) | 0 |

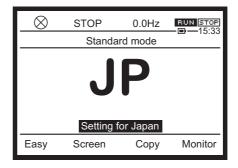
Selecting a setting value

0: Setup menu starting

The setup menu to select the region where the inverter is used is started.

When you select the region, parameters such as the base frequency and the base frequency voltage of the motor that are described on the separate table are automatically set.







- While the setup menu is started, you cannot return to the previous step even if you press the [ESC] key.
- Note that all parameters return to status of default setting and the trip history data is cleared.
- 1: Japan (read only)
- 2: Mainly North America (read only)
- 3: Mainly Asia (read only)
- 4: Mainly Europe (read only)
- 5: Mainly China (read only)

All of 1 to 5 are display to check the setting. Even if you select any of them and press the [OK] key, new setting cannot be made.

There is a mark at the right end of the region selected in the setup menu.

Parameters set with setup menu

| Parameter title | Function | Mainly North America | Mainly Asia | Mainly Europe | China | Japan |
|---|--|----------------------------|----------------|------------------|-------|-------|
| FH | Maximum frequency (Hz) | 80.0 | 80.0 | 80.0 | 50.0 | 80.0 |
| F307 | Supply voltage compensation | 2 | 2 | 2 | 2 | 3 |
| F319 | Regenerative over-flux upper limit (%) | 120 | 120 | 120 | 140 | 140 |
| F417 | Motor rated speed (min ⁻¹) | *1 | *1 | *1 | *1 | *1 |
| vLv, F171, F175, F179 | Base frequency Voltage (V) | 230 | 230 | 230 | 200 | 200 |
| | | 460 | 400 | 400 | 380 | 400 |
| vL, UL, F170, F174, F178, F204, F213, F219, F225, F231, F237, F330, F335, F364, F367, F370, F426, F428, F814, A316, A319, A322, A346, A349, A352, A376, A379, A382 | Frequency (Hz) | 60.0 | 50.0 | 50.0 | 50.0 | 60.0 |

| Parameter title | Function | | Mainly North America | Mainly Asia | Mainly Europe | China | Japan |
|-----------------|-----------------------------------|-----|----------------------------|----------------|------------------|-------|-------|
| F606, F643 | Frequency (max of set value) (Hz) | | 60.0 | 50.0 | 50.0 | 50.0 | 60.0 |
| F405 | Motor rated 3.7 Capacity (kW) 0.4 | 3.7 | 4.0 | 4.0 | 4.0 | 3.7 | 3.7 |
| | | 0.4 | 0.4 | 0.4 | 0.4 | 0.37 | 0.4 |

^{*1} Depending on the region and the capacity. Refer to [11. 6].

Memo

• The setting values of the parameters set with the setup menu can be changed as in the case of other parameters.

5. 3 Setting of extended parameters that are especially important

This section explains the parameters that are especially important among the extended parameters. For other extended parameters not introduced here, refer to "Chapter 6".

5. 3. 1 Switching two frequency commands

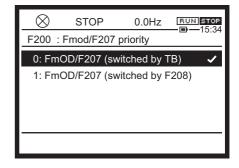
<FMOd: Frequency command select 1>

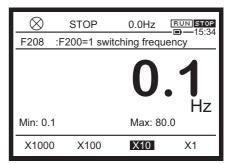


<F207: Frequency command select 2>

<F200: Frequency command priority select>

<F208: Frequency command switching frequency>





Function

Two frequency commands, for example manual setting with external potentiometer and automatic setting with 4 - 20 mA signals, can be switched.

Switch two frequency commands set with <FMOd: Frequency command select 1> and <F207: Frequency command select 2> with input terminal signals or switching frequency set with <F200: Frequency command priority select>.

Parameter setting

| Title | Parameter name | Adjustment range | Default setting |
|-------|----------------------------|--|--------------------|
| FMOd | Frequency command select 1 | 0: - 1: Terminal RR | 1 |
| F207 | Frequency command select 2 | 2: Terminal RX 3: Terminal II 4: Terminal Al4 (option) 5: Terminal Al5 (option) 6 - 9: - 10: Touch wheel 1 (power off or press OK to save) 11: Touch wheel 2 (press OK to save) 12: Sr0 13, 14: - 15: Terminal Up/Down frequency 16: Pulse train 17: High resolution pulse train (option) 18, 19: - 20: Embedded Ethernet 21: RS485 communication (connector 1) 22: RS485 communication (connector 2) 23: Communication option | 3 |

| Title | Parameter name | Adjustment range | Default setting |
|-------|-----------------------------------|--|--------------------|
| F200 | Frequency command priority select | 0: FMOd/F207 (switched by TB) 1: FMOd/F207 (switched by <f208>)</f208> | 0 |

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|---------------------------------------|------------------|------|--------------------|
| F208 | Frequency command switching frequency | 0.1 - FH | Hz | 0.1 |

Setting of two frequency commands

Set with <FMOd: Frequency command select 1> and <F207: Frequency command select 2>. The adjustment range is the same.

Refer to "■ Selection of setting value" of <FMOd: Frequency command select 1> in [5. 1. 1].

Setting of <F200: Frequency command priority select>

0: FMOd/F207 (switched by TB)

The frequency commands set with <FMOd: Frequency command select 1> and <F207: Frequency command select 2> are switched with input terminal signals.

Setting of the function number of the input terminal is required.

1: FMOd/F207 (switched by <F208>)

The frequency commands set with <FMOd: Frequency command select 1> and <F207: Frequency command select 2> are switched with frequency.

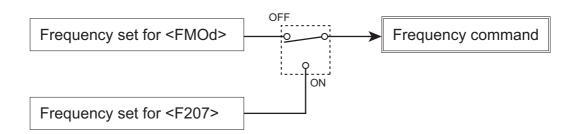
Set the switching frequency with <F208: Frequency command switching frequency>.

■ Switching with input terminal <F200> = "0"

Set <F200: Frequency command priority select> to "0".

Assign "104: FMOd/F207 priority switching" to an unused input terminal. For details, refer to [7. 2. 1].

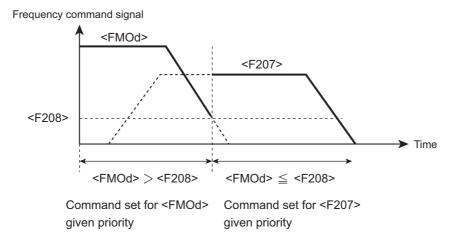
- When the input terminal is OFF, run the motor with the frequency command set with <FMOd: Frequency command select 1>.
- When the input terminal is ON, run the motor with the frequency command set with <F207: Frequency command select 2>.



■ Automatic switching with switching frequency <F200> = "1"

Set <F200: Frequency command priority select> to "1" and set the frequency with <F208: Frequency command switching frequency>.

- If the frequency command set with <FMOd: Frequency command select 1> is larger than the value set with <F208>, the value set with <FMOd> becomes the frequency command.
- If the frequency command set with <FMOd> is larger than the value set with <F208>, the value set with <F207: Frequency command value 2> becomes the frequency command.



5. 3. 2 Restarting smoothly after momentary power failure

⚠ CAUTION



Mandatory

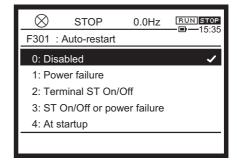
 When the auto-restart after momentary stop function is selected, stand clear of motors and machines at momentary power failure.

The motors and machines which have stopped due to momentary power failure will restart suddenly after power is restored, and this will result in injury.

 Attach caution labels indicating functions programmed for Auto restart, on inverters, motors and machines.

Please prevent accidents with the caution labels.

<F301: Auto-restart>



Function

The motor that is coasting due to momentary power failure is accelerated immediately after the power is restored (auto-restart function).

In addition, this parameter detects the motor speed and direction of rotation of the motor during coasting at the time of startup, and allows switching from commercial power operation to inverter operation without stopping the motor(motor speed search function).

Parameter setting

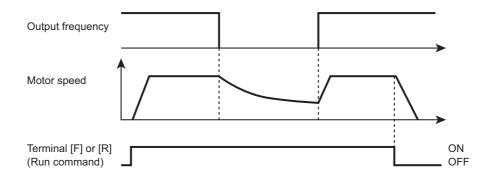
| Title | Parameter name | Adjustment range | Default setting |
|-------|----------------|---|--------------------|
| F301 | Auto-restart | 0: Disabled 1: Power failure 2: Terminal ST On/Off 3: Terminal ST On/Off or power failure 4: At startup | 0 |

■ Selecting a setting value

1: Power failure

The motor that is coasting due to momentary power failure is accelerated immediately after the power is restored.

It is operated after power is restored after power circuit undervoltage is detected. Turn on the run command.



2: Terminal ST On/Off

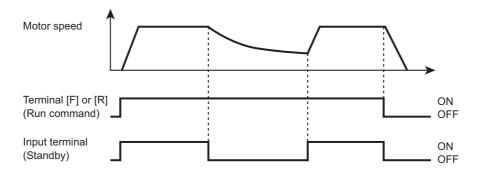
The motor speed and direction of rotation of the coasting motor are detected to start it smoothly (motor speed search function).

The input terminal to which "ST: Standby" is assigned is turned off. It is operated when the input terminal is turned on again. Turn on the run command.

Since "ST: Standby" is always ON in default setting, make setting as follows.

- Set <F110: Always active function 1> to "0: No function" (Refer to [6. 3. 1])
- · Assign "6: ST: Standby" to an unused input terminal

For assignment of a function to an input terminal, refer to [7. 2. 1].



3: Terminal ST On/Off or power failure

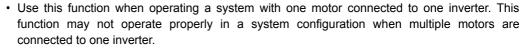
It is operated both in "1" and "2"

4: At startup

A motor speed search is executed each time at startup.

When the motor is rotated by the external factor before running by the inverter, it can be started without trip.

• At restart, it takes about 1 second for the inverter to check the motor speed. For this reason, the startup takes more time than usual.



- When using this parameter, do not set <F605: Output phase loss detection> to "1", "2", or "4". For details, refer to [6. 30. 5].
- · Do not apply it for cranes. The load may be lowered during waiting time from input of the run command to startup. To apply the inverter to cranes, therefore, set <F301: Auto-restart> to "0: Disabled". Do not use the retry function, either.

Memo

Important

- · When the motor is restarted from retry, this function is operated regardless of the setting of this parameter.
- · It is not malfunction that abnormal noise might be heard from the motor during the motor speed search at the auto-restart.

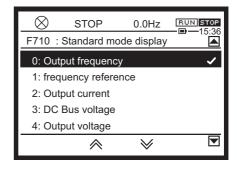
5. 3. 3 Customizing display

(1) Selecting contents displayed in [Standard mode]

<F710: Standard mode display>

<F720: Standard mode display of extension

panel>



■ Function

The display contents in [Standard mode] can be changed. Different contents can be displayed on the operation panel of the inverter unit and the extension panel (optional).

Select the display contents in [Standard mode] when the power is turned on. In the default setting, the output frequency is displayed.

Parameter setting

| Title | Parameter name | Adjustment range | Default setting |
|-------|--|-----------------------|--------------------|
| F710 | Standard mode display | 0 - 162 ^{*1} | 0 |
| F720 | Standard mode display of extension panel | 0 - 162 ^{*1} | 0 |

^{*1} For details, refer to the table at the end of this subsection.

■ Reference of setting

With <F710: Standard mode display>, set the contents to be displayed in [Standard mode] on the operation panel when the power is turned on. Set the extension panel with <F720: Standard mode display of extension panel>.

In either case, "0: Output frequency" in the default setting.

Memo

• Different contents can be displayed on the operation panel of the inverter unit and the extension panel (optional).

■ Setting list of <F710: Standard mode display> and <F720: Standard mode display of extension panel>

| Set- ting value | Function name | Display unit | Set- ting value | Function name | Display unit |
|-----------------------|---|-------------------------------|-----------------------|---|-----------------|
| 0 | Output frequency | 0.1 Hz | 71 | Motor speed (estimated value) | 1 |
| 1 | Frequency command value | 0.1 Hz | 72 | Communication option Receiving counter | 1 |
| 2 | Output current | 1%/ <f701> setting</f701> | 73 | Communication option Abnormal counter | 1 |
| 3 | Input voltage (DC detection) | 1%/ <f701> setting</f701> | 76 | Terminal S4/S5 pulse train input value | 0.10% |
| 4 | Output voltage | 1%/ <f701> setting</f701> | 77 | My function COUNT1 | 1 |
| 5 | Stator frequency | 0.1 Hz | 78 | My function COUNT2 | 1 |
| 6 | Speed feedback frequency (real time) | 0.1 Hz | 79 | Dancer control PID result frequency | 0.1 Hz |
| 7 | Speed feedback frequency (1-second filter) | 0.1 Hz | 80 | Embedded Ethernet Transmission counter | 1 |
| 8 | Torque | 1% | 81 | Embedded Ethernet Receiving counter | 1 |
| 9 | Torque command | 1% | 82 | Embedded Ethernet Abnormal counter | 1 |
| 10 | Output frequency during run. Frequency command value during stop. | Hz/free unit | 83 | Connected option number | 1 |
| 11 | Torque current | 1% | 84 | My function COUNT3 | 1 |
| 12 | Exciting current | 1% | 85 | My function COUNT4 | 1 |
| 13 | PID feedback value | 0.1 Hz | 86 | My function COUNT5 | 1 |
| 14 | Motor overload factor (OL2 data) | 1% | 90 | Cumulative power ON time | 100 hours |
| 15 | Inverter overload factor (OL1 data) | 1% | 91 | Cumulative cooling fan run time | 100 hours |
| 16 | Braking resistor overload factor (OLr data) | 1% | 92 | Cumulative run time | 100 hours |
| 17 | Braking resistor load factor (%ED) | 1% | 93 | Cumulative overcurrent time | 100 hours |
| 18 | Input power | 0.1 kW | 95 | Pump 0 run time | 100 hours |
| 19 | Output power | 0.1 kW | 96 | Pump 1 run time | 100 hours |
| 20 | Input cumulative power | <f749> set- ting</f749> | 97 | Pump 2 run time | 100 hours |
| 21 | Output cumulative power | <f749> set- ting</f749> | 98 | Pump 3 run time | 100 hours |

| Set- ting value | Function name | Display unit | Set- ting value | Function name | Display unit |
|-----------------------|---|--------------|-----------------------|---|-----------------|
| 22 | Fixed output 1 | - | 99 | Pump 4 run time | 100 hours |
| 23 | Fixed output 2 | - | 100 | Number of starting | 10000 times |
| 24 | Terminal RR input value | 1% | 101 | Number of Fwd starting | 10000 times |
| 25 | Terminal RX input value | 1% | 102 | Number of Rev starting | 10000 times |
| 26 | Terminal II input value | 1% | 103 | External equipment counter | Time |
| 27 | Motor speed command | - | 105 | Pump 5 run time | 100 hours |
| 28 | Terminal FM output value | 1 | 106 | Pump 6 run time | 100 hours |
| 29 | Terminal AM output value | 1 | 107 | Pump 7 run time | 100 hours |
| 30 | - | - | 108 | Pump 8 run time | 100 hours |
| 31 | Communication data output | *1 | 109 | Pump 9 run time | 100 hours |
| 32 | Slot A option CPU version | - | 110 | Number of trip | Time |
| 33 | Slot B option CPU version | - | 111 | Number of serious failure trip | 1 |
| 34 | Motor load factor | % | 112 | Number of slight failure trip | 1 |
| 35 | Inverter load factor | % | 113 | Number of specified trip 1 | 1 |
| 36 | Inverter rated current | А | 114 | Number of specified trip 2 | 1 |
| 37 | Inverter rated current (with carrier frequency correction) | Α | 115 | Number of specified trip 3 | 1 |
| 38 | Actual carrier frequency | kHz | 120 | Internal temperature 1 | °C |
| 39 | Slot C option CPU version | - | 124 | Power circuit board temperature | °C |
| 40 | Embedded Ethernet CPU version | - | 130 | External PID3 set value | 0.1 Hz |
| 41 | Terminal FP pulse train output value | pps | 131 | External PID3 feedback value | 0.1 Hz |
| 43 | Terminal FM/AM gain setting value | - | 132 | External PID3 result value | 0.1 Hz |
| 44 | Terminal Al4 input value | 1% | 133 | External PID4 set value | 0.1 Hz |
| 45 | Terminal AI5 input value | 1% | 134 | External PID4 feedback value | 0.1 Hz |
| 46 | My function monitor output 1 | - | 135 | External PID4 result value | 0.1 Hz |
| 47 | My function monitor output 2 | - | 150 | Signed output frequency | 0.1 Hz |
| 48 | My function monitor output 3 | - | 151 | Signed frequency command value | 0.1 Hz |
| 49 | My function monitor output 4 | - | 152 | Signed stator frequency | 0.1 Hz |
| 62 | PID result frequency | 0.1 Hz | 153 | Signed speed feedback frequency (real time) | 0.1 Hz |

| Set- ting value | Function name | Display unit | Set- ting value | Function name | Display unit |
|-----------------------|--|--------------|-----------------------|---|-----------------|
| 63 | PID set value | 0.1 Hz | 154 | Signed speed feedback frequency (1-second filter) | 0.1Hz |
| 64 | Light-load high-speed switching load torque | 1% | 155 | Signed torque | 1% |
| 65 | Light-load high-speed torque during constant speed run | 1% | 156 | Signed torque command | 1% |
| 66 | Pattern operation group number | 0.1 | 158 | Signed torque current | 1% |
| 67 | Pattern operation remaining cycle number | 1 | 159 | Signed PID feedback value | 0.1 Hz |
| 68 | Pattern operation preset speed number | 1 | 160 | Signed terminal RX input value | 1% |
| 69 | Pattern operation remaining time | 0.1 | 161 | Signed terminal Al4 input value | 1% |
| 70 | Inverter rated voltage | 1 | 162 | Signed terminal AI5 input value | 1% |

^{*1} For details, refer to "RS485 Communication Function Instruction Manual".

(2) Selecting contents displayed in the status area

<F723: Status area display of operation panel>

■ Function

Sets the content displayed third from the left end of the status area. Default setting displays the frequency command value.



Parameter setting

| Title | Parameter name | Adjustment range | Default setting |
|-------|--|-----------------------|-----------------|
| F723 | Status area display of operation panel | 0 - 162 ^{*1} | 1 |

^{*1} For details, refer to the table at the end of the previous subsection (1).

VF-AS3

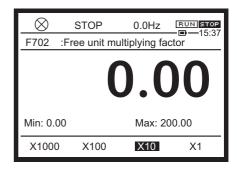
(3) Displaying frequency by converting to other unit

<F702: Free unit multiplication factor>

<F703: Target of free unit>

<F705: Free unit inclination polarity>

<F706: Free unit bias>



Function

The monitor display and the frequency display of parameters can be converted into the motor speed or load speed.

The unit of the set value or that of feedback can be changed at PID control for easy setting.

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|---------------------------------|---|-------|--------------------|
| F702 | Free unit multiplication factor | 0.00: Disabled 0.01 - 200.0 | times | 0.00 |
| F703 | Target of free unit | O: All frequencies 1: PID frequencies | - | 0 |
| F705 | Free unit inclination polarity | Negative inclination (downward slope) Positive inclination (upward slope) | - | 1 |
| F706 | Free unit bias | 0.00 - FH | Hz | 0.00 |

Reference of setting

The value obtained by multiplying the displayed frequency by the setting value of <F702: Free unit multiplication factor> is displayed.

"Value displayed" = "Monitor-displayed" or "parameter-set frequency" x <F702>

Parameters converted with <702: Free unit multiplication factor>

When <F703: Target of free unit> is "0"

It applies to all the frequency.

- Frequency monitor display: Frequency command value, Output frequency, PID feedback value, Stator frequency, During stop: Frequency command value (During run: Output frequency)
- Frequency-related parameters: <FC>, <FH>, , <LL>, <FPId>, <Sr0> <Sr7>, <F100>, <F101>, <F102>, <F190>, <F192>, <F194>, <F196>, <F198>, <F202>, <F204>, <F208>, <F211>, <F213>, <F217>, <F219>, <F223>, <F225>, <F229>, <F231>, <F235>, <F237>, <F240>, <F241>, <F242>, <F243>, <F244>, <F250>, <F260>, <F265>, <F267>, <F268>, <F270> <F275>, <F287> <F294>, <F321>, <F322>, <F330>, <F331>, <F346>, <F350>, <F352>, <F355>, <F364>, <F365>, <F367>, <F368>, <F370>, <F371>, <F374>, <F383>, <F391> <F393>, <F426>, <F428>, <F431>, <F432>, <F466>, <F505>, <F513>, <F517>, <F606>, <F623>, <F624>, <F643>, <F649>, <F812>, <F814>, <F964> <F979>

```
<A316>, <A317>, <A319>, <A320>, <A322>, <A323>, <A326>, <A327>, <A346>, <A347>,
<A349>, <A350>, <A352>, <A353>, <A357>, <A376>, <A377>, <A379>, <A380>, <A382>,
<A383>, <A387>, <A923> - <A927>
<C154>, <C155>, <C697>
```

When <F703: Target of free unit> is "1"

It applies only to the PID control-related frequency.

PID control-related parameters: <FPId>, <F364>, <F365>, <F367>, <F368>, <F374>, <F388>,
 <A316>, <A317>, <A319>, <A320>, <A326>, <A327>, <A328>, <A346>, <A347>, <A349>,
 <A350>, <A357>, <A376>, <A377>, <A379>, <A380>, <A387>

Memo

Base frequency is always Hz.
 <vL: Base frequency 1>, <F170: Base frequency 2>, <F174: Base frequency 3>, <F178: Base frequency 4>

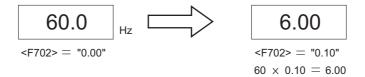
Setting example of <F702: Free unit multiplication factor>

1) Motor speed display

When output frequency 60 Hz is displayed as 1800min⁻¹ at the time of 4-pole motor operation

2) Load speed display

When output frequency 60 Hz is displayed as conveyor speed of 6m/min



Setting of <F705: Free unit inclination polarity> and <F706: Free unit bias>

The inclination of the free unit can be changed, and the bias can be set. The following are examples of setting and screen display (when <F702> = "10.0", <FH> = "80.0").

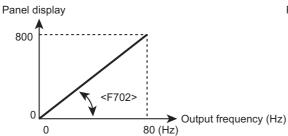
Output frequency (Hz)

Positive inclination

Positive inclination with bias

<F705>="1", <F706>="20.00"

<F705>="1 ", <F706>="0.00"



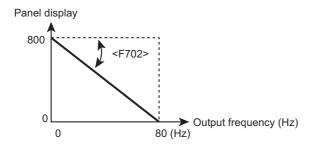
Panel display

1000

F702>

Negative inclination

<F705>="0", <F706>="80.00"



(Important

• This parameter is a function to display the output frequency of the inverter multiplied by the factor. It does not display the actual motor speed or line speed precisely.

200

[Advanced] How to use parameters

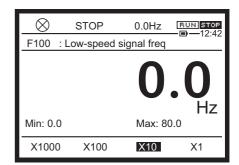
This inverter has basic parameters and other three types of parameters such as extended parameters (with F), advanced parameters, (with A), and communication parameters (with C). These parameters are used for sophisticated operations, detailed settings, special purposes, etc. This chapter explains how to use the parameters that are not mentioned in the previous chapters.

6. 1 Output signals from the control terminals

Various signals are output for motor operation. For details on the output terminal functions, refer to [7. 2. 2].

6. 1. 1 Output the running signal and the brake signal (output the low-speed signal)

<F100: Low-speed signal output frequency>



Function

When the output frequency becomes over <F100: Low-speed signal output frequency>, the low-speed signal is output from the output terminal.

- When <F100: Low-speed signal output frequency> is set to "0.0", the ON signal is output when the output frequency is over 0.0 Hz. Therefore, this setting can be used as a running signal.
- This signal can be also used as brake/release signal for the electromagnetic brake.

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|-----------------------------------|------------------|------|-----------------|
| F100 | Low-speed signal output frequency | 0.0-FH | Hz | 0.0 |

Ι

П

1

2

)

7

8

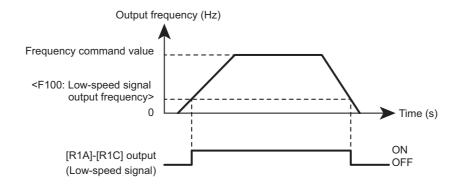
11

12

13

14

15



Output terminal parameter setting

Low-speed signal is the default setting for terminal [R1].

| Title | Parameter name | Adjustment range | Default setting |
|-------|------------------------|---------------------|-----------------|
| F133 | Terminal R1 function 1 | 0-255 ^{*1} | 4 |

^{*1} For details on the output terminal functions, refer to [7. 2. 2].

Memo

• When you want to output the inversion signal (OFF signal), set "5".

• The signals can be also output from the other output terminals depending on the parameter setting.

When you want to output the signals from the relay logic output terminals [FLA]-[FLB]-[FLC], set "4" or "5" for <F132: Terminal FL function>. When you want to output the signals from the terminals [R2A]-[R2C], set "4" or "5" for <F134: Terminal R2 function>. When you want to output the signals from the terminal [FP], set "4" or "5" for <F130: Terminal FP function 1>.

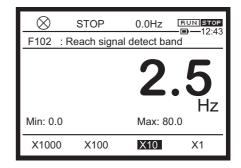
Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

VF-AS3

6. 1. 2 Output a signal when reached to a frequency command (output the Acc/Dec completed signal)

<F102: Reach signal detection band>

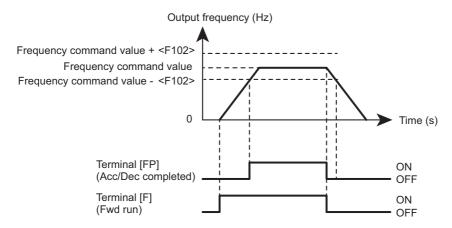


Function

When the output frequency becomes the frequency command ±<F102: Reach signal detection band>, the Acc/Dec completed signal is output from the output terminal.

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|-----------------------------|------------------|------|-----------------|
| F102 | Reach signal detection band | 0.0-FH | Hz | 2.5 |



Output terminal parameter setting

Acc/Dec completed signal is the default setting for output terminal [FP].

| Title | Parameter name | Adjustment range | Default setting |
|-------|------------------------|---------------------|-----------------|
| F130 | Terminal FP function 1 | 0-255 ^{*1} | 6 |

^{*1} For details on the output terminal functions, refer to [7. 2. 2].

- When you want to output the inversion signal (OFF signal), set "7".
- The signals can be also output from the other output terminals depending on the parameter setting.

Memo

When you want to output the signals from the [FLA]-[FLB]-[FLC] relay logic output terminals, set at <F132: Terminal FL function>. When you want to output the signals from the terminals [R1A]-[R1C], set at <F133: Terminal R1 function 1>. When you want to output the signals from the terminals [R2A]-[R2C]. set at <F134: Terminal R2 function >.

• When the run command (Fwd signal or Rev signal) is OFF, the Acc/Dec completed signal is also OFF.

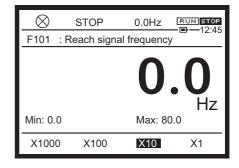
Reference

- How to operate the operation panel -> Refer to [3. 1. 1.
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3].
- Details on operation by external signals -> Refer to [Chapter 7].

VF-AS3

6. 1. 3 Output a signal when reached to a specified frequency (output the specified frequency attainment signal)

<F101: Reach signal specified frequency>
<F102: Reach signal detection band>

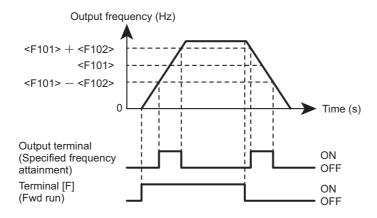


■ Function

When the output frequency becomes the frequency that is equal to the value for <F101: Reach signal specified frequency> plus or minus the value for <F102: Reach signal detection band>, the ON signal (specified frequency attainment signal) is output from a specified output terminal.

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|----------------------------------|------------------|------|-----------------|
| F101 | Reach signal specified frequency | 0.0-FH | Hz | 0.0 |
| F102 | Reach signal detection band | 0.0-FH | Hz | 2.5 |



Output terminal parameter setting

When you want to output the specified frequency attainment signal to the output terminal [FP], set "8" for <F130: Terminal FP function 1>.

When you want to output the signal from the relay logic output terminals [FLA]-[FLB]-[FLC], set <F132: Terminal FL function>. When you want to output the signal from the [R1A]-[R1C] terminals, set <F133: Terminal R1 function 1>. When you want to output the signal from the terminals [R2A]-[R2C] set <F134: Terminal R2 function >.

Memo

- When you want to output the inversion signal (OFF signal), set "9".
- When a run command (Fwd signal or Rev signal) is OFF, the specified frequency attainment signal is also OFF.

Reference

- How to operate the operation panel -> Refer to [3. 1. 1.
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3].
- Details on operation by external signals -> Refer to [Chapter 7].

VF-AS3

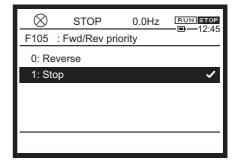
6. 2 Input signals to the control terminals

Various signals are input to the inverter for motor operation.

For details on the input terminal function, refer to [7. 2. 1].

6. 2. 1 Selecting operation at simultaneous input of Fwd/ Rev commands

<F105: Fwd/Rev priority of both close>



Function

This parameter selects operation performed (reverse run or deceleration stop) when the Fwd and Rev signals are simultaneously input.

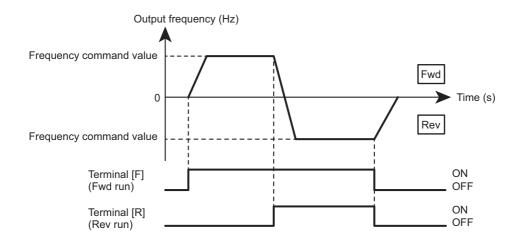
Parameter setting

| Title | Parameter name | Adjustment range | Default setting |
|-------|--------------------------------|-----------------------|-----------------|
| F105 | Fwd/Rev priority of both close | 0: Reverse 1: Stop | 1 |

Difference between the settings

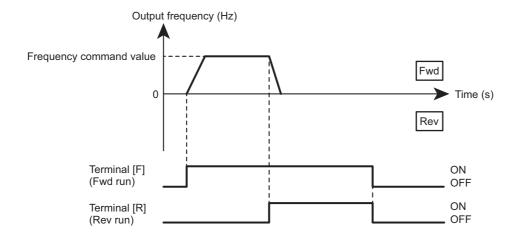
0: Reverse

When the Fwd and Rev signals are simultaneously input, reverse run is performed.



1: Stop

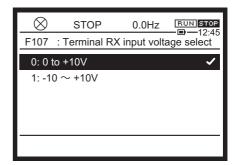
When the Fwd and Rev signals are simultaneously input, deceleration stop is performed.



- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3].
- Details on operation by external signals -> Refer to [Chapter 7].

6. 2. 2 Selecting input voltage of the terminal [RX]

<F107: Terminal RX input voltage select>



■ Function

This parameter selects the input voltage of the terminal [RX].

Parameter setting

| Title | Parameter name | Adjustment range | Default setting |
|-------|----------------------------------|----------------------------------|-----------------|
| F107 | Terminal RX input voltage select | 0: 0 to +10 V 1: -10 to +10 V | 0 |

Difference between the settings

0: 0 to +10 V

Input 0 to 10 Vdc between the terminals [RX]-[CC].

The resolution is 1/1000 at the maximum at 0 to 10 Vdc.

1: -10 to +10 V

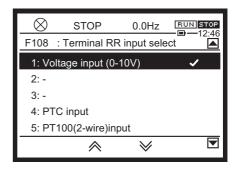
Input -10 to +10 Vdc between the terminals [RX]-[CC].

The resolution is 1/2000 at the maximum at -10 to +10 Vdc.

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 2. 3 Selecting input signal of the terminal [RR]

<F108: Terminal RR input select>



■ Function

This parameter selects the input signal of the terminal [RR].

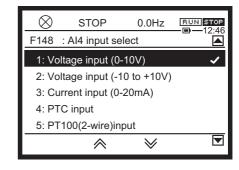
Parameter setting

| Title | Parameter name | Adjustment range | Default setting |
|-------|--------------------------|--|-----------------|
| F108 | Terminal RR input select | 1: Voltage input (0-10 V) 2, 3: - 4: PTC input 5: PT100 (2-wire) input 6: - 7: PT1000 (2-wire) input 8: - 9: KTY84 input | 1 |

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 2. 4 Selecting input signals of the optional terminals [Al4] and [Al5]

<F148: Terminal Al4 input select>
<F149: Terminal Al5 input select>



■ Function

These parameters select an input signal for the optional terminals [Al4] and [Al5].

Parameter setting

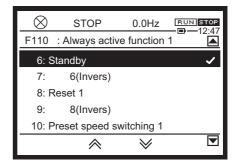
| Title | Parameter name | Adjustment range | Default setting |
|-------|---------------------------|---|-----------------|
| F148 | Terminal Al4 input select | 1: Voltage input (0-10 V) 2: Voltage input (-10 to +10 V) 3: Current input (0-20 mA) 4: PTC input 5: PT100 (2-wire) input | 1 |
| F149 | Terminal AI5 input select | 6: PT100 (3-wire) input 7: PT1000 (2-wire) input 8: PT1000 (3-wire) input 9: KTY84 input | 1 |

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3].

6. 3 Selecting terminal functions

6. 3. 1 Always enabling the input terminal functions (always ON)

<F110: Always active function 1> <F127: Always active function 2> <F128: Always active function 3>



Function

These parameters select an input terminal function to be always enabled (always ON). You can set three points.

Parameter setting

| Title | Parameter name | Adjustment range | Default setting |
|-------|--------------------------|------------------|-----------------|
| F110 | Always active function 1 | 0-177*1 | 6 |
| F127 | Always active function 2 | | 0 |
| F128 | Always active function 3 | | 0 |

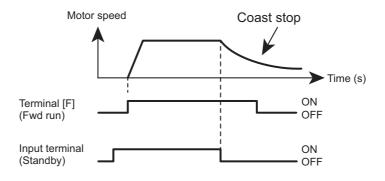
^{*1} For details on the input terminal functions, refer to [7. 2. 1].

• Coast stop is a stop pattern where the inverter output is turned OFF, and the motor rotation stops spontaneously.

The deceleration stop is performed by default setting (the frequency is decreased to 0 Hz by the inverter deceleration time).

- When "ST" (standby) is turned OFF, the motor performs coast stop.
- "ST"(standby)is always ON by default setting. Therefore, change the setting as shown below:
 - <F110: Always active function 1> = "0: No function"
 - Assign "6: ST" (standby) to an unused input terminal.
- When the terminal where "ST" (standby) is assigned is turned OFF, coast stop will be performed.

Memo



- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3].
- Details on operation by external signals -> Refer to [Chapter 7].

6. 3. 2 Changing the input terminal functions

<F111: Terminal F function 1> <F112: Terminal R function 1> <F113: Terminal RES function 1> <F114: Terminal S1 function 1> <F115: Terminal S2 function> <F116: Terminal S3 function> <F117: Terminal S4 function> <F118: Terminal S5 function> <F119: Terminal DI11 function> <F120: Terminal DI12 function> <F121: Terminal DI13 function> <F122: Terminal DI14 function> <F123: Terminal DI15 function> <F124: Terminal DI16 function> <F140: Terminal F response time> <F141: Terminal R response time> <F142: Terminal RES response time> <F143: Terminal S1 response time> <F144: Terminal S2-S5 response time> <F145: Terminal DI11-DI16 response time> <F146: Terminal S4 input select> <F147: Terminal S5 input select> <F151: Terminal F function 2> <F152: Terminal R function 2> <F153: Terminal RES function 2> <F154: Terminal S1 function 2> <F155: Terminal F function 3> <F156: Terminal R function 3> <F157: Terminal RES function 3> <F158: Terminal S1 function 3>

For details on the input terminal functions, refer to [7. 2. 1].

6. 3. 3 Changing the output terminal functions

<F130: Terminal FP function 1>
<F132: Terminal FL function >
<F133: Terminal R1 function 1>
<F134: Terminal R2 function >
<F135: Terminal R1 delay time>
<F136: Terminal R2 delay time>
<F137: Terminal FP function 2>
<F138: Terminal R1 function 2>
<F139: Terminal FP, R1 logic selct>
<F159: Terminal DQ11 function>
<F160: Terminal DQ12 function>
<F161: Terminal R4 function>
<F162: Terminal R5 function>

<F163: Terminal R6 function>

For details on the output terminal functions, refer to [7. 2. 2].

6. 4 Switching two to four types of motor characteristics

<F170: Base frequency 2>

<F171: Base frequency voltage 2>

<F172: Manual torque boost 2>

<F174: Base frequency 3>

<F175: Base frequency voltage 3>

<F176: Manual torque boost 3>

<F178: Base frequency 4>

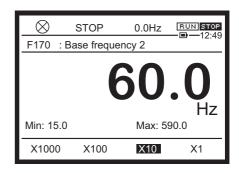
<F179: Base frequency voltage 4>

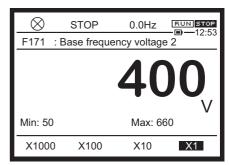
<F180: Manual torque boost 4>

<F182: Motor overload protection current 2>

<F183: Motor overload protection current 3>

<F184: Motor overload protection current 4>





■ Function

These parameters are used for setting when you want to switch up to four types of motors for an inverter, or when you want to switch the motor V/f characteristics (four types) according to the purpose or operation method.

V/f1 to V/f4 are switched by the input terminal signals.

Memo

- <Pt: V/f Pattern> is valid only for V/f1.
- When V/f2 to V/f4 are selected, V/f constant control is applied regardless of the setting of <Pt>.
- Do not switch the motors when <Pt: V/f Pattern> is set to "7" or "8".
- For the parameters that are selected when V/f1 to V/f4 are switched, refer to the following table.

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|--------------------------|--|------|-------------------------|
| F170 | Base frequency 2 | 15.0-590.0 | Hz | 50.0/60.0 ^{*1} |
| F171 | Base frequency voltage 2 | 240V class: 50-330V 480V class: 50-660V | V | *1 |
| F172 | Manual torque boost 2 | 0.00-30.00 | % | *2 |
| F174 | Base frequency 3 | 15.0 - 590.0 | Hz | 50.0/60.0 ^{*1} |
| F175 | Base frequency voltage 3 | 240V class: 50-330V 480V class: 50-660V | V | *1 |

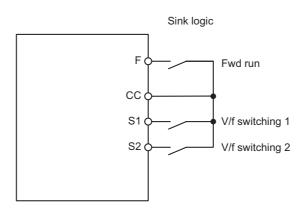
| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|-------------------------------------|--|------|-----------------|
| F176 | Manual torque boost 3 | 0.00-30.00 | % | *2 |
| F178 | Base frequency 4 | 15.0 - 590.0 | Hz | 50.0/60.0 *1 |
| F179 | Base frequency voltage 4 | 240V class: 50-330V 480V class: 50-660V | V | *1 |
| F180 | Manual torque boost 4 | 0.00-30.00 | % | *2 |
| F182 | Motor overload protection current 2 | Depending on capacity*2 | A | *2 |
| F183 | Motor overload protection current 3 | Depending on capacity*2 | Α | *2 |
| F184 | Motor overload protection current 4 | Depending on capacity*2 | Α | *2 |

^{*1} Depending on the setup menu. For details, refer to [5. 2. 10], [11. 10].

Switch terminal setting

V/f1 to V/f4 switching functions are not assigned to the input terminals by default setting. Thus, assign them to unused input terminals.

Example: When V/f switching 1 function is assigned to the terminal [S1], and V/f switching 2 function to the terminal [S2].



| Input terminal | | V/f | Parameters selected | Output terminal (function number) | |
|----------------|-------|-----|---|-----------------------------------|--------|
| S1-CC | S2-CC | | | No.186 | No.188 |
| OFF | OFF | 1 | Base frequency 1: <vl> Base frequency voltage 1: <vlv> Manual torque boost 1: <vb> Motor overload protection current 1: <thra></thra></vb></vlv></vl> | OFF | OFF |
| ON | OFF | 2 | Base frequency 2: <f170> Base frequency voltage 2: <f171> Manual torque boost 2: <f172> Motor overload protection current 2: <f182></f182></f172></f171></f170> | ON | OFF |

^{*2} Varies depending on capacity. For details, refer to [11. 6].

| Input terminal | | V/f | Parameters selected | Output terminal (function number) | |
|----------------|-------|-----|---|-----------------------------------|--------|
| S1-CC | S2-CC | | | No.186 | No.188 |
| OFF | ON | 3 | Base frequency 3: <f174> Base frequency voltage 3: <f175> Manual torque boost 3: <f176> Motor overload protection current 3: <f183></f183></f176></f175></f174> | OFF | ON |
| ON | ON | 4 | Base frequency 4: <f178> Base frequency voltage 4: <f179> Manual torque boost 4: <f180> Motor overload protection current 4: <f184></f184></f180></f179></f178> | ON | ON |

- Be sure to perform V/f switching in the stop state. Switching is impossible during run. It takes 0.1 second before switching. Therefore, be sure to wait 0.1 second or more after inputting a switching signal, and then start operation.
- When you want to use the vector control and V/f 5-point setting, select V/f1. When V/f2 to V/f4 are selected, V/f constant is obtained, and thus making the vector control impossible.
- When you use an input terminal where a variety of functions can be assigned, you can link the switching of torque limit or acceleration/deceleration time to V/f switching.

For operation panel run, you can also set the acceleration/deceleration time at <F504: Panel Acc/ Dec select>. For details, refer to [6. 27. 2].

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3].
- Details on operation by external signals -> Refer to [Chapter 7].

6. 5 V/f 5-point setting

<F190: V/f 5-point VF1 frequency>
<F191: V/f 5-point VF1 voltage>
<F192: V/f 5-point VF2 frequency>
<F193: V/f 5-point VF2 voltage>
<F194: V/f 5-point VF3 frequency>
<F195: V/f 5-point VF3 voltage>
<F196: V/f 5-point VF4 frequency>
<F197: V/f 5-point VF4 voltage>
<F198: V/f 5-point VF5 frequency>
<F199: V/f 5-point VF5 voltage>

Refer to [5. 2. 4].

6. 6 Setting the frequency commands

You can set the frequency commands in various methods. Select a frequency command setting method according to operation. You can also switch the frequency commands using signals to the terminals.

6. 6. 1 Switching two types of frequency commands

<F200: Frequency command priority select>

<FMOd: Frequency command select 1>

<F207: Frequency command select 2>

<F208: Frequency command switching frequency>

Refer to [5. 3. 1].

6. 6. 2 Setting frequency command characteristics by analog signals

<F107: Terminal RX input voltage select>

<F108: Terminal RR input select>

<F148: Terminal Al4 input select>

<F149: Terminal Al5 input select>

<F201: RR point 1 input value>

<F202: RR point 1 frequency>

<F203: RR point 2 input value>

<F204: RR point 2 frequency>

<F205: RR point 1 rate>

<F206: RR point 2 rate>

<F209: Analog input filter>

<F210: RX point 1 input value>

<F211: RX point 1 frequency>

<F212: RX point 2 input value>

<F213: RX point 2 frequency>

<F214: RX point 1 rate>

<F215: RX point 2 rate>

<F216: Il point 1 input value>

<F217: Il point 1 frequency>

<F218: Il point 2 input value>

<F219: II point 2 frequency>

<F220: Il point 1 rate>

<F221: Il point 2 rate>

<F222: Al4 point 1 input value>

<F223: Al4 point 1 frequency>

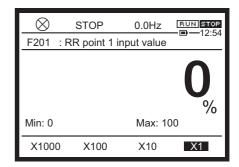
<F224: Al4 point 2 input value>

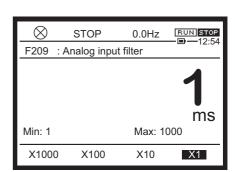
<F225: Al4 point 2 frequency>

<F226: Al4 point 1 rate>

<F227: Al4 point 2 rate>

<F228: Al5 point 1 input value>





VF-AS3

<F229: Al5 point 1 frequency>
<F230: Al5 point 2 input value>
<F231: Al5 point 2 frequency>

<F810: Communication frequency point select>
<F811: Communication point 1 input value>
<F812: Communication point 1 frequency>
<F813: Communication point 2 input value>
<F814: Communication point 2 frequency>

■ Function

These parameters set the output frequencies for the frequency commands of the analog signals. You can use the following terminals. The terminals [Al4] and [Al5] are optional.

Voltage input (0 to 10 V) : terminals [RR], [RX], [Al4], and [Al5] Voltage input (-10 to +10 V) : terminals [RR], [RX], [Al4], and [Al5]

Curret input (4 to 20 mA) : terminals [II], [Al4], and [Al5]

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|----------------------------------|--|------|-----------------|
| F107 | Terminal RX input voltage select | 0: 0 to +10 V 1: -10 to +10 V | - | 0 |
| F108 | Terminal RR input select | 1: Voltage input (0-10 V) 2: - 3: - 4: PTC input 5: PT100 (2-wire) input 6: - 7: PT1000 (2-wire) input 8: - 9: KTY84 input | - | 1 |
| F148 | Terminal Al4 input select | 1: Voltage input (0-10 V) 2: Voltage input (-10 to +10 V) 3: Current input (0-20 mA) 4: PTC input 5: PT100 (2-wire) input 6: PT100 (3-wire) input 7: PT1000 (2-wire) input 8: PT1000 (3-wire) input 9: KTY84 input | - | 1 |
| F149 | Terminal Al5 input select | | | 1 |
| F201 | RR point 1 input value | 0-100 | % | 0 |
| F202 | RR point 1 frequency | 0.0-590.0 | Hz | 0.0 |
| F203 | RR point 2 input value | 0-100 | % | 100 |
| F204 | RR point 2 frequency | 0.0-590.0 | Hz | 50.0/60.0 *1 |
| F205 | RR point 1 rate | 0-250 | % | 0 |
| F206 | RR point 2 rate | 0-250 | % | 100 |
| F209 | Analog input filter | 1: Disabled 2-1000 | ms | 1 |

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|--------------------------------------|--|------|-----------------|
| F210 | RX point 1 input value | -100 to +100 | % | 0 |
| F211 | RX point 1 frequency | 0.0-590.0 | Hz | 0.0 |
| F212 | RX point 2 input value | -100 to +100 | % | 100 |
| F213 | RX point 2 frequency | 0.0-590.0 | Hz | 50.0/60.0 *1 |
| F214 | RX point 1 rate | -250 to +250 | % | 0 |
| F215 | RX point 2 rate | -250 to +250 | % | 100 |
| F216 | II point 1 input value | 0-100 | % | 0 |
| F217 | II point 1 frequency | 0.0-590.0 | Hz | 0.0 |
| F218 | II point 2 input value | 0-100 | % | 100 |
| F219 | II point 2 frequency | 0.0-590.0 | Hz | 50.0/60.0 *1 |
| F220 | II point 1 rate | 0-250 | % | 0 |
| F221 | II point 2 rate | 0-250 | % | 100 |
| F222 | Al4 point 1 input value | -100 to +100 | % | 0 |
| F223 | Al4 point 1 frequency | 0.0-590.0 | Hz | 0.0 |
| F224 | Al4 point 2 input value | -100 to +100 | % | 100 |
| F225 | Al4 point 2 frequency | 0.0-590.0 | Hz | 50.0/60.0 *1 |
| F226 | Al4 point 1 rate | -250 to +250 | % | 0 |
| F227 | Al4 point 2 rate | -250 to +250 | % | 100 |
| F228 | Al5 point 1 input value | -100 to +100 | % | 0 |
| F229 | Al5 point 1 frequency | 0.0-590.0 | Hz | 0.0 |
| F230 | Al5 point 2 input value | -100 to +100 | % | 100 |
| F231 | Al5 point 2 frequency | 0.0-590.0 | Hz | 50.0/60.0 *1 |
| F810 | Communication frequency point select | 0: Disabled 1: RS485 (1) 2: RS485 (2) 3: Communication option 4: Embedded Ethernet | | 0 |
| F811 | Communication point 1 input value | 0-100 | % | 0 |
| F812 | Communication point 1 frequency | 0.0-FH | Hz | 0.0 |
| F813 | Communication point 2 input value | 0-100 | % | 100 |
| F814 | Communication point 2 frequency | 0.0-FH | Hz | 50.0/60.0 *1 |

^{*1} Depending on the setup menu. Refer to [11. 10].

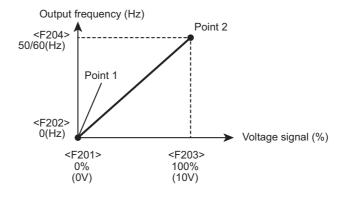
Setting method

Set a frequency command for an analog input amount at two points.

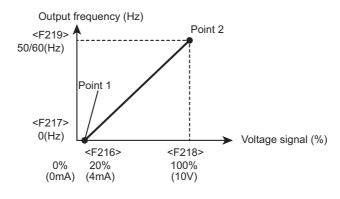
For the corresponding parameters of each terminal and the setting method, refer to the following. As default setting, the range between the minimum and maximum input amounts is set to 0 to 50.0/60.0 Hz for main analog signal of the terminals. For example, the terminal [RR] is set to 0 to 50.0/60.0 Hz at 0-10 V.

- For the terminal [RX], select the voltage for <F107: Terminal RX input voltage select>.
- For the terminal [AI4], select the analog signal for <F148: Terminal AI4 input select>. For the terminal [AI5], select the analog signal for <F149: Terminal AI5 input select>. The terminals [AI4] and [AI5] are optional.
- If noise disturbs stable operation, increase the value for <F209: Analog input filter>. Doing so eliminates the noise of the frequency setting circuit.
- Do not set the same value for point 1 and point 2. Failure to do so displays "Err1". For details on the analog signal setting, refer to [7. 3].

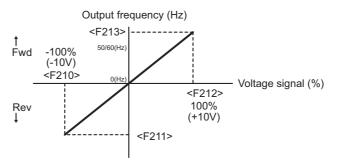
1) For setting the voltage input of 0-10 V (terminals [RR] and [RX]), refer to the following figure.



2) For setting current input of 4-20 mA (terminal [II]), refer to the following figure.



3) For setting voltage input of -10 to +10 V (terminal [RX]), refer to the following figure.



<F107: Terminal RX input voltage select> = "-10 to +10 V"

Memo

- When you want to fine adjust the frequency command characteristics, adjust the bias and gain
 of each input terminal at <F470: RR input bias>-<F479: Al5 input gain>. For details, refer to [6.
 6. 3].
- When you want to set an analog signal for a frequency command, set at <FMOd: Frequency command select 1> (or <F207: Frequency command select 2>).
- 1: Terminal RR
 - 2: Terminal RX
 - 3: Terminal II
 - 4: Terminal Al4 (option)
 - 5: Terminal AI5 (option)

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3].
- Details on operation by external signals -> Refer to [Chapter 7].

6. 6. 3 Fine adjusting the analog frequency commands

<F470: RR input bias>

<F471: RR input gain>

<F472: RX input bias>

<F473: RX input gain>

<F474: II input bias>

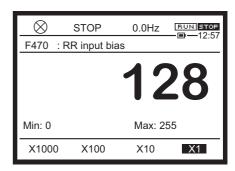
<F475: II input gain>

<F476: Al4 input bias>

<F477: Al4 input gain>

<F478: Al5 input bias>

<F479: Al5 input gain>



■ Function

These parameters fine adjust the characteristics set in [6. 6. 2] "Setting frequency command characteristics by analog signals".

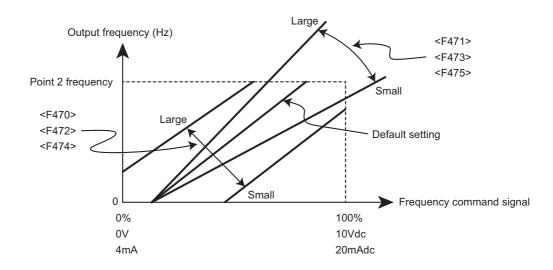
The allowance is zero setting on default setting.

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|----------------|------------------|------|-----------------|
| F470 | RR input bias | 0-255 | - | 128 |
| F471 | RR input gain | 0-255 | - | 128 |
| F472 | RX input bias | 0-255 | - | 128 |
| F473 | RX input gain | 0-255 | - | 128 |
| F474 | II input bias | 0-255 | - | 128 |
| F475 | II input gain | 0-255 | - | 128 |
| F476 | Al4 input bias | 0-255 | - | 128 |
| F477 | Al4 input gain | 0-255 | - | 128 |
| F478 | Al5 input bias | 0-255 | - | 128 |
| F479 | Al5 input gain | 0-255 | - | 128 |

Adjustment method

For the frequency commands to be input to the analog terminals and the output frequency characteristics, refer to the following figure.



Analog input terminal bias adjustment (<F470>, <F472>, <F474>, <F476>, and <F478>)

To avoid the influence of noise, there is a tolerance for the minimum input amount so that the inverter starts output after some voltage/current is applied to the analog input terminal by default setting.

To decrease this tolerance value, increase the bias value for a corresponding terminal.

However, if the set value is too large, frequency may be output even when the frequency command is set to 0 (zero).

Analog input terminal gain adjustment (<F471>, <F473>, <F475>, <F477>, and <F479>)

The set maximum frequency is output before voltage/current reach the maximum value to avoid trouble such as voltage drop by default setting.

When you want to output the set maximum frequency at the maximum voltage and current values, decrease the gain value for a corresponding terminal.

However, if the set value is too small, the maximum frequency may not be output even when voltage and current reach the maximum values.

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3].
- Details on operation by external signals -> Refer to [Chapter 7].

VF-AS3

6. 6. 4 Input the frequency commands by pulse trains

<F146: Terminal S4 input select>

<F147: Terminal S5 input select>

<F234: Pulse train input point 1 input value>

<F235: Pulse train input point 1 frequency>

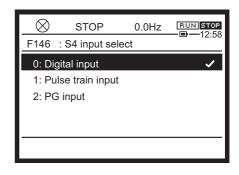
<F236: Pulse train input point 2 input value>

<F237: Pulse train input point 2 frequency>

<F376: PG phases number select>

<F378: Pulse train input pulses number>

<F679: Pulse train input filter>



■ Function

These parameters set the frequency command characteristics by pulse train input.

You can use the terminals [S4] and [S5].

When you want to use pulse train input, set <FMOd: Frequency command select 1> (or <F207: Frequency command select 2>) to "16: Pulse train".

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|---------------------------------------|---|------|-----------------|
| F146 | Terminal S4 input select | 0: Digital input 1: Pulse train input 2: PG input | | 0 |
| F147 | Terminal S5 input select | 0: Digital input 1: Pulse train input 2: PG input | | 0 |
| F378 | Pulse train input pulses number | 1-9999 | pps | 1000 |
| F679 | Pulse train input filter | 1-1000 | ms | 1 |
| F234 | Pulse train input point 1 input value | 0 - 100 | % | 0 |
| F235 | Pulse train input point 1 frequency | 0.0 - 590.0 | Hz | 0.0 |
| F236 | Pulse train input point 2 input value | 0 - 100 | % | 100 |
| F237 | Pulse train input point 2 frequency | 0.0 - 590.0 | Hz | 50.0/60.0 *1 |
| F376 | PG phases number select | 0: PTI (Command) - PTI (FB) 1: PTI (Command) - Digital option (FB) 2 - 5: - 6: Digital option (Command) - Non FB 7 - 9: - 10: PTI (Command) - PTI (FB inversion) 11: PTI (Command) - Digital option (FB inversion) 12 - 15: - 16: Digital option (Command inversion) - Non FB | | 0 |

^{*1} Depending on the setup menu. For details, refer to [5. 2. 10], [11. 10].

■ Guideline for the setting

When you want to use the terminal [S4], set <F146: Terminal S4 input select> to "1: Pulse train input". When you want to use the terminal [S5], set <F147: Terminal S5 input select> to "1: Pulse train input".

Set the number of pulses per 1 Hz of output frequency at <F378; Pulse train input pulses number>. The minimum number of pulses that can be input to the terminals [S4] and [S5] is 10 pps, and the maximum number of pulses 30 kpps. The duty is 50 ±10%.

The maximum frequency that can be output is 200 Hz.

Setting example

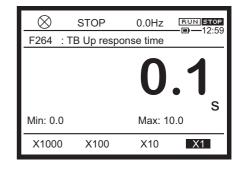
| <f378> setting value</f378> | Input signal | Output frequency |
|-----------------------------|--------------|------------------|
| | 25 (pps) | 1.0 (Hz) |
| 25 (pps) | 100 (pps) | 4.0 (Hz) |
| | 2k (pps) | 80.0 (Hz) |
| 50 (pps) | 50 (pps) | 1.0 (Hz) |
| | 100 (pps) | 2.0 (Hz) |
| | 2k (pps) | 40.0 (Hz) |

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3].

 Details on operation by external signals -> Refer to [Chapter 7].

6. 6. 5 Changing frequency by the terminal UP and DOWN signal

<F264: Terminal Up response time>
<F265: Terminal Up frequency step>
<F266: Terminal Down response time>
<F267: Terminal Down frequency step>
<F268: Initial Up/Down frequency>
<F269: Up/Down frequency rewrite>



Function

These parameters are the frequency commands that input the logic signals to the two input terminals for the UP and DOWN signals. You can input a logic signal either as a continuous signal or as a pulse signal.

Set <FMOd: Frequency command select 1>= "15".

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|------------------------------|---|------|-----------------|
| F264 | Terminal Up response time | 0.0-10.0 | s | 0.1 |
| F265 | Terminal Up frequency step | 0.0-FH | Hz | 0.1 |
| F266 | Terminal Down response time | 0.0-10.0 | s | 0.1 |
| F267 | Terminal Down frequency step | 0.0-FH | Hz | 0.1 |
| F268 | Initial Up/Down frequency | LL-UL | Hz | 0.0 |
| F269 | Up/Down frequency rewrite | O: F268 is not changed. T: F268 is changed after power off. | | 1 |

Input terminal parameter setting

Three input terminals are used.

Two of the three input terminals are used for the UP and DOWN signals. The other input terminal is used for the signal that clears the set frequency command.

| Input terminal function | | ON | OFF |
|-------------------------|-----------------------------------|---|-----------------------|
| 88 | Terminal Up frequency | Frequency setting increase | - |
| 90 | Terminal Down frequency | Frequency setting decrease | - |
| 92 | Terminal Up, Down frequency clear | OFF → ON: Input terminal up/ down frequency command clear | <f268> setting</f268> |

When the signals are simultaneously input

- When the clear signal, and an UP or a DOWN signal are simultaneously input, the clear signal takes priority.
- When an UP signal and a DOWN signal are simultaneously input, the frequency changes according to the up rate and the down rate.

Memo

- The next number of each function number ("89", "91", or "93") is an inversion signal.
- When <F702: Free unit multiplication factor>="1.00", you can make setting in steps of 0.01 Hz.

Setting example 1: Increase or decrease by the continuous signals

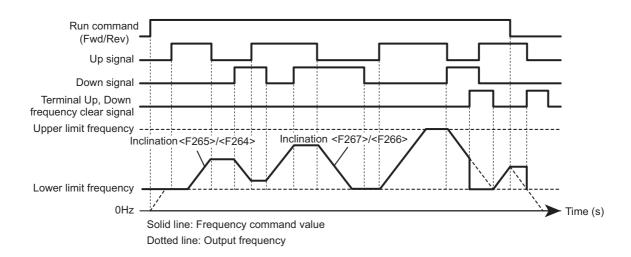
When you want to increase or decrease the output frequency in proportion to the input time of the UP and DOWN signals, set the parameters as shown below:

UP/DOWN frequency increase inclination=Setting time for <F265>/<F264>

UP/DOWN frequency decrease inclination=Setting time for <F267>/<F266>

When you want to increase or decrease the output frequency almost in synchronization with the increase or decrease in the UP/DOWN frequency command, set the parameters as shown below:

$$<$$
F264>= = "0.1"
 $<$ FH>/ \ge (Setting time for $<$ F265>/ $<$ F264>)
 $<$ FH>/ \ge (Setting time for $<$ F267>/ $<$ F266>)



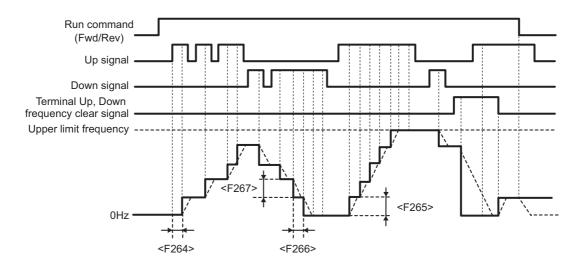
Setting example 2: Increase or decrease by the pulse signals

When you want to increase or decrease the frequency per pulse stepwise, set the parameters as shown below:

<F264>, <F266> \leq Pulse ON time

<F265>, <F267> = Frequency that increases or decreases per pulse

However, no response is obtained to the pulse below the time set for <F264> and <F266>. Set 12 ms or more for the clear signal.



Solid line: Frequency command value Dotted line: Output frequency

Initial UP/DOWN frequency setting method

When you want to set a specified frequency other than 0.0 Hz at first after power on, set <F268: Initial Up/Down frequency>.

Also, set <F269: Up/Down frequency rewrite> to "0: F268 is not changed".

Save the frequency before power off. When you want to start at the saved frequency the next time the power is turned ON, set <F269: Up/Down frequency rewrite> to "1: F268 is changed after power off."

Keep in mind that <F268: Initial Up/Down frequency> is changed every time the power is turned OFF.

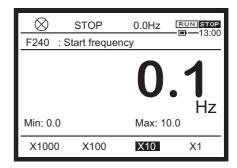
The adjustment range of <F268: Initial Up/Down frequency> is <LL: Lower limit frequency> to <FH: Maximum frequency>. When Terminal Up, Down frequency clear (function number: "92" or "93") is input, the lower limit frequency is set for the frequency command.

- How to operate the operation panel -> Refer to [3, 1, 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3].
- Details on operation by external signals -> Refer to [Chapter 7].

6. 7 Setting the start and end frequencies

6. 7. 1 Setting the starting frequency and the end frequency

<F240: Start frequency> <F243: End frequency>



■ Function

The frequency set for <F240: Start frequency> is instantly output at startup.

This parameter is used when the delayed response of starting torque caused by the acceleration/ deceleration time affects the frequency.

When the output frequency is decreased to the frequency set for <F243: End frequency>, the frequency instantly becomes 0 Hz when stopping.

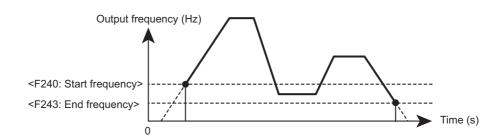
Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|-----------------|------------------|------|-----------------|
| F240 | Start frequency | 0.0-10.0 | Hz | 0.1 |
| F243 | End frequency | 0.0-30.0 | Hz | 0.0 |

Setting method

Use the parameters when the delayed response of starting torque caused by the acceleration/ deceleration time affects the frequency. For the setting values, 0.5-3.0 Hz (5 Hz or less) is recommended. Overcurrent can be reduced by setting the value to the motor rated slippage or less. Set the values so that <F240: Start frequency> is higher than <F243: End frequency>.

When <F240> is lower than <F243>, no operation is performed by any frequency command lower than <F243>.

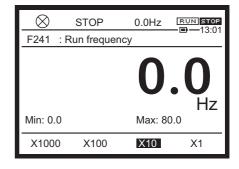


- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3].

6. 7. 2 Run/stop with a frequency command

<F241: Run frequency>

<F242: Run frequency hysteresis>



Function

You can run/stop the motor with only a frequency command when a run command remains ON. When the frequency command reaches the set frequency value, the inverter will start to run. When it becomes below the set value, the inverter will stop.

Parameter setting

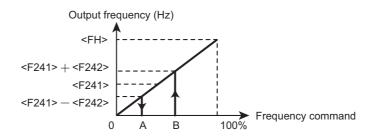
| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|--------------------------|------------------|------|-----------------|
| F241 | Run frequency | 0.0 - FH | Hz | 0.0 |
| F242 | Run frequency hysteresis | 0.0 - FH | Hz | 0.0 |

Setting method

When the frequency command reaches the setting value of <F241: Run frequency>, the inverter will start to run. When the command becomes below the setting value, the inverter will stop.

To prevent the inverter from repeatedly running/stopping around the frequency set with <F241: Run frequency>, use <F242: Run frequency hysteresis> to provide hysteresis.

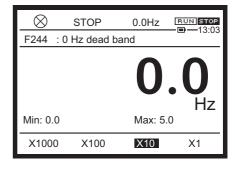
Set the parameter, referring to the following figure.



- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 7. 3 Setting a frequency command to 0 Hz securely

<F244: 0 Hz dead band>

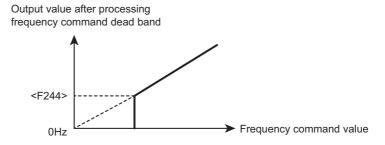


Function

Set the frequency command to 0 Hz when it is under the setting value of <F244: 0 Hz dead band>. This function is used to securely set the frequency command to 0 Hz in the following case: although an analog signal is set to 0 Hz in order to use the vector control with a sensor to fix the motor shaft, it does not become 0 Hz due to a drift or offset.

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|----------------|------------------|------|-----------------|
| F244 | 0 Hz dead band | 0.0 - 5.0 | Hz | 0.0 |



Memo

- · This function is invalid for a preset speed frequency command.
- It is valid for frequency commands which are prioritized in <FMOd: Frequency command selection 1>, <F207: Frequency command selection 2>, and communications.
- For the override function, values are added or multiplied for frequencies with this function enabled.

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

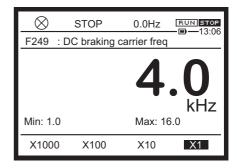
6. 8 DC braking

6. 8. 1 Obtaining large torque with DC braking

<F249: DC braking carrier frequency>

<F250: DC braking frequency>
<F251: DC braking amount>
<F252: DC braking time>

<F253: Fwd/Rev DC braking priority>



■ Function

Apply direct current to the motor to obtain braking torque. This will stop the motor. It is used, for example, to securely decelerate and stop the motor.

You can set the amount and time of direct current applied to the motor and the start frequency.

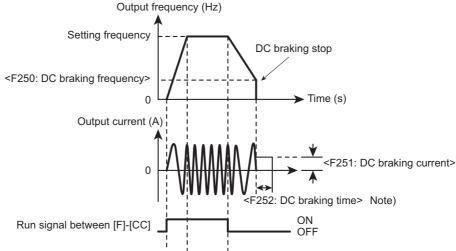
Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|------------------------------|---------------------------|------|-----------------|
| F249 | DC braking carrier frequency | 1.0 - 16.0 | kHz | *1 |
| F250 | DC braking frequency | 0.0 - FH | Hz | 0.0 |
| F251 | DC braking current | 0 - 100 | % | 50 |
| F252 | DC braking time | 0.0 - 25.5 | s | 1.0 |
| F253 | Fwd/Rev DC braking priority | 0: Disabled 1: Enabled | | 0 |

^{*1} Depending on capacity. For details, refer to [11. 6].

Important

• The inverter has high sensitivity for overload protection when DC braking is in progress. It may automatically adjust the DC braking amount to prevent a trip.



Note) Actually it will be longer than the setting value of <F252> because of the reduced voltage operation.

DC braking with the set frequency

When the inverter decelerates until the setting value of <F250: DC braking frequency>, it applies DC braking.

Set the DC braking amount with <F251: DC braking current>. Set the amount based on 100% meaning the rated current of the inverter. With <F701: Current, voltage units select> set to "1: A (ampere), V (volt)", specify a current value (A).

DC braking with an external signal

A signal input to the terminal can forcibly cause the inverter to apply DC braking.

Assign "22: DC braking" ("23" for inversion) to the input terminal.

DC braking is applied while the terminal is turned ON regardless of the settings of <F250: DC braking frequency> and <F252: DC braking time>.

Even when the terminal is turned OFF, it is applied for the period set with <F252: DC braking time>. The DC braking amount depends on the setting of <F251: DC braking current>.

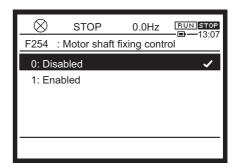
Memo

• The carrier frequency when DC braking is in progress is the setting value of either <F249: DC braking carrier frequency> or <F300: Carrier frequency> which is lower.

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 8. 2 Fixing the motor shaft with DC braking

<F254: Motor shaft fixing control>



Function

Use DC braking to temporarily fix the motor shaft.

This function is used to avoid the free rotation of the motor or to preheat the motor.

Parameter setting

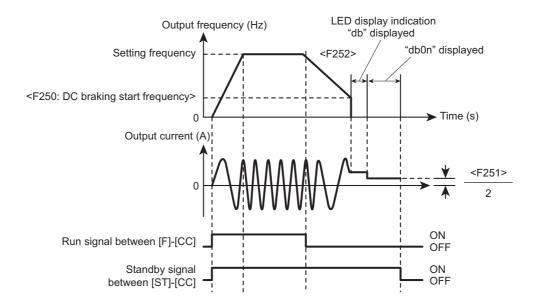
| Title | Parameter name | Adjustment range | Default setting |
|-------|----------------------------|---------------------------|-----------------|
| F254 | Motor shaft fixing control | 0: Disabled 1: Enabled | 0 |

Selecting a setting value

1: Enabled

Continue to apply DC braking at half the DC braking amount specified with <F251: DC braking current> after the normal DC braking action.

During shaft fixing control, "dbOn" appears on the LCD screen.



How to use

To perform motor shaft fixing control, set <F254: Motor shaft fixing control> to 1. To cancel it, turn OFF standby (ST signal).

Since standby (ST) is always turned ON in the default setting, you should set values as shown below.

- Set <F110: Always active function 1> to "1: No function".
- · Assign "6:ST" (standby) to an unused input terminal.

Cancel motor shaft fixing control if the following problems occur during motor shaft fixing control: the inverter coasts due to power failure, or it is restored with the retry function after a trip.

Even when DC braking is activated with a signal from the input terminal, the almost same motor shaft fixing control can be performed.

Memo

• The carrier frequency during shaft fixing control is the setting value of either <F249: DC braking carrier frequency> or <F300: Carrier frequency> which is lower.

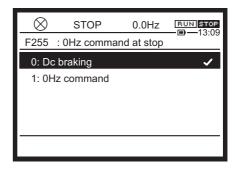
- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 8. 3 Making the motor standstill with PG feedback control

<F255: 0Hz command select at stop>

<F250: DC braking frequency>

<F252: DC braking time>



Function

This function works only for the speed control of PG feedback control. Use a way other than DC braking to make the motor standstill.

When this function is set, the inverter outputs a 0 Hz command instead of applying DC braking when stopping to make the motor standstill for the specified time.

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|----------------------------|----------------------------------|------|-----------------|
| F255 | 0Hz command select at stop | 0: DC braking 1: 0 Hz command | | 0 |
| F250 | DC braking frequency | 0.0 - FH | Hz | 0.0 |
| F252 | DC braking time | 0.0 - 25.5 | S | 1.0 |

How to select a setting value

0: DC braking

This function works as the DC braking function described in [6. 8. 1].

1: 0 Hz command

This function works only for the speed control of PG feedback control.

The inverter outputs 0 Hz for the period set with <F252: DC braking time> when the frequency reaches the setting value of <F250: DC braking frequency>.

It does not work when <F250: DC braking frequency> is set to "0.0".

With this function enabled, <F254: Motor shaft fixing control> cannot be used.

How to use

This function is used for PG feedback control (<Pt: V/f Pattern> = "10", "11").

You should set the terminals [S4] and [S5] or have any option for PG feedback.

The normal DC braking action (the same action set with <F255> = "0") is performed for non-PG feedback control.



Important

 Note that a higher value of <250: DC braking frequency> will cause a command indicating the sudden stop of the motor from a high rotation state. A trip may occur depending on a load condition.

Memo

• When <F255: 0Hz command select at stop> is set to "1", the inverter outputs a 0 Hz command instead of applying the following DC braking.

DC braking with a command from the terminal or communication (input terminal function "22"/ "23", communication command)

Emergency DC braking of DC braking emergency stop (<F603: Emergency off stop pattern> = "2") when the DC braking stop of the jog stop pattern is specified (<F261: Jog stop select> = "2")

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 9 Automatic stop when run continues at the lower limit frequency (sleep function)

<F256: Run sleep detection time>

<F259: Run sleep detection time at startup>

<F391: Sleep detection hysteresis>

<F392: Wakeup deviation> <F393: Wakeup feedback>



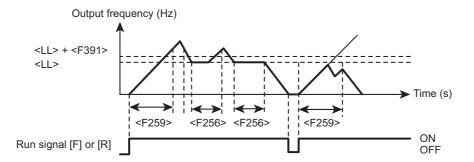
Function

This function is used to automatically decelerate and stop the inverter in the following case: the inverter continues to run at the frequency set with <LL: Lower limit frequency>, which has a low workload, for the period specified in <F256: Run sleep detection time> for energy-saving, etc. (sleep function).

The LCD screen displays "LStP" during sleep.

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|-------------------------------------|------------------------------|------|-----------------|
| F256 | Run sleep detection time | 0.0: Disabled 0.1 - 600.0 | S | 0.0 |
| F259 | Run sleep detection time at startup | 0.0: Disabled 0.1 - 600.0 | S | 0.0 |
| F391 | Sleep detection hysteresis | 0.0 - UL | Hz | 0.0 |
| F392 | Wakeup deviation | 0.0 - UL | Hz | 0.0 |
| F393 | Wakeup feedback | 0.0 - UL | Hz | 0.2 |



Guideline for the setting

This function is used to automatically decelerate and stop the inverter when it continues to run at the frequency set with <LL: Low limit frequency>.

Set a duration with <F256: Sleep detection time>.

When the inverter starts to run, the sleep function works after the output frequency is over the value of <LL: Lower limit frequency>.

Also, when it starts, this function enables you to automatically stop the inverter after the period set with <F259: Run sleep detection time at startup> if the output frequency does not increase to the value of <LL> due to a load error. However, if the output frequency is over the value of <LL>, the function of <F259> is invalid until the run signal is turned OFF

For non-PID control, this function is canceled when the frequency command value is over the values of <LL: Lower limit frequency> and <F391: Sleep detection hysteresis> (Hz) or when the run command is turned OFF.

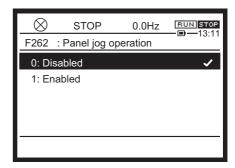
For PID control, set values with <F392: Wakeup deviation> and <F393: Wakeup feedback>.

This function is also valid when you switch between forward and reverse run.

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 10 Jog run

<F260: Jog frequency>
<F261: Jog stop select>



■ Function

Jog run represents inching the motor.

When you input a jog run signal, the inverter immediately outputs a jog run frequency regardless of the set acceleration time.

You can start/stop jog run even on the operation panel.

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|-----------------|--|------|-----------------|
| F262 | Panel jog run | 0: Disabled 1: Enabled | | 0 |
| F260 | Jog frequency | F240 - 20.0 | Hz | 5.0 |
| F261 | Jog stop select | Deceleration stop Coast stop DC braking stop | | 0 |

Setting example

Assign "18: jog run" to the unused input terminal.

While that input terminal is turned ON, the inverter can perform jog run.

To use only the panel jog run, you should not assign it to the input terminal.

Example) When it is assigned to the terminal [RES]: <F113: Terminal RES function 1> = "18"

The inverter outputs a low-speed detection signal but does not output an output frequency attainment signal during jog run. Also, PID control is disabled.

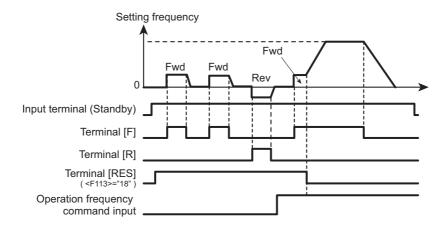
<Example of jog run>

Terminal [RES] (JOG): ON + terminal [F]: Forward jog run when the terminal is turned ON

Terminal [RES] (JOG): ON + terminal [R]: Reverse jog run when the terminal is turned ON

(Frequency command + terminal [F]: Forward run when the terminal is turned ON, terminal [R]:

Reverse run when the terminal is turned ON)



- The terminal [RES] (JOG) is valid when the output frequency is the jog frequency or less. It does not work when the output frequency is higher than the jog frequency.
- The inverter can perform jog run while the terminal [RES] (JOG) is turned ON.
- Jog run is prioritized even if a run command is input on the way.
- Even when <F261: Jog stop select> is set to "0" or "1", DC braking is applied for emergency DC braking (F603: Emergency off stop pattern = "2").
- The jog frequency is not limited by <UL: Upper limit frequency>.

■ Panel jog run (when <F262: Panel jog run> is set to 1)

Each time you press the [FWD/REV] key, the state of jog run is switched as follows:

- · The inverter performs forward jog run while the [F4] key is pressed.
- The inverter performs reverse jog run while the [F4] key is pressed.
- When you press the key for 20 seconds or more, the key failure alarm "A-17" appears.

The inverter cannot move to panel jog run while it runs or a run command is input.

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 11 Jumping the frequency to avoid the resonant frequency

<F270: Jump frequency 1>

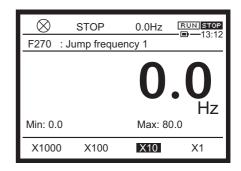
<F271: Jump frequency 1 band>

<F272: Jump frequency 2>

<F273: Jump frequency 2 band>

<F274: Jump frequency 3>

<F275: Jump frequency 3 band>



■ Function

When you want to avoid resonance caused by the natural frequency of the mechanical system to run the inverter, the resonant frequency can be jumped.

This characteristic has hysteresis given to the jump frequency.

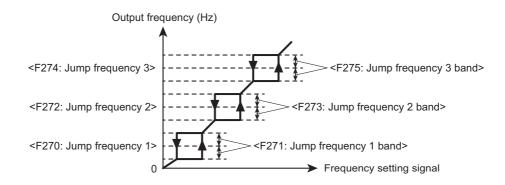
Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|-----------------------|------------------|------|-----------------|
| F270 | Jump frequency 1 | 0.0 - FH | Hz | 0.0 |
| F271 | Jump frequency 1 band | 0.0 - 30.0 | Hz | 0.0 |
| F272 | Jump frequency 2 | 0.0 - FH | Hz | 0.0 |
| F273 | Jump frequency 2 band | 0.0 - 30.0 | Hz | 0.0 |
| F274 | Jump frequency 3 | 0.0 - FH | Hz | 0.0 |
| F275 | Jump frequency 3 band | 0.0 - 30.0 | Hz | 0.0 |

Setting method

You can set three jump frequencies. To do that, avoid the overlap of the adjustment range of each jump frequency.

The frequency does not jump during acceleration or deceleration.



- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 12 Setting the preset-speed operation frequency

6. 12. 1 Setting the preset-speed operation frequency

<F287: Preset speed 8>

<F288: Preset speed 9>

<F289: Preset speed 10>

<F290: Preset speed 11>

<F291: Preset speed 12>

<F292: Preset speed 13>

<F293: Preset speed 14>

<F294: Preset speed 15 / Forced run speed>

<F560: Preset speed operation style>

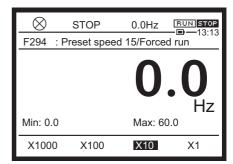
<F561: Operation function (1-speed)> through <F575: Operation function (15-speed)>

<F576: Operation function (0-speed)>

For details of preset speed operation, refer to [5. 2. 7].

6. 12. 2 Forced run in emergency

<F294: Preset speed 15 / Forced run speed>



■ Function

You can run the inverter at a specified speed (frequency) in emergencies or continue to forcibly run it during slight failure. When the input terminal with the assigned function is turned ON, the inverter runs at the frequency set with <F294: Preset speed 15 / Forced run speed> regardless of run and frequency commands.

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|------------------------------------|------------------|------|-----------------|
| F294 | Preset speed 15 / Forced run speed | LL - UL | Hz | 0.0 |

Guideline for the setting

Assign the function to unused input terminal.

· When the inverter runs at a specified speed in an emergency

Input terminal function "58: Fire speed run"

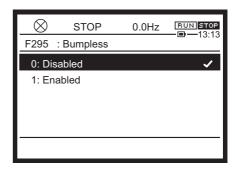
· When the inverter continues to forcibly run even during slight failure

Input terminal function "56: Forced run"

When the input terminal with the assigned function is turned ON, the inverter runs at the frequency set with <F294: Preset speed 15 / Forced run speed>.

6. 13 Bumpless operation

<F295: Bumpless>



Function

This function is used to pass on the run/stop state and output frequency under the automatic operation to the manual operation when a switch between the two operation modes is made. When a switch from the manual to automatic operation is made, the operation status under the manual operation is not passed on to the automatic operation.

Parameter setting

| Title | Parameter name | Adjustment range | Default setting |
|-------|----------------|---------------------------|-----------------|
| F295 | Bumpless | 0: Disabled 1: Enabled | 0 |

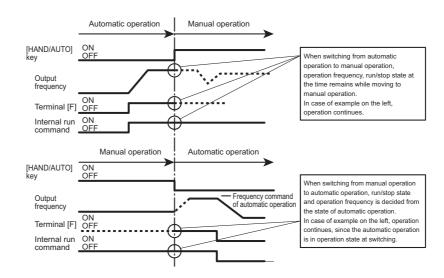
How to use

The [HAND/AUTO] key is used to make a switch between the manual and automatic operations.

- [HAND] indicates the panel operation at hand. (Manual operation)
- [AUTO] indicates the operation method selected by <CMOd: Run command select> or <FMOd: Frequency command select 1> (or <F207: Frequency command select 2>). (Automatic operation)

Operation example

When <CMOd: Run command select> is "0: Terminal" under the automatic operation



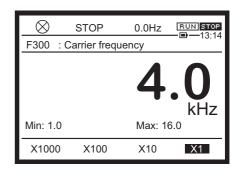
When you do not want to pass on the run/stop state and output frequency under the automatic operation to the manual operation, set <F295> to "0: Disabled".

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 14 Changing carrier frequency to reduce noise and magnetic noise

<F300: Carrier frequency> <F312: Random switching>

<F316: Carrier frequency control>



■ Function

The inverter noise can be reduced by decreasing the carrier frequency.

You can respond to unpleasant motor magnetic noise by increasing the carrier frequency or changing the tone with the random switching.

Adjustment of carrier frequency is effective when a resonance with a load machine or motor fan cover occurs.

However, note that a low carrier frequency causes the motor magnetic noise to increase, and a high carrier frequency causes the inverter noise to increase.

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|---------------------------|---|------|-----------------|
| F300 | Carrier frequency | Depending on capacity*1 kHz | | *1 |
| F312 | Random switching | O: Disabled Random switching 1 Random switching 2 Random switching 3 | | 0 |
| F316 | Carrier frequency control | 0: No decrease 1: Valid decrease 2: No decrease, 480V class 3: Valid decrease, 480V class 4: No decrease with sinusoidal filter 5: Valid decrease with sinusoidal filter | | *1 |

^{*1} Depending on capacity. For details, refer to [11. 6].

<F300: Carrier frequency> setting

Some models require current reduction depending on the <F300: Carrier frequency> setting and ambient temperature.

<F312: Random switching> setting

When you want to reduce the motor magnetic noise with a low carrier frequency, set <F312: Random switching>. The tone can be changed.

This function works in the low output frequency range producing unpleasant magnetic noise from the motor.

<F312: Random switching> has three different tones: "1", "2" and "3". Select the appropriate setting for the load.

With <F300: Carrier frequency> set to 8.0 kHz or more, the motor magnetic noise decreases, and thus the random switching does not function.

<F316: Carrier frequency control> setting as a measure to protect motors against surge voltages

When a 480 V class inverter is used to operate a motor, very high surge voltages may be produced depending on the wire length, wire routing and types of wires used.

Here are some examples of measures against surge voltages.

- Decrease <F300: Carrier frequency>.
- When the wire length between the inverter and motor is long (approx. 20 to 100 m), set <F316: Carrier frequency control> to "2" or "3".
- Turn off power to set <F316: Carrier frequency control> to "2" or "3".
- Install a sinusoidal filter to the output side of inverter. In this case, set <F316: Carrier frequency control> to "4" or "5".
- · Use a motor with high insulation strength.



Important

- If an overload occurs while <F316: Carrier frequency control> is set to "0: No decrease", an overload trip will be caused.
- When no decrease of carrier frequency is selected while a high carrier frequency is set, a trip occurs by overcurrent, etc. more easily than the case with automatic decrease.
- With <F316: Carrier frequency control> set to "2" or "3", the carrier frequency is restricted to 4 kHz or less automatically.
- With <F316: Carrier frequency control> set to "4" or "5", the carrier frequency is 4 kHz or more automatically.
- With <Pt: V/f pattern> set to "2" "6" or "9" "12", the carrier frequency is 2 kHz or more automatically.

Reduction of load current

When the ambient temperature is above 40 or 50°C, reduce the current according to "Instruction manual for load reduction".

With <F316: Carrier frequency control> set to "0", "2" or "4" (no decrease), an motor overload prealarm "L" or overheat pre-alarm "H" is displayed when the IGBT overload "OL3" or overheat "OH" protection level nears. When the cumulative amount of overload further increases, an "OL3" or "OH" trip will occur. In this case, decrease <F601: Stall prevention level 1> to avoid trips.

Even when <F300: Carrier frequency> is set to a low value, the carrier frequency increases in the high output frequency range to ensure stable operation.

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 15 Avoiding trips

Occurrences of trips may be avoided using the appropriate function in consideration of the causes of alarms or trips.

6. 15. 1 Restarting smoothly after momentary power failure (restarting from motor coasting state)

<F301: Auto-restart>

For detailed settings of auto-restart, refer to [5. 3. 2].

6. 15. 2 Selecting operation for momentary power failure

<F302: Regenerative power ride-through>

<F310: Dec time at power failure>

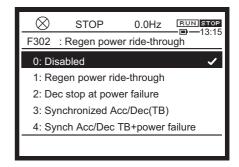
<F313: Ridethrough time>

<F317: Synchronized stop time>

<F318: Synchronized reach time>

<F625: Undervoltage detection level>

<F629: Regenerative power ride-through level>



Function

Select the reaction to a momentary power failure during operation from regenerative power ridethrough, deceleration stop at power failure and synchronized Acc/Dec.

- Regenerative power ride-through: When a momentary power failure occurs, the operation is continued using the regenerative energy of the motor.
- Deceleration stop at power failure: When a momentary power failure occurs, the operation is stopped forcibly and swiftly using the regenerative energy of the motor. The deceleration time varies by the control. "StOP" is displayed on the operation panel during the stop. After the deceleration stop at power failure, the stop state is kept until the run command is turned OFF.
- Synchronized Acc/Dec: For a spindle winder of textile machine or the like, multiple machines are stopped in a lined-up manner or brought to reach the frequency command simultaneously during momentary power failure or restoration of power to prevent thread breakage.

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|-------------------------------------|---|------------|-----------------|
| F302 | Regenerative power ride- through | Disabled Regenerative power ride-through Deceleration stop at power failure Synchronized Acc/Dec (TB) Synchronized Acc/Dec (TB + power failure) | 9 F | 0 |
| F310 | Dec time at power failure | 0.0 - 320.0 | S | 2.0 |

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|--------------------------------------|--------------------------------|------|-----------------|
| F313 | Ridethrough time | 0.0: Continuous 0.1 - 320.0 | s | 2.0 |
| F317 | Synchronized stop time | 0.0 - 6000 | S | 2.0 |
| F318 | Synchronized reach time | 0.0 - 6000 | s | 2.0 |
| F625 | Undervoltage detection level | 50 - 79 80: Auto | % | 80 |
| F629 | Regenerative power ridethrough level | 55 - 100 | % | 75 |

Selecting the setting value

When using the regenerative power ride-through: <F302: Regenerative power ride-through> = "1"

- Set <F302> to "1: Regenerative power ride-through".
- A motor is controlled according to <F313: Ridethrough time>.
 Note that the available time to continue the operation varies by the mechanical inertia or load condition. The motor may enter the coasting state depending on the load condition.
- Set the operation level of regenerative power ride-through with <F629: Regenerative power ride-through level>.
 - 100% reference is 200 V (240V class), 400 V (480V class)
 - Set it to a value equal to <F625: Undervoltage detection level> increased by 5%, or more. If the setting is inappropriate, the regenerative power ride-through control time may become too short. This is not required when <F625> is "80: Auto".
- When <F303: Retry> is used together, you can restart a motor without stopping it in case a trip
 occurs.
- To restart a motor smoothly after restoration of power, use <F301: Auto-restart> together.
- This does not function during torque control.

When using the deceleration stop at power failure: <F302: Regenerative power ride-through> = "2"

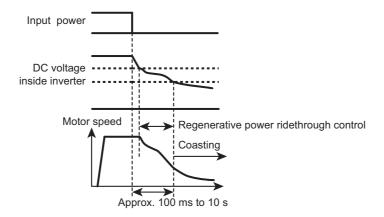
- Set <F302> to "2: Deceleration stop at power failure".
- A motor makes a deceleration stop according to <F310: Dec time at power failure>. The deceleration time is from <FH: Maximum frequency> to 0 Hz. With <F302> set to "2", <F310> cannot be written during run.
- Set the operation level of deceleration stop at power failure with <F629: Regenerative power ridethrough level>. 100% reference is 200 V (240V class), 400 V (480V class).
- When the voltage falls to <F625: Undervoltage detection level> or less during a deceleration stop due to power failure, the motor will enter the coasting state.
- "StOP" is displayed on the operation panel during the stop. The stop state is kept until the run command is turned OFF.
- This does not function during torque control.

When using the synchronized Acc/Dec: <F302: Regenerative power ride-through> = "3" or "4"

- Set <F302> to "3: Synchronized Acc/Dec (TB)" or "4: Synchronized Acc/Dec (TB + power failure)".
- The deceleration time set by <F317: Synchronized stop time> and acceleration time set by <F318: Synchronized reach time> are used.
- · This does not function during torque control.
- The jog run is disabled while this function is set.

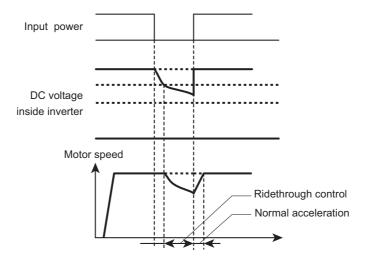
■ Setting example of <F302: Regenerative power ride-through> = "1"

1) When the power supply is shut off



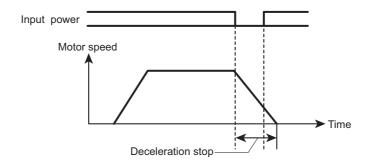
- * Available time to continue the operation varies by the mechanical inertia or load condition. Perform verification test when using this function.
- * Using retry function at the same time enables to automatically restart without failure stop. When the power supply is shut off during deceleration stop, the regenerative power ride-through does not function.

2) When a momentary power failure occurs



When a momentary power failure occurs during deceleration stop, the regenerative power ridethrough does not function.

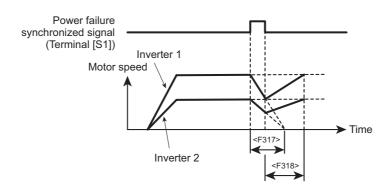
■ Setting example of <F302: Regenerative power ride-through> = "2"



- The motor makes a deceleration stop also when the power is restored. However, when the voltage
 in power circuit inside the inverter falls to or below a certain value, the control is stopped and the
 motor enters the coasting state.
- A motor makes a deceleration stop according to <F310: Dec time at power failure>. The deceleration time is from <FH: Maximum frequency> to 0 Hz.
- When the voltage falls to <F625: Undervoltage detection level> or less during a deceleration stop
 due to power failure, the motor will enter the coasting state. The display shows "StOP", and the
 motor is kept in the coasting state after power is restored.

■ Setting example of <F302: Regenerative power ride-through> = "3"

When <F114: Terminal S1 function 1> is set to "62: Synchronized Acc/Dec", and a power failure synchronized signal is allocated to the terminal [S1].



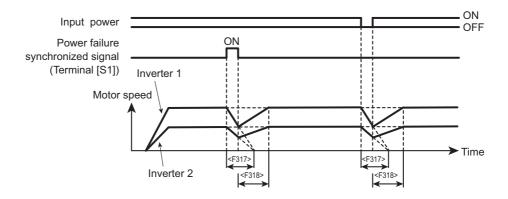
- When the terminal [S1] is turned ON with <F317: Synchronized stop time> and <F318: Synchronized reach time> of acceleration/deceleration set to the same value, multiple motors can be stopped almost at the same time. After power is restored, the motors can reach respective frequency command values almost at the same time.
- When the terminal [S1] is turned ON, linear deceleration is performed for the specified time by <F317> from the output frequency at this point to 0 Hz. The S-pattern deceleration and brake sequence are unavailable.
 - "StOP" is displayed when the stop process is completed.
- When the terminal [S1] is turned OFF during synchronized deceleration, linear acceleration is performed for the specified time by <F318: Synchronized reach time> from the output frequency at this point to the output frequency at which the synchronized deceleration was started or frequency command value, whichever is lower. The S-pattern acceleration, brake sequence and auto-tuning are unavailable.
 - "StOP" disappears when acceleration is started.

- When a Fwd/Rev switching or stop command is input during synchronized deceleration, synchronized acceleration/deceleration stops.
- To operate a motor again after a synchronized deceleration function stop, turn OFF the terminal [S1].
- When using the synchronized deceleration function, check that the overvoltage stall prevention function is not working during deceleration.

■ Setting example of <F302: Regenerative power ride-through> = "4"

When <F114: Terminal S1 function 1> is set to "62: Synchronized Acc/Dec", and a power failure synchronized signal is allocated to the terminal [S1].

Synchronized deceleration is performed when the terminal [S1] is ON or power failure occurs, and synchronized acceleration is performed when the terminal [S1] is OFF or restoration of power occurs.



- When <F302> is set to "1", "2" or "4", the voltage in power circuit inside the inverter is controlled between <F625: Undervoltage detection level> and <F629: Regenerative power ride-through level>.
- When the voltage falls to <F625: Undervoltage detection level> or less, the power circuit
 undervoltage (MOFF) alarm is displayed and the motor enters the coasting state. If "MOFF" is
 displayed immediately after a power failure, adjust by decreasing the <F625> setting or slightly
 increasing the <F629: Regenerative power ride-through level> setting.

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 15. 3 Automatic reset at trip (retry function)

⚠ CAUTION



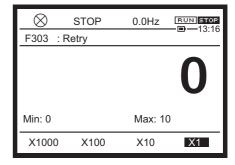
Mandatory action

• Do not go near the motor or machine.

When the retry function is selected, the motor/machine stopped at an occurrence of alarm will be started after a selected period of time (suddenly). Going near the motor/machine may result in unexpected injury.

• Affix the caution label about sudden restart in retry function to the inverter, motor and machine. Take a preventive measure against accidents.

<F303: Retry>



■ Function

The inverter is reset automatically when a trip occurs.

During retry, the motor speed search is activated automatically as occasion demands to start a motor smoothly.

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|----------------|-----------------------|-------|-----------------|
| F303 | Retry | 0: Disabled 1 - 10 | Times | 0 |

How to use

The following table shows the causes of trip and retry processes.

| Cause of trip | Retry process | Stop condition |
|--|--|---|
| Overcurrent Overvoltage Overload Overheat Step-out detection (PM only) | Consecutive retries up to 10 times 1st time: Approx. 1 second after occurrence of a trip 2nd time: Approx. 2 seconds after occurrence of a trip 3rd time: Approx. 3 seconds after occurrence of a trip | A trip other than overcurrent, overvoltage, overload, overheat and step-out detection occurs during retry. Retry fails with the specified number of times. |
| | 10th time: Approx. 10 seconds after occurrence of a trip | |

Followings are the trips of retry targets.

"OC1", "OC2", "OC3", "OP1", "OP2", "OP3", "OL1", "OL2", "OL3", "OL7", "OH", "SOUT"

During retry, "rtry" is displayed on LCD screen.

The retry count is cleared (number of retry: 0) after a specified time without occurrence of trips from a retry success.

A retry success means that the output frequency reaches the frequency command value without tripping.

Important

A failure signal is not output during retry.

A "10: Failure signal 1" is allocated to the [FLA]-[FLB]-[FLC] terminals in the default setting.

- To output a failure signal during retry, allocate the function "116: Failure signal 4" or "117" to the output terminal.
- The virtual cooling time is provided for the overload trips "OL1" and "OL2".
 A retry is performed after the virtual cooling time and retry time elapse.
- For the overvoltage trips "OP1", "OP2" and "OP3", a retry is performed after the voltage in the DC section decreases.
- For the overheat trip "OH", a retry is performed after the inverter internal temperature decreases to the operable level.

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

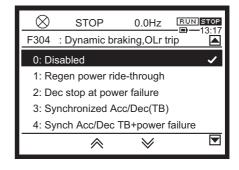
6. 15. 4 Dynamic braking - Abrupt motor stop

<F304: Dynamic braking, OLr trip>

<F308: Braking resistance>

<F309: Braking resistor capacity>

<F626: Overvoltage limit operation level>
<F639: Braking resistor overload time>



■ Function

The dynamic braking function can be enabled by connecting an external braking resistor.

- · When an abrupt deceleration is necessary
- When an overvoltage "OP" trip occurs at a deceleration stop
- When the continuous regenerative state, such as moving down of a lifting gear and winding-out operation for tension control, is entered
- When the regenerative state is entered by load fluctuation during constant speed run of a press machine, etc.

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|-----------------------------------|--|-----------------------------------|-----------------|
| F304 | Dynamic braking, OLr trip | O: Disabled 1: Enabled, OLr trip 2: Enabled, No OLr trip 3: Enabled (except during ST OFF), 0 4: Enabled (except during ST OFF), 1 trip 5: Enabled (except during trip), OLr tri 6: Enabled (except during trip), No O 7: Enabled (except during trip & ST OOLr trip 8: Enabled (except during trip & ST OOLr trip) | No OLr rip Lr trip DFF), | 0 |
| F308 | Braking resistance | 0.5 - 1000 | Ω | *1 |
| F309 | Braking resistor capacity | 0.01 - 600.0 | kW | *1 |
| F626 | Overvoltage limit operation level | 100 - 150 | % | 134 |
| F639 | Braking resistor overload time | 0.1 - 600.0 | s | 5.0 |

^{*1} Depending on capacity, refer to [11. 6].

How to use

To use dynamic braking, set <F304: Dynamic braking, OLr trip> to "1" - "8" (dynamic braking enabled). At this time, the overvoltage limit operation is automatically disabled as in the case of <F305: Overvoltage limit operation> ="1: Disabled", and the regenerative energy of the motor is consumed by a braking resistor. (Refer to [6. 15. 5].)

Set <F308: Braking resistance> and <F309: Braking resistor capacity> according to the braking resistor to be connected.

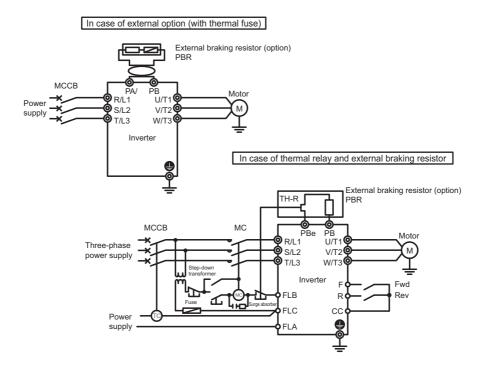
Set the overload time of braking resistor with <F639: Braking resistor overload time>. Set a value so that a trip occurs at a value 10 times the <F309: Braking resistor capacity> setting. The default setting is intended for our recommended braking resistors (DGP600 Series excluded). To use the DGP600 Series, use the characteristic value of overload relay as a guide.

Set the operation level of dynamic braking with <F626: Overvoltage limit operation level>.

To output an overload of braking resistor, allocate the braking resistor overload (OLr) pre-alarm (function number: "30", "31") to the output terminal.

Setting example

When using an external braking resistor (option)



The above connection is for the case where MCCB with a trip coil is used instead of MC for TC (trip coil).

Prepare a step-down transformer for the 480V class. It is not required for the 240V class.



Important

Be sure to install a thermal relay (THR) to prevent fire.

The inverter is equipped with the functions that protect a braking resistor from overload or overcurrent. A thermal relay needs to be activated when these protective functions become disabled.

Select the appropriate thermal relay (THR) according to the braking resistor capacity (watt).

For an application that requires the continuous regenerative state, such as moving down of a lifting gear, press and tension control, or when a deceleration stop is performed for a machine with large load inertial moment, increase the braking resistor capacity according to the operation rate.

Connect a braking resistor with a resistance value greater than the minimum allowable resistance value (resultant resistance value). Be sure to set <F308: Braking resistance> and <F309: Braking resistor capacity> for overload protection.

To use a braking resistor without thermal fuse, connect a thermal relay to shut off the power.

Braking resistor option

Following table shows the optional braking resistors. Operation rate is 3%ED.

Rating shows resultant resistance capacities (watt) and resultant resistance values (ohm).

A braking resistor for frequent regenerative braking is also available. Please contact your Toshiba distributor for information.

The type-form "PBR-" features built-in thermal fuse, and "PBR7-" features built-in thermal fuse and thermal relay.

The default settings of <F308: Braking resistance> and <F309: Braking resistor capacity> are intended for the optional braking resistors.

Minimum resistance of connectable braking resistor

Following shows the minimum resistance of connectable braking resistor.

Use a braking resistor with a resistance value greater than the minimum allowable resistance value (resultant resistance value).

■ Minimum resistances of connectable braking resistors

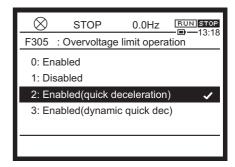
| Voltage class | Inverter output capacity (kW) | Minimum allowable resistance (Ω) |
|---------------|-------------------------------|----------------------------------|
| 3-phase 240V | 0.4 to 4.0 | 7.9 |
| | 5.5, 7.5 | 5.3 |
| | 11, 15 | 5 |
| | 18.5 | 4.5 |
| | 22 to 55 | 1 |
| 3-phase 480V | 0.4 to 1.5 | 78 |
| | 2.2, 4.0 | 31.2 |
| | 5.5, 7.5 | 22.3 |
| | 11 to 18.5 | 15.6 |
| | 22, 30 | 12 |
| | 37 | 7.9 |
| | 45 to 75 | 2.5 |
| | 90 to 160 | 1.9 |
| | 220 to 280 | 1 |

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 15. 5 Avoiding overvoltage trip

<F305: Overvoltage limit operation>

<F319: Regenerative over-flux upper limit> <F626: Overvoltage limit operation level>



Function

These parameters are used to temporarily maintain the output frequency constant or increase the frequency to prevent overvoltage tripping when the voltage in the DC section rises during deceleration or while constant speed run is in progress (overvoltage limit operation).



- During overvoltage limit operation, deceleration time may be longer than the time set.
- During overvoltage limit operation, the overvoltage (OP) pre-alarm is displayed.

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|------------------------------------|--|------|-------------------|
| F305 | Overvoltage limit operation | 0: Enabled 1: Disabled 2: Enabled (quick deceleration) 3: Enabled (dynamic quick deceleration) | on) | 2 |
| F319 | Regenerative over-flux upper limit | 100 - 160 | % | *1 |
| F626 | Overvoltage limit operation level | 100 - 150 | % | 134 ^{*1} |

^{*1} Depending on the setup menu. For details, refer to [11. 6].

Difference in specific settings

<F305: Overvoltage limit operation> = "2"

This value sets quick deceleration.

When the voltage reaches the overvoltage limit operation level during deceleration, the motor may be decelerated more quickly than normal deceleration by increasing the voltage to be applied to the motor (over-excitation control) to increase the amount of energy consumed by the motor.

<F305: Overvoltage limit operation> = "3"

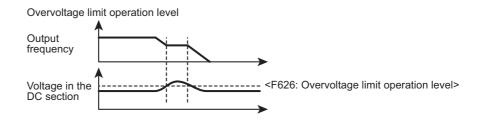
This value sets dynamic quick deceleration.

The motor may be decelerated more quickly than quick deceleration by increasing the voltage to be applied to the motor (over-excitation control) to increase the amount of energy consumed by the motor as soon as the motor starts decelerating.

<F319: Regenerative over-flux upper limit> is enabled when <F305: Overvoltage limit operation> is set to "2" or "3".

This parameter is used to adjust the maximum value of energy the motor consumes during deceleration. Increase this value if overvoltage tripping occurs during deceleration.

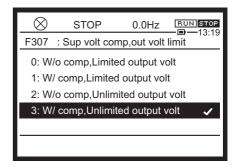
<F626: Overvoltage limit operation level> also serves as the parameter to set the dynamic braking level.



- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 15. 6 Adjusting and limiting output voltage

<F307: Supply voltage compensation, Output voltage limitation>



■ Function

- Supply voltage compensation: maintains a constant V/f ratio even when the input voltage fluctuates to suppress torque reduction in the low-speed range.
- Output voltage limitation: limits the output voltage so that voltage set with <vLv: Base frequency voltage 1> or more will not be output at frequency set with <vL: Base frequency 1> or more. This function is used when operating a special motor with low induced voltage.

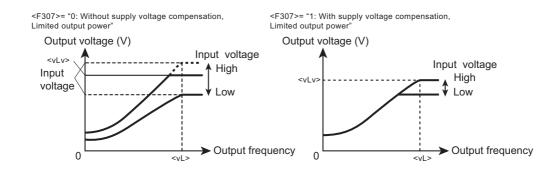
Parameter setting

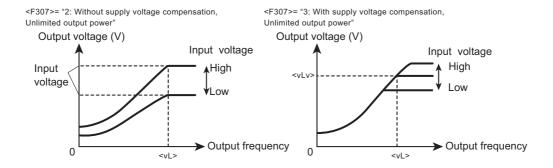
| Title | Parameter name | Adjustment range | Default setting |
|-------|--|---|-----------------|
| F307 | Supply voltage compensation, Output voltage limitation | Without supply voltage compensation, Limited output voltage With supply voltage compensation, Limited output voltage Without supply voltage compensation, Unlimited output voltage With supply voltage compensation, Unlimited output voltage | *1 |

^{*1} Depending on the setup menu. Refer to [5. 2. 10], [11. 10].

Selecting a setting value

- To maintain a constant V/f ratio even when the input voltage fluctuates to suppress torque reduction in the low-speed range, set <F307: Supply voltage compensation, Output voltage limitation> to "1" or "3" (With supply voltage compensation).
 - When <F307> is set to "0" or "2", output voltage will change in proportion to the input voltage.
- The output voltage can be limited according to the motor rating. When <F307> is set to "0" or "1", the output voltage will be limited to <vLv: Base frequency voltage 1> when operated at frequency set with <vL: Base frequency 1> or more.
- Even if <vLv> is set to the input voltage or more, the output voltage will not exceed the input voltage.
- When <Pt: V/f Pattern> is set to "2" "6" or "9" "12", With supply voltage compensation will be set regardless of the <F307> setting.



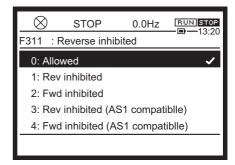


Rated voltages are fixed to values 240 V class: 200 V and 480 V class: 400 V.

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 15. 7 Inhibiting Reverse run

<F311: Reverse inhibited>



Function

This function limits the direction of rotation when the wrong Fwd or Rev run command is input.

Parameter setting

| Title | Parameter name | Adjustment range | Default setting |
|-------|-------------------|---|-----------------|
| F311 | Reverse inhibited | 0: Allowed 1: Rev inhibited 2: Fwd inhibited 3, 4: - | 0 |



Important

- When the motor is operated in the inhibited direction during operations such as preset speed operation with functions or jog run, the run command will be set to OFF.
- If the motor parameters are not set to the appropriate values when vector control or automatic torque boost is set, the motor may run in the reverse direction at approximately the slip frequency.

Set <F243: End frequency> to approximately the slip frequency.

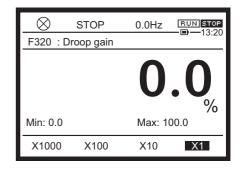
- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 16 Single load sharing by multiple inverters (droop control)

<F320: Droop gain>

<F321: Frequency at 0% droop gain> <F322: Frequency at F320 droop gain> <F323: Droop deadband torque>

<F324: Droop output filter>



Function

Droop control is a function that prevents loads from concentrating at a specific motor due to load imbalance when multiple inverters and motors are used to drive a common load.

These parameters are used to allow the motor to slip (drooping characteristic) according to the load torque current.

These parameters are used to adjust the frequency range, deadband torque, and gain.

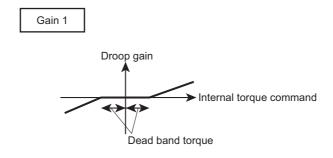
Parameter setting

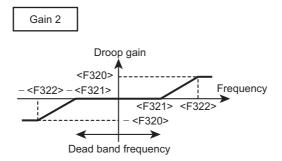
| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|------------------------------|------------------|-------|-----------------|
| F320 | Droop gain | 0.0 - 100.0 *1 | % | 0.0 |
| F321 | Frequency at 0% droop gain | 0.0 - 320.0 | Hz | 10.0 |
| F322 | Frequency at F320 droop gain | 0.0 - 320.0 | Hz | 100.0 |
| F323 | Droop deadband torque | 0 - 100 | % | 10 |
| F324 | Droop output filter | 0.1 - 200.0 | rad/s | 100.0 |

^{*1} Range that can be changed during run is 0.1 - 100.0%. Setting or changing to 0.0 (no droop) must be performed after stop.

Setting methods

- Droop control is enabled when <Pt: V/f Pattern> is set to "3", "9", "10", or "11".
- When the applied torque is equal to or more than the deadband torque value, output frequency is reduced during power running or increased during regeneration.
- Droop control is enabled at frequency range <F321: Frequency at 0% droop gain> or more.
- The amount of droop will vary depending on the output frequency for frequency ranges <F321: Frequency at 0% droop gain> or more or <F322: Frequency at F320 droop gain> or less.
- For the frequency range over <vL: Base frequency 1>, the amount of error for <F323: Droop deadband torque> will increase. Therefore, we recommend you use this parameter at base frequency or less.
- Output frequency in droop control will not be limited by <FH: Maximum frequency>.





Calculating formula

The amount of output frequency adjusted by droop control can be calculated with the following formula.

1) Gain based on internal torque command (Gain 1)

• When internal torque command (%) >= 0,

Gain 1 = (internal torque command - <F323>)/100

Note that 0 (zero) or a positive number must be set to Gain 1.

• When internal torque command (%) < 0,

Gain 1 = (internal torque command + <F323>)/100

Note that 0 (zero) or a negative number must be set to Gain 1.

2) Gain based on frequency after acceleration (Gain 2)

• When <F321> < <F322>

When |frequency after acceleration| <= <F321>,

Gain 2 = 0

When |frequency after acceleration| > <F322>,

Gain 2 = <F320>/100

When <F321> < |frequency after acceleration| <= <F322>,

Gain 2 = (<F320>/100) x (((frequency after acceleration) - <F321>)/(<F322> - <F321>))

• When <F321> >= <F322>

When |frequency after acceleration| <= <F321>,

Gain 2 = 0

When |frequency after acceleration| > <F321>,

Gain 2 = <F320>/100

3) Droop frequency

Droop frequency = <vL: Base frequency 1> x Gain 1 x Gain 2 Note that, when <vL: Base frequency 1> is over 100 Hz, this value is calculated as 100 Hz.

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 17 High-speed operation with light load on cranes

<F328: Light-load high-speed operation>

<F329: Light-load high-speed learning function>

<F330: Light-load high- speed automatic operation frequency>

<F331: Light-load high-speed operation switching lower-limit frequnecy>

<F332: Light-load high-speed operation load detection wait time>

<F333: Light-load high-speed operation load detection time>

<F334: Light-load high-speed operation heavy load detection time>

<F335: Switching load torque during power running>

<F336: Heavy-load torque during power running>

<F337: Heavy-load torque during constant speed power running>

<F338: Switching load torque during regen>

For details, refer to Lift Application Instruction Manual (light-load high-speed operation, brake sequence, learning).

6. 18 Brake sequence

6. 18. 1 Brake sequence

<F325: Brake release wait time>

<F326: Brake release undercurrent threshold>

<F340: Creep time 1>

<F341: Brake function>

<F342: Load torque input select>

<F343: Hoisting torque bias>

<F344: Lowering torque bias rate>

<F345: Brake releasing time>

<F346: Creep frequency>

<F347: Creep time 2>

<F348: Brake learning>

<F630: Brake answer wait time>

For details, refer to Lift Application Instruction Manual (light-load high-speed operation, brake sequence, learning).

6. 18. 2 Hit and stop control

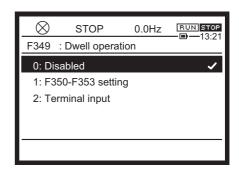
<F382: Hit and stop control> <F383: Hit and stop frequency>

For details, refer to Hit and Stop Function Instruction Manual.

6. 19 Constant speed run with Acc/Dec suspended (dwell operation)

<F349: Dwell operation>

<F350: Acc suspended frequency>
<F351: Acc suspended time>
<F352: Dec suspended frequency>
<F353: Dec suspended time>



Function

This function suspends acceleration/deceleration temporarily and let the inverter run in constant speed according to the brake delay during run/stop for transportation of heavy load. This will prevent occurrence of overcurrent at startup or slippage when stopping by adjusting the timing with the brake.

There are two ways to set dwell operation: automatic stop by setting the stop frequency and stop time and stop by using signals to the input terminal.

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|-------------------------|--|------|-----------------|
| F349 | Dwell operation | 0: Disabled 1: F350-F353 setting 2: Terminal input | | 0 |
| F350 | Acc suspended frequency | 0.0 - FH | Hz | 0.0 |
| F351 | Acc suspended time | 0.0 - 10.0 | S | 0.0 |
| F352 | Dec suspended frequency | 0.0 - FH | Hz | 0.0 |
| F353 | Dec suspended time | 0.0 - 10.0 | s | 0.0 |

Setting method

Select whether to automatically suspend acceleration/deceleration by parameter settings or by signal input to the input terminal. This is set with <F349: Dwell operation>.

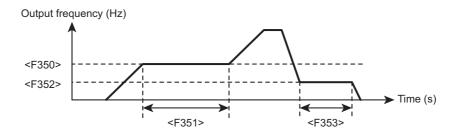
- When <F349> is set to "1", you must also set parameters <F350: Acc suspended frequency> through <F353: Dec suspended time>.
 - <F350: Acc suspended frequency> must be set to a value over <F240: Start frequency>.
 - <F352: Dec suspended frequency> must be set to a value over <F243: End frequency>.
 - When the frequency command value is the same as values set for <F350> and <F352> settings, dwell operation will not be enabled.
- When <F349> is set to "2", you must also assign function numbers "60", "61" (dwell operation) to the unused input terminal.



 When output frequency falls due to the stall preventive function, dwell operation may be enabled.

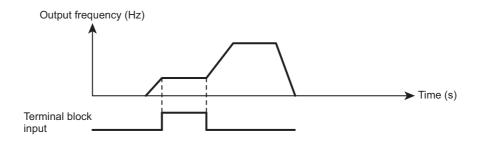
■ Setting example: for automatic dwell operation

Set <F350: Acc suspended frequency>, <F352: Dec suspended frequency>, <F351: Acc suspended time>, and <F353: Dec suspended time>. Then set <F349: Dwell operation> to "1". When the output frequency reaches the set frequency, operation will automatically switch to constant speed run (acceleration/deceleration suspended).



Setting example: for dwell operation by external signal input

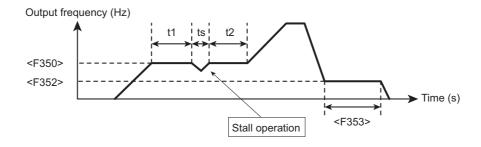
Assign function numbers "60", "61" (dwell operation) to the unused input terminal. Dwell operation will be performed while the input terminal is ON.



When you set run command ON after you set the dwell operation signal ON, operation will start at <F240: Start frequency>.

■ If the stall preventive function is enabled during dwell operation

Duration of any temporary output frequency change due to the stall preventive function will be included in the acceleration/deceleration suspended time.



Memo

- The stall preventive function automatically changes the output frequency when overcurrent, overload or overvoltage occurs. Specific functions that are set with each parameter are as follows:
 - Overcurrent stall: <F601: Stall prevention level 1>
 - Overload stall: <OLM: Motor overload protection characteristic>
 - Overvoltage stall; <F305: Overvoltage limit operation>

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 20 Switching to commercial power run

<F354: Commercial power/Inverter switching>

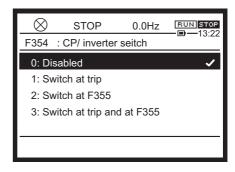
<F355: Commercial power switching frequency>

<F356: Inverter switching wait time>

<F357: Commercial power switching wait time>

<F358: Commercial power switching frequency continu-

ous time>



■ Function

This function allows output of switching signals to an external sequence (such as MC) so that when tripping occurs, operation will be switched to commercial power run without stopping the motor.

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|--|--|------|-----------------|
| F354 | Commercial power/ Inverter switching | O: Disabled Switch at trip Switch at F355 Switch at trip and at F355 | | 0 |
| F355 | Commercial power switching frequency | 0 - UL | Hz | 50.0/60.0 *1 |
| F356 | Inverter switching wait time | 0.10 - 10.00 | s | *2 |
| F357 | Commercial power switching wait time | 0.10 - 10.00 | S | 0.62 |
| F358 | Commercial power switching frequency continuous time | 0.10 - 10.00 | S | 2.00 |

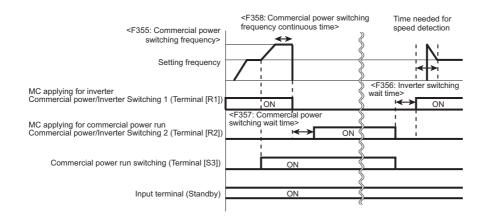
^{*1} Depending on the setup menu. Refer to [5. 3. 10], [11. 10].

Trips that are automatically switched are those not displayed as "OCL", "E", "EF1", and "EF2".

<F341: Brake function> will not be enabled.

^{*2} Depending on capacity. For details, refer to [11. 5].

■ Timing chart (setting example)



When function numbers "102", "103" (switch to commercial power run) is set to terminal [S3].

Terminal [S3] ON: commercial power operation

Terminal [S3] OFF: inverter operation

Switching cannot be performed properly if standby function is OFF.

| Title | Parameter name | Setting example | Unit |
|-------|--|--|------|
| F354 | Commercial power/ Inverter switching | 2: Switch at F355 or 3: Switch at trip and at F355 | - |
| F355 | Commercial power switching frequency | Power supply frequency, etc. | Hz |
| F356 | Inverter switching wait time | Depending on capacity *1 | S |
| F357 | Commercial power switching wait time | 0.62 | S |
| F358 | Commercial power switching frequency continuous time | 2.00 | S |
| F116 | Terminal S3 function | 102: Commercial powr run switching | - |
| F133 | Terminal R1 function 1 | 46: Commercial power/Inverter Switching 1 | - |
| F134 | Terminal R2 function | 48: Commercial power/Inverter Switching 2 | - |

^{*1} Depending on capacity. For details, refer to [11. 6].



Important

- To allow switching to commercial power operation, forward run of the inverter and the direction of rotation of the motor for commercial power operation must match.
- Do not set <F311: Reverse inhibited> to "2: Fwd inhibited". The inverter will not be able to forward run and switching to commercial power cannot be accomplished.
- This function can only be used in induction motors. Do not use this function with PM motors.

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 21 PID control

<FPId: PID1 set value> <F359: PID control 1>

<F360: PID1 feedback input select >

<F361: PID1 filter>

<F362: PID1 proportional gain> <F363: PID1 integral gain>

<F364: PID1 integral gain>
<F365: PID1 deviation upper-limit>
<F366: PID1 differential gain>
<F367: PID1 set value upper-limit>
<F368: PID1 set value lower-limit>
<F369: PID1 start wait time>

<F369: PID1 start wait time>
<F370: PID1 output upper-limit>
<F371: PID1 output lower-limit>
<F372: PID1 set value increase time>
<F373: PID1 set value decrease time>

<F374: PID1 set value agreement detection band>

<F388: PID1 output dead band> <F389: PID1 set value select>

For details of PID control, refer to PID Control Instruction Manual. For parameter setting, refer to [5. 2. 8] "Setting PID control" as well.

6. 22 Retaining the stop position

<Pt: V/f Pattern>

<F381: Simple positioning completion range>

<F359: PID control1>

<F362: PID1 proportional gain>
<F369: PID1 start wait time>
<F375: PG pulses number>

<F376: PG phases number select>

For details of stop position retain function, refer to PID Control Instruction Manual.

6. 23 Setting of motor parameters

M WARNING



Prohibited

Do not touch terminals or motor of the inverter while performing auto tuning.

Touching the terminals or motor while voltage is applied to the terminals and motor may result in electric shock, even if the motor is stopped.

After setting offline auto-tuning (F400 = "2"), execute the auto tuning at first start of the inverter. The auto tuning takes several seconds and the motor is stopped meanwhile, but voltage is applied to the terminals and motor. The motor may also generate a sound during the auto tuning, but this is not malfunction.



Mandatory action

Install circuit protection such as the mechanical brake in the crane.
 If there is no sufficient circuit protection installed in the crane, insufficient motor torque while auto tuning will cause the machine stalling/falling.

6. 23. 1 Setting induction motor parameters

<F400: Offline auto-tuning>

<F401: Slip frequency gain>

<F402: Automatic torque boost>

<F403: Online auto-tuning>

<F405: Motor rated capacity>

<F412: Leakage inductance>

<F413: Exciting current coefficient>

<F414: Stall prevention coefficient>

<F415: Motor rated current>

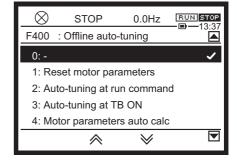
<F416: Motor no load current>

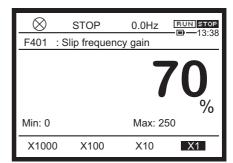
<F417: Motor rated speed>

<F459: Load inertia ratio>

<F462: Speed reference filter coefficient 1>

<F465: Speed reference filter coefficient 2>





■ Function

To select vector control, automatic torque boost, or automatic energy-saving with <Pt: V/f Pattern>, you must set motor parameters (auto-tuning).

There are four setting methods.

- Use <AU2: Torque boost macro> to set both <Pt> and <F400: Offline auto-tuning>.
- Set <Pt> and <F400> individually.
- Set <Pt> and <F400> individually. Perform an auto-tuning after calculating the motor parameter automatically (available with motor not connected).

· Set <Pt> and set the motor parameter manually.



Important

- · Check the motor name plate and set the following parameters first.
 - The value of 4 pole general purpose motor, with same capacity as the inverter, is set by default setting.
 - <vL: Base frequency 1> (Rated frequency)
 - <vLv: Base frequency voltage 1> (Rated voltage)
 - <F405: Motor rated capacity>
 - <F415: Motor rated current>
 - <F417: Motor rated speed>
- · Set other motor parameters as necessary.

Setting method 1: Use torque boost macro

This is the simplest setting method. Vector control/automatic torque boost/automatic energy-saving and auto-tuning are all set at once.

Check the motor name plate and set the following parameters first.

- <vL: Base frequency 1> (Rated frequency)
- <vLv: Base frequency voltage 1> (Rated voltage)
- <F405: Motor rated capacity>
- <F415: Motor rated current>
- · <F417: Motor rated speed>

Next, set <AU2: Torque boost macro>.

- 1: Automatic torque boost + offline auto-tuning
- 2: Vector control 1 + offline auto-tuning
- 3: Energy savings + offline auto-tuning

For details of setting methods, refer to [5. 2. 5].

Setting method 2: Set auto-tuning

Set vector control/automatic torque boost/automatic energy-saving and auto-tuning individually. First, set <Pt: V/f Pattern>. For details of setting methods, refer to [5. 2. 4]. Next, perform offline auto-tuning.

1) Parameter setting

| Title | Parameter name | Adjustment range | Default setting |
|-------|---------------------|---|-----------------|
| F400 | Offline auto-tuning | C: - Reset motor parameters (0 after execution) Auto-tuning at run command (0 after execution) Auto-tuning at TB ON Motor parameters auto calculation (0 after execution) 4+2 (0 after execution) Auto-tuning at run command during TB ON Auto-tuning F402 only at run command during TB ON | 0 |

2) Selecting auto-tuning setting

1: Reset motor parameters (0 after execution)

Set motor parameters <F402: Automatic torque boost>, <F412: Leakage inductance>, and <F416: Motor no load current> to default setting values (same motor parameter values as a 4 pole general purpose motor with same capacity as the inverter).

2: Auto-tuning at run command (0 after execution)

Perform auto-tuning when the motor starts for the first time after settings are made and automatically set <F402: Automatic torque boost> and <F412: Leakage inductance> while considering the motor wiring.

3: Auto-tuning at TB ON

Assign "66: Offline auto-tuning" (67 is the inversion signal) to the digital input terminal.

When the assigned input terminal is ON, make an auto-tuning and automatically set <F402: Automatic torque boost> and <F412: Leakage inductance>.

This setting allows auto-tuning while the motor is stopped; use this function when the motor cannot run following the auto-tuning due to some reason related to the operation of the machinery.

However, if standby signal is OFF, this function will not be enabled.

To make an auto-tuning again, tern input terminal off once, then turn on again.

6: Auto-tuning at run command during TB ON

Assign "66: Offline auto-tuning" (67 is the inversion signal) to the digital input terminal.

When the assigned input terminal is ON, always make an auto-tuning and automatically set <F402: Automatic torque boost> and <F412: Leakage inductance> at startup.

7: Auto-tuning F402 only at run command during TB ON

Assign "66: Offline auto-tuning" (67 is the inversion signal) to the digital input terminal.

Always make an auto-tuning at startup when the motor starts for the first time after the assigned input terminal is ON and set <F402: Automatic torque boost> only.

3) Cautions during offline auto-tuning

• Offline auto-tuning must be performed with the motor connected but in a completely stopped state.

Due to residual voltage, tuning may not be properly executed immediately after running motor is stopped.

- There would be almost no rotation of the motor during offline auto-tuning, but you must keep in mind that voltage is still applied during this time.
- During auto-offline tuning, "Atn" will be displayed on the LCD screen.
- Offline auto-tuning takes a few seconds. If any failure is found, tripping will occur with autotuning error "Etn1" or "Etn2", and motor parameters will not be set.
- Offline auto-tuning cannot be performed on special motors such as a high-speed motor or high-slip motor. Calculate the motor parameters using "Setting method 3".
- If offline auto-tuning cannot be executed or auto-tuning error "Etn1" or "Etn2" occurs, perform manual setting using "Setting method 4".

Setting method 3: Make auto-tuning of motor parameter after automatic setting.

Make auto-tuning after setting vector control/automatic torque boost/automatic energy-saving and performing motor parameters auto calculation.

Check the motor name plate and set the following parameters first.

- <vL: Base frequency 1> (Rated frequency)
- <vLv: Base frequency voltage 1> (Rated voltage)
- <F405: Motor rated capacity>
- <F415: Motor rated current>
- <F417: Motor rated speed>

Next, set <Pt: V/f Pattern>. For details of setting methods, refer to [5. 2. 4].

Then, select <F400> = "4: Motor parameters auto calculation (0 after execution)" and calculate motor parameters automatically.

Motor parameters <F402: Automatic torque boost>, <F412: Leakage inductance>, and <F416: Motor no load current> will be set automatically.

This setting can be made without connecting the motor since it only calculates.

After automatic setting of motor parameter with <F400> = "4", be sure to set <F400> to "2: Autotuning at run command (0 after execution)" and perform an auto-tuning.

You can set <F400> to "4" and "2" collectively by setting <F400> to "5: 4+2 (0 after excecution)". Since calculation is performed based on general trend, the calculation results may not be correct. In this case, set the parameter manually.

Setting method 4: Manually setting motor parameter

Set <Pt: V/f Pattern> and set the motor parameter manually.

If tuning error "Etn1" is displayed during auto-tuning setting or when you want to improve vector control characteristics, set motor parameters individually.

4) Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|---|------------------|-------------------|-----------------|
| F401 | Slip frequency gain | 0 - 250 | % | 70 |
| F402 | Automatic torque boost | 0.1 - 30.00 | % | *1 |
| F405 | Motor rated capacity | 0.10 - 315.0 | kW | *1 |
| F412 | Leakage inductance | 0.0 - 25.0 | % | *1 |
| F413 | Exciting current coefficient | 100 - 150 | % | 100 |
| F415 | Motor rated current | *1 | Α | *1 |
| F416 | Motor no load current | 10 - 90 | % | *1 |
| F417 | Motor rated speed | 100 - 64000 | min ⁻¹ | *2 |
| F459 | Load inertia ratio | 0.1 - 100.0 | Times | 1.0 |
| F460 | Speed control response 1 | 0.0 - 25.0 | - | 0.0 |
| F461 | Speed control stabilization coefficient 1 | 0.50 - 2.50 | - | 1.00 |
| F462 | Speed reference filter coefficient 1 | 0 - 100 | - | 35 |
| F463 | Speed control response 1 | 0.0 - 25.0 | - | 0.0 |

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|--|------------------|------|-----------------|
| F464 | Speed control stabilization coefficient 1 | 0.50 - 2.50 | - | 1.00 |
| F465 | Speed reference filter coefficient 2 | 0 - 100 | - | 35 |
| F466 | Speed control response switching frequency | 0.0 - FH | Hz | 0.0 |

^{*1} Depending on capacity. For details, refer to [11. 6].

5) Motor parameter setting method (Basic)

<F401: Slip frequency gain>

This parameter sets the compensation gain for motor slip.

Increasing the value will reduce motor slip.

Set <F417: Motor rated speed> and then make fine adjustments to <F401>.

Keep in mind that setting a higher value than necessary will cause unstable operation such as hunting.

<F402: Automatic torque boost>

This parameter adjusts the primary resistive component of the motor.

Increasing this value will prevent torque reduction due to voltage drop during low speed.

Adjust the value according to the actual operation.

Keep in mind that setting a higher value than necessary will increase current at low speed and may cause tripping.

<F405: Motor rated capacity>

This parameter sets the motor rated capacity.

Check the motor name plate or test report while setting.

<F412: Leakage inductance>

This parameter sets the leakage inductance component of the motor.

Increasing this value will improve torque in the high-speed region.

<F415: Motor rated current>

This parameter sets the motor rated current.

Check the motor name plate or test report while setting.

<F416: Motor no load current>

This parameter sets the ratio of the motor no-load current to the rated current.

This is equivalent to the exciting inductance of the motor.

Check the no-load current value in the motor test report and divide it by the rated current value.

Set the calculated value in %.

Increasing this value will increase the exciting current.

Keep in mind that setting a value too high will cause hunting in the motor.

<F417: Motor rated speed>

This parameter sets the motor rated speed.

Check the motor name plate or test report while setting.

^{*2} Depending on the setup menu. Refer to [5. 2. 10], [11. 10].

6) Motor parameter setting method (Advanced)

· How to adjust the moment of inertia of the load

<F459: Load inertia ratio>

This parameter adjusts the excess response speed.

Increasing this value will reduce the overshoot at the acceleration/deceleration completion point.

Default setting values are set so that the moment of inertia of the load (including the motor shaft) value is set to be appropriate at 100% of the motor shaft. If the moment of inertia of the load is not 100%, set a value appropriate for the actual moment of inertia of the load.

<F461: Speed control stabilization coefficient 1>

<F462: Speed reference filter coefficient 1>

<F463: Speed control response 2>

<F464: Speed control stabilization coefficient 2>

<F465: Speed reference filter coefficient 2>

<F466: Speed control response switching frequency>

This parameter adjusts the excess response speed.

Increasing this value will reduce the overshoot at the acceleration/deceleration completion point. Set a value appropriate for the actual moment of inertia of the load.

- If the torque needs to be increased in low speed range (10Hz or less as a guide)
 Perform the basic settings for the motor parameters. Then, if the torque needs to be increased even further, increase <F413: Exciting current coefficient> to a maximum of 130%.
 <F413> is a parameter that increases the magnetic flux of the motor at low speeds, so specifying a higher value for <F413> increases the no-load current. If the no-load current exceeds the rated current, do not adjust this parameter.
- If the motor stalls when operated at frequencies over the base frequency Adjust <F414: Stall prevention coefficient>.

If a heavy load is applied momentarily (transiently), the motor may stall before the load current reaches the stall prevention level (<F601>, etc.). In such a case, a motor stall may be avoided by reducing the value of <F414> gradually.

Memo

• To use vector control, the motor capacity must be the same as the inverter rated capacity, or you can use a general purpose squirrel-cage motor with capacity no less than one rank below. Note that the minimum applicable motor capacity is 0.1 kW.

Online auto-tuning setting

<F403: Online auto-tuning> is a function that automatically adjusts motor parameters by predicting the increase in motor temperature.

- Online auto-tuning must be performed along with <F400: Offline auto-tuning>.
- Perform auto-tuning when the motor has cooled down (same temperature as the ambient temperature).

7) Parameter setting

| Title | Parameter name | Adjustment range | Default setting |
|-------|--------------------|--|-----------------|
| F403 | Online auto-tuning | Disabled Self-cooling motor auto-tuning Forced air-cooling motor auto-tuning | 0 |

8) Selecting a setting value

1: Self-cooling motor auto-tuning

Set this value when the motor is equipped with a self-cooling fan (a type in which a fan is directly connected to the motor shaft).

2: Forced air-cooling motor auto-tuning

Set this value when the motor is equipped with a fan motor (forced air-cooling).

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

VF-AS3

6. 23. 2 Setting PM motor parameters

<F400: Offline auto-tuning>

<F402: Automatic torque boost>

<F405: Motor rated capacity>

<F415: Motor rated current>

<F417: Motor rated speed>

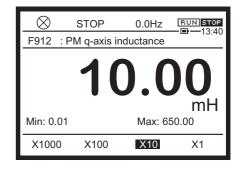
<F459: Load inertia ratio>

<F462: Speed reference filter coefficient 1>

<F465: Speed reference filter coefficient 2>

<F912: PM q-axis inductance> <F913: PM d-axis inductance>

<F915: PM control method>



Function

To select PM motor control with <Pt: V/f Pattern>, you must set motor parameters (auto-tuning). There are three setting methods.

- Set <Pt> and <F400: Offline auto-tuning> individually.
- Set <Pt> and <F400> individually. Perform an auto-tuning after calculating the motor parameter automatically (available with motor not connected).
- Set <Pt> and set the motor parameter manually.

• To set <Pt: V/f Pattern> to "6: PM motor control", check the motor name plate and set the following parameters first.



Important

- <vL: Base frequency 1> (Rated frequency): calculate from back EMF
- <vLv: Base frequency voltage 1> (Rated voltage): calculate from back EMF
- <F405: Motor rated capacity>
- <F415: Motor rated current>
- <F417: Motor rated speed>
- <F912: PM q-axis inductance>
- <F913: PM d-axis inductance>

Setting method 1: Set auto-tuning

Set PM motor control and auto-tuning individually.

First, set <Pt: V/f Pattern> to "6: PM motor control". For details of setting methods, refer to [5. 2. 4]. Next, perform offline auto-tuning.

1) Parameter setting

| Title | Parameter name | Adjustment range | Default setting |
|-------|---------------------|---|-----------------|
| F400 | Offline auto-tuning | C: - Reset motor parameters (0 after execution) Auto-tuning at run command (0 after execution) Auto-tuning at TB ON Motor parameters auto calculation (0 after execution) - Auto-tuning at run command during TB ON Auto-tuning F402 only at run command during TB ON | 0 |

2) How to select a setting value

1: Reset motor parameters (0 after execution)

Motor parameters <F402: Automatic torque boost>, <F912: PM q-axis inductance>, and <F913: PM d-axis inductance> are set with default setting values.

2: Auto-tuning at run command (0 after execution)

Perform tuning when the motor starts for the first time after settings are made and automatically set <F402: Automatic torque boost>, <F912: PM q-axis inductance>, and <F913: PM d-axis inductance> while considering the motor wiring.

3: Auto-tuning at TB ON

Assign "66: Offline auto-tuning" (67 is the inversion signal) to the digital input terminal.

When the assigned input terminal is ON, executed an auto-tuning and automatically set <F402: Automatic torque boost>, <F912: PM q-axis inductance>, and <F913: PM d-axis inductance>.

This setting allows auto-tuning while the motor is stopped; use this function when the motor cannot run following the auto-tuning due to some reason related to the operation of the machinery.

However, if standby signal is OFF, this function will not be enabled.

To make an auto-tuning again, tern input terminal off once, then turn on again.

6: Auto-tuning at run command during TB ON

Assign "66: Offline auto-tuning" (67 is the inversion signal) to the digital input terminal.

When the assigned input terminal is ON, always make an auto-tuning and automatically set <F402: Automatic torque boost>, <F912: PM q-axis inductance>, and <F913: PM d-axis inductance> at startup.

7: Auto-tuning F402 only at run command during TB ON

Assign "66: Offline auto-tuning" (67 is the inversion signal) to the digital input terminal.

Always execute an auto-tuning at startup when the motor starts for the first time after the assigned input terminal is ON and set <F402: Automatic torque boost> only.

3) Cautions during offline auto-tuning

 Offline auto-tuning must be performed with the motor connected but in a completely stopped state. Due to residual voltage, auto-tuning may not be properly performed immediately after running motor is stopped.

- There would be almost no rotation of the motor during offline auto-tuning, but you must keep in mind that voltage is still applied during this time.
- During auto-offline tuning, "Atn" will be displayed on the LCD screen.
- Offline auto-tuning takes a few seconds. If any failure is found, tripping will occur with auto-tuning error "Etn1" or "Etn2", and motor parameters will not be set.
- Offline auto-tuning cannot be performed on special motors. Calculate the motor parameters using "Setting method 2".
- If offline auto-tuning cannot be performed or auto-tuning error "Etn1" or "Etn2" occurs, set manually using "Setting method 3".

■ Setting method 2: Make auto-tuning of motor parameter after automatic setting.

Set PM motor control and then perform motor parameters auto calculation.

Check the motor name plate and set the following parameters first.

- <vL: Base frequency 1> (Rated frequency)
- <vLv: Base frequency voltage 1> (Rated voltage)
- <F405: Motor rated capacity>
- <F415: Motor rated current>
- <F417: Motor rated speed>

Next, set <Pt: V/f Pattern> to "6: PM motor control". For details of setting methods, refer to [5. 2. 4]. Then, select <F400> = "4: Motor parameters auto calculation (0 after execution)" and perform <vLv: Base frequency voltage> auto calculation.

This setting can be made without connecting the motor since it only calculates.

After automatic setting of motor parameter with <F400> = "4", be sure to set <F400> to "2: Autotuning at run command (0 after execution)" and execute an auto-tuning.

Since calculation is performed based on general trend, the calculation results may not be correct. In this case, set the parameter manually.

Setting method 3: Manually setting motor parameter

Set <Pt: V/f Pattern> to "6: PM motor control" and set the motor parameter manually. If tuning error "Etn1" is displayed during auto-tuning setting or when you want to improve PM motor control characteristics, set motor parameters individually. For details of setting methods, refer to [5. 2. 4].

4) Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|------------------------|------------------|-------------------|-----------------|
| F402 | Automatic torque boost | 0.1 - 30.00 | % | *1 |
| F405 | Motor rated capacity | 0.10 - 315.0 | kW | *1 |
| F415 | Motor rated current | *1 | Α | *1 |
| F417 | Motor rated speed | 100 - 64000 | min ⁻¹ | *2 |
| F459 | Load inertia ratio | 0.1 - 100.0 | Times | 1.0 |
| F460 | Speed control response | 0.0 - 25.0 | - | 0.0 |

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|--|------------------|------|-----------------|
| F461 | Speed control stabilization coefficient 1 | 0.50 - 2.50 | - | 1.00 |
| F462 | Speed reference filter coefficient 1 | 0 - 100 | - | 35 |
| F463 | Speed control response | 0.0 - 25.0 | - | 0.0 |
| F464 | Speed control stabilization coefficient 1 | 0.50 - 2.50 | - | 1.00 |
| F465 | Speed reference filter coefficient 2 | 0 - 100 | - | 35 |
| F466 | Speed control response switching frequency | 0.0 - FH | Hz | 0.0 |
| F912 | PM q-axis inductance | 0.01 - 650.00 | mH | 10.00 |
| F913 | PM d-axis inductance | 0.01 - 650.00 | mH | 10.00 |

^{*1} Depending on capacity. For details, refer to [11. 6].

5) Motor parameter setting method

<F402: Automatic torque boost>

This parameter adjusts the primary resistive component of the motor.

Increasing this value will prevent torque reduction due to voltage drop during low speed.

Adjust the value according to the actual operation. Keep in mind that setting a higher value than necessary will increase current at low speed and may cause tripping.

If there is a motor test report, check the stator resistance value per phase.

<F402> (%) = ($\sqrt{3}$ x Rs x <F415>)/(Vtype x 100)

where Rs is the stator resistance value per phase (Ω), Vtype is 240, 480 V (depends on voltage class).

<F405: Motor rated capacity>

This parameter sets the motor rated capacity.

Check the motor name plate or test report while setting.

<F415: Motor rated current>

This parameter sets the motor rated current.

Check the motor name plate or test report while setting.

<F417: Motor rated speed>

This parameter sets the motor rated speed.

Check the motor name plate or test report while setting.

How to adjust the moment of inertia of the load

<F459: Load inertia ratio>

This parameter adjusts the excess response speed.

Increasing this value will reduce the overshoot at the acceleration/deceleration completion point.

^{*2} Depending on the setup menu. Refer to [5. 2. 10], [11. 10].

Default setting values are set so that the moment of inertia of the load (including the motor shaft) value is set to be appropriate at 100% of the motor shaft. If the moment of inertia of the load is not 100%, set a value appropriate for the actual moment of inertia of the load.

<F461: Speed control stabilization coefficient 1>

<F462: Speed reference filter coefficient 1>

<F463: Speed control response 2>

<F464: Speed control stabilization coefficient 2>

<F465: Speed reference filter coefficient 2>

<F466: Speed control response switching frequency>

This parameter adjusts the excess response speed.

Increasing this value will reduce the overshoot at the acceleration/deceleration completion point. Set a value appropriate for the actual moment of inertia of the load.

<F912: PM q-axis inductance>

<F913: PM d-axis inductance>

Set q-axis inductance and d-axis inductance (mH) of PM motor.

Use values measured by LCR meters, etc.

Memo

 To use PM motor control, the motor capacity must be the same as the inverter rated capacity, or you can use a motor with capacity no less than one rank below.

PM motor control and starting torque optimization setting

If the PM motor does not start after auto-tuning due to heavy load, set <F915: PM control method> to "4" for starting torque optimization.

6) Parameter setting

| Title | Parameter name | Adjustment range | Default setting |
|-------|-------------------|---|-----------------|
| F915 | PM control method | 0: Method 0 1: Method 1 2: Method 2 3: Method 3 4: Method 4 | 3 |

7) How to select setting values

0: Method 0

This value sets no initial position estimation control. Reverse run may occur at startup. If tripping occurs with PM auto-tuning error "E-39", use this function by setting <F915> to "0".

1: Method 1

This value sets initial position estimation for high saliency motors.

2: Method 2

This value sets initial position estimation and starting torque optimization for high saliency motors.

3: Method 3

This value sets initial position estimation for weak saliency motors.

4: Method 4

This value sets initial position estimation and starting torque optimization for weak saliency motors.

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 24 Torque control

For details of switching to torque control, refer to Torque control.

6. 24. 1 Setting external torque commands

- <F420: Torque command select>
- <F421: Torque command filter>
- <F435: Rotation direction limit during torque control>
- <F455: Torque command polarity at Rev>
- <F725: Panel torque command>

For details, refer to Torque control.

6. 24. 2 Speed limit during torque control

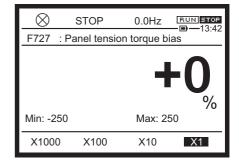
- <F425: Fwd speed limit input>
- <F426: Fwd speed limit level>
- <F427: Rev speed limit input>
- <F428: Rev speed limit level>
- <F430: Speed limit center value input select>
- <F431: Speed limit center value>
- <F432: Speed limit band>

For details, refer to Torque control.

6. 24. 3 Selecting tension control torque bias input and load sharing gain input

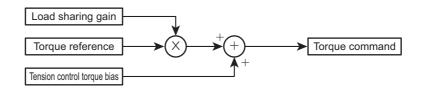
<F423: Tension control torque bias input>

<F424: Load sharing gain input> <F727: Panel tension torque bias> <F728: Panel load sharing gain>



■ Function

These parameters are used to select tension control torque bias input and load sharing gain input.



Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|-----------------------------------|--|------|-----------------|
| F423 | Tension control torque bias input | 0: - 1: Terminal RR 2: Terminal RX 3: Terminal II 4: Terminal Al4 (option) 5 - 11: - 12: <f727> 13 - 19: - 20: Embedded Ethernet 21: RS485 communication connector 22: RS485 communication connector 23: Communication option</f727> | • | 0 |
| F424 | Load sharing gain input | 0: - Terminal RR 2: Terminal RX 3: Terminal II 4: Terminal Al4 (option) 5 - 11: - 12: <f728> 13 - 19: - 20: Embedded Ethernet 21: RS485 communication connector 22: RS485 communication connector 23: Communication option</f728> | | 0 |
| F727 | Panel tension torque bias | -250 to +250 | % | 0 |
| F728 | Panel load sharing gain | 0 - 250 | % | 100 |

b

Setting example

Select destination of tension control torque bias input and load sharing gain input.

When setting with input of 0 to 10 Vdc to terminal [RR]

Set <F423: Tension control torque bias input> = "1" or <F424: Load sharing gain input> = "1".

When setting with input of -10 to +10 Vdc to terminal [RX]

Set <F423: Tension control torque bias input> = "2" or <F424: Load sharing gain input> = "2".

When setting with input of 4 to 20 mAdc to terminal [II]

Set <F423: Tension control torque bias input> = "3" or <F424: Load sharing gain input> = "3".

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 25 Torque limits

6. 25. 1 Switching torque limits

<F440: Power running torque limit input select 1>

<F441: Power running torque limit level 1>

<F442: Regenerative torque limit input select 1>

<F443: Regenerative torque limit level 1>

<F444: Power running torque limit level 2>

<F445: Regenerative torque limit level 2>

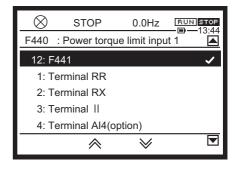
<F446: Power running torque limit level 3>

<F447: Regenerative torque limit level 3>

<F448: Power running torque limit level 4>

<F449: Regenerative torque limit level 4>

<F454: Torque limit in field weakening>



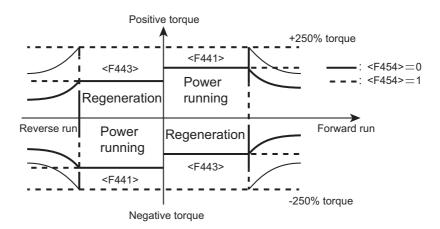
Function

When the motor-generated torque reaches a certain level, the inverter reduce the torque by lowering the output frequency.

You can select a constant output limit or a constant torque limit in the constant output zone.

Selecting a setting value

1) When torque limits are applied by the parameter setting values



Select from where to input a torque limit value at <F440: Power running torque limit input select 1> and <F442: Regenerative torque limit input select 1>.

As default setting, torque limits are applied by the parameter setting values.

| Title | Parameter name | Adjustment range | Default setting |
|-------|---|---|-----------------|
| F440 | Power running torque limit input select 1 | 0: - 1: Terminal RR 2: Terminal RX 3: Terminal II 4: Terminal Al4 (option) 5 - 11: - 12: F441 | 12 |
| F442 | Regenerative torque limit input select 1 | 0: - 1: Terminal RR 2: Terminal RX 3: Terminal II 4: Terminal Al4 (option) 5 - 11: - 12: F443 | 12 |

Set the torque limit values for the power running and regenerative torques at <F441: Power running torque limit level 1> and <F443: Regenerative torque limit level 1>.

Set limit treatment of the constant output zone (weak magnetic field) at <F454: Torque limit in field weakening>. You can select either constant output limit <F454> = "0" (default setting) or constant torque limit <F454> ="1".

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|------------------------------------|--|------|-----------------|
| F441 | Power running torque limit level 1 | 0.0-249.9 250.0: Disabled | % | 250.0 |
| F443 | Regenerative torque limit level 1 | 0.0-249.9 250.0: Disabled | % | 250.0 |
| F454 | Torque limit in field weakening | Constant power limit Constant torque limit | | 0 |

You can set four patterns each for the power running torque limit or the regenerative torque limit at the parameter settings.

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|------------------------------------|------------------------------|------|-----------------|
| F444 | Power running torque limit level 2 | 0.0-249.9 250.0: Disabled | % | 250.0 |
| F445 | Regenerative torque limit level 2 | | % | 250.0 |
| F446 | Power running torque limit level 3 | | % | 250.0 |
| F447 | Regenerative torque limit level 3 | | % | 250.0 |
| F448 | Power running torque limit level 4 | | % | 250.0 |
| F449 | Regenerative torque limit level 4 | | % | 250.0 |

Patterns 1 to 4 can be switched by turning the input terminal ON/OFF.

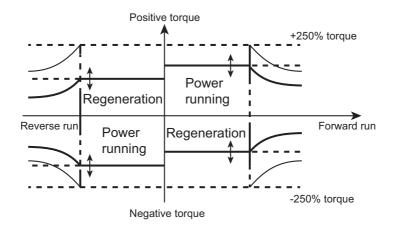
Assign "32: Stall prevention switching/Torque limit switching 1" and "34: Torque limit switching 2" to the two unused input terminals.

| | 32: Stall prevention switching/ Torque limit switching 1 | 34: Torque limit switching 2 |
|----------------------|--|------------------------------|
| Torque limit level 1 | OFF | OFF |
| Torque limit level 2 | ON | OFF |
| Torque limit level 3 | OFF | ON |
| Torque limit level 4 | ON | ON |

Memo

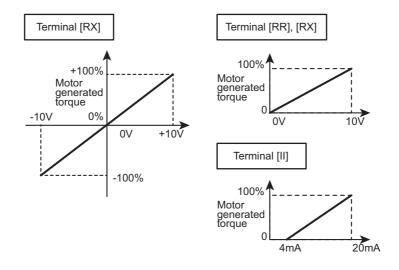
- Set the torque limit level to "250.0" when disabling this function.
- When <Pt: V/f Pattern>="0", "1", or "7", the torque limit will be disabled.
- When the current value is big, or the setting value of <F601: Stall prevention level 1> is small, the stall preventive function may be active before torque limit and lower the frequency.

2) When torque limits are applied by external signals



Torque limit value can be changed by external signals.

- When setting with input of 0 to 10 Vdc to terminal [RR]
 Set "1" for <F440: Power running torque limit input select 1> and <F442: Regenerative torque limit input select 1>.
- When setting with input of -10 to 10 Vdc to terminal [RX]
 Set "2" for <F440: Power running torque limit input select 1> and <F442: Regenerative torque limit input select 1>.
- When setting with input of 4 to 20 mAdc to terminal [II]
 Set "3" for <F440: Power running torque limit input select 1> and <F442: Regenerative torque limit input select 1>.



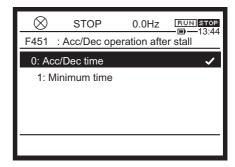
Memo

- The torque command values are limited to the torque limit level in torque control.
- When V/f Pattern is "V/f constant" or "Variable torque", the torque limit will be disabled.

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 25. 2 Selecting Acc/Dec operation after stall prevention operation

<F451: Acc/Dec operation after stall operation>



Function

When you use lifting gear (crane or hoist) in combination with mechanical brakes, and if the output frequency is decreasing due to stall prevention operation before mechanical brake release, accelerate the mechanical brake delay time in the minimum time to prevent load from falling due to torque reduction after mechanical brake release.

This will also improve the response in inching operation, and thus preventing the load from slipping down.

Parameter setting

| Title | Parameter name | Adjustment range | Default setting |
|-------|---|------------------------------------|-----------------|
| F451 | Acc/Dec operation after stall operation | 0: Acc/Dec time 1: Minimum time | 0 |

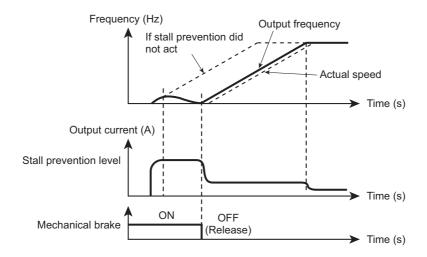
Selecting a setting value

0: Acc/Dec time

When stall prevention is active, the output frequency gets low.

If stall prevention was active and the output frequency is decreasing before releasing the machine, even if the mechanical brake is released, the stall prevention remains active during the delay time of the brake operation. After delay time of the brake operation, the output current value gets low, the stall prevention operation is deactivated and the output frequency increases.

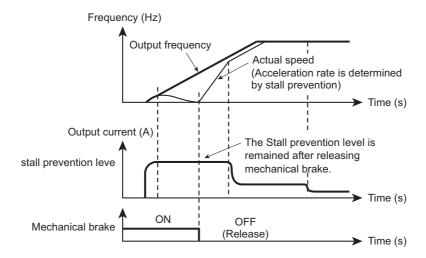
With this setting, the output frequency reaches the frequency command value after brake operation delay time + acceleration time. The actual speed of the machinery changes in sync with the output frequency.



1: Minimum time

With the same situation as in 0, the output frequency precedes and accelerates in minimum time, even when the stall prevention is active. After release of the mechanical brake, the output current is retained, and the actual speed of the machinery changes in sync with the output frequency.

This setting can prevent the load from falling, thus improving the response of the inching operation.



- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

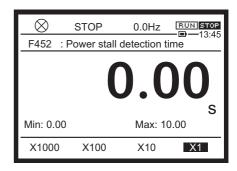
6

6. 25. 3 Detecting the stall time during power running to trip

<F452: Stall detection time during power running>

<F441: Power running torque limit level 1>

<F601: Stall prevention level 1>



Function

This function is one of the functions to prevent lifting gear from falling. If stall prevention operation occurs in succession, this function judges that the motor has stalled to trip it.

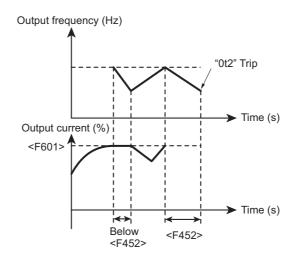
Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|---|------------------------------|------|-----------------|
| F452 | Stall detection time during power running | 0.00-10.00 | S | 0.00 |
| F441 | Power running torque limit level 1 | 0.0-249.9 250.0: Disabled | % | 250.0 |
| F601 | Stall prevention level 1 | 10-200 (HD) 10-160 (ND) | % | *1 |

^{*1} Depending on capacity. For details, refer to [11. 6].

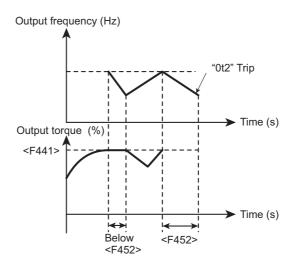
Setting method

1) In case of overcurrent stall



If, during power running, the output current reaches the value for <F601: Stall prevention level 1> or more, and continues for the period of time set for <F452: Stall detection time during power running>, the trip "Ot2" will occur.

2) In case of torque limit

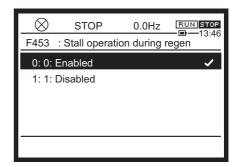


If, during power running, the output torque reaches the value for <F441: Power running torque limit level 1> or more, and continues for the period of time set for <F452: Stall detection time during power running>, the trip "Ot2" will occur.

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 25. 4 Selecting stall operation during regeneration

<F453: Stall operation during regen>



■ Function

This function is one of the functions to prevent the lifting gear from being displaced at stop. If current stall prevention gets active during regeneration of controlled stop, there may be a mismatch at stop. Set to inhibit only the stall prevention of current.

Parameter setting

| Title | Parameter name | Adjustment range | Default setting |
|-------|------------------------------|---------------------------|-----------------|
| F453 | Stall operation during regen | 0: Enabled 1: Disabled | 0 |

■ Selecting a setting value

To inhibit the stall prevention of current during regeneration of controlled stop, set <F453: Stall operation during regen> to "1".

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 26 Adjusting current and speed control gain

6. 26. 1 Setting current and speed control gain

<F458: Current control response>

<F459: Load inertia ratio>

<F460: Speed control response 1>

<F461: Speed control stabilization coefficient 1>

<F462: Speed reference filter coefficient 1>

<F463: Speed control response 2>

<F464: Speed control stabilization coefficient 2>

<F465: Speed reference filter coefficient 2>

<F466: Speed control response switching frequency>

For details, refer to "How to adjust current and speed control gain".

6. 26. 2 Setting the over modulation ratio

<F495: Over modulation ratio>

6. 27 Switching multiple acceleration/ deceleration

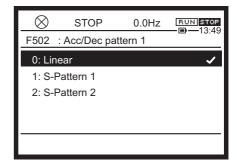
6. 27. 1 Setting Acc/Dec patterns

<F502: Acc/Dec pattern 1>

<F506: S-Pattern range at Acc start>

<F507: S-Pattern range at Acc completion> <F508: S-Pattern range at Dec completion>

<F509: S-Pattern range at Dec start>



■ Function

You can select acceleration/deceleration patterns suitable for the purpose.

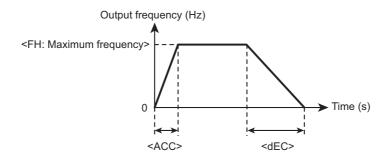
Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|-----------------------------------|---|------|-----------------|
| F502 | Acc/Dec pattern 1 | 0: Linear 1: S-Pattern 1 2: S-Pattern 2 | | 0 |
| F506 | S-Pattern range at Acc start | 0-50 | % | 10 |
| F507 | S-Pattern range at Acc completion | 0-50 | % | 10 |
| F508 | S-Pattern range at Dec completion | 0-50 | % | 10 |
| F509 | S-Pattern range at Dec start | 0-50 | % | 10 |

How to select the setting value for <F502>

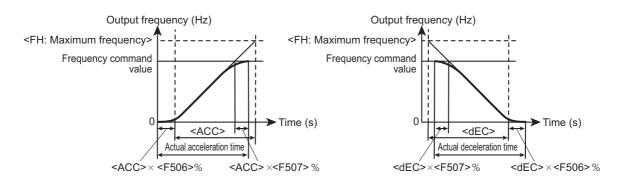
0: Linear pattern

This is linear acceleration and deceleration, and is a normal Acc/Dec pattern. Normally, you can use this setting for operation.



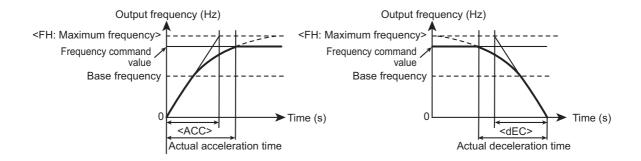
1: S-Pattern 1

The S-Pattern Acc/Dec 1 is selected to minimize the shock at acceleration/deceleration. This is suitable for pneumatic transport machines, etc.



2: S-Pattern 2

For the S-Pattern ACC/DEC 2, the motor accelerating torque accelerates in the small demagnetizing region. This is suitable for high-speed spindle operation, etc.



- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6

6. 27. 2 Switching four types of acceleration/deceleration

<F500: Acceleration time 2>

<F501: Deceleration time 2>

<F503: Acc/Dec pattern 2>

<F504: Panel Acc/Dec select>

<F505: Acc/Dec switching frequency 1>

<F510: Acceleration time 3>

<F511: Deceleration time 3>

<F512: Acc/Dec pattern 3>

<F513: Acc/Dec switching frequency 2>

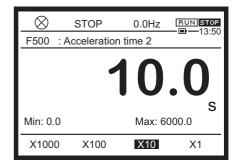
<F514: Acceleration time 4>

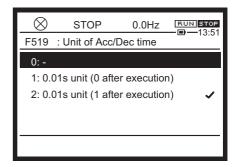
<F515: Deceleration time 4>

<F516: Acc/Dec pattern 4>

<F517: Acc/Dec switching frequency 3>

<F519: Unit of Acc/Dec time>





Function

You can set four types of options for each acceleration and deceleration time. There are three setting methods to choose from four types.

- 1) Selection by the parameters
- 2) Switching by frequencies
- 3) Switching by the terminals

Setting of parameters

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|----------------------|---|------|-----------------|
| ACC | Acceleration time 1 | 0.0 - 6000 (600.0) | S | *1 |
| dEC | Deceleration time 1 | 0.0 - 6000 (600.0) | s | *1 |
| F500 | Acceleration time 2 | 0.0 - 6000 (600.0) | s | *1 |
| F501 | Deceleration time 2 | 0.0 - 6000 (600.0) | s | *1 |
| F510 | Acceleration time 3 | 0.0 - 6000 (600.0) | s | *1 |
| F511 | Deceleration time 3 | 0.0 - 6000 (600.0) | s | *1 |
| F514 | Acceleration time 4 | 0.0 - 6000 (600.0) | s | *1 |
| F515 | Deceleration time 4 | 0.0 - 6000 (600.0) | S | *1 |
| F519 | Unit of Acc/Dec time | 0: - 1: 0.01 s unit (0 after execution) 2: 0.1 s unit (0 after execution) | - | 0 |

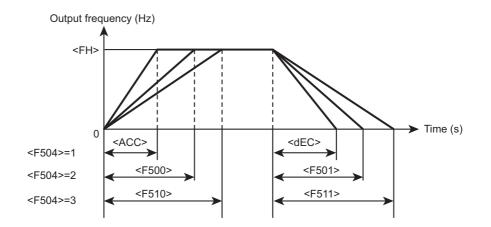
^{*1} Depending on capacity. For details, refer to [11. 6].

In default setting, the acceleration/deceleration time is set in the increment unit of 0.1 second. When you set <F519: Unit of Acc/Dec time> to "1", you can change the increment unit for the acceleration/deceleration time to 0.01 second. (After setting <F519>, the unit returns to 0.)

How to use the parameters

1) Selection by the parameters

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|----------------------|--|------|-----------------|
| F504 | Panel Acc/Dec select | 1: Acc/Dec 1 2: Acc/Dec 2 3: Acc/Dec 3 4: Acc/Dec 4 | | 1 |



Set run command to panel run. Set <CMOd: Run command select> to "1: Operation panel, Extension panel".

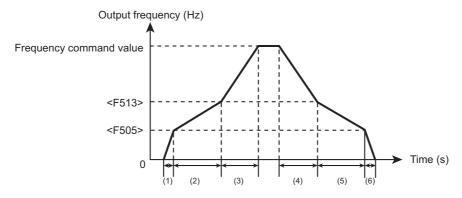
At default setting, "Acc/Dec 1" is set, and <ACC: Acceleration time 1> and <dEC: Deceleration time 1> is enabled.

When using "Acc/Dec 2" to "Acc/Dec 4", set <F504: Panel Acc/Dec select>.

2) Switching by frequencies

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|-------------------------------|-------------------------|------|-----------------|
| F505 | Acc/Dec switching frequency 1 | 0.0: Disabled 0.1-UL | Hz | 0.0 |
| F513 | Acc/Dec switching frequency 2 | 0.0: Disabled 0.1-UL | Hz | 0.0 |
| F517 | Acc/Dec switching frequency 3 | 0.0: Disabled 0.1-UL | Hz | 0.0 |

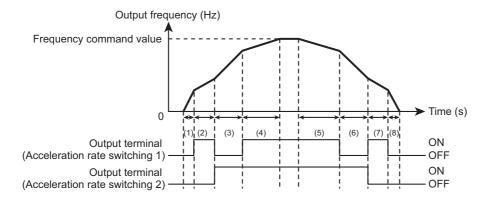
The acceleration/deceleration time is automatically switched according to the set frequency. Even if the order of the switching frequencies is changed, it will be switched between Acc/Dec 1 and 2, Acc/Dec 2 and 3, and then Acc/Dec 3 and 4 in the order of the increasing frequencies. For example, if <F505: Acc/Dec switching frequency 1> is higher than <F513: Acc/Dec switching frequency 2>, Acc/Dec 1 is selected to <F513>, and Acc/Dec 2 to <F505>.



- (1) Accelerate by the inclination of the acceleration time <ACC>
- (4) Decelerate by the inclination of the deceleration time <F511>
- (2) Accelerate by the inclination of the acceleration time <F500> (3) Accelerate by the inclination of the acceleration time <F510>
- (5) Decelerate by the inclination of the deceleration time <F501> (6) Decelerate by the inclination of the deceleration time <dEC>

3) Switching by the terminals

The acceleration/deceleration time is switched by signals to terminals.



- (1) Accelerate by the inclination of the acceleration time <ACC>
- (5) Decelerate by the inclination of the deceleration time <F515>
- (2) Accelerate by the inclination of the acceleration time <F500>
- (3) Accelerate by the inclination of the acceleration time <F510>
 (4) Accelerate by the inclination of the acceleration time <F514>
- (6) Decelerate by the inclination of the deceleration time <F511>
 (7) Decelerate by the inclination of the deceleration time <F501>
 (8) Decelerate by the inclination of the deceleration time <dEC>

Set run command to terminal run. Set <CMOd: Run command select> to "0: Terminal".

Patterns 1 - 4 can be switched by turning the two input terminals ON/OFF.

Assign "32: Stall prevention switching/Torque limit switching 1" and "34: Torque limit switching 2" to the two unused input terminals.

| | 24: Acc/Dec switching 1 | 26: Acc/Dec switching 2 |
|-----------|-------------------------|-------------------------|
| Acc/Dec 1 | OFF | OFF |
| Acc/Dec 2 | ON | OFF |
| Acc/Dec 3 | OFF | ON |
| Acc/Dec 4 | ON | ON |

■ Acc/Dec patterns

You can individually select Acc/Dec patterns by selecting Acc/Dec 1, 2, 3 or 4.

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|-----------------------------------|----------------------------------|------|-----------------|
| F502 | Acc/Dec pattern 1 | 0: Linear | | 0 |
| F503 | Acc/Dec pattern 2 | 1: S-Pattern 1 2: S-Pattern 2 | | 0 |
| F512 | Acc/Dec pattern 3 | | | 0 |
| F516 | Acc/Dec pattern 4 | | | 0 |
| F506 | S-Pattern range at Acc start | 0-50 | % | 10 |
| F507 | S-Pattern range at Acc completion | 0-50 | % | 10 |
| F508 | S-Pattern range at Dec completion | 0-50 | % | 10 |
| F509 | S-Pattern range at Dec start | 0-50 | % | 10 |

For details on the Acc/Dec patterns, refer to [6. 27. 1].

Parameters to determine S-Pattern ranges of "1: S-Pattern 1", <F506><F507><F508><F509>, is common to Acc/Dec patterns 1 - 4.

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 28 Pattern operation

<F520: Pattern operation>

<F521: Pattern operation continue select>

<F522: Pattern 1 repeat number>

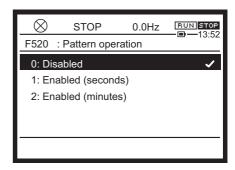
<F523: Pattern 1 select 1> to <F530: Pattern 1 select 8>

<F531: Pattern 2 repeat number>

<F532: Pattern 2 select 1> to <F539: Pattern 2 select 8>

<F540: Operation time (1-speed)> to <F554: Operation time

(15-speed)>



Function

You can perform terminal run according to up to 30 types (15 types x 2 patterns) of operation frequencies, operation time, and acceleration/deceleration time that were set in advance. Pattern operation switching, and Run/Stop are all input from the terminals.

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-----------|-----------------------------------|--|------------------------------------|-----------------|
| F520 | Pattern operation | 0: Disabled 1: Enabled (seconds) 2: Enabled (minutes) | | 0 |
| F521 | Pattern operation continue select | 0: Reset after stop 1: Continue after stop | | 0 |
| F522 | Pattern 1 repeat number | 1-254 255: Continuous | Times | 1 |
| F523-F530 | Pattern 1 select 1-8 | 0: Skip 1: Sr1 2: Sr2 3: Sr3 4: Sr4 5: Sr5 6: Sr6 7: Sr7 8: F287 9: F288 10: F289 11: F290 12: F291 13: F292 14: F293 15: F294 | | 0 |
| F531 | Pattern 2 repeat number | 1-254 255: Continuous | Times | 1 |
| F532-F539 | Pattern 2 select 1-8 | Same as <f523></f523> | | 0 |
| F540-F554 | Operation time (1 to 15-speed) | 0.1-5999 6000: Continuous | The unit is set at <f 520="">.</f> | 5.0 |

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------------|--|---|------|-----------------|
| F560 | Preset speed operation style | 0: Frequency only 1: With function | - | 0 |
| F561 - F575 | Operation function (1- speed) to Operation function (15-speed) | 0: Fwd run +1: Rev run +2: Acc/Dec switching signal 1 +4: Acc/Dec switching signal 2 +8: V/f switching signal 1 +16: V/f switching signal 2 +32: Torque limit switching signal 1 +64: Torque limit switching signal 2 | | 0 |

When auto-restart after momentary stop is set, time is also added to the pattern operation time during catch on fly. Therefore, the actual operation time may be shorter than the setting time.

How to use the parameters

The basic operation method is as follows:

1) Set <F520: Pattern operation> to "1: Enabled (seconds)" or "2: Enabled (minutes)".

This parameter is used to select the time unit (seconds/minutes) for <F540: Operation time (1-speed)> to <F554: Operation time (15-speed)>.

2) Set the frequency to operate.

To set the frequencies to be used for pattern operations, do so at the following parameters related to preset-speed frequencies, not at specific parameters.

- <Sr1: Preset speed 1> to <Sr7: Preset speed 7>
- <F287: Preset speed 8> to <F294: Preset speed 15>
- 3) To attach function to the frequency to operate, set <F560: Preset speed operation style> to "1: With function".

The function can be set to each frequency to operate. Set required functions, e.g. Fwd, Rev, Acc/Dec switching 1, 2, V/f switching 1, 2, to the following parameters.

- <F561: Operation function (1-speed)> through <F575: Operation function (15-speed)> For details, refer to [5. 2. 7].
- 4) Set the required operation time at <F540: Operation time (1-speed)> to <F554: Operation time (15-speed)> for every frequency to operate. Select the unit (seconds/minutes) at <F520: Acc/Dec switching frequency 1>.
- 5) Set the order of frequency to operate.

Three parameter setting methods are provided.

• Select pattern operation mode at <F521: Pattern operation continue select>.

0: Reset after stop

Operation is resumed after the pattern operations are reset by stop or switching operation.

1: Continue after stop

Pattern operations are started by stop or switching operation. After completion of a routine, operation stops or the next routine is started.

- Select pattern groups to set the order of frequencies to operate.
 - <F522: Pattern 1 repeat number>
 - <F523: Pattern 1 select 1> to <F530: Pattern 1 select 8>
 - <F531: Pattern 2 repeat number>
 - <F532: Pattern 2 select 1> to <F539: Pattern 2 select 8>
- You can set parameter groups to operate by turning the input terminal ON/OFF.

Assign "38: Pattern operation 1" and "40: Pattern operation 2" to the two unused input terminals.

Also, assigning "42: Pattern operation continuation" and "44: Pattern operation start" to other input terminals allows you can select operation method by turning them ON/OFF.

6) Display status of pattern operation in [Monitor mode].

The status of the pattern operation can be checked in [Monitor mode]. Set the monitor numbers shown in the following table to <F711: Monitor mode 1 display> to <F718: Monitor mode 8 display>.

| Monitor number | Operation status | Example of display | Example of content |
|-------------------|--|--------------------|--|
| 66 | Pattern operation group number | P1.0 | Indicates Pattern group 1. |
| 67 | Pattern operation remaining cycle number | n123 | Indicates that the 123rd pattern is being performed. |
| 68 | Pattern operation preset speed number | F1 | Indicates that 1-speed frequency is used to operate. |
| 69 | Pattern operation remaining time | 123.4 | Indicates that the current pattern will be ended in 123.4 seconds. |

■ Pattern operation switching output

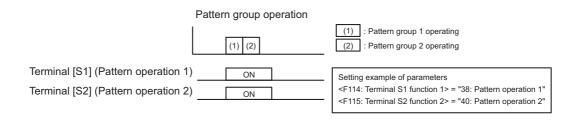
Signals can be output when all pattern operations are ended.

Assign "36: Pattern operation switching" to an output terminal.

Output is turned OFF when run command is off and when the pattern operation selection is changed.

■ Notes for pattern operation

- You need to input pattern operation group selection from the terminal.
- When all input terminals with pattern operation assigned are turned OFF, and after pattern operation is ended, normal operation will start.
- When multiple group numbers are simultaneously input, operations will be performed in the order of the increasing group numbers, to automatically change to the next group. In this case, it may take approximately 0.06 second (per pattern) to search the patterns.
- Turn pattern operation 1 or 2 ON, wait for 10 ms or more to elapse, then turn ON the run command. Turning the run command ON early may cause operation with normal output frequency instead of pattern operation.
- <F964: Preset speed 16> to <F979: Preset speed 31> cannot be set to pattern operation.



- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 29 Shock monitoring function

<F590: Shock monitoring>

<F591: Shock monitoring trip>

<F592: Shock monitoring detection>

<F593: Shock monitoring detection level>

<F595: Shock monitoring detection time>

<F596: Shock monitoring detection hysteresis>

<F597: Shock monitoring dtection wait time>

<F598: Shock monitoring detection condition>

For details, refer to Shock Monitoring Function Instruction Manual.

6. 30 Setting the protection functions

Set the protection functions against electric thermal, current stall prevention operation, input/output phase failure, short circuit, ground fault, overtorque, undervoltage, analog signal disconnection, etc. for safety operation.

6. 30. 1 Setting the motor electronic thermal protection

<F606: Motor overload reduction frequency threshold>

<F607: Motor overload time>

<F631: Inverter overload detection>

<F632: Electronic thermal memory target>

<F657: Overload alarm level>

For details on the motor electronic thermal functions, refer to [5. 1. 5].

6. 30. 2 Setting overcurrent stall

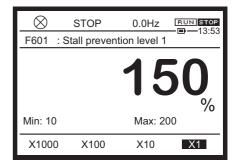
⚠ CAUTION



Do not set the stall prevention level parameters (F601 and F185) extremely low.
 If the stall prevention level parameters (F601 and F185) are set at or below the motor no-load current, the stall preventive function will be always enabled and increase the frequency when it judges that regenerative braking is taking place.

Do not set the stall prevention level parameters (F601 and F185) at 30% or less under normal use conditions.

<F601: Stall prevention level 1> <F185: Stall prevention level 2>



Function

If the current exceeding the level set at Stall prevention level 1 or 2 is flowed, stall prevention operation will be enabled to lower the output frequencies.

Setting the output frequency low lowers output current of fans and pumps, which prevents overcurrent trip.

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|--------------------------|----------------------------|------|-----------------|
| F601 | Stall prevention level 1 | 10-200 (HD) 10-160 (ND) | % | *1 |
| F185 | Stall prevention level 2 | 10-100 (140) | | |

^{*1} Depending on capacity. For details, refer to [11. 6].

How to set the parameter

100% reference is the inverter rated current.

To switch <F601: Stall prevention level 1> between <F185: Stall prevention level 2>, use signals to input terminal. Assign "32: Stall prevention switching/Torque limit switching 1" to the unused input terminal.

For details, refer to [7. 2. 1].

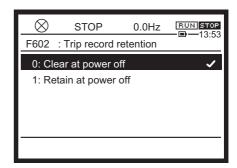
Display during the stall prevention operation

If the current exceeding the stall prevention level is about to flow, the output frequency will change. At this time, the letter "C" will blink.

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 30. 3 Retaining trip types

<F602: Trip record retention>



■ Function

Trip can be reset by turning power off, but you can set to retain details about trip occurrence even when power is turned off.

After power off, the saved trip type will be displayed after turning power on again. If trip factor is remaining, however, the trip will occur again.

Parameter setting

| Title | Parameter name | Adjustment range | Default setting |
|-------|-----------------------|---|-----------------|
| F602 | Trip record retention | O: Clear at power off 1: Retain at power off | 0 |

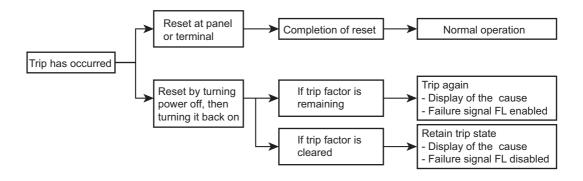
Selecting a setting value

0: Clear at power off

Reset the trip at power off. Trip type will not be retained after turning power on again.

1: Retain at power off

The following shows how the inverter operates after power off.



• The causes of the last eight trips can be displayed in [Monitor mode] even if the trip record retention is set. For details, refer to [8. 1. 1].

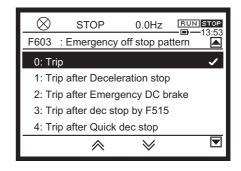
Memo

- If the power is turned on again, the data at trip in [Monitor mode] will not be retained. Check the data on the details monitor for the past trip history. For details, refer to [8. 1. 2].
- Even if the power is turned ON during retry, a trip record will be retained.

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 30. 4 Emergency off

<F603: Emergency off stop pattern> <F604: Emergency DC braking time>



■ Function

Set the stop pattern for emergency off
At the time of emergency off, a trip occurs. The trip display is "E".

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|----------------------------|--|------|-----------------|
| F603 | Emergency off stop pattern | Trip Trip after Deceleration stop Trip after Emergency DC braking Trip after deceleration stop by F515 Trip after Quick deceleration stop Trip after Dynamic quick deceleration stop | | 0 |
| F604 | Emergency DC braking time | 0.0-20.0 | S | 1.0 |
| F251 | DC braking current | 0 - 100 | % | 50 |
| F515 | Deceleration time 4 | 0.0-6000 | s | *1 |

^{*1} Depending on capacity. For details, refer to [11. 6].

■ Select the setting value for <F603: Emergency off stop pattern>

0: Trip

A trip occurs by emergency off command. The motor performs coast stop.

1: Trip after Deceleration stop

A trip occurs after deceleration stop is performed for the period of time set for <dEC: Deceleration time 1>.

2: Trip after Emergency DC braking

The inverter stops after emergency DC braking, and a trip occurs.

Set <F251: DC braking current> and <F604: Emergency DC braking time>.

3: Trip after deceleration stop by <F515>

A trip occurs after deceleration stop is performed for the period of time set for <F515: Deceleration time 4>.

Set <F515>.

Use this parameter when you want to set deceleration time for normal operation and emergency off in different time.

4: Trip after Quick deceleration stop

After quick deceleration is performed, a trip occurs after stop.

In quick deceleration stop, the motor can decelerate more quickly than normal deceleration by increasing the voltage to the motor (over-excitation control) to increase the energy consumed by the motor when the voltage reaches the overvoltage limit operation level during deceleration.

5: Trip after Dynamic quick deceleration stop

A trip occurs after Dynamic quick deceleration stop.

In Dynamic quick deceleration, the motor may be decelerated more quickly than quick deceleration control by increasing the voltage to the motor (over-excitation control) to increase the energy consumed by the motor as soon as the motor starts decelerating.

How to use

1) Emergency off via external signal

Emergency off can be performed via a signal to a terminal. Assign "20: Emergency off" to the input terminal. Select how to stop the operation in <F603>.

Emergency off from the terminals is always given priority even during panel run.

2) Emergency off from the operation panel

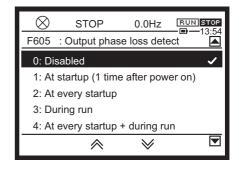
Emergency off can be performed on the operation panel when panel run is not performed. To perform emergency off, press the [STOP] key on the operation panel twice. For details on the operation, refer to [3. 2. 3].

The inverter cannot be reset the trip while the emergency off signal is being input to the input terminal. Reset a trip after releasing the signal.

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 30. 5 Output phase loss detection

<F605: Output phase loss detection>



Function

When the phase loss on the inverter output side is detected, and after a certain period of time passed, a trip occurs. The trip display is "EPHO".

Parameter setting

| Title | Parameter name | Adjustment range | Default setting |
|-------|-----------------------------|---|-----------------|
| F605 | Output phase loss detection | Disabled At startup (only one time after power on) At every startup During run At every startup + during run Output shut off detection | 0 |

How to select a setting value

0: Disabled

A trip does not occur. (Failure signal FL disabled)

1: At startup (only one time after power on)

After the power is turned on, output phase loss is detected at the first startup, and a trip occurs after a certain period of time passed. (Failure signal FL enabled)

2: At every startup

At every startup, output phase loss is detected, and a trip occurs after a certain period of time passed. (Failure signal FL enabled)

3: During run

A phase loss is detected during run, and a trip occurs after a certain period of time passed. (Failure signal FL enabled)

4: At every startup + during run

At every startup and during run, a phase loss is detected, and a trip occurs after a certain period of time passed. (Failure signal FL enabled)

5: Output shut off detection

In case you release between the motor and inverter for commercial power supply, restart the operation with low-voltage by controlling impact after the connection at the output side is off and connect it again. (Failure signal FL disabled)

Detection is not performed at auto-restart.

An output phase loss is detected at auto-tuning regardless of the setting for <F605: Output phase loss detection>.

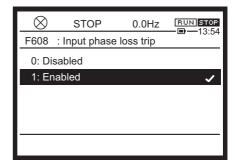
Memo

- If <Pt: V/f Pattern> = "5" and "6" is set, <F605: Output phase loss detection> = "3", "4" or "5" will be disabled.
- For special motors such as high-speed motors, detection error may occur.

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 30. 6 Input phase loss detection

<F608: Input phase loss trip>



Function

If the phase loss on the inverter input side is detected and an abnormal ripple voltage persists in the power circuit capacitor for a certain period of time, a trip occurs. The trip display is "EPHI".

Parameter setting

| Title | Parameter name | Adjustment range | Default setting |
|-------|-----------------------|---------------------------|-----------------|
| F608 | Input phase loss trip | 0: Disabled 1: Enabled | 1 |

Difference between the settings

0: Disabled

A trip does not occur. (Failure signal FL disabled)

1: Enabled

If the phase loss is detected during run and an abnormal ripple voltage persists in the power circuit capacitor for a certain period of time, a trip occurs. (Failure signal FL enabled)



Important

- In case of light-load operation or if the motor capacity is too small for the inverter capacity, input phase loss may not be detected.
- If the power supply capacity is too large for the inverter capacity (500 kVA or more, and 10 times or more), detection error may occur. In this case, install an input reactor.
- When <F608> = "0: Disabled", if heavy-load operation continues in the phase loss status on the input side, the power circuit capacitor of inverter may be damaged.
- To operate the inverter with DC input, set <F608: Input phase loss trip> to "0: Disabled".

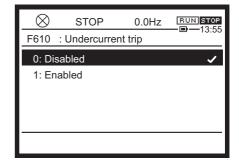
- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 30. 7 Undercurrent detection

<F610: Undercurrent trip>

<F609: Undercurrent detection hysteresis>

<F611: Undercurrent detection level>
<F612: Undercurrent detection time>



■ Function

Trips or outputs an alarm when the output current falls to the value set in <F611: Undercurrent detection level> or less for the time specified in <F612: Undercurrent detection time>. Hysteresis can be set by <F609: Undercurrent detection hysteresis> The trip display is "UC".

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|-----------------------------------|---------------------------|------|-----------------|
| F610 | Undercurrent trip | 0: Disabled 1: Enabled | | 0 |
| F609 | Undercurrent detection hysteresis | 1 - 20 | % | 10 |
| F611 | Undercurrent detection level | 0 - 150 | % | 0 |
| F612 | Undercurrent detection time | 0 - 255 | S | 0 |

■ Difference depending on the setting of <F610: Undercurrent trip>

0: Disabled

A trip does not occur. (Failure signal FL disabled)

Undercurrent (UC) alarm can be output from the output terminal.

Assign "26: Undercurrent (UC) alarm" to an unused output terminal.

1: Enabled

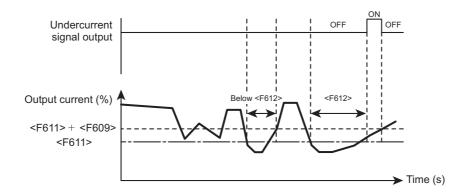
When a current level set in <F611: Undercurrent detection level> or less is detected for the period of time set in <F612: Undercurrent detection time> or more, the inverter trips and "UC" is displayed. (Failure signal FL enabled)

Setting example

Set "26: Undercurrent (UC) alarm" to the unused output terminal.

In the case of <F610: Undercurrent trip> = "0: Disabled", the signal can be output from the output terminal as follows.

6-128



In the case of <F610: Undercurrent trip> = "1: Enabled", when a current is <F611: Undercurrent detection level> or less for the period of time specified by <F612: Undercurrent detection time>, the inverter trips.

After tripping, undercurrent (UC) alarm signal remains ON.

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 30. 8 Overtorque detection

<F615: Overtorque trip>

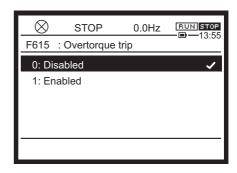
<F616: Overtorque detection level during power run-

ning>

<F617: Overtorque detection level during regen>

<F618: Overtorque detection time>

<F619: Overtorque detection hysteresis>



■ Function

When the torque value is <F616: Overtorque detection level during power running> or more and remains over for the time specified by <F618: Overtorque detection time>, tripping or alarm can be output. You can enable or disable the trip setting by <F615: Overtorque trip>. The trip display is "Ot".

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|---|---------------------------|------|-----------------|
| F615 | Overtorque trip | 0: Disabled 1: Enabled | | 0 |
| F616 | Overtorque detection level during power running | 0: Disabled *1 1 - 320 | % | 150 |
| F617 | Overtorque detection level during regen | 0: Disabled *1 1 - 320 | % | 150 |
| F618 | Overtorque detection time | 0.00 - 10.00 *2 | s | 0.5 |
| F619 | Overtorque detection hysteresis | 0 - 100 | % | 10 |

^{*1} You can output an alarm set regardless of the <F615> setting. Trip or alarm cannot be output when <F616> or <F617> is set to "0: Disabled".

■ Difference depending on the setting of <F615: Overtorque trip>

0: Disabled

A trip does not occur. (Failure signal FL disabled)

Overtorque (OT) alarm can be output when a torque is <F616: Overtorque detection level during power running> or more is detected for the period of time specified by <F618: Overtorque detection time>.

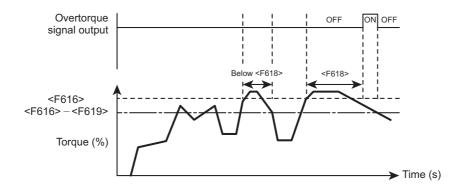
^{*2 &}lt;F618>= "0.0" seconds is the shortest time detected on control.

1: Enabled

The inverter trips when a torque is <F616: Overtorque detection level during power running> or more is detected over the period of time specified by <F618: Overtorque detection time> or longer. Overtorque (OT) alarm can also be output from the output terminal. (Failure signal FL enabled)

Setting example

Assign "28: Overtorque (OT) alarm" to the unused output terminal. In the case of <F615: Overtorque trip> = "0: Disabled", the alarm functions as follows.



When <F615: Overtorque trip> = "1: Enabled", the inverter trips if overtorque is detected for the period of time specified by <F618: Overtorque detection time>.

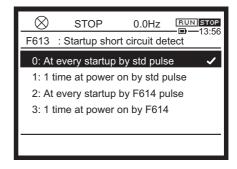
After that, overtorque (OT) alarm remains ON.

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 30. 9 Short circuit detection at start

<F613: Short circuit detection at start>

<F614: Pulse width of short circuit detection at start>



Function

Inverter detects inverter output short-circuit at the start.

Normally, short-circuit can be detected in the length of standard pulse (50 μ s). When operating a low-impedance motor, such as a high-speed motor, however, select the short-time pulse by <F614:Pulse width of short circuit detection at start> to prevent an error detection.

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|---|--|------|-----------------|
| F613 | Short circuit detection at start | At every startup by standard pulse Only one time after power on by st pulse At every startup by F614 setting pulse Only one time after power on by F6 setting pulse | ılse | 0 |
| F614 | Pulse width of short circuit detection at start | 0: No short circuit detection at start 1 - 50 | μs | 25 |

Setting the <F613: Short circuit detection at start>

0: At every startup by standard pulse

Detection is executed in the length of standard pulse every time at the start of inverter operation.

1: Only one time after power on by standard pulse

Detection is executed in the length of standard pulse only during the first start-up at power on or after resetting.

2: At every startup by F614 setting pulse

Detection is executed in the length of short-time pulse specified by <F614: Pulse width of short circuit detection at start> every time at the start of inverter operation.

3: Only one time after power on by F614 setting pulse

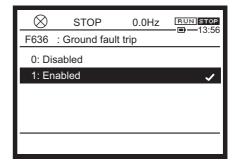
Detection is executed in the length of short-time pulse specified by <F614: Pulse width of short circuit detection at start> only one time during the first start-up at power on or after resetting.

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 30. 10 Ground fault detection

<F636: Ground fault trip>



■ Function

Inverter detects the ground fault.

If a ground fault occurs in the inverter unit or output side, the inverter will trip. The trip display is "EF2".

Parameter setting

| Title | Parameter name | Adjustment range | Default setting |
|-------|-------------------|---------------------------|-----------------|
| F636 | Ground fault trip | 0: Disabled 1: Enabled | 1 |

■ How to select a setting value

0: Disabled

A trip does not occur. (Failure signal FL disabled)

In this case, installation of a ground detector, such as a ground relay, is recommended.

1: Enabled

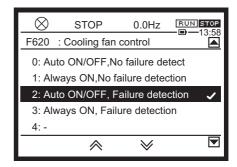
Ground fault detection is enabled.

The inverter will trip when ground fault is detected. (Failure signal FL enabled)

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 30. 11 Cooling fan control

<F620: Cooling fan control>



■ Function

The cooling fan run only when the ambient temperature is high and during run. This way, the service life of cooling fan can be extended compared to when keep running the cooling fan while the power is ON. It is also able to trip when the capability of the cooling fan falls below a certain level. The trip display is "E-42".

Parameter setting

| Title | Parameter name | Adjustment range | Default setting |
|-------|---------------------|--|-----------------|
| F620 | Cooling fan control | O: Auto ON/OFF, No failure detection Always ON, No failure detection Auto ON/OFF, Failure detection Always ON, Failure detection A - 7: - | 2 |

^{*}When the motor speed of the cooling fan is lower than a certain level, cooling fan fault alarm can be output from the output terminal regardless of the setting in <F620>.

Selecting a setting value

0: Auto ON/OFF, No failure detection

Cooling fan is automatically controlled. Cooling fan operates only when the ambient temperature is high and during run.

Cooling fan operates automatically, if the ambient temperature is high, even when the inverter is in a stop.

1: Always ON, No failure detection

Cooling fan runs all the time when the inverter is on.

Trip does not occur at the time of the cooling fan failure. (Failure signal FL disabled)

2: Auto ON/OFF, Failure detection

Cooling fan is automatically controlled. Cooling fan runs only when the ambient temperature is high and during operation.

When the motor speed of the cooling fan is lower than a certain level, a trip occurs. (Failure signal FL enabled)

3: Always ON, Failure detection

Cooling fan runs all the time when the inverter is on.

When the motor speed of the cooling fan is lower than a certain level, a trip occurs. (Failure signal FL enabled)

■ Output during cooling fan run

If you assign the function to the unused output terminal, cooling fan fault alarm can be output while the cooling fan is running.

"50: During cooling fan run"

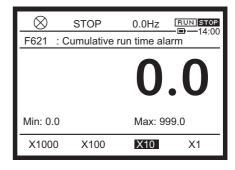
"190: Cooling fan fault alarm"

If you set <F620: Cooling fan control> to "2" or "3", a trip occurs at the time of the cooling fan fault. The trip display is "E-42".

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 30. 12 Cumulative run time alarm setting

<F621: Cumulative run time alarm>



Function

This parameter activates the alarm from the output terminal after the inverter's cumulative run time is <F621: Cumulative run time alarm> or more.

■ Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|---------------------------|------------------|-------|-----------------|
| F621 | Cumulative run time alarm | 0.0 - 999.0 | 100 h | 876.0 |

Signal output of cumulative run time alarm

Assign "56: Cumulative run time alarm" to the unused output terminal.

Memo

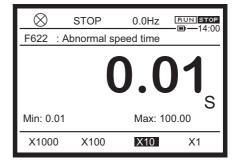
- Cumulative run time up to the present time can be confirmed in the [Monitor mode].
- Monitor value of the cumulative run time can be reset to 0 (zero) by selecting "5: Clear cumulative run time" in the default setting <tyP: Default setting>. For details, refer to [5. 1. 9].

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 30. 13 Speed error (over speed) detection

<F622: Abnormal speed detection time> <F623: Abnormal speed increase band> <F624: Abnormal speed decrease band>



Function

When operating without the PG feedback (<Pt: V/f Pattern> = "0" - "9"), if the rough speed exceeds the speed limit over the setting time, this parameter announces an error and outputs a failure. When operating with the PG feedback (<Pt: V/f Pattern> = "10" or "11"), the parameter monitors the speed feedback value and a trip occurs when speed exceeds the speed limit over the setting time. When output frequency > (<FH> +12 Hz) or > (<FH> + <vL>/10) at all <Pt>, a trip occurs. The trip display is "E-13".

Parameter setting

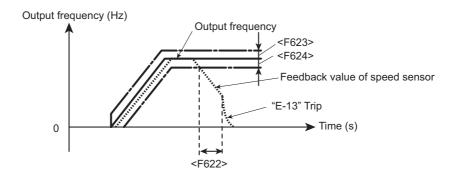
| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|-------------------------------|-------------------------------|------|-----------------|
| F622 | Abnormal speed detection time | 0.01 - 100.0 | S | 0.01 |
| F623 | Abnormal speed increase band | 0.00: Disabled 0.01 - 30.0 | Hz | 0.00 |
| F624 | Abnormal speed decrease band | 0.00: Disabled 0.01 - 30.0 | Hz | 0.00 |

Guideline for the setting

If speed feedback (Estimated speed) > (Output frequency + <F623>) or speed feedback (Estimated speed) < (Output frequency - <F624>), and a certain period of time set with <F622: Abnormal speed detection time>, a trip occurs.

You can provide range for a detection level of a trip with a setting of <F623: Abnormal speed increase band> and <F624: Abnormal speed decrease band>

During torque control, if speed feedback (Estimated speed) > (Speed upper limit + <F623>) or > (Speed lower limit - <F624>) a certain period of time set with <F622: Abnormal speed detection time>, "E-13" trip occurs.



Memo

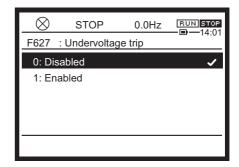
• When the setting value is 0 (zero), this function may not become activated properly while in the stall protection mode. To maintain this function, use of setting <F451: Acc/Dec operation after stall operation> = "1: Minimum time" is recommended. For details, refer to [6. 25. 2].

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 30. 14 Undervoltage trip setting

<F627: Undervoltage trip>

<F625: Undervoltage detection level> <F628: Undervoltage detection time>



■ Function

This parameter sets the action when undervoltage of the power circuit is detected.

When undervoltage is detected, it displays "MOFF" and stops. Alarm can be output from the output terminal.

If you want to trip, set by <F627: Undervoltage trip>. The trip display is "UP1".

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|---|---------------------------|------|-----------------|
| F627 | Undervoltage trip | 0: Disabled 1: Enabled | | 0 |
| F625 | Undervoltage detection level | 50 - 79 80: Auto | % | 80 *1 |
| F628 | Undervoltage detection time | 0.01 - 10.00 | S | 0.03 |
| F629 | Regenerative power ride- through level | 55 - 100 | % | 75 |

^{*1 100%} reference of <F625> is 200 V (240V class), 400 V (480V class).

■ Detection level of undervoltage alarm "MOFF"

Exclude <F625: Undervoltage detection level> = "80: Auto"

The occurrence level of MOFF alarm is the setting value of <F625>. MOFF alarm will be cleared at the setting value of <F629: Regenerative power ride-through level>.

When <F625: Undervoltage detection level> = "80: Auto"

Both occurrence level and clear level of MOFF alarm is followed by the level specified by the internal setting.

Setting the <F627: Undervoltage trip>

0: Disabled

The inverter stops but does not trip. (Failure signal FL disabled)

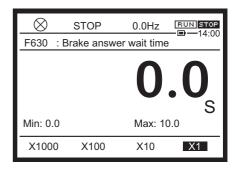
1: Enabled

The inverter trips after undervoltage is detected for the period of time set by <F628: Undervoltage detection time> or longer. The trip display is "UP1". (Failure FL enabled)

| Memo | While the inverter is stopped, undervoltage is not detected. | | |
|-------------|---|--|--|
| Reference | How to operate the operation panel -> Refer to [3. 1. 1]. How to switch display mode on the operation panel -> Refer to [3. 1. 2]. | | |
| I/GIGIGIIGG | Procedure to change parameter setting -> Refer to [4. 2. 3] | | |

6. 30. 15 Brake answer waiting time setting

<F630: Brake answer wait time>



■ Function

This parameter can set the waiting time for the brake answer (reply) from the system. Input brake answer to the input terminal with "130: Brake answerback" is assigned.

After the operation start, when there is no answer after elapse of the setting time, the inverter trips. The trip display is "E-11".

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|------------------------|-----------------------------|------|-----------------|
| F630 | Brake answer wait time | 0.0: Disabled 0.1 - 10.0 | S | 0.0 |

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

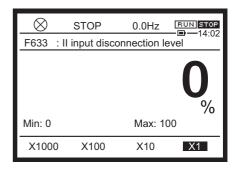
6. 30. 16 Analog input disconnection detection

<F633: Il analog input disconnection detection level>

<F644: Operation after II analog input disconnection

detection>

<F649: Fallback frequency>



■ Function

This parameter sets the action when the analog input level for [II] terminal is the setting value of <F633: II analog input disconnection detection level> or less for approximately 0.3 seconds. You can trip the inverter or maintain its operation. The trip display is "E-18". If you select other than a trip, alarm "A-18" blinks.

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|---|--|------|-----------------|
| F633 | II analog input disconnection detection level | 0: Disabled 1 - 100 | % | 0 |
| F644 | Operation after II analog input disconnection detection | Continue running Deceleration stop Coast stop Trip Run by F649 | - | 1 |
| F649 | Fallback frequency | LL-UL | Hz | 0.0 |

Setting the <F633: Il analog input disconnection detection level>

0: Disabled

No detection.

1 - 100

Action of the inverter is based on the setting of <F644: Operation after II analog input disconnection detection> when the analog input level for [II] terminal is the setting value of <F633> or less for approximately 0.3 seconds.

Setting the <F644: Operation after II analog input disconnection detection>

This parameter sets the action when the analog input level for [II] terminal is the setting value of <F633> or less for approximately 0.3 seconds.

0: Trip

Trip. The trip display is "E-18".

1: Coast stop

Coast stop.

Alarm "A-18" blinks.

2: Run by F649

The inverter runs with the frequency setting by <F649: Fallback frequency>. Alarm "A-18" blinks.

3: Continue running

Continue running.

Alarm "A-18" blinks.

4: Deceleration stop

Deceleration stop.

Alarm "A-18" blinks.

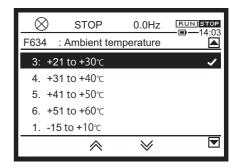
Memo

• Depending on the degree of deviation of the analog data detected, disconnection may be detected too early.

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3].
- Details on operation by external signals -> Refer to [Chapter 7].

6. 30. 17 Setting parts replacement alarm by the ambient temperature

<F634: Annual average ambient temperature>



Function

Based on the inverter ON time (cumulative power ON time), motor run time (cumulative run time), cooling fan run time (cumulative cooling fan run time), output current, and <F634: Annual average ambient temperature>, the time of replacement of the cooling fan, power circuit capacitor, and capacitor mounted on a printed circuit board is calculated. When the time of replacement approaches, the alarm can be output on the monitor display and output terminal.

Parameter setting

| Title | Parameter name | Adjustment range | Default setting |
|-------|------------------------------------|--|-----------------|
| F634 | Annual average ambient temperature | 1: -15 to +10°C 2: +11 to +20°C 3: +21 to +30°C 4: +31 to +40°C 5: +41 to +50°C 6: +51 to +60°C | 3 |

Selecting a setting value

Set the annual average temperature around the inverter. (This is not the annual highest temperature.)



• Set <F634: Annual average ambient temperature> when installing the inverter. After the installation, this setting should not be changed. Otherwise, calculation of parts replacement alarm may have an error.

Signal output of parts replacement alarm

Assign the parts replacement alarm to the unused output terminal. For details, refer to [7. 2. 2].

"128: Parts replacement alarm"

"160: Cooling fan replacement alarm"

Monitor display of parts replacement alarm

Parts replacement alarm information (refer to [8. 1. 1]) can be checked in the [Monitor mode].

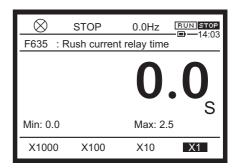
Memo

- Cumulative power ON time, cumulative fan run time, and cumulative run time can be checked in the [Monitor mode]. For details, refer to [8. 1. 1].
- Monitor value of cumulative fan run time and cumulative run time can be reset to 0 (zero) by the setting of <tyP: Default setting>. For details, refer to [5. 1. 9].

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 30. 18 Rush current suspension relay control

<F635: Rush current suppression relay delay time>



Function

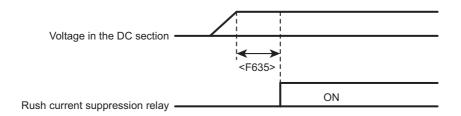
This function is used for DC input or when multiple inverters are connected with DC section and when the rush current suspension resistor relay needs to be controlled.

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|---|------------------|------|-----------------|
| F635 | Rush current suppression relay delay time | 0.0 - 2.5 | S | 0.0 |

Guideline for the setting

When the voltage of DC section in the inverter has reached the specified voltage, after a lapse of setting time by <F635: Rush current suppression relay delay time>, the rush current suspension relay is turned on.



- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 30. 19 Motor PTC thermal protection setting

<F645: Terminal RRPTC trip>

<F646: PTC detection resistance>

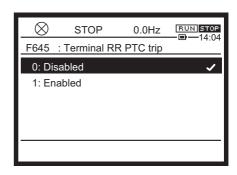
<F108: Terminal RR input select>

<F148: Terminal Al4 input select>

<F149: Terminal Al5 input select>

<F637: Terminal AI4 PTC trip>

<F638: Terminal Al5 PTC trip>



■ Function

This function is set to protect the motor from overheating by using PTC, which is integrated in the monitor.

You can trip the motor. The trip display is "E-32".

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|---------------------------|---|------|-----------------|
| F645 | Terminal RR PTC trip | 0: Disabled 1: Enabled | | 0 |
| F646 | PTC detection resistance | 100 - 9999 | Ω | 3000 |
| F656 | PTC detection temperature | 0 - 200 | °C | 90 |
| F108 | Terminal RR input | 1: Voltage input (0-10V) 2, 3: - 4: PTC input 5: PT100 (2-wire) input 6: - 7: PT100 (2-wire) input 8: - 9: KTY84 input | | 1 |
| F148 | Terminal Al4 input select | 1: Voltage input (0-10 V) | | 0 |
| F149 | Terminal Al5 input select | 2: Voltage input (-10 to +10 V) 3: Current input (0-20 mA) 4: PTC input 5: PT100 (2-wire) input 6: PT100 (3-wire) input 7: PT100 (2-wire) input 8: PT1000 (3-wire) input 9: KTY84 input | | |
| F637 | Terminal Al4 PTC trip | 0: Disabled | | 0 |
| F638 | Terminal AI5 PTC trip | 1: Enabled | | |

■ PTC thermal protection using terminal [RR]

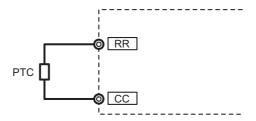
Connect PTC between terminals [RR]-[CC].

Set "4", "5", "7", and "9" with <F108: Terminal RR switching>.

In <F645: Terminal RR PTC trip>, when "0: Disabled" is selected, pre-alarm only, and when "1: Enabled" is selected, pre-alarm and trip are enabled.

The trip level is the value which is set by <F646> when <F108>= "4", and if <F108>= "5", "7", and "9", it is the setting value of <F656>.

Pre-alarm level is 60% of the trip level.



■ Signal output of PTC input pre-alarm

Assign "150: PTC input pre-alarm" to the unused output terminal.

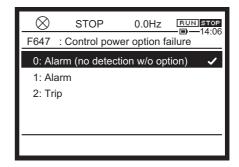
Memo

• With optional terminals [Al4] and [Al5], PTC thermal protection is possible in the same manner. For details, refer to the instruction manual for Expansion I/O option.

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 30. 20 Protecting the control power supply option unit at a time of failure

<F647: Control power option failure detection>



Function

When the control power supply option unit (CPS002Z) is used, if the unit does not output the voltage for 15 minutes or more due to some error, this function can activate alarm display or tripping.

Parameter setting

| Title | Parameter name | Adjustment range | Default setting |
|-------|--|---|-----------------|
| F647 | Control power option failure detection | O: Alarm (no detection without option) Alarm Trip | 0 |

How to select a setting value

0: Alarm (no detection without option)

This is selected when the control power supply backup is not necessary.

When no control power supply is input between terminals [+SU] externally, use this setting.

Also when the control power supply backup is selected, when failure occurs during run, the inverter output is shut off and the alarm "COFF" is displayed. When failure exists already at the time of voltage input, errors are not detected.

1: Alarm

This is selected for the control power supply backup (alarm output).

When voltage of the control power supply which is input to terminal [+SU] drops, the inverter output is shut off, and the alarm "COFF" is displayed.

Once "COFF" has occurred, the alarm is not reset even when the control power supply voltage is recovered to the normal level. The alarm can be reset by turning off the power circuit.

2: Trip

This is set for the control power supply backup (trip output).

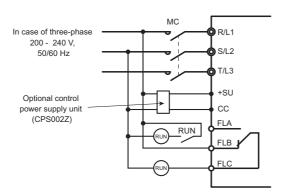
This option enables the inverter trip when voltage of the control power drops. The trip display is "E-29". Different from the normal trip, the trip is maintained regardless of the setting status of <F602: Trip record retention>.

This setting is valid when the standard connection in [2. 3. 2] is used.

To reset the trip, set <F647: Control power option failure detection> to "0" and "1" and perform the reset operation.

When an inverter failure occurs while the control power supply has an failure as follows, the main power supply may turn ON/OFF repeatedly. In such a case, select "1: Retain at power off" in <F602: Trip record retention>.

For details, refer to [6. 30. 3].



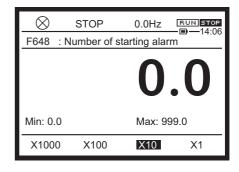
- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 30. 21 Setting number of starting alarm and alarm occurrence of the specified trip

<F648: Number of starting alarm>

<658: Number of external equipment starting alarm>

<664: Specified trip 1> <665: Specified trip 2> <F666: Specified trip 3>



Function

This parameter counts the number of starting of the inverter, and when it reaches the value set by <F648: Number of starting alarm>, it outputs the alarm and confirm it in [Monitor mode].

For number of external equipment starting alarm, you can outputs the alarm and confirm it in [Monitor mode]. For number of starting for external equipment, the number of input to the input terminal is counted.

Also, occurrence of the specified trip can be confirmed in [Monitor mode].

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|---|------------------|---------------|-----------------|
| F648 | Number of starting alarm | 0 - 999.0 | x10,000 times | 999.0 |
| F658 | Number of external equipment starting alarm | 0 - 999.0 | x10,000 times | 999.0 |
| F664 | Specified trip 1 | 0 - 1 00 | Times | 0 |
| F665 | Specified trip2 | 0 - 1 00 | Times | 0 |
| F666 | Specified trip3 | 0 - 1 00 | Times | 0 |

Signal output of the number of starting alarm of the inverter

This parameter counts the number of starting of the inverter, and when it reaches the value set by <F648: Number of starting alarm>, it outputs the alarm and confirm it in [Monitor mode]. Output alarm

Assign "162: Number of starting alarm" to the unused output terminal. For details, refer to [7. 2. 2]. [Monitor mode]

Set "100: Number of starting" to <F711: Monitor mode 1 display> through <F718: Monitor mode 8 display>. For details, refer to [8. 1. 1].

Signal output of the number of external equipment starting alarm

This parameter counts the number of starting of the external equipment, and when it reaches the values set by <F658: Number of external equipment starting alarm>, it outputs the alarm and can be confirmed in [Monitor mode].

For Number of starting for external equipment, a signal to the input terminal with the function of "114: External equipment counter" is assigned is counted.

Output alarm

Assign "184: Number of external equipment starting alarm" to the unused output terminal. For details, refer to [7. 2. 2].

[Monitor mode]

Set "103: External equipment counter" to <F711: Monitor mode 1 display> through <F718: Monitor mode 8 display>. For details, refer to [8. 1. 1].

Signal output of the number of occurrence of the specified trip

You can confirm occurrence of the specified trip in [Monitor mode]. You can set up to three specified trips.

Set the monitor numbers shown in the following table to <F711: Monitor mode 1 display> to <F718: Monitor mode 8 display>. For details, refer to [8. 1. 1].

"113: Number of specified trip 1"

"114: Number of specified trip 2"

"115: Number of specified trip 3"

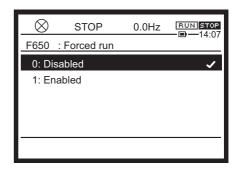
Memo

• The number of starting, the number of forward run, and the number of reverse starting up to the present time can be confirmed in [Monitor mode]. You can reset the monitor value to 0 with the setting of "12: Clear number of starting" in <tyP: Default setting>. For details, refer to [5. 1. 9].

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 31 Forced run control in emergency

<F650: Forced run>



Function

With the forced run control, the motor runs at the specified speed in an emergency.

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|------------------------------------|---------------------------|------|-----------------|
| F650 | Forced run | 0: Disabled 1: Enabled | | 0 |
| F294 | Preset speed 15 / Forced run speed | LL - UL | Hz | 0.0 |

Setting the parameters and input terminal

Set <F650: forced run> = "1: Enabled"

Set any of the function to the unused input terminal. For details, refer to [7. 2. 1].

You can perform the forced run or fire speed run with the setting of <F650> = "1" and an assigned input terminal is ON.

"56: Forced run"

- Once the input signal is ON, it is self-retained. The motor runs at the frequency set by <F294>.
- In case of a slight failure, the motor performs the forced run, in which the operation is continued.

"58: Fire speed run"

 Once the input signal is ON, it is self-retained. The motor performs the fire speed run at the frequency set by <F294>.

In both cases, to stop the running, the power circuit needs to be turned off.

During the forced run and the fire speed run, "FirE" is displayed.

Signal output of forced run

Assign any of these to the unused output terminal. For details, refer to [7. 2. 2].

"138: During forced run"

"140: During fire speed run"

Reference

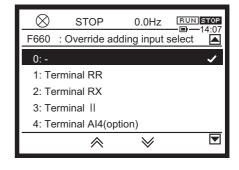
• How to operate the operation panel -> Refer to [3. 1. 1].

- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 32 Frequency adjustment using external input (override function)

<F660: Override adding input select>

<F661: Override multiplying input select><F729: Panel override multiplication gain>



■ Function

You can make adjustment for adding or multiple to frequency command value by external signal.

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|------------------------------------|--|-----------|-----------------|
| F660 | Override adding input select | 0: - 1: Terminal RR 2: Terminal RX 3: Terminal II 4: Terminal Al4 (option) 5: Terminal Al5 (option) 6 - 9: - 10: Touch wheel 1 (power off or pressave) 11 - 14: - 15: Terminal Up/Down frequency 16: Pulse train 17: High resolution pulse train (option 18/19: - 20: Embedded Ethernet 21: RS485 communication connector 22: RS485 communication connector 23: Communication option | n) · 1 | 0 |
| F661 | Override multiplying input select | 0: - 1: Terminal RR 2: Terminal RX 3: Terminal II 4: Terminal Al4 (option) 5 - 11: - 12: F729 13 - 23: - | | 0 |
| F729 | Panel override multiplication gain | -100 to +100 | % | 0 |

Guideline for the setting

The override functions calculate the frequency command value by means of the following expression:

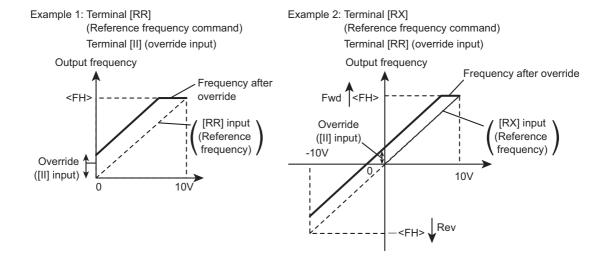
• Frequency command value × (1+<F661> Input (%)/100) + <F660> Input (Hz)

However, when the setting value of <F661: Override multiplying input select> is *1 in the table, use the following expression.

• Frequency command value × (<F661> Input (%)/100) + <F660> Input (Hz)

Additive override

An input override frequency is added to the frequency command value externally.



Example 1: <F660>= "3: Terminal II", <F661>= "0: Disabled"

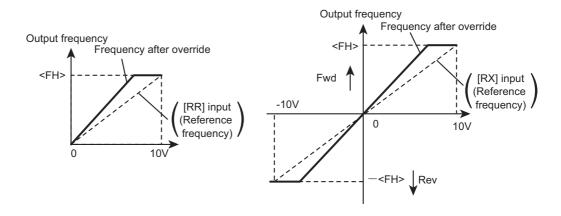
Output frequency = Reference frequency + Override (terminal [II] input (Hz))

Example 2: <F660>= "1: Terminal RR", <F661>= "0: Disabled"

Output frequency = Reference frequency + Override (terminal [RR] input (Hz))

Multiple override

An input override frequency is added to the frequency command value externally.



Example 1: <F660>= "0: Disabled", <F661>= "3: Terminal II"

<FMOd>= "1: Terminal RR", <FH>= "80.0", = "80.0" terminal [RR] input <F201>= "0", <F202>= "0.0", <F203>= "100", <F204>= "80.0" terminal [II] input <F216>= "0", <F220>= "0", <F218>= "100", <F221>= "100"

Output frequency = Reference frequency x {1 + Override (terminal [II] input (%)/100)}

Example 2: <F660>=0 (disabled), <F661>=1 (terminal [RR])

<FMOd>= "2: Terminal RX", <FH>= "80.0", = "80.0"
terminal [RX] input
<F210>= "0", <F211>= "0.0", <F212>= "100", <F213>= "80.0"
terminal [RR] input
<F201>= "0", <F205>= "0", <F203>= "100", <F206>= "100"
Output frequency = Reference frequency x {1 + Override (terminal [RR] input (%)/100)}

Example 3

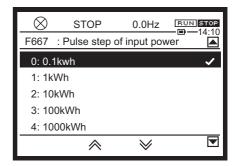
Output frequency = Reference frequency x $\{1 + \text{Override (} < \text{F729: Panel override multiplication gain} > \text{Setting value (} \%)/100)\}$

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 33 Adjustment parameters

6. 33. 1 Pulse output based on input cumulative power by a fixed integral value

<F667: Pulse output step of input cumulative power><F668: Pulse output width of input cumulative power>



Function

Every time the integral input power reaches the cumulative power unit set by <F667: Pulse output step of input cumulative power>, pulse signal can be output. You can display the power by pulse count without an external power meter.

Pulse output width is set by <F668: Pulse output width of input cumulative power>.

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|--|--|------|-----------------|
| F667 | Pulse output step of input cumulative power | 0: 0.1kWh 1: 1kWh 2: 10kWh 3: 100kWh 4: 1000kWh 5: 10000kWh | | 1 |
| F668 | Pulse output width of input cumulative power | 0.1 - 1.0 | s | 0.1 |

Setting the parameters

This is a setting for pulse output from terminal [FP].

Set <F130: Terminal FP function 1> = "180: For input cumulative power"

Set the integral power unit with <F667: Pulse output step of input cumulative power>, and set the pulse output width with <F668: Pulse output step of input cumulative power>.

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

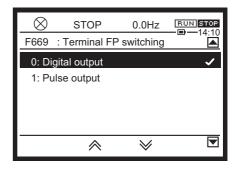
6. 33. 2 Pulse train output

<F669: Terminal FP switching>

<F676: Terminal FP pulse train output function>

<F677: Maximum pulse number of pulse train output>

<F678: Pulse train output filter>



Function

Pulse trains can be output from terminal [FP]. Set the pulse output function and the number of pulses.

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|--|---------------------------------|------|-----------------|
| F669 | Terminal FP switching | Digital output Pulse output | | 0 |
| F676 | Terminal FP pulse train output function | 0-162 *1 | | 0 |
| F677 | Maximum pulse number of pulse train output | 0.50 - 43.20 | kpps | 8.00 |
| F678 | Pulse train output filter | 1 - 1000 | ms | 64 |

^{*1} For details, refer to [11. 7].

Setting method

For example, to output frequency (0 - 60Hz) at 0 - 600 pulse, set as follows. <FH>= "60.0", <F669>= "1", <F676>= "0", <F677>= "0.60"

When the item selected by <F676> has reached the value of the reference of maximum value, the number of pulse set by <F677: maximum pulse number of pulse train output> is output.

ON pulse width is a fixed width. When outputting the maximum number of pulses set by <F677>, the width is fixed at a value, where the duty ratio is 50%.

Therefore, the duty ratio varies according to the output pulse.

For example,

- <F677>="0.80" (kpps), ON pulse width = approx. 0.6 (ms)
- <F677>="1.00" (kpps), ON pulse width = approx. 0.5 (ms)
- <F677>="1.60" (kpps), ON pulse width = approx. 0.3 (ms)

Pulses below 15pps cannot be output.

110

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 33. 3 Analog output adjustment

<F681: Terminal FM switching>

<F682: Terminal FM inclination polarity>

<F683: Terminal FM bias>

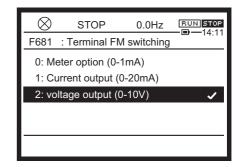
<F685: Terminal FM upper-limit level>

<F686: Terminal AM switching>

<F687: Terminal AM inclination polarity>

<F688: Terminal AM bias>

<F690: Terminal AM upper-limit level>



■ Function

With the setting of <F681>, you can switch the output signal from terminal [FM] to 0 - 1mAdc output, 0 - 20mAdc output, and 0 - 10 Vdc output. Default setting is 0 - 10Vdc output. Similarly, the output signal from the terminal [AM] can be also switched.

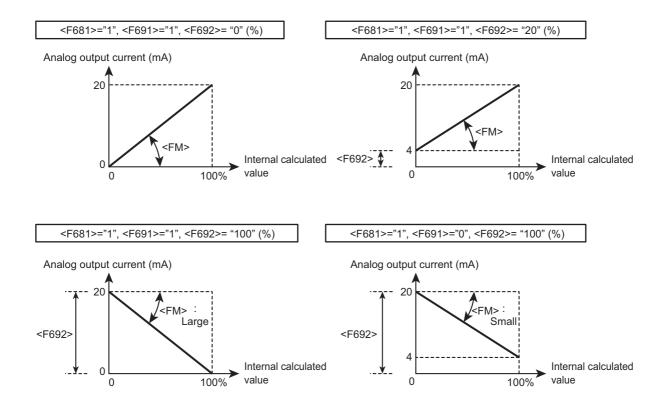
Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|----------------------------------|--|------|-----------------|
| F681 | Terminal FM switching | 0: Meter option (0-1mA)1: Current output (0-20mA)2: Voltage output (0-10V) | | 2 |
| F682 | Terminal FM inclination polarity | Negative inclination (downward slope) Positive inclination (upward slope) | | 1 |
| F683 | Terminal FM bias | -100.0 to +100.0 | % | 0.0 |
| F684 | Terminal FM filter | 1 - 1000 | ms | 1 |
| F685 | Terminal FM upper-limit level | 0.0 - 100.0 | % | 100.0 |
| F686 | Terminal AM switching | 0: Meter option (0-1mA) 1: Current output (0-20mA) 2: Voltage output (0-10V) | | 2 |
| F687 | Terminal AM inclination polarity | Negative inclination (downward slope) Positive inclination (upward slope) | | 1 |
| F688 | Terminal AM bias | -100.0 to 100.0 | % | 0.0 |
| F689 | Terminal AM filter | 1 - 1000 | ms | 1 |
| F690 | Terminal AM upper-limit level | 0.0 - 100.0 | % | 100.0 |

Setting methods

To obtain 4 - 20 mAdc output, adjust <F683: Terminal FM bias> and <F688: Terminal AM bias>. When using the optional frequency meter (QS60T), set <F681> to "0" or F686 to "0".

■ Setting example



Set the inclination of analog output with <FM: Terminal FM adjustment> and <F671: Terminal AM adjustment>. For details of how to adjust, refer to [5. 1. 6].

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 34 Setting functions of operation panel

Lock or unlock the key operation of the operation panel and parameter setting. Also, set the display functions of the operation panel.

6. 34. 1 Lockout key operation and parameter setting

<F700: Parameter reading&writing access lockout>

<F730: Panel frequency setting lockout>

<F731: Operation after disconnection detection during</p>

panel run>

<F732: Panel Hand/Auto function lockout>

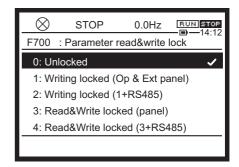
<F733: Panel Run lockout>

<F734: Panel emergency off lockout>

<F735: Panel reset lockout>

<F736: CMOd/FMOd change lockout during run>

<F737: Panel keys lockout>
<F738: Password setting>
<F739: Password verification>



Function

These parameters allow you to locked or unlocked operation on the operation panel and the change of parameters. Using these parameters, you can also lock various key operations to prevent malfunction.

Lock parameters with a password to prevent configuration.

Parameter setting

| Title | Parameter name | Adjustment range | Default setting |
|-------|--|--|-----------------|
| F700 | Parameter reading&writing access lockout *1 | Unlocked Writing locked (Operation panel, Extension panel) Writing locked (1+RS485) Reading&Writing locked (Operation panel, Extension panel) Reading&Writing locked (3+RS485) | 0 |
| F730 | Panel frequency setting lockout | 0: Unlocked 1: Locked 2: Unlocked after press OK | 2 |
| F731 | Operation after disconnection detection during panel run*2 | 1: Continue running 2, 3: - 4: Trip | 4 |
| F732 | Panel Hand/Auto function lockout | 0: Unlocked 1: Locked | 1 |
| F733 | Panel Run lockout | 0: Unlocked 1: Locked | 0 |
| F734 | Panel emergency off lockout | 0: Unlocked 1: Locked | 0 |

| Title | Parameter name | Adjustment range | Default setting |
|-------|-------------------------------------|---|-----------------|
| F735 | Panel reset lockout | 0: Unlocked 1: Locked | 0 |
| F736 | CMOd/FMOd change lockout during run | 0: Unlocked 1: Locked | 1 |
| F737 | Panel keys lockout *3 | 0: Unlocked 1: Locked 2: Locked only extension panel 3: Locked only operation panel | 0 |
| F738 | Password setting *4 | 0: Disabled 1 - 9998 9999: Password was set | 0 |
| F739 | Password verification | 0: non-setting 1 - 9998 9999: Password was set | 0 |

^{*1} The setting of <F700>="2" and "4" is valid after reset (turning off power) for RS485 communication.

- *2 Enabled when run command is input from the operation panel.
- *3 After setting <F737>. turn on the power again. The setting is valid after the power is turned on again.
- *4 The setting of <738>="9999" is valid after reset (turning off power) for communication.

Selecting a setting value

In [Standard mode], if you lock the frequency setting on the operation panel (<FC>, <FPId>, Preset speed), set <F730: Panel frequency setting lockout> to "1".

You cannot lock the setting with <F700>.

Setting/clearing method of password when it is required for protection

1) Password setting method

Parameters other than <F700>, <F738>, and <F739> cannot be changed when <F700> is set to "1" to "4".

When <F738> or <F739> is "0", a password has not been set. You can set a new password.

When <F738> or <F739> is "9999", a password has already been set.

If not set, select and register a number from "1" to "9998" for <F738> as a password. Do not forget your password as it is required to release the lock.



• The lock cannot be released if you forget the password. Do not forget this password as we cannot retrieve it.

Memo

• The password cannot be set when <F700> = "0". Select a number other then 0 and then set the password.

 The password can be read out to parameter writer (optional device) until the power is off after setting <F738>. Please note that password will not be able to read out due to password protection after the power is off.

2) Password clearing method

When <F738> or <F739> is read out and the value is "9999", a password has already been set. The password has to be cleared in order to change parameters.

To <F739>, input the number registered to <F738> when the password was set.

If the password matches, "PASS" is displayed and the password is cleared.

If the password is incorrect, "FAIL" is displayed and the screen returns to <F739>.

The setting of <F700> can be changed after the password is cleared.

By setting <F700> to "0", settings of all the parameters are enabled.



Important

 You cannot try inputting <F739> for more than three times. If a wrong password has been input three times, setting is no longer possible. However, the number of times is reset after power is off.

■ Cancellation method of <F700> and <F737> lockout setting

3) Cancellation of <F700> lockout setting

The setting of <F700> can be changed at any time, regardless of its setting value.

4) Cancellation of <F737> lockout setting

When the key operation lockout is set, press and hold down the [OK] key for 5 seconds or more.

The message "Undo" appears and this setting is canceled temporarily for the key operation.

To cancel this setting permanently, change the setting of <F737> directly.

Parameter setting unlocked with digital input

When "110: Parameter writing unlocked" is assigned to the unused input terminal, setting of parameters is possible regardless of the setting of <F700: Parameter reading&writing access lockout>.

Parameter setting lockout with digital input

If the following functions are assigned to the unused input terminal, parameter writing or reading is locked.

"200: Parameter writing locked"

"202: Parameter reading locked"

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6

6. 34. 2 Changing current/voltage display from percentage to unit (A/V)

<F701: Current, voltage units select>

For details, refer to [5. 1. 7].

6. 34. 3 Displaying motor or line speed

<F702: Free unit multiplication factor>

<F703: Target of free unit>

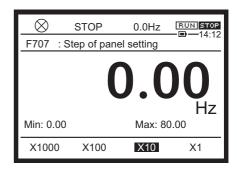
<F705: Free unit inclination polarity>

<F706: Free unit bias>

For details, refer to [5. 3. 3].

6. 34. 4 Changing variation steps of panel display

<F707: Step of panel setting>
<F708: Step of panel display>



■ Function

The changeable step width can be changed at panel frequency setting.

This function is useful when only running with frequencies of intervals of 1 Hz, 5 Hz, and 10 Hz units.

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|-----------------------|-----------------------------|------|-----------------|
| F707 | Step of panel setting | 0.00: Disabled 0.01 - FH | Hz | 0.00 |
| F708 | Step of panel display | 0: Disabled 1 - 255 | | 0 |

Caution when used

The settings of these parameters do not work when <F702: Free unit multiplication factor> is set. When you set other than "0" to <F707> and increase the frequency by turning the touch wheel to the right, frequency will not be increased beyond this point and the "HI" message is displayed if the frequency is over <UL: Upper limit frequency by turning the touch wheel to the left and if the

Similarly, when you decrease the frequency by turning the touch wheel to the left and if the frequency falls under <LL: Lower limit frequency> with just one more step rotation, the "LO" message is displayed in advance and the frequency cannot be lowered beyond this point.

Setting example

1) <F707> = not "0.00", <F708> = "0: Auto"

Under normal conditions, the frequency command value on the operation panel increases by 0.1 Hz when you turn the touch wheel to the right. If <F707> is not "0.00", the frequency command value will increase by the value with <F707> each time you turn the touch wheel to the right by 1 step. Similarly, the frequency command value on the operation panel will decrease by the value set with <F707> when you turn the touch wheel to the left by 1 step. When the second decimal place of <F707> is 0, the second decimal place of the frequency command value is not displayed.

2) When <F707> is not "0.00", and <F708> is not "0"

The value displayed on the panel can also be changed in steps.

Output frequency displayed on LCD screen = Internal output frequency x <F708>/<F707>

■ Operation example

<F707> = "0.00: Disabled"

By rotating the touch wheel by 1 step, the panel run frequency command value changes only by 0.1 Hz.

<F707> = "10.00"

Rotating the touch wheel by 1 step changes the panel run frequency command value in 10.00 Hz increments, from 0.00 up to 60.00 (Hz).

By rotating the touch wheel by 1 step, the frequency command value changes in steps of 1Hz: $0 \rightarrow 1$ $\rightarrow 2 \rightarrow ... \rightarrow 60$ (Hz) and also the value displayed on the LCD panel changes in steps of 1.

Use these settings to hide decimal fractions.

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 34. 5 Selecting data displayed in [Standard mode]

<F710: Standard mode display>

<F720: Standard mode display of extension panel>

<F723: Status area display of operation panel>

Different contents can be displayed on the operation panel of the inverter unit and the extension panel (optional).

You can set the content displayed on Status area on the operation panel.

For details, refer to [5. 3. 3].

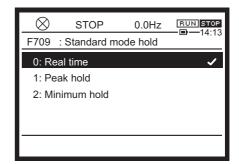
6. 34. 6 Changing display in [Monitor model]

<F711: Monitor mode 1 display> to <F718: Monitor mode 8 display>

Change the display items in [Monitor mode]. For details, refer to [8. 1. 1].

6. 34. 7 Holding display in [Standard mode]

<F709: Hold function of standard mode>



Function

The display in [Standard mode] can be held.

Parameter setting

| Title | Parameter name | Adjustment range | Default setting |
|-------|--------------------------------|---|-----------------|
| F709 | Hold function of standard mode | 0: Real time 1: Peak hold 2: Minimum hold | 0 |

Selecting a setting value

0: Real time

The contents selected with <F710: Standard mode display> are displayed.

1: Peak hold

2: Minimum hold

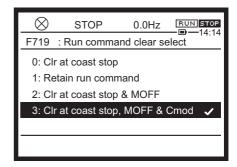
For peak hold values and minimum hold values, the maximum/minimum values in each operation cycle are displayed.

- When the motor is at a standstill, the values monitored last are held as they were until the motor is started the next time.
- The maximum and minimum values monitored after power is on are always displayed whether the motor is running or at a standstill.

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 34. 8 Clearing run command

<F719: Run command clear select>



■ Function

This parameter is used to select whether the run command is retained or cleared when the following events occur during panel run or RS485 communication run.

- Coast stop with standby function (ST) is off (OFF display)
- · Coast stop with coast command function (FRR) is on (OFF display)
- Coast stop with terminal [STO] is off ("PrA" display)
- · Power circuit undervoltage (MOFF) alarm

Parameter setting

| Title | Parameter name | Adjustment range | Default setting |
|-------|--------------------------|---|-----------------|
| F719 | Run command clear select | Clear at coast stop. Retain when MOFF occurs and CMOd is changed. Retain run command. Clear at coast stop and at MOFF. Retain when CMOd is changed. Clear at coast stop, at MOFF and when CMOd is changed. | 2 |

Difference between the settings

| <f719> setting value</f719> | Coast stop | When power circuit undervoltage (MOFF) alarm occurred | When <cmod> is changed</cmod> |
|-----------------------------|--------------------------------------|---|-------------------------------|
| 0 | Run command clear Retain run command | | command |
| 1 | Retain run command | | |
| 2 | Run command clear | | Retain run command |
| 3 | Run command clear | | |

^{*} If "PrA" alarm occurs when terminal [STO] is off, run command is cleared regardless of the <F719> setting.

Retain run command.

Inverter restarts when coast stop is cleared after its occurrence.

Inverter restarts when power is supplied again when the power circuit undervoltage (MOFF) alarm occurs.

Run command clear

Inverter does not restart after coast stop or occurrence of the power circuit undervoltage (MOFF) alarm.

Press the [RUN] key to operate it again in panel run. Turn on the run command in RS485 communication run.

Setting example of parameters of input terminals

Set necessary function to the unused input terminal. For details, refer to 7. 2. 1].

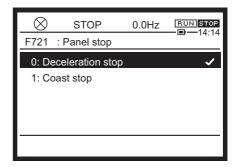
"6: Standby"

"96: Coast stop"

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details of operation by external signals -> Refer to Chapter 7

6. 34. 9 Selecting panel stop pattern

<F721: Panel stop>



■ Function

This parameter is used to select a panel stop pattern by pressing the [STOP] key on the operation panel from Deceleration stop or Coast stop.

Parameter setting

| Title | Parameter name | Adjustment range | Default setting |
|-------|----------------|----------------------------------|-----------------|
| F721 | Panel stop | Deceleration stop Coast stop | 0 |

Selecting a setting value

0: Deceleration stop

The motor decelerate to a stop in the deceleration time set with <dEC: Deceleration time 1>.

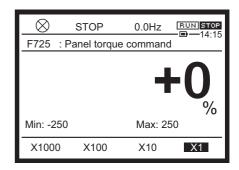
1: Coast stop

The inverter cuts off power supply to the motor. The motor comes to a stop after coasting for a while. Depending on the load, the motor may keep running for a longer time.

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 34. 10 Setting torque command value in panel run

<F725: Panel torque command>



■ Function

This parameter is used to set a torque command value when torque control is performed in panel run.

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|----------------------|------------------|------|-----------------|
| F725 | Panel torque command | -250 to +250 | % | 0 |

Guideline for the setting

<F725: Panel torque command> is enabled only when <F420: Torque command select> is "12" and acts as command value(%).

For details, refer to torque control.

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 34. 11 Selecting panel display at power on

<F790: Panel display at power on>

<F791: 1st and 2nd characters of F790>

<F792: 3rd and 4th characters of F790>

<F793: 5th and 6th characters of F790>

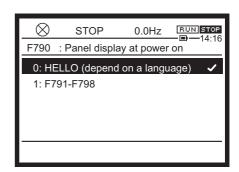
<F794: 7th and 8th characters of F790>

<F795: 9th and 10th characters of F790>

<F796: 11th and 12th characters of F790>

<F797: 13th and 14th characters of F790>

<F798: 15th and 16th characters of F790>



■ Function

These parameters allow you to change the characters on panel display at power on. By default setting, "HELLO" is displayed, but the word changes depending on the language selection. (The word equivalent of "Hello" for each language is displayed.)

Parameter setting

| Title | Parameter name | Adjustment range | Default setting |
|-------|----------------------------------|---|-----------------|
| F790 | Panel display at power on | 0: HELLO (depending on language selection) 1: F791 - F798 2, 3: - | 0 |
| F791 | 1st and 2nd characters of F790 | 0-FFFF | 2d2d |
| F792 | 3rd and 4th characters of F790 | 0-FFFF | 2d2d |
| F793 | 5th and 6th characters of F790 | 0-FFFF | 2d2d |
| F794 | 7th and 8th characters of F790 | 0-FFFF | 2d2d |
| F795 | 9th and 10th characters of F790 | 0-FFFF | 2d2d |
| F796 | 11th and 12th characters of F790 | 0-FFFF | 2d2d |
| F797 | 13th and 14th characters of F790 | 0-FFFF | 2d2d |
| F798 | 15th and 16th characters of F790 | 0-FFFF | 2d2d |

Guideline for the setting

To display characters other than "HELLO", set <F790> to "1" and set the characters Changing variation steps of panel display displayed with <F791> to <F798>.

Refer to "ASCII LED" of RS485 Communication Function Instruction Manual for setting of characters and set by hex number.

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 35 Trace function

<F740: Trace>

<F741: Trace cycle>

<F742: Trace data 1>

<F743: Trace data 2>

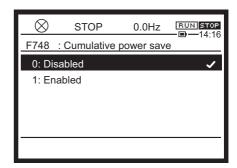
<F744: Trace data 3>

<F745: Trace data 4>

For details, refer to Trace Function Instruction Manual.

6. 36 Store cumulative power

<F748: Cumulative power save> <F749: Cumulative power unit>



■ Function

At the main power off, the integrating wattmeter can be stored, or the unit of the integral output power can be selected.

Parameter setting

| Title | Parameter name | Adjustment range | Default setting |
|-------|-----------------------|--|-----------------|
| F748 | Cumulative power save | 0: Disabled 1: Enabled | 0 |
| F749 | Cumulative power unit | 0: 1.0=1 kWh 1: 1.0=10 kWh 2: 1.0=100 kWh 3: 1.0=1000 kWh 4: 1.0=100000 kWh 5: 1.0=100000 kWh | *1 |

^{*1} Depending on capacity. For details, refer to [11. 6].

Memo

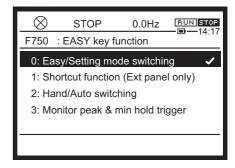
• The integrating wattmeter display can be cleared by the signal to the input terminal. Assign "74: Cumulative power monitor clear" to the unused input terminal. For details, refer to [7. 2. 1].

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 37 Select EASY key function

<F750: EASY key function>

LED extension panel option



■ Function

This parameter is valid when the [EASY] key exists (extension panel, etc.)

Since the operation panel of this inverter has no [EASY] key, values other than "0", "2" are invalid even if they are set with <F750>.

When the [EASY] key exists, the following four functions can be selected.

- · [Easy mode]/[Setting mode] switching
- · Shortcut key function
- · Hand/Auto switching
- · Monitor peak and minimum hold trigger

For options such as the extension panel, refer to [10. 3].

Parameter setting

| Title | Parameter name | Adjustment range | Default setting |
|-------|-------------------|--|-----------------|
| F750 | EASY key function | Easy/Setting mode switching Shortcut function (Extension panel only) Hand/Auto switching Monitor peak and minimum hold trigger | 0 |

Difference between the settings

0: Easy/Setting mode switching

When you press the [EASY] key while the inverter is stopped, the [Setting mode] and [Easy mode] can be switched.

In the default setting, the [Setting mode] is set at the time of power on.

The display of parameter setting varies depending on the mode. For details, refer to [4. 2. 1].

1: Shortcut function (Extension panel only)

Parameters whose settings are frequently changed can be registered as shortcuts so that they can be read out easily with one operation.

Shortcuts are valid only in [Standard mode]

After setting <F750: EASY key function> to "1", read the setting value of the parameter to be stored and press the [EASY] key for two seconds or more. Now shortcut registration is complete.

To read out the parameter, press the [EASY] key.

2: Hand/Auto switching

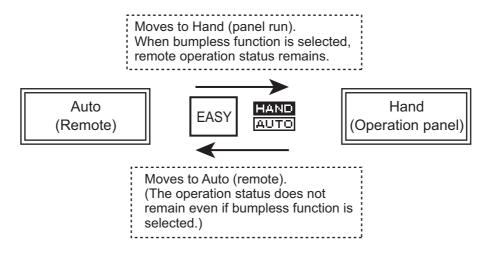
You can switch manual (operation panel) and automatic (remote) easily.

After setting <F750: EASY key function> to "2", switch the mode with the [EASY] key.

When <F295: Bumpless> is set to "1: Enabled", the mode can be switched even during run.

In manual, the [EASY] key lamp or HAND is lit.

In automatic, the inverter is operated with the operation method selected with <CMOd: Run command select>, <FMOd: Frequency command select 1>, etc.



Memo

 Note that when you set <F750> to "0" in manual, the panel operation status remains and the setting is different from the one with <CMOd: Run command select>.

3: Monitor peak and minimum hold trigger

Set the peak hold and minimum hold triggers of <F709: Hold function of standard mode> with the [EASY] key.

The measurement of the minimum and maximum values set for <F709> starts at the instant when you press the [EASY] key after setting <F750: EASY key function> to "3".

The peak hold and minimum hold values are displayed in absolute values.

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 38 Communication functions

Use the communication and monitor functions in communication run using RS485 communication and various optional open networks.

6. 38. 1 Setting communication functions

WARNING



Mandatory

Set the parameter Communication time-out.

If the parameter is not properly set, the inverter cannot be stopped immediately and this will result in injury and accidents.

• Install an emergency stop device and an interlock that are configured in accordance with the system specifications.

If the inverter cannot be stopped immediately via communication or the extension panel, this will result in injury and accidents.

For details, refer to RS485 Communication Function Instruction Manual.

<F800: RS485 (1) baud rate>

<F801: RS485 (1) parity>

<F802: Inverter number (RS485 common)>

<F803: RS485 (1) time-out time>

<F804: RS485 (1) time-out operation>

<F805: RS485 (1) transmission wait time>

<F806: RS485 (1) inverter to inverter communication>

<F807: RS485 (1) protocol>

<F808: RS485 (1) time-out detection>

<F809: Operation panel connection priority>

<F810: Communication frequency point select>

<F811: Communication point 1 input value>

<F812: Communication point 1 frequency>

<F813: Communication point 2 input value>

<F814: Communication point 2 frequency>

<F820: RS485 (2) baud rate>

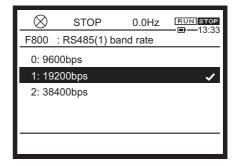
<F821: RS485 (2) parity>

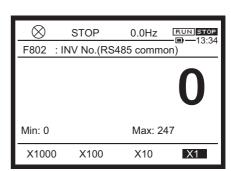
<F823: RS485 (2) time-out time>

<F824: RS485 (2) time-out operation>

<F825: RS485 (2) transmission wait time>

<F826: RS485 (2) inverter to inverter communication>





<F827: RS485 (2) protocol>

<F828: RS485 (2) time-out detection>

<F829: RS485 (2) wiring type>

<F830: MODBUS continuous address>

<F856: Motor pole number for communication>

<F870: Block write data 1>

<F871: Block write data 2>

<F875: Block read data 1>

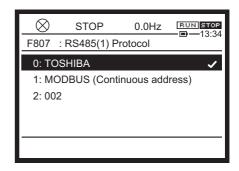
<F876: Block read data 2>

<F877: Block read data 3>

<F878: Block read data 4>

<F879: Block read data 5>

<F899: Communication option reset>



Function

RS485 communication is built-in as standard.

It can be connected to the host to create a network for transmitting data between multiple inverters. An inverter-to-inverter communication function is also available.

Communication function

1) Computer-linking functions

The following functions are enabled by data communication between the computer and inverter.

- Monitoring inverter status (such as the output frequency, current, and voltage)
- · Sending Run/Stop and other control commands to the inverter
- · Reading, editing and writing inverter parameter settings

2) Inverter-to-inverter communication function

This function allows you to set up a network that makes it possible to carry out proportional operation of multiple inverters. A host computer is not required.

One inverter serves as a leader and sends data selected with the parameter to other inverters that are followers in the same network. By using this function, you can configure a network for easy synchronized operation and proportional operation (setting of point frequency).

Time-out

This is a function to detect cable disconnection during communication.

When data is not sent even once to the inverter during a user-defined period of time, an inverter trip ("Err5" is displayed on the panel) or an alarm("t" is blinking) is output.

Broadcast communication

This is a function used to send a command (data write) to multiple inverters with single communication.

Communication protocol

Toshiba inverter protocol and a part of Modbus RTU protocol are supported.

■ Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|--|---|------------------------------|-----------------|
| F800 | RS485 (1) baud rate *1 | 0: 9600 bps 1: 19200 bps 2: 38400 bps 3: - | 1: 19200 bps 2: 38400 bps | |
| F801 | RS485 (1) parity *1 | 0: Disabled 1: Even parity 2: Odd parity | | 1 |
| F802 | Inverter number (RS485 common) | 0 - 247 | | 0 |
| F803 | RS485 (1) time-out time *2 | 0.0: Disabled 0.1 - 100.0 | s | 0.0 |
| F804 | RS485 (1) time-out operation *2 | 0: Continue running 2, 3: - 4: Trip 5: - 6: Trip after deceleration stop | | 0 |
| F805 | RS485 (1) transmission wait time | 0.00 - 2.00 | S | 0.00 |
| F806 | RS485 (1) inverter to inverter communication*1 | O: Follower (0Hz command when Leader fails) 1: Follower (continue running when Leader fails) 2: Follower (emergency off when Leader fails) 3: Leader (transmit frequency command) 4: Leader (transmit output frequency signal) 5: Leader (transmit torque command) 6: Leader (transmit output torque command) | | 0 |
| F807 | RS485 (1) protocol | 0: TOSHIBA 1: MODBUS 2: | | 0 |
| F808 | RS485 (1) time-out detection | Always Run command and frequency command by communication are enabled. During run by communication | | 1 |
| F809 | Operation panel connection priority *3 | 0: By the parameter setting 1: Connect to connector 1 2: Connect to connector 2 | | 1 |
| F810 | Communication frequency point select | 0: Disabled 1: RS485 (1) 2: RS485 (2) 3: Communication option 4: Embedded Ethernet | | 0 |
| F811 | Communication point 1 input value | 0-100 | % | 0 |
| F812 | Communication point 1 frequency | 0.0-FH | Hz | 0.0 |
| F813 | Communication point 2 input value | 0-100 | % | 100 |

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|--|--|------|-----------------|
| F814 | Communication point 2 frequency | 0.0-FH | Hz | 50.0/60.0 *4 |
| F820 | RS485 (2) baud rate *1 | 0: 9600 bps 1: 19200 bps 2: 38400 bps 3: - | | 1 |
| F821 | RS485 (2) parity *1 | Disabled Even parity Odd parity | | 1 |
| F823 | RS485 (2) time-out time *2 | 0.0: Disabled 0.1 - 100.0 | s | 0.0 |
| F824 | RS485 (2) time-out operation *2 | 0: Continue running 2, 3: - 4: Trip 5: - 6: Trip after Deceleration stop | | 0 |
| F825 | RS485 (2) transmission wait time | 0.00 - 2.00 | s | 0.00 |
| F826 | RS485 (2) inverter to inverter communication*1 | Follower (0Hz command when Leader fails) Follower (continue running when Leader fails) Follower (emergency off when Leader fails) Leader (transmit frequency command) Leader (transmit output frequency signal) Leader (transmit torque command) Leader (transmit output torque command) | | 0 |
| F827 | RS485 (2) protocol | 0: TOSHIBA 1: MODBUS 2: | | 0 |
| F828 | RS485 (2) time-out detection | O: Always 1: Run command and frequency command by communication are enabled. 2: During run by communication | | 1 |
| F829 | RS485 (2) wiring type | 0: 2-wire 1: 4-wire | | 0 |
| F830 | MODBUS continuous address | 0: Disabled 1: Enabled | | 0 |
| F856 | Motor pole number for communication | 1: 2 pole 2: 4 pole 3: 6 pole 4: 8 pole 5: 10 pole 6: 12 pole 7: 14 pole 8: 16 pole | | 2 |

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|----------------------------|--|------|-----------------|
| F870 | Block write data 1 | 0: Disabled | | 0 |
| F871 | Block write data 2 | Communication command 1 Communication command 2 Frequency command TB output Analog output Speed command by communication | | 0 |
| F875 | Block read data 1 | Disabled Status information | | 0 |
| F876 | Block read data 2 | 2: Output frequency | | 0 |
| F877 | Block read data 3 | 3: Output current 4: Output voltage | | 0 |
| F878 | Block read data 4 | 5: Alarm information 6: PID feedback value | | 0 |
| F879 | Block read data 5 | 7: Input terminal monitor 8: Output terminal monitor 9: Terminal RR monitor 10: Terminal RX monitor 11: Terminal II monitor 12: Input voltage (DC detection) 13: Speed feedback frequency 14: Torque 15: My function output monitor 1 16: My function output monitor 2 17: My function output monitor 3 18: My function output monitor 4 19: Free memorandum 20: Motor speed 21: Input power 22: Output power 23: Trip information | | 0 |
| F899 | Communication option reset | 0: - 1: Reset option and inverter | | 0 |

- *1 Valid after the setting is changed and the power is turned off and on again.
- *2 The setting contents are as follows.
 - Disabled: The inverter does not trip even if a communication error occurs.
 - Trip: The inverter trips when communication time-over occurs, and "Err5" is displayed.
 - Alarm: When communication time-over occurs, an alarm can be output from the output terminal. Assign the output terminal function "78" (RS485 communication time-out) (79 is inversion output) to the output terminal.
- *3 When using RS485 communication, set <F809>="0".
- *4 Depending on the setup menu. Refer to [11. 10].

Communication option

Options related to RS485 communication are as follows.

To use these options, set <F805: RS485 (1) transmission wait time > to "0.00".

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 38. 2 Using RS485 communication

Operation by RS485 communication

To run/stop the inverter by RS485 communication, select "3: RS485 communication (connector 1)" or "4: RS485 communication (connector 2)" with <CMOd: Run command select>.

To issue frequency commands by RS485 communication, select "21: RS485 communication (connector 1)" or "22: RS485 communication (connector 2)" with <FMOd: Frequency command select 1>.

Run commands and frequency commands by communication have priority over those from the operation panel and terminals. Therefore, run commands and frequency commands from communication can be enabled regardless of the settings of <CMOd> and <FMOd>.

However, when "48" (Communication priority cancel) of input terminal function selection is assigned to the input terminal and a signal is input externally, perform panel run with the setting of <CMOd> and <FMOd>.

When "2: Hand/Auto switching " is selected with <F750: EASY key function>, you can switch the operation panel run and communication run with the [HAND/AUTO] key of the operation panel.

Transmission specifications

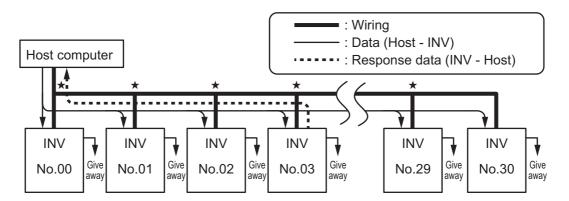
| Item | Specification | ns | |
|----------------------------------|--|-----------------------------------|--|
| Communication protocol | TOSHIBA inverter protocol | MODBUS-RTU protocol | |
| Interface | RS485 compliant | | |
| Transmission scheme | Half duplex [Serial bus type (Line terminations resystem)] | esistor necessary at both ends of | |
| Wiring | 2-wire | | |
| Transmission distance | 500 m max. (total length) | | |
| Connection terminals | 32 max. (including upper host computer) Inverters connected in the system: 32 max. | | |
| Synchronization scheme | Start-stop synchronization | | |
| Communication baud rate | 9600 bps - 38.4 kbps | | |
| Character transmission | ASCII mode: JIS X0201 8-bit (ASCII) Binary mode: Binary codes fixed to 8 bits | Binary codes fixed to 8 bits | |
| Error detecting scheme 1 | Parity: Even/Odd/Non parity (selectable using a | parameter) | |
| Error detecting scheme 2 | Checksum | CRC | |
| Stop bit length | Received by inverter: 1bit/Sent by inverter: 2 bits | 3 | |
| Order of bit transmission format | Low-order bits transmitted first | | |
| Character transmission format | 11-bit characters (Stop bit =1, with parity) | | |
| Inverter Number | ASCII mode: 0 - 99 Binary mode: 0 - 63 (3Fh) | 1 - 247 | |

| Item | Specifications | | | | |
|-------------------------|---|------------------------------------|--|--|--|
| Broadcast communication | Inverter Number should be set to ASCII mode: ** (*? or ?* (?=0-9) is available) Binary mode: 255 (0FFh) | Inverter Number should be set to 0 | | | |
| Frame length | Variable | | | | |
| Error correction | Disabled | | | | |
| Response monitoring | Disabled | | | | |
| Other | Inverter operation at communication time-over: Select from trip/alarm/none - When alarm is selected, an alarm is output from the output terminal When trip is selected, "Err5" blinks on the panel. | | | | |

Connection example when using computer link function

1) Independent communication

Here is a case where an operation frequency command is sent from the host computer to inverter No.3.



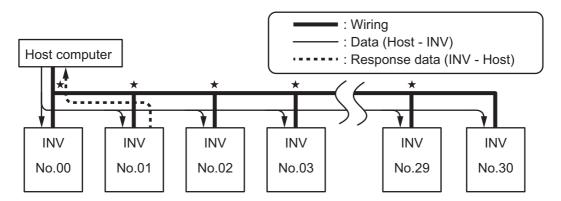
INV: Inverter

Give away: Only the inverter with the selected inverter number conducts data processing. All other inverters, even if they have received the data, give it away and stand by to receive the next data.

- ★ : Use the terminal block, etc. to branch the cable.
 - 1. Data is sent from the host computer.
 - 2. Data from the computer is received at each inverter, and the inverter numbers are checked.
 - 3. The command is decoded and processed only by the inverter with the selected inverter number.
 - 4. The selected inverter responds by sending the processing results, together with its own inverter number, to the host computer.
 - 5. As a result, only the selected inverter starts operating in accordance with the operation frequency command sent by the host computer.

2) Broadcast communication

Here is a case where a frequency command is sent via a broadcast from the host computer.



INV: Inverter

★ : Use the terminal block, etc. to branch the cable.

- 1. Data is sent from the host computer.
- 2. Data from the computer is received at each inverter and the inverter numbers are checked.
- 3. When "*" is added to the position of an inverter number, it is judged a broadcast. The command is decoded and processed.
- 4. To prevent data conflicts, only inverters where "*" is overwritten to "0" can reply with data to the host computer.
- 5. As a result, all inverters are operating with the broadcast operation frequency command.

Specify inverter numbers by group for group broadcasts.

This is a function only for ASCII mode. For parity mode, refer to RS485 Communications Function Instruction Manual.

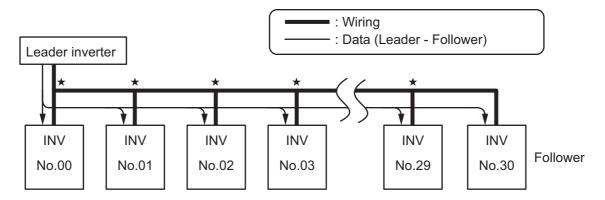
For example, when "*1" is set, inverters "01", "02", "03", "04", ..., "09" can be broadcast to. In this case, the inverter specified as "01" can reply.

Connection example of inverter-to-inverter communication

One inverter is a leader and the other inverters are followers.

Here is a case where all follower inverters connected operate at the same frequency as the leader inverter.

No frequency point is set.



INV: Inverter

★: Use the terminal block, etc. to branch the cable.

1. The leader inverter transmits frequency command data to its follower inverters.

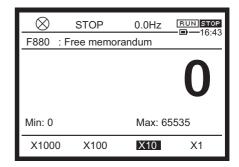
- 2. The follower inverters calculate a frequency reference from the data received and save the frequency calculated.
- 3. As a result, all follower inverters operate at the same frequency as the leader inverter.

The leader inverter always sends frequency command data to its follower inverters.

The follower inverters are always on standby so that they can receive an frequency command from the leader inverter at any time.

6. 38. 3 Input numbers as memorandum

<F880: Free memorandum>



■ Function

You can enter the identification number, etc. for easier management and maintenance of the inverter.

Parameter setting

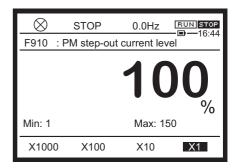
| Title | Parameter name | Adjustment range | Default setting |
|-------|-----------------|------------------|-----------------|
| F880 | Free memorandum | 0 - 65535 | 0 |

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3].

6. 39 Step-out detection of PM motor

<F910: PM step-out detection current level>

<F911: PM step-out detection time>



Function

If the PM motor steps out and if the exciting current increases (it increases in such a case) and remains over the value set by <F910: PM step-out detection current level > for the period of time set by <F911: PM step-out detection time>, the inverter will judge the motor to be stepping out and trip if

At that time, the trip message "SOUT" is displayed.

Parameter setting

| Title | Parameter name | Adjustment range | Unit | Default setting |
|-------|-------------------------------------|-------------------------------|------|-----------------|
| F910 | PM step-out detection current level | 1 - 150 | % | 100 |
| F911 | PM step-out detection time | 0.00: Disabled 0.01 - 2.55 | S | 0.00 |



Important

- When using an PM motor, consult your Toshiba distributor, since the inverter is not compatible with all types of PM motors.
- The inverter may fail to detect step-out in some cases, because it uses an electrical method to detect step-out. To avoid detection failures, you are recommended to install a mechanical stepout detector.

Memo

• For setting of PM motor parameter, refer to [6. 23. 2].

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 40 Traverse function

<F980: Traverse operation>
<F981: Traverse Acc time>
<F982: Traverse Dec time>
<F983: Traverse step>
<F984: Traverse jump step>

For details, refer to Traverse Function Instruction Manual.

6. 41 My function

My function <A800> - <A847>, <A900> - <A982>

For details, refer to My Function Instruction Manual.

7

Operating using external signals

You can operate the inverter by inputting external signals to the control terminals.

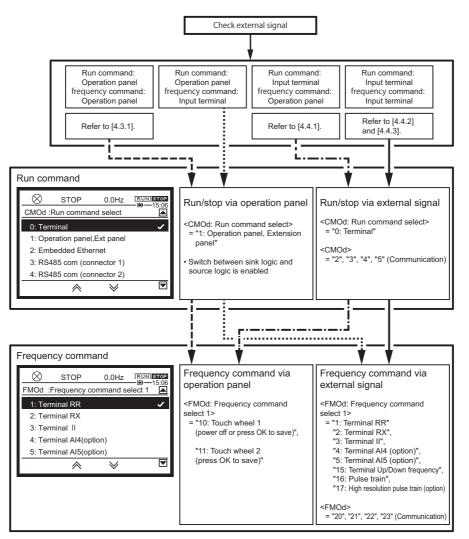
The run commands are input to the digital input terminals by the ON/OFF signals.

The frequency commands are input to the analog input terminals by the voltage signals (potentiometer, etc.), or the current signals. This chapter explains how to set the parameters required to operate the inverter using external signals and how to assign the functions to the terminals.

7. 1 How to externally operate the inverter

You can operate the inverter by external signals.

The parameter setting items vary depending on the operation method. Before setting the parameters, be sure to check the operation method (how to input run commands and frequency commands).



For operation by communication, refer to "Communication Function Instruction Manual" [6. 38].

Ι

П

1

2

3

4

5

6

10

.1

12

13

14

15

16

7. 2 Applied operation by I/O signals

You can assign the functions to the digital input terminals. The assigned functions can be switched for operation.

Also, you can assign the functions to the digital output terminals and the relay logic output terminals to output signals to external equipment.

For the digital terminals, sink logic and source logic can be switched with the slide switch [SW1]. For details, refer to [2. 3. 5].

7. 2. 1 Setting the functions to the input terminals (for sink logic)

Signals are input to the digital input terminals from an external programmable controller. The signals are used for operating the inverter and switching the functions.

The digital input terminal functions can be selected from a variety of functions, thus allowing flexible compatibility with system design.

■ Configuration of the control terminal block



Function setting for the digital input terminals

| Terminal symbol | Title | Parameter name | Adjustment range | Default setting |
|-----------------|-------|-----------------------|------------------|--------------------|
| F | F111 | Terminal F function 1 | 0 - 203 *1 | 2 |
| | F151 | Terminal F function 2 | | 0 |
| | F155 | Terminal F function 3 | | 0 |
| R | F112 | Terminal R function 1 | 0 - 203 *1 | 4 |
| | F152 | Terminal R function 2 | | 0 |
| | F156 | Terminal R function 3 | | 0 |

| Terminal symbol | Title | Parameter name | Adjustment range | Default setting |
|-----------------|-------|-------------------------------------|--|--------------------|
| RES | F113 | Terminal RES function 1 | 0 - 203 *1 | 8 |
| | F153 | Terminal RES function 2 | | 0 |
| | F157 | Terminal RES function 3 | | 0 |
| S1 | F114 | Terminal S1 function 1 | 0 - 203 *1 | 10 |
| | F154 | Terminal S1 function 2 | | 0 |
| | F158 | Terminal S1 function 3 | | 0 |
| S2 | F115 | Terminal S2 function | 0 - 203 | 12 |
| S3 | F116 | Terminal S3 function | 0 - 203 | 14 |
| S4 | F117 | Terminal S4 function *2 | 0 - 203 | 16 |
| | F146 | Terminal S4 input select | Digital input Pulse train input PG input | 0 |
| S5 | F118 | Terminal S5 function *3 | 0 - 203 | 118 |
| | F147 | Terminal S5 input select | Digital input Pulse train input PG input | 0 |
| DI11 | F119 | Terminal DI11 function *4 | 0 - 203 | 0 |
| DI12 | F120 | Terminal DI12 function *4 | 0 - 203 | 0 |
| DI13 | F121 | Terminal DI13 function *4 | 0 - 203 | 0 |
| DI14 | F122 | Terminal DI14 function *4 | 0 - 203 | 0 |
| DI15 | F123 | Terminal DI15 function *4 | 0 - 203 | 0 |
| DI16 | F124 | Terminal DI16 function *4 | 0 - 203 | 0 |
| F | F140 | Terminal F response time | 1 - 1000 (ms) | 1 *5 |
| R | F141 | Terminal R response time | 1 - 1000 (ms) | 1 *5 |
| RES | F142 | Terminal RES response time | 1 - 1000 (ms) | 1 *5 |
| S1 | F143 | Terminal S1 response time | 1 - 1000 (ms) | 1 *5 |
| S2 - S5 | F144 | Terminal S2-S5 response time | 1 - 1000 (ms) | 1 * ⁵ |
| DI11-DI16 | F145 | Terminal DI11-DI16 response time *4 | 1 - 1000 (ms) | 1 *5 |

^{*1} If a variety of functions are assigned to a terminal, the assigned functions will be simultaneously enabled.

^{*2} When you use the terminal [S4] as digital input, set <F146: Terminal S4 input select> = "0: Digital input".

^{*3} When you use the terminal [S5] as digital input, set <F147: Terminal S5 input select> = "0: Digital input".

^{*4} Indicates optional. For details, refer to [10. 4. 1].

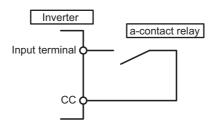
^{*5} If stable operation cannot be achieved because of noise of the frequency setting circuit, etc., increase the values for <F140: Terminal F response time> to <F145: Terminal DI11-DI16 response time>.

Memo

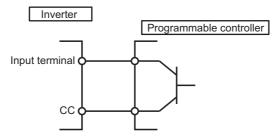
• To always enable the functions, assign the functions to <F110: Always active function 1>, <F127: Always active function 2>, and <F128: Always active function 3>.

Connecting methods

1) A contact input (for sink logic)



2) Transistor output connection (for sink logic)



You can connect the input terminal and the terminal [CC] (common) to the programmable controller output (non-logic switch) for control purposes. Use this connecting method for forward/reverse run, or preset speed operation, etc.

■ Usage example: 3-wire operation (one-push operation)

The use of the 3-wire operation function allows the one-push signal (reset logic signal) to be self-held during operation. No external sequence circuit is needed.

To perform 3-wire operation, make setting as shown below:

<F110: Always active function 1> = "6: Standby"

<CMOd: Run command select> = "0: Terminal"

<F111: Terminal F function 1> = "2: Fwd run" (default setting)

<F112: Terminal R function 1> = "4: Rev run"(default setting)

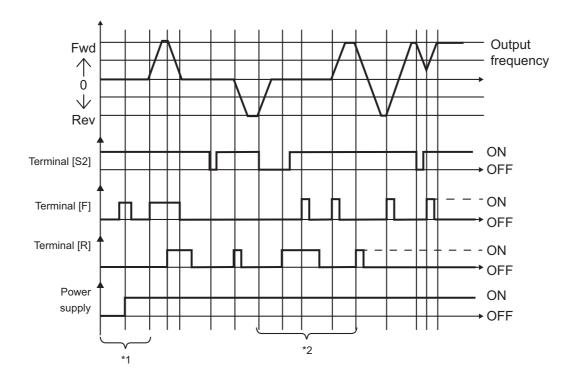
Also, assign "50: 3-wire operation hold/stop" ("51" for inversion input) to the input terminal.

The following shows an example for assignment to the terminal [S2].

<F115: Terminal S2 function > = "50"

For sink logic





- *1 -> If each terminal is turned ON before the power is turned ON, it is very dangerous because sudden movement occurs. Therefore, the input terminal ON signal is ignored at power on. After power on, turn ON the input terminal again.
- *2 -> Turn ON 3-wire operation hold/stop(HD), and then Fwd run (F) or Rev run (R).

 Even if Fwd run or Rev run is turned ON while 3-wire operation hold/stop is OFF, the signal will be ignored. Even if 3-wire operation hold/stop is turned ON while Rev run is ON, operation will not occur. Even If Fwd run is turned ON in that state, operation will not occur. Turn OFF Fwd run and Rev run, and then turn ON Fwd run or Rev run.

The input terminal function of 3-wire operation hold/stop is held only for Fwd run (F) and Rev run (R). Keep in mind that the other functions are not held when Fwd run or Rev run is used in combination of any other function. For example, when Fwd run and Preset speed switching 1 (SS1) are assigned, Fwd run is held, but not Preset speed switching 1.

Memo

- If the jog run command is input during 3-wire operation, operation will stop.
- Keep in mind that DC braking continues even if a run command is input during DC braking.

List of the digital input terminal functions

| Setting value | | | Setting value | | |
|-------------------|--------------------------------|---|-------------------|--------------------------------|--|
| Positive logic | Negative logic (Inverse) | Input terminal function | Positive logic | Negative logic (Inverse) | Input terminal function |
| 0 | 1 | No function | 84 | 85 | Terminal R2 output hold |
| 2 | 3 | Fwd run | 88 | 89 | Terminal Up frequency *1 |
| 4 | 5 | Rev run | 90 | 91 | Terminal Down frequency *1 |
| 6 | 7 | Standby | 92 | 93 | Terminal Up, Down frequency clear *1 |
| 8 | 9 | Reset 1 | 94 | 95 | Dancer correction OFF |
| 10 | 11 | Preset speed switching 1 | 96 | 97 | Coast stop |
| 12 | 13 | Preset speed switching 2 | 98 | 99 | Fwd/Rev |
| 14 | 15 | Preset speed switching 3 | 100 | 101 | Run/Stop |
| 16 | 17 | Preset speed switching 4 | 102 | 103 | Commercial power run switching |
| 18 | 19 | Jog run | 104 | 105 | FMOd/F207 priority switching |
| 20 | 21 | Emergency off | 106 | 107 | Terminal II priority |
| 22 | 23 | DC braking | 108 | 109 | Terminal operation priority |
| 24 | 25 | Acc/Dec switching 1 | 110 | 111 | Parameter writing unlocked |
| 26 | 27 | Acc/Dec switching 2 | 112 | 113 | Speed control/Torque control switching |
| 28 | 29 | V/f switching 1 | 114 | 115 | External equipment counter |
| 30 | 31 | V/f switching 2 | 116 | 117 | PID 1, 2 switching |
| 32 | 33 | Stall prevention switching/Torque limit switching 1 | 118 | 119 | Preset speed switching 5 |
| 34 | 35 | Torque limit switching 2 | 120 | 121 | Quick deceleration 1 |
| 36 | 37 | PID control OFF | 122 | 123 | Quick deceleration 2 |
| 38 | 39 | Pattern operation 1 | 124 | 125 | Preliminary excitation |
| 40 | 41 | Pattern operation 2 | 126 | 127 | Brake |
| 42 | 43 | Pattern operation continuation | 130 | 131 | Brake answerback |
| 44 | 45 | Pattern operation start | 134 | 135 | Traverse operation |
| 46 | 47 | External thermal trip | 136 | 137 | Rescue operation |
| 48 | 49 | Communication priority cancel | 138 | 139 | Pump control switching |
| 50 | 51 | 3-wire operation hold/stop | 140 | 141 | Fwd slowdown |
| 52 | 53 | PID differential/integral reset | 142 | 143 | Fwd stop |
| 54 | 55 | PID plus/minus switching | 144 | 145 | Rev slowdown |
| 56 | 57 | Forced run | 146 | 147 | Rev stop |

| Setting value | | | Setting value | | |
|-------------------|--------------------------------|---|-------------------|--------------------------------|---|
| Positive logic | Negative logic (Inverse) | Input terminal function | Positive logic | Negative logic (Inverse) | Input terminal function |
| 58 | 59 | Fire speed run | 148 | 149 | Fwd/Rev slowdown |
| 60 | 61 | Dwell operation | 150 | 151 | Hit and stop clear |
| 62 | 63 | Synchronized Acc/Dec | 152 | 153 | No.2 motor switching |
| 64 | 65 | My function start | 154 | 155 | External PID3 enabled |
| 66 | 67 | Offline auto-tuning | 156 | 157 | External PID4 enabled |
| 68 | 69 | Speed control gain switching | 158 | 159 | Reset 2 |
| 70 | 71 | Servo lock | 162 | 163 | External PID3 differential/integral reset |
| 72 | 73 | Simple positioning | 164 | 165 | External PID3 plus/minus switching |
| 74 | 75 | Cumulative power monitor clear | 170 | 171 | External PID4 differential/integral reset |
| 76 | 77 | Trace trigger | 172 | 173 | External PID4 plus/minus switching |
| 78 | 79 | Light-load high-speed operation inhibited | 176 | 177 | Pump control release |
| 80 | 81 | Terminal FP output hold | 200 | 201 | Parameter writing locked |
| 82 | 83 | Terminal R1 output hold | 202 | 203 | Parameter reading locked |

^{*1} Enabled only for <FMOd: Frequency command select 1> = "15: Terminal Up/Down frequency".

The frequency command range is 0.0 to <FH: Maximum frequency>. The acceleration/deceleration time is the time set for <ACC: Acceleration time 1> and <dEC: Deceleration time 1> unless acceleration/deceleration switching is performed.

For details on the input terminal functions, refer to [11. 5].

7. 2. 2 Setting the functions to the output terminals (for sink logic)

Signals are output to external equipment from the inverter.

You can select the functions for the digital output terminals and the relay logic output terminals from a variety of output terminal functions.

Two types of functions can be set for the terminals [FP] and [R1A]-[R1C]. In this case, output is possible when the two functions are simultaneously turned ON or either of the functions is turned ON.

Configuration of the control terminal block



Use conditions

FLA Functions of the terminals FLB [FLA]-[FLB]-[FLC]: FLC Set in parameter <F132> *1 R1A R1C Functions of the terminals [R1A]-[R1C], [R2A]-[R2C]: Set in parameter <F130>, <F137> *1 R2A R2C FP Functions of the terminal [FP]: Set in parameter <F131>, <F138> *1 cc

*1 With relay contact output, chattering (momentary ON/OFF of contact) is generated by external factors of the vibration and the impact, etc. In particular, please set a filter of 10 ms or more, or timer for measures when connecting it directly to the input unit of the programmable controller. When connecting the programmable controller, use the terminal [FP] if possible.

■ Function setting for the output terminals

| Terminal symbol | Title | Parameter name | Adjustment range | Default setting |
|-----------------|-------|------------------------------|--|--------------------|
| FP | F130 | Terminal FP function 1 *1 | 0 - 255 | 6 |
| | F137 | Terminal FP function 2 *1 | | 255 |
| | F669 | Terminal FP switching | Digital output Pulse train output | 0 |
| FLA-FLB-FLC | F132 | Terminal FL function | 0 - 255 | 10 |
| R1A-R1C | F133 | Terminal R1 function 1 | 0 - 255 | 4 |
| | F138 | Terminal R1 function 2 | | 255 |
| R2A-R2C | F134 | Terminal R2 function | 0 - 255 | 254 |
| DQ11 | F159 | Terminal DQ11 function *2 | 0 - 255 | 254 |
| DQ12 | F160 | Terminal DQ12 function *2 | 0 - 255 | 254 |
| R4 | F161 | Terminal R4 function *2 | 0 - 255 | 254 |
| R5 | F162 | Terminal R5 function *2 | 0 - 255 | 254 |
| R6 | F163 | Terminal R6 function *2 | 0 - 255 | 254 |
| R1 | F135 | Terminal R1 delay time | 0.0 - 60.0 (s) | 0.0 |
| R2 | F136 | Terminal R2 delay time | 0.0 - 60.0 (s) | 0.0 |
| FP R1A-R1C | F139 | Terminal FP, R1 logic select | 0: F130 and F137, F133 and F138 1: F130 and F137, F133 or F138 2: F130 or F137, F133 and F138 3: F130 or F137, F133 or F138 | 0 |

^{*1} When you use the terminal [FP] as digital input, set <F669: Terminal FP switching> = "0: Digital output".

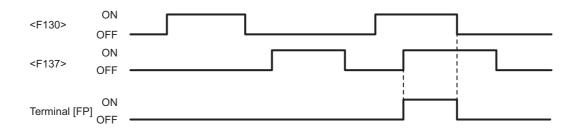
Assigning two types of functions to a terminal

For the output terminals, you can assign two types of functions to the terminals [FP] and [R1A]-[R1C].

1) Logical product (AND): Signals are output when two types of functions are simultaneously turned ON.

In case of the terminal [FP], when you set <F139: Terminal FP, R1 logic select> = "0" or "1", signals are output when the functions set for <F130: Terminal FP function 1> and <F137: Terminal FP function 2> are simultaneously turned ON.

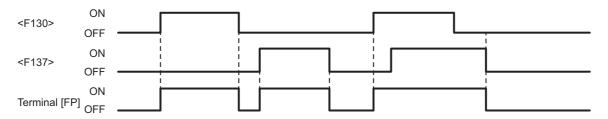
^{*2} Indicates optional. For details, refer to [10. 4. 1].



In case of the terminals [R1A]-[R1C], when you set <F139> = "0" or "2", signals are output when the functions set for <F133: Terminal R1 function 1> and <F138: Terminal R1 function 2> are simultaneously turned ON.

2) Logical sum (OR): Signals are output when either of two functions is turned ON.

In case of the terminal [FP], when you set <F139: Terminal FP, R1 logic select> = "2" or "3", signals are output when either of the functions set for <F130: Terminal FP function 1> and <F137: Terminal FP function 2> is turned ON.



In case of the terminals [R1A]-[R1C], when you set <F139> = "1" or "3", signals are output when either of the functions set for <F133: Terminal R1 function 1> and <F138: Terminal R1 function 2> is turned ON.

Holding the signal output ON state (output hold function)

You can set the terminals [FP], [R1A]-[R1C], and [R2A]-[R2C] so that the ON state is held even after the condition is changed when a signal is once turned ON.

When a corresponding output terminal is turned ON while the input terminal where the output hold function is assigned is ON, the ON state is held.

Assign the following function numbers to any open input terminals.

For holding the output of the terminal [FP]: "80: Terminal FP output hold"

For holding the output of the terminal [R1A]: "82: Terminal R1 output hold"

For holding the output of the terminal [R2A]: "84: Terminal R2 output hold"

Usage example 1: Outputting running signals

The following shows examples for outputting running signals.

Running signals can be output from the terminals [R1A]-[R1C] as default setting.

- <F133: Terminal R1 function 1> = "4: Low-speed signal" (default setting)
- <F100: Low-speed signal output frequency> = "0.0" (Hz) (default setting)

For the output terminal function of "4: Low-speed signal", signals are output when the output frequency becomes the frequency set for <F100: Low-speed signal output frequency> or more. In case of <F100> = "0.0" (Hz), the signal is turned ON when the frequency is output. Therefore, you can use it as a running signal.

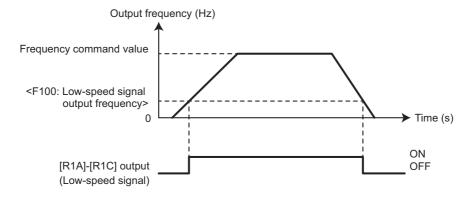
■ Usage example 2: Outputting braking signals

The following shows an example for outputting the excitation/release signals for the electromagnetic brake.

To output the braking signals from the terminals [R1A]-[R1C], make setting as follows:

- <F133: Terminal R1 function 1> = "4: Low-speed signal" (default setting)
- <F100: Low-speed signal output frequency> = "2.5" (Hz) (setting example)

Set <F100> to the value for the motor rated slip.



■ List of the digital output terminal functions

| Setting | g value | | Setting | g value | | |
|-------------------|--------------------------------|--|-------------------|--------------------------------|---|--|
| Positive logic | Negative logic (Inverse) | Output terminal function | Positive logic | Negative logic (Inverse) | Output terminal function | |
| 0 | 1 | Lower limit frequency (LL) | 116 | 117 | Failure signal 4 | |
| 2 | 3 | Upper limit frequency (UL) | 118 | 119 | Stop positioning completion | |
| 4 | 5 | Low-speed signal | 120 | 121 | During sleep | |
| 6 | 7 | Acc/Dec completed | 122 | 123 | During synchronized Acc/Dec | |
| 8 | 9 | Specified frequency attainment | 124 | 125 | During traverse operation | |
| 10 | 11 | Failure signal 1 | 126 | 127 | During traverse Dec | |
| 12 | 13 | Failure signal 2 | 128 | 129 | Parts replacement alarm | |
| 14 | 15 | Overcurrent (OC) pre-alarm | 130 | 131 | Overtorque (OT) pre-alarm | |
| 16 | 17 | Inverter overload (OL1) pre-alarm | 132 | 133 | Frequency command 1/ Frequency command 2 | |
| 18 | 19 | Motor overload (OL2) pre-alarm | 134 | 135 | Failure signal 3 | |
| 20 | 21 | Overheat (OH) pre-alarm | 136 | 137 | Hand/Auto | |
| 22 | 23 | Overvoltage (OP) pre-alarm | 138 | 139 | During forced run | |
| 24 | 25 | Main circuit undervoltage (MOFF) alarm | 140 | 141 | During fire speed run | |
| 26 | 27 | Undercurrent (UC) alarm | 142 | 143 | Undertorque alarm | |
| 28 | 29 | Overtorque (OT) alarm | 144 | 145 | PID1, 2 frequency command agreement | |

| Setting | Setting value Setting value | | g value | | |
|-------------------|--------------------------------|---|-------------------|--------------------------------|---|
| Positive logic | Negative logic (Inverse) | Output terminal function | Positive logic | Negative logic (Inverse) | Output terminal function |
| 30 | 31 | Braking resistor overload (OLr) pre-alarm | 150 | 151 | PTC input pre-alarm |
| 32 | 33 | Emergency off trip | 152 | 153 | During Safe Torque Off (STO) |
| 34 | 35 | During retry | 154 | 155 | Analog input disconnecting alarm |
| 36 | 37 | Pattern operation end | 156 | 157 | Terminal F ON/OFF |
| 38 | 39 | PID deviation limit | 158 | 159 | Terminal R ON/OFF |
| 40 | 41 | Run/Stop | 160 | 161 | Cooling fan replacement alarm |
| 42 | 43 | Serious failure | 162 | 163 | Number of starting alarm |
| 44 | 45 | Slight failure | 164 | 165 | Light load detection 2 |
| 46 | 47 | Commercial power/Inverter Switching 1 | 166 | 167 | During Acc |
| 48 | 49 | Commercial power/Inverter Switching 2 | 168 | 169 | During Dec |
| 50 | 51 | During cooling fan run | 170 | 171 | During constant speed run |
| 52 | 53 | During jog run | 172 | 173 | During DC braking |
| 54 | 55 | During terminal run | 174 | 175 | During hit and stop |
| 56 | 57 | Cumulative run time alarm | 176 | 177 | During run including servo lock |
| 58 | 59 | Communication option communication time-out | 178 | 179 | During servo lock |
| 60 | 61 | Fwd/Rev run | 180 | 181 | For input cumulative power |
| 62 | 63 | Ready for run 1 | 182 | 183 | Shock monitoring alarm |
| 64 | 65 | Ready for run 2 | 184 | 185 | Number of external equipment starting alarm |
| 68 | 69 | During brake | 186 | 187 | V/f switching status 1 |
| 70 | 71 | During alarm or pre-alarm | 188 | 189 | V/f switching status 2 |
| 72 | 73 | During Fwd speed limit | 190 | 191 | Cooling fan fault alarm |
| 74 | 75 | During Rev speed limit | 192 | 193 | Embedded Ethernet communication time-out |
| 76 | 77 | Inverter healthy output | 194 - | - 201 | Calendar 1 - 4 |
| 78 | 79 | RS485 communication time-out | 202 | 203 | During PID2 control |
| 92 | 93 | Designated data bit 0 | 204 | 205 | During External PID3 control |
| 94 | 95 | Designated data bit 1 | 206 | 207 | External PID3 deviation limit |
| 106 | 107 | Light load detection 1 | 208 | 209 | During External PID4 control |
| 108 | 109 | Heavy load detection | 210 | 211 | External PID4 deviation limit |
| 110 | 111 | During positive torque limit | 212 | 213 | Pump control |

| Setting value | | | Setting value | | | |
|----------------|--------------------------------|--|-------------------|--------------------------------|---------------------------|--|
| Positive logic | Negative logic (Inverse) | Output terminal function | Positive logic | Negative logic (Inverse) | Output terminal function | |
| 112 | 113 | During negative torque limit | 222 - 253 | | My function output 1 - 16 | |
| 114 | 115 | For external relay of rush current suppression | 254 | 255 | Always OFF | |

The setting items in the table are as follows:

- Alarm: Indicates an alarm output where the inverter or external equipment may be damaged if it continues.
- Pre-alarm: Indicates an alarm output almost at the trip level.

For positive logic

- "ON": Indicates that the digital output transistor or the relay is ON.
- "OFF": Indicates that the digital output transistor or the relay is OFF.

For negative logic

- "ON": Indicates that the digital output transistor or the relay is OFF.
- "OFF": Indicates that the digital output transistor or the relay is ON.

For details on the output terminal functions and the levels, refer to [11. 6].

7. 3 Frequency commands by the analog signals

You can input voltage signals and current signals to the analog input terminals as a frequency command.

7. 3. 1 <u>Inputting frequency commands by analog signals</u>

You can select four types of analog signals as a frequency command signal.

- Potentiometer
- 0 10 Vdc
- 4(0) 20 mAdc
- -10 to +10 Vdc

For how to fine adjust the analog signals and output frequencies, refer to [6. 6. 3].

Configuration of the control terminal block



Analog input terminal function settings

| Terminal symbol | Title | Parameter name | Adjustment range | Default setting |
|-----------------|-------|------------------------|------------------|--------------------|
| RR | F201 | RR point 1 input value | 0 - 100 (%) | 0 |
| | F202 | RR point 1 frequency | 0.0 - 590.0 (Hz) | 0.0 |
| | F203 | RR point 2 input value | 0 - 100 (%) | 100 |
| | F204 | RR point 2 frequency | 0.0 - 590.0 (Hz) | 50.0/60.0 *1 |

| Terminal symbol | Title | Parameter name | Adjustment range | Default setting |
|-----------------|-------|----------------------------------|--|--------------------|
| RX | F210 | RX point 1 input value | -100 to 100 (%) | 0 |
| | F211 | RX point 1 frequency | 0.0 - 590.0 (Hz) | 0.0 |
| | F212 | RX point 2 input value | -100 to 100 (%) | 100 |
| | F213 | RX point 2 frequency | 0.0 - 590.0 (Hz) | 50.0/60.0 *1 |
| | F107 | Terminal RX input voltage select | 0: 0 to +10 V 1: -10 to +10 V | 0 |
| II | F216 | II point 1 input value | 0 - 100 (%) | 20 |
| | F217 | II point 1 frequency | 0.0 - 590.0 (Hz) | 0.0 |
| | F218 | II point 2 input value | 0 - 100 (%) | 100 |
| | F219 | II point 2 frequency | 0.0 - 590.0 (Hz) | 50.0/60.0 *1 |
| Al4 | F222 | Al4 point 1 input value *2 | -100 to 100 (%) | 0 |
| | F223 | Al4 point 1 frequency *2 | 0.0 - 590.0 (Hz) | 0.0 |
| | F224 | Al4 point 2 input value *2 | -100 to 100 (%) | 100 |
| | F225 | Al4 point 2 frequency *2 | 0.0 - 590.0 (Hz) | 50.0/60.0 *1 |
| | F148 | Terminal Al4 input select *2 | 1: Voltage input (0 - 10 V) 2: Voltage input (-10 to +10 V) 3: Current input (0 - 20 mA) 4: PTC input 5: PT100 (2-wire) input 6: PT100 (3-wire) input 7: PT1000 (2-wire) input 8: PT1000 (3-wire) input 9: KTY84 input | 1 |
| AI5 | F228 | Al5 point 1 input value *2 | -100 to 100 (%) | 0 |
| | F229 | AI5 point 1 frequency *2 | 0.0 - 590.0 (Hz) | 0.0 |
| | F230 | Al5 point 2 input value *2 | -100 to 100 (%) | 100 |
| | F231 | Al5 point 2 frequency *2 | 0.0 - 590.0 (Hz) | 50.0/60.0 *1 |
| | F149 | Terminal Al5 input select *2 | 1: Voltage input (0 to 10V) 2: Voltage input (-10 to +10 V) 3: Current input (0 - 20 mA) 4: PTC input 5: PT100 (2-wire) input 6: PT100 (3-wire) input 7: PT1000 (2-wire) input 8: PT1000 (3-wire) input 9: KTY84 input | 1 |

| Terminal symbol | Title | Parameter name | Adjustment range | Default setting |
|-----------------|-------|--|---|--------------------|
| Common | F209 | Analog input filter | 1: Disabled 2 - 1000 (ms) | 1 * ³ |
| | A959 | Analog input function target 11 | 0: Disabled 1: Terminal RR 2: Terminal RX 3: Terminal II 4: Terminal Al4 5: Terminal Al5 | |
| | A961 | Analog function setting destination 11 | 0: Disabled 1: Acc/Dec rate (ACC.dEC etc.) 2: Upper limit frequency (UL) 3: Acc multiplication factor (FH/ACC etc.) 4: Dec multiplication factor (FH/dEC etc.) 5: Manual torque boost (vb etc.) 6: Stall prevention level (F601 etc.) 7: Motor OL protection current (tHrA) 8: Speed control response (F460 etc.) 9: Droop gain (F320 etc.) 10: PID proportional gain (F362 etc.) 11: Base frequency voltage (VL etc.) 12 - 20: - | |
| | A962 | Analog input function target 21 | Same as A959 | |
| | A964 | Analog function setting destination 21 | Same as A961 | |

^{*1} The default setting value is depending on the setup menu. Refer to [5. 2. 10].

For details on switching two types of analog signals for operation, refer to [5. 3. 1].

^{*2} Indicates optional. For details, refer to [10. 4. 1].

^{*3} If stable operation cannot be achieved because of noise of the frequency command circuit, etc., increase the value for <F209: Analog input filter>.

7. 3. 2 <u>Inputting the frequency commands by potentiometer/voltage (0 - 10 Vdc)</u>

Connect a potentiometer (1 k - 10 k Ω) between the terminals [PP]-[RR]-[CC] to input frequency commands.

Divide the reference voltage (10 Vdc) of the terminal [PP] using a potentiometer to input the voltage of 0 - 10 Vdc between the terminals [RR]-[CC].

You can also directly input a voltage signal of 0 - 10 Vdc between the terminals [RR]-[CC] without using a potentiometer.

Setting example

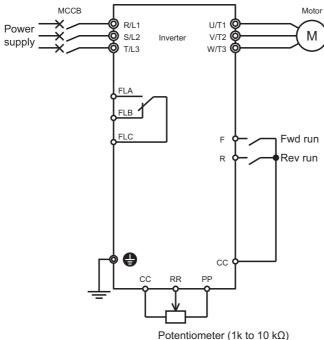
The following shows an example of how to externally input the run commands to the digital input terminals, and how to input the frequency commands using a potentiometer.

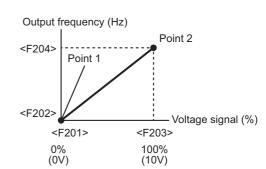
The frequency shall be 0 Hz at the minimum setting of a potentiometer, and 60 Hz at the maximum setting of a potentiometer.

- <CMOd: Run command select> = "0: Terminal"
- <FMOd: Frequency command select 1> = "1: Terminal RR"
- <F201: RR point 1 input value> = "0" (%) (default setting)
 <F202: RR point 1 frequency> = "0" (Hz) (default setting)
 <F203: RR point 2 input value> = "100" (%) (default setting)
- <F204: RR point 2 frequency> = "60" (Hz) (default setting)

For the characteristics of input voltages and output frequencies, set at two points of <F201> and <F202>, and <F203> and <F204>. The reference for 100% of the input value is 10 V.

(In case of sink logic)





7. 3. 3 Inputting the frequency commands by current (4 - 20 mAdc)

Input the current signal of 4(0) - 20 mAdc between the terminals [II]-[CC].

Setting example

The following shows an example of how to externally input the run commands to the digital input terminals with a current input of 4 - 20 mAdc.

The frequency shall be 0 Hz for the minimum input of 4 mA, and 60 Hz for the maximum input of 20 mA.

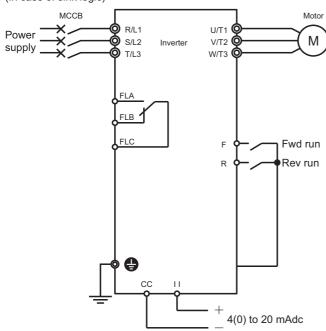
- <CMOd: Run command select> = "0: Terminal"
- <FMOd: Frequency command select 1> = "3: Terminal II"

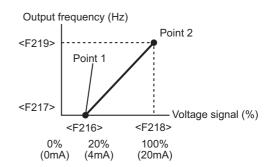
<F216: II point 1 input value> = "20" (%) (default setting)
 <F217: II point 1 frequency> = "0" (Hz) (default setting)
 <F218: II point 2 input value> = "100" (%) (default setting)

<F219: Il point 2 frequency> = "60" (Hz) (default setting)
 For the characteristics of input currents and output frequencies, set at two points of <F216> and

<F217>, and <F218> and <F219>. The reference for 100% of the input value is 20mA.

(In case of sink logic)





7. 3. 4 Inputting frequency commands by voltage (-10 to +10 Vdc)

Input the voltage signal of -10 to +10 Vdc between the terminals [RX]-[CC].

You can also input a voltage of 0 - 10 Vdc. Set <F107: Terminal RX input voltage select> = "0: 0 to +10 V".

Setting example

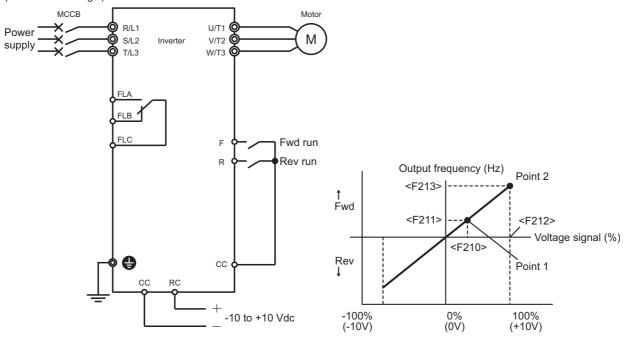
The following shows an example of how to externally input the run commands to the digital input terminals with a voltage input of -10 to +10 V.

The frequency shall be 0 Hz at 0 V, and 60 Hz at +10 V. At this time, the frequency becomes 60 Hz in reverse run at -10 V.

- <CMOd: Run command select> = "0: Terminal"
- <FMOd: Frequency command select 1> = "2: Terminal RX"
- Set <F107: Terminal RX input voltage select> = "1: -10 to +10 V".
- <F210: RX point 1 input value> = "0" (%) (default setting)
- <F211: RX point 1 frequency> = "0" (Hz) (default setting)
- <F212: RX point 2 input value> = "100" (%) (default setting)
- <F213: RX point 2 frequency> = "60" (Hz) (default setting)

For the characteristics of input currents and output frequencies, set at two points of <F210> and <F211>, and <F212> and <F213>. The reference for 100% of the input value is 10 V.

(In case of sink logic)



8

Monitoring operation status

In [Monitor mode], the operation status of the inverter, ON/OFF information of input/output terminals, trip record, etc. are displayed.

This chapter explains the display contents of [Monitor mode].

Furthermore, display at the time of occurrence of a trip and causes and remedies are also introduced.

8. 1 Screen display of [Monitor mode]

For the outline of screen display of [Monitor mode], refer to [3. 1. 2] "■Screen display of [Monitor mode]".

8. 1. 1 Operation Status monitor

When [Standard mode] is displayed on the LCD screen during run, press the [F4] key or press [ESC] key twice to switch to [Monitor mode].

Ī

П

1

2

3

4

5

6

7

8

9

10

L1

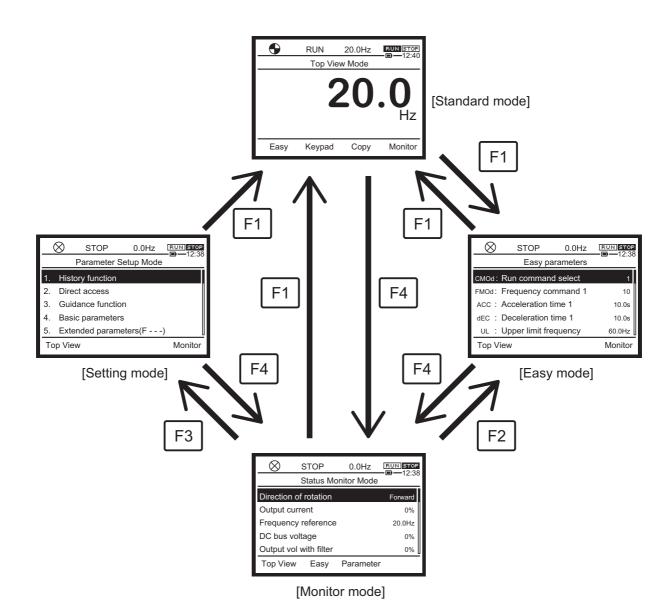
12

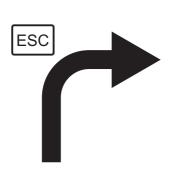
13

14

15

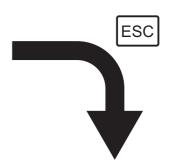
16







[Standard mode]



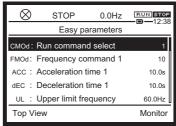
[Monitor mode]



Parameter Setup Mode

1. History function
2. Direct access
3. Guidance function
4. Basic parameters
5. Extended parameters(F - - -)
Top View Monitor

[Setting mode]



[Easy mode]

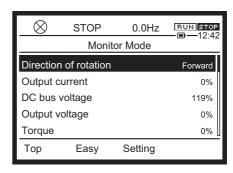
Screen configuration of [Monitor mode]

If an "OK" mark is displayed on the [F4] key when you select any of the displayed items, a details monitor is available. When you press the [F4] key or [OK] key, you can go to the details monitor. When you press the [i] key, you can check the inverter rating and the CPU version.

1) Direction of rotation

"Forward" or "Reverse" is displayed.

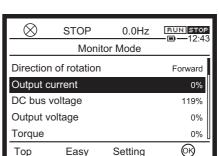
The direction of rotation of the monitor output by the inverter is displayed whether the motor is run or stopped.



2) Selected monitor 1 to 8

The monitor items selected with <F711: Monitor mode 1 display> to <F718: Monitor mode 8 display> are displayed. In the default setting, the following monitor items are displayed.

- Output current
- · Input voltage (DC detection)
- · Output voltage
- Torque
- · Input power
- Output power
- · Inverter load factor
- · Motor load factor



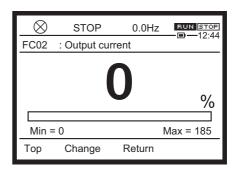
- Output current: The current monitored is displayed in percentage. The value indicated on the nameplate is 100%. The unit can be switched to A (amperes). Set <F701: Current, voltage units select> to "1: A (ampere), V (volt)."
- Input voltage: The reference values (100% values) are 200 V (240 V class) and 400 V (480 V class). The voltage displayed is the voltage determined by converting the voltage measured in the DC section into an AC voltage. The unit can be switched to V (volts). Set <F701: Current, voltage units select> to "1: A (ampere), V (volt)."

Memo

- Output voltage: The reference values (100% values) are 200 V (240 V class) and 400 V (480 V class). The voltage displayed is the output command voltage. The unit can be switched to V (volts). Set <F701: Current, voltage units select> to "1: A (ampere), V (volt)."
- Load factor of inverter: Depending on <F300: Carrier frequency> setting and so on, the actual
 rated current may become smaller than the rated output current indicated on the nameplate.
 With the actual rated current at that time (after reduction) as 100%, the proportion of the load
 current to the rated current is indicated in percent. The load factor is also used to calculate the
 conditions for overload trip "OL1".

In the details monitor, it is indicated with a graphic bar.

When you press the [F2] key ("Change"), you can go to <F711: Monitor mode 1 display> to <F718: Monitor mode 8 display> to change settings.



| Title | Parameter name | Adjustment range | Default setting |
|-------|------------------------|-----------------------|--------------------|
| F711 | Monitor mode 1 display | 0 - 162 ^{*1} | 2 |
| F712 | Monitor mode 2 display | 0 - 162 ^{*1} | 3 |
| F713 | Monitor mode 3 display | 0 - 162 ^{*1} | 4 |
| F714 | Monitor mode 4 display | 0 - 162 ^{*1} | 8 |
| F715 | Monitor mode 5 display | 0 - 162 ^{*1} | 18 |
| F716 | Monitor mode 6 display | 0 - 162 ^{*1} | 19 |
| F717 | Monitor mode 7 display | 0 - 162 ^{*1} | 35 |
| F718 | Monitor mode 8 display | 0 - 162 ^{*1} | 34 |

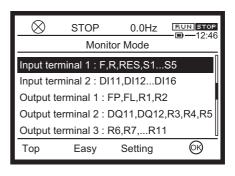
^{*1} For details, refer to the table at the end of this subsection.

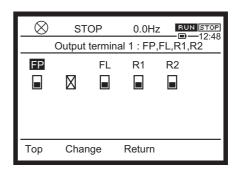
3) Input/output terminals

The details monitor displays the ON/OFF status of the following input/output terminals.

- Input terminal 1 (F, R, RES, S1...S4, S5)
- Input terminal 2 (DI11, DI12...DI16)
- Output terminal 1 (FP, FL,R1, R2)
- Output terminal 2 (DQ11, DQ12, R3, R4, R5)
- Output terminal 3 (R6, R7...R11)

If the terminal you have selected has a related parameter, the [F2] key ("Change") is displayed. When you press the [F2] key ("Change"), you can go to the screen of the related parameter to change the setting.





4) Past trip 1 to 8

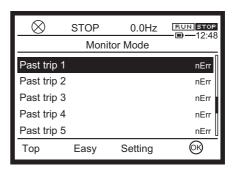
The trip records are displayed. Past trip 1 is the record of the latest trip, and Past trip 8 is the record of the oldest trip.

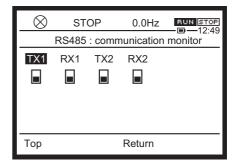
If no trip information exists, "nErr" is displayed.

On the details monitor, you can check the details of trips. Refer to [8.1.2].

5) Communication status

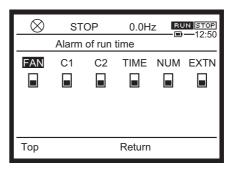
The details monitor displays the transmitting/receiving status of RS485 communication connector 1, 2. The connector 1 signal transmitting "TX1", connector 1 signal receiving "RX1", connector 2 signal transmitting "TX2", and connector 2 signal receiving "RX2" are displayed.





6) Parts replacement alarm information

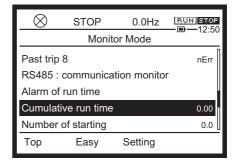
The details monitor displays replacement alarms of the cooling fan, capacitor, etc.



7) Cumulative run time

The cumulative run time of the inverter is displayed. The display unit is 100 hours, and the minimum value 0.01 is equal to 1 hour.

To clear the value, set <tyP: Default setting> to "5: Clear cumulative run time."

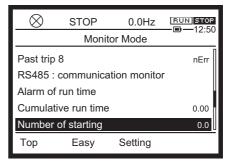


8) Number of starting

The number of starting of the inverter is displayed. The display unit is one time, and the maximum value is 9.99 million times.

(In the case of an LED display extension panel, the display unit is 10000 times, and the minimum value 0.1 is equal to 1000 times.)

To clear the value, set <tyP: Default setting> to "12: Clear cumulative run time."



■ Settings for <F711: Monitor mode 1 display> to <F718: Monitor mode 8 display>

| Set- ting value | Function name | Display unit | Set- ting value | Function name | Display unit |
|-----------------------|---|-------------------------------|-----------------------|--|-----------------|
| 0 | Output frequency | 0.1 Hz | 71 | Motor speed (estimated value, Max. 32700 min ⁻¹) | 1 |
| 1 | Frequency command value | 0.1 Hz | 72 | Communication option Receiving counter | 1 |
| 2 | Output current | 1%/ <f701> setting</f701> | 73 | Communication option Abnormal counter | 1 |
| 3 | Input voltage (DC detection) | 1%/ <f701> setting</f701> | 76 | Terminal S4/S5 pulse train input value | 0.10% |
| 4 | Output voltage | 1%/ <f701> setting</f701> | 77 | My function COUNT1 | 1 |
| 5 | Stator frequency | 0.1 Hz | 78 | My function COUNT2 | 1 |
| 6 | Speed feedback frequency (real time) | 0.1 Hz | 79 | Dancer control PID result frequency | 0.1 Hz |
| 7 | Speed feedback frequency (1-second filter) | 0.1 Hz | 80 | Embedded Ethernet Trans- mission counter | - |
| 8 | Torque | 1% | 81 | Embedded Ethernet Receiving counter | 1 |
| 9 | Torque command | 1% | 82 | Embedded Ethernet Abnor- mal counter | 1 |
| | Output frequency during run. | | 83 | Connected option number | 1 |
| 10 | Frequency command value during stop. | Hz/free unit | 84 | My function COUNT3 | 1 |
| 11 | Torque current | 1% | 85 | My function COUNT4 | 1 |
| 12 | Exciting current | 1% | 86 | My function COUNT5 | 1 |
| 13 | PID feedback value | 0.1 Hz | 90 | Cumulative power ON time | 100 hours |
| 14 | Motor overload factor (OL2 data) | 1% | 91 | Cumulative cooling fan run time | 100 hours |
| 15 | Inverter overload factor (OL1 data) | 1% | 92 | Cumulative run time | 100 hours |
| 16 | Braking resistor overload factor (OLr data) | 1% | 93 | Cumulative overcurrent time | 100 hours |
| 17 | Braking resistor load factor (%ED) | 1% | 95 | Pump 0 run time | 100 hours |
| 18 | Input power | 0.1 kW | 96 | Pump 1 run time | 100 hours |
| 19 | Output power | 0.1 kW | 97 | Pump 2 run time | 100 hours |
| 20 | Input cumulative power | <f749> set- ting</f749> | 98 | Pump 3 run time | 100 hours |
| 21 | Output cumulative power | <f749> set- ting</f749> | 99 | Pump 4 run time | 100 hours |

| Set- ting value | Function name | Display unit | Set- ting value | Function name | Display unit |
|-----------------------|---|--------------|-----------------------|---|-----------------|
| 22 | Fixed output 1 | - | 100 | Number of starting | 10000 times |
| 23 | Fixed output 2 | - | 101 | Number of Fwd starting | 10000 times |
| 24 | Terminal RR input value | 1% | 102 | Number of Rev starting | 10000 times |
| 25 | Terminal RX input value | 1% | 103 | External equipment counter | Time |
| 26 | Terminal II input value | 1% | 105 | Pump 5 run time | 100 hours |
| 27 | Motor speed command | - | 106 | Pump 6 run time | 100 hours |
| 28 | Terminal FM output value | 1 | 107 | Pump 7 run time | 100 hours |
| 29 | Terminal AM output value | 1 | 108 | Pump 8 run time | 100 hours |
| 30 | - | - | 109 | Pump 9 run time | 100 hours |
| 31 | Communication data output | *1 | 110 | Number of trip | Time |
| 32 | Slot A option CPU version | - | 111 | Number of serious failure trip | 1 |
| 33 | Slot B option CPU version | - | 112 | Number of slight failure trip | 1 |
| 34 | Motor load factor | % | 113 | Number of specified trip 1 | 1 |
| 35 | Inverter load factor | % | 114 | Number of specified trip 2 | 1 |
| 36 | Inverter rated current | Α | 115 | Number of specified trip 3 | 1 |
| 37 | Inverter rated current (with carrier frequency correction) | А | 120 | Internal temperature 1 | °C |
| 38 | Actual carrier frequency | kHz | 124 | Main circuit board temperature | °C |
| 39 | Slot C option CPU version | - | 130 | External PID3 set value | 0.1 Hz |
| 40 | Embedded Ethernet CPU version | - | 131 | External PID3 feedback value | 0.1 Hz |
| 41 | Terminal FP pulse train output value | pps | 132 | External PID3 result value | 0.1 Hz |
| 43 | Terminal FM/AM gain setting value | - | 133 | External PID4 set value | 0.1 Hz |
| 44 | Terminal Al4 input value | 1% | 134 | External PID4 feedback value | 0.1 Hz |
| 45 | Terminal Al5 input value | 1% | 135 | External PID4 result value | 0.1 Hz |
| 46 | My function monitor output 1 | - | 150 | Signed output frequency | 0.1 Hz |
| 47 | My function monitor output 2 | - | 151 | Signed frequency command value | 0.1 Hz |
| 48 | My function monitor output 3 | - | 152 | Signed stator frequency | 0.1 Hz |
| 49 | My function monitor output 4 | - | 153 | Signed speed feedback frequency (real time) | 0.1 Hz |

| Set- ting value | Function name | Display unit | Set- ting value | Function name | Display unit |
|-----------------------|--|--------------|-----------------------|---|-----------------|
| 62 | PID result frequency | 0.1 Hz | 154 | Signed speed feedback frequency (1-second filter) | 0.1 Hz |
| 63 | PID set value | 0.1 Hz | 155 | Signed torque | 1% |
| 64 | Light-load high-speed switching load torque | 1% | 156 | Signed torque command | 1% |
| 65 | Light-load high-speed torque during constant speed run | 1% | 158 | Signed torque current | 1% |
| 66 | Pattern operation group number | 0.1 | 159 | Signed PID feedback value | 0.1 Hz |
| 67 | Pattern operation remaining cycle number | 1 | 160 | Signed terminal RX input value | 1% |
| 68 | Pattern operation preset speed number | 1 | 161 | Signed terminal Al4 input value | 1% |
| 69 | Pattern operation remaining time | 0.1 | 162 | Signed terminal AI5 input value | 1% |
| 70 | Inverter rated voltage | 1 | | | 1 |

^{*1} For details, refer to "RS485 Communication Function Instruction Manual".

8. 1. 2 Detailed display of past trip

When you press the [OK] key while Past trip 1 to 8 are displayed in [Monitor mode], more detailed information can be displayed as follows.

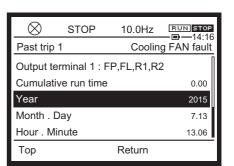
Unlike "Display at the time of trip" in [3. 2. 2], it can be displayed after the inverter is turned off or reset. However, the monitor value of a trip is not always recorded as the maximum value because of the time required for detection.

■Details of the past

On the detail screen of the past trip show the information of the 13 items.

The trip history number and trip name are displayed in the mode name area.

- · Number of occurrences
- · Output frequency
- · Direction of rotation
- · Frequency command value
- Output current
- · Input voltage (DC detection)
- · Output voltage
- Input terminal 1 (F, R, RES, S1...S4, S5)
- Output terminal 1 (FP, FL,R1, R2)
- · Cumulative operation time
- Year
- · Month, Date
- · Hour, Minutes



8. 2 Screen display at trip occurrence

If an alarm occurs, text is displayed on the LCD screen according to the contents of the alarm.

If a trip occurs, text is displayed on the LCD screen, and the backlight turns red to indicate an error.

8. 2. 1 Display of trip information and alarm information

If the inverter trips, the contents of the trip are displayed. You can also check the status at the time of trip in [Monitor mode].

If the inverter issues an alarm, the contents of the alarm are displayed.

Refer to "Chap 13" for trip and alarm display.

8. 2. 2 Monitor display at trip

Data at the time of occurrence of the trip are retained.

Before the inverter is turned off or reset, information equivalent to "Operation Status monitor" in [8. 1. 1] can be displayed in [Monitor mode].

After power off or reset, information is stored in Past trip 1 to 8 in [Monitor mode]. For details, refer to [8. 1. 2].

9

Measures to satisfy standards

This chapter explains the measures to comply with the EMC Directive, UL/CSA Standards, etc. by introducing examples.

9. 1 How to deal with CE marking

In Europe, the EMC Directive and the Low Voltage Directive, which took effect in 1996 and 1997 respectively, made it obligatory to put the CE mark on every applicable product to prove that it complies with the directives. Inverters do not work alone but are designed to be installed in a control panel and always used in combination with other machines and systems for the purpose of controlling them. So they themselves were not considered to be subject to the EMC Directive. However, the component also became subject to law with the enforcement of the new EMC Directive 2004/108/EC in 2007. For this reason, we put CE mark on all inverters in accordance with the EMC Directive and the Low Voltage Directive.

The CE mark must be put on all machines and systems with built-in inverters because such machines and systems are subject to the above directives. If they are final products, they might also be subject to the Machinery Directive.

It is the responsibility of the manufacturers of such final products to put the CE mark on each final product. In order to make machines and systems with built-in inverters comply with the EMC Directive and the Low Voltage Directive, we recommend the installation method of inverters and measures for EMC Directive described in this instruction manual.

We have tested representative models with them installed under the environment described later in this manual to check for conformity with the EMC Directive. However, we cannot check the inverters under your operating environment. EMC varies depending on the composition of the control panel with a built-in inverter(s), the relationship with other built-in electrical components, the wiring condition, the layout condition, and so on. Therefore, you need to verify yourself whether your machine and system conforms to the EMC Directive.

9. 1. 1 Compliance with EMC Directive

The CE mark must be put on every final product that includes an inverter(s) and a motor(s). This series of inverters are equipped with an EMC filter and complies with the EMC Directive 2004/108/EC if wiring is carried out correctly.

The EMC standards are broadly divided into two categories; Emission and Immunity, each of which is further categorized according to the operating environment of each individual machine as shown in the table below. We consider that the tests required for machines and systems as final products are almost the same as those required for inverters.

П

1

1

5

6

_

1 0

11

<u>12</u>

13

14

15

16

| Category | Subcategory | Product standards | Test standard |
|-------------|--|-------------------|-------------------|
| Emission | Radiated noise | | CISPR11 (EN55011) |
| LIIIISSIOII | Conducted noise | | CISPR11 (EN55011) |
| | Static discharge | | IEC61000-4-2 |
| | Radioactive radio-frequency magnetic contactor field | IEC61800-3 | IEC61000-4-3 |
| Immunity | First transient burst | | IEC61000-4-4 |
| ininianity | Surge | | IEC61000-4-5 |
| | Radio-frequency induction/transmission interference | | IEC61000-4-6 |
| | Voltage dip/Interruption of power | | IEC61000-4-11 |

(1) EMC Directive compliance of this inverter

The built-in EMC filter on the input side of this inverter (480 V class) reduces conducted noise and radiated noise from input cables. The compliance with the EMC Directive is as shown in the table below.

| Inverter type | Carrier frequency <f300></f300> | Conducted noise IEC61800-3 category C2 (EN55011 classB Group1) | Conducted noise IEC61800-3 category C3 (EN55011 classB Group1) | |
|---------------|---------------------------------------|--|--|--|
| inverter type | \F300> | Length of motor connecting cable | Length of motor connecting cable | |
| | (kHz) | (m) | (m) | |
| VFAS3-2004P | 4 | - | - | |
| VFAS3-2007P | 4 | - | - | |
| VFAS3-2015P | 4 | - | - | |
| VFAS3-2022P | 4 | - | - | |
| VFAS3-2037P | 4 | - | - | |
| VFAS3-2055P | 4 | - | - | |
| VFAS3-2075P | 4 | - | - | |
| VFAS3-2110P | 4 | - | - | |
| VFAS3-2150P | 4 | - | - | |
| VFAS3-2185P | 4 | - | - | |
| VFAS3-2220P | 2.5 | - | - | |
| VFAS3-2300P | 2.5 | - | - | |
| VFAS3-2370P | 2.5 | - | - | |
| VFAS3-2450P | 2.5 | - | - | |
| VFAS3-2550P | 2.5 | - | - | |
| VFAS3-4004PC | 4 | 50 | 150 | |
| VFAS3-4007PC | 4 | 50 | 150 | |

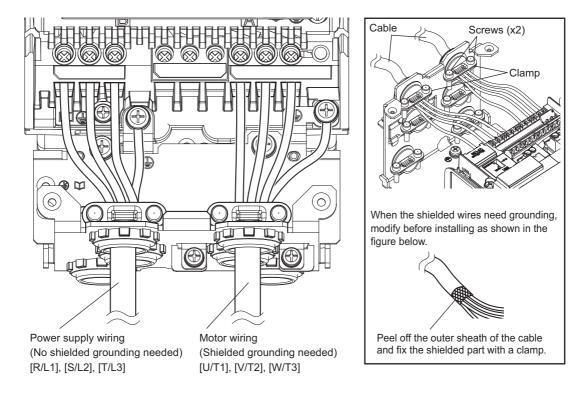
| Inverter type | Carrier frequency <f300></f300> | Conducted noise IEC61800-3 category C2 (EN55011 classB Group1) | Conducted noise IEC61800-3 category C3 (EN55011 classB Group1) |
|---------------|---------------------------------------|--|--|
| inverter type | \r\300> | Length of motor connecting cable | Length of motor connecting cable |
| | (kHz) | (m) | (m) |
| VFAS3-4015PC | 4 | 50 | 150 |
| VFAS3-4022PC | 4 | 50 | 150 |
| VFAS3-4037PC | 4 | 50 | 150 |
| VFAS3-4055PC | 4 | 50 | 150 |
| VFAS3-4075PC | 4 | 50 | 150 |
| VFAS3-4110PC | 4 | 50 | 150 |
| VFAS3-4150PC | 4 | 50 | 150 |
| VFAS3-4185PC | 4 | 50 | 150 |
| VFAS3-4220PC | 4 | 50 | 150 |
| VFAS3-4300PC | 4 | 50 | 150 |
| VFAS3-4370PC | 4 | 50 | 150 |
| VFAS3-4450PC | 2.5 | - | 150 |
| VFAS3-4550PC | 2.5 | - | 150 |
| VFAS3-4750PC | 2.5 | - | 150 |
| VFAS3-4900PC | 2.5 | - | 150 |
| VFAS3-4110KPC | 2.5 | - | 150 |
| VFAS3-4132KPC | 2.5 | - | 150 |
| VFAS3-4160KPC | 2.5 | - | 50 |
| VFAS3-4200KPC | 2.5 | - | 50 |
| VFAS3-4220KPC | 2.5 | - | 50 |
| VFAS3-4280KPC | 2.5 | - | 50 |

(2) Examples of measures to comply with EMC Directive

The following are measures to comply with the EMC Directive when you use this inverter by installing it in other machines and systems.

- Examples of general measures
- · When adding an EMC filter for further reduction of noise
- Measures for operation with external signals

The following are general EMC measures explained concretely.



Using shielded power wires and shielded control wires

- Use shielded power wires, such as inverter input/output wires, and shielded control wires.
- Route the wires and wires so as to minimize their lengths.
- Keep a distance between the power cable and the control wire and between the input and output wires of the power cable. Do not route them in parallel or bind them together. Instead, if necessary, cross at right angle.

Installing inverter in steel cabinet

- · Install the inverter in a sealed steel cabinet.
- Using wires as thick and short as possible, ground the metal plate and the control panel securely with a distance kept between the grounding wire and the power wire.

Routing input and output wires apart

• Route the input and output wires apart as far as possible from each other.

Grounding of shielded wires

- · To ground shielded wires through a metal conduit.
- To ground the shielded control wires by fixing the metal saddle of the body.
- Inserting a ferrite core in a shielded wire is even more effective in limiting the radiated noise.

Inserting zero-phase reactor and ferrite cores

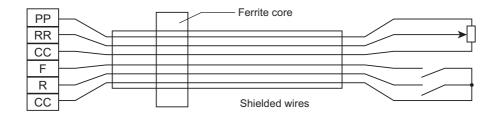
- Insert a zero-phase reactor in the inverter output line.
- · Insert ferrite cores in the grounding wires of the metal plate and cabinet.

Recommended parts for EMC Directive compliance are shown in the table below.

| Part | Specifications/remarks |
|--------------------|---|
| Shielded wire | Rating: 600 V or less Cross-section area: 2 - 1000 mm² If a shielded wire is difficult to obtain, shield with a conduit. |
| Zero-phase reactor | Option: RC5078ZZ RC9129ZZT |

(3) Measures for operation with external signals

To operate with external signals, take measures as shown in the figure below (e.g.: using a potentiometer and Fwd/Rev terminals).



| Part | Specifications/remarks |
|---------------|---|
| Shielded wire | Rating: 600 V or less Cross-section area: 2 - 1000 mm² |

9. 1. 2 Compliance with Low Voltage Directive

The Low Voltage Directive provides for the safety of machines and systems.

(1) Low Voltage Directive Compliance of this inverter

Inverters are CE-marked in accordance with the standard IEC61800-5-1 specified by the Low Voltage Directive, and can therefore be installed in machines or systems and exported without problem to European countries.

- Applicable standard: IEC61800-5-1
- Pollution level: 2
- · Overvoltage category: 3

(2) Example of measures to comply with Low Voltage Directive

When incorporating the inverter into a machine and system, it is necessary to take the following measures so that the inverter satisfies the Low Voltage Directive.

Installing in cabinet

- Install the inverter in a cabinet and ground the inverter enclosure.
- When doing maintenance, be extremely careful not to put your fingers into the inverter through a wiring hole and touch a charged part, which may occur depending on the model of the inverter used.

Paying attention to how to ground

- To ground shielded wires through a metal conduit.
- Connect grounding wires other than the shielded wires to the grounding terminals on the inverter.
- However, do not connect two or more grounding wires to the grounding terminals (screws) for the inverter main circuit.
- Refer to the table in [10. 1] to select a grounding wire size.

Installing circuit breaker

• Install a fuse or a molded-case circuit breaker (MCCB) on the input side of the inverter. For details, refer to [10. 2. 2].

9. 2 Compliance with UL/CSA Standards

This inverter complies with the UL Standard and CSA Standard. An inverter that has obtained certifications of these standards has a nameplate with a UL/CSA mark attached.

9. 2. 1 Cautions for installation

Since this inverter has obtained the certification of the UL Standard on the assumption that it will be installed in the cabinet, be sure to install it in the cabinet.

Consider ventilation and cooling in the cabinet to keep the ambient temperature (temperature inside the cabinet) within the specification temperature range. For details, refer to [12. 1].

 With models with applicable motor output of 15 kW or less, the ambient temperature is 50°C or less, however, if the top cover is removed, the ambient temperature becomes 60°C. Models with applicable motor output of 18.5 kW or more can be used at an ambient temperature of up to 60°C (without the top cover).

9. 2. 2 Cautions for wiring

Pay attention to the types and sizes of wires to be used for wiring, types of crimp-style terminals, tightening torque of screws, etc.

(1) Power terminal

For wiring to the input terminals ([R/L1], [S/L2], [T/L3]) and output terminals ([U/T1], [V/T2], [W/T3]) of the inverter and other power terminals, attach rod crimp-style terminals to UL conformed wires (copper wires with the maximum allowable temperature for conductor of 75°C or more).

- Use crimping pliers recommended by terminal manufacturer to attach rod crimp-style terminals. For recommended crimp-style terminals, refer to [2, 3, 1].
- Attach them to the terminal block with specified tightening torque. For recommended torque values, refer to [2. 3. 3].
- For recommended wire sizes, refer to [9. 2. 3].

(2) Terminal FL, R1, R2

For wiring to the terminal FL ([FLA], [FLB], [FLC]), terminal R1 ([R1], [RC]) and terminal R2 ([R2], [RC]) use UL conform wires and rod crimp-style terminal V1.25-3.

- For recommended wire sizes, refer to [9. 2. 3].
- The UL conformed rated output current is different from the inverter unit rated current. For details, refer to [9. 2. 3].

(3) Other control terminals

For wiring to other control terminals, use Class 1 wires.

For the recommended torque, refer to the product label

(4) Protection for branch circuit

If the inverter is installed in the U.S., provide protection for the branch circuit according to National Electrical Code and local standards.

If it is installed Canada, provide protection according to Canadian Electrical Code and local standards.

9. 2. 3 Cautions for peripheral devices

Install a UL conformed fuse on the input side of the inverter.

For this inverter, a UL test has been conducted under the interrupting current (current that runs when interruption of power occurs) conditions in the table below. Note that the interrupting current varies depending on the applicable motor output.

| Max input voltage (V) | Applicable motor (kW) | Power supply short-circuit current (A) |
|-----------------------|--------------------------|---|
| | 0.4 - 30 | Suitable For Use On A Circuit Capable Of Delivering Not More Than 5,000A rms Symmetrical Amperes, 240 Volts Maximum When Protected by J Class Fuses |
| 3-phase 240 V | 37 | Suitable For Use On A Circuit Capable Of Delivering Not More Than 10,000A rms Symmetrical Amperes, 240 Volts Maximum When Protected by J Class Fuses |
| | 45 - 55 | Suitable For Use On A Circuit Capable Of Delivering Not More Than 10,000A rms Symmetrical Amperes, 240 Volts Maximum When Protected by AR Class Fuses |
| | 0.4 - 30 | Suitable For Use On A Circuit Capable Of Delivering Not More Than 5,000A rms Symmetrical Amperes, 480 Volts Maximum When Protected by J Class Fuses |
| | 37 - 75 | Suitable For Use On A Circuit Capable Of Delivering Not More Than 10,000A rms Symmetrical Amperes, 480 Volts Maximum When Protected by J Class Fuses |
| 3-phase | 90 - 110 | Suitable For Use On A Circuit Capable Of Delivering Not More Than 10,000A rms Symmetrical Amperes, 480 Volts Maximum When Protected by AR Class Fuses |
| 480 V | 132 | Suitable For Use On A Circuit Capable Of Delivering Not More Than 18,000A rms Symmetrical Amperes, 480 Volts Maximum When Protected by AR Class Fuses |
| | 160 - 220 | Suitable For Use On A Circuit Capable Of Delivering Not More Than 18,000A rms Symmetrical Amperes, 480 Volts Maximum When Protected by J Class Fuses |
| | 280 | Suitable For Use On A Circuit Capable Of Delivering Not More Than 30,000A rms Symmetrical Amperes, 480 Volts Maximum When Protected by T Class Fuses |

For the classes, current values, and the wire sizes of fuses, refer to the following table.

HD rating

| Voltage class | Applicable motor [kW] | Inverter type | UL Output current *1 *2 | AIC (A) (Interrupting capacity) | Fuse class and current (A) | Power wire sizes *3 | Grounding wire sizes |
|------------------|-----------------------|---------------|-------------------------------|---------------------------------------|----------------------------|---------------------------|----------------------|
| 3-phase 240 V | 0.4 | VFAS3-2004P | 3.3 <f300>="4"</f300> | AIC 5000A | J 6Amax. | AWG 14 | AWG 14 |
| | 0.75 | VFAS3-2007P | 4.6 <f300>="4"</f300> | AIC 5000A | J 10Amax. | AWG 14 | AWG 14 |
| | 1.5 | VFAS3-2015P | 8.0 <f300>="4"</f300> | AIC 5000A | J 15Amax. | AWG 14 | AWG 14 |
| | 2.2 | VFAS3-2022P | 11.2 <f300>="4"</f300> | AIC 5000A | J 25A max. | AWG 14 | AWG 14 |
| | 4.0 | VFAS3-2037P | 18.7 <f300>="4"</f300> | AIC 5000A | J 35Amax. | AWG 10 | AWG 12 |
| | 5.5 | VFAS3-2055P | 25.4 <f300>="4"</f300> | AIC 5000A | J 45Amax. | AWG 8 | AWG 10 |
| | 7.5 | VFAS3-2075P | 32.7 <f300>="4"</f300> | AIC 5000A | J 60Amax. | AWG 8 | AWG 10 |
| | 11 | VFAS3-2110P | 46.8 <f300>="4"</f300> | AIC 5000A | J 90Amax. | AWG 6 | AWG 10 |
| | 15 | VFAS3-2150P | 63.4 <f300>="4"</f300> | AIC 5000A | J 110Amax. | AWG 4 | AWG 10 |
| | 18.5 | VFAS3-2185P | 78.4 <f300>="4"</f300> | AIC 5000A | J 125Amax. | AWG 2 | AWG 8 |
| | 22 | VFAS3-2220P | 92.6 <f300>="2.5"</f300> | AIC 5000A | J 150Amax. | AWG 1 | AWG 8 |
| | 30 | VFAS3-2300P | 123.0 <f300>="2.5"</f300> | AIC 5000A | J 175Amax. | AWG 2/0 | AWG 6 |
| | 37 | VFAS3-2370P | 149.0 <f300>="2.5"</f300> | AIC 5000A | J 225Amax. | AWG 3/0 | AWG 6 |
| | 45 | VFAS3-2450P | 176.0 <f300>="2.5"</f300> | AIC 10000A | AR 315Amax. | 250MCN | AWG 6 |
| | 55 | VFAS3-2550P | 211.0 <f300>="2.5"</f300> | AIC 10000A | AR 350Amax. | AWG 2/0 × 2 | AWG 6 |

| Voltage class | Applicable motor [kW] | Inverter type | UL Output current *1 *2 | AIC (A) (Interrupting capacity) | Fuse class and current (A) | Power wire sizes | Grounding wire sizes |
|------------------|-----------------------|---------------|-------------------------------|---------------------------------------|----------------------------|------------------|----------------------|
| 3-phase 480 V | 0.4 | VFAS3-4004PC | 1.5 <f300>="4"</f300> | AIC 5000A | J 3Amax. | AWG 14 | AWG 14 |
| | 0.75 | VFAS3-4007PC | 2.2 <f300>="4"</f300> | AIC 5000A | J 6Amax. | AWG 14 | AWG 14 |
| | 1.5 | VFAS3-4015PC | 4.0 <f300>="4"</f300> | AIC 5000A | J 10Amax. | AWG 14 | AWG 14 |
| | 2.2 | VFAS3-4022PC | 5.6 <f300>="4"</f300> | AIC 5000A | J 15Amax. | AWG 14 | AWG 14 |
| | 4.0 | VFAS3-4037PC | 9.3 <f300>="4"</f300> | AIC 5000A | J 15Amax. | AWG 14 | AWG 14 |
| | 5.5 | VFAS3-4055PC | 12.7 <f300>="4"</f300> | AIC 5000A | J 20Amax. | AWG 12 | AWG 14 |
| | 7.5 | VFAS3-4075PC | 16.5 <f300>="4"</f300> | AIC 5000A | J 30Amax. | AWG 10 | AWG 14 |
| | 11 | VFAS3-4110PC | 23.5 <f300>="4"</f300> | AIC 5000A | J 40Amax. | AWG 10 | AWG 10 |
| | 15 | VFAS3-4150PC | 31.7 <f300>="4"</f300> | AIC 5000A | J 50Amax. | AWG 8 | AWG 10 |
| | 18.5 | VFAS3-4185PC | 39.2 <f300>="4"</f300> | AIC 5000A | J 60Amax. | AWG 8 | AWG 10 |
| | 22 | VFAS3-4220PC | 46.3 <f300>="4"</f300> | AIC 5000A | J 80Amax. | AWG 6 | AWG 10 |
| | 30 | VFAS3-4300PC | 61.5 <f300>="4"</f300> | AIC 5000A | J 100Amax. | AWG 4 | AWG 10 |
| | 37 | VFAS3-4370PC | 74.5 <f300>="4"</f300> | AIC 10000A | J 110Amax. | AWG 3 | AWG 8 |
| | 45 | VFAS3-4450PC | 88.0 <f300>="2.5"</f300> | AIC 10000A | J 150Amax. | AWG 1 | AWG 8 |
| | 55 | VFAS3-4550PC | 106.0 <f300>="2.5"</f300> | AIC 10000A | J 200Amax. | AWG 1/0 | AWG 6 |
| | 75 | VFAS3-4750PC | 145.0 <f300>="2.5"</f300> | AIC 10000A | J 225Amax. | AWG 3/0 | AWG 6 |
| | 90 | VFAS3-4900PC | 173.0 <f300>="2.5"</f300> | AIC 10000A | AR 250Amax. | 250MCM | AWG 6 |
| | 110 | VFAS3-4110KPC | 211.0 <f300>="2.5"</f300> | AIC 10000A | AR 315Amax. | AWG 1/0 × 2 | AWG 4 |
| | 132 | VFAS3-4132KPC | 250.0 <f300>="2.5"</f300> | AIC 18000A | AR 350Amax. | AWG 2/0 × 2 | AWG 4 |
| | 160 | VFAS3-4160KPC | 314.0 <f300>="2.5"</f300> | AIC 18000A | J 500Amax. | 300MCM × 2 | AWG 1/0 |
| | 200 | VFAS3-4200KPC | 387.0 <f300>="2.5"</f300> | AIC 18000A | J 600Amax. | AWG 4/0 × 3 | AWG 1/0 |
| | 220 | VFAS3-4220KPC | 427.0 <f300>="2.5"</f300> | AIC 18000A | J 600Amax. | 250MCM × 3 | AWG 2/0 |

| Voltage class | Applicable motor [kW] | Inverter type | UL Output current *1 *2 | AIC (A) (Interrupting capacity) | Fuse class and current (A) | Power wire sizes | Grounding wire sizes *3 |
|------------------|-----------------------|---------------|-------------------------------|---------------------------------------|----------------------------|------------------|-------------------------------|
| 3-phase 480 V | 280 | VFAS3-4280KPC | 550.0 <f300>="2.5"</f300> | AIC 30000A | T 800Amax. | 350 MCM × 3 | AWG 3/0 |

- *1 The UL rated output current is different from the inverter unit rated output current.
- *2 The UL rated output current is the one when the carrier frequency <F300> is equal to less than the value in the table.
- *3 The wire size is the one when 75°C is continuously allowed (ambient temperature of 40°C or less).

ND rating

| Voltage class | Applicable motor [kW] | Inverter type | UL Output current *1 *2 | AIC (A) (Interrupting capacity) | Fuse class and current (A) | Power wire sizes | Grounding wire sizes |
|------------------|-----------------------|---------------|-------------------------------|---------------------------------------|----------------------------|------------------|----------------------|
| 3-phase 240 V | 0.75 | VFAS3-2004P | 4.6 <f300>="4"</f300> | AIC 5000A | J 6Amax. | AWG 14 | AWG 14 |
| | 1.5 | VFAS3-2007P | 8.0 <f300>="4"</f300> | AIC 5000A | J 10Amax. | AWG 14 | AWG 14 |
| | 2.2 | VFAS3-2015P | 11.2 <f300>="4"</f300> | AIC 5000A | J 15Amax. | AWG 14 | AWG 14 |
| | 4.0 | VFAS3-2022P | 18.7 <f300>="4"</f300> | AIC 5000A | J 25A max. | AWG 10 | AWG 12 |
| | 5.5 | VFAS3-2037P | 25.4 <f300>="4"</f300> | AIC 5000A | J 35Amax. | AWG 8 | AWG 10 |
| | 7.5 | VFAS3-2055P | 32.7 <f300>="4"</f300> | AIC 5000A | J 45Amax. | AWG 8 | AWG 10 |
| | 11 | VFAS3-2075P | 46.8 <f300>="4"</f300> | AIC 5000A | J 60Amax. | AWG 6 | AWG 10 |
| | 15 | VFAS3-2110P | 63.4 <f300>="4"</f300> | AIC 5000A | J 90Amax. | AWG 4 | AWG 10 |
| | 18.5 | VFAS3-2150P | 78.4 <f300>="4"</f300> | AIC 5000A | J 110Amax. | AWG 2 | AWG 8 |
| | 22 | VFAS3-2185P | 92.6 <f300>="4"</f300> | AIC 5000A | J 125Amax. | AWG 1 | AWG 8 |
| | 30 | VFAS3-2220P | 123.0 <f300>="2.5"</f300> | AIC 5000A | J 150Amax. | AWG 2/0 | AWG 6 |
| | 37 | VFAS3-2300P | 149.0 <f300>="2.5"</f300> | AIC 5000A | J 175Amax. | AWG 3/0 | AWG 6 |
| | 45 | VFAS3-2370P | 176.0 <f300>="2.5"</f300> | AIC 5000A | J 225Amax. | 250MCN | AWG 6 |
| | 55 | VFAS3-2450P | 211.0 <f300>="2.5"</f300> | AIC 10000A | AR 315Amax. | AWG 2/0 × 2 | AWG 6 |
| | 75 | VFAS3-2550P | 282.0 <f300>="2.5"</f300> | AIC 10000A | AR 350Amax. | AWG 3/0 × 2 | AWG 4 |

| Voltage class | Applicable motor [kW] | Inverter type | UL Output current *1 *2 | AIC (A) (Interrupting capacity) | Fuse class and current (A) | Power wire sizes | Grounding wire sizes *3 |
|------------------|-----------------------|---------------|-------------------------------|---------------------------------------|----------------------------|------------------|-------------------------------|
| 3-phase 480 V | 0.75 | VFAS3-4004PC | 2.2 <f300>="4"</f300> | AIC 5000A | J 3Amax. | AWG 14 | AWG 14 |
| | 1.5 | VFAS3-4007PC | 4.0 <f300>="4"</f300> | AIC 5000A | J 6Amax. | AWG 14 | AWG 14 |
| | 2.2 | VFAS3-4015PC | 5.6 <f300>="4"</f300> | AIC 5000A | J 10Amax. | AWG 14 | AWG 14 |
| | 4.0 | VFAS3-4022PC | 9.3 <f300>="4"</f300> | AIC 5000A | J 15Amax. | AWG 14 | AWG 14 |
| | 5.5 | VFAS3-4037PC | 12.7 <f300>="4"</f300> | AIC 5000A | J 15Amax. | AWG 12 | AWG 14 |
| | 7.5 | VFAS3-4055PC | 16.5 <f300>="4"</f300> | AIC 5000A | J 20Amax. | AWG 10 | AWG 14 |
| | 11 | VFAS3-4075PC | 23.5 <f300>="4"</f300> | AIC 5000A | J 30Amax. | AWG 10 | AWG 10 |
| | 15 | VFAS3-4110PC | 31.7 <f300>="4"</f300> | AIC 5000A | J 40Amax. | AWG 8 | AWG 10 |
| | 18.5 | VFAS3-4150PC | 39.2 <f300>="4"</f300> | AIC 5000A | J 50Amax. | AWG 8 | AWG 10 |
| | 22 | VFAS3-4185PC | 46.3 <f300>="4"</f300> | AIC 5000A | J 60Amax. | AWG 6 | AWG 10 |
| | 30 | VFAS3-4220PC | 61.5 <f300>="4"</f300> | AIC 5000A | J 80Amax. | AWG 4 | AWG 10 |
| | 37 | VFAS3-4300PC | 74.5 <f300>="4"</f300> | AIC 5000A | J 100Amax. | AWG 3 | AWG 8 |
| | 45 | VFAS3-4370PC | 88.0 <f300>="4"</f300> | AIC 10000A | J 110Amax. | AWG 1 | AWG 8 |
| | 55 | VFAS3-4450PC | 106.0 <f300>="2.5"</f300> | AIC 10000A | J 150Amax. | AWG 1/0 | AWG 6 |
| | 75 | VFAS3-4550PC | 145.0 <f300>="2.5"</f300> | AIC 10000A | J 200Amax. | AWG 3/0 | AWG 6 |
| | 90 | VFAS3-4750PC | 173.0 <f300>="2.5"</f300> | AIC 10000A | J 225Amax. | 250MCN | AWG 6 |
| | 110 | VFAS3-4900PC | 211.0 <f300>="2.5"</f300> | AIC 10000A | AR 250Amax. | AWG 1/0 × 2 | AWG 4 |
| | 132 | VFAS3-4110KPC | 250.0 <f300>="2.5"</f300> | AIC 10000A | AR 315Amax. | AWG 2/0 × 2 | AWG 4 |
| | 160 | VFAS3-4132KPC | 302.0 <f300>="2.5"</f300> | AIC 18000A | AR 350Amax. | AWG 4/0 × 2 | AWG 4 |
| | 220 | VFAS3-4160KPC | 427.0 <f300>="2.5"</f300> | AIC 18000A | J 500Amax. | 350MCN × 2 | AWG 2/0 |
| | 250 | VFAS3-4200KPC | 481.0 <f300>="2.5"</f300> | AIC 18000A | J 600Amax. | 250MCN × 3 | AWG 2/0 |
| | 280 | VFAS3-4220KPC | 550.0 <f300>="2.5"</f300> | AIC 18000A | J 600Amax. | 300MCM × 3 | AWG 3/0 |

| Voltage class | Applicable motor [kW] | Inverter type | UL Output current *1 *2 | AIC (A) (Interrupting capacity) | Fuse class and current (A) | Power wire sizes | Grounding wire sizes *3 |
|------------------|-----------------------|---------------|-------------------------------|---------------------------------------|----------------------------|------------------|-------------------------------|
| 3-phase 480 V | 315 | VFAS3-4280KPC | 616.0 <f300>="2.5"</f300> | AIC 30000A | T 800Amax. | 350 MCM × 3 | AWG 3/0 |

- *1 The UL rated output current is different from the inverter unit rated output current.
- *2 The UL rated output current is the one when the carrier frequency <F300> is equal to less than the value in the table.
- *3 The wire size is the one when 75°C is continuously allowed (ambient temperature of 40°C or less).
 - The input withstand rating is obtained with heat calculation. If the fuse is installed to a circuit with larger input withstand rating, a reactor should be installed so that the input withstand rating should be reduced below this level.
 - Output interrupt rating varies depending on the type of integral solid state short circuit. Install the fuse according to the NEC standard, local standard and type of installation.
 - · Use a fuse of Cooper Bussmann or Mersen.
 - Be sure to use rod crimp-style terminals for the grounding terminals of the heat sink and metal plate of the inverter.

9. 2. 4 Overload protection

The overload protection levels are below,

Frame size

HD rating: 150%-1minute, 185%-2s ND rating: 120%-1minute, 150%-2s

For the rated current, refer to the name plate.

9. 2. 5 Motor thermal protection

To use the electronic thermal function of this inverter for motor thermal protection, set parameters according to the motor specifications applied. For details, refer to [5. 1. 5].

When operating multiple motors with one inverter, install overload relay for each motor.

9. 2. 6 Motor PTC thermal protection

For details, refer to [6. 30. 19]

9. 2. 7 Compliance with UL Standard and CSA Standard

For details, refer to Appendix of this instruction manual.

9. 3 Compliance with safety standards

For details, refer to "VF-AS3 Safety function manual" (E6582068).

10

Selection and installation of peripheral devices

In this chapter, the selection and installation methods of peripheral devices for this inverter are described.

A WARNING



Mandatory action

- All options to be used must be those specified by Toshiba.
 The use of options other than those specified by Toshiba will result in an accident.
- In using a power distribution device and options for the inverter, they must be installed in a cabinet.

When they are not installed in the cabinet, this will result in electric shock.



Be sure to connect the grounding wire.

The grounding wire must be connected securely.
 If the grounding wire is not securely connected, when the inverter has failure or earth leakage, this will result in electric shock or fire.

10. 1 Selection of wire size

According to the voltage class and capacity of the inverter, perform wiring using appropriate wires as shown in the table below. When connecting peripheral devices to the inverter also, perform wiring according to the wire size for a wire location shown in the table below.

- The wire size is a value when using a 600 V HIV insulation wire (copper wire with the maximum allowable temperature 75 °C of an insulator) with 50 °C ambient temperature and 30 m or less the length of each wire.
- For the wire of the control circuit, use a shielded wire with 0.75 mm² or more.

Ι

П

4

2

3

4

5

b

/

8

10

13

L4

T2

16

■Wire size for HD rating

| | | | | | | Wire size (n | nm²) | |
|---------|------------|----------|-----------|-------|---------|--------------|------------------------|----------|
| Voltage | Applicable | Inverter | type-form | Power | circuit | | Braking | Ground- |
| class | motor (kW) | | | Input | Output | DC wire | resistor (Optional) | ing wire |
| 3-phase | 0.4 | VFAS3- | 2004P | 1.5 | 1.5 | 2.5 | 1.5 | 2.5 |
| 240 V | 0.75 | | 2007P | 1.5 | 1.5 | 2.5 | 1.5 | 2.5 |
| | 1.5 | | 2015P | 1.5 | 1.5 | 2.5 | 1.5 | 2.5 |
| | 2.2 | | 2022P | 1.5 | 1.5 | 2.5 | 1.5 | 2.5 |
| | 4.0 | | 2037P | 2.5 | 4 | 2.5 | 1.5 | 4 |
| | 5.5 | | 2055P | 4 | 6 | 4 | 1.5 | 6 |
| | 7.5 | | 2075P | 6 | 10 | 6 | 2.5 | 10 |
| | 11 | | 2110P | 10 | 16 | 10 | 4 | 16 |
| | 15 | | 2150P | 16 | 25 | 16 | 6 | 16 |
| | 18.5 | | 2185P | 25 | 35 | 25 | 10 | 16 |
| | 22 | | 2220P | 35 | 50 | 35 | 16 | 25 |
| | 30 | | 2300P | 50 | 70 | 50 | 25 | 35 |
| | 37 | | 2370P | 70 | 95 | 70 | 35 | 50 |
| | 45 | | 2450P | 95 | 120 | 95 | 50 | 70 |
| | 55 | | 2550P | 120 | 70x2 | 120 | 50 | 95 |
| 3-phase | 0.4 | VFAS3- | 4004PC | 1.5 | 1.5 | 2.5 | 1.5 | 2.5 |
| 480 V | 0.75 | | 4007PC | 1.5 | 1.5 | 2.5 | 1.5 | 2.5 |
| | 1.5 | | 4015PC | 1.5 | 1.5 | 2.5 | 1.5 | 2.5 |
| | 2.2 | | 4022PC | 1.5 | 1.5 | 2.5 | 1.5 | 2.5 |
| | 4.0 | | 4037PC | 1.5 | 1.5 | 2.5 | 1.5 | 2.5 |
| | 5.5 | | 4055PC | 1.5 | 2.5 | 2.5 | 1.5 | 2.5 |
| | 7.5 | | 4075PC | 2.5 | 4 | 2.5 | 1.5 | 2.5 |
| | 11 | | 4110PC | 4 | 6 | 4 | 1.5 | 4 |
| | 15 | | 4150PC | 6 | 10 | 6 | 2.5 | 10 |
| | 18.5 | | 4185PC | 10 | 10 | 10 | 2.5 | 10 |
| | 22 | | 4220PC | 16 | 16 | 10 | 4 | 16 |
| | 30 | | 4300PC | 25 | 25 | 16 | 6 | 16 |
| | 37 | | 4370PC | 25 | 35 | 25 | 10 | 16 |
| | 45 | | 4450PC | 35 | 35 | 35 | 16 | 16 |
| | 55 | | 4550PC | 50 | 50 | 50 | 16 | 25 |
| | 75 | | 4750PC | 95 | 95 | 70 | 35 | 50 |
| | 90 | | 4900PC | 120 | 120 | 95 | 35 | 70 |
| | 110 | | 4110KPC | 70x2 | 70x2 | 70x2 | 50 | 95 |
| | 132 | | 4132KPC | 70x2 | 70x2 | 70x2 | 70 | 95 |
| | 160 | | 4160KPC | 120x2 | 95x2 | 150x2 | 95 | 120 |
| | 220 | | 4200KPC | 150x2 | 120x2 | 150x3 | 150 | 150 |
| | 250 | | 4220KPC | 150x3 | 120x2 | 150x3 | 150 | 150 |
| | 280 | | 4280KPC | 150x3 | 185x2 | 150x4 | 150 | 120x2 |

■Wire size for ND rating

| | | | | | | Wire size (n | nm²) | |
|---------|-----------------------|----------|-----------|-------|---------|--------------|------------------------|----------|
| Voltage | Applicable motor (kW) | Inverter | type-form | Power | circuit | | Braking | Ground- |
| class | motor (kvv) | | | Input | Output | DC wire | resistor (Optional) | ing wire |
| 3-phase | 0.75 | VFAS3- | 2004P | 1.5 | 1.5 | 2.5 | 1.5 | 2.5 |
| 240 V | 1.5 | | 2007P | 1.5 | 1.5 | 2.5 | 1.5 | 2.5 |
| | 2.2 | | 2015P | 1.5 | 1.5 | 2.5 | 1.5 | 2.5 |
| | 4.0 | | 2022P | 2.5 | 4 | 2.5 | 1.5 | 4 |
| | 5.5 | | 2037P | 4 | 6 | 4 | 1.5 | 6 |
| | 7.5 | | 2055P | 6 | 10 | 6 | 2.5 | 10 |
| | 11 | | 2075P | 10 | 16 | 10 | 4 | 16 |
| | 15 | | 2110P | 16 | 25 | 16 | 6 | 16 |
| | 18.5 | | 2150P | 25 | 35 | 25 | 10 | 16 |
| | 22 | | 2185P | 35 | 50 | 35 | 16 | 25 |
| | 30 | | 2220P | 50 | 70 | 50 | 25 | 35 |
| | 37 | | 2300P | 70 | 95 | 70 | 35 | 50 |
| | 45 | | 2370P | 95 | 120 | 95 | 50 | 70 |
| | 55 | | 2450P | 70x2 | 70x2 | 50x2 | 50 | 95 |
| | 75 | | 2550P | 95x2 | 95x2 | 70x2 | 70 | 120 |
| 3-phase | 0.75 | VFAS3- | 4004PC | 1.5 | 1.5 | 2.5 | 1.5 | 2.5 |
| 480 V | 1.5 | | 4007PC | 1.5 | 1.5 | 2.5 | 1.5 | 2.5 |
| | 2.2 | | 4015PC | 1.5 | 1.5 | 2.5 | 1.5 | 2.5 |
| | 4.0 | | 4022PC | 1.5 | 1.5 | 2.5 | 1.5 | 2.5 |
| | 5.5 | | 4037PC | 1.5 | 2.5 | 2.5 | 1.5 | 2.5 |
| | 7.5 | | 4055PC | 2.5 | 4 | 2.5 | 1.5 | 2.5 |
| | 11 | | 4075PC | 4 | 6 | 4 | 1.5 | 4 |
| | 15 | | 4110PC | 6 | 10 | 6 | 2.5 | 10 |
| | 18.5 | | 4150PC | 10 | 10 | 10 | 2.5 | 10 |
| | 22 | | 4185PC | 10 | 16 | 10 | 4 | 16 |
| | 30 | | 4220PC | 16 | 25 | 16 | 6 | 16 |
| | 37 | | 4300PC | 25 | 35 | 25 | 10 | 16 |
| | 45 | | 4370PC | 35 | 35 | 35 | 16 | 16 |
| | 55 | | 4450PC | 50 | 50 | 50 | 16 | 25 |
| | 75 | | 4550PC | 70 | 95 | 70 | 35 | 50 |
| | 90 | | 4750PC | 95 | 120 | 95 | 35 | 70 |
| | 110 | | 4900PC | 50x2 | 50x2 | 70x2 | 35 | 95 |
| | 132 | | 4110KPC | 70x2 | 70x2 | 70x2 | 50 | 95 |
| | 160 | | 4132KPC | 95x2 | 95x2 | 95x2 | 70 | 120 |
| | 220 | | 4160KPC | 150x2 | 150x2 | 150x2 | 95 | 150 |
| | 250 | | 4200KPC | 150x2 | 120x2 | 150x2 | 150 | 150 |
| | 280 | | 4220KPC | 150x3 | 120x3 | 150x3 | 150 | 120x2 |
| | 315 | | 4280KPC | 150x3 | 150x3 | 150x3 | 150 | 120x2 |

Memo

- The wire size of this chapter comply with IEC60364-5-52 (Grounding wire: IEC60364-5-54). It does not comply with UL Standard.
- For the wire size to comply with UL Standard, refer to [9. 2. 3].

10. 2 Selection of a wiring device

According to the table [10. 2. 1], select an appropriate wiring device depending on the voltage class and capacity of the inverter.

10. 2. 1 Selection table of a wiring device

Select a wiring device depending on the inverter type and input current in the table next.

■ Wiring devices for HD rating

| | | | | | Rated cu | urrent (A) | |
|------------------|-----------------------|----------|--------------------------------------|-------|--|-------------------------|-------|
| Voltage class | Applicable motor (kW) | Inverter | Inverter type-form Input current (A) | | Molded-case circuit breaker (MCCB) Earth leakage circuit breaker (ELCB) | Magnetic contactor (MC) | |
| 3-phase | 0.4 | VFAS3- | 2004P | 1.7 | 3 | 20 | |
| 240 V | 0.75 | | 2007P | 3.3 | 5 | 20 | |
| | 1.5 | | 2015P | 6.0 | 10 | 20 | |
| | 2.2 | | 2022P | 9.0 | 15 | 20 | |
| | 4.0 | | 2037P | 15.1 | 20 | 20 | |
| | 5.5 | | 2055P | 20.1 | 30 | 32 | |
| | 7.5 | | 2075P | 27.3 | 40 | 32 | |
| | 11 | | 2110P | 40.0 | 50 | 50 | |
| | 15 | | 2150P | 53.2 | 75 | 60 | |
| | 18.5 | | 2185P | 64.8 | 100 | 80 | |
| | 22 | | 2220P | 78.3 | 100 | 80 | |
| | 30 | | 2300P | 104.7 | 150 | 150 | |
| | 37 | | | 2370P | 128.4 | 175 | 200 |
| | 45 | | | | | 2450P | 157.6 |
| | 55 | | 2550P | 189.0 | 250 | 260 | |

| | | | | | Rated co | urrent (A) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|------------------|-----------------------|----------|-----------|-------------------|--|-------------------------|---|---|--|--|--|--------|------|----|----|--|--|--|--|---------|-------|-----|-----|--|--|--|---|---|---|---|--|--|--------|-------|-----|-----|
| Voltage class | Applicable motor (kW) | Inverter | type-form | Input current (A) | Molded-case circuit breaker (MCCB) Earth leakage circuit breaker (ELCB) | Magnetic contactor (MC) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3-phase | 0.4 | VFAS3- | 4004PC | 0.9 | 3 | 20 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 480 V | 0.75 | | 4007PC | 1.8 | 3 | 20 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1.5 | | 4015PC | 3.2 | 5 | 20 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 2.2 | | 4022PC | 4.9 | 10 | 20 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 4.0 | | 4037PC | 8.3 | 10 | 20 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 5.5 | | 4055PC | 10.9 | 15 | 20 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 7.5 | | 4075PC | 14.7 | 20 | 20 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 11 | | 4110PC | 21.4 | 30 | 32 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 15 | | 4150PC | 28.9 | 40 | 32 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 18.5 | | 4185PC | 35.4 | 50 | 50 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 22 | | | | | | | | | | | 4220PC | 42.1 | 60 | 50 | | | | | | | | | | | | | | | | | | | | | |
| | 30 | | 4300PC | 57.1 | 75 | 60 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 37 | | 4370PC | 69.9 | 100 | 80 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 45 | | 4450PC | 84.8 | 125 | 100 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 55 | | | | | | | | | | | | | | | | | | | | ı | | | | | | - | _ | _ | - | | | 4550PC | 103.3 | 125 | 135 |
| | 75 | | 4750PC | 139.8 | 175 | 200 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 90 | | 4900PC | 170.2 | 225 | 260 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 110 | _ | _ | - | | - | - | - | | | | | | _ | - | | | | | 4110KPC | 203.5 | 250 | 260 | | | | | | | | | | | | | |
| | 132 | | 4132KPC | 240.3 | 300 | 260 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 160 | | 4160KPC | 290.0 | 350 | 350 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 220 | | 4200KPC | 360.0 | 500 | 450 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 250 | | 4220KPC | 395.0 | 500 | 450 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 280 | | 4280KPC | 495.0 | 700 | 660 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

■Wiring devices for ND rating

| | | | | | Rated co | urrent (A) |
|------------------|-----------------------|----------|-----------|-------------------|--|-------------------------|
| Voltage class | Applicable motor (kW) | Inverter | type-form | Input current (A) | Molded-case circuit breaker (MCCB) Earth leakage circuit breaker (ELCB) | Magnetic contactor (MC) |
| 3-phase | 0.75 | VFAS3- | 2004P | 3.0 | 5 | 20 |
| 240 V | 1.5 | | 2007P | 5.9 | 10 | 20 |
| | 2.2 | | 2015P | 8.5 | 15 | 20 |
| | 4.0 | | 2022P | 15.1 | 20 | 20 |
| | 5.5 | | 2037P | 20.2 | 30 | 32 |
| | 7.5 | | 2055P | 27.1 | 40 | 32 |
| | 11 | | 2075P | 39.3 | 50 | 50 |
| | 15 | | 2110P | 53.0 | 75 | 60 |
| | 18.5 | | 2150P | 65.1 | 100 | 80 |
| | 22 | | 2185P | 76.0 | 100 | 80 |
| | 30 | | 2220P | 104.7 | 150 | 150 |
| | 37 | | 2300P | 128.0 | 175 | 200 |
| | 45 | | 2370P | 154.7 | 200 | 260 |
| | 55 | | 2450P | 191.9 | 250 | 260 |
| | 75 | | 2550P | 256.0 | 350 | 350 |
| 3-phase | 0.75 | VFAS3- | 4004PC | 1.6 | 3 | 20 |
| 480 V | 1.5 | | 4007PC | 3.1 | 5 | 20 |
| | 2.2 | | 4015PC | 4.5 | 10 | 20 |
| | 4.0 | | 4022PC | 8.0 | 10 | 20 |
| | 5.5 | | 4037PC | 10.8 | 15 | 20 |
| | 7.5 | | 4055PC | 14.4 | 20 | 20 |
| | 11 | | 4075PC | 20.8 | 30 | 32 |
| | 15 | | 4110PC | 28.3 | 40 | 32 |
| | 18.5 | | 4150PC | 34.9 | 50 | 50 |
| | 22 | | 4185PC | 41.4 | 50 | 50 |
| | 30 | | 4220PC | 55.9 | 75 | 60 |
| | 37 | | 4300PC | 69.0 | 100 | 80 |
| | 45 | | 4370PC | 83.4 | 125 | 100 |
| | 55 | | 4450PC | 101.9 | 125 | 135 |
| | 75 | | 4550PC | 138.0 | 175 | 200 |
| | 90 | | 4750PC | 165.1 | 200 | 260 |
| | 110 | | 4900PC | 203.5 | 250 | 260 |
| | 132 | | 4110KPC | 240.3 | 300 | 260 |
| | 160 | | 4132KPC | 284.2 | 350 | 350 |
| | 220 | | 4160KPC | 395.0 | 500 | 450 |
| | 250 | | 4200KPC | 444.0 | 500 | 450 |
| | 280 | | 4220KPC | 495.0 | 700 | 660 |
| | 315 | | 4280KPC | 555.0 | 1000 | 660 |

- Install a surge absorber on the exciting coil of a magnetic contactor (MC) and relays.
- When using an auxiliary contacts 2a type magnetic contactor (MC), use the 2a contacts in parallel to increase the liability of the contacts.
- Selection is for assuming a normal power supply capacity and using a Toshiba 4-pole standard motor with input power 200 V/400 V-50 Hz.
- For the influence of the leakage current, refer to [2. 4. 3].

10. 2. 2 Installation of a molded-case circuit breaker (MCCB) and earth leakage circuit breaker (ELCB)

For protection of the wiring system, install a molded-case circuit breaker (MCCB) between the power supply and the inverter (primary side).

An earth leakage current breaker (ELCB) that is equipped with a function to shut off by detecting leakage current can be also installed. However, be cautious that an earth leakage circuit breaker (ELCB) may operate improperly, because the leakage current becomes large due to the influence of a wiring method, a built-in noise filter, etc.

Because the short-circuit current is different with power supply capacity and wiring system conditions, select molded-case circuit breaker (MCCB) or earth leakage circuit breaker (ELCB) depending on the inverter type and input current in the table [10. 2. 1].

Memo

• When complying with UL Standard and CSA Standard, a fuse needs to be installed on the primary side of the inverter. For details, refer to [9. 2. 3].

10. 2. 3 Installation of a magnetic contactor (MC)

When installing a magnetic contactor (MC) on the primary or secondary side of the inverter, select following the below.

Installation on the primary side

When the power side and the inverter need to be detached in the following cases, install a magnetic contactor (MC) between the power supply and the inverter (primary side).

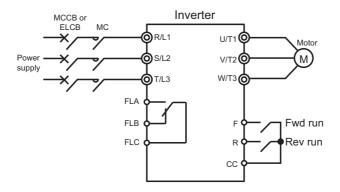
Select a magnetic contactor (MC) depending on the inverter type and input current in the table [10. 2. 1].

- · Thermal relay on the motor is activated
- Protection detection relay (FL) inside the inverter is activated
- Not to automatically restart at restoration of power after power failure
- When using the braking resistor (option), the thermal relay of the braking resistor is activated

To open the power circuit (primary side) when the protective function detection relay inside the inverter is activated, the molded-case circuit breaker (MCCB) with a power cutoff device can be installed instead of magnetic contactors (MC). Make sure the molded-case circuit breaker (MCCB) trips at the contact of protection detection relay.

A connection example for installing the primary-side magnetic contactor (MC) is shown next.

Sink logic





- Do not run/stop the inverter by turning the magnetic contactor (MC) installed on the primary side ON/OFF. When run/stop the inverter, set the terminal [F] (forward) or terminal [R] (reverse) of the control terminal ON/OFF.
- Install a surge absorber on the exciting coil of a magnetic contactor (MC).

Installation on the secondary side

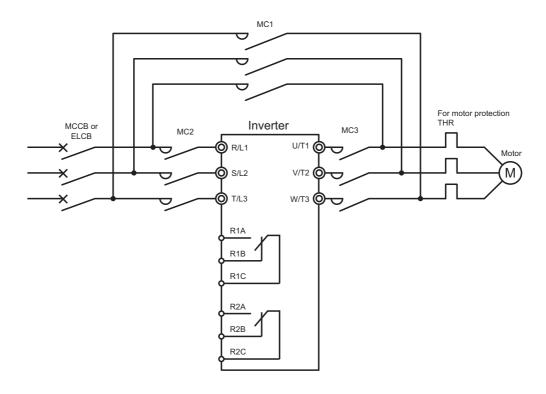
To switch the motor during the inverter is stopped, and change the motor power, a magnetic contactor (MC) can be installed between the inverter and motor (secondary side).

When operating the motor with commercial power supply by switching the circuit and not through the inverter, select a magnetic contactor (MC) with AC-3 Class and confirming to the motor rated current.

A connection example for installing the secondary-side magnetic contactor (MC) is shown next.

VF-AS3

Sink logic





- Be sure to have interlock for the commercial power supply is applied to the inverter output terminal.
- Do not turn the magnetic contactor (MC) in the secondary circuit ON/OFF during run. It can cause failure due to rush current flowing to the inverter.
- Install a surge absorber on the exciting coil of a magnetic contactor (MC).

10. 2. 4 Installation of a thermal relay (THR)

Use an electronic thermal protector of the inverter for motor overload protection. Set a motor overload protection level with a parameter according to the motor rating.

However, in the following cases, install a thermal relay (THR) between the inverter and motor (secondary side).

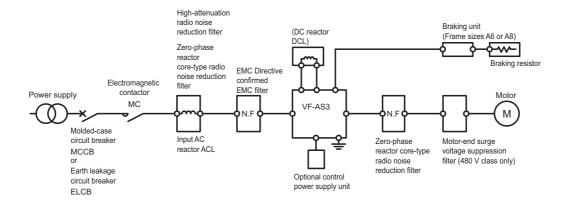
- Running multiple motors simultaneously with one inverter. In this case, install a thermal relay on each motor.
- Running a motor with smaller output than applicable motor output of the standard specification (When the motor capacity is too small to set with a parameter of the motor overload protection level).

For details on motor overload protection level, refer to [5. 2. 5].

To give sufficient protection for the motor running in a low-speed range, the use of a motor with motor winding embedded type thermal relay is recommended.

10.3 External options

This inverter provides external options shown in the next figure.



Functions, purposes, notes, etc. of individual external option are explained next. External options are shown in [10. 3. 10].

10. 3. 1 Input AC reactor, (DC reactor)

Input AC reactor is used for improving input power factor on the inverter power side (primary side), reducing harmonics or restriction of surge voltage.

It is also installed when the power supply capacity is 500 kVA or more and is 10 times or more of the inverter capacity, and when devices that cause distorted waves (a device with thyristor, etc.) and a large capacity inverter is connected on the same power distribution line. Install an input AC reactor between the power supply and the inverter (primary side).

A DC reactor is a reactor to connect with the DC terminal, and used for improving input power factor and reducing harmonics. It has better power factor improvement effect than an input AC reactor. When a facility applying the inverter requires high reliability, it is recommended to use with an input AC reactor that has surge voltage restriction effect.

However, the frame size A1 to A6 of the inverter has a built-in DC reactor as standard, and the frame size A7 and A8 attached with a DC reactor, no option is available.

| | Effect | | | | | |
|------------------|--------------------------|---------------------|---------------------------|--|--|--|
| Туре | Power factor improvement | Harmonics reduction | Surge voltage restriction | | | |
| Input AC reactor | Enabled | Enabled | Enabled | | | |
| DC reactor | Enabled (large) | Enabled (large) | Disabled | | | |

10. 3. 2 Radio noise reduction filter

It is effective for electrical interference to audio equipment, etc. used near the inverter.

■ High-attenuation radio noise reduction filter

- It is a LC filter installed on the input side of the inverter.
- It has a wide attenuation characteristic from AM radio band range to around 10 MHz.
- It is used when equipment susceptible to surrounding noise is installed.

■ Zero-phase reactor

- · It is an inductive filter.
- It is effective for noise reduction for both input side and output side of the inverter.
- It has an attenuation characteristic of several dB from AM radio band range to 10 MHz frequency band

10. 3. 3 EMC filter

When installing an EMC filter and wire properly, it can comply with EMC Directive.

480 V model of the inverter has the built-in EMC filter as standard; however, if an EMC filter is added externally, noise reduction becomes more effective. Please contact your Toshiba distributor for details.

10. 3. 4 Braking resistor, Braking unit

It is a resistor to consume regenerative energy from a motor.

When making frequent rapid deceleration and stop, it is used to shorten deceleration time with load in large inertia.

A braking unit is necessary in addition to a braking resistor for the frame size A6 and A8.

For details on using a braking resistor, refer to [6. 15. 4].

10. 3. 5 Motor-end surge voltage suppression filter

When operating a 480 V class general purpose motor with a voltage type PWM control inverter that uses high speed switching element (IGBT, etc.), surge voltage exceeding the insulation level of motor winding is generated depending on power supply voltage, motor wire length and its laying method, and type. When the condition is repeatedly applied for a long time, it may cause deterioration of insulation on the motor.

Such measures as installation of an AC reactor, surge voltage suppression filter, sinusoidal filter on the inverter output side (secondary side), and use of a high insulation strength motor are necessity.

When using a sinusoidal filter, set the carrier frequency to 4.0 to 8.0 kHz.

For details of carrier frequency, refer to [6. 14].

10. 3. 6 Optional control power supply

This inverter supplies control power supply from the power supply inside the inverter. When control power supply is backed up with this option, display and output signal can be maintained in case of power supply shut off.

• It is common with 240 V/480 V class.

• Type-form: CPS002Z

10. 3. 7 LED extension panel option

It is an extension panel for LED display. A specific cable is used to connect between the inverter and LED panel.

When using this panel, remove the standard operation panel, and connect to the RS485 communication connector 1.

• Panel type-form: RKP002Z

Specific cable type-form: CAB0011 (1 m), CAB0013 (3 m), CAB0015 (5 m)

• Panel type-form: RKP007Z

Specific calbe type-form: CAB0071 (1 m), CAB0073 (3 m), CAB0075 (5 m)

10. 3. 8 USB communication conversion unit

It enables to set and manage parameters on a personal computer.

Connect between the RS485 communication connector 1 of the inverter and a personal computer. Use the specific cable for the inverter side, and a commercial USB cable (USB 1.1/2.0 compatible A-B connection type) for a personal computer side. Software PCM001Z for parameter management is required.

- Type-form: USB001Z
- Specific cable type-form: CAB0011 (1 m), CAB0013 (3 m), CAB0015 (5 m)

10. 3. 9 External heatsink option

It reduces heat rising up inside the panel.

10. 3. 10 External option list

External options are shown in the next table.

| Category | Product name | Specification / Ranges | Type-form | Remarks |
|----------------|------------------|---|-----------|-------------|
| Control option | Door mount kit | IP65 kit for operation panel | SBP010Z | Coming soon |
| | 3rd slot adapter | For Safety option & For using case of 3 options | SBP011Z | Coming soon |

| Category | Product name | Specification / Ranges | Type-form | Remarks |
|--------------|------------------------------------|---|-----------------------|-------------|
| Power option | Push through mounting kit | For Frame size A1 to A5 | FOT018Z to FOT022Z | |
| | Push through mounting kit | For Frame size A6 | FOT023Z | Coming soon |
| | Push through mounting kit | For Frame size A7 | FOT013Z | |
| | Push through mounting kit | For Frame size A8 | FOT014Z | |
| | EMC noise filter | For Frame size A1 to A6 | xxxx *1 | Coming soon |
| | EMC noise filter | For Frame size A7 | EMF3-4300I | |
| | EMC noise filter | For Frame size A8 | EMF3-4600J | |
| | Braking unit | For Frame size A6 | PB7-4132K | Coming soon |
| | Braking unit | For Frame size A8 | PB7-4200K | |
| | Braking resistor | All ranges | PBR-xxxx*1 | |
| | Input reactor | All ranges | PFL-xxxxS*1 | |
| | Motor end surge suppression filter | 480 V all ranges | MSF-4xxxZ*1 | |
| | Sinusoidal output filter | All ranges | SWF-4xxxZ*1 | |
| Others | LED extension panel | Big LED keypad | RKP002Z | |
| | LED extension panel | Small LED keypad | RKP007Z | |
| | Control power supply unit | DC24V backup option | CPS002Z | |
| | USB communication conversion unit | Converter between RS485 (Inverter) and USB (PC) | USB001Z | |

^{*1} xxx (number) varies depending on capacity.

10. 4 Insert type options

This inverter is equipped with two option slots (A, B) as standard. The option 3 slot adapter (option) can be mounted.

10. 4. 1 Insert type options and functions

Cassette options are available as shown in the next table.

Cassette options

| Name | Specification | Type-form | Slot availability | Remarks |
|-------------------|--|-------------------------------|-------------------|-------------|
| I/O extension (1) | 6x digital input 2x digital output 2x analog input | ETB013Z | A, B, C | |
| I/O extension (2) | 3x 1a relay | ETB014Z | A, B ,C | |
| Digital encoder | RS422 Line receiver | VEC008Z | В | |
| Resolver | Resolver | VEC010Z | В | Coming soon |
| Safety module | SS1, SS2, SOS, SBC, SMS, SLS, SDI, SSM | SFT001Z | С | Coming soon |
| PROFINET | PROFINET interface | PNE001Z | Α | |
| EtherCAT | EtherCAT interface | IPE003Z | А | Coming soon |
| PROFIBUS-DP | PROFIBUS-DP interface | PDP003Z | А | Coming soon |
| DeveceNet | DeviceNet interface | DEV003Z | А | Coming soon |
| CANopen | CANopen interface RJ45 D-sub Open style | CAN001Z CAN002Z CAN003Z | A | Coming soon |

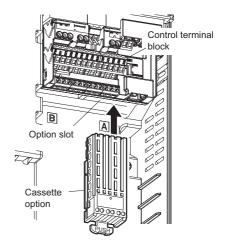
10. 4. 2 Mounting/removing insert type options

WARNING Do not connect any communication options other than supported by option slots. It can cause failure and accident. Mounting/removing options should be performed 15 minutes or more after the power is shut off, and checking the charge lamp of the inverter is OFF. The inverter and options may be damaged. Do not use tools for mounting/removing options. The inverter and options may be damaged.

Mounting/removing methods of a cassette option to the option slot A, B are as follows. When using the option slot 3, refer to [10. 4. 3].

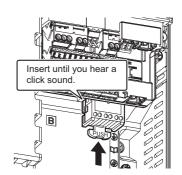
■ Mounting (Option slot A, B)

1 Remove the front cover and other parts. Covers to be removed at the time of wiring vary depending on the frame size. For how to remove, refer to [2. 2].



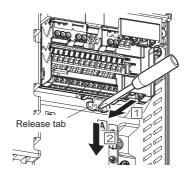
- Insert a cassette option to the option slot A, B until you hear a click sound.
- 3 Perform wiring to the cassette option.
- 4 When wiring is complete, mount the removed cover.

For how to mount them, refer to [2. 2].



■ Removing (Option slot A, B)

- Remove the front cover and other parts.
 Covers to be removed vary depending on the frame size.
 For how to remove, refer to [2. 2].
- 2 Remove wiring to the cassette option.
- While pressing the release tab down, pull the cassette option to remove from the option slot.



4 Mount the removed covers. For how to mount them, refer to [2. 2].



Important

- Do not use excessive force to press a cassette option to the option slot, or the connector pin may be damaged. Along the guide, insert straight slowly.
- Depending on a cassette option, insertion to the option slot A, B may not be possible. Refer to [10. 4. 1].
- In the case of frame size A7 or A8, remove the wire-holding fitting mounted at the lower part of the option slot A, B before inserting/removing the cassette option.

10. 4. 3 Mounting/removing the option 3 slot adapter

Mounting/removing methods of the option 3 slot adapter are as follows.

Mounting and removing methods of a cassette option is the same with option slot A, B. For details, refer to [10. 4. 2].

Mounting method

1 Remove the front covers and other parts in advance.

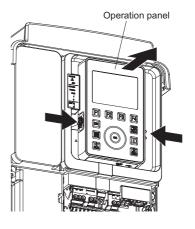
Covers to be removed at the time of wiring vary depending on the frame size.

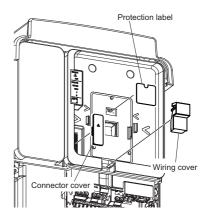
For how to remove, refer to [2. 2].

While pressing the PUSH part located on both right and left side of the operation panel, pull the operation panel straight upward.

The operation panel is connected to the unit with the connector on the center of back side.

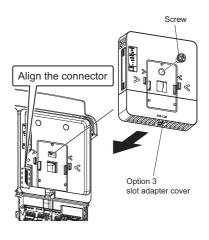
- 3 Remove the protection label.
- 4 Remove the option connector cover.
 Store the removed parts so as not to be lost.
- 5 Remove the option wiring cover.
 The option wiring cover can be removed by fingers.
 Store the removed parts so as not to be lost.

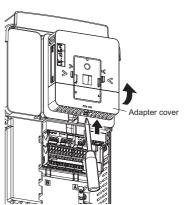




- 6 Match the position of the option 3 slot adapter cover connector and the unit, and mount the option 3 slot adapter.
- 7 Tighten a screw.

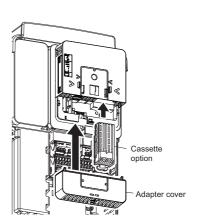
8 Insert a screwdriver, etc. to the lock removal hole of the option 3 slot adapter cover to push and unlock, and remove the option 3 slot adapter cover upward.





In this state, a cassette option can be inserted to the option 3 slot.

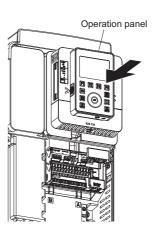
Using the groove of removed option wiring cover, perform wiring of the cassette option.



9 After wiring is complete, mount the option 3 slot adapter cover on the option 3 slot adapter. Be cautious that the wiring of the cassette option does not get pinched by the option 3 slot adapter cover.

The removed operation panel can be installed on top surface of the option 3 slot adapter.

10 Mount the removed covers. For how to mount them, refer to [2. 2].



Removing method

Remove the front cover and other parts.
 Covers to be removed vary depending on the frame

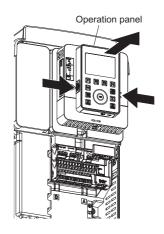
For how to remove, refer to [2. 2].

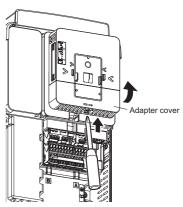
While pressing the PUSH part located on both right and left side of the operation panel, pull the operation panel straight upward.

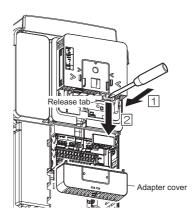
The operation panel is connected with the connector on the center of back side to the option 3 slot adapter.

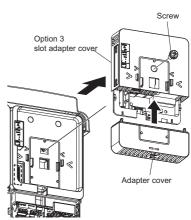
- Insert a screwdriver, etc. to the lock removal hole of the option 3 slot adapter cover to push and unlock, and remove the option 3 slot adapter cover of the option 3 slot adapter.
- 4 Remove wiring to the cassette option.
- While pressing the release tab down, pull the cassette option to remove from the option slot.

- 6 Remove the option 3 slot adapter.
 Store the removed screws so as not to be lost.
- 7 Remove the option 3 slot adapter. To the option 3 slot adapter, mount the option 3 slot adapter cover removed before.





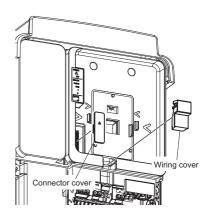


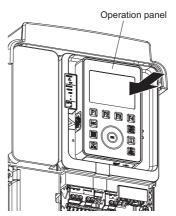


8 Mount the screw protection label, the option connector cover and option wiring cover to each specific position on the unit.

The operation panel can be also mounted to its original position.

9 Mount the removed covers.For how to mount them, refer to [2. 2].





11 Table of parameters

Frequency setting parameter

| Title | Parameter name | Adjustment range | Unit | Minimum setting unit (Panel/Communication) | Default setting | Write during running ^{*6} | User setting | Reference |
|-------|---------------------|------------------|------|--|--------------------|--|-----------------|-----------|
| FC | Panel run frequency | LL - UL | Hz | 0.1/0.01 | 0.0 | Y | - | [4. 3. 1] |

- *1 Parameter values vary depending on the capacity. For details, refer to [11. 6].
- *2 Depending on the setup menu. Refer to [11. 10].
- *3 For details on the analog output and monitor output function, refer to [11. 7].
- *4 Refer to section [11. 8] for details about the input terminal function.
- *5 Refer to section [11. 9] for details about the output terminal function.
- *6 Y: Writable N: Not writable

11. 2 Basic parameter

| Title | Communication No. | Parameter name | Adjustment range | Unit | Minimum setting unit (Panel/ Communication) | Default setting | Write during run-ning*6 | User | Reference |
|-------|-------------------|---------------------------|--|------|--|--------------------|-------------------------|------|--------------------------------------|
| AUH | - | History func- tion | - | - | - | 0 | - | | [4. 2. 1] |
| AUF | 0093 | Guidance function | 0: - 1: Embedded Ethernet setting 2: Preset speed operation 3: Analog frequency command 4: Motor 1, 2 switching 5: Motor parameter 6: PM motor parameter | - | - | 0 | N | | [4. 2. 1] |
| AUA | 0090 | Application easy setting | 0: - 1: Initial easy setting 2: Conveyor 3: Material handling 4: Hoisting 5: Fan 6: Pump 7: Compressor | - | - | 0 | N | | - |
| AUE | 0032 | Eco-standby power setting | 0: - +1: Embedded Ethernet OFF | - | - | 0 | N | | [5. 2. 1] |
| AUL | 0094 | Multi-rating select | 0: - 1: - 2: ND rating (120%-60s) (0 after execution) 3: HD rating (150%-60s) (0 after execution) 4 - 8: - | - | - | 0 | N | | [1. 2] [5. 2. 2] |
| AU1 | 0000 | Automatic Acc/Dec | 0: Disabled 1: Automatic Acc/Dec 2: Automatic Acc only | - | - | 0 | N | | [5. 2. 3] |
| AU2 | 0001 | Torque boost macro | 0: Disabled 1: Automatic torque boost + offline auto-tuning 2: Vector control 1 + offline auto-tuning 3: Energy savings + offline auto-tuning | - | - | 0 | N | | [5. 2. 4] [5. 2. 5] [6. 23. 1] |
| CMOd | 0003 | Run com- mand select | 1: Operation panel, Extension panel 2: Embedded Ethernet 3: RS485 communication (connector 1) 4: RS485 communication (connector 2) 5: Communication option | - | - | 0 | N | | [4. 3. 1] [4. 4. 1] [5. 1. 1] |

11

| Title | Communication No. | Parameter name | Adjustment range | Unit | Minimum setting unit (Panel/ Communication) | Default setting | Write during run-ning*6 | User setting | Reference |
|-------|-------------------|----------------------------------|--|------|--|-------------------|-------------------------|-----------------|---|
| FMOd | 0004 | Frequency command select 1 | 0: - 1: Terminal RR 2: Terminal RX 3: Terminal RI 4: Terminal Al4 (option) 5: Terminal Al5 (option) 6 - 9: - 10: Touch wheel 1 (power off or press OK to save) 11: Touch wheel 2 (press OK to save) 12: Sr0 13,14: - 15: Terminal Up/Down frequency 16: Pulse train 17: High resolution pulse train (option) 18,19: - 20: Embedded Ethernet 21: RS485 communication (connector 1) 22: RS485 communication (connector 2) 23: Communication option | - | - | 1 | N | | [4. 3. 1] [4. 4. 1] [5. 1. 1] [5. 3. 1] [7. 3. 2] [7. 3. 3] [7. 3. 4] |
| Pt | 0015 | V/f Pattern | 0: V/f constant 1: Variable torque 2: Automatic torque boost 3: Vector control 1 4: Energy savings 5: Dynamic energy savings (for fan and pump) 6: PM motor control 7: V/f 5-point setting 8: - 9: Vector control 2 (speed / torque) 10: PG feedback control 11: PG feedback vector control (speed / torque) 12: - | - | - | 0 | N | | [5. 2. 4] [5. 2. 5] [6. 23. 1] [6. 23. 2] |
| vb | 0016 | Manual torque boost 1 | 0.00 - 30.00 | % | | *1 | Y | | [5. 2. 6] |
| vL | 0014 | Base frequency 1 | 15.0 - 590.0 | Hz | | 50.0 / 60.0 *2 | Y | | [5. 1. 2] |
| vLv | 0409 | Base frequency voltage 1 | 240V class: 50-330V 480V class: 50-660V | V | | *2 | Y | | [5. 1. 2] |
| FH | 0011 | Maximum frequency | 30.0 - 590.0 | Hz | | *2 | N | | [5. 1. 3] |
| UL | 0012 | Upper limit frequency | 0.0 - FH | Hz | | 50.0 / 60.0 *2 | Y | | [5. 1. 3] |
| LL | 0013 | Lower limit frequency | 0.0 - UL | Hz | | 0.0 | Y | | [5. 1. 3] [6. 9] |
| ACC | 0009 | Acceleration time 1 | 0.0 - 6000 (600.0) | s | | *1 | Y | | [5. 1. 4] [5. 2. 3] [6. 27. 2] |

| Title | Communication No. | Parameter name | Adjustment range | Unit | Minimum setting unit (Panel/ Communication) | Default setting | Write during run-ning*6 | User | Reference |
|-------|-------------------|---|---|------|--|-----------------|-------------------------|------|--------------------------------------|
| dEC | 0010 | Deceleration time 1 | 0.0 - 6000 (600.0) | s | | *1 | Y | | [5. 1. 4] [5. 2. 3] [6. 27. 2] |
| Sr0 | 0030 | Preset speed 0 | LL - UL | Hz | | 0.0 | Y | | [5. 2. 7] |
| Sr1 | 0018 | Preset speed 1 | LL - UL | Hz | | 0.0 | Y | | |
| Sr2 | 0019 | Preset speed 2 | LL - UL | Hz | | 0.0 | Y | | [4. 4. 3] [5. 2. 7] [6. 28] |
| Sr3 | 0020 | Preset speed 3 | LL - UL | Hz | | 0.0 | Y | | [0. =0] |
| Sr4 | 0021 | Preset speed 4 | LL - UL | Hz | | 0.0 | Y | | |
| Sr5 | 0022 | Preset speed 5 | LL - UL | Hz | | 0.0 | Y | | [5. 2. 7] |
| Sr6 | 0023 | Preset speed 6 | LL - UL | Hz | | 0.0 | Y | | [6. 28] |
| Sr7 | 0024 | Preset speed 7 | LL - UL | Hz | | 0.0 | Y | | |
| FPId | 0025 | PID1 set value | F368 - F367 | Hz | | 0.0 | Y | | [5. 2. 8] [6. 21] |
| Fr | 0008 | Panel Fwd/ Rev run select | 0: Fwd run 1: Rev run 2: Fwd run (switchable F/R by panel) 3: Rev run (switchable F/R by panel) | - | - | 0 | Y | | [4. 3. 2] [5. 2. 9] |
| tHrA | 0031 | Motor over- load protec- tion current 1 | Depending on capacity *1 | Α | | *1 | Y | | [5. 1. 5] |
| OLM | 0017 | Motor over- load protec- tion characteristic | O: Standard motor, OL2, No stall 1: Standard motor, OL2, Stall 2: Standard motor, No OL2 trip, No stall 3: Standard motor, No OL2 trip, Stall 4: Constant torque motor, OL2, No stall 5: Constant torque motor, OL2, Stall 6: Constant torque motor, No OL2 trip, No stall 7: Constant torque motor, No OL2 trip, No stall 7: Constant torque motor, No OL2 trip, Stall | - | - | 0 | Y | | [5. 1. 5] |
| FMSL | 0005 | Terminal FM function | 0 - 162 *3 | - | - | 0 | Y | | [5. 1. 6] |
| FM | 0006 | Terminal FM adjustment | - | - | - | - | Y | | [5. 1. 0] |

| Title | Communication No. | Parameter name | Adjustment range | Unit | Minimum setting unit (Panel/ Communication) | Default setting | Write during run-ning*6 | User setting | Reference |
|-------|-------------------|----------------------------------|---|------|--|--------------------|-------------------------|-----------------|------------|
| tyP | 0007 | Default set- ting | 0: - 1: 50Hz setting 2: 60Hz setting 3: Default setting 1 4: Clear past trips 5: Clear cumulative run time 6: Initialize type form 7: Store user settings 8: Rewrite user settings 9: Clear cumulative fan run time 10,11: - 12: Clear number of starting 13: Default setting 2 (complete initialization) 14: Clear number of external equipment starting | - | - | 0 | Ν | | [5. 1. 9] |
| SEt | 0099 | Region set- ting check | 0: Setup menu starting 1: Japan (read only) 2: Mainly North America (read only) 3: Mainly Asia (read only) 4: Mainly Europe (read only) 5: Mainly China (read only) | - | - | 0 | N | | [5. 2. 10] |
| PSEL | 0050 | Parameter mode select | 0: Setting mode at power on 1: Easy mode at power on 2: Easy mode only | - | - | 0 | Y | | [5. 1. 8] |
| F1 | - | Head of F100 | - | - | - | - | - | | |
| F2 | - | Head of F200 | - | - | - | - | - | | |
| F3 | - | Head of F300 | - | - | - | - | - | | |
| F4 | - | Head of F400 | - | - | - | - | - | | |
| F5 | - | Head of F500 | - | - | - | - | - | | [11. 3] |
| F6 | - | Head of F600 | - | - | - | - | - | | |
| F7 | - | Head of F700 | - | - | - | - | - | | |
| F8 | - | Head of F800 | - | - | - | - | - | | |
| F9 | - | Head of F900 | - | - | - | - | - | | |
| A | - | Start of A | - | - | - | - | - | | [11. 4] |
| C | - | Start of C | - | - | - | - | - | | [11. 5] |
| GrU | - | Changed parameters search & edit | - | - | - | - | - | | - |

^{*1} Parameter values vary depending on the capacity. For details, refer to [11.6].

^{*2} Depending on the setup menu. Refer to [11.10].

^{*3} For details on the analog output and monitor output function, refer to [11.7].

^{*4} Refer to section [11.8] for details about the input terminal function.

^{*5} Refer to section [11.9] for details about the output terminal function.

^{*6} Y: writable N: Not writable

TOSHIBA E6582062①

11. 3 Extended parameter

| Title | Communication No. | Parameter name | Adjustment range | Unit | Minimum setting unit (Panel/Commu- nication) | Default setting | Write during run-ning*6 | User | Reference |
|-------|-------------------|-----------------------------------|--|------|---|--------------------|-------------------------|------|--|
| F100 | 0100 | Low-speed signal output frequency | 0.0 - FH | Hz | | 0.0 | Y | | [2. 4. 1] [6. 1. 1] |
| F101 | 0101 | Reach signal specified frequency | 0.0 - FH | Hz | | 0.0 | Y | | [6. 1. 3] |
| F102 | 0102 | Reach signal detection band | 0.0 - FH | Hz | | 2.5 | Y | | [6. 1. 2] [6. 1. 3] |
| F105 | 0105 | Fwd/Rev priority of both close | 0: Reverse 1: Stop | - | - | 1 | N | | [6. 2. 1] |
| F107 | 0107 | Terminal RX input voltage select | 0: 0 to +10 V 1: -10 to +10 V | - | - | 0 | N | | [6. 2. 2] [6. 6. 2] [7. 3. 1] [7. 3. 4] |
| F108 | 0108 | Terminal RR input select | 1: Voltage input (0-10 V) 2: - 3: - 4: PTC input 5: PT100 (2-wire) input 6: - 7: PT1000 (2-wire) input 8: - 9: KTY84 input | - | - | 1 | N | | [6. 2. 3] [6. 6. 2] [6. 30. 19] |
| F110 | 0110 | Always active function 1 | 0 - 177*4 | - | - | 6 | N | | [6. 3. 1] [7. 2. 1] |

11. Table of parameters

| Title | Communication No. | Parameter name | Adjustment range | Unit | Minimum setting unit (Panel/Commu- nication) | Default setting | Write during run-ning*6 | User setting | Reference |
|-------|-------------------|--------------------------|-----------------------|------|---|--------------------|-------------------------|-----------------|-----------|
| F111 | 0111 | Terminal F function 1 | | - | - | 2 | N | | |
| F112 | 0112 | Terminal R function | | - | - | 4 | N | | |
| F113 | 0113 | Terminal RES function 1 | | - | - | 8 | N | | |
| F114 | 0114 | Terminal S1 function 1 | | - | - | 10 | N | | |
| F115 | 0115 | Terminal S2 function | | - | - | 12 | N | | |
| F116 | 0116 | Terminal S3 function | | - | - | 14 | N | | |
| F117 | 0117 | Terminal S4 function | 0 - 203 ^{*4} | - | - | 16 | N | | F7 0 41 |
| F118 | 0118 | Terminal S5 function | | - | - | 118 | N | | [7. 2. 1] |
| F119 | 0119 | Terminal DI11 function | | - | - | 0 | N | | |
| F120 | 0120 | Terminal DI12 function | | - | - | 0 | N | | |
| F121 | 0121 | Terminal DI13 function | | - | - | 0 | N | | |
| F122 | 0122 | Terminal DI14 function | | - | - | 0 | N | | |
| F123 | 0123 | Terminal DI15 function | | - | - | 0 | N | | |
| F124 | 0124 | Terminal DI16 function | 0 - 203 ^{*4} | - | - | 0 | N | | |
| F127 | 0127 | Always active function 2 | *4 | - | - | 0 | N | | [6. 3. 1] |
| F128 | 0128 | Always active function 3 | 0 - 177 ^{*4} | - | - | 0 | N | | [7. 2. 1] |
| F130 | 0130 | Terminal FP function 1 | | - | - | 6 | N | | |
| F132 | 0132 | Terminal FL function | | - | - | 10 | N | | |
| F133 | 0133 | Terminal R1 function 1 | 0 - 255 ^{*5} | - | - | 4 | N | | [7. 2. 2] |
| F134 | 0134 | Terminal R2 function | | - | - | 254 | N | | |

| Title | Communication No. | Parameter name | Adjustment range | Unit | Minimum setting unit (Panel/Commu- nication) | Default setting | Write during run- ning*6 | User setting | Reference |
|-------|-------------------|----------------------------------|---|------|---|--------------------|-----------------------------------|-----------------|--------------------------|
| F135 | 0135 | Terminal R1 delay time | 0.0 - 60.0 | s | | 0.0 | N | | |
| F136 | 0136 | Terminal R2 delay time | 0.0 - 60.0 | s | | 0.0 | N | | |
| F137 | 0137 | Terminal FP function 2 | 0.055*5 | - | - | 255 | N | | |
| F138 | 0138 | Terminal R1 function 2 | 0 - 255 ^{*5} | - | - | 255 | N | | [7. 2. 2] |
| F139 | 0139 | Terminal FP, R1 logic select | 0: F130 and F137, F133 and F138 1: F130 and F137, F133 or F138 2: F130 or F137, F133 and F138 3: F130 or F137, F133 or F138 | - | - | 0 | N | | |
| F140 | 0140 | Terminal F response time | 1 - 1000 | ms | | 1 | N | | |
| F141 | 0141 | Terminal R response time | 1 - 1000 | ms | | 1 | N | | |
| F142 | 0142 | Terminal RES response time | 1 - 1000 | ms | | 1 | N | | [7. 2. 1] |
| F143 | 0143 | Terminal S1 response time | 1 - 1000 | ms | | 1 | N | | [7. 2. 1] |
| F144 | 0144 | Terminal S2-S5 response time | 1 - 1000 | ms | | 1 | N | | |
| F145 | 0145 | Terminal DI11-DI16 response time | 1 - 1000 | ms | | 1 | N | | |
| F146 | 0146 | Terminal S4 input select | 0: Digital input. 1: Pulse train input 2: PG input | - | - | 0 | N | | [6. 6. 4] |
| F147 | 0147 | Terminal S5 input select | 0: Digital input. 1: Pulse train input 2: PG input | - | - | 0 | N | | [7. 2. 1] |
| F148 | 0148 | Terminal Al4 input select | 1: Voltage input (0-10 V) 2: Voltage input (-10 to +10V) 3: Current input (0-20 mA) 4: PTC input 5: PT100 (2-wire) input 6: PT100 (3-wire) input 7: PT1000 (2-wire) input 8: PT1000 (3-wire) input 9: KTY84 input | - | - | 1 | N | | [6. 2. 4] [6. 6. 2] |
| F149 | 0149 | Terminal AI5 input select | 1: Voltage input (0-10 V) 2: Voltage input (-10 to +10V) 3: Current input (0-20 mA) 4: PTC input 5: PT100 (2-wire) input 6: PT100 (3-wire) input 7: PT1000 (2-wire) input 8: PT1000 (3-wire) input 9: KTY84 input | - | - | 1 | N | | [6. 30. 19] [7. 2. 1] |

| Title | Communication No. | Parameter name | Adjustment range | Unit | Minimum setting unit (Panel/Commu- nication) | Default setting | Write during run-ning*6 | User setting | Reference |
|-------|-------------------|----------------------------|--|------|---|-------------------|-------------------------|-----------------|-----------|
| F151 | 0151 | Terminal F function 2 | | - | - | 0 | N | | |
| F152 | 0152 | Terminal R function 2 | | - | - | 0 | N | | |
| F153 | 0153 | Terminal RES function 2 | | - | - | 0 | N | | |
| F154 | 0154 | Terminal S1 function 2 | 0 - 203 ^{*4} | - | - | 0 | N | | [7 O 1] |
| F155 | 0155 | Terminal F function 3 | 0 - 203 | - | - | 0 | N | | [7. 2. 1] |
| F156 | 0156 | Terminal R function 3 | | - | - | 0 | N | | |
| F157 | 0157 | Terminal RES function 3 | | - | - | 0 | N | | |
| F158 | 0158 | Terminal S1 function 3 | | - | - | 0 | N | | |
| F159 | 0159 | Terminal DQ11 function | | - | - | 254 | N | | |
| F160 | 0160 | Terminal DQ12 function | | - | - | 254 | N | | |
| F161 | 0161 | Terminal R4 function | 0 - 255 ^{*5} | - | - | 254 | N | | [7. 2. 2] |
| F162 | 0162 | Terminal R5 function | | - | - | 254 | N | | |
| F163 | 0163 | Terminal R6 function | | - | - | 254 | N | | |
| F170 | 0170 | Base frequency 2 | 15.0 - 590.0 | Hz | | 50.0 / 60.0 *2 | Y | | |
| F171 | 0171 | Base frequency voltage 2 | 240V class: 50-330V 480V class: 50-660V | V | | *2 | Y | | [6. 4] |
| F172 | 0172 | Manual torque boost 2 | 0.00 - 30.00 | % | | *1 | Υ | | |
| F173 | 0173 | Parameter for manufacturer | - | - | - | - | - | | - |
| F174 | 0174 | Base frequency 3 | 15.0 - 590.0 | Hz | | 50.0/ 60.0 *2 | Y | | |
| F175 | 0175 | Base frequency voltage 3 | 240V class: 50-330V 480V class: 50-660V | V | | *2 | Y | | [6. 4] |
| F176 | 0176 | Manual torque boost 3 | 0.00 - 30.00 | % | | *1 | Y | | |
| F177 | 0177 | Parameter for manufacturer | - | - | - | - | - | | - |
| F178 | 0178 | Base frequency 4 | 15.0 - 590.0 | Hz | | 50.0/ 60.0 *2 | Y | | |
| F179 | 0179 | Base frequency voltage 4 | 240V class: 50-330V 480V class: 50-660V | V | | *2 | Υ | | [6. 4] |
| F180 | 0180 | Manual torque boost 4 | 0.00 - 30.00 | % | | *1 | Y | | - |

| Title | Communication No. | Parameter name | Adjustment range | Unit | Minimum setting unit (Panel/Commu- nication) | Default setting | Write during run-ning*6 | User setting | Reference |
|-------|-------------------|-------------------------------------|--|-------|---|----------------------|-------------------------|-----------------|------------------------|
| F181 | 0181 | Parameter for manufacturer | - | - | - | - | - | | - |
| F182 | 0187 | Motor overload protection current 2 | | Α | | *1 | Y | | |
| F183 | 0188 | Motor overload protection current 3 | Depending on capacity *1 | Α | | *1 | Y | | [6. 4] |
| F184 | 0189 | Motor overload protection current 4 | | Α | | *1 | Y | | |
| F185 | 0185 | Stall prevention level 2 | 10-200 (HD) 10-160 (ND) | % (A) | | 150 (HD) 120 (ND) | Y | | [6. 30. 2] |
| F190 | 0190 | V/f 5-point VF1 frequency | 0.0 - FH | Hz | | 0.0 | N | | |
| F191 | 0191 | V/f 5-point VF1 voltage | 0.0 - 125.0 | % (V) | | 0.0 | N | | |
| F192 | 0192 | V/f 5-point VF2 frequency | 0.0 - FH | Hz | | 0.0 | N | | |
| F193 | 0193 | V/f 5-point VF2 voltage | 0.0 - 125.0 | % (V) | | 0.0 | N | | |
| F194 | 0194 | V/f 5-point VF3 frequency | 0.0 - FH | Hz | | 0.0 | N | | [5. 2. 4] |
| F195 | 0195 | V/f 5-point VF3 voltage | 0.0 - 125.0 | % (V) | | 0.0 | N | | [5. 2. 4] |
| F196 | 0196 | V/f 5-point VF4 frequency | 0.0 - FH | Hz | | 0.0 | N | | |
| F197 | 0197 | V/f 5-point VF4 voltage | 0.0 - 125.0 | % (V) | | 0.0 | N | | |
| F198 | 0198 | V/f 5-point VF5 frequency | 0.0 - FH | Hz | | 0.0 | N | | |
| F199 | 0199 | V/f 5-point VF5 voltage | 0.0 - 125.0 | % (V) | | 0.0 | N | | |
| F200 | 0200 | Frequency command priority select | 0: FMOd/F207 (switched by TB) 1: FMOd/F207 (switched by F208) | - | - | 0 | Y | | [5. 3. 1] [6. 6. 1] |
| F201 | 0201 | RR point 1 input value | 0 - 100 | % | | 0 | Y | | |
| F202 | 0202 | RR point 1 frequency | 0.0 - 590.0 | Hz | | 0.0 | Y | | [6. 6. 2] |
| F203 | 0203 | RR point 2 input value | 0 - 100 | % | | 100 | Y | | [7. 3. 1] [7. 3. 2] |
| F204 | 0204 | RR point 2 frequency | 0.0 - 590.0 | Hz | | 50.0/ 60.0 *2 | Y | | |
| F205 | 0205 | RR point 1 rate | 0 - 250 | % | | 0 | Υ | | 10 0 0 |
| F206 | 0206 | RR point 2 rate | 0 - 250 | % | | 100 | Υ | | [6. 6. 2] |

| Title | Communication No. | Parameter name | Adjustment range | Unit | Minimum setting unit (Panel/Commu- nication) | Default setting | Write during run-ning*6 | User setting | Reference |
|-------|-------------------|---------------------------------------|--|------|---|------------------|-------------------------|-----------------|-------------------------------------|
| F207 | 0207 | Frequency command select 2 | 0: - 1: Terminal RR 2: Terminal RX 3: Terminal II 4: Terminal Al4 (option) 5: Terminal Al5 (option) 6 - 9: - 10: Touch wheel 1 | - | - | 3 | N | | [5. 3. 1] [6. 6. 1] |
| F208 | 0208 | Frequency command switching frequency | 0.1 - FH | Hz | | 0.1 | Y | | |
| F209 | 0209 | Analog input filter | 1: Disabled 2 - 1000 | ms | | 1 | Y | | |
| F210 | 0210 | RX point 1 input value | -100 to +100 | % | | 0 | Y | | |
| F211 | 0211 | RX point 1 frequency | 0.0 - 590.0 | Hz | | 0.0 | Y | | [6. 6. 2] [7. 3. 1] [7. 3. 4] |
| F212 | 0212 | RX point 2 input value | -100 to +100 | % | | 100 | Y | | |
| F213 | 0213 | RX point 2 frequency | 0.0 - 590.0 | Hz | | 50.0/ 60.0 *2 | Y | | |
| F214 | 0214 | RX point 1 rate | -250 to +250 | % | | 0 | Y | | [6. 6. 2] |
| F215 | 0215 | RX point 2 rate | -250 to +250 | % | | 100 | Y | | [0. 0. 2] |
| F216 | 0216 | II point 1 input value | 0 - 100 | % | | 20 | Y | | |
| F217 | 0217 | II point 1 frequency | 0.0 - 590.0 | Hz | | 0.0 | Y | | [6. 6. 2] |
| F218 | 0218 | II point 2 input value | 0 - 100 | % | | 100 | Y | | [7. 3. 1] [7. 3. 3] |
| F219 | 0219 | II point 2 frequency | 0.0 - 590.0 | Hz | | 50.0/ 60.0 *2 | Y | | [1.0.0] |
| F220 | 0220 | II point 1 rate | 0 - 250 | % | | 0 | Y | | [6. 6. 2] |
| F221 | 0221 | II point 2 rate | 0 - 250 | % | | 100 | Y | | [5. 5. 2] |

| Title | Communication No. | Parameter name | Adjustment range | Unit | Minimum setting unit (Panel/Commu- nication) | Default setting | Write during run-ning*6 | User | Reference |
|-------|-------------------|---------------------------------------|----------------------------------|------|---|--------------------|-------------------------|------|-------------------------|
| F222 | 0222 | Al4 point 1 input value | -100 to +100 | % | | 0 | Y | | |
| F223 | 0223 | Al4 point 1 frequency | 0.0 - 590.0 | Hz | | 0.0 | Y | | [6. 6. 2] |
| F224 | 0224 | Al4 point 2 input value | -100 to +100 | % | | 100 | Y | | [7. 3. 1] |
| F225 | 0225 | Al4 point 2 frequency | 0.0 - 590.0 | Hz | | 50.0/ 60.0 *2 | Y | | |
| F226 | 0226 | Al4 point 1 rate | -250 to +250 | % | | 0 | Υ | | 10 0 01 |
| F227 | 0227 | Al4 point 2 rate | -250 to +250 | % | | 100 | Y | | [6. 6. 2] |
| F228 | 0228 | Al5 point 1 input value | -100 to +100 | % | | 0 | Y | | |
| F229 | 0229 | Al5 point 1 frequency | 0.0 - 590.0 | Hz | | 0.0 | Y | | [6. 6. 2] |
| F230 | 0230 | Al5 point 2 input value | -100 to +100 | % | | 100 | Y | | [7. 3. 1] |
| F231 | 0231 | Al5 point 2 frequency | 0.0 - 590.0 | Hz | | 50.0/ 60.0 *2 | Y | | |
| F234 | 0234 | Pulse train input point 1 input value | 0 - 100 | % | | 0 | Y | | |
| F235 | 0235 | Pulse train input point 1 frequency | 0.0 - 590.0 | Hz | | 0.0 | Y | | [6 6 4] |
| F236 | 0236 | Pulse train input point 2 input value | 0 - 100 | % | | 100 | Y | | [6. 6. 4] |
| F237 | 0237 | Pulse train input point 2 frequency | 0.0 - 590.0 | Hz | | 50.0/ 60.0 *2 | Y | | |
| F239 | 0239 | Parameter for manufacturer | - | - | - | - | - | | - |
| F240 | 0240 | Start frequency | 0.0 - 10.0 | Hz | | 0.1 | Y | | [6. 7. 1] |
| F241 | 0241 | Run frequency | 0.0 - FH | Hz | | 0.0 | Y | | |
| F242 | 0242 | Run frequency hysteresis | 0.0 - FH | Hz | | 0.0 | Y | | [6. 7. 2] |
| F243 | 0243 | End frequency | 0.0 - 30.0 | Hz | | 0.0 | Y | | [6. 7. 1] |
| F244 | 0244 | 0 Hz dead band | 0.0 - 5.0 | Hz | | 0.0 | Y | | [6. 7. 3] |
| F249 | 0249 | DC braking carrier frequency | 1.0 - 16.0 | kHz | | *1 | Y | | [6. 8. 1] |
| F250 | 0250 | DC braking frequency | 0.0 - FH | Hz | | 0.0 | Y | | [6. 8. 1] [6. 8. 3] |
| F251 | 0251 | DC braking current | 0 - 100 | % | | 50 | Y | | [6. 8. 1] [6. 30. 4] |
| F252 | 0252 | DC braking time | 0.0 - 25.5 | S | | 1.0 | Y | | [6. 8. 1] [6. 8. 3] |
| F253 | 0253 | Fwd/Rev DC braking priority | 0: Disabled 1: Enabled | - | - | 0 | Y | | [6. 8. 1] |
| F254 | 0254 | Motor shaft fixing control | 0: Disabled 1: Enabled | - | - | 0 | Y | | [6. 8. 2] |
| F255 | 0255 | 0Hz command select at stop | 0: DC braking 1: 0 Hz command | - | - | 0 | N | | [6. 8. 3] |

| Title | Communication No. | Parameter name | Adjustment range | Unit | Minimum setting unit (Panel/Commu- nication) | Default setting | Write during run-ning*6 | User setting | Reference |
|-------|-------------------|---------------------------------------|---|------|---|-----------------|-------------------------|-----------------|---|
| F256 | 0256 | Run sleep detection time | 0.0: Disabled 0.1 - 600.0 | s | | 0.0 | Y | | [6. 9] |
| F257 | 0257 | Parameter for manufacturer | - | - | - | - | - | | - |
| F258 | 0258 | Parameter for manufacturer | - | - | - | - | - | | - |
| F259 | 0259 | Run sleep detection time at startup | 0.0: Disabled 0.1 - 600.0 | s | | 0.0 | Y | | [6. 9] |
| F260 | 0260 | Jog frequency | F240 - 20.0 | Hz | | 5.0 | Y | | |
| F261 | 0261 | Jog stop select | 0: Deceleration stop 1: Coast stop 2: DC braking stop | - | - | 0 | N | | [6. 10] |
| F262 | 0262 | Panel jog run | 0: Disabled 1: Enabled | - | - | 0 | Y | | |
| F264 | 0264 | Terminal Up response time | 0.0 - 10.0 | s | | 0.1 | Y | | |
| F265 | 0265 | Terminal Up frequency step | 0.0 - FH | Hz | | 0.1 | Y | | |
| F266 | 0266 | Terminal Down response time | 0.0 - 10.0 | s | | 0.1 | Y | | |
| F267 | 0267 | Terminal Down frequency step | 0.0 - FH | Hz | | 0.1 | Y | | [6. 6. 5] |
| F268 | 0268 | Initial Up/Down frequency | LL - UL | Hz | | 0.0 | Y | | |
| F269 | 0269 | Up/Down frequency rewrite | F268 is not changed. F268 is changed after power off. | - | - | 1 | Y | | |
| F270 | 0270 | Jump frequency 1 | 0.0 - FH | Hz | | 0.0 | Y | | |
| F271 | 0271 | Jump frequency 1 band | 0.0 - 30.0 | Hz | | 0.0 | Y | | |
| F272 | 0272 | Jump frequency 2 | 0.0 - FH | Hz | | 0.0 | Y | | |
| F273 | 0273 | Jump frequency 2 band | 0.0 - 30.0 | Hz | | 0.0 | Y | | [6. 11] |
| F274 | 0274 | Jump frequency 3 | 0.0 - FH | Hz | | 0.0 | Υ | | |
| F275 | 0275 | Jump frequency 3 band | 0.0 - 30.0 | Hz | | 0.0 | Y | | |
| F287 | 0287 | Preset speed 8 | LL - UL | Hz | | 0.0 | Y | | |
| F288 | 0288 | Preset speed 9 | LL - UL | Hz | | 0.0 | Y | | |
| F289 | 0289 | Preset speed 10 | LL - UL | Hz | | 0.0 | Y | | |
| F290 | 0290 | Preset speed 11 | LL - UL | Hz | | 0.0 | Y | | [5. 2. 7] [6. 28] |
| F291 | 0291 | Preset speed 12 | LL - UL | Hz | | 0.0 | Y | | |
| F292 | 0292 | Preset speed 13 | LL - UL | Hz | | 0.0 | Υ | | |
| F293 | 0293 | Preset speed 14 | LL - UL | Hz | | 0.0 | Y | | |
| F294 | 0294 | Preset speed 15 / Forced run speed | LL - UL | Hz | | 0.0 | Y | | [5. 2. 7] [6. 12. 2] [6. 28] [6. 31] |

| Title | Communication No. | Parameter name | Adjustment range | Unit | Minimum setting unit (Panel/Commu- nication) | Default setting | Write during run-ning*6 | User | Reference |
|-------|-------------------|---------------------------------|--|-------|---|--------------------|-------------------------|------|-----------------------------------|
| F295 | 0295 | Bumpless | 0: Disabled 1: Enabled | - | - | 0 | Y | | [6. 13] |
| F297 | 0297 | Parameter for manufacturer | - | - | - | - | - | | - |
| F298 | 0298 | Parameter for manufacturer | - | - | - | - | - | | - |
| F300 | 0300 | Carrier frequency | Depending on capacity *1 | kHz | | *1 | Y | | [2. 4. 1] [2. 4. 3] [6. 14] |
| F301 | 0301 | Auto-restart | 0: Disabled 1: Power failure 2: Terminal ST On/Off 3: Terminal ST On/Off or power failure 4: At startup | - | - | 0 | N | | [5. 3. 2] |
| F302 | 0302 | Regenerative power ride-through | O: Disabled 1: Regenerative power ride-through 2: Deceleration stop at power failure 3: Synchronized Acc/ Dec (TB) 4: Synchronized Acc/ Dec (TB + power failure) | - | - | 0 | N | | [6. 15. 2] |
| F303 | 0303 | Retry | 0: Disabled 1 - 10 | Times | | 0 | Y | | [6. 15. 3] |
| F304 | 0304 | Dynamic braking, OLr trip | 0: Disabled 1: Enabled, OLr trip 2: Enabled, No OLr trip 3: Enabled (except during ST OFF), OLr trip 4: Enabled (except during ST OFF), No OLr trip 5: Enabled (except during trip), OLr trip 6: Enabled (except during trip), No OLr trip 7: Enabled (except during trip), ST OFF), OLr trip 8: Enabled (except during trip & ST OFF), OLr trip 8: Enabled (except during trip & ST OFF), No OLr trip | - | - | 0 | N | | [6. 15. 4] |
| F305 | 0305 | Overvoltage limit operation | 0: Enabled 1: Disabled 2: Enabled (quick deceleration) 3: Enabled (dynamic quick deceleration) | - | - | 2 | N | | [6. 15. 5] |
| F306 | 0306 | Parameter for manufacturer | - | - | - | - | - | | - |

| Title | Communication No. | Parameter name | Adjustment range | Unit | Minimum setting unit (Panel/Commu- nication) | Default setting | Write during run-ning*6 | User setting | Reference |
|-------|-------------------|---|--|------|---|-----------------|-------------------------|-----------------|----------------------|
| F307 | 0307 | Supply voltage compensation, Output voltage limitation | O: Without supply voltage compensation, Limited output voltage 1: With supply voltage compensation, Limited output voltage 2: Without supply voltage compensation, Unlimited output voltage 3: With supply voltage compensation, Unlimited output voltage ompensation, Unlimited output voltage | - | - | *2 | N | | [6. 15. 6] |
| F308 | 0308 | Braking resistance | 0.5 - 1000 | Ω | | *1 | N | | |
| F309 | 0309 | Braking resistor capacity | 0.01 - 600.0 | kW | | *1 | N | | [6. 15. 4] |
| F310 | 0310 | Dec time at power failure | 0.0 - 320.0 | s | | 2.0 | N | | [6. 15. 2] |
| F311 | 0311 | Reverse inhibited | 0: Allowed 1: Rev inhibited 2: Fwd inhibited 3: - 4: - | - | - | 0 | N | | [6. 15. 7] |
| F312 | 0312 | Random switching | 0: Disabled 1: Random switching 1 2: Random switching 2 3: Random switching 3 | - | - | 0 | N | | [6. 14] |
| F313 | 0313 | Ridethrough time | 0.0: Continuous 0.1 - 320.0 | s | | 2.0 | N | | [6. 15. 2] |
| F314 | 0314 | Parameter for manufacturer | - | - | - | - | - | | - |
| F315 | 0315 | Parameter for manufacturer | - | - | - | - | - | | - |
| F316 | 0316 | Carrier frequency control | 0: No decrease 1: Valid decrease 2: No decrease, 480V class 3: Valid decrease, 480V class 4: No decrease with sinusoidal filter 5: Valid decrease with sinusoidal filter | - | - | 1 | N | | [2. 4. 1] [6. 14] |
| F317 | 0317 | Synchronized stop time | 0.0 - 6000 | s | | 2.0 | Y | | [6. 15. 2] |
| F318 | 0318 | Synchronized reach time | 0.0 - 6000 | s | | 2.0 | Y | | |
| F319 | 0319 | Regenerative over- flux upper limit | 100 - 160 | % | | *2 | N | | [6. 15. 5] |

| Title | Communication No. | Parameter name | Adjustment range | Unit | Minimum setting unit (Panel/Commu- nication) | Default setting | Write during run-ning*6 | User | Reference |
|-------|-------------------|--------------------------------------|------------------|-------|---|--------------------|-------------------------|------|------------|
| F320 | 0320 | Droop gain | 0.0 - 100.0 | % | | 0.0 | Y | | [6. 16] |
| F321 | 0321 | Frequency at 0% droop gain | 0.0 - 320.0 | Hz | | 0.0 | Y | | |
| F322 | 0322 | Frequency at F320 droop gain | 0.0 - 320.0 | Hz | | 100.0 | Y | | |
| F323 | 0323 | Droop deadband torque | 0 - 100 | % | | 10 | Y | | |
| F324 | 0324 | Droop output filter | 0.1 - 200.0 | rad/s | | 100.0 | Υ | | |
| F325 | 0325 | Brake release wait time | 0.00 - 2.50 | s | | 0.00 | N | | [6. 18. 1] |
| F326 | 0326 | Brake release undercurrent threshold | 0 - 100 | % (A) | | 0 | Y | | |
| F327 | 0327 | Parameter for manufacturer | - | - | - | - | - | | - |

| Title | Communication No. | Parameter name | Adjustment range | Unit | Minimum setting unit (Panel/Commu- nication) | Default setting | Write during run-ning*6 | User setting | Reference |
|-------|-------------------|---|--|------|---|-----------------------------|-------------------------|-----------------|------------|
| F328 | 0328 | Light-load high- speed operation | 0: Disabled 1: Auto speed (Fwd: up) 2: Auto speed (Rev: up) 3: Speed F330 (Fwd: up) 4: Speed F330 (Rev: up) | - | - | 0 | N | | |
| F329 | 0329 | Light-load high- speed learning function | 0: - 1: Fwd run only 2: Rev run only | - | - | 0 | N | | |
| F330 | 0330 | Light-load high- speed automatic operation frequency | 30.0 - UL | Hz | | 50.0/ 60.0 ^{*2} | N | | |
| F331 | 0331 | Light-load high- speed operation switching lower-limit frequnecy | 5.0 - UL | HZ | | 40.0 | Y | | |
| F332 | 0332 | Light-load high- speed operation load detection wait time | 0.0 - 10.0 | S | | 0.5 | Y | | [6. 17] |
| F333 | 0333 | Light-load high- speed operation load detection time | 0.0 - 10.0 | s | | 1.0 | Y | | [0.17] |
| F334 | 0334 | Light-load high- speed operation heavy load detec- tion time | 0.0 - 10.0 | S | | 0.5 | Y | | |
| F335 | 0335 | Switching load torque during power running | -250 to +250 | % | | 50 | Y | | |
| F336 | 0336 | Heavy-load torque during power running | -250 to +250 | % | | 100 | Y | | |
| F337 | 0337 | Heavy-load torque during constant speed power running | -250 to +250 | % | | 50 | Y | | |
| F338 | 0338 | Switching load torque during regen | -250 to +250 | % | | 50 | Y | | |
| F339 | 0339 | Parameter for manufacturer | - | - | - | - | - | | - |
| F340 | 0340 | Creep time 1 | 0.00 - 10.00 | s | | 0.00 | N | | |
| F341 | 0341 | Brake function | 0: Disabled 1: Fwd hoisting 2: Rev hoisting 3: Horizontal operation | - | - | 0 | N | | [6. 18. 1] |

| Title | Communication No. | Parameter name | Adjustment range | Unit | Minimum setting unit (Panel/Commu- nication) | Default setting | Write during run-ning*6 | User setting | Reference |
|-------|-------------------|--|---|------|---|-----------------------------|-------------------------|-----------------|------------|
| F342 | 0342 | Load torque input select | 0: - 1: Terminal RR 2: Terminal RX 3: Terminal II 4: Terminal Al4 (option) 5 - 11: - 12: F343 13 - 19: - 20: Embedded Ethernet 21: RS485 communication (connector 1) 22: RS485 communication (connector 2) 23: Communication option | - | - | 12 | Y | | [6. 18. 1] |
| F343 | 0343 | Hoisting torque bias | -250 to +250 (F342 = "4" only) | % | | 100 | Y | | |
| F344 | 0344 | Lowering torque bias rate | 0 - 100 | % | | 100 | Y | | |
| F345 | 0345 | Brake releasing time | 0.00 - 10.00 | s | | 0.05 | Y | | |
| F346 | 0346 | Creep frequency | F240 - 20.0 | Hz | | 3.0 | N | | |
| F347 | 0347 | Creep time 2 | 0.00 - 10.00 | S | | 0.10 | Y | | - |
| F348 | 0348 | Brake learning | 0: - 1: Enabled (0 after execution) | - | - | 0 | N | | |
| F349 | 0349 | Dwell operation | 0: Disabled 1: F350-F353 setting 2: Terminal input | - | - | 0 | N | | |
| F350 | 0350 | Acc suspended frequency | 0.0 - FH | Hz | | 0.0 | Y | | |
| F351 | 0351 | Acc suspended time | 0.0 - 10.0 | s | | 0.0 | Y | | [6. 19] |
| F352 | 0352 | Dec suspended frequency | 0.0 - FH | Hz | | 0.0 | Y | | |
| F353 | 0353 | Dec suspended time | 0.0 - 10.0 | s | | 0.0 | Y | | |
| F354 | 0354 | Commercial power/ Inverter switching | 0: Disabled 1: Switch at trip 2: Switch at F355 3: Switch at trip and at F355 | - | - | 0 | N | | |
| F355 | 0355 | Commercial power switching frequency | 0.0 - UL | Hz | | 50.0/ 60.0 ^{*2} | Y | | |
| F356 | 0356 | Inverter switching wait time | 0.10 - 10.00 | s | | *1 | Y | | [6. 20] |
| F357 | 0357 | Commercial power switching wait time | 0.10 - 10.00 | s | | 0.62 | Y | | |
| F358 | 0358 | Commercial power switching frequency continuous time | 0.10 - 10.00 | S | | 2.00 | Y | | |

| Title | Communication No. | Parameter name | Adjustment range | Unit | Minimum setting unit (Panel/Commu- nication) | Default setting | Write during run-ning*6 | User setting | Reference |
|-------|-------------------|------------------------------|---|-----------------|---|-----------------------------|-------------------------|-----------------|---------------------------------|
| F359 | 0359 | PID control1 | 0: Disabled 1: Process PID control 2: Speed PID control 3: Easy positioning P control 4: Dancer control 5 - 10: - 11: Minus Process PID control 12: Minud Speed PID control 13: Minus Easy positioning P control 14: Minus Dancer control | - | - | 0 | N | | [5. 2. 8] [6. 21] [6. 22] |
| F360 | 0360 | PID1 feedback input select | 0: - 1: Terminal RR 2: Terminal RX 3: Terminal II 4: Terminal Al4 (option) 5: Terminal Al5 (option) 6 - 16: - 17: High resolution pulse train (option) | - | - | 0 | N | | [5. 2. 8] |
| F361 | 0361 | PID1 filter | 0.0 - 25.0 | S | | 0.0 | Υ | | [6. 21] |
| F362 | 0362 | PID1 proportional gain | 0.01 - 100.0 | - | | 0.30 | Y | | [5. 2. 8] [6. 21] [6. 22] |
| F363 | 0363 | PID1 integral gain | 0.01 - 100.0 | s ⁻¹ | | 0.20 | Y | | [5. 2. 8] [6. 21] |
| F364 | 0364 | PID1 deviation upper-limit | LL - UL | Hz | | 50.0/ 60.0 ^{*2} | Y | | IC 041 |
| F365 | 0365 | PID1 deviation lower-limit | LL - UL | Hz | | 50.0/ 60.0 ^{*2} | Y | | [6. 21] |
| F366 | 0366 | PID1 differential gain | 0.00 - 2.55 | s | | 0.00 | Y | | |
| F367 | 0367 | PID1 set value upper-limit | 0.0 - FH | Hz | | 50.0/ 60.0 ^{*2} | Y | | [5. 2. 8] [6. 21] |
| F368 | 0368 | PID1 set value lower-limit | 0.0 - F367 | Hz | | 0.0 | Y | | |
| F369 | 0369 | PID1 start wait time | 0 - 2400 | S | | 0 | Y | | [5. 2. 8] [6. 21] [6. 22] |
| F370 | 0370 | PID1 output upper- limit | LL - UL | Hz | | 50.0/ 60.0 ^{*2} | Y | | |
| F371 | 0371 | PID1 output lower- limit | LL - UL | Hz | | 0.0 | Y | | [6. 21] |
| F372 | 0372 | PID1 set value increase time | 0.1-600.0 (Speed PID) | s | | 10.0 | Y | | [1] |
| F373 | 0373 | PID1 set value decrease time | 0.1-600.0 (Speed PID) | s | | 10.0 | Y | | |

| Title | Communication No. | Parameter name | Adjustment range | Unit | Minimum setting unit (Panel/Commu- nication) | Default setting | Write during run-ning*6 | User setting | Reference |
|-------|-------------------|---|---|-------|---|--------------------|-------------------------|-----------------|----------------------|
| F374 | 0374 | PID1 set value agreement detec- tion band | 0.0 - FH | Hz | | 2.5 | Y | | [6. 21] |
| F375 | 0375 | PG pulses number | 1 - 9999 | | | 1000 | N | | [6. 22] |
| F376 | 0376 | PG select | 0: PTI (Command) - PTI (FB) 1: PTI (Command) - Digital option (FB) 2 - 5: - 6: Digital option (Command) - Non FB 7 - 9: - 10: PTI (Command) - PTI (FB inversion) 11: PTI (Command) - Digital option (FB inversion) 12 - 15: - 16: Digital option (Command inversion) - Non FB | - | - | 0 | N | | [6. 6. 4] [6. 22] |
| F377 | 0377 | PG option discon- nection detection | 0: Disabled 1: Enabled | - | - | 0 | N | | - |
| F378 | 0378 | Pulse train input pulses number | 1 - 9999 | pps | | 1000 | N | | [6. 6. 4] |
| F379 | 0379 | PG option voltage | 0: 5V 1: 12V 2: 24V | - | - | 0 | N | | - |
| F381 | 0381 | Simple positioning completion range | 1 - 4000 | pulse | | 100 | Y | | [6. 22] |
| F382 | 0382 | Hit and stop control | 0: Disabled 1: Enabled 2: - | - | - | 0 | Y | | [6. 18. 2] |
| F383 | 0383 | Hit and stop frequency | 0.1 - 30.0 | Hz | | 5.0 | Y | | |
| F384 | 0384 | Hit and stop torque limit | 0 - 100 | % | | 100 | Y | | - |
| F385 | 0385 | Hit and stop detection time | 0.0 - 25.0 | s | | 0.3 | Y | | - |
| F386 | 0386 | Hit and stop contin- uation torque limit | 0 - 100 | % | | 50 | Y | | - |
| F388 | 0388 | PID1 output dead band | 0 - 100 | % | | 0 | Y | | [6. 21] |

| Title | Communication No. | Parameter name | Adjustment range | Unit | Minimum setting unit (Panel/Commu- nication) | Default setting | Write during run-ning*6 | User | Reference |
|-------|-------------------|----------------------------|---|------|---|--------------------|-------------------------|------|--------------------------|
| F389 | 0389 | PID1 set value select | O: selected by FMOd/ F207 1: Terminal RR 2: Terminal RX 3: Terminal II 4: Terminal Al4 (option) 5: Terminal Al5 (option) 6 - 11: - 12: FPId 13,14: - 15: Terminal Up/Down frequency 16: Pulse train 17: High resolution pulse train (option) 18,19: - 20: Embedded Ethernet 21: RS485 communication (connector 1) 22: RS485 communication (connector 2) 23: Communication option | - | - | 0 | N | | [5. 2. 8] [6. 21] |
| F390 | 0390 | Parameter for manufacturer | - | - | - | - | - | | - |
| F391 | 0391 | Sleep detection hysteresis | 0.0 - UL | Hz | | 0.0 | Y | | |
| F392 | 0392 | Wakeup deviation | 0.0 - UL | Hz | | 0.0 | Υ | | [6. 9] |
| F393 | 0393 | Wakeup feedback | 0.0 - UL | Hz | | 0.2 | Υ | | |
| F394 | 0394 | Parameter for manufacturer | - | - | - | - | - | | - |
| F399 | 0399 | Parameter for manufacturer | - | - | - | - | - | | - |
| F400 | 0400 | Offline auto-tuning | 0: - 1: Reset motor parameters (0 after execution) 2: Auto-tuning at run command (0 after execution) 3: Auto-tuning at TB ON 4: Motor parameters auto calculation (0 after execution) 5: 4+2 (0 after execution) 6: Auto-tuning at run command during TB ON 7: Auto-tuning F402 only at run command during TB ON | - | - | 0 | N | | [6. 23. 1] [6. 23. 2] |
| F401 | 0401 | Slip frequency gain | 0 - 250 | % | | 70 | Υ | | [6. 23. 1] |
| F402 | 0402 | Automatic torque boost | 0.1 - 30.00 | % | | *1 | Y | | [6. 23. 1] [6. 23. 2] |

| Title | Communication No. | Parameter name | Adjustment range | Unit | Minimum setting unit (Panel/Commu- nication) | Default setting | Write during run-ning*6 | User | Reference |
|-------|-------------------|-----------------------------------|---|-------------------|---|--------------------|-------------------------|------|--------------------------|
| F403 | 0403 | Online auto-tuning | Disabled Self-cooling motor auto-tuning Forced air-cooling motor auto-tuning | - | - | 0 | N | | [6. 23. 1] |
| F405 | 0405 | Motor rated capacity | 0.10 - 315.0 | kW | | *1 | N | | [6. 23. 1] [6. 23. 2] |
| F412 | 0412 | Leakage inductance | 0.0 - 25.0 | % | | *1 | N | | |
| F413 | 0413 | Exciting current coefficient | 100 - 150 | % | | 100 | N | | [6. 23. 1] |
| F414 | 0414 | Stall prevention coefficient | 10 - 250 | - | | 100 | N | | - |
| F415 | 0415 | Motor rated current | Depending on capacity *1 | Α | | *1 | N | | [6. 23. 1] [6. 23. 2] |
| F416 | 0416 | Motor no load cur- rent | 10 - 90 | % | | *1 | N | | [6. 23. 1] |
| F417 | 0417 | Motor rated speed | 100 - 64000 | min ⁻¹ | | *2 | N | | [6. 23. 1] [6. 23. 2] |
| F418 | 0418 | Parameter for manufacturer | - | - | - | - | - | | - |
| F420 | 0420 | Torque command select | 0: - 1: Terminal RR 2: Terminal RX 3: Terminal II 4: Terminal Al4 (option) 5 - 11: - 12: F725 13 - 19: - 20: Embedded Ethernet 21: RS485 communication (connector 1) 22: RS485 communication (connector 2) 23: Communication option | - | - | 2 | Y | | [6. 24. 1] |
| F421 | 0421 | Torque command filter | 0 - 1000 | ms | | 0 | Y | | |
| F423 | 0423 | Tension control torque bias input | 0: - 1: Terminal RR 2: Terminal RX 3: Terminal II 4: Terminal Al4 (option) 5 - 11: - 12: F725 13 - 19: - 20: Embedded Ethernet 21: RS485 communication connector 1 22: RS485 communication connector 2 23: Communication option | - | - | 0 | Y | | [6. 24. 3] |

| Title | Communication No. | Parameter name | Adjustment range | Unit | Minimum setting unit (Panel/Commu- nication) | Default setting | Write during run-ning*6 | User setting | Reference |
|-------|-------------------|---|---|------|---|-----------------------------|-------------------------|-----------------|--------------------------|
| F424 | 0424 | Load sharing gain input | 0: - 1: Terminal RR 2: Terminal RX 3: Terminal II 4: Terminal Al4 (option) 5 - 11: - 12: F725 13 - 19: - 20: Embedded Ethernet 21: RS485 communication connector 1 22: RS485 communication connector 2 23: Communication option | - | - | 0 | Y | | [6. 24. 3] |
| F425 | 0425 | Fwd speed limit input | 0: - 1: Terminal RR 2: Terminal RX 3: Terminal II 4: Terminal Al4 (option) 5 - 11: - 12: F426 | - | - | 0 | Y | | |
| F426 | 0426 | Fwd speed limit level | 0.0 - UL | Hz | | 50.0/ 60.0 ^{*2} | Y | | |
| F427 | 0427 | Rev speed limit input | 0: - 1: Terminal RR 2: Terminal RX 3: Terminal II 4: Terminal Al4 (option) 5 - 11: - 12: F428 | - | - | 0 | Y | | [6. 24. 2] |
| F428 | 0428 | Rev speed limit level | 0.0 - UL | Hz | | 50.0/ 60.0 ^{*2} | Y | | |
| F430 | 0430 | Speed limit center value input select | 0: - 1: Terminal RR 2: Terminal RX 3: Terminal II 4: Terminal Al4 (option) 5 - 11: - 12: F431 | - | - | 0 | Y | | |
| F431 | 0431 | Speed limit center value | 0.0 - FH | Hz | | 0.0 | Y | | |
| F432 | 0432 | Speed limit band | 0.0 - FH | Hz | | 0.0 | Y | | |
| F435 | 0435 | Rotation direction limit during torque control | 0: Fwd/Rev permit 1: Command direction permit | - | - | 0 | Y | | [6. 24. 1] |
| F440 | 0440 | Power running torque limit input select 1 | 0: - 1: Terminal RR 2: Terminal RX 3: Terminal II 4: Terminal Al4 (option) 5 - 11: - 12: F441 | - | - | 12 | Y | | [6. 25. 1] |
| F441 | 0441 | Power running torque limit level 1 | 0.0-249.9 250.0: Disabled | % | | 250.0 | Y | | [6. 25. 1] [6. 25. 3] |

| Title | Communication No. | Parameter name | Adjustment range | Unit | Minimum setting unit (Panel/Commu- nication) | Default setting | Write during run-ning*6 | User setting | Reference |
|-------|-------------------|---|---|------|---|--------------------|-------------------------|-----------------|------------|
| F442 | 0442 | Regenerative torque limit input select 1 | 0: - 1: Terminal RR 2: Terminal RX 3: Terminal II 4: Terminal Al4 (option) 5 - 11: - 12: F443 | - | - | 12 | Y | | |
| F443 | 0443 | Regenerative torque limit level 1 | 0.0-249.9 250.0: Disabled | % | | 250.0 | Y | | |
| F444 | 0444 | Power running torque limit level 2 | 0.0-249.9 250.0: Disabled | % | | 250.0 | Y | | IC 05 41 |
| F445 | 0445 | Regenerative torque limit level 2 | 0.0-249.9 250.0: Disabled | % | | 250.0 | Y | | [6. 25. 1] |
| F446 | 0446 | Power running torque limit level 3 | 0.0-249.9 250.0: Disabled | % | | 250.0 | Y | | |
| F447 | 0447 | Regenerative torque limit level 3 | 0.0-249.9 250.0: Disabled | % | | 250.0 | Y | | |
| F448 | 0448 | Power running torque limit level 4 | 0.0-249.9 250.0: Disabled | % | | 250.0 | Y | | |
| F449 | 0449 | Regenerative torque limit level 4 | 0.0-249.9 250.0: Disabled | % | | 250.0 | Y | | |
| F451 | 0451 | Acc/Dec operation after stall operation | 0: Acc/Dec time 1: Minimum time | - | - | 0 | N | | [6. 25. 2] |
| F452 | 0452 | Stall detection time during power running | 0.00 - 10.00 | S | | 0.00 | Y | | [6. 25. 3] |
| F453 | 0453 | Stall operation during regen | 0: Enabled 1: Disabled | - | - | 0 | Y | | [6. 25. 4] |
| F454 | 0454 | Torque limit in field weakening | 0: Constant power limit 1: Constant torque limit | - | - | 0 | N | | [6. 25. 1] |
| F455 | 0455 | Torque command polarity at Rev | Regeneration at positive torque command Power running at positive torque command | - | - | 0 | N | | [6. 24. 1] |
| F456 | 0456 | Exciting forcing level | 20 - 150 | % | | 100 | N | | - |
| F457 | 0457 | Exciting forcing control gain | 5 - 75 | Hz | | 50 | N | | - |
| F458 | 0458 | Current control response | 0 - 100 | - | _ | 0 | N | | [6. 26. 1] |

| Title | Communication No. | Parameter name | Adjustment range | Unit | Minimum setting unit (Panel/Commu- nication) | Default setting | Write during run-ning*6 | User setting | Reference |
|-------|-------------------|--|------------------|-------|---|--------------------|-------------------------|-----------------|--------------------------|
| F459 | 0459 | Load inertia ratio | 0.1 - 100.0 | Times | | 1.0 | Υ | | |
| F460 | 0460 | Speed control response 1 | 0.0 - 25.0 | - | | 0.0 | Y | | |
| F461 | 0461 | Speed control stabilization coefficient 1 | 0.50 - 2.50 | - | | 1.00 | Y | | |
| F462 | 0462 | Speed reference filter coefficient 1 | 0 - 100 | - | | 35 | Y | | [6. 23. 1] |
| F463 | 0463 | Speed control response 2 | 0.0 - 25.0 | - | | 0.0 | Y | | [6. 23. 2] [6. 26. 1] |
| F464 | 0464 | Speed control stabilization coefficient 2 | 0.50 - 2.50 | - | | 1.00 | Y | | |
| F465 | 0465 | Speed reference fil- ter coefficient 2 | 0 - 100 | - | | 35 | Y | | |
| F466 | 0466 | Speed control response switching frequency | 0.0 - FH | Hz | | 0.0 | Y | | |
| F467 | 0467 | Parameter for manufacturer | - | - | - | - | - | | - |
| F468 | 0468 | Parameter for manufacturer | - | - | - | - | - | | - |
| F469 | 0469 | Parameter for manufacturer | - | - | - | - | - | | - |
| F470 | 0470 | RR input bias | 0 - 255 | - | 1/1 | 128 | Υ | | |
| F471 | 0471 | RR input gain | 0 - 255 | - | 1/1 | 128 | Υ | | - |
| F472 | 0472 | RX input bias | 0 - 255 | - | 1/1 | 128 | Υ | | - |
| F473 | 0473 | RX input gain | 0 - 255 | - | 1/1 | 128 | Υ | | - |
| F474 | 0474 | II input bias | 0 - 255 | - | 1/1 | 128 | Υ | | 10 0 01 |
| F475 | 0475 | II input gain | 0 - 255 | - | 1/1 | 128 | Υ | | [6. 6. 3] |
| F476 | 0476 | Al4 input bias | 0 - 255 | - | 1/1 | 128 | Υ | | - |
| F477 | 0477 | Al4 input gain | 0 - 255 | - | 1/1 | 128 | Υ | | |
| F478 | 0478 | Al5 input bias | 0 - 255 | - | 1/1 | 128 | Υ | | |
| F479 | 0479 | Al5 input gain | 0 - 255 | - | 1/1 | 128 | Υ | | - |
| F480 | 0480 | Inertia auto-tuning | 0 - 1 | - | | 0 | N | | - |
| F481 | 0481 | Speed command at inertia auto-tuning | 10 - 100 | % | | 25 | N | | - |
| F482 | 0482 | Speed variation width at inertia autotuning | 0.1 - 25.0 | % | | 5.0 | N | | - |
| F483 | 0483 | Number of speed variation at inertia auto-tuning | 5 - 50 | Times | | 10 | N | | - |
| F490 | 0490 | Parameter for manufacturer | - | - | - | - | - | | - |
| F491 | 0491 | Parameter for manufacturer | - | - | - | - | - | | - |
| F495 | 0495 | Over modulation ratio | 90 - 120 | % | | 104 | N | | [6. 26. 2] |

| Title | Communication No. | Parameter name | Adjustment range | Unit | Minimum setting unit (Panel/Commu- nication) | Default setting | Write during run-ning*6 | User setting | Reference |
|-------|-------------------|-----------------------------------|---|------|---|--------------------|-------------------------|-----------------|--------------------------|
| F498 | 0498 | Parameter for manufacturer | - | - | - | - | - | | - |
| F499 | 0499 | Parameter for manufacturer | - | - | - | - | - | | - |
| F500 | 0500 | Acceleration time 2 | 0.0 - 6000 (600.0) | s | | *1 | Y | | 10 07 01 |
| F501 | 0501 | Deceleration time 2 | 0.0 - 6000 (600.0) | S | | *1 | Y | | [6. 27. 2] |
| F502 | 0502 | Acc/Dec pattern 1 | 0: Linear 1: S-Pattern 1 2: S-Pattern 2 | - | - | 0 | Y | | [6. 27. 1] [6. 27. 2] |
| F503 | 0503 | Acc/Dec pattern 2 | 0: Linear 1: S-Pattern 1 2: S-Pattern 2 | - | - | 0 | Y | | |
| F504 | 0504 | Panel Acc/Dec select | 1: Acc/Dec 1 2: Acc/Dec 2 3: Acc/Dec 3 4: Acc/Dec 4 | - | - | 1 | Y | | [6. 27. 2] |
| F505 | 0505 | Acc/Dec switching frequency 1 | 0.0: Disabled 0.1 - UL | Hz | | 0.0 | Y | | |
| F506 | 0506 | S-Pattern range at Acc start | 0 - 50 | % | | 10 | Y | | |
| F507 | 0507 | S-Pattern range at Acc completion | 0 - 50 | % | | 10 | Y | | [6. 27. 1] |
| F508 | 0508 | S-Pattern range at Dec completion | 0 - 50 | % | | 10 | Y | | [6. 27. 2] |
| F509 | 0509 | S-Pattern range at Dec start | 0 - 50 | % | | 10 | Y | | |
| F510 | 0510 | Acceleration time 3 | 0.0 - 6000 (600.0) | s | | *1 | Y | | |
| F511 | 0511 | Deceleration time 3 | 0.0 - 6000 (600.0) | S | | *1 | Y | | |
| F512 | 0512 | Acc/Dec pattern 3 | 0: Linear 1: S-Pattern 1 2: S-Pattern 2 | - | - | 0 | Y | | |
| F513 | 0513 | Acc/Dec switching frequency 2 | 0.0: Disabled 0.1 - UL | Hz | | 0.0 | Y | | [6. 27. 2] |
| F514 | 0514 | Acceleration time 4 | 0.0 - 6000 (600.0) | S | | *1 | Y | | [0. 21. 2] |
| F515 | 0515 | Deceleration time 4 | 0.0 - 6000 (600.0) | S | | *1 | Υ | | |
| F516 | 0516 | Acc/Dec pattern 4 | 0: Linear 1: S-Pattern 1 2: S-Pattern 2 | - | - | 0 | Y | | |
| F517 | 0517 | Acc/Dec switching frequency 3 | 0.0: Disabled 0.1 - UL | Hz | | 0.0 | Y | | |
| F519 | 0519 | Unit of Acc/Dec time | 0: - 1: 0.01 s unit (0 after execution) 2: 0.1 s unit (0 after execution) | - | - | 0 | N | | [5. 1. 4] [6. 27. 2] |

Title

F520

F521

F522

Communication

No.

0520

0521

0522

Parameter name

Pattern operation

Pattern operation

continue select

Pattern 1 repeat

number

Adjustment range

1: Enabled (seconds)

2: Enabled (minutes)

0: Reset after stop

1: Continue after stop

255: Continuous

0: Disabled

1 - 254

Reference

[6. 28]

Write

during

run-

ning*6

Ν

Ν

Ν

User

setting

Default

setting

0

0

1

Minimum

setting unit

(Panel/Commu-

nication)

1/1

Unit

Times

| Z | P | П |
|---|---|---|
| | | П |
| | 7 | ч |

| Title | Communication No. | Parameter name | Adjustment range | Unit | Minimum setting unit (Panel/Commu- nication) | Default setting | Write during run-ning*6 | User setting | Reference |
|-------|-------------------|---------------------------|--|-------|---|--------------------|-------------------------|-----------------|-----------|
| F523 | 0523 | Pattern 1 select 1 | 0: Skip | - | - | 0 | N | | |
| F524 | 0524 | Pattern 1 select 2 | 1: Sr1 2: Sr2 | - | - | 0 | N | | |
| F525 | 0525 | Pattern 1 select 3 | 3: Sr3 4: Sr4 | - | - | 0 | N | | |
| F526 | 0526 | Pattern 1 select 4 | 5: Sr5 | - | - | 0 | N | | |
| F527 | 0527 | Pattern 1 select 5 | 6: Sr6 7: Sr7 | - | - | 0 | N | | |
| F528 | 0528 | Pattern 1 select 6 | 8: F287 | - | - | 0 | N | | |
| F529 | 0529 | Pattern 1 select 7 | 9: F288 10: F289 | - | - | 0 | N | | |
| F530 | 0530 | Pattern 1 select 8 | 11: F290 12: F291 13: F292 14: F293 15: F294 | - | - | 0 | N | | |
| F531 | 0531 | Pattern 2 repeat number | 1 - 254 255: Continuous | Times | | 1 | N | | |
| F532 | 0532 | Pattern 2 select 1 | 0: Skip | - | - | 0 | N | | |
| F533 | 0533 | Pattern 2 select 2 | 1: Sr1 2: Sr2 | - | - | 0 | N | | |
| F534 | 0534 | Pattern 2 select 3 | 3: Sr3 4: Sr4 | - | - | 0 | N | | |
| F535 | 0535 | Pattern 2 select 4 | 5: Sr5 | - | - | 0 | N | | |
| F536 | 0536 | Pattern 2 select 5 | 6: Sr6 7: Sr7 | - | - | 0 | N | | |
| F537 | 0537 | Pattern 2 select 6 | 8: F287 9: F288 | - | - | 0 | N | | |
| F538 | 0538 | Pattern 2 select 7 | 10: F289 | - | - | 0 | N | | |
| F539 | 0539 | Pattern 2 select 8 | 11: F290 12: F291 13: F292 14: F293 15: F294 | - | - | 0 | N | | [6. 28] |
| F540 | 0540 | Operation time (1-speed) | | s/min | 0.1/0.1 | 5.0 | Y | | |
| F541 | 0541 | Operation time (2-speed) | | s/min | 0.1/0.1 | 5.0 | Y | | |
| F542 | 0542 | Operation time (3-speed) | | s/min | 0.1/0.1 | 5.0 | Y | | |
| F543 | 0543 | Operation time (4-speed) | | s/min | 0.1/0.1 | 5.0 | Y | | |
| F544 | 0544 | Operation time (5-speed) | 0.4 5000 | s/min | 0.1/0.1 | 5.0 | Y | | |
| F545 | 0545 | Operation time (6-speed) | 0.1 - 5999 (Unit by F520) 6000: Continuous | s/min | 0.1/0.1 | 5.0 | Y | | |
| F546 | 0546 | Operation time (7-speed) | | s/min | 0.1/0.1 | 5.0 | Y | | |
| F547 | 0547 | Operation time (8-speed) | | s/min | 0.1/0.1 | 5.0 | Y | | |
| F548 | 0548 | Operation time (9-speed) | | s/min | 0.1/0.1 | 5.0 | Y | | |
| F549 | 0549 | Operation time (10-speed) | | s/min | 0.1/0.1 | 5.0 | Y | | |
| F550 | 0550 | Operation time (11-speed) | | s/min | 0.1/0.1 | 5.0 | Y | | |

| Title | Communication No. | Parameter name | Adjustment range | Unit | Minimum setting unit (Panel/Commu- nication) | Default setting | Write during run-ning*6 | User setting | Reference |
|-------|-------------------|-------------------------------|--|-------|---|--------------------|-------------------------|-----------------|------------------------------------|
| F551 | 0551 | Operation time (12-speed) | | s/min | 0.1/0.1 | 5.0 | Y | | |
| F552 | 0552 | Operation time (13-speed) | 0.1 - 5999 (Unit by F520) | s/min | 0.1/0.1 | 5.0 | Y | | [6. 28] |
| F553 | 0553 | Operation time (14-speed) | 6000: Continuous | s/min | 0.1/0.1 | 5.0 | Y | | [0. 20] |
| F554 | 0554 | Operation time (15-speed) | | s/min | 0.1/0.1 | 5.0 | Y | | |
| F560 | 0560 | Preset speed operation style | 0: Frequency only 1: With function | - | - | 0 | N | | [5. 2. 7] [6. 12. 1] |
| F561 | 0561 | Operation function (1-speed) | | - | 1/1 | 0 | N | | |
| F562 | 0562 | Operation function (2-speed) | | - | 1/1 | 0 | N | | |
| F563 | 0563 | Operation function (3-speed) | 0: Fwd run +1: Rev run +2: Acc/Dec switching signal 1 | - | 1/1 | 0 | N | | |
| F564 | 0564 | Operation function (4-speed) | | - | 1/1 | 0 | N | | |
| F565 | 0565 | Operation function (5-speed) | | - | 1/1 | 0 | N | | |
| F566 | 0566 | Operation function (6-speed) | | - | 1/1 | 0 | N | | |
| F567 | 0567 | Operation function (7-speed) | | - | 1/1 | 0 | N | | |
| F568 | 0568 | Operation function (8-speed) | +4: Acc/Dec switching signal 2 +8: V/f switching signal | - | 1/1 | 0 | N | | [5. 2. 7] [6. 12. 1] [6. 28] |
| F569 | 0569 | Operation function (9-speed) | 1 +16: V/f switching signal 2 | - | 1/1 | 0 | N | | |
| F570 | 0570 | Operation function (10-speed) | +32: Torque limit switching signal 1 | - | 1/1 | 0 | N | | |
| F571 | 0571 | Operation function (11-speed) | +64: Torque limit switching signal 2 | - | 1/1 | 0 | N | | |
| F572 | 0572 | Operation function (12-speed) | | - | 1/1 | 0 | N | | |
| F573 | 0573 | Operation function (13-speed) | | - | 1/1 | 0 | N | | |
| F574 | 0574 | Operation function (14-speed) | | - | 1/1 | 0 | N | | |
| F575 | 0575 | Operation function (15-speed) | | - | 1/1 | 0 | N | | |
| F576 | 0576 | Operation function (0-speed) | | - | 1/1 | 0 | N | | [5. 2. 7] [6. 12. 1] |
| F590 | 0590 | Shock monitoring | 0: Disabled 1: Current detection 2: Torque detection 3: Torque current detection | - | - | 0 | N | | [6. 29] |
| F591 | 0591 | Shock monitoring trip | 0: Disabled 1: Enabled | - | - | 0 | Y | | |

| Title | Communication No. | Parameter name | Adjustment range | Unit | Minimum setting unit (Panel/Commu- nication) | Default setting | Write during run-ning*6 | User setting | Reference |
|-------|-------------------|--|--|------|---|----------------------|-------------------------|-----------------|--------------------------|
| F592 | 0592 | Shock monitoring detection | O: Overcurrent/ Overtorque detection Undercurrent/ Undertorque detection | - | - | 0 | Y | | |
| F593 | 0593 | Shock monitoring detection level | 0 - 250 | % | | 150 | Y | | |
| F595 | 0595 | Shock monitoring detection time | 0.0 - 10.0 | s | | 0.5 | Y | | [6. 29] |
| F596 | 0596 | Shock monitoring detection hysteresis | 0 - 100 | % | | 10 | Y | | |
| F597 | 0597 | Shock monitoring detection wait time | 0.0 - 300.0 | s | | 0.0 | Y | | |
| F598 | 0598 | Shock monitoring detection condition | 0: During run 1: During run (except Acc/Dec) | - | - | 0 | Y | | |
| F600 | 0600 | Parameter for manufacturer | - | - | - | - | - | | - |
| F601 | 0601 | Stall prevention level 1 | 10 - 200 (HD) 10 - 160 (ND) | % | | 150 (HD) 120 (ND) | Y | | [6. 25. 3] [6. 30. 2] |
| F602 | 0602 | Trip record retention | 0: Clear at power off 1: Retain at power off | - | - | 0 | Y | | [6. 30. 3] |
| F603 | 0603 | Emergency off stop pattern | Trip Trip after Deceleration stop Trip after Emergency DC braking Trip after deceleration stop by F515 Trip after Quick deceleration stop Trip after Dynamic quick deceleration stop | - | - | 0 | N | | [6. 30. 4] |
| F604 | 0604 | Emergency DC braking time | 0.0 - 20.0 | s | | 1.0 | Y | | |
| F605 | 0605 | Output phase loss detection | 0: Disabled 1: At startup (only one time after power on) 2: At every startup 3: During run 4: At every startup + during run 5: Output shut off detection | - | - | 0 | N | | [6. 30. 5] |
| F606 | 0606 | Motor overload reduction fre- quency threshold | 0.0 - 60.0 | Hz | | 6.0 | Y | | [5. 1. 5] [6. 30. 1] |
| F607 | 0607 | Motor overload time | 10 - 2400 | s | | 300 | Y | | |
| F608 | 0608 | Input phase loss trip | 0: Disabled 1: Enabled | - | - | 1 | N | | [6. 30. 6] |

| Title | Communication No. | Parameter name | Adjustment range | Unit | Minimum setting unit (Panel/Commu- nication) | Default setting | Write during run-ning*6 | User setting | Reference |
|-------|-------------------|---|---|-------|---|--------------------|-------------------------|-----------------|---------------------------|
| F609 | 0609 | Undercurrent detection hysteresis | 1 - 20 | % | | 10 | Y | | |
| F610 | 0610 | Undercurrent trip | 0: Disabled 1: Enabled | - | - | 0 | Y | | [6. 30. 7] |
| F611 | 0611 | Undercurrent detection level | 0 - 150 | % | | 0 | Y | | [0. 30. 7] |
| F612 | 0612 | Undercurrent detection time | 0 - 255 | s | | 0 | Y | | |
| F613 | 0613 | Short circuit detection at start | 0: At every startup by standard pulse 1: Only one time after power on by standard pulse 2: At every startup by F614 setting pulse 3: Only one time after power on by F614 setting pulse | - | - | 0 | N | | [6. 30. 9] |
| F614 | 0614 | Pulse width of short circuit detection at start | 0: No short circuit detection at start 1 - 50 | μs | | 25 | N | | |
| F615 | 0615 | Overtorque trip | 0: Disabled 1: Enabled | - | - | 0 | Y | | |
| F616 | 0616 | Overtorque detection level during power running | 0: Disabled 1 - 320 | % | | 150 | Y | | |
| F617 | 0617 | Overtorque detection level during regen | 0: Disabled 1 - 320 | % | | 150 | Y | | [6. 30. 8] |
| F618 | 0618 | Overtorque detection time | 0.00 - 10.00 | s | | 0.5 | Y | | |
| F619 | 0619 | Overtorque detection hysteresis | 0 - 100 | % | | 10 | Y | | |
| F620 | 0620 | Cooling fan control | O: Auto ON/OFF, No failure detection 1: Always ON, No failure detection 2: Auto ON/OFF, Failure detection 3: Always ON, Failure detection 4 - 7: - | - | - | 2 | Y | | [6. 30. 11] |
| F621 | 0621 | Cumulative run time alarm | 0.0 - 999.0 | 100 h | | 876.0 | Y | | [6. 30. 12] |
| F622 | 0622 | Abnormal speed detection time | 0.01 - 100.0 | s | | 0.01 | Y | | |
| F623 | 0623 | Abnormal speed increase band | 0.00: Disabled 0.01 - 30.0 | Hz | | 0.00 | Y | | [6. 30. 13] |
| F624 | 0624 | Abnormal speed decrease band | 0.00: Disabled 0.01 - 30.0 | Hz | | 0.00 | Y | | |
| F625 | 0625 | Undervoltage detection level | 50 - 79 80: Auto | % | | 80 | N | | [6. 15. 2] [6. 30. 14] |
| F626 | 0626 | Overvoltage limit operation level | 100 - 150 | % | | 134 | N | | [6. 15. 4] [6. 15. 5] |

| Title | Communication No. | Parameter name | Adjustment range | Unit | Minimum setting unit (Panel/Commu- nication) | Default setting | Write during run-ning*6 | User setting | Reference |
|-------|-------------------|---|--|------|---|--------------------|-------------------------|-----------------|---------------------------|
| F627 | 0627 | Undervoltage trip | 0: Disabled 1: Enabled | - | - | 0 | N | | [6 20 44] |
| F628 | 0628 | Undervoltage detection time | 0.01 - 10.00 | s | | 0.03 | N | | [6. 30. 14] |
| F629 | 0629 | Regenerative power ride-through level | 55 - 100 | % | | 75 | N | | [6. 15. 2] [6. 30. 14] |
| F630 | 0630 | Brake answer wait time | 0.0: Disabled 0.1 - 10.0 | s | | 0.0 | Y | | [6. 18. 1] [6. 30. 15] |
| F631 | 0631 | Inverter overload detection | 0: 150% - 60s (HD) 120% - 60s (ND) 1: Temperature estimation | - | - | 0 | N | | |
| F632 | 0632 | Electronic thermal memory target | 0: No.1 to 4 motor, memory disabled 1: No.1 to 4 motor, memory enabled 2: No.1 motor, memory disabled 3: No.1 motor, memory enabled | - | - | 0 | Y | | [5. 2. 5] [6. 30. 1] |
| F633 | 0633 | II analog input disconnection detection level | 0: Disabled 1 - 100 | % | | 0 | Y | | [6. 30. 16] |
| F634 | 0634 | Annual average ambient temperature | 1: -15 to +10°C 2: +11 to +20°C 3: +21 to +30°C 4: +31 to +40°C 5: +41 to +50°C 6: +51 to +60°C | - | - | 3 | Y | | [6. 30. 17] |
| F635 | 0635 | Rush current suppression relay delay time | 0.0 - 2.5 | s | | 0.0 | N | | [6. 30. 18] |
| F636 | 0636 | Ground fault trip | 0: Disabled 1: Enabled | - | - | 1 | N | | [6. 30. 10] |
| F637 | 0637 | Terminal Al4 PTC trip | 0: Disabled 1: Enabled | - | - | 0 | N | | [0, 20, 40] |
| F638 | 0638 | Terminal AI5 PTC trip | 0: Disabled 1: Enabled | - | - | 0 | N | | [6. 30. 19] |
| F639 | 0639 | Braking resistor overload time | 0.1 - 600.0 | s | | 5.0 | N | | [6. 15. 4] |
| F640 | 0640 | DC supply input | 0: Disabled 1: Enabled | - | - | 0 | N | | - |
| F643 | 0643 | Residual voltage waiting control fre- quency threshold | 0.0 - 60.0 | Hz | | 10.0 | N | | - |
| F644 | 0644 | Operation after II analog input discon- nection detection | 1: Continue running 2: Deceleration stop 3: Coast stop 4: Trip 5: Run by F649 | - | - | 1 | N | | [6. 30. 16] |
| F645 | 0645 | Terminal RR PTC trip | 0: Disabled 1: Enabled | - | - | 0 | Y | | [6. 30. 19] |
| F646 | 0646 | PTC detection resistance | 100 - 9999 | Ω | | 3000 | Y | | [0. 30. 19] |

| Title | Communication No. | Parameter name | Adjustment range | Unit | Minimum setting unit (Panel/Commu- nication) | Default setting | Write during run-ning*6 | User setting | Reference |
|-------|-------------------|--|--|----------------|---|-----------------|-------------------------|-----------------|-------------------------|
| F647 | 0647 | Control power option failure detection | 0: Alarm (no detection without option) 1: Alarm 2: Trip | - | - | 0 | Y | | [6. 30. 20] |
| F648 | 0648 | Number of starting alarm | 0.0 - 999.0 | 10000 times | | 999.0 | Y | | [6. 30. 21] |
| F649 | 0649 | Fallback frequency | LL - UL | Hz | | 0.0 | Υ | | [6. 30. 16] |
| F650 | 0650 | Forced run | 0: Disabled 1: Enabled | - | - | 0 | Y | | [6. 31] |
| F651 | 0651 | Undertorque trip | 0: Disabled 1: Enabled | - | - | 0 | Y | | - |
| F652 | 0652 | Undertorque detection level during power running | 0 - 250 | % | | 0 | Y | | - |
| F653 | 0653 | Undertorque detection level during regen | 0 - 250 | % | | 0 | Y | | - |
| F654 | 0654 | Undertorque detection time | 0.00 - 10.00 | s | | 0.50 | Y | | - |
| F655 | 0655 | Undertorque detection hysteresis | 0 - 100 | % | | 10 | Y | | - |
| F656 | 0656 | PTC detection temperature | 0 - 200 | °C | | 90 | Y | | [6. 30. 19] |
| F657 | 0657 | Overload alarm level | 10 - 100 | % | | 50 | Y | | [5. 1. 5] [6. 30. 1] |
| F658 | 0658 | Number of external equipment starting alarm | 0.0 - 999.0 | 10000 times | | 999.0 | Υ | | [6. 30. 21] |
| F660 | 0660 | Override adding input select | 0: - 1: Terminal RR 2: Terminal RX 3: Terminal II 4: Terminal Al4 (option) 5: Terminal Al5 (option) 6 - 9: - 10: Touch wheel 1 | - | - | 0 | Y | | [6. 32] |

| Title | Communication No. | Parameter name | Adjustment range | Unit | Minimum setting unit (Panel/Commu- nication) | Default setting | Write during run-ning*6 | User setting | Reference |
|-------|-------------------|--|--|-------|---|--------------------|-------------------------|-----------------|-------------------------|
| F661 | 0661 | Override multiply- ing input select | 0: - 1: Terminal RR 2: Terminal RX 3: Terminal II 4: Terminal Al4 (option) 5 - 11: - 12: F729 13 - 23: - | - | - | 0 | Y | | [6. 32] |
| F664 | 0664 | Specified trip 1 | 0 - 100 | Times | 1/1 | 0 | N | | |
| F665 | 0665 | Specified trip 2 | 0 - 100 | Times | 1/1 | 0 | N | | [6. 30. 21] |
| F666 | 0666 | Specified trip 3 | 0 - 100 | Times | 1/1 | 0 | N | | |
| F667 | 0667 | Pulse output step of input cumulative power | 0: 0.1kWh 1: 1kWh 2: 10kWh 3: 100kWh 4: 1000kWh 5: 10000kWh | - | - | 1 | Y | | [6. 33. 1] |
| F668 | 0668 | Pulse output width of input cumulative power | 0.1 - 1.0 | S | | 0.1 | Y | | |
| F669 | 0669 | Terminal FP switching | 0: Digital output 1: Pulse output | - | - | 0 | N | | [6. 33. 2] [7. 2. 2] |
| F670 | 0670 | Terminal AM function | 0 - 162 *3 | - | - | 2 | Y | | [5. 1. 6] |
| F671 | 0671 | Terminal AM adjustment | - | - | - | - | Y | | [5. 1. 6] |
| F676 | 0676 | Terminal FP pulse train output function | 0 - 162 *3 | - | - | 0 | Y | | |
| F677 | 0677 | Maximum pulse number of pulse train output | 0.50 - 43.20 | kpps | | 8.00 | Y | | [6. 33. 2] |
| F678 | 0678 | Pulse train output filter | 1 - 1000 | ms | | 64 | Y | | |
| F679 | 0679 | Pulse train input filter | 1 - 1000 | ms | | 1 | Y | | [6. 6. 4] |
| F681 | 0681 | Terminal FM switching | 0: Meter option (0-1mA) 1: Current output (0-20mA) 2: Voltage output (0-10V) | - | - | 2 | N | | [6. 33. 3] |
| F682 | 0682 | Terminal FM inclination polarity | Negative inclination (downward slope) Positive inclination (upward slope) | - | - | 1 | Y | | |

| Title | Communication No. | Parameter name | Adjustment range | Unit | Minimum setting unit (Panel/Commu- nication) | Default setting | Write during run-ning*6 | User setting | Reference |
|-------|-------------------|--|---|-------|---|--------------------|-------------------------|-----------------|-------------------------|
| F683 | 0683 | Terminal FM bias | -100.0 to +100.0 | % | | 0.0 | Y | | |
| F684 | 0684 | Terminal FM filter | 1 - 1000 | ms | | 1 | Y | | |
| F685 | 0685 | Terminal FM upper-limit level | 0.0 - 100.0 | % | | 100.0 | Y | | |
| F686 | 0686 | Terminal AM switching | 0: Meter option (0-1mA) 1: Current output (0-20mA) 2: Voltage output (0-10V) | - | - | 2 | N | | [6. 33. 3] |
| F687 | 0687 | Terminal AM inclination polarity | Negative inclination (downward slope) Positive inclination (upward slope) | - | - | 1 | Y | | |
| F688 | 0688 | Terminal AM bias | -100.0 to +100.0 | % | | 0.0 | Υ | | |
| F689 | 0689 | Terminal AM filter | 1 - 1000 | ms | | 1 | Υ | | |
| F690 | 0690 | Terminal AM upper-limit level | 0.0 - 100.0 | % | | 100.0 | Y | | |
| F699 | 0699 | Trip for test | 0 - 100 | | | 0 | Y | | - |
| F700 | 0700 | Parameter reading & writing access lockout | O: Unlocked 1: Writing locked (Operation panel, Extension panel) 2: Writing locked (1+RS485) 3: Reading & Writing locked (Operation panel, Extension panel) 4: Reading & Writing locked (3+RS485) | - | - | 0 | Y | | [6. 34. 1] |
| F701 | 0701 | Current, voltage units select | 0: % 1: A (ampere), V (volt) | - | - | 0 | Y | | [5. 1. 7] [6. 34. 2] |
| F702 | 0702 | Free unit multiplicaton factor | 0.00: Disabled 0.01 - 200.0 | Times | | 0.00 | Y | | |
| F703 | 0703 | Target of free unit | 0: All frequencies 1: PID frequencies | - | - | 0 | Y | | |
| F704 | 0704 | Reference Website | 0: English (USA website) 1: English (Japan website) | - | - | *2 | Y | | [5. 3. 3] [6. 34. 3] |
| F705 | 0705 | Free unit inclination polarity | Negative inclination (downward slope) Positive inclination (upward slope) | - | - | 1 | Y | | |
| F706 | 0706 | Free unit bias | 0.00 - FH | Hz | | 0.00 | Y | | |
| F707 | 0707 | Step of panel setting | 0.00: Disabled 0.01 - FH | Hz | | 0.00 | Y | | 10.04.43 |
| F708 | 0708 | Step of panel display | 0: Disabled 1 - 255 | - | - | 0 | Y | | [6. 34. 4] |
| F709 | 0709 | Hold function of standard mode | 0: Real time 1: Peak hold 2: Minimum hold | - | - | 0 | Y | | [6. 34. 7] |

| Title | Communication No. | Parameter name | Adjustment range | Unit | Minimum setting unit (Panel/Commu- nication) | Default setting | Write during run- ning*6 | User setting | Reference |
|-------|-------------------|--|---|------|---|-----------------|-----------------------------------|-----------------|--------------------------------------|
| F710 | 0710 | Standard mode display | | - | - | 0 | Y | | [4. 2. 3] [5. 3. 3] [6. 34. 5] |
| F711 | 0711 | Monitor mode 1 display | | - | - | 2 | Y | | |
| F712 | 0712 | Monitor mode 2 display | | - | - | 3 | Y | | |
| F713 | 0713 | Monitor mode 3 display | | - | - | 4 | Y | | |
| F714 | 0714 | Monitor mode 4 display | 0 - 162 ^{*3} | - | - | 8 | Y | | [6. 34. 6] |
| F715 | 0715 | Monitor mode 5 display | | - | - | 18 | Y | | [8. 1. 1] |
| F716 | 0716 | Monitor mode 6 display | | - | - | 19 | Y | | |
| F717 | 0717 | Monitor mode 7 display | | - | - | 35 | Y | | |
| F718 | 0718 | Monitor mode 8 display | 0: Clear at coast step | - | - | 34 | Y | | |
| F719 | 0719 | Run command clear select | O: Clear at coast stop. Retain at MOFF and when CMOd is changed. 1: Retain run command. 2: Clear at coast stop and at MOFF. Retain when CMOd is changed. 3: Clear at coast stop, at MOFF and when CMOd is changed. | - | - | 2 | Y | | [6. 34. 8] |
| F720 | 0720 | Standard mode display of extension panel | 0 - 162 * 4 | - | - | 0 | Y | | [5. 3. 3] [6. 34. 5] |
| F721 | 0721 | Panel stop | 0: Deceleration stop 1: Coast stop | - | - | 0 | Y | | [6. 34. 9] |
| F722 | 0722 | Monitor mode filter | 8 - 1000 | ms | | 200 | Y | | - |
| F723 | 0723 | Status area display of operation panel | 0 - 162 *4 | - | - | 1 | Y | | [5. 3. 3] [6. 34. 5] |
| F724 | 0724 | Frequency setting target by touch wheel | 0: Panel run frequency command (FC) 1: FC + Preset speed | - | - | 0 | Y | | [5. 2. 7] |
| F725 | 0725 | Panel torque command | -250 to +250 | % | | 0 | Y | | [6. 24. 1] [6. 34. 10] |
| F727 | 0727 | Panel tension torque bias | -250 to +250 | % | | 0 | Y | | [6 04 0] |
| F728 | 0728 | Panel load sharing gain | 0 - 250 | % | | 100 | Y | | [6. 24. 3] |
| F729 | 0729 | Panel override multiplication gain | -100 to +100 | % | | 0 | Y | | [6. 32] |

| Title | Communication No. | Parameter name | Adjustment range | Unit | Minimum setting unit (Panel/Commu- nication) | Default setting | Write during run-ning*6 | User | Reference |
|-------|-------------------|---|---|------|---|-----------------|-------------------------|------|------------|
| F730 | 0730 | Panel frequency setting lockout | 0: Unlocked without press OK 1: Locked 2: Unlocked after press OK | - | - | 2 | Y | | |
| F731 | 0731 | Operation after dis- connection detec- tion during panel run | 1: Continue running 2 - 3: - 4: Trip | - | - | 4 | Y | | |
| F732 | 0732 | Panel Hand/Auto function lockout | 0: Unlocked 1: Locked | - | - | 1 | Y | | |
| F733 | 0733 | Panel Run lockout | 0: Unlocked 1: Locked | - | - | 0 | Y | | |
| F734 | 0734 | Panel emergency off lockout | 0: Unlocked 1: Locked | - | - | 0 | Y | | |
| F735 | 0735 | Panel reset lockout | 0: Unlocked 1: Locked | - | - | 0 | Y | | [6. 34. 1] |
| F736 | 0736 | CMOd/FMOd change lockout during run | 0: Unlocked 1: Locked | - | - | 1 | Y | | |
| F737 | 0737 | Panel keys lockout | 0: Unlocked 1: Locked 2: Locked only extension panel 3: Locked only operation panel | - | - | 0 | Y | | |
| F738 | 0738 | Password setting | 0: Disabled 1 - 9998 9999: Password was set | - | - | 0 | Y | | |
| F739 | 0739 | Password verification | 0: non-setting 1 - 9998 9999: Password was set | - | - | 0 | Y | | |
| F740 | 0740 | Trace | O: Disabled 1: Trip has occurred 2: At trigger input 3: At trip & at trigger input | - | - | 1 | Y | | |
| F741 | 0741 | Trace cycle | 0: 4ms 1: 20ms 2: 100ms 3: 1s 4: 10s | - | - | 2 | Y | | [6. 35] |
| F742 | 0742 | Trace data 1 | | - | - | 0 | Υ | | |
| F743 | 0743 | Trace data 2 | 0 400 *3 | - | - | 1 | Y | | |
| F744 | 0744 | Trace data 3 | 0 - 162 ^{*3} | - | - | 2 | Υ | | |
| F745 | 0745 | Trace data 4 | | - | - | 3 | Υ | | |
| F748 | 0748 | Cumulative power save | 0: Disabled 1: Enabled | - | - | 0 | Y | | |
| F749 | 0749 | Cumulative power unit | 0: 1.0=1 kWh 1: 1.0=10 kWh 2: 1.0=100 kWh 3: 1.0=1000 kWh 4: 1.0=10000 kWh 5: 1.0=100000 kWh | - | - | *1 | Y | | [6. 36] |

| Title | Communication No. | Parameter name | Adjustment range | Unit | Minimum setting unit (Panel/Commu- nication) | Default setting | Write during run-ning*6 | User setting | Reference |
|-------|-------------------|-------------------|--|------|---|-----------------|-------------------------|-----------------|-----------|
| F750 | 0750 | EASY key function | 0: Easy/Setting mode switching 1: Shortcut function (Extension panel only) 2: Hand/Auto switching 3: Monitor peak and minimum hold trigger | - | - | 0 | N | | [6. 37] |
| F751 | 0751 | Easy setting 1 | | - | - | 3 | Υ | | |
| F752 | 0752 | Easy setting 2 | | - | - | 4 | Y | | |
| F753 | 0753 | Easy setting 3 | - | - | - | 9 | Y | | |
| F754 | 0754 | Easy setting 4 | | - | - | 10 | Υ | | |
| F755 | 0755 | Easy setting 5 | - | - | - | 12 | Υ | | |
| F756 | 0756 | Easy setting 6 | - | - | - | 13 | Y | | |
| F757 | 0757 | Easy setting 7 | | - | - | 31 | Y | | |
| F758 | 0758 | Easy setting 8 | | - | - | 6 | Y | | |
| F759 | 0759 | Easy setting 9 | | - | - | 999 | Y | | |
| F760 | 0760 | Easy setting 10 | | - | - | 999 | Y | | |
| F761 | 0761 | Easy setting 11 | | - | - | 999 | Y | | |
| F762 | 0762 | Easy setting 12 | | - | - | 999 | Y | | |
| F763 | 0763 | Easy setting 13 | - | - | - | 999 | Y | | |
| F764 | 0764 | Easy setting 14 | 0-2999 | - | - | 999 | Υ | | |
| F765 | 0765 | Easy setting 15 | Set easy setting param- | - | - | 999 | Y | | |
| F766 | 0766 | Easy setting 16 | eters by the communica- tion number | - | - | 999 | Y | | |
| F767 | 0767 | Easy setting 17 | 0000-0998: Basic, | - | - | 999 | Υ | | [5. 1. 8] |
| F768 | 0768 | Easy setting 18 | F100-F998 1000-1999: A000-A999 | - | - | 999 | Υ | | |
| F769 | 0769 | Easy setting 19 | 2000-2999: C000-C999 | - | - | 999 | Y | | |
| F770 | 0770 | Easy setting 20 | - | - | - | 999 | Υ | | |
| F771 | 0771 | Easy setting 21 | | - | - | 999 | Y | | |
| F772 | 0772 | Easy setting 22 | | - | - | 999 | Y | | |
| F773 | 0773 | Easy setting 23 | | - | - | 999 | Υ | | |
| F774 | 0774 | Easy setting 24 | | - | - | 999 | Υ | | |
| F775 | 0775 | Easy setting 25 | | - | - | 999 | Υ | | |
| F776 | 0776 | Easy setting 26 | | - | - | 999 | Y | | • |
| F777 | 0777 | Easy setting 27 | | - | - | 999 | Y | | • |
| F778 | 0778 | Easy setting 28 | | - | - | 999 | Y | | • |
| F779 | 0779 | Easy setting 29 | | - | - | 999 | Y | | • |
| F780 | 0780 | Easy setting 30 | | - | - | 999 | Υ | | |
| F781 | 0781 | Easy setting 31 | | - | - | 701 | Υ | | |
| F782 | 0782 | Easy setting 32 | | - | - | 50 | Y | | |

Title

F790

F791

F792

F793

F794

F795

F796

F797

F798

F799

Communication

No.

0790

0791

0792

0793

0794

0795

0796

0797

0798

0799

Parameter name

Panel display at

1st and 2nd charac-

3rd and 4th charac-

5th and 6th charac-

7th and 8th charac-

power on

ters of F790

ters of F790

ters of F790

ters of F790 9th and 10th char-

acters of F790 11th and 12th char-

acters of F790 13th and 14th char-

acters of F790 15th and 16th char-

acters of F790
Parameter for

manufacturer

Adjustment range

0: HELLO (Depending

1: F791 - F798 2, 3: -

0-FFFF

0-FFFF

0-FFFF

0-FFFF

0-FFFF

0-FFFF

0-FFFF

0-FFFF

on language setting)

Reference

[6. 34. 11]

Write

during

run-

ning*6

Υ

Υ

Υ

Υ

Υ

Υ

Υ

Υ

Υ

User

setting

Default

setting

0

2d2d

2d2d

2d2d

2d2d

2d2d

2d2d

2d2d

2d2d

Minimum

setting unit

(Panel/Commu-

nication)

Unit

Hex

Hex

Hex

Hex

Hex

Hex

Hex

Hex

| E | E | 1 |
|---|---|---|
| Ł | Ŧ | |

| Title | Communication No. | Parameter name | Adjustment range | Unit | Minimum setting unit (Panel/Commu- nication) | Default setting | Write during run-ning*6 | User setting | Reference |
|-------|-------------------|--|--|------|---|--------------------|-------------------------|-----------------|------------|
| F800 | 0800 | RS485 (1) baud rate | 0: 9600 bps 1: 19200 bps 2: 38400 bps 3: - | - | - | 1 | Y | | |
| F801 | 0801 | RS485 (1) parity | 0: Disabled 1: Even parity 2: Odd parity | - | - | 1 | Y | | |
| F802 | 0802 | Inverter number (RS485 common) | 0 - 247 | - | - | 0 | Y | | |
| F803 | 0803 | RS485 (1) time-out time | 0.0: Disabled 0.1 - 100.0 | s | | 0.0 | Y | | |
| F804 | 0804 | RS485 (1) time-out operation | 1: Continue running 2, 3: - 4: Trip 5: - 6: Trip after deceleration stop | - | - | 1 | Y | | |
| F805 | 0805 | RS485 (1) transmission wait time | 0.00 - 2.00 | S | | 0.00 | Y | | |
| F806 | 0806 | RS485 (1) inverter to inverter communication | 0: Follower (0Hz command when Leader fails) 1: Follower (continue running when Leader fails) 2: Follower (emergency off when Leader fails) 3: Leader (transmit frequency command) 4: Leader (transmit output frequency signal) 5: Leader (transmit torque command) 6: Leader (transmit output frequency command) | - | - | 0 | Y | | [6. 38. 1] |
| F807 | 0807 | RS485 (1) protocol | 0: TOSHIBA 1: MODBUS | - | - | 0 | Y | | |
| F808 | 0808 | RS485 (1) time-out detection | Always Run command and frequency command by communication are enabled. During run by communication | - | - | 1 | Y | | |
| F809 | 0809 | Operation panel connection priority | 0: By the parameter setting 1: Connect to conector 1 2: Connect to conector 2 | - | - | 1 | Y | | - |

| Title | Communication No. | Parameter name | Adjustment range | Unit | Minimum setting unit (Panel/Commu- nication) | Default setting | Write during run-ning*6 | User setting | Reference |
|-------|-------------------|--|---|------|---|-----------------------------|-------------------------|-----------------|-------------------------|
| F810 | 0810 | Communication frequency point select | 0: Disabled 1: RS485 (1) 2: RS485 (2) 3: Communication option 4: Embedded Ethernet | - | - | 0 | Y | | |
| F811 | 0811 | Communication point 1 input value | 0 - 100 | % | | 0 | Y | | [6. 6. 2] [6. 38. 1] |
| F812 | 0812 | Communication point 1 frequency | 0.0 - FH | Hz | | 0.0 | Y | | [0. 36. 1] |
| F813 | 0813 | Communication point 2 input value | 0 - 100 | % | | 100 | Y | | |
| F814 | 0814 | Communication point 2 frequency | 0.0 - FH | Hz | | 50.0/ 60.0 ^{*2} | Y | | |
| F820 | 0820 | RS485 (2) baud rate | 0: 9600 bps 1: 19200 bps 2: 38400 bps 3: - | - | - | 1 | Y | | |
| F821 | 0821 | RS485 (2) parity | 0: Disabled 1: Even parity 2: Odd parity | - | - | 1 | Y | | |
| F823 | 0823 | RS485 (2) time-out time | 0.0: Disabled 0.1 - 100.0 | s | | 0.0 | Y | | |
| F824 | 0824 | RS485 (2) time-out operation | 1: Continue running 2, 3: - 4: Trip 5: - 6: Trip after deceleration stop | - | - | 1 | Y | | |
| F825 | 0825 | RS485 (2) transmission wait time | 0.00 - 2.00 | s | | 0.00 | Y | | |
| F826 | 0826 | RS485 (2) inverter to inverter communication | O: Follower (0Hz command when Leader fails) 1: Follower (continue running when Leader fails) 2: Follower (emergency off when Leader fails) 3: Leader (transmit frequency command) 4: Leader (transmit output frequency signal) 5: Leader (transmit torque command) 6: Leader (transmit output forque command) | - | - | 0 | Y | | [6. 38. 1] |
| F827 | 0827 | RS485 (2) protocol | 0: TOSHIBA 1: MODBUS | - | - | 0 | Y | | |

| Title | Communication No. | Parameter name | Adjustment range | Unit | Minimum setting unit (Panel/Commu- nication) | Default setting | Write during run-ning*6 | User setting | Reference |
|-------|-------------------|-------------------------------------|--|------|---|--------------------|-------------------------|-----------------|------------|
| F828 | 0828 | RS485 (2) time-out detection | O: Always I: Run command and frequency command by communication are enabled. During run by communication | - | - | 1 | Y | | |
| F829 | 0829 | RS485 (2) wiring type | 0: 2-wire 1: 4-wire | - | - | 0 | Υ | | |
| F830 | 0830 | MODBUS continuous address | 0: Disabled 1: Enabled | - | - | 1 | Y | | |
| F856 | 0856 | Motor pole number for communication | 1: 2 pole 2: 4 pole 3: 6 pole 4: 8 pole 5: 10 pole 6: 12 pole 7: 14 pole 8: 16 pole | - | - | 2 | Υ | | [6. 38. 1] |
| F870 | 0870 | Block write data 1 | 0: Disabled 1: FA00 (Communication command 1) 2: FA20 (Communication command 2) | - | - | 0 | Y | | |
| F871 | 0871 | Block write data 2 | 3: FA01 (Frequency command) 4: FA50 (TB output) 5: FA51 (Analog output) 6: FA13 (Speed command by communication) | - | - | 0 | Y | | |

| Title | Communication No. | Parameter name | Adjustment range | Unit | Minimum setting unit (Panel/Commu- nication) | Default setting | Write during run-ning*6 | User setting | Reference |
|-------|-------------------|----------------------------|---|------|---|--------------------|-------------------------|-----------------|------------|
| F875 | 0875 | Block read data 1 | 0: Disabled | - | - | 0 | Y | | |
| F876 | 0876 | Block read data 2 | 1: FD01 (Status information) | - | - | 0 | Υ | | - |
| F877 | 0877 | Block read data 3 | 2: FD00 (Output | - | - | 0 | Υ | | - |
| F878 | 0878 | Block read data 4 | frequency) 3: FD03 (Output current) | - | - | 0 | Υ | | |
| F879 | 0879 | Block read data 5 | 4: FD05 (Output voltage) 5: FC91 (Alarm information) 6: FD22 (PID feedback value) 7: FD06 (Input terminal monitor) 8: FD07 (Output terminal RR monitor) 10: FE35 (Terminal RR monitor) 10: FE36 (Terminal RX monitor) 11: FE37 (Terminal II monitor) 12: FD04 (Input voltage (DC detection)) 13: FD16 (Speed feedback frequency) 14: FD18 (Torque) 15: FE60 (My function output monitor 1) 16: FE61 (My function output monitor 2) 17: FE62 (My function output monitor 3) 18: FE63 (My function output monitor 4) 19: 0880 (Free memorandum) 20: FD90 (Motor speed) 21: FD29 (Input power) 22: FD30 (Output power) 23: FC90 (Trip information) | - | - | 0 | Y | | [6. 38. 1] |
| F880 | 0880 | Free memorandum | 0-65535 | - | 1/1 | 0 | Y | | [6. 38. 3] |
| F896 | 0896 | Parameter for manufacturer | - | - | - | - | - | | - |
| F897 | 0897 | Parameter writing | Storage to memory device Storage to memory device except by communication | - | - | 0 | Y | | - |
| F898 | 0898 | Trip reset | 0: Clear trip by request from communication option. Reset by request except from communication option. 1: Reset 2: Trip clear 3 - 5: - | - | - | 0 | N | | - |

| Title | Communication No. | Parameter name | Adjustment range | Unit | Minimum setting unit (Panel/Commu- nication) | Default setting | Write during run-ning*6 | User setting | Reference |
|-------|-------------------|---|---|------|---|--------------------|-------------------------|-----------------|------------|
| F899 | 0899 | Communication option reset | 0: - 1: Reset option and inverter | - | - | 0 | N | | [6. 38. 1] |
| F907 | 0907 | PM regenerative over-flux upper limit | 0 - 150 | % | | 50 | N | | - |
| F908 | 0908 | PM no load current | 0 - 100 | % | | 0 | N | | - |
| F909 | 0909 | PM step-out detection frequency rate | 0 - 100 | % | | 0 | N | | - |
| F910 | 0910 | PM step-out detection current level | 1 - 150 | % | | 100 | N | | [6. 39] |
| F911 | 0911 | PM step-out detection time | 0.00: Disabled 0.01 - 2.55 | s | | 0.00 | N | | [0. 39] |
| F912 | 0912 | PM q-axis inductance | 0.01 - 650.0 | mH | | 10.00 | N | | [6 22 2] |
| F913 | 0913 | PM d-axis inductance | 0.01 - 650.0 | mH | | 10.00 | N | | [6. 23. 2] |
| F914 | 0914 | Parameter for manufacturer | - | - | - | - | - | | - |
| F915 | 0915 | PM control method | 0: Method 0 1: Method 1 2: Method 2 3: Method 3 4: Method 4 | - | - | 3 | N | | [6. 23. 2] |
| F916 | 0916 | PM starting current | 0 - 100 | % | | 25 | N | | - |
| F917 | 0917 | IPM maximum torque control | 0: Disabled 1: Enabled | - | | 0 | Y | | - |
| F918 | 0918 | IPM current phase adjustment | -45.0 to +45.0 | °C | | 0.0 | Y | | - |
| F919 | 0919 | Parameter for manufacturer | - | - | - | - | - | | - |
| F920 | 0920 | Parameter for manufacturer | - | - | - | - | - | | - |
| F921 | 0921 | SPM initial position estimation current | 10 - 150 | % | | 100 | N | | - |
| F922 | 0922 | PM HF control speed estimation response | 5 - 80 | Hz | | 15 | N | | - |
| F923 | 0923 | PM control switch- ing speed | 5 - 100 | % | | 25 | N | | - |
| F924 | 0924 | PM speed estima- tion filter cutoff fre- quency | 1 - 80 | Hz | | 30 | N | | - |
| F925 | 0925 | PM HF control speed estimation stabilization coeffi- cient | 0.50 - 2.50 | | | 1.00 | N | | - |
| F926 | 0926 | PM HF control har- monic frequency | 100 - 1000 | Hz | | 500 | N | | - |
| F927 | 0927 | PM HF control cur- rent level | 5 - 100 | % | | 25 | N | | - |

| Title | Communication No. | Parameter name | Adjustment range | Unit | Minimum setting unit (Panel/Commu- nication) | Default setting | Write during run-ning*6 | User setting | Reference |
|-------|-------------------|-------------------------------------|---------------------------|------|---|--------------------|-------------------------|-----------------|-----------|
| F928 | 0928 | PM initial position estimation time | 0 - 1000 | ms | | 125 | N | | - |
| F929 | 0929 | PM dead time com- pensation time | -1 to +32767 | ns | | 0 | N | | - |
| F930 | 0930 | Parameter for manufacturer | - | - | - | - | - | | - |
| F964 | 0964 | Preset speed 16 | LL - UL | Hz | | 0.0 | Y | | |
| F965 | 0965 | Preset speed 17 | LL - UL | Hz | | 0.0 | Y | | |
| F966 | 0966 | Preset speed 18 | LL - UL | Hz | | 0.0 | Y | | |
| F967 | 0967 | Preset speed 19 | LL - UL | Hz | | 0.0 | Y | | |
| F968 | 0968 | Preset speed 20 | LL - UL | Hz | | 0.0 | Y | | |
| F969 | 0969 | Preset speed 21 | LL - UL | Hz | | 0.0 | Y | | |
| F970 | 0970 | Preset speed 22 | LL - UL | Hz | | 0.0 | Y | | |
| F971 | 0971 | Preset speed 23 | LL - UL | Hz | | 0.0 | Y | | re 0.71 |
| F972 | 0972 | Preset speed 24 | LL - UL | Hz | | 0.0 | Y | | [5. 2. 7] |
| F973 | 0973 | Preset speed 25 | LL - UL | Hz | | 0.0 | Y | | |
| F974 | 0974 | Preset speed 26 | LL - UL | Hz | | 0.0 | Y | | |
| F975 | 0975 | Preset speed 27 | LL - UL | Hz | | 0.0 | Y | | |
| F976 | 0976 | Preset speed 28 | LL - UL | Hz | | 0.0 | Y | | |
| F977 | 0977 | Preset speed 29 | LL - UL | Hz | | 0.0 | Y | | |
| F978 | 0978 | Preset speed 30 | LL - UL | Hz | | 0.0 | Y | | |
| F979 | 0979 | Preset speed 31 | LL - UL | Hz | | 0.0 | Y | | |
| F980 | 0980 | Traverse operation | 0: Disabled 1: Enabled | - | - | 0 | N | | |
| F981 | 0981 | Traverse Acc time | 0.1 - 120.0 | S | | 25.0 | Υ | | |
| F982 | 0982 | Traverse Dec time | 0.1 - 120.0 | s | | 25.0 | Υ | | [6. 40] |
| F983 | 0983 | Traverse step | 0.0 - 25.0 | % | | 10.0 | Υ | | |
| F984 | 0984 | Traverse jump step | 0.0 - 50.0 | % | | 10.0 | Y | F | |
| F997 | 0997 | Parameter for manufacturer | - | - | - | - | - | | - |
| F998 | 0998 | Parameter for manufacturer | - | - | - | - | - | | - |
| F999 | 0999 | Parameter for manufacturer | - | - | - | - | - | | - |

^{*1} Parameter values vary depending on the capacity. For details, refer to [11. 6].

^{*2} Depending on the setup menu. Refer to [11. 10].

^{*3} For details on the analog output and monitor output function, refer to [11. 7].

^{*4} Refer to section [11. 8] for details about the input terminal function.

^{*5} Refer to section [11. 9] for details about the output terminal function.

^{*6} Y: Writable N: Not writable

11. 4 Advanced parameter

| Title | Function | Reference |
|--------------------------------------|-------------------|-----------|
| Starting at A000 | Calendar function | |
| Starting at A200 | Pump control | |
| Starting at A300 | Multi PID | |
| Starting at A800 Starting at A900 | My function | |

11

11

11. 5 Communication parameter

| Title | Function | Reference |
|----------------------------|---------------------------------|-----------|
| C001 - C111 | Common to communication options | |
| C152 - C157 C500 - C556 | For PROFINET option | |
| C606 - C699 | For embedded Ethernet | |

11. 6 Parameter setting range and default setting depending on capacity

ACC,dEC,

tHrA,F182,F183,F184

■ HD rating

| Voltage class | Applicable motor (kW) | | erter -form | vb,F172, F176,F180 (%) | F500, F501, F510, F511, F514, F515 (s) | Adjustment range | (A) | F249 (kHz) | F298 (V) |
|------------------|-----------------------|--------|----------------|------------------------------|--|------------------|-------|---------------|-------------|
| | 0.4 | | 2004P | 4.80 | 10.0 | 0.33-3.30 | 3.30 | 4.0 | 120.0 |
| | 0.75 | | 2007P | 4.80 | 10.0 | 0.46-4.60 | 4.60 | 4.0 | 120.0 |
| | 1.5 | | 2015P | 4.80 | 10.0 | 0.80-8.00 | 8.00 | 4.0 | 120.0 |
| | 2.2 | | 2022P | 3.10 | 10.0 | 1.12-11.20 | 11.20 | 4.0 | 120.0 |
| | 4.0 | | 2037P | 3.10 | 10.0 | 1.87-18.70 | 18.70 | 4.0 | 120.0 |
| | 5.5 | | 2055P | 2.50 | 10.0 | 2.54-25.40 | 25.40 | 4.0 | 120.0 |
| | 7.5 | | 2075P | 2.30 | 10.0 | 3.27-32.70 | 32.70 | 4.0 | 120.0 |
| 3-phase 240 V | 11 | VFAS3- | 2110P | 1.80 | 10.0 | 4.68-46.80 | 46.80 | 4.0 | 120.0 |
| 2.00 | 15 | | 2150P | 1.60 | 10.0 | 6.34-63.40 | 63.40 | 4.0 | 120.0 |
| | 18.5 | | 2185P | 1.50 | 30.0 | 7.84-78.40 | 78.40 | 4.0 | 120.0 |
| | 22 | | 2220P | 1.70 | 30.0 | 9.3-92.6 | 92.6 | 4.0 | 120.0 |
| | 30 | | 2300P | 1.40 | 30.0 | 12.3-123.0 | 123.0 | 4.0 | 120.0 |
| | 37 | | 2370P | 0.90 | 30.0 | 14.9-149.0 | 149.0 | 4.0 | 120.0 |
| | 45 | | 2450P | 0.80 | 30.0 | 17.6-176.0 | 176.0 | 4.0 | 120.0 |
| | 55 | | 2550P | 0.80 | 30.0 | 21.1-211.0 | 211.0 | 2.5 | 120.0 |
| | 0.4 | | 4004PC | 4.80 | 10.0 | 0.15-1.50 | 1.50 | 4.0 | 240.0 |
| | 0.75 | | 4007PC | 4.80 | 10.0 | 0.22-2.20 | 2.20 | 4.0 | 240.0 |
| | 1.5 | | 4015PC | 4.80 | 10.0 | 0.40-4.00 | 4.00 | 4.0 | 240.0 |
| | 2.2 | | 4022PC | 3.10 | 10.0 | 0.56-5.60 | 5.60 | 4.0 | 240.0 |
| | 4.0 | | 4037PC | 3.10 | 10.0 | 0.93-9.30 | 9.30 | 4.0 | 240.0 |
| | 5.5 | | 4055PC | 2.50 | 10.0 | 1.27-12.70 | 12.70 | 4.0 | 240.0 |
| | 7.5 | | 4075PC | 2.30 | 10.0 | 1.65-16.50 | 16.50 | 4.0 | 240.0 |
| | 11 | | 4110PC | 1.80 | 10.0 | 2.35-23.50 | 23.50 | 4.0 | 240.0 |
| | 15 | | 4150PC | 1.60 | 10.0 | 3.17-31.70 | 31.70 | 4.0 | 240.0 |
| | 18.5 | | 4185PC | 1.50 | 30.0 | 3.92-39.20 | 39.20 | 4.0 | 240.0 |
| | 22 | | 4220PC | 1.70 | 30.0 | 4.63-46.30 | 46.30 | 4.0 | 264.0 |
| 3-phase 480 V | 30 | VFAS3- | 4300PC | 1.40 | 30.0 | 6.15-61.50 | 61.50 | 4.0 | 264.0 |
| 400 1 | 37 | | 4370PC | 0.90 | 30.0 | 7.45-74.50 | 74.50 | 4.0 | 264.0 |
| | 45 | | 4450PC | 0.80 | 30.0 | 8.8-88.0 | 88.0 | 4.0 | 264.0 |
| | 55 | | 4550PC | 0.80 | 30.0 | 10.6-106.0 | 106.0 | 4.0 | 264.0 |
| | 75 | | 4750PC | 1.40 | 60.0 | 14.5-145.0 | 145.0 | 4.0 | 264.0 |
| | 90 | | 4900PC | 1.30 | 60.0 | 17.3-173.0 | 173.0 | 2.5 | 240.0 |
| | 110 | | 4110KPC | 1.00 | 60.0 | 21.1-211.0 | 211.0 | 2.5 | 240.0 |
| | 132 | | 4132KPC | 0.80 | 60.0 | 25.0-250.0 | 250.0 | 2.5 | 240.0 |
| | 160 | | 4160KPC | 0.80 | 60.0 | 31.4-314.0 | 314.0 | 2.5 | 240.0 |
| | 220 | | 4200KPC | 0.80 | 60.0 | 38.7-387.0 | 387.0 | 2.5 | 240.0 |
| | 250 | | 4220KPC | 0.80 | 60.0 | 42.7-427.0 | 427.0 | 2.5 | 240.0 |
| | 280 | | 4280KPC | 0.80 | 60.0 | 55.0-550.0 | 550.0 | 2.5 | 240.0 |

11

| | Applicable | | | F300 |) | | F200 | | | F405 | 5 |
|------------------|---------------|--------|----------------|------------------|-------|---------------|--------------|------|-------------|-----------------------------|---------------|
| Voltage class | motor (kW) | | erter -form | Adjustment range | (kHz) | F308 (Ohm) | F309 (kW) | F316 | F402 (%) | <set> = "JP" (kW)</set> | other (kW) |
| | 0.4 | | 2004P | 1.0-16.0 | 4.0 | 2000 | 0.12 | 1 | 4.30 | 0.40 | 0.40 |
| | 0.75 | | 2007P | 1.0-16.0 | 4.0 | 2000 | 0.12 | 1 | 4.30 | 0.75 | 0.75 |
| | 1.5 | | 2015P | 1.0-16.0 | 4.0 | 750 | 0.12 | 1 | 4.40 | 1.50 | 1.50 |
| | 2.2 | | 2022P | 1.0-16.0 | 4.0 | 750 | 0.12 | 1 | 2.90 | 2.20 | 2.20 |
| | 4.0 | | 2037P | 1.0-16.0 | 4.0 | 400 | 0.12 | 1 | 2.80 | 3.70 | 4.00 |
| | 5.5 | | 2055P | 1.0-16.0 | 4.0 | 200 | 0.24 | 1 | 2.30 | 5.50 | 5.50 |
| | 7.5 | | 2075P | 1.0-16.0 | 4.0 | 150 | 0.44 | 1 | 2.00 | 7.50 | 7.50 |
| 3-phase 240 V | 11 | VFAS3- | 2110P | 1.0-16.0 | 4.0 | 100 | 0.66 | 1 | 1.60 | 11.00 | 11.00 |
| | 15 | | 2150P | 1.0-16.0 | 4.0 | 75 | 0.88 | 1 | 1.50 | 15.00 | 15.00 |
| | 18.5 | | 2185P | 1.0-16.0 | 4.0 | 75 | 0.88 | 1 | 1.40 | 18.50 | 18.50 |
| | 22 | | 2220P | 1.0-16.0 | 4.0 | 33 | 1.76 | 1 | 1.60 | 22.00 | 22.00 |
| | 30 | | 2300P | 1.0-8.0 | 4.0 | 33 | 1.76 | 1 | 1.20 | 30.00 | 30.00 |
| | 37 | | 2370P | 1.0-8.0 | 4.0 | 20 | 2.20 | 1 | 0.80 | 37.00 | 37.00 |
| | 45 | | 2450P | 1.0-8.0 | 4.0 | 20 | 2.20 | 1 | 0.70 | 45.00 | 45.00 |
| | 55 | | 2550P | 1.0-8.0 | 2.5 | 20 | 2.20 | 1 | 0.80 | 55.00 | 55.00 |
| | 0.4 | | 4004PC | 1.0-16.0 | 4.0 | 2000 | 0.12 | 3 | 4.30 | 0.40 | 0.40 |
| | 0.75 | | 4007PC | 1.0-16.0 | 4.0 | 2000 | 0.12 | 3 | 4.30 | 0.75 | 0.75 |
| | 1.5 | | 4015PC | 1.0-16.0 | 4.0 | 2000 | 0.12 | 3 | 4.40 | 1.50 | 1.50 |
| | 2.2 | | 4022PC | 1.0-16.0 | 4.0 | 2000 | 0.12 | 3 | 2.90 | 2.20 | 2.20 |
| | 4.0 | | 4037PC | 1.0-16.0 | 4.0 | 1600 | 0.12 | 3 | 2.80 | 3.70 | 4.00 |
| | 5.5 | | 4055PC | 1.0-16.0 | 4.0 | 800 | 0.24 | 3 | 2.30 | 5.50 | 5.50 |
| | 7.5 | | 4075PC | 1.0-16.0 | 4.0 | 600 | 0.44 | 3 | 2.00 | 7.50 | 7.50 |
| | 11 | | 4110PC | 1.0-16.0 | 4.0 | 400 | 0.66 | 3 | 1.60 | 11.00 | 11.00 |
| | 15 | | 4150PC | 1.0-16.0 | 4.0 | 300 | 0.88 | 3 | 1.50 | 15.00 | 15.00 |
| | 18.5 | | 4185PC | 1.0-16.0 | 4.0 | 300 | 0.88 | 3 | 1.40 | 18.50 | 18.50 |
| | 22 | | 4220PC | 1.0-16.0 | 4.0 | 150 | 1.76 | 3 | 1.60 | 22.00 | 22.00 |
| 3-phase 480 V | 30 | VFAS3- | 4300PC | 1.0-16.0 | 4.0 | 150 | 1.76 | 3 | 1.20 | 30.00 | 30.00 |
| | 37 | | 4370PC | 1.0-16.0 | 4.0 | 80 | 1.76 | 3 | 0.80 | 37.00 | 37.00 |
| | 45 | | 4450PC | 1.0-16.0 | 4.0 | 80 | 1.76 | 3 | 0.70 | 45.00 | 45.00 |
| | 55 | | 4550PC | 1.0-8.0 | 4.0 | 80 | 1.76 | 3 | 0.80 | 55.00 | 55.00 |
| | 75 | | 4750PC | 1.0-8.0 | 4.0 | 80 | 1.76 | 3 | 1.30 | 75.00 | 75.00 |
| | 90 | | 4900PC | 1.0-8.0 | 2.5 | 37 | 7.40 | 3 | 1.20 | 90.00 | 9000 |
| | 110 | | 4110KPC | 1.0-8.0 | 2.5 | 37 | 7.40 | 3 | 0.90 | 110.00 | 11000 |
| | 132 | | 4132KPC | 1.0-8.0 | 2.5 | 37 | 7.40 | 3 | 0.80 | 132.00 | 13200 |
| | 160 | | 4160KPC | 1.0-8.0 | 2.5 | 37 | 7.40 | 3 | 0.80 | 160.00 | 16000 |
| | 220 | | 4200KPC | 1.0-8.0 | 2.5 | 19 | 8.70 | 3 | 0.80 | 200.00 | 20000 |
| | 250 | | 4220KPC | 1.0-8.0 | 2.5 | 19 | 8.70 | 3 | 0.80 | 220.00 | 22000 |
| | 280 | | 4280KPC | 1.0-8.0 | 2.5 | 14 | 14.00 | 3 | 0.80 | 280.00 | 28000 |

| | | | | | E411 | F415 | | F4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|------------------|------------------|--------|---------|------|------------------|-------|--------|--------------|--------------|-------|----|------|------|---|--|--|---|--|--|--|--|--|--|--|--|------------|---|--|--|--|---|--|---|--|--|--|--------|-----|------------|-------|----|------|------|---|
| Voltage | Applicable motor | | erter | F412 | F41; | | F416 | 50Hz setting | 60Hz setting | F749 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| class | (kW) | type | -form | (%) | Adjustment range | (A) | (%) | (mi | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 0.4 | | 2004P | 7.0 | 0.01-99.99 | 1.70 | 55 | 1440 | 1730 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 0.75 | | 2007P | 7.0 | 0.01-99.99 | 3.40 | 55 | 1440 | 1730 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1.5 | | 2015P | 5.0 | 0.01-99.99 | 6.40 | 42 | 1445 | 1740 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 2.2 | | 2022P | 5.0 | 0.01-99.99 | 9.40 | 50 | 1460 | 1755 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 4.0 | | 2037P | 5.0 | 0.01-99.99 | 14.60 | 38 | 1460 | 1755 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 5.5 | | 2055P | 5.0 | 0.01-99.99 | 21.40 | 41 | 1465 | 1760 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 7.5 | | 2075P | 5.0 | 0.01-99.99 | 28.60 | 38 | 1460 | 1755 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3-phase 240 V | 11 | VFAS3- | 2110P | 4.0 | 0.01-99.99 | 42.00 | 38 | 1475 | 1770 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 15 | | 2150P | 4.0 | 0.01-99.99 | 55.60 | 33 | 1470 | 1760 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 18.5 | | 2185P | 4.0 | 0.01-99.99 | 69.00 | 37 | 1475 | 1770 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 22 | | 2220P | 4.0 | 0.1-999.9 | 80.0 | 32 | 1470 | 1760 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 30 | | 2300P | 4.0 | 0.1-999.9 | 108.0 | 33 | 1470 | 1765 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 37 | | 2370P | 4.0 | 0.1-999.9 | 132.0 | 32 | 1480 | 1775 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 45 | | 2450P | 3.0 | 0.1-999.9 | 159.0 | 31 | 1480 | 1775 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 55 | | 2550P | 3.0 | 0.1-999.9 | 192.0 | 28 | 1480 | 1775 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 0.4 | | 4004PC | 7.0 | 0.01-99.99 | 0.85 | 55 | 1440 | 1730 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 0.75 | | 4007PC | 7.0 | 0.01-99.99 | 1.70 | 55 | 1440 | 1730 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1.5 | | 4015PC | 5.0 | 0.01-99.99 | 3.20 | 42 | 1445 | 1740 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 2.2 | - | 4022PC | 5.0 | 0.01-99.99 | 4.70 | 50 | 1460 | 1755 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 4.0 | | 4037PC | 5.0 | 0.01-99.99 | 7.30 | 38 | 1460 | 1755 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 5.5 | | | | | _ | | | | - | _ | | | ı | | | - | | | | | | | | | · | 1 | | | | - | | - | | | | 4055PC | 5.0 | 0.01-99.99 | 10.70 | 41 | 1465 | 1760 | 1 |
| | 7.5 | | | | | | 4075PC | 5.0 | 0.01-99.99 | 14.30 | 38 | 1460 | 1755 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 11 | | 4110PC | 4.0 | 0.01-99.99 | 21.00 | 38 | 1475 | 1770 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 15 | | 4150PC | 4.0 | 0.01-99.99 | 27.80 | 33 | 1470 | 1760 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 18.5 | | 4185PC | 4.0 | 0.01-99.99 | 34.50 | 37 | 1475 | 1770 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 22 | | 4220PC | 4.0 | 0.01-99.99 | 40.00 | 32 | 1470 | 1760 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3-phase 480 V | 30 | VFAS3- | 4300PC | 4.0 | 0.01-99.99 | 54.00 | 33 | 1470 | 1765 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 37 | | 4370PC | 4.0 | 0.01-99.99 | 66.00 | 32 | 1480 | 1775 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 45 | | 4450PC | 3.0 | 0.1-999.9 | 79.5 | 31 | 1480 | 1775 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 55 | | 4550PC | 3.0 | 0.1-999.9 | 96.0 | 28 | 1480 | 1775 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 75 | | 4750PC | 3.0 | 0.1-999.9 | 129.0 | 28 | 1480 | 1775 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 90 | | 4900PC | 3.0 | 0.1-999.9 | 154.0 | 26 | 1480 | 1775 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 110 | | 4110KPC | 3.0 | 0.1-999.9 | 190.0 | 21 | 1480 | 1780 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 132 | | 4132KPC | 3.0 | 0.1-999.9 | 230.0 | 20 | 1485 | 1780 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 160 | | 4160KPC | 3.0 | 0.1-999.9 | 252.0 | 20 | 1485 | 1785 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 220 | | 4200KPC | 3.0 | 0.1-999.9 | 315.0 | 20 | 1485 | 1785 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 250 | | 4220KPC | 3.0 | 0.1-999.9 | 345.0 | 20 | 1485 | 1785 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 280 | | 4280KPC | 3.0 | 0.1-999.9 | 445.0 | 20 | 1485 | 1785 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

■ ND rating

| | Applica- | | | vb,F172,F1 | ACC,dEC,F500,F5 | tHrA,F182,F | 183,F184 | F240 | F209 | | | | | | | | | | | | | | | | | | | |
|------------------|-------------------|--------|----------------|----------------|-----------------------------------|------------------|----------|---------------|-------------|--|--|--|--|--|--|------|--|--|--|--|--|--|--------|------|------|------------|-------|-----|
| Voltage class | ble motor (kW) | | erter -form | 76,F180 (%) | 01,F510,F511,F51 4,F515 (s) | Adjustment range | (A) | F249 (kHz) | F298 (V) | | | | | | | | | | | | | | | | | | | |
| | 0.75 | | 2004P | 4.80 | 10.0 | 0.46-4.60 | 4.60 | 4.0 | 120.0 | | | | | | | | | | | | | | | | | | | |
| | 1.5 | | 2007P | 4.80 | 10.0 | 0.80-8.00 | 8.00 | 4.0 | 120.0 | | | | | | | | | | | | | | | | | | | |
| | 2.2 | | 2015P | 3.10 | 10.0 | 1.12-11.20 | 11.20 | 4.0 | 120.0 | | | | | | | | | | | | | | | | | | | |
| | 4.0 | | 2022P | 3.10 | 10.0 | 1.87-18.70 | 18.70 | 4.0 | 120.0 | | | | | | | | | | | | | | | | | | | |
| | 5.5 | | 2037P | 2.50 | 10.0 | 2.54-25.40 | 25.40 | 4.0 | 120.0 | | | | | | | | | | | | | | | | | | | |
| | 7.5 | | 2055P | 2.30 | 10.0 | 3.27-32.70 | 32.70 | 4.0 | 120.0 | | | | | | | | | | | | | | | | | | | |
| | 11 | | 2075P | 1.80 | 10.0 | 4.68-46.80 | 46.80 | 4.0 | 120.0 | | | | | | | | | | | | | | | | | | | |
| 3-phase 240 V | 15 | VFAS3- | 2110P | 1.60 | 10.0 | 6.34-63.40 | 63.40 | 4.0 | 120.0 | | | | | | | | | | | | | | | | | | | |
| | 18.5 | | 2150P | 1.50 | 30.0 | 7.84-78.40 | 78.40 | 4.0 | 120.0 | | | | | | | | | | | | | | | | | | | |
| | 22 | | 2185P | 1.70 | 30.0 | 9.3-92.6 | 92.6 | 4.0 | 120.0 | | | | | | | | | | | | | | | | | | | |
| | 30 | | 2220P | 1.40 | 30.0 | 12.3-123.0 | 123.0 | 4.0 | 120.0 | | | | | | | | | | | | | | | | | | | |
| | 37 | | 2300P | 0.90 | 30.0 | 14.9-149.0 | 149.0 | 4.0 | 120.0 | | | | | | | | | | | | | | | | | | | |
| | 45 | | 2370P | 0.80 | 30.0 | 17.6-176.0 | 176.0 | 4.0 | 120.0 | | | | | | | | | | | | | | | | | | | |
| | 55 | | 2450P | 0.80 | 30.0 | 21.1-211.0 | 211.0 | 4.0 | 120.0 | | | | | | | | | | | | | | | | | | | |
| | 75 | | 2550P | 1.40 | 60.0 | 28.2-282.0 | 282.0 | 2.5 | 120.0 | | | | | | | | | | | | | | | | | | | |
| | 0.75 | | 4004PC | 4.80 | 10.0 | 0.22-2.20 | 2.20 | 4.0 | 240.0 | | | | | | | | | | | | | | | | | | | |
| | 1.5 | | 4007PC | 4.80 | 10.0 | 0.40-4.00 | 4.00 | 4.0 | 240.0 | | | | | | | | | | | | | | | | | | | |
| | 2.2 | | 4015PC | 3.10 | 10.0 | 0.56-5.60 | 5.60 | 4.0 | 240.0 | | | | | | | | | | | | | | | | | | | |
| | 4.0 | | 4022PC | 3.10 | 10.0 | 0.93-9.30 | 9.30 | 4.0 | 240.0 | | | | | | | | | | | | | | | | | | | |
| | 5.5 | | 4037PC | 2.50 | 10.0 | 1.27-12.70 | 12.70 | 4.0 | 240.0 | | | | | | | | | | | | | | | | | | | |
| | 7.5 | | | | | | | | | | | | | | | | | | | | | | 4055PC | 2.30 | 10.0 | 1.65-16.50 | 16.50 | 4.0 |
| | 11 | | 4075PC | 1.80 | 10.0 | 2.35-23.50 | 23.50 | 4.0 | 240.0 | | | | | | | | | | | | | | | | | | | |
| | 15 | | 4110PC | 1.60 | 10.0 | 3.17-31.70 | 31.70 | 4.0 | 240.0 | | | | | | | | | | | | | | | | | | | |
| | 18.5 | | 4150PC | 1.50 | 30.0 | 3.92-39.20 | 39.20 | 4.0 | 240.0 | | | | | | | | | | | | | | | | | | | |
| | 22 | | 4185PC | 1.70 | 30.0 | 4.63-46.30 | 46.30 | 4.0 | 240.0 | | | | | | | | | | | | | | | | | | | |
| | 30 | | 4220PC | 1.40 | 30.0 | 6.15-61.50 | 61.50 | 4.0 | 264.0 | | | | | | | | | | | | | | | | | | | |
| 3-phase 480 V | 37 | VFAS3- | 4300PC | 0.90 | 30.0 | 7.45-74.50 | 74.50 | 4.0 | 264.0 | | | | | | | | | | | | | | | | | | | |
| | 45 | | 4370PC | 0.80 | 30.0 | 8.8-88.0 | 88.0 | 4.0 | 264.0 | | | | | | | | | | | | | | | | | | | |
| | 55 | | 4450PC | 0.80 | 30.0 | 10.6-106.0 | 106.0 | 4.0 | 264.0 | | | | | | | | | | | | | | | | | | | |
| | 75 | | 4550PC | 1.40 | 60.0 | 14.5-145.0 | 145.0 | 4.0 | 264.0 | | | | | | | | | | | | | | | | | | | |
| | 90 | | 4750PC | 1.30 | 60.0 | 17.3-173.0 | 173.0 | 4.0 | 264.0 | | | | | | | | | | | | | | | | | | | |
| | 110 | | 4900PC | 1.00 | 60.0 | 21.1-211.0 | 211.0 | 2.5 | 240.0 | | | | | | | | | | | | | | | | | | | |
| | 132 | | 4110KPC | 0.80 | 60.0 | 25.0-250.0 | 250.0 | 2.5 | 240.0 | | | | | | | | | | | | | | | | | | | |
| | 160 | | 4132KPC | 0.80 | 60.0 | 31.4-314.0 | 314.0 | 2.5 | 240.0 | | | | | | | | | | | | | | | | | | | |
| | 220 | | 4160KPC | 0.80 | 60.0 | 38.7-387.0 | 387.0 | 2.5 | 240.0 | | | | | | | | | | | | | | | | | | | |
| | 250 | | 4200KPC | 0.80 | 60.0 | 42.7-427.0 | 427.0 | 2.5 | 240.0 | | | | | | | | | | | | | | | | | | | |
| | 280 | | 4220KPC | 0.80 | 60.0 | 55.0-550.0 | 550.0 | 2.5 | 240.0 | | | | | | | | | | | | | | | | | | | |
| | 315 | | 4280KPC | 0.60 | 60.0 | 61.6-616.0 | 616.0 | 2.5 | 240.0 | | | | | | | | | | | | | | | | | | | |

| | Applicable | Inverter | | F300 | | F308 | F309 | | F402 | | |
|------------------|---------------|----------|---------|------------------|-------|-------|-------|------|------|-------------------------|---------------|
| Voltage class | motor (kW) | | -form | Adjustment range | (kHz) | (Ohm) | (kW) | F316 | (%) | <set> =" JP" (kW)</set> | other (kW) |
| | 0.75 | | 2004P | 1.0-16.0 | 4.0 | 2000 | 0.12 | 1 | 4.30 | 0.75 | 0.75 |
| | 1.5 | | 2007P | 1.0-16.0 | 4.0 | 750 | 0.12 | 1 | 4.40 | 1.50 | 1.50 |
| | 2.2 | | 2015P | 1.0-16.0 | 4.0 | 750 | 0.12 | 1 | 2.90 | 2.20 | 2.20 |
| | 4.0 | | 2022P | 1.0-16.0 | 4.0 | 400 | 0.12 | 1 | 2.80 | 3.70 | 4.00 |
| | 5.5 | | 2037P | 1.0-16.0 | 4.0 | 200 | 0.24 | 1 | 2.30 | 5.50 | 5.50 |
| | 7.5 | | 2055P | 1.0-16.0 | 4.0 | 150 | 0.44 | 1 | 2.00 | 7.50 | 7.50 |
| | 11 | | 2075P | 1.0-16.0 | 4.0 | 100 | 0.66 | 1 | 1.60 | 11.00 | 11.00 |
| 3-phase 240 V | 15 | VFAS3- | 2110P | 1.0-16.0 | 4.0 | 75 | 0.88 | 1 | 1.50 | 15.00 | 15.00 |
| | 18.5 | | 2150P | 1.0-16.0 | 4.0 | 75 | 0.88 | 1 | 1.40 | 18.50 | 18.50 |
| | 22 | | 2185P | 1.0-16.0 | 4.0 | 33 | 1.76 | 1 | 1.60 | 22.00 | 22.00 |
| | 30 | | 2220P | 1.0-16.0 | 4.0 | 33 | 1.76 | 1 | 1.20 | 30.00 | 30.00 |
| | 37 | | 2300P | 1.0-8.0 | 4.0 | 20 | 2.20 | 1 | 0.80 | 37.00 | 37.00 |
| | 45 | | 2370P | 1.0-8.0 | 4.0 | 20 | 2.20 | 1 | 0.70 | 45.00 | 45.00 |
| | 55 | | 2450P | 1.0-8.0 | 4.0 | 20 | 2.20 | 1 | 0.80 | 55.00 | 55.00 |
| | 75 | | 2550P | 1.0-8.0 | 2.5 | 17 | 3.40 | 1 | 1.30 | 75.00 | 75.00 |
| | 0.75 | | 4004PC | 1.0-16.0 | 4.0 | 2000 | 0.12 | 3 | 4.30 | 0.75 | 0.75 |
| | 1.5 | | 4007PC | 1.0-16.0 | 4.0 | 2000 | 0.12 | 3 | 4.40 | 1.50 | 1.50 |
| | 2.2 | | 4015PC | 1.0-16.0 | 4.0 | 2000 | 0.12 | 3 | 2.90 | 2.20 | 2.20 |
| | 4.0 | | 4022PC | 1.0-16.0 | 4.0 | 1600 | 0.12 | 3 | 2.80 | 3.70 | 4.00 |
| | 5.5 | | 4037PC | 1.0-16.0 | 4.0 | 800 | 0.24 | 3 | 2.30 | 5.50 | 5.50 |
| | 7.5 | | 4055PC | 1.0-16.0 | 4.0 | 600 | 0.44 | 3 | 2.00 | 7.50 | 7.50 |
| | 11 | | 4075PC | 1.0-16.0 | 4.0 | 400 | 0.66 | 3 | 1.60 | 11.00 | 11.00 |
| | 15 | | 4110PC | 1.0-16.0 | 4.0 | 300 | 0.88 | 3 | 1.50 | 15.00 | 15.00 |
| | 18.5 | | 4150PC | 1.0-16.0 | 4.0 | 300 | 0.88 | 3 | 1.40 | 18.50 | 18.50 |
| | 22 | | 4185PC | 1.0-16.0 | 4.0 | 150 | 1.76 | 3 | 1.60 | 22.00 | 22.00 |
| | 30 | | 4220PC | 1.0-16.0 | 4.0 | 150 | 1.76 | 3 | 1.20 | 30.00 | 30.00 |
| 3-phase 480 V | 37 | VFAS3- | 4300PC | 1.0-16.0 | 4.0 | 80 | 1.76 | 3 | 0.80 | 37.00 | 37.00 |
| | 45 | | 4370PC | 1.0-16.0 | 4.0 | 80 | 1.76 | 3 | 0.70 | 45.00 | 45.00 |
| | 55 | | 4450PC | 1.0-16.0 | 4.0 | 80 | 1.76 | 3 | 0.80 | 55.00 | 55.00 |
| | 75 | | 4550PC | 1.0-8.0 | 4.0 | 80 | 1.76 | 3 | 1.30 | 75.00 | 75.00 |
| | 90 | | 4750PC | 1.0-8.0 | 4.0 | 37 | 7.40 | 3 | 1.20 | 90.00 | 90.00 |
| | 110 | | 4900PC | 1.0-8.0 | 2.5 | 37 | 7.40 | 3 | 0.90 | 110.0 | 110.0 |
| | 132 | | 4110KPC | 1.0-8.0 | 2.5 | 37 | 7.40 | 3 | 0.80 | 132.0 | 132.0 |
| | 160 | | 4132KPC | 1.0-8.0 | 2.5 | 37 | 7.40 | 3 | 0.80 | 160.0 | 160.0 |
| | 220 | | 4160KPC | 1.0-8.0 | 2.5 | 19 | 8.70 | 3 | 0.80 | 200.0 | 200.0 |
| | 250 | | 4200KPC | 1.0-8.0 | 2.5 | 19 | 8.70 | 3 | 0.80 | 220.0 | 220.0 |
| | 280 | | 4220KPC | 1.0-8.0 | 2.5 | 14 | 14.00 | 3 | 0.80 | 280.0 | 280.0 |
| | 315 | | 4280KPC | 1.0-8.0 | 2.5 | 14 | 14.00 | 3 | 0.60 | 315.0 | 315.0 |

| | | | | | F.14 | _ | | F4 | .17 | |
|------------------|------------------|----------|-----------|-------------|------------------|-------|------|--------------|--------------|------|
| Voltage | Applicable motor | Inverter | | F412 (%) | F41 | 5 | F416 | 50Hz setting | 60Hz setting | F749 |
| class | (kW) | type | type-form | | Adjustment range | (A) | (%) | (mi | n-1) | |
| | 0.75 | | 2004P | 7.0 | 0.01-99.99 | 3.40 | 55 | 1440 | 1730 | 0 |
| | 1.5 | | 2007P | 5.0 | 0.01-99.99 | 6.40 | 42 | 1445 | 1740 | 0 |
| | 2.2 | | 2015P | 5.0 | 0.01-99.99 | 9.40 | 50 | 1460 | 1755 | 0 |
| | 4.0 | | 2022P | 5.0 | 0.01-99.99 | 14.60 | 38 | 1460 | 1755 | 0 |
| | 5.5 | | 2037P | 5.0 | 0.01-99.99 | 21.40 | 41 | 1465 | 1760 | 1 |
| | 7.5 | | 2055P | 5.0 | 0.01-99.99 | 28.60 | 38 | 1460 | 1755 | 1 |
| | 11 | | 2075P | 4.0 | 0.01-99.99 | 42.00 | 38 | 1475 | 1770 | 1 |
| 3-phase 240 V | 15 | VFAS3- | 2110P | 4.0 | 0.01-99.99 | 55.60 | 33 | 1470 | 1760 | 1 |
| | 18.5 | | 2150P | 4.0 | 0.01-99.99 | 69.00 | 37 | 1475 | 1770 | 1 |
| | 22 | | 2185P | 4.0 | 0.1-999.9 | 80.0 | 32 | 1470 | 1760 | 1 |
| | 30 | | 2220P | 4.0 | 0.1-999.9 | 108.0 | 33 | 1470 | 1765 | 1 |
| | 37 | | 2300P | 4.0 | 0.1-999.9 | 132.0 | 32 | 1480 | 1775 | 1 |
| | 45 | | 2370P | 3.0 | 0.1-999.9 | 159.0 | 31 | 1480 | 1775 | 2 |
| | 55 | | 2450P | 3.0 | 0.1-999.9 | 192.0 | 28 | 1480 | 1775 | 2 |
| | 75 | | 2550P | 3.0 | 0.1-999.9 | 264.0 | 28 | 1480 | 1775 | 2 |
| | 0.75 | | 4004PC | 7.0 | 0.01-99.99 | 1.70 | 55 | 1440 | 1730 | 0 |
| | 1.5 | | 4007PC | 5.0 | 0.01-99.99 | 3.20 | 42 | 1445 | 1740 | 0 |
| | 2.2 | | 4015PC | 5.0 | 0.01-99.99 | 4.70 | 50 | 1460 | 1755 | 0 |
| | 4.0 | | 4022PC | 5.0 | 0.01-99.99 | 7.30 | 38 | 1460 | 1755 | 0 |
| | 5.5 | | 4037PC | 5.0 | 0.01-99.99 | 10.70 | 41 | 1465 | 1760 | 1 |
| | 7.5 | | 4055PC | 5.0 | 0.01-99.99 | 14.30 | 38 | 1460 | 1755 | 1 |
| | 11 | | 4075PC | 4.0 | 0.01-99.99 | 21.00 | 38 | 1475 | 1770 | 1 |
| | 15 | | 4110PC | 4.0 | 0.01-99.99 | 27.80 | 33 | 1470 | 1760 | 1 |
| | 18.5 | | 4150PC | 4.0 | 0.01-99.99 | 34.50 | 37 | 1475 | 1770 | 1 |
| | 22 | | 4185PC | 4.0 | 0.01-99.99 | 40.00 | 32 | 1470 | 1760 | 1 |
| | 30 | | 4220PC | 4.0 | 0.01-99.99 | 54.00 | 33 | 1470 | 1765 | 1 |
| 3-phase 480 V | 37 | VFAS3- | 4300PC | 4.0 | 0.01-99.99 | 66.00 | 32 | 1480 | 1775 | 1 |
| | 45 | | 4370PC | 3.0 | 0.1-999.9 | 79.5 | 31 | 1480 | 1775 | 2 |
| | 55 | | 4450PC | 3.0 | 0.1-999.9 | 96.0 | 28 | 1480 | 1775 | 2 |
| | 75 | | 4550PC | 3.0 | 0.1-999.9 | 129.0 | 28 | 1480 | 1775 | 2 |
| | 90 | | 4750PC | 3.0 | 0.1-999.9 | 154.0 | 26 | 1480 | 1775 | 2 |
| | 110 | 1 | 4900PC | 3.0 | 0.1-999.9 | 190.0 | 21 | 1480 | 1780 | 2 |
| | 132 | | 4110KPC | 3.0 | 0.1-999.9 | 230.0 | 20 | 1485 | 1780 | 2 |
| | 160 | | 4132KPC | 3.0 | 0.1-999.9 | 252.0 | 20 | 1485 | 1785 | 2 |
| | 220 | | 4160KPC | 3.0 | 0.1-999.9 | 315.0 | 20 | 1485 | 1785 | 2 |
| | 250 | | 4200KPC | 3.0 | 0.1-999.9 | 345.0 | 20 | 1485 | 1785 | 2 |
| | 280 | | 4220KPC | 3.0 | 0.1-999.9 | 445.0 | 20 | 1485 | 1785 | 2 |
| | 315 | | 4280KPC | 3.0 | 0.1-999.9 | 544.0 | 20 | 1485 | 1785 | 2 |

11. 7 Analog output/Monitor output function

| 0 " | Communi | cation No. | | | |
|---------------|---------------|----------------|---|---------------------------|-----------------------|
| Option No. | Analog output | Monitor output | Function | Display unit | Unit (Communication) |
| 0 | FD00 | FE00 | Output frequency | 0.1Hz | 0.01Hz |
| 1 | FD02 | FE02 | Frequency command value | 0.1Hz | 0.01Hz |
| 2 | FD03 | FE03 | Output current | 1%/ <f701> setting</f701> | 0.01% |
| 3 | FD04 | FE04 | Input voltage (DC detection) | 1%/ <f701> setting</f701> | 0.01% |
| 4 | FD05 | FE05 | Output voltage | 1%/ <f701> setting</f701> | 0.01% |
| 5 | FD15 | FE15 | Stator frequency | 0.1Hz | 0.01Hz |
| 6 | FD16 | FE16 | Speed feedback frequency (real time) | 0.1Hz | 0.01Hz |
| 7 | FD17 | FE17 | Speed feedback frequency (1-second filter) | 0.1Hz | 0.01Hz |
| 8 | FD18 | FE18 | Torque | 1% | 0.01% |
| 9 | FD19 | FE19 | Torque command | 1% | 0.01% |
| 10 | FD99 | FE99 | Output frequency during run. Frequency command value during stop. | Hz/free unit | - |
| 11 | FD20 | FE20 | Torque current | 1% | 0.01% |
| 12 | FD21 | FE21 | Exciting current | 1% | 0.01% |
| 13 | FD22 | FE22 | PID feedback value | 0.1Hz | 0.01Hz |
| 14 | FD23 | FE23 | Motor overload factor (OL2 data) | 1% | 0.01% |
| 15 | FD24 | FE24 | Inverter overload factor (OL1 data) | 1% | 0.01% |
| 16 | FD25 | FE25 | Braking resistor overload factor (OLr data) | 1% | 1% |
| 17 | FD28 | FE28 | Braking resistor load factor (%ED) | 1% | 1% |
| 18 | DF29 | FE29 | Input power | 0.1kW | 0.01kW |
| 19 | FD30 | FE30 | Output power | 0.1kW | 0.01kW |
| 20 | | FE76 | Input cumulative power | <f749> setting</f749> | <f749> setting</f749> |
| 21 | | FE77 | Output cumulative power | <f749> setting</f749> | <f749> setting</f749> |
| 22 | | | Fixed output 1 | - | - |
| 23 | | | Fixed output 2 | - | - |
| 24 | | FE35 | Terminal RR input value | 1% | 0.01% |
| 25 | | FE36 | Terminal RX input value | 1% | 0.01% |
| 26 | | FE37 | Terminal II input value | 1% | 0.01% |
| 27 | FD94 | FE94 | Motor speed command | - | - |
| 28 | | FE40 | Terminal FM output value *1 | 1 | 0.01 |
| 29 | | FE41 | Terminal AM output value *2 | 1 | 0.01 |
| 31 | | FA51 | Communication data output | *3 | *3 |
| 32 | | FE66 | Slot A option CPU version | - | - |
| 33 | | FE67 | Slot B option CPU version | - | - |
| 34 | FD26 | FE26 | Motor load factor | % | - |
| 35 | FD27 | FE27 | Inverter load factor | % | - |
| 36 | | FE70 | Inverter rated current | А | - |
| 37 | | FD70 | Inverter rated current (with carrier frequency correction) | А | - |

| | Communic | cation No. | | | |
|---------------|---------------|----------------|--|--------------|-------------------------|
| Option No. | Analog output | Monitor output | Function | Display unit | Unit (Communication) |
| 38 | | FD81 | Actual carrier frequency | kHz | - |
| 39 | | FE68 | Slot C option CPU version | - | - |
| 40 | | FE91 | Embedded Ethernet CPU version | - | - |
| 41 | | FD43 | Terminal FP pulse train output value | pps | - |
| 43 | | FM/F671 | Terminal FM/AM gain setting value | - | - |
| 44 | | FE38 | Terminal Al4 input value | 1% | 0.01% |
| 45 | | FE39 | Terminal Al5 input value | 1% | 0.01% |
| 46 | | FE60 | My function monitor output 1 | - | - |
| 47 | | FE61 | My function monitor output 2 | - | - |
| 48 | | FE62 | My function monitor output 3 | - | - |
| 49 | | FE63 | My function monitor output 4 | - | - |
| 62 | FD48 | FE48 | PID result frequency | 0.1Hz | 0.01Hz |
| 63 | FD58 | FE58 | PID set value | 0.1Hz | 0.01Hz |
| 64 | | FD50 | Light-load high-speed switching load torque | 1% | 0.01% |
| 65 | | FD51 | Light-load high-speed torque during constant speed run | 1% | 0.01% |
| 66 | | FE31 | Pattern operation group number | 0.1 | 0.1 |
| 67 | | FE32 | Pattern operation remaining cycle number | 1 | 1 |
| 68 | | FE33 | Pattern operation preset speed number | 1 | 1 |
| 69 | | FE34 | Pattern operation remaining time | 0.1 | 0.1 |
| 70 | | FE71 | Inverter rated voltage | 1 | 0.1 |
| 71 | FD90 | FE90 | Motor speed (estimated value) | 1 | 1 |
| 72 | | FA15 | Communication option Receiving counter | 1 | 1 |
| 73 | | FA16 | Communication option Abnormal counter | 1 | 1 |
| 76 | | FE56 | Terminal S4/S5 pulse train input value | 0.001 | 0.0001 |
| 77 | | FD85 | My function COUNT1 | 1 | 1 |
| 78 | | FD86 | My function COUNT2 | 1 | 1 |
| 79 | | FD87 | Dancer control PID result frequency | 0.1Hz | 0.01Hz |
| 80 | | FA25 | Embedded Ethernet Transmission counter | 1 | 1 |
| 81 | | FA17 | Embedded Ethernet Receiving counter | 1 | 1 |
| 82 | | FA18 | Embedded Ethernet Abnormal counter | 1 | 1 |
| 83 | | FE81 | Connected option number | 1 | 1 |
| 84 | | FD91 | My function COUNT3 | 1 | 1 |
| 85 | | FD92 | My function COUNT4 | 1 | 1 |
| 86 | | FD93 | My function COUNT5 | 1 | 1 |
| 90 | | FE80 | Cumulative power ON time | 100 hours | - |
| 91 | | FD41 | Cumulative cooling fan run time | 100 hours | - |
| 92 | | FD14 | Cumulative run time | 100 hours | - |
| 93 | | FD31 | Cumulative overcurrent time | - | - |
| 95 | | E960 | Pump 0 run time | 100 hours | - |
| 96 | | E961 | Pump 1 run time | 100 hours | - |

| Option | Communic | ation No. | | | Unit |
|--------|---------------|----------------|---|--------------|-----------------|
| No. | Analog output | Monitor output | Function | Display unit | (Communication) |
| 97 | | E962 | Pump 2 run time | 100 hours | - |
| 98 | | E963 | Pump 3 run time | 100 hours | - |
| 99 | | E964 | Pump 4 run time | 100 hours | - |
| 100 | | FD32 | Number of starting | 10000 times | - |
| 101 | | FD33 | Number of Fwd starting | 10000 times | - |
| 102 | | FD34 | Number of Rev starting | 10000 times | - |
| 103 | | FE59 | External equipment counter | Times | - |
| 105 | | E965 | Pump 5 run time | 100 hours | - |
| 106 | | E966 | Pump 6 run time | 100 hours | - |
| 107 | | E967 | Pump 7 run time | 100 hours | - |
| 108 | | E968 | Pump 8 run time | 100 hours | - |
| 109 | | E969 | Pump 9 run time | 100 hours | - |
| 110 | | FD35 | Number of trip | Times | - |
| 111 | | FD36 | Number of serious failure trip | Times | - |
| 112 | | FD37 | Number of slight failure trip | Times | - |
| 113 | | FD38 | Number of specified trip 1 | Times | - |
| 114 | | FD39 | Number of specified trip 2 | Times | - |
| 115 | | FD40 | Number of specified trip 3 | Times | - |
| 120 | FD83 | FE83 | Internal temperature 1 | - | - |
| 124 | | FE78 | Power circuit board temperature | - | - |
| 130 | | FD96 | External PID3 set value | - | - |
| 131 | | FD97 | External PID3 feedback value | - | - |
| 132 | | FD98 | External PID3 result value | - | - |
| 133 | | FE96 | External PID4 set value | - | - |
| 134 | | FE97 | External PID4 feedback value | - | - |
| 135 | | FE98 | External PID4 result value | - | - |
| 150 | FD00 | FE00 | Signed output frequency | 0.1Hz | 0.01Hz |
| 151 | FD02 | FE02 | Signed frequency command value | 0.1Hz | 0.01Hz |
| 152 | FD15 | FE15 | Signed stator frequency | 0.1Hz | 0.01Hz |
| 153 | FD16 | FE16 | Signed speed feedback frequency (real time) | 0.1Hz | 0.01Hz |
| 154 | FD17 | FE17 | Signed speed feedback frequency (1-second filter) | 0.1Hz | 0.01Hz |
| 155 | FD18 | FE18 | Signed torque | 1% | 0.01% |
| 156 | FD19 | FE19 | Signed torque command | 1% | 0.01% |
| 158 | FD20 | FE20 | Signed torque current | 1% | 0.01% |
| 159 | FD22 | FE22 | Signed PID feedback value | 0.1Hz | 0.01Hz |
| 160 | | FE37 | Signed terminal RX input value | 1% | 0.01% |
| 161 | | FE38 | Signed terminal Al4 input value | 1% | 0.01% |
| 162 | | FE39 | Signed terminal AI5 input value | 1% | 0.01% |

^{*1} Disabled with <FMSL: Terminal FM function>.

^{*2} Disabled with <F670: Terminal AM function>.

^{*3} For details, refer to RS485 Communication Function Instruction Manual.

11. 8 Input terminal function

The function No. in the following table can be assigned to parameters <F110>-<F124>, <F127>, <F128>. and <F151>-<F158>.

| | number | | | | |
|----------------|-------------------|--------|---|--|--|
| Positive logic | Negative logic | Symbol | Function | Action | Reference |
| 0 | 1 | - | No function | Disabled | - |
| 2 | 3 | F | Fwd run | ON: Forward run, OFF: Deceleration stop | [7 0 4] |
| 4 | 5 | R | Rev run | ON: Reverse run, OFF: Deceleration stop | [7. 2. 1] |
| 6 | 7 | ST | Standby | ON: Ready for operation, OFF: Coast stop (gate OFF) | [5. 3. 2] [6. 3. 1] [6. 34. 8] [6. 8. 2] [7. 2. 1] |
| 8 | 9 | RES1 | Reset 1 | ON: Acceptance of reset command, ON→OFF: Trip reset | [7. 2. 1] [13. 1] |
| 10 | 11 | SS1 | Preset speed switching 1 | | |
| 12 | 13 | SS2 | Preset speed switching 2 | Colorism of 24 amond CC4 to CC5 (5 hits) | [5. 2. 7] |
| 14 | 15 | SS3 | Preset speed switching 3 | Selection of 31-speed SS1 to SS5 (5 bits) | [7. 2. 1] |
| 16 | 17 | SS4 | Preset speed switching 4 | | |
| 18 | 19 | JOG | Jog run | ON: Jog run enabled | [6. 10] [7. 2. 1] |
| 20 | 21 | EXT | Emergency off | ON: "E" trip after <f603> operation</f603> | [6. 30. 4] [7. 2. 1] |
| 22 | 23 | DB | DC braking | ON: DC braking | [6. 8. 1] [6. 8. 3] [7. 2. 1] |
| 24 | 25 | AD2 | Acc/Dec switching 1 | | |
| 26 | 27 | AD3 | Acc/Dec switching 2 | Selection of Acc/Dec 1 - 4 AD2, AD3 (2 bits) | |
| 28 | 29 | VFSW1 | V/f switching 1 | | [7. 2. 1] |
| 30 | 31 | VFSW2 | V/f switching 2 | Selection of V/f 1 - 4 VFSW1, VFSW2 (2 bits) | |
| 32 | 33 | OCS2 | Stall prevention switching/Torque limit switching 1 | ON: <f185: 2="" level="" prevention="" stall=""> enabled OFF: <f601: 1="" level="" prevention="" stall=""> enabled</f601:></f185:> | [6. 25. 1] [6. 27. 2] [6. 30. 2] [7. 2. 1] |
| 34 | 35 | TRQL2 | Torque limit switching 2 | Selection of Power running/Regenerative torque limit 1 - 4 OCS2, TRQL1 (2 bits) | [6. 25. 1] [6. 27. 2] [7. 2. 1] |
| 36 | 37 | PID | PID control OFF | ON: PID control OFF | [5. 2. 8] [7. 2. 1] |
| 38 | 39 | PTTN1 | Pattern operation 1 | ON: Pattern operation 1 enabled | |
| 40 | 41 | PTTN2 | Pattern operation 2 | ON: Pattern operation 2 enabled | 16 001 |
| 42 | 43 | PTTNC | Pattern operation continuation | ON: Pattern operation continued | [6. 28] [7. 2. 1] |
| 44 | 45 | PTTNS | Pattern operation start | ON: Pattern operation start | |
| 46 | 47 | OH2 | External thermal trip | ON: "OH2" trip | [7. 2. 1] |
| 48 | 49 | SCLC | Communication priority cancel | ON: Run at the setting of <cmod: command="" run="" select=""> and <fmod: 1="" command="" frequency="" select=""> OFF: Run by communication</fmod:></cmod:> | [6. 38. 2] [7. 2. 1] |

| Function | number | | | | |
|----------------|-------------------|--------|---|---|---------------------------------------|
| Positive logic | Negative logic | Symbol | Function | Action | Reference |
| 50 | 51 | HD | 3-wire operation hold/ stop | ON: Forward run (F), Reverse run (R) held, 3-wire operation OFF: Deceleration stop | [7. 2. 1] |
| 52 | 53 | IDC | PID differential/integral reset | ON: PID differential/integral cleared | [5. 2. 8] [7. 2. 1] |
| 54 | 55 | PIDSW | PID plus/minus switching | ON: Plus/minus characteristics of <f359: 1="" control="" pid=""> setting OFF: Characteristics of <f359: 1="" control="" pid=""> setting</f359:></f359:> | [7. 2. 1] |
| 56 | 57 | FORCE | Forced run | ON: Forced run, continues in a slight failure condition (Set <f650: forced="" run=""> = "1: Enabled". Frequency command value = <f294: 15="" forced="" preset="" run="" speed="">.) *Stop with power off</f294:></f650:> | [6. 12. 2] [6. 31] |
| 58 | 59 | FIRE | Fire speed run | ON: Fire speed run (Set <f650: fire="" run="" speed=""> = "1: Enabled". Frequency command value = <f294: 15="" forced="" preset="" run="" speed="">.) *Stop with power off</f294:></f650:> | [7. 2. 1] |
| 60 | 61 | DWELL | Dwell operation | ON: Dwell operation (Stop acceleration and deceleration and run the motor at a constant speed) | [6. 19] [7. 2. 1] |
| 62 | 63 | KEB | Synchronized Acc/Dec | ON: Deceleration stop with synchronizing at power failure | |
| 64 | 65 | MYF | My function start | ON: My function start (When <a977: function="" my=""> = "1: Enabled by permission signal")</a977:> | [7. 2. 1] |
| 66 | 67 | AUTT | Offline auto-tuning | <f400> = "3" ON: Offline auto-tuning executed <f400> = "6" ON: Offline auto-tuning executed at run command while this signal is ON. <f400> = "7" ON: Offline auto-tuning executed only for <f402> at run command while this signal is ON.</f402></f400></f400></f400> | [6. 23. 1] [6. 23. 2] [7. 2. 1] |
| 68 | 69 | SGSW | Speed control gain switching | ON: Use F463-F465 OFF: Use F460-F462 | |
| 70 | 71 | SRVL | Servo lock | ON: Servo lock | [7. 2. 1] |
| 72 | 73 | SIMP | Simple positioning | ON: Simple positioning operation | |
| 74 | 75 | CKWH | Cumulative power monitor clear | ON: Clear cumulative power (kWh) monitor display | [6. 36] [7. 2. 1] |
| 76 | 77 | TRACE | Trace trigger | ON: Trace trigger (start) signal | |
| 78 | 79 | HSLL | Light-load high-speed operation inhibited | ON: Light-load high-speed operation inhibited OFF: Light-load high-speed operation permitted | |
| 80 | 81 | HDFP | Terminal FP output hold | ON: Terminal [FP] is held ON once turned ON | [7. 2. 1] |
| 82 | 83 | HDR1 | Terminal R1 output hold | ON: Terminal [R1] is held ON once turned ON | |
| 84 | 85 | HDR2 | Terminal R2 output hold | ON: Terminal [R2] is held ON once turned ON | |
| 88 | 89 | UP | Terminal Up frequency | ON: Frequency command increased | |
| 90 | 91 | DOWN | Terminal Down frequency | ON: Frequency command decreased | [6. 6. 5] |
| 92 | 93 | CLR | Terminal Up, Down frequency clear | OFF-> ON: Clear Terminal Up, Down frequency command | [7. 2. 1] |
| 94 | 95 | DANC | Dancer correction OFF | ON: Dancer correction OFF | [7. 2. 1] |
| 96 | 97 | FRR | Coast stop | ON: Coast stop (gate OFF) | [6. 34. 8] [7. 2. 1] |
| 98 | 99 | FR | Fwd/Rev | ON: Forward command, OFF: Reverse command | [7 2 41 |
| 100 | 101 | RS | Run/Stop | ON: Run command, OFF: Stop command | [7. 2. 1] |
| 102 | 103 | CPSW | Commercial powr run switching | ON: Commercial power run, OFF: Inverter run | [6. 20] [7. 2. 1] |

11. Table of parameters

| Function | n number | | | | |
|----------------|-------------------|--------|--|---|--------------------------|
| Positive logic | Negative logic | Symbol | Function | Action | Reference |
| 104 | 105 | FCHG | FMOd/F207 priority switching | ON: <f207: 2="" command="" frequency="" select=""> enabled (When <f200: command="" frequency="" priority="" select=""> = "0") OFF: <fmod: 1="" command="" frequency="" select=""> enabled</fmod:></f200:></f207:> | [5. 3. 1] [7. 2. 1] |
| 106 | 107 | FMTB | Terminal II priority | ON: Frequency command of Terminal [II] enabled OFF: <fmod: 1="" command="" frequency="" select=""> enabled</fmod:> | [7. 2. 1] |
| 108 | 109 | СМТВ | Terminal run priority | ON: Run command of terminal enabled OFF: <cmod: command="" run="" select=""> enabled</cmod:> | [5. 1. 1] [7. 2. 1] |
| 110 | 111 | PWE | Parameter writing unlocked | ON: Parameter writing unlocked OFF: <f700: &="" access="" lockout="" parameter="" reading="" writing=""> setting</f700:> | [6. 34. 1] [7. 2. 1] |
| 112 | 113 | STSW | Speed control/Torque control switching | ON: Torque control, OFF: Speed control | [7. 2. 1] |
| 114 | 115 | EXCUT | External equipment counter | ON: Count the signals (Monitor number "103" can monitor the number of ON signal) | [6. 30. 21] [7. 2. 1] |
| 116 | 117 | PI1SW | PID 1, 2 switching | ON: PID2, OFF: PID1 | [7. 2. 1] |
| 118 | 119 | SS5 | Preset speed switching 5 | Selection of 31-speed SS1 to SS5 (5 bits) | [5. 2. 7] [7. 2. 1] |
| 120 | 121 | FSTP1 | Quick deceleration 1 | ON: Dynamic quick deceleration OFF: Canceled *Operation is resumed when dynamic quick deceleration is canceled | |
| 122 | 123 | FSTP2 | Quick deceleration 2 | ON: Quick deceleration OFF: Canceled *Operation is resumed when quick deceleration is canceled | [7. 2. 1] |
| 124 | 125 | PREX | Preliminary excitation | ON: Preliminary excitation | |
| 126 | 127 | BRK | Brake | ON: Brake closed | |
| 130 | 131 | BRKA | Brake answerback | ON: Comparison signal with output terminal function "68: During brake release" ("E-11" trip when mismatching) | [6. 30. 15] [7. 2. 1] |
| 134 | 135 | TVS | Traverse operation | ON: Traverse operation permission | |
| 136 | 137 | RSC | Rescue operation | ON: Rescure operation (Low voltage operation) | |
| 138 | 139 | PMPSW | Pump control switching | ON: Pump switching during pump control | |
| 140 | 141 | SLOWF | Fwd slowdown | ON: Forward run toward the setting value of <f383: and="" frequency="" hit="" stop=""></f383:> | |
| 142 | 143 | STOPF | Fwd stop | ON: Stop (Forward run only) | [7. 2. 1] |
| 144 | 145 | SLOWR | Rev slowdown | ON: Reverse run toward the setting value of <f383: and="" frequency="" hit="" stop=""></f383:> | |
| 146 | 147 | STOPR | Rev stop | ON: Stop (Reverse run only) | |
| 148 | 149 | SLOFR | Fwd/Rev slowdown | ON: Stop (Forward/Reverse run) | |
| 150 | 151 | HSC | Hit and stop clear | ON: Hit and stop cleared | |

| Function | number | | | | |
|----------------|----------------|--------|---|---|-------------------------|
| Positive logic | Negative logic | Symbol | Function | Action | Reference |
| 152 | 153 | MOT2 | No. 2 motor switching | ON: No.2 motor setting + No.2 Acc/Dec + No.2 Stall (Torque limit) (V/f constant, <f170>, <f171>, <f172>, <f182>, <f185>, <f500>, <f501>, <f503>) <thra> (not <f182>) when <f632> = "2", "3" OFF: No.1 motor setting + No.1 Acc/Dec + No. 1 Stall (Torque limit) (<pt>, <vl>, <vl>, <vl>, <vb>, <thra>, <acc>, <dec>, <f502>, <f601>)</f601></f502></dec></acc></thra></vb></vl></vl></vl></pt></f632></f182></thra></f503></f501></f500></f185></f182></f172></f171></f170> | |
| 154 | 155 | PID3 | External PID3 enabled | ON: External PID3 enabled | |
| 156 | 157 | PID4 | External PID4 enabled | ON: External PID4 enabled | |
| 158 | 159 | RES2 | Reset 2 | ON: Reset accepted, ON -> OFF: Trip reset | [7. 2. 1] |
| 162 | 163 | PID3R | External PID3 differential/ integral reset | ON: External PID3 differential/integral reset | [] |
| 164 | 165 | PID3S | External PID3 plus/minus switching | ON: Plus/minus characteristics of <a340: 3="" control="" pid=""> setting OFF: Characteristics of <a340: 3="" control="" pid=""> setting</a340:></a340:> | |
| 170 | 171 | PID4R | External PID4 differential/ integral reset | ON: External PID4 differential/integral reset | |
| 172 | 173 | PID4S | External PID4 plus/minus switching | ON: Plus/minus characteristics of <a370: 4="" control="" pid=""> setting OFF: Characteristics of <a370: 4="" control="" pid=""> setting</a370:></a370:> | |
| 176 | 177 | PMPR | Pump control release | ON: Pump release during pump control | |
| 200 | 201 | PWP | Parameter writing locked | ON: Parameter writing locked (Reading unlocked) OFF: <f700: &="" access="" lockout="" parameter="" reading="" writing=""> setting</f700:> | [6. 34. 1] [7. 2. 1] |
| 202 | 203 | PRWP | Parameter reading locked | ON: Parameter reading & writing access lockout OFF: <f700: &="" access="" lockout="" parameter="" reading="" writing=""> setting</f700:> | [1.2.1] |

11. 9 Output terminal function

The function No. in the following table can be assigned to parameters <F130>, <F132>-<F134>, <F137>, <F138>, and <F159>-<F163>.

| Function | Number | | | | |
|----------------|-------------------|--------|---|---|---|
| Positive logic | Negative logic | Symbol | Function | Action | Reference |
| 0 | 1 | LL | Lower limit frequency (LL) | ON: Output frequency over <ll: frequency="" limit="" lower=""></ll:> | [7. 2. 2] |
| 2 | 3 | UL | Upper limit frequency (UL) | ON: Output frequency is <ul: frequency="" limit="" upper=""> or more</ul:> | [7. 2. 2] |
| 4 | 5 | LOW | Low-speed signal | ON: Output frequency is <f100: frequency="" low-speed="" output="" signal=""> or more</f100:> | [6. 1. 1] [7. 2. 2] |
| 6 | 7 | RCH | Acc/Dec completed | Output frequency is within command frequency ± <f102: band="" detection="" reach="" signal=""></f102:> | [6. 1. 2] [7. 2. 2] |
| 8 | 9 | RCHF | Specified frequency attainment | ON: Output frequency is within <f101: frequency="" reach="" signal="" specified=""> ± <f102: band="" detection="" reach="" signal=""></f102:></f101:> | [6. 1. 3] [7. 2. 2] |
| 10 | 11 | FL1 | Failure signal 1 | ON: Tripped | [6. 30. 5] [6. 30. 6] [6. 30. 7] [6. 30. 8] [6. 30. 10] [6. 30. 14] [7. 2. 2] |
| 12 | 13 | FL2 | Failure signal 2 | ON: At trip, except "EF", "OCL", "EPHO", and "OL2" | |
| 14 | 15 | POC | Overcurrent (OC) pre- alarm | ON: Output current is <f601: 1="" level="" prevention="" stall=""> or more</f601:> | |
| 16 | 17 | POLI | Inverter overload (OL1) pre-alarm | ON: Calculated value of overload protection level is a specific level or more | |
| 18 | 19 | POLM | Motor overload (OL2) pre-alarm | ON: Calculated value of overload protection level is <f657: alarm="" level="" overload=""> or more</f657:> | [7. 2. 2] |
| 20 | 21 | РОН | Overheat (OH) pre-alarm | ON: Approx. 95°C or more of IGBT element OFF: Under approx. 95°C of IGBT element (90°C or less after detection is turned on) | |
| 22 | 23 | POP | Overvoltage (OP) pre- alarm | ON: Overvoltage limit in operation | |
| 24 | 25 | MOFF | Power circuit undervoltage (MOFF) alarm | ON: Main circuit undervoltage (MOFF) detected | |
| 26 | 27 | UC | Undercurrent (UC) alarm | ON: When the output current falls below the value set by <f611: detection="" level="" undercurrent=""> and remains below <f611: detection="" level="" undercurrent="">+<f609: detection="" hysteresis="" undercurrent=""> for the period of time specified by <f612: detection="" time="" undercurrent=""> OFF: Output current is over <f611> (<f611>+<f609> or more after detection turns on)</f609></f611></f611></f612:></f609:></f611:></f611:> | [6. 30. 7] [7. 2. 2] |
| 28 | 29 | ОТ | Overtorque (OT) alarm | ON: When the torque becomes <f616: detection="" during="" level="" overtorque="" power="" running=""> or more, and remains over <f616: detection="" during="" level="" overtorque="" power="" running=""> - <f619: detection="" hysteresis="" overtorque=""> for the time specified by <f618: detection="" overtorque="" time=""> OFF: Torque is under <f616> (<f616>-<f619> or less after detection turns on)</f619></f616></f616></f618:></f619:></f616:></f616:> | [6. 30. 8] [7. 2. 2] |
| 30 | 31 | POLR | Braking resistor overload (OLr) pre-alarm | ON: 50% or more of calculated value of <f309: braking="" capacity="" resistor=""> set overload protection level</f309:> | [6. 15. 4] [7. 2. 2] |

| Function | Number | | | | |
|----------------|-------------------|--------|--|--|--------------------------|
| Positive logic | Negative logic | Symbol | Function | Action | Reference |
| 32 | 33 | E | Emergency off trip | ON: During emergency off trip ("E" is displayed) | [7 2 2] |
| 34 | 35 | RETRY | During retry | ON: During retry | [7. 2. 2] |
| 36 | 37 | PTNS | Pattern operation end | ON: All pattern operation end | [6. 28] [7. 2. 2] |
| 38 | 39 | PIDL | PID deviation limit | ON: Within the setting value of <f364: deviation="" pid1="" upper-limit="">, <f365: deviation="" lower-limit="" pid1=""></f365:></f364:> | |
| 40 | 41 | RUN | Run/Stop | ON: During run or DC braking, OFF: During stop | |
| 42 | 43 | HFL | Serious failure | ON: At trip *1, OFF: Other than those trip above | |
| 44 | 45 | LFL | Slight failure | ON: At trip ("OC1", "OC2", "OC3", "OP1", "OP2", "OP3", "OH", "OL1", "OL2", "OL3", "OLr") OFF: Other than those trip above | [7. 2. 2] |
| 46 | 47 | CPSW1 | Commercial power/ Inverter Switching 1 | ON: For inverter run | |
| 48 | 49 | CPSW2 | Commercial power/ Inverter Switching 2 | ON: For commercial power run | |
| 50 | 51 | FAN | During cooling fan run | ON: During cooling fan run | [6. 30. 11] [7. 2. 2] |
| 52 | 53 | JOG | During jog run | ON: During jog run | [7. 2. 2] |
| 54 | 55 | JBM | During terminal run | ON: During terminal run, OFF: Other than terminal run | [7.2.2] |
| 56 | 57 | СОТ | Cumulative run time alarm | ON: Cumulative operation time is <f621: alarm="" cumulative="" run="" time=""> or more</f621:> | [6. 30. 12] [7. 2. 2] |
| 58 | 59 | СОМОР | Communication option communication time-out | ON: Time-out of communication option occurs (held until reset) | |
| 60 | 61 | FR | Fwd/Rev run | ON: During reverse run, OFF: During forward run * Command direction or OFF during stop | |
| 62 | 63 | RDY1 | Ready for run 1 | ON: Run when frequency command is ON | |
| 64 | 65 | RDY2 | Ready for run 2 | ON: Run when ST, RUN, or frequency command is ON | |
| 68 | 69 | BR | During brake | ON: Brake, OFF: Break release | [7. 2. 2] |
| 70 | 71 | PAL | During alarm or pre-alarm | ON: Alarm or pre-alarm occuring | |
| 72 | 73 | FSL | During Fwd speed limit | ON: <f426: fwd="" level="" limit="" speed=""> or more (Torque control)</f426:> | |
| 74 | 75 | RSL | During Rev speed limit | ON: <f428: level="" limit="" rev="" speed=""> or more (Torque control)</f428:> | |
| 76 | 77 | HLTH | Inverter healthy output | Output while switching ON and OFF over at every 1 sec. (to check inverter soundness) | |
| 78 | 79 | COME | RS485 communication time-out | ON:RS485 communication time-out | [6. 38. 1] [7. 2. 2] |
| 92 | 93 | DATA1 | Designated data bit 0 | ON: bit0 of FA50 is ON, OFF: bit0 of FA50 is OFF | |
| 94 | 95 | DATA2 | Designated data bit 1 | ON: bit1 of FA50 is ON, OFF: bit1 of FA50 is OFF | |
| 106 | 107 | LLD1 | Light load detection 1 | ON: Under heavy load torque(<f335> to <f338>)</f338></f335> | |
| 108 | 109 | HLD | Heavy load detection | ON: Heavy load torque(<f335> to <f338>)or more</f338></f335> | |
| 110 | 111 | PTL | During positive torque limit | ON: During positive torque limit | [7. 2. 2] |
| 112 | 113 | MTL | During negative torque limit | ON: During negative torque limit | |
| 114 | 115 | RCRY | For external relay of rush current suppression | ON: For external relay of rush current suppression | |
| 116 | 117 | FL4 | Failure signal 4 | ON: During trip (including retry waite time) | [6. 15. 3] [7. 2. 2] |

| | Number | Symbol | Function | Action | Reference |
|----------------|-------------------|--------|---|--|----------------------------------|
| Positive logic | Negative logic | Symbol | Function | Action | Reference |
| 118 | 119 | STPC | Stop positioning completion | ON: Stop position completion | |
| 120 | 121 | LLS | During sleep | ON: During sleep | |
| 122 | 123 | KEB | During synchronized Acc/ Dec | ON: During synchronized acceleration/deceleration | [7. 2. 2] |
| 124 | 125 | TVS | During traverse operation | ON: During traverse operation | |
| 126 | 127 | TVSD | During traverse Dec | ON: During traverse deceleration | |
| 128 | 129 | LTA | Parts replacement alarm | ON: Any one of cooling fan, control board capacitor, or power circuit capacitor reaches parts replacement time | [6. 30. 17 [7. 2. 2] |
| 130 | 131 | POT | Overtorque (OT) pre- alarm | ON: Torque current is 70% of <f616: detection="" during="" level="" overtorque="" power="" running=""> setting value or more OFF: Torque current is under <f616> x 70%-<f619: detection="" hysteresis="" overtorque=""></f619:></f616></f616:> | |
| 132 | 133 | FMOD | Frequency command 1/ Frequency command 2 | ON: <f207: 2="" command="" frequency="" select=""> enabled OFF: <fmod: 1="" command="" frequency="" select=""> enabled</fmod:></f207:> | [7. 2. 2] |
| 134 | 135 | FL3 | Failure signal 3 | ON: During trip (except Emergency off) | |
| 136 | 137 | FLC | Hand/Auto | ON: Run command or panel run, OFF: Other than those at left | |
| 138 | 139 | FORCE | During forced run | ON: During forced run | [6. 31] |
| 140 | 141 | FIRE | During fire speed run | ON: During fire speed run | [7. 2. 2] |
| 142 | 143 | UTA | Undertorque alarm | ON: Undertorque alarm level or more | |
| 144 | 145 | PIDF | PID1,2 frequency command agreement | ON: Frequency commanded by <f389: pid1="" select="" set="" value=""> and <f360: feedback="" input="" pid1="" select=""> are within ± <f374: agreement="" band="" detection="" pid1="" set="" value=""></f374:></f360:></f389:> | [7. 2. 2] |
| 150 | 151 | PTCA | PTC input pre-alarm | ON: PTC thermal input value is 60% of <f646: detection="" ptc="" resistance=""> or more</f646:> | [6. 30. 19 [7. 2. 2] |
| 152 | 153 | STO | During Safe Torque Off (STO) | ON: Open between [STOA]-[STOB]-[PLC] OFF: Short circuit between [STOA]-[STOB]-[PLC] | |
| 154 | 155 | DISK | Analog input disconnecting alarm | ON: The input value of terminal [II] is <f633: analog="" detection="" disconnection="" ii="" input="" level=""> or less</f633:> | [7. 2. 2] |
| 156 | 157 | LI1 | Terminal F ON/OFF | ON: Terminal [F] is ON, OFF: Terminal [F] is OFF | |
| 158 | 159 | LI2 | Terminal R ON/OFF | ON: Terminal [R] is ON, OFF: Terminal [R] is OFF | |
| 160 | 161 | LTAF | Cooling fan replacement alarm | ON: Cooling fan reaches parts replacement time | [6. 30. 17 [7. 2. 2] |
| 162 | 163 | NSA | Number of starting alarm | ON: Number of starting is <f648: alarm="" number="" of="" starting=""> or more</f648:> | [6. 30. 2 ² [7. 2. 2] |
| 164 | 165 | LLD2 | Light load detection 2 | ON: Light load detection (compatible with old model) | |
| 166 | 167 | DACC | During Acc | ON: During acceleration | |
| 168 | 169 | DDEC | During Dec | ON: During deceleration | |
| 170 | 171 | DRUN | During constant speed run | ON: During constant speed run | [7. 2. 2] |
| 172 | 173 | DDC | During DC braking | ON: During DC braking | |
| 174 | 175 | HSTOP | During hit and stop | ON: During hit and stop | |
| 176 | 177 | SRVLR | During run including servo lock | ON: During run including servo lock | [7. 2. 2] |

| Function | Number | | | | |
|----------------|----------------|--------|---|--|--------------------------|
| Positive logic | Negative logic | Symbol | Function | Action | Reference |
| 178 | 179 | SRVL | During servo lock | ON: During servo lock | |
| 180 | 181 | IPU | For input cumulative power | ON: Input cumulative power unit reach | [7. 2. 2] |
| 182 | 183 | SMPA | Shock monitoring alarm | ON: Current / torque value reach the shock monitoring detection condition | |
| 184 | 185 | ENSA | Number of external equipment starting alarm | ON: Number of starting of external equipment is <f658: alarm="" equipment="" external="" number="" of="" starting=""> or more</f658:> | [6. 30. 21] [7. 2. 2] |
| 186 | 187 | VFS1 | V/f switching status 1 | ON: V/f switching status 1 | [7. 2. 2] |
| 188 | 189 | VFS2 | V/f switching status 2 | ON: V/f switching status 2 | [1.2.2] |
| 190 | 191 | FAL | Cooling fan fault alarm | ON: Cooling fan fault | [6. 30. 11] [7. 2. 2] |
| 192 | 193 | ETHE | Embedded Ethernet communication time-out | ON: Embedded Ethernet communication time-out | |
| 194 | 195 | CLD1 | Calendar 1 | ON: Calendar 1 | |
| 196 | 197 | CLD2 | Calendar 2 | ON: Calendar 2 | |
| 198 | 199 | CLD3 | Calendar 3 | ON: Calendar 3 | |
| 200 | 201 | CLD4 | Calendar 4 | ON: Calendar 4 | |
| 202 | 203 | PID2 | During PID2 control | ON: During PID2 control | |
| 204 | 205 | PID3 | During External PID3 control | ON: During External PID3 control | |
| 206 | 207 | PID3L | External PID3 deviation limit | ON: Within the setting value of <a346: deviation="" pid3="" upper-limit="">, <a347: deviation="" lower-limit="" pid3=""></a347:></a346:> | |
| 208 | 209 | PID4 | During External PID4 control | ON: During External PID4 control | |
| 210 | 211 | PID4L | External PID4 deviation limit | ON: Within the setting value of <a376: deviation="" pid4="" upper-limit="">, <a377: deviation="" lower-limit="" pid4=""></a377:></a376:> | |
| 212 | 213 | PMPC | Pump control | ON: For pump operation | |
| 222 | 223 | MYF1 | My function output 1 | ON: My function output 1 | [7. 2. 2] |
| 224 | 225 | MYF2 | My function output 2 | ON: My function output 2 | |
| 226 | 227 | MYF3 | My function output 3 | ON: My function output 3 | |
| 228 | 229 | MYF4 | My function output 4 | ON: My function output 4 | |
| 230 | 231 | MYF5 | My function output 5 | ON: My function output 5 | |
| 232 | 233 | MYF6 | My function output 6 | ON: My function output 6 | |
| 234 | 235 | MYF7 | My function output 7 | ON: My function output 7 | |
| 236 | 237 | MYF8 | My function output 8 | ON: My function output 8 | |
| 238 | 239 | MYF9 | My function output 9 | ON: My function output 9 | |
| 240 | 241 | MYF10 | My function output 10 | ON: My function output 10 | |
| 242 | 243 | MYF11 | My function output 11 | ON: My function output 11 | |
| 244 | 245 | MYF12 | My function output 12 | ON: My function output 12 | |
| 246 | 247 | MYF13 | My function output 13 | ON: My function output 13 | |
| 248 | 249 | MYF14 | My function output 14 | ON: My function output 14 | |
| 250 | 251 | MYF15 | My function output 15 | ON: My function output 15 | |
| 252 | 253 | MYF16 | My function output 16 | ON: My function output 16 | [7. 2. 2] |
| 254 | - | AOFF | Always OFF | Always OFF | _ |

| Positive logic | Negative logic | Symbol | Function | Action | Reference |
|----------------|----------------|--------|-----------|-----------|-----------|
| - | 255 | AON | Always ON | Always ON | - |

^{*1} At trip "OCL", "OCR", "EPH1", "EPH0", "Ot", "Ot2", "OtC3", "UtC3", "OH2", "E", "EEP1"-"EEP3", "Err2"-"Err5", "UC", "UP1", "Etn", "Etn1"-"Etn3", "EF2", "PrF", "EtyP", "E-13", "E-18"-"E-21", "E-26", "E-32", "E-37", "E-39"

TOSHIBA E6582062①

11. 10 Setup menu

| Parameter title | Func | tion | Mainly North America | Mainly Asia | Mainly Europe | China | Japan | | |
|---|---|-----------------------------------|-------------------------|--|------------------|-------|-------|----|----|
| FH | Maximum frequ (Hz) | iency | 80.0 | 80.0 | 80.0 | 50.0 | 80.0 | | |
| F307 | Supply voltage compensation | | 2 | 2 | 2 | 2 | 3 | | |
| F319 | Regenerative over-flux upper limit (%) | | 120 | 120 | 120 | 140 | 140 | | |
| F417 | Motor rated spe (min ⁻¹) | • | | Motor rated speed (min ⁻¹) | | *1 | *1 | *1 | *1 |
| vLv, F171, F175, | Base frequency | Base frequency | | 230 | 230 | 200 | 200 | | |
| F179 | Voltage (V) | | 460 | 400 | 400 | 380 | 400 | | |
| vL, UL, F170, F174, F178, F204, F213, F219, F225, F231, F237, F330, F335, F364, F367, F370, F426, F428, F814, A316, A319, A322, A346, A349, A352, A376, A379, A382 | Frequency (Hz | Frequency (Hz) | | 50.0 | 50.0 | 50.0 | 60.0 | | |
| F606, F643 | Frequency (ma value) (Hz) | Frequency (max of set value) (Hz) | | 50.0 | 50.0 | 50.0 | 60.0 | | |
| F405 | Motor rated | 3.7 | 4.0 | 4.0 | 4.0 | 3.7 | 3.7 | | |
| F400 | Capacity (kW) | 0.4 | 0.4 | 0.4 | 0.4 | 0.37 | 0.4 | | |

^{*1} Depending on the region and the capacity. Refer to [11. 6].

11. 11 Guidance function

| Embedded Ethernet setting | | | | | | | | | |
|---------------------------|--|--|--|--|--|--|--|--|--|
| | <auf>=1</auf> | | | | | | | | |
| C081-C096 | Device name 1-16 | | | | | | | | |
| C610 | Emb Eth. IP setting mode | | | | | | | | |
| C611-C614 | Emb Eth. IP address setting value | | | | | | | | |
| C615-C618 | Emb Eth. Subnet mask setting value | | | | | | | | |
| C619-C622 | Emb Eth. Default gateway setting value | | | | | | | | |
| C629-C632 | Emb Eth. IP address monitor | | | | | | | | |
| C633-C636 | Emb Eth. Subnet mask monitor | | | | | | | | |
| C637-C640 | Emb Eth. Default gateway monitor | | | | | | | | |
| | Preset speed operation | | | | | | | | |
| | <auf>=2</auf> | | | | | | | | |
| CMOd | Run command select | | | | | | | | |
| FMOd | Frequency command select | | | | | | | | |
| ACC | Acceleration time 1 | | | | | | | | |
| dEC | Deceleration time 1 | | | | | | | | |
| FH | Maximum frequency | | | | | | | | |
| UL | Upper limit frequency | | | | | | | | |
| Sr1-Sr7 | Preset speed 1-7 | | | | | | | | |
| F111-F116 | Terminal xx function | | | | | | | | |
| F287-F294 | Preset speed 8-15 | | | | | | | | |
| Ar | nalog frequency command | | | | | | | | |
| | <auf>=3</auf> | | | | | | | | |
| CMOd | Command mode selection | | | | | | | | |
| FMOd | Frequency mode selection | | | | | | | | |
| ACC | Acceleration time 1 | | | | | | | | |
| dEC | Deceleration time 1 | | | | | | | | |
| FH | Maximum frequency | | | | | | | | |
| UL | Upper limit frequency | | | | | | | | |
| LL | Lower limit frequency | | | | | | | | |
| F201 | RR point 1 input value | | | | | | | | |
| F202 | RR point 1 frequency | | | | | | | | |
| F203 | RR point 2 input value | | | | | | | | |
| F204 | RR point 2 frequency | | | | | | | | |
| F216 | II point 1 input value | | | | | | | | |
| F217 | II point 1 frequency | | | | | | | | |
| F218 | II point 2 input value | | | | | | | | |
| F219 | II point 2 frequency | | | | | | | | |

| | Motor 1,2 switching |
|-----------|-------------------------------------|
| | <auf>=4</auf> |
| vL | Base frequency |
| vLv | Base frequency voltage 1 |
| vb | Manual torque boost |
| tHrA | Motor overload protection current 1 |
| ACC | Acceleration time 1 |
| dEC | Deceleration time 1 |
| F111-F116 | Terminal xx function |
| F170 | Base frequency 2 |
| F171 | Base frequency voltage 2 |
| F172 | Manual torque boost 2 |
| F182 | Motor overload protection current 2 |
| F185 | Stall prevention level 2 |
| F415 | Motor rated current |
| F500 | Acceleration time 2 |
| F501 | Deceleration time 2 |
| F601 | Stall prevention level 1 |
| | Motor parameter |
| | |
| Pt | V/f pattern |
| vL | Base frequency |
| vLv | Base frequency voltage 1 |
| F405 | Motor rated capacity |
| F415 | Motor rated current |
| F417 | Motor rated speed |
| F400 | Offline auto-tuning |
| | PM motor parameter |
| | <auf>=6</auf> |
| Pt | Motor control type |
| vL | Motor base frequency |
| vLv | Motor nominal voltage |
| F400 | Auto tuning |
| F402 | Automatic torque boost |
| F405 | Motor rated capacity |
| F415 | Motor nominal current |
| F417 | Motor nominal speed |
| F458 | Current control P gain |
| F460 | Speed loop P gain |
| F461 | Speed loop I gain |
| F462 | Load inertia |
| F910 | Step-out detection current |
| F911 | Step-out detection time |
| F912 | Auto tune Lq axis |
| F913 | Auto tune Ld axis |
| F914 | Current stall prevention frequency |
| F915 | Starting method |
| F916 | Id current at starting |
| F917 | Lq ratio at 100% load |
| F918 | Lq ratio at 200% load |
| F919 | Reluctance torque ratio |
| | 1 |

12 Specifications

In this chapter, the inverter's model and type, standard specification, outside dimensions, and approx. mass are described.

12. 1 Model and main standard specification

■ Standard specification depending on model

< 240 V class: HD rating >

| | Item | | | | | | | Sį | oecificati | on | | | | | | |
|-----------------------|---|---|---|--------|---------|----------|---------|----------|------------|-----------|----------|-----------|----------|----------|-------|-------|
| Volta | age class | | | | | | | 2 | 40 V cla | ss | | | | | | |
| Fran | ne size | | Α | 1 | | A2 | Д | .3 | A4 | | | A5 | | | A6 | |
| Appl | icable motor (kW) | 0.4 | 0.75 | 1.5 | 2.2 | 4 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 | 45 | 55 |
| Appl | icable motor (HP) | 0.5 | 1 | 2 | 3 | 5 | 7.5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 75 |
| | Туре | | • | • | | | • | | VFAS3- | | | • | • | • | • | |
| | Form | 2004P | 2007P | 2015P | 2022P | 2037P | 2055P | 2075P | 2110P | 2150P | 2185P | 2220P | 2300P | 2370P | 2450P | 2550P |
| Rating | Output capacity (kVA) *1 | 1.3 | 1.8 | 3.0 | 4.3 | 7.1 | 9.7 | 12.5 | 17.8 | 24.2 | 29.9 | 35.3 | 46.9 | 56.8 | 67.1 | 80.4 |
| Rat | Output current (A) *2 | 3.3 | 3.3 4.6 8.0 11.2 18.7 25.4 32.7 46.8 63.4 78.4 92.6 123 149 176 211 | | | | | | | | | | | | | |
| | Output voltage | | | 3-phas | e 200 V | to 240 V | (The ma | ximum o | output vo | oltage is | equal to | the input | t supply | voltage) | | |
| | Overload current rating | | | | | | | 150%-1 | minute, | 180%-2 | 3 | | | | | |
| Electrical braking | Dynamic braking circuit | | | | | | | Built-in | | | | | | | Opt | onal |
| Elect | Dynamic braking resistor | | External braking resistor (Optional) | | | | | | | | | | | | | |
| oly | Voltage-frequency | 3-phase 200 V to 240 V - 50/60 Hz | | | | | | | | | | | | | | |
| Power supply | Allowable fluctuation | Voltage 170 V to 264 V *3, Frequency ± 5% | | | | | | | | | | | | | | |
| Powe | Required power supply capacity (kVA) *4 | 0.7 | 1.4 | 2.4 | 3.5 | 5.9 | 7.7 | 10.5 | 15.7 | 20.6 | 24.9 | 30.7 | 40.5 | 49.6 | 61.0 | 73.3 |
| Prot | ective method (IEC60529) | | | | | | | IP20 | | | | | | | IP | 00 |
| Coo | ling method | | | | | | | Forc | ed air-co | ooled | | | | | • | |
| Colo | r | | | | | | | RAL7 | 016 / RA | L7035 | | | | | | |
| EMC | Cfilter | | | | | | | No | EMC fi | lter | | | | | | |
| DC i | DC reactor | | Built-in | | | | | | | | | | | | | |
| NEM | 1A type1 kit | Built-in Optional | | | | | | | | | | | onal | | | |

 $^{^{\}star}1$ $\,$ Capacity is calculated at 220 V for the 240 V class.

Ι

П

Л

5

8

10

11

L2

13

14

15

^{*2} Indicates rated output current setting when the PWM carrier frequency (parameter F300) is 4 kHz for frame size A1 to A5, 2.5 kHz for frame size A6.

 $^{^{\}star}3$ Lower limit of voltage for 240 V class is 180 V when the inverter is used continuously (load of 100%).

^{*4} Required power supply capacity varies with the value of the power supply side inverter impedance (including those of the input reactor and wires).

< 240 V class: ND rating >

| | Item | | Specification | | | | | | | | | | | | | | |
|-----------------------|---|-------------------|---|---------|---------|----------|-----------|-----------|-----------|-----------|----------|-----------|----------|----------|-------|-------|--|
| Volta | age class | | | | | | | 2 | 40 V clas | ss | | | | | | | |
| Fran | ne size | | Α | .1 | | A2 | A2 A3 | | | A4 | | | A5 | | | A6 | |
| Appl | licable motor (kW) | 0.75 | 1.5 | 2.2 | 4 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 | 45 | 55 | 75 | |
| Appl | licable motor (HP) | 1 | 2 | 3 | 5 | 7.5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 75 | 100 | |
| | Туре | | | | | | | | VFAS3- | | | | | | | | |
| | Form | 2004P | 2007P | 2015P | 2022P | 2037P | 2055P | 2075P | 2110P | 2150P | 2185P | 2220P | 2300P | 2370P | 2450P | 2550P | |
| Rating | Output capacity (kVA) *1 | 1.8 | 3.0 | 4.3 | 7.1 | 9.7 | 12.5 | 17.8 | 24.2 | 29.9 | 35.3 | 46.9 | 56.8 | 67.1 | 80.4 | 107 | |
| Rat | Output current (A) *2 | 4.6 | 4.6 8.0 11.2 18.7 25.4 32.7 46.8 63.4 78.4 92.6 123 149 176 211 282 | | | | | | | | | | | | | | |
| | Output voltage | | | 3-phase | e 200 V | to 240 V | (The ma | iximum (| output vo | ltage is | equal to | the input | supply v | voltage) | | | |
| | Overload current rating | | | | | | | 120%-1 | minute, | 150%-2 s | 6 | | | | | | |
| Electrical braking | Dynamic braking circuit Built-in | | | | | | | | Optional | | | | | | | | |
| Elect | Dynamic braking resistor | | | | | | Exte | rnal brak | ing resis | tor (Opti | onal) | | | | | | |
| ply | Voltage-frequency | | | | | | 3-ph | ase 200 | V to 240 | V - 50/6 | 60 Hz | | | | | | |
| Power supply | Allowable fluctuation | | | | | ١ | /oltage 1 | 70 V to | 264 V *3 | , Freque | ncy ± 5% | 6 | | | | | |
| Powe | Required power supply capacity (kVA) *4 | 1.2 | 2.3 | 3.3 | 5.9 | 7.8 | 10.3 | 15.0 | 20.6 | 24.9 | 29.4 | 40.5 | 49.3 | 59.6 | 73.3 | 98.1 | |
| Prot | ective method (IEC60529) | IP20 | | | | | | | | | | | IP | 00 | | | |
| Coo | ling method | | | | | | | Ford | ed air-co | ooled | | | | | | | |
| Colo | or | RAL7016 / RAL7035 | | | | | | | | | | | | | | | |
| EMC | Cfilter | No EMC filter | | | | | | | | | | | | | | | |
| DC i | reactor | Built-in | | | | | | | | | | | | | | | |
| NEN | 1A type1 kit | Built-in Optional | | | | | | | | | | | onal | | | | |

^{*1} Capacity is calculated at 220 V for the 240 V class.

^{*2} Indicates rated output current setting when the PWM carrier frequency (parameter F300) is 4 kHz for frame size A1 to A5, 2.5 kHz for frame size A6.

^{*3} Lower limit of voltage for 240 V class is 180 V when the inverter is used continuously (load of 100%).

^{*4} Required power supply capacity varies with the value of the power supply side inverter impedance (including those of the input reactor and wires).

< 480 V class: HD rating >

| | < 480 V class: HL | Talling | | | | | | | | | | | | |
|-----------------------|---|--------------------------------------|---------|-----------|------------|-------------------------|--------------|--------------|-----------|--|-------------|------------|----------|---------|
| 1/-11 | Item | | | | | | | pecificatio | | | | | | |
| - | age class | | | | | | 1 | 80 V class | 3 | 40 | | | | |
| | ne size | 0.4 | 0.75 | A1 | 0.0 | 1 4 | A | | | A3 | 40.5 | | A4 | 1 07 |
| | licable motor (kW) | 0.4 | 0.75 | 1.5 | 2.2 | 4 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 |
| Appi | licable motor (HP) | 0.5 | 1 | 2 | 3 | 5 | 7.5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |
| | Туре | 400400 | 400700 | 404500 | 4000000 | 400700 | 405500 | VFAS3- | 444000 | 445000 | 440500 | 400000 | 40000 | 107000 |
| | Form | 4004PC | 4007PC | 4015PC | 4022PC | - | 4055PC | 4075PC | 4110PC | + | 4185PC | 4220PC | | + |
| Rating | Output capacity (kVA) *1 | 1.1 | 1.7 | 3.0 | 4.3 | 7.1 | 9.7 | 12.6 | 17.9 | 24.2 | 29.9 | 35.3 | 46.9 | 56.8 |
| ď | Output current (A) *2 | 1.5 | 2.2 | 4.0 | 5.6 | 9.3 | 12.7 | 16.5 | 23.5 | 31.7 | 39.2 | 46.3 | 61.5 | 74.5 |
| | Output voltage | | 3- | phase 38 | 80 V to 48 | 30 V (The | maximum | output volt | age is e | qual to the | input sup | oly voltag | e) | |
| | Overload current rating | 150%-1 minute, 180%-2 s | | | | | | | | | | | | |
| rical | Dynamic braking circuit | Built-in | | | | | | | | | | | | |
| Electrical braking | Dynamic braking resistor | External braking resistor (Optional) | | | | | | | | | | | | |
| ply | Voltage-frequency | | | | | 3- | phase 380 | V to 480 \ | V - 50/60 |) Hz | | | | |
| dns J | Allowable fluctuation | | | | | Volta | ge 323V to | 528V *3, F | requen | cy ± 5% | | | | |
| Power supply | Required power supply capacity (kVA) *4 | 0.7 | 1.4 | 2.6 | 3.7 | 6.6 | 8.5 | 11.4 | 16.6 | 22.3 | 27.3 | 32.7 | 44.3 | 53.9 |
| Prote | ective method (IEC60529) | 1 | | | | ı | | IP20 | | | | | 1 | 1 |
| Cool | ling method | Forced air-cooled | | | | | | | | | | | | |
| Colo | or | RAL7016 / RAL7035 | | | | | | | | | | | | |
| EMC | C filter | Built-in | | | | | | | | | | | | |
| DC r | reactor | | | | | | | Built-in | | | | | | |
| NEM | //A type1 kit | | | | | | | Built-in | | | | | | |
| | Item | | | | | | 9 | pecificatio | n | | | | | |
| Volta | age class | | | | | | | 80 V class | | | | | | |
| - | ne size | A5 A6 A7 A8 | | | | | | | | | | | | |
| | licable motor (kW) | 45 | 55 | | 75 | 90 | 110 | 132 | , | 160 | 200 | 22 | | 280 |
| | licable motor (HP) | 60 | 75 | _ | 00 | 125 | 150 | 200 | | 250 | 300 | 35 | | 450 |
| | Туре | | | | | | | VFAS3- | | | | | | |
| | Form | 4450PC | 4550F | C 475 | iopc 4 | 1900PC | 4110KPC | 4132K | PC 4 | 160KPC | 4200KP0 | 4220 | KPC | 4280KPC |
| D D | Output capacity (kVA) *1 | 67.1 | 80.8 | 1 | 11 | 132 | 161 | 191 | | 239 | 295 | 32 | 25 | 419 |
| Rating | Output current (A) *2 | 88.0 | 106 | 1 | 45 | 173 | 211 | 250 |) | 314 | 387 | 42 | 77 | 550 |
| | Output voltage | - | | | | | maximum | | | | | | | |
| | Overload current rating | | | pridoc oc | 00 1 10 10 | 70 7 (1110 | | minute, 18 | | • | трас оар | ory voltag | <u> </u> | |
| <u>a</u> a | Dynamic braking circuit | | Built-i | n | | | Optiona | | 1070 2 0 | | | Built-in | | |
| Electrical braking | | | Duit | | | | | | | | | Julic-III | | |
| P. E. | Dynamic braking resistor | | | | | Ex | kternal bral | king resisti | · · | | | | | |
| > | Voltage-frequency | | ; | 3-phase | 380 V to | 480 V - 50 | /60 Hz | | | phase 380 phase 380 | | | | |
| Power supply | Allowable fluctuation | | Volta | ge 323 V | / to 528 \ | / ^{*3} , Frequ | ency ± 5% | | 32 | oltage 323 23 V to 528 equency ± | 3 V - 60 Hz | | | |
| Po | Required power supply capacity (kVA) *4 | 65.6 | 79.5 | 1 | 08 | 133 | 155 | 181 | ı | 225 | 275 | 30 |)8 | 379 |
| Prote | ective method (IEC60529) | | IP20 | | | | | | | IP00 | | | | |
| Cool | ling method | Forced air-cooled | | | | | | | | | | | | |
| Colo | or | RAL7016 / RAL7035 | | | | | | | | | | | | |
| EMC | Cfilter | Built-in | | | | | | | | | | | | |
| DC r | reactor | Built-in Attached | | | | | | | | | | | | |
| NEM | //A type1 kit | Built-in | | | | | | • - | Optional | | | | | |

- *1. Capacity is calculated at 220 V for the 240 V class.
- *2. Indicates rated output current setting when the PWM carrier frequency (parameter F300) is 4 kHz for frame size A1 to A5, 2.5 kHz for frame size A6.
- *3. Lower limit of voltage for 240 V class is 180 V when the inverter is used continuously (load of 100%).
- *4. Required power supply capacity varies with the value of the power supply side inverter impedance (including those of the input reactor and wires).

< 480V class: ND rating >

| | Item | | | | | | S | pecification | on | | | | | |
|-----------------------|---|---|--------------------------------------|-----------|------------|----------|---------|--------------|------------|------------|-----------|------------|--------|--------|
| Volta | age class | | | | | | 4 | 480V clas | S | | | | | |
| Fran | me size | | | A1 | | | Δ | .2 | | A3 | | | A4 | |
| App | licable motor (kW) | 0.75 | 1.5 | 2.2 | 4 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 | 45 |
| App | licable motor (HP) | 1 | 2 | 3 | 5 | 7.5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 |
| | Туре | | VFAS3- | | | | | | | | | | | |
| | Form | 4004PC | 4007PC | 4015PC | 4022PC | 4037PC | 4055PC | 4075PC | 4110PC | 4150PC | 4185PC | 4220PC | 4300PC | 4370PC |
| Rating | Output capacity (kVA) *1 | 1.7 | 3.0 | 4.3 | 7.1 | 9.7 | 12.6 | 17.9 | 24.2 | 29.9 | 35.3 | 46.9 | 56.8 | 67.1 |
| Rat | Output current (A) *2 | 2.2 | 4 | 5.6 | 9.3 | 12.7 | 16.5 | 23.5 | 31.7 | 39.2 | 46.3 | 61.5 | 74.5 | 88.0 |
| | Output voltage | | 3- | -phase 38 | 0 V to 480 | V (The r | naximum | output vol | tage is eq | ual to the | input sup | ply voltag | e) | |
| | Overload current rating | | | | | | 120%-1 | minute, 1 | 50%-2 s | | | | | |
| cal | Dynamic braking circuit | | | | | | | Built-in | | | | | | |
| Electrical braking | Dynamic braking resistor | | External braking resistor (Optional) | | | | | | | | | | | |
| ply | Voltage-frequency | 3-phase 380 V to 480 V - 50/60 Hz | | | | | | | | | | | | |
| dns. | Allowable fluctuation | Voltage 323 V to 528 V *3, Frequency ± 5% | | | | | | | | | | | | |
| Power supply | Required power supply capacity (kVA) *4 | 1.2 | 2.4 | 3.4 | 6.1 | 8.3 | 10.9 | 15.6 | 21.3 | 26.4 | 31.4 | 42.0 | 52.4 | 63.2 |
| Prot | ective method (IEC60529) | | | | | | | IP20 | | | | | | |
| Coo | ling method | | | | | | For | ced air-co | oled | | | | | |
| Colo | or | | RAL7016 / RAL7035 | | | | | | | | | | | |
| EMO | C filter | | Built-in | | | | | | | | | | | |
| DC | reactor | Built-in | | | | | | | | | | | | |
| NEN | //A type1 kit | | Built-in | | | | | | | | | | | |

| | Item | Specification | | | | | | | | | | | |
|-----------------------|---|-------------------|--|--------------|--------------|----------------|----------------|---------|--|---------|---------|--|--|
| Volta | age class | | | | | 480 V | class | | | | | | |
| Fran | ne size | | A5 | | | A6 | | A7 | | A8 | | | |
| Appl | icable motor (kW) | 55 | 75 | 90 | 110 | 132 | 160 | 220 | 250 | 280 | 315 | | |
| Appl | icable motor (HP) | 75 | 100 | 125 | 150 | 200 | 250 | 350 | 400 | 450 | 500 | | |
| | Туре | VFAS3- | | | | | | | | | | | |
| • | Form | 4450PC | 4550PC | 4750PC | 4900PC | 4110KPC | 4132KPC | 4160KPC | 4200KPC | 4220KPC | 4280KPC | | |
| Rating | Output capacity (kVA) *1 | 80.8 | 111 | 132 | 161 | 191 | 230 | 325 | 367 | 419 | 469 | | |
| Rat | Output current (A) *2 | 106 | 145 | 173 | 211 | 250 | 302 | 427 | 481 | 550 | 616 | | |
| | Output voltage | | 3-phase 380 V to 480 V (The maximum output voltage is equal to the input supply voltage) | | | | | | | | | | |
| • | Overload current rating | | 120%-1 minute, 150%-2 s | | | | | | | | | | |
| cal Jg | Dynamic braking circuit | | Built-in | | Optional | | | | | | | | |
| Electrical braking | Dynamic braking resistor | | | | Exte | rnal braking ı | resistor (Opti | onal) | | | | | |
| Á | Voltage-frequency | | 3-phase 380 V to 480 V - 50/60 Hz | | | | | | 0 to 440 V - 0 to 480 V - | | | | |
| Power supply | Allowable fluctuation | | Voltage 3 | 323 V to 528 | V *3, Freque | ncy ± 5% | | | 3 to 484 V - 5 28 V - 60 Hz ± 5% | * | | | |
| Po | Required power supply capacity (kVA) *4 | 77.0 | 103 | 125 | 155 | 181 | 214 | 296 | 335 | 379 | 422 | | |
| Prote | ective method (IEC60529) | | IP20 | | | | IP00 | | | | | | |
| Cool | ling method | | | | • | Forced a | ir-cooled | | | | | | |
| Colo | r | | | | | RAL7016 | / RAL7035 | | | | | | |
| EMC | Cfilter | | | | | Bui | lt-in | | | | | | |
| DC r | reactor | Built-in Attached | | | | | | | | ched | | | |
| NEM | IA type1 kit | Built-in Optional | | | | | | | | | | | |
| *4 | Capacity is calculated at 440 \ | /fortha 100 |) \ / alaaa | | • | | | | | | | | |

- *1. Capacity is calculated at 440 V for the 480 V class.
- *2. Indicates rated output current setting when the PWM carrier frequency (parameter F300) is 4 kHz for frame size A1 to A5, 2.5 kHz for frame size A6 to A8
- *3. Lower limit of voltage for 480 V class is 342 V when the inverter is used continuously (load of 100%).
- *4. Required power supply capacity varies with the value of the power supply side inverter impedance (including those of the input reactor and wires).

■ Common specification

| | Item | Specification |
|------------------------|--|---|
| | Control system | Sinusoidal PWM control |
| | Output voltage adjustment | Adjustable within the range of 50 - 330 V (240 V class) and 50 - 660 V (480 V class) by correcting the supply voltage |
| | Output frequency range | Setting between 0.01 - 590 Hz. Default max. frequency is set to 0.01 - 80 Hz. Maximum frequency adjustment (30 to 590Hz) |
| | Minimum setting steps of frequency | 0.01 Hz: operation panel input (60 Hz base), 0.03 Hz: analog input (60 Hz base, 11 bit/0 - 10 Vdc) |
| | Frequency accuracy | Analog input: ±0.2% of the maximum output frequency (at 25±10°C) Digital input: ±0.01%±0.022 Hz of the output frequency |
| ification | Voltage/frequency characteristics | V/f constant, variable torque, automatic torque boost, vector control, base frequency adjustment 1, 2, 3, and 4 (15 - 590 Hz), V/f 5-point arbitrary setting, torque boost adjustment (0 - 30%), start frequency adjustment (0 - 10 Hz), stop frequency adjustment (0 - 30 Hz) |
| Control specification | Frequency setting signal | 3 kΩ potentiometer (possible to connect to 1 - 10 kΩ-rated potentiometer) 0 - 10Vdc (input impedance Zin: 31.5 kΩ) -10 to +10 Vdc (Zin: 31.5 kΩ) 4 - 20 mAdc (Zin: 250 Ω) |
| | Terminal block frequency command | The characteristic can be set arbitrarily by two-point setting. Compliant with 7 types of input; analog input (RR, RX, II, Al4, Al5), and pulse input (S4, S5) |
| | Frequency jump | Three frequency can be set. Setting of jump frequency and width. |
| | Upper and lower limit frequencies | Upper limit frequency: 0 to max. frequency, lower limit frequency: 0 to upper limit frequency |
| | PWM carrier frequency | Frame size A1 to A4: adjustable between 1.0 - 16 kHz Frame size A5 to A8: adjustable between 2.5 - 8 kHz |
| | PID control | Adjustment of proportional gain, integral time, differential time and delay filter. Multi PID and external PID control. |
| | Torque control | Voltage command input specification: -10 - +10 Vdc |
| | Acceleration/deceleration time | 0.01 - 6000 sec. Selectable from among acceleration/deceleration. times 1, 2, 3 and 4. Automatic acceleration/deceleration function. S-pattern acceleration/deceleration 1 and 2 pattern adjustable. |
| | DC braking | Adjustment of braking start frequency (0 - <fh>Hz), braking (0 - 100%) and braking time (0 - 25.5 sec.). With emergency off braking function and motor shaft fix control function.</fh> |
| | Forward run/reverse run *1 | Forward run with ON of the terminal [F], Reverse run with ON of the terminal [R] (Default setting). Coast stop with OFF of the terminal assigned Stad-by function. Emergency off by panel operation or terminal. |
| | Jog run *1 | Jog run, if selected, allows jog operation from the operation panel Jog run operation by terminal block is possible by setting the parameters. |
| | Preset speed operation *1 | By changing the combination of the terminals [S1], [S2], [S3], [S4], [S5] set frequency + 31-speed operation. Selectable between acceleration/deceleration time, torque limit and V/f by set frequency. |
| ions | Retry | Capable of restarting after a check of the power circuit elements in case the protective function is activated. Max. 10 times selectable arbitrarily. Waiting time adjustment (0 - 10 sec.) |
| ificat | Soft stall | Automatic load reduction control at overloading. (Default: OFF) |
| sbec | Cooling fan ON/OFF | The cooling fan will be stopped automatically to assure long life when unnecessary. |
| eration specifications | Operation panel key operation ON/OFF control | Key lock selectable between STOP key only, MODE key only, etc. All key operations can be locked. |
| ð | Regenerative power ride-through control | Possible to keep the motor running using its regenerative energy in case of a momentary power failure. (Default: OFF) |
| | Auto-restart operation | Possible to restart the motor in coasting in accordance with its speed and direction. (Default: OFF) |
| | Simplified pattern operation | Possible to select each 8 patterns in 2 groups from 15-speed operation frequency. Max. 16 types of operation possible. Terminal operation/repeat operation possible. |
| | Commercial inverter switching | Possible to switch operation by commercial power supply or inverter |
| | Light-load high-speed operation | Increases the operating efficiency of the machine by increasing the rotational speed of the motor when it is operated under light load. |
| | Droop function | When two or more inverters are used to operate a single load, this function prevents load from concentrating on one inverter due to unbalance. |
| | Override function | External input signal adjustment is possible to the operation frequency command value. |
| Protective function | Protective function | Stall prevention, current limit, overcurrent, overvoltage, short circuit on the load side, ground fault on the load side *5, undervoltage, momentary power failure (15 ms or more), non-stop control at momentary power failure, overload protection, arm overload at starting, overcurrent on the load side at starting, overcurrent and overload at braking resistor, overheat, emergency off |
| ectiv | Electronic thermal characteristic | Switchable between standard motor/constant torque motor, adjustment of overload protection and stall prevention level. |
| Prot | Reset | Reset by 1a contact closed (or 1b contact opened), or by operation panel. Or power supply OFF/ON. This function is also used to save and clear trip records. |

(Continued overleaf)

(Continued)

| | Item | | Specification | | | | | |
|------------------|---------------------------|-------------------------|--|--|--|--|--|--|
| | | Alarms | Stall prevention during run, overload limit, overload, undervoltage on power supply side, DC circuit undervoltage, setting error, in retry, upper limit, lower limit. | | | | | |
| | | Causes of failures | Overcurrent, overvoltage, overheat, short circuit on the load side, ground fault on the load side, inverter overload, arm overcurrent at starting, overcurrent on the load side at starting, CPU fault, EEPROM fault, RAM fault, ROM fault, communication error, (braking resistor overcurrent/overload), (emergency off), (undervoltage), (undercurrent), (overtorque), (motor overload), (input phase failure), (output phase failure) The items in the parentheses are selectable. | | | | | |
| Display function | Screen of LCD | Monitoring function | Output frequency, frequency command, forward run/reverse run, output current, DC voltage, output voltage, compensated frequency, terminal input/output information, CPU version, past trip history, cumulative operation time, feedback frequency, torque, torque command, torque current, exiting current, PID feedback value, motor overload factor, inverter overload factor, PBR overload factor, PBR load factor, input power, output power, peak output current, peak DC voltage, RR input, II input, RX input, Al4 input, Al5 input, FM output, AM output, expansion I/O card option CPU version, integral input power, integral output power, communication option reception counter, communication option abnormal counter. | | | | | |
| | | Free unit display | Display of optional units other than output frequency (motor speed, line speed, etc), current ampere/% switch, voltage volt/% switch | | | | | |
| | | Automatic edit function | Searches automatically parameters that are different from the default setting parameters. Easy to find changed parameters. | | | | | |
| | | User default setting | User parameter settings can be saved as default settings. Allows to reset the parameters to the user-defined parameter settings. | | | | | |
| | LED | Charge display | Displays power circuit capacitor charging. | | | | | |
| Input/ | output terminal inpu | it function | Possible to select positive logic or negative logic with programmable input/output terminal function menu. 2 or 3 function can be assigned for some terminals. *1 *2 (Default setting: positive logic) | | | | | |
| Sink/s | source switching | | Possible to switch between minus common (CC) and plus common (P24) for control terminal. (Default setting: external power supply) | | | | | |
| | Failure detection s | ignal | 1c contact output (250 Vac-2 A-cosΦ=1, 250 Vac-1 A-cosΦ=0.4, 30 Vdc-1 A) | | | | | |
| | Relay output | | 2×1a contact output (250 Vac-2 A-cosΦ=1, 250 Vac-1 A-cosΦ=0.4, 30 Vdc-1 A) | | | | | |
| output signal | Low speed/speed output *2 | reach signal | Digital output (24 Vdc, max. 50 mA) | | | | | |
| ontbr | Output for frequen | , | Analog output for meter: 1 mA dc full-scale dc ammeter 0 - 20 mA (4 - 20 mA) output: DC ammeter (allowable load resistance: $500~\Omega$ or less) 0 - $10~V$ output: DC voltmeter (allowable load resistance: $1~K$ 0 or more) | | | | | |
| | Pulse train frequer | ncy output | Pulse train output (Up to 30 kpps, duty 50%) | | | | | |
| Comr | nunication function | | Ethernet standard 2-channel equipped (connector: RJ45) RS485 standard 2-channel equipped (connector: RJ45) PROFINET, DeviceNet, PROFIBUS-DP are optional. | | | | | |
| | Use environments | | Indoor use. Altitude: 4800 m or less (current reduction necessary if above 1000 m.) Place not exposed to direct sunlight and free of corrosive and explosive gases. | | | | | |
| Environments | Ambient temperatu | ure | -10 to +60°C (Remove the upper cover if 50°C or more, max. 60°C) *4 | | | | | |
| /ironr | Storage temperatu | ire | -25 to +70°C | | | | | |
| Ш | Relative humidity | | 5 to 95% (free from condensation) | | | | | |
| | Vibration | | 5.9 m/s ² {0.6G} or less (10 - 55 Hz) | | | | | |

- *1: 14 digital input terminals (of which 6 are options) are programmable digital input terminals, and they make it possible to arbitrarily select from 178 types of signals.
- *2: Programmable ON/OFF output terminals make it possible to arbitrarily select from 256 types of signals.
- *3: Programmable analog output terminals make it possible to arbitrarily select from 54 types of signals.
- *4: When using inverters where the ambient temperature will rise above 50°C, remove the upper cover and operation panel, and operate each inverter at a current lower than the rated one. (Above 45°C for Frame size A7 and A8 of ND)
- *5: This function protects inverters from overcurrent due to output circuit ground fault.

12. 2 Outside and Mass

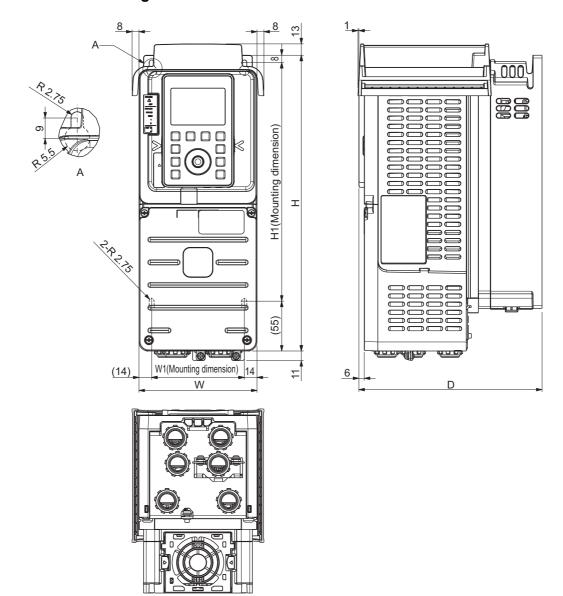
Outside dimensions and mass

| Volume Class Capacity Class Color | Input | Applicable motor | | | | ı | Dimension (mm | 1) | | F 0' | Approx. mass | |
|---|------------------|------------------|----------|---------|--------|-------|---------------|-------|-------|------------|-------------------------|-----|
| 1 | voltage Class | capacity (kW) | Invert | er type | W | Н | D | W1 *1 | H1 *1 | Frame Size | (kg) | |
| 1.5 | | 0.4 | | 2004P | | | | | | | 4.3 | |
| 1.5 | | 0.75 | | 2007P | | | | | | | 4.3 | |
| 1 | | 1.5 | | 2015P | 130 | 326 | 202 | 102 | 263 | A1 | 4.5 | |
| S.5 7.5 205P 195 534.5 232 168 460 A3 13.8 | | 2.2 | | 2022P | | | | | | | 4.6 | |
| 3-phase 11 | | 4 | | 2037P | 155 | 391.5 | 231 | 125 | 324 | A2 | 7.7 | |
| 7.5 2078 | | 5.5 | | 2055P | 405 | 504.5 | | 400 | 400 | | 13.8 | |
| 116 | | 7.5 | | 2075P | 195 | 534.5 | 232 | 168 | 460 | A3 | 13.8 | |
| 116 | 3-phase 240 V | 11 | VFAS3- | 2110P | | | | | | | 27.3 | |
| Second Part | 2.00 | 15 | | 2150P | 210 | 660 | 268 | 174 | 570 | A4 | 27.3 | |
| 100 265 | | 18.5 | | 2185P | | | | | | | 27.3 | |
| 377 | | 22 | | 2220P | | | | | | | 57.6 | |
| A5 | | 30 | | 2300P | 265 | 908 | 313 | 220 | 718 | A5 | 57.6 | |
| S | | 37 | | 2370P | | | | | | | 57.6 | |
| 10 | | 45 | | 2450P | 300 | 950 | 202 | 255 | 920 | ۸۶ | 82 | |
| 1.5 | | 55 | | 2550P | 300 | 650 | 303 | 255 | 020 | Ao | 82 | |
| 1.5 4015PC 130 326 202 102 263 A1 4.5 | | 0.4 | | 4004PC | | | | | | | 4.5 | |
| 3-phase 480 V 3-phase 480 V NFAS3- 110 410PC 418PC 420PC 420PC 430PC 4150PC 195 534.5 231 125 324 A2 7.7 7.7 13.6 14.3 14.2 14.3 14.2 14.3 14.3 14.2 14.3 14.3 14.2 14.3 14.2 14.3 14.2 14.3 14.2 14.3 14.2 14.3 14.2 14.3 14.2 14.3 | | 0.75 | | 4007PC | | | | | | | 4.5 | |
| A | | 1.5 | | 4015PC | 130 | 326 | 202 | 102 | 263 | A1 | 4.5 | |
| S.5 T.5 T.7 | | 2.2 | | 4022PC | | | | | | | 4.6 | |
| 7.5 11 15 15 18.5 22 3-phase 480 V 7.7 45 45 55 75 90 110 110 110 120 4110PC 415PC 410PC 420PC 420PC 420PC 420PC 420PC 420PC 420PC 585 1190 377 540 920 A8 134 420PC 430 136 136 136 136 136 136 136 136 136 136 | | 4 | | 4037PC | | | | | | | 4.7 | |
| 7.5 4075PC 4110PC 4110PC 4150PC 195 534.5 232 168 460 A3 14.2 14.3 14.3 14.3 14.5 | | 5.5 | | | 4055PC | 155 | 201.5 | 221 | 125 | 324 | A2 | 7.7 |
| 15 | | 7.5 | | 4075PC | 155 | 391.5 | 231 | 125 | 324 | A2 | 7.7 | |
| 18.5 22 28 28 28 28 28 28 2 | | 11 | | 4110PC | | | | | | | 13.6 | |
| 3-phase 480 V 3 | | 15 | | 4150PC | 195 | 534.5 | 232 | 168 | 460 | A3 | 14.2 | |
| 3-phase 480 V | | 18.5 | | 4185PC | | | | | | | 14.3 | |
| 480 V 37 4370PC 28.7 45 4450PC 265 908 313 220 718 A5 59 75 4750PC 59.5 90 4900PC 300 850 383 255 820 A6 82 110 4110KPC 300 850 383 255 820 A6 82 132 4132KPC 82 160 4160KPC 430 1190 377 350 920 A7 104 (166)*2 200 4220KPC 585 1190 377 540 920 A8 136 (204)*2 | | 22 | | 4220PC | | | | | | | 28 | |
| 37 | 3-phase | 30 | VFAS3- | 4300PC | 210 | 660 | 268 | 174 | 570 | A4 | 28.2 | |
| 55 4550PC 265 908 313 220 718 A5 59 75 4750PC 59.5 90 4900PC 82 110 4110KPC 300 850 383 255 820 A6 82 132 4132KPC 82 160 4160KPC 430 1190 377 350 920 A7 104 (166)*2 200 4200KPC 134 (194)*2 220 4220KPC 585 1190 377 540 920 A8 136 (204)*2 | 400 V | 37 | | 4370PC | | | | | | | 28.7 | |
| 75 4750PC 59.5 90 4900PC 82 110 4110KPC 300 850 383 255 820 A6 82 132 4132KPC 82 160 4160KPC 430 1190 377 350 920 A7 104 (166)*2 200 4200KPC 134 (194)*2 220 4220KPC 585 1190 377 540 920 A8 136 (204)*2 | | 45 | | 4450PC | | | | | | | 57.5 | |
| 90 | | 55 | | 4550PC | 265 | 908 | 313 | 220 | 718 | A5 | 59 | |
| 110 4110KPC 300 850 383 255 820 A6 82 132 4132KPC 82 160 4160KPC 430 1190 377 350 920 A7 104 (166)*2 200 4200KPC 134 (194)*2 220 4220KPC 585 1190 377 540 920 A8 136 (204)*2 | | 75 | | 4750PC | | | | | | | 59.5 | |
| 132 4132KPC 82 160 4160KPC 430 1190 377 350 920 A7 104 (166) ² 200 4200KPC 134 (194) ² 220 4220KPC 585 1190 377 540 920 A8 136 (204) ² | | 90 | | 4900PC | | | | | | | 82 | |
| 160 4160KPC 430 1190 377 350 920 A7 104 (166) ² 2 200 4200KPC 134 (194) ² 220 4220KPC 585 1190 377 540 920 A8 136 (204) ² 2 | | 110 | | 4110KPC | 300 | 850 | 383 | 255 | 820 | A6 | 82 | |
| 200 4200KPC 134 (194) ^{*2} 220 4220KPC 585 1190 377 540 920 A8 136 (204) ^{*2} | | 132 | | 4132KPC | | | | | | | 82 | |
| 220 4220KPC 585 1190 377 540 920 A8 136 (204) ^{*2} | | 160 | | 4160KPC | 430 | 1190 | 377 | 350 | 920 | A7 | 104 (166)*2 | |
| | | 200 | | 4200KPC | | | | | | | 134 (194) ^{*2} | |
| | | 220 | <u> </u> | 4220KPC | 585 | 1190 | 377 | | 920 | A8 | 136 (204)*2 | |
| | | 280 | | 4280KPC | | | | | | | 136 (204)*2 | |

^{*1} W1 and H1 are the mounting dimensions of the inverter.

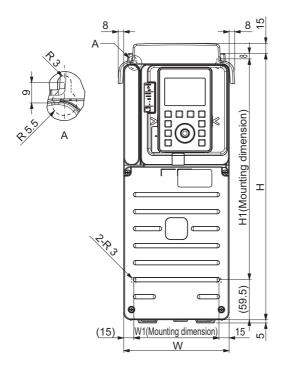
^{*2} Value in () includes attached DC reactor.

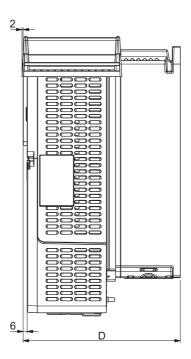
Outline drawing

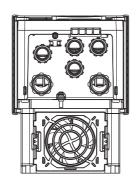


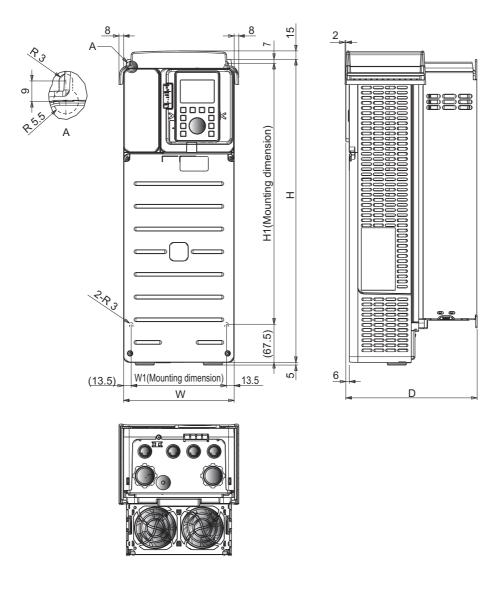
12

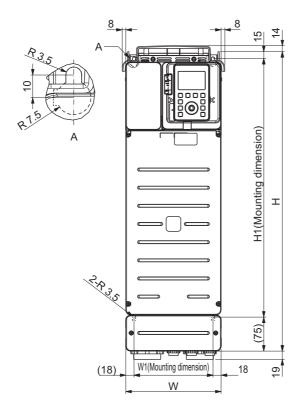
Frame size A1

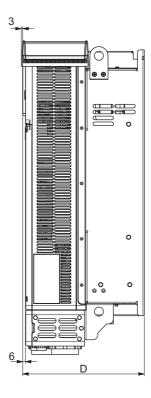


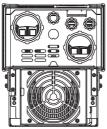


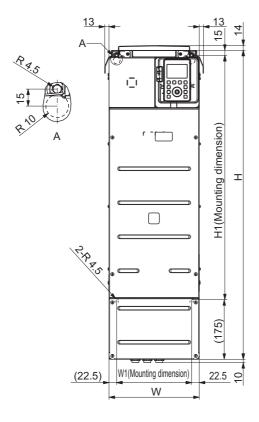


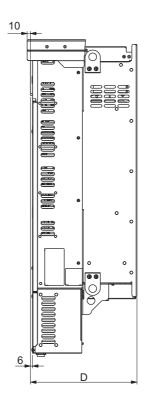




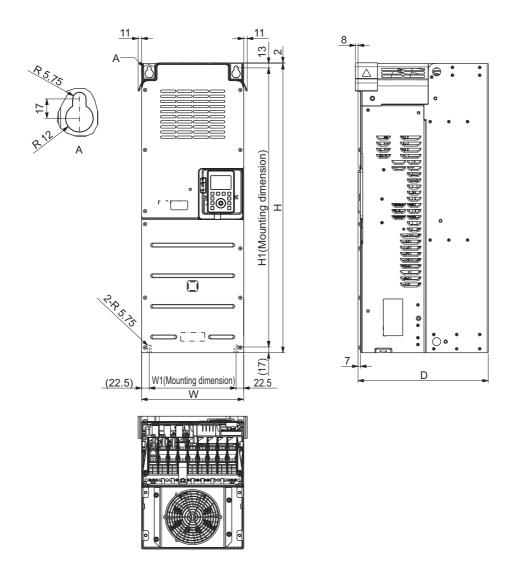












13

Trip information and measures

13. 1 Description of trip and alarm information and measures

If a trip occurs, make failure diagnosis according to the table below before contacting your Toshiba distributor.

■ Term description

| Trip | Output of the inverter is turned OFF for protection of the inverter or external equipment. A failure signal can be output if the output terminal function is assigned. (A failure signal is assigned to the terminal [FL] in the default setting). |
|-----------|--|
| Alarm | Indicates a condition that the inverter or external equipment may be damaged if continued. A signal can be output if the output terminal function is assigned. Under voltage, etc. are displayed with blinking on the operation panel. |
| Pre-alarm | A condition close to the trip level. A signal can be output when the output terminal function is assigned. "C", "P", "L", and "H" blink in the operation panel during run for overcurrent, overvoltage, overload, and overheat respectively. |
| Message | Informs a status of the inverter and setting error. It is not an alarm. |

Trip information

| Trip display | Failure code | Trip name | Detection factor | Measures |
|-----------------|--------------|----------------------|---|---|
| E | 0011 | Emergency | Emergency off is input. 1) When a run command is other than the operation panel, [STOP/RESET] key was pressed twice. 2) A signal was input to the input terminal in which emergency off is assigned. 3) Emergency off is input from communication. | Reset after solving problems. Clear the emergency off signal. |
| E-11 | 002B | Brake answer error * | The system does not reply even after the setting time in <f630: answer="" brake="" time="" wait=""> elapsed.</f630:> | Check the system. Check if the <f630> setting is correct. When not used, set <f630>="0.0: Disabled".</f630></f630> |
| E-12 | 002C | PG error | PG is disconnected. Error exists in PG wiring. PG voltage is improper. When using PG option and setting <f377: detection="" disconnection="" option="" pg=""> = "0: Disabled."</f377:> | Check the PG wiring. Check if the PG settings are correct. <f376: number="" pg="" phases="" select="">,</f376:> <f379: option="" pg="" voltage=""></f379:> |

^{*}Enable/Disable can be selected for trip with a parameter.

_

П

1

2

3

5

6

_

 \cap

11

2

13

L4

15

| Trip display | Failure code | Trip name | Detection factor | Measures |
|-----------------|--------------|--|--|---|
| E-13 | 002D | Abnormal speed error | 1) When <pt: f="" pattern="" v=""> = "0" to "9", an over speed condition occurred. 2) When <pt: f="" pattern="" v=""> = "10" to "11", over speed continued by PG failure, etc. 3) Due to overvoltage limit operation, the output frequency exceeded <fh: frequency="" maximum=""> +12 Hz or <fh> + <vl: 1="" base="" frequency=""> x 0.1.</vl:></fh></fh:></pt:></pt:> | 1) 3) Check whether a problem exists in input voltage. When the regenerative energy is large, install a braking resistor (option). 2) Check the PG wiring and setting. |
| E-18 | 0032 | Analog input disconnecting * | The input level of the terminal [II] became the setting value or less of <f633: analog="" detection="" disconnection="" ii="" input="" level=""></f633:> | Check that the signal line connected to the terminal [II] is not disconnected. Check if the <f633> setting is correct.</f633> |
| E-19 | 0033 | CPU commu- nication error | Communication error between control CPU. | Turn off the power and then turn it on again. If the error occurs again, contact your Toshiba distributor. |
| E-20 | 0034 | Over torque boost | The setting value of the <f402: automatic="" boost="" torque=""> is very high.</f402:> Impedance on the motor is low. | Set the motor parameters according to the motor characteristic, and perform autotuning. <vl: 1="" base="" frequency="">, <vlv: base="" frequency="" voltage="">, <f405: capacity="" motor="" rated="">, <f415: current="" motor="" rated="">, <f417: motor="" rated="" speed="">, <f400: auto-tuning="" offline="">, etc.</f400:></f417:></f415:></f405:></vlv:></vl:> |
| E-21 | 0035 | CPU1 fault B | Control CPU fault. | Fault in internal inverter. Contact your Toshiba distributor. |
| E-22 | 0036 | Embedded Ethernet fault | Fault in the embedded Ethernet. | Fault in internal inverter. Contact your Toshiba distributor. |
| E-23 | 0037 | Option fault (slot A) | Fault in the option connected to slot A. | Fault in the option. Contact your Toshiba distributor. |
| E-24 | 0038 | Option fault (slot B) | Fault in the option connected to slot B. | Fault in the option. Contact your Toshiba distributor. |
| E-25 | 0039 | Option fault (slot C) | Fault in option 3. | Fault in the option. Contact your Toshiba distributor. |
| E-26 | 003A | CPU2 fault | Control CPU fault. | Fault in internal inverter. Contact your Toshiba distributor. |
| E-29 | 003D | Control power option failure * | Failure on the control power supply option. The setting of <f647: control="" detection="" failure="" option="" power=""> is improper.</f647:> | 1) When input voltage of the control power supply is normal and the voltage between terminals [+SU]-[CC] is under 20 Vdc, it is a failure in the control power supply option. Contact your Toshiba distributor. 2) When the control power supply option is not used, set <f647> = "0".</f647> |
| E-31 | 003F | Rush current suppression relay fault | Fault on the rush current suppression relay. The power was turned ON/OFF frequently. | Fault in internal inverter. Contact your Toshiba distributor. Instead of turning ON/OFF with the power supply, turn ON/OFF with a run command. |
| <u> </u> | | *Enable/Disabl | e can be selected for trip with a parameter. | |
| E-32 | 0040 | PTC failure | PTC protection for the motor became enabled. Failure in the PTC circuit. | Check the motor and PTC. Failure in internal inverter. Contact your Toshiba distributor. |

| Trip display | Failure code | Trip name | Detection factor | Measures |
|-----------------|--|--|--|---|
| E-37 | 0045 | Servo lock error | The lock up torque or more external load is applied to the motor. Setting of motor parameters is improper. | 1) Reduce the load to apply the servo lock. 2) Set the motor parameters according to the motor characteristic, and perform auto-tuning. <vl: 1="" base="" frequency="">, <vlv: base="" frequency="" voltage="">, <f405: capacity="" motor="" rated="">, <f415: current="" motor="" rated="">, <f417: motor="" rated="" speed="">, <f400: auto-tuning="" offline="">, etc.</f400:></f417:></f415:></f405:></vlv:></vl:> |
| E-39 | 0047 | PM control error | During auto-tuning or initial position, the motor current became very high. | Measure inductance with a LCR meter, etc., and set to the parameter directly. |
| E-42 | 004A | Cooling fan fault | The cooling fan failed. | The cooling fan needs to be replaced. Contact your Toshiba distributor. |
| E-43 | 004B | Communication time-out (embedded Ethernet) | Embedded Ethernet communication timed out. | Check the Ethernet communication equipment and wiring. |
| E-44 | 004C | Battery of panel failure | 1) A battery is not in. 2) The battery level is low. | Put a battery. Replace the battery. |
| E-99 | 0058 | Trip for test * | Trip for test occurred. | Reset if no problem is found. |
| EEP1 | 0012 | EEPROM fault 1 | Fault occurred during internal data writing. | Turn off the power and then turn it on again. If the fault occurs again, contact your Toshiba distributor. |
| EEP2 | 0013 | EEPROM fault 2 | 1) While setting <typ: default="" setting="">, the power was turned OFF or momentary power failure occurred. 2) Fault occurred during internal data writing.</typ:> | 1) Set <typ> again. If the fault occurs again, contact your Toshiba distributor. 2) Turn off the power and then turn it on again. If the fault occurs again, contact your Toshiba distributor.</typ> |
| EEP3 | 0014 | EEPROM fault 3 | Fault occurred during internal data reading. | Turn off the power and then turn it on again. If the fault occurs again, contact your Toshiba distributor. |
| EF2 | 0022 | Grounding fault * | Grounding fault occurred in the output wiring or the motor. Overcurrent occurred in the braking resistor. When connected to AC power supply and common DC bus link is done, sneak circuit is generated causing unnecessary trip. | Check grounding fault in the wiring on the output side and the motor. Increase the deceleration time. <dec: 1="" deceleration="" time="">, etc.</dec:> Set <f307: compensation,="" limitation="" output="" supply="" voltage=""> to "1" or "3".</f307:> <f636: fault="" ground="" trip=""> = "0: Disabled"</f636:> |
| EPHI | 0008 | Input phase loss * | Input side phase has failed. Power circuit capacitor capacity is inadequate. | Check phase failure in the wiring on the input side. Contact your Toshiba distributor. |
| EPHO | 0009 | Output phase loss * | Output side phase has failed. | Check phase failure in the wiring on the output side. |
| | *Enable/Disable can be selected for trip with a parameter. | | | |
| Err2 | 0015 | RAM fault | Control RAM fault. | Fault in internal inverter. Contact your Toshiba distributor. |

| Trip display | Failure code | Trip name | Detection factor | Measures |
|-----------------|--------------|--------------------------------------|---|---|
| Err3 | 0016 | ROM fault | Control ROM fault. | Fault in internal inverter. Contact your Toshiba distributor. |
| Err4 | 0017 | CPU1 fault A | Control CPU fault. | Fault in internal inverter. Contact your Toshiba distributor. |
| Err5 | 0018 | Communication time-out (RS485) | RS485 communication timed out. | Check the communication equipment and wiring on RS485 communication. |
| Err6 | 0019 | Gate array fault | Fault in the gate array. | Fault in internal inverter. Contact your Toshiba distributor. |
| Err7 | 001A | Current detector fault | Fault in the output current detector. | Fault in internal inverter. Contact your Toshiba distributor. |
| Err8 | 001B | Communication time-out (option) | Communication option timed out. | Check the communication equipment and wiring on communication option. |
| Err9 | 001C | Panel disconnection during run | While running with a run command from the operation panel and extension panel, the cable connecting the inverter and panel are disconnected. | Check the connection on the inverter and panel. |
| Etn | 0028 | Auto-tuning error | The motor parameter does not match the motor characteristic. Executed auto-tuning while the motor is rotating. The output frequency does not increase within few minutes. | 1) Set the motor parameters according to the motor characteristic. <vl: 1="" base="" frequency="">, <vlv: base="" frequency="" voltage="">, <f405: capacity="" motor="" rated="">, <f415: current="" motor="" rated="">, <f417: motor="" rated="" speed="">, etc. 2) Check that the motor is stopped, and perform auto-tuning again. 3) Check that the motor is not stopped while the output frequency is risin on the system.</f417:></f415:></f405:></vlv:></vl:> |
| Etn1 | 0054 | Auto-tuning error 1 | The motor is not connected. Something other than the motor is connected. In the induction motor, an improper value, a synchronized motor speed value or a value close to it is set in <f417: motor="" rated="" speed="">.</f417:> | 1) and 2) Check that the motor is connected. 3) Set <f417> according to the motor rating.</f417> |
| Etn2 | 0055 | Auto-tuning error 2 | The motor parameter does not match the motor characteristic. | Set the motor parameters according to the motor characteristic. <vl: 1="" base="" frequency="">, <vlv: base="" frequency="" voltage="">, <f405: capacity="" motor="" rated="">, <f415: current="" motor="" rated="">, <f417: motor="" rated="" speed="">, etc.</f417:></f415:></f405:></vlv:></vl:> |
| Etn3 | 0056 | Auto-tuning error 3 | The setting on <vl: 1="" base="" frequency=""> or <f417: motor="" rated="" speed=""> does not match the motor rating.</f417:></vl:> | Set <vl: 1="" base="" frequency=""> or <f417: Motor rated speed> according to the motor rating.</f417: </vl:> |
| EtyP | 0029 | Inverter type error | Internal error exists. Replaced the printed circuit board (contact your Toshiba distributor for replacing the printed circuit board). | 1) Error in internal inverter. Contact your Toshiba distributor. 2) Set <typ: default="" setting=""> = "6: Initialize typeform".</typ:> |

^{*}Enable/Disable can be selected for trip with a parameter.

| Trip display | Failure code | Trip name | Detection factor | Measures |
|-----------------|--------------|---|--|---|
| OC1 | 0001 | Overcurrent (during acceleration) | The acceleration time is short. <pt: f="" pattern="" v=""> does not match the machinery.</pt:> Momentary power failure occurred, and tried to start the rotating motor. Tried to run the special motor (impedance small). Tried to run a low inductance motor like a high-speed motor. When <pt> = "11", polarity of PG is opposite.</pt> When <f614: at="" circuit="" detection="" of="" pulse="" short="" start="" width=""> = "0", inverter output short circuit.</f614:> | Increase the acceleration time. <acc: 1="" acceleration="" time="">, etc.</acc:> Set <pt: f="" pattern="" v=""> according to the machinery.</pt:> Set <f301: auto-restart="">. Depending on the characteristic of machinery, <f302: power="" regenerative="" ridethrough=""> = "1" is also effective.</f302:></f301:> When <pt> is set to "0", "1", "2", or "7", lower <vb: 1="" boost="" manual="" torque="">. For settings other than "0", "1", "2", or "7", perform auto-tuning with <f400: auto-tuning="" offline="">. <f402: automatic="" boost="" torque=""> is set matching the motor.</f402:></f400:></vb:></pt> Change the inverter to large capacity. |
| OC2 | 0002 | Overcurrent (during deceleration) | The deceleration time is short. Tried to run a low inductance motor like a high-speed motor. When <pt> = "11", polarity of PG is opposite.</pt> When <f614: at="" circuit="" detection="" of="" pulse="" short="" start="" width=""> = "0", inverter output short circuit.</f614:> | Increase the deceleration time. <dec: 1="" deceleration="" time="">, etc. Change the inverter to large capacity.</dec:> |
| OC3 | 0003 | Overcurrent (during constant speed running) | The load changed rapidly. Error occurred in the machinery (something got stuck, etc.). Tried to run a low inductance motor like a high-speed motor. When <pt> = "11", polarity of PG is opposite.</pt> When <f614: of="" pulse="" short<br="" width="">circuit detection at start> = "0", inverter output short circuit.</f614:> | Suppress load fluctuation. Check whether a problem exists in the machinery. Change the inverter to large capacity. |
| OCA1 | 0005 | Overcurrent (U-phase arm) | Fault on IGBT in U-phase. | Fault in internal inverter. Contact your Toshiba distributor. |
| OCA2 | 0006 | Overcurrent (V-phase arm) | Fault on IGBT in V-phase. | Fault in internal inverter. Contact your Toshiba distributor. |
| OCA3 | 0007 | Overcurrent (W-phase arm) | Fault on IGBT in W-phase. | Fault in internal inverter. Contact your Toshiba distributor. |
| OCL | 0004 | Overcurrent (load side at startup) | 1) Short circuit occurred on the output side. 2) The motor and output side wiring have defective insulation. 3) Impedance on the motor is low. | 1) Check the wiring on the output side. 2) Check the insulation on the output side. 3) Set <f613: at="" circuit="" detection="" short="" start=""> to "2" or "3".</f613:> |
| OCr | 0024 | Overcurrent (Braking resistor) | When "Enabled" is set in <f304: <p="">Dynamic braking, OLr trip>: The braking resistor is not connected. The braking resistor connection is disconnected. A braking resistor with a resistance value under the minimum allowable resistance value is connected. </f304:> Short circuit occurred between [PB] and [PC/-]. IGBT fault on the dynamic braking drive circuit control. | 1) Check if an adequate braking resistor is connected. When a braking resistor is not necessary, set "Disabled" in <f304>. 2) Check for problems on impedance of the braking resistor, wiring, etc. 3) Fault in internal inverter. Contact your Toshiba distributor.</f304> |

^{*}Enable/Disable can be selected for trip with a parameter.

| Trip display | Failure code | Trip name | Detection factor | Measures |
|-----------------|--------------|--------------------------------------|--|---|
| ОН | 0010 | Overheat | 1) The cooling fan is not working. 2) Ambient temperature is high. 3) The vent of the cooling fan is blocked. 4) Other heating units are nearby. | Replace if the cooling fan is not working during run. Lower the ambient temperature. Reset after the inverter cools down. Make sure the vent of the cooling fan is not blocked. Place other heating units away from the inverter. |
| OH2 | 002E | External ther- mal trip * | A signal of external thermal trip is input. | Check that the motor is not overloaded. |
| OL1 | 000D | Overload (Inverter) | 1) Sudden acceleration occurs and the acceleration time is short. 2) <pt: f="" pattern="" v=""> does not match the machinery. 3) Momentary power failure occurred, and tried to start the rotating motor. 4) The DC braking amount is large. 5) The load is large for the inverter capacity.</pt:> | Increase the acceleration time. <acc: 1="" acceleration="" time="">, etc.</acc:> Set <pt: f="" pattern="" v=""> according to the machinery.</pt:> Set <f301: auto-restart="">. Depending on the characteristic of machinery, <f302: power="" regenerative="" ride-through=""> = "1" is also effective.</f302:></f301:> Set <f251: braking="" current="" dc=""> small and <f252: braking="" dc="" time=""> short.</f252:></f251:> Change the inverter to large capacity. |
| OL2 | 000E | Overload (Motor) * | 1) The motor is locked up. 2) Operation continues in low-speed range. 3) The motor is overloaded. 4) The setting of the electronic thermal does not match the motor characteristic. 5) <pt: f="" pattern="" v=""> does not match the machinery.</pt:> | 1) Check the machinery. 2), 3), and 4) Set the electronic thermal according to the motor. <olm: characteristic="" motor="" overload="" protection="">, <thra: 1="" current="" motor="" overload="" protection="">, etc. 5) Set <pt: f="" pattern="" v=""> according to the machinery.</pt:></thra:></olm:> |
| OL3 | 003E | Overload (IGBT) | 1) While operating the low-speed range (15 Hz or less) with high carrier frequency, overload occurred. 2) Momentary power failure occurred, and tried to start the rotating motor. | 1) Reduce the load. Lower the carrier frequency. Or set <f316: carrier="" control="" frequency=""> to "Valid decrease". Increase the output frequency. 2) Set <f301: auto-restart="">. Depending on the characteristic of machinery, <f302: power="" regenerative="" ridethrough=""> = "1" is also effective.</f302:></f301:></f316:> |
| OLr | 000F | Overload (Braking resistor) * | 1) The braking rate is large.2) The deceleration time is short. | Increase the deceleration time. <dec: <p="">Deceleration time 1>, etc. </dec:> Change the braking resistor (option) to a large capacity, and set <f309: braking="" capacity="" resistor="">.</f309:> |
| OP1 | 000A | Overvoltage (during acceleration) | 1) Input voltage is high and showed abnormal fluctuation. 2) Connection is made as the following system. • Power supply capacity is 500 kVA or more. • The power factor improvement capacitor was opened/closed. • Equipment is connected that uses thyristor on the same system. 3) Momentary power failure occurred, and tried to start the rotating motor. | 1) Use within the power supply voltage range. When no problem is found in the input voltage, install an input AC reactor (option). 2) Install an input AC reactor (option). 3) Set <f301: auto-restart="">. Depending on the characteristic of machinery, <f302: power="" regenerative="" ridethrough=""> = "1" is also effective.</f302:></f301:> |

^{*}Enable/Disable can be selected for trip with a parameter.

| Trip display | Failure code | Trip name | Detection factor | Measures |
|-----------------|--------------|--|--|---|
| OP2 | 000B | Overvoltage (during deceleration) | 1) The deceleration time is short and the regenerative energy is large. 2) <f305: limit="" operation="" overvoltage=""> is set to "1: Disabled". 3) Input voltage is high and showed abnormal fluctuation. 4) Connection is made as the following system. • Power supply capacity is 500 kVA or more. • The power factor improvement capacitor was opened/closed. • Equipment is connected that uses thyristor on the same system.</f305:> | Increase the deceleration time. <dec: 1="" deceleration="" time="">, etc.</dec:> When the regenerative energy is large, install a braking resistor. Change <f305> = "0", "2", and "3" to enable the Overvoltage limit operation. When the deceleration time is limited, install a braking resistor (option).</f305> Use within the power supply voltage range. When no problem is found in the input voltage, install an input AC reactor (option). Install an input AC reactor (option). |
| OP3 | 000C | Overvoltage (during con- stant speed running) | 1) Input voltage is high and showed abnormal fluctuation. 2) Connection is made as the following system. • Power supply capacity is 500 kVA or more. • The power factor improvement capacitor was opened/closed. • Equipment is connected that uses thyristor on the same system. 3) The motor was rotated with the force on the load side, and it became to regenerative status. | 1) Use within the power supply voltage range. When no problem is found in the input voltage, install an input AC reactor (option). 2) Install an input AC reactor (option). 3) Install a braking resistor (option). |
| Ot | 0020 | Overtorque * | The load torque reached the overtorque level during run. | Check the load side. Check the overtorque detection setting is correct. CF615: Overtorque trip>, CF616: Overtorque detection level during power running>, CF617: Overtorque detection level during regen>, CF618: Overtorque detection time>, etc. |
| Ot2 | 0041 | Overtorque 2 | 1) The output current during power running reached <f601: 1="" level="" prevention="" stall=""> or more, and the setting time in <f452: detection="" during="" power="" running="" stall="" time=""> elapsed. 2) The power running torque during power running reached <f441: 1="" level="" limit="" power="" running="" torque=""> or more, and the setting time in <f452: detection="" during="" power="" running="" stall="" time=""> elapsed.</f452:></f441:></f452:></f601:> | Reduce the load. Lower the detection level of <f601> or <f441>.</f441></f601> |
| OtC3 | 0048 | Overtorque/ Overcurrent * | Overtorque or overcurrent on the shock monitoring function was detected. | Check the load. When no problem is found, check if the shock monitoring function setting is correct. F590: Shock monitoring> to <f598: condition="" detection="" monitoring="" shock=""></f598:> |
| PrF | 003B | STO circuit fault | Fault in the safe torque off (STO) circuit. | Fault in internal inverter. Contact your Toshiba distributor. |
| SOUT | 002F | PM step-out * | 1) The load changed rapidly. 2) Sudden acceleration/deceleration occurs. 3) The motor shaft is locked up. 4) Output side phase has failed. | 1) and 2) Increase the acceleration/ deceleration time. <acc: acceleration="" time1="">, <dec: 1="" deceleration="" time="">, etc. 3) Check the motor and release the lock. 4) Check the wiring on the output side.</dec:></acc:> |

^{*}Enable/Disable can be selected for trip with a parameter.

| Trip display | Failure code | Trip name | Detection factor | Measures |
|-----------------|--------------|--|--|--|
| UC | 001D | Undercurrent * | The output current declined to the under- current detection level during run. | Check the load. Check that the undercurrent detection setting is correct. F610: Undercurrent trip>, F611: Undercurrent detection level>, F612: Undercurrent detection time>, etc. |
| UP1 | 001E | Undervoltage (Power cir- cuit) * | The input voltage (power circuit) declined. | Check the input voltage. Check that the undervoltage detection setting is correct. <f625: detection="" level="" undervoltage="">, <f627: trip="" undervoltage="">, etc. To avoid trip in momentary power failure, set <f627> = "0: Disabled", and set <f301: auto-restart=""> and <f302: level="" power="" regenerative="" ride-through=""> to "1".</f302:></f301:></f627></f627:></f625:> |
| Ut | 003C | Undertorque * | The load torque reached the undertorque level during run. | Check the load side. Check that the undertorque detection setting is correct. Set 1: Undertorque trip, Set 2: Undertorque detection level during power running, Set 3: Undertorque detection level during regen, Set 4: Undertorque detection time, etc. |
| UtC3 | 0049 | Undertorque/ Undercurrent * | Undertorque or undercurrent on the shock monitoring function was detected. | Check the load. When no problem is found, check if the shock monitoring function setting is correct. F590: Shock monitoring> to <f598: condition="" detection="" monitoring="" shock=""></f598:> |

^{*}Enable/Disable can be selected for trip with a parameter.

■ Alarm information

| Alarm display | English | Detection factor | Measures |
|------------------|---|--|--|
| A-09 | Panel disconnection alarm | The cable connecting the inverter and panel are disconnected during run with a run command from the operation panel and extension panel. | Check the connection on the inverter and panel. |
| A-17 | Key failure alarm | [RUN] or [STOP/RESET] key on the operation panel is pressed and hold for 20 seconds or more. The operation panel key has failed. | Check the operation panel. If the failure occurs again, contact your Toshiba distributor. |
| A-18 | Analog input dis- connection alarm | The input level of the terminal [II] became the setting value or less of <f633: analog="" detection="" disconnection="" ii="" input="" level=""> .</f633:> | Check that the signal line connected to the terminal [II] is not disconnected. Check that the <f633> setting is correct.</f633> |
| A-43 | Communication alarm (embedded Ethernet) | Condition very close to the communication time out trip. | Perform the same measures with communication time out "E-43". |
| COFF | Control power option alarm | 1) Undervoltage on the control power supply input between [+SU] and [CC]. 2) The setting of <f647: control="" detection="" failure="" option="" power=""> is improper.</f647:> | 1) Check the voltage on the control power supply input between [+SU] and [CC]. 20 Vdc or more is required. 2) When the control power supply option is not used, set <f647> = "0". *When [COFF] occurs, turn the power OFF once, and reset.</f647> |

| Alarm display | English | Detection factor | Measures |
|------------------|---|---|--|
| MOFF | Undervoltage alarm | The input voltage (power circuit) declined. | Check the input voltage. If no problem is found, internal error may be the issue. Contact your Toshiba distributor. |
| PrA | Terminal STO OFF | Terminal [STO] is OFF. | Short circuit [STOA] - [STOB] - [PLC]. (By default, short circuit is done with a shorting bar). |
| t | Communication alarm (RS485, option) | Condition very close to the communication time out trip. | Perform the same measures with communication time out "Err5" and "Err8". |
| tUn1 | Brake learning error | 1) The load is heavy. 2) Parameter setting is improper. 3) Braking operation is abnormal. | Perform learning with no load or light load in approx. 3 % or less rating. Set the motor parameters and learning related parameters in advance. Check the brake. |
| tUn3 | Light-load high- speed learning error | Setting of the motor parameter is improper. | Set the motor parameters according to the motor. |

■ Pre-alarm information

| Pre-alarm display | English | Detection factor | Measures |
|-------------------|------------------------------|--|---|
| С | Overcurrent pre- alarm | Condition close to the overcurrent trip. | Perform the same measures with overcurrent "OC1", "OC2", and "OC3". |
| Н | Overheat pre-alarm | Condition close to the overheat trip. | Perform the same measures with overheat "OH". |
| L | Motor overload pre- alarm | Condition close to the overload trip. | Perform the same measures with overload "OL1", "OL2", and "OL3". |
| Р | Overvoltage pre- alarm | Condition close to the overvoltage trip. | Perform the same measures with overvoltage "OP1", "OP2", and "OP3". |

■ Message information

| Message display | English | Description | Remarks |
|--------------------|-------------------------------------|--|--|
| A-01 | V/f 5-point setting error 1 | When <pt:v f="" pattern=""> = "7: V/f 5-point setting", two or more from <vl>, <f190>, <f192>, <f194>, <f196> and <f198> are set to the same value other than 0.0 Hz.</f198></f196></f194></f192></f190></vl></pt:v> | Set different value on each parameter. |
| A-02 | V/f 5-point setting error 2 | Inclination of V/f is large. | Set V/f 5-point and <vlv>/<vl> for the V/f inclination to be gentle.</vl></vlv> |
| A-05 | Base frequency set- ting error | Tries to run in frequency over 10 times of the base frequency. | Check that the base frequency setting is correct. <vl: 1="" base="" frequency="">, etc.</vl:> Operate in frequency within 10 times of the base frequency. |
| ASIA | Setting for Asia | Setting for Asia is selected in the setup menu. | - |
| Atn | During auto tuning | Auto-tuning in progress. | A message that indicates auto-tuning in progress. No problem if the message disappears after several seconds. |
| CHn | Setting for China | Setting for China is selected in the setup menu. | - |
| CLr | Reset command acceptable | The following was operated after trip is occurring. 1) Pressed [STOP] key once. 2) Set the reset terminal ON. (During trip resetting operation) | Reset is performed with the following operation. 1) Press [STOP] key again. 2) Set the reset terminal OFF. |
| db | During DC braking | DC braking in progress. | - |
| dbOn | During motor shaft fixing | Motor shaft fixing in progress. | A message indicates the motor fixing control in progress. When standby is turned OFF, the control stops. |
| E1 | Panel display one digit overflow | The display digit on the operation panel over-flowed by one digit. | - |
| E2 | Panel display two digits overflow | The display digit on the operation panel over-flowed by two digits. | - |
| E3 | Panel display three digits overflow | The display digit on the operation panel over-flowed by three digits. | - |
| EASy | Easy mode | Switched to [Easy mode]. | - |
| End | Last of data | The last data item in <history function="">.</history> | - |
| EOFF | Emergency off command acceptable | When a run command is other than the operation panel, [STOP/RESET] key was pressed once. | To apply emergency off, press [STOP] key again. If emergency off does not occur, press other keys. |
| Err1 | Frequency point setting error | The setting on point 1 and point 2 of the frequency command is close. | Set apart point 1 and point 2 of the frequency command. |
| EU | Setting for Europe | Setting for Europe is selected in the setup menu. | - |
| FAIL | Password failure | Entered number in <f739: password="" verification=""> does not match <f738: password="" setting="">.</f738:></f739:> | - |
| FIrE | During Fire speed run/Forced run | Fire speed run/Forced run is in progress. ("FIrE" and the output frequency are alternately displayed) | A message indicates fire speed run/forced run in progress. It stops when turning the power OFF. |
| FJOG | Fwd JOG | Forward jog run in progress. | |

| Message display | English | Description | Remarks |
|-----------------|---|---|---|
| HEAd | Head of data | The first data item in <history function="">.</history> | - |
| н | Upper limit of set- ting value | The upper limit of the setting value. | - |
| Init | During Initializing | Set <typ: default="" setting=""> = "3" or "13" and initialization is in progress.</typ:> Region setting in progress with the setup menu. | No problem if the display shows "0.0" after several seconds. |
| JP | Setting for Japan | Setting for Japan is selected in the setup menu. | - |
| LO | Lower limit of set- ting value | The lower limit of the setting value. | - |
| LStP | During run sleep | Run sleep in progress. | - |
| n | No detailed information of past trip | While "nErr" and a value are alternately displayed, [OK] key is pressed and detailed information are read. | Normal display. |
| nErr | No error | No trip records in the past trip history on [Monitor mode]. | - |
| OFF | Standby OFF | The input terminal with assigned standby is OFF. | - |
| PASS | Password coincidence | Entered number in <f739: password="" verification=""> matched <f738: password="" setting="">.</f738:></f739:> | - |
| rJOG | Rev JOG | Reverse jog run in progress. | - |
| rtry | During Retry/Speed search | Retry/speed search in progress. | - |
| SEt | Region setting acceptable | Display at first power on. Display after setting <set> = "0".</set> | Set a region to use in the setup menu. |
| Srvo | During servo lock | Servo lock in progress. | - |
| Std | Setting mode | Switched to [Setting mode]. | - |
| StOP | During deceleration stop at power failure | Deceleration stop at power failure in progress. | A message indicates deceleration stop during power failure. The stop state is kept until the run command is turned OFF. |
| tUn | During learning | Learning the brake sequence or light-load high-speed operation in progress. ("tUn1" and the output frequency are alternately dis- played) | - |
| tUn2 | Light-load high- speed learning set- ting error | Error exists in learning operation. | Refer to Operation Manual, and perform learning operation. |
| U | Waiting for search | Waiting for search condition in <changed &="" edit="" parameters="" search="">.</changed> | - |
| UF | During forward search | Forward search in progress in <changed &="" edit="" parameters="" search="">.</changed> | - |
| Undo | All key unlocked | When "Locked" is set in <f737: keys="" lockout="" panel="">, pressed [OK] key for five seconds or more.</f737:> | The key operation on the operation panel is temporarily valid. |
| Ur | During reverse search | Reverse search in progress in <changed &="" edit="" parameters="" search="">.</changed> | - |

| Message display | English | Description | Remarks |
|--------------------|------------------------------|--|---------|
| USA | Setting for North America | Setting for North America is selected in the setup menu. | - |

13. 2 How to reset trip



• Reset the inverter that has tripped after eliminating the cause of the trip.

If it is not eliminated, the inverter will trip again even after reset. Pay enough attention.

The inverter can be reset with the following four methods after a trip occurs.

(1) Panel operation

You can reset from the operation panel even if terminal run or communication run is performed when the trip occurs.

The following is the reset procedure.

1 Press the [STOP/RESET] key with the trip displayed.

"CLr" blinks in the main area, and "Trip reset? (STOP-Key)" is displayed on the lower side.

The backlight is red.
 (It is white when the setting of the backlight is changed.)



When you press the [STOP/RESET] key again while "CLr" is blinking, the trip is reset. The display on the screen once disappears, and the screen immediately after power on is displayed.

The backlight returns to while.

(2) Terminal input (external signal)

Short the terminal [RES] and then open.

The inverter is reset when the terminal is opened.

In the default setting, the function "8: Reset 1" is assigned to the terminal [RES].

To reset with other input terminal, assignment of the reset function is required.

(3) Communication

For details, refer to "RS485 Communication Function Instruction Manual".

(4) Turning off power

Turn OFF the power and then turn it ON again.

When the power is off, some contents of the monitor at the time of the trip are lost.

To retain the contents of the monitor at the time of the trip, set <F602: Trip record retention> to "1: Retain at power off." Even after the inverter is reset with power off, the stored contents of the trip are displayed.

For details, refer to [6. 30. 3].



• The inverter can be reset with power off, however, note that the equipment and the motor are damaged if the power is turned off frequently.

- When the inverter cannot be reset immediately after the trip
 - 1) For overload (inverter) "OL1", overload (motor) "OL2" and overload (braking resistor) "OLr", virtual cooling time is provided. During this time, the inverter cannot be reset by external signal or from the operation panel.

The reference virtual cooling time is as follows.

- "OL1": approximately 30 seconds after the occurrence of a trip
- "OL2": approximately 120 seconds after the occurrence of a trip
- "OLr": approximately 20 seconds after the occurrence of a trip

For overload (IGBT) "OL3", there is no virtual cooling time.

- 2) In case of overheat "OH", the inverter checks the temperature within. Wait until the temperature in the inverter falls sufficiently before resetting the inverter.
- 3) In case of overvoltage "OP1", "OP2" and "OP3", wait until the power circuit voltage decrease under the setting value of <F626: Overvoltage limit operation level>.
- 4) The inverter cannot be reset while the emergency off signal is being input to the input terminal.
- 5) The inverter cannot be reset while a pre-alarm occurs.

13. 3 How to determine causes of other problems

The following table provides a listing of other problems, their possible causes and measures.

| Problems | Causes | Measures |
|---|--|--|
| | - The phase sequence of the output terminals [U/T1], [V/T2] and [W/T3] is wrong. | - Invert the phases of the output terminals [U/T1], [V/T2] and [W/T3]. |
| The motor runs in the wrong direction. | - The Fwd/Rev run signals are input inversely in terminal run. | - Invert the Fwd/Rev run signal terminals of the external input device. (Refer to [7. 2]) |
| | - The setting of <fr: fwd="" panel="" rev="" run="" select=""> is incorrect in panel run.</fr:> | - Change <fr> setting.</fr> |
| | - The load is large. | - Reduce the load. |
| | - The overload stall function is activated. | - Disable the overload stall function OFF in <olm: characteristic="" motor="" overload="" protection="">, and reduce the load (Refer to [5. 1. 5]).</olm:> |
| The motor runs | - <fh: frequency="" maximum=""> and <ul: Upper limit frequency> are set too low.</ul: </fh:> | - Increase the setting values of these parameters. |
| but its frequency does not change. | The value of analog signal in the fraguency | - Check the value of the signal, circuit, wiring, etc. |
| onango. | - The value of analog signal in the frequency command is small. | - Check the characteristics (point 1 and point 2 setting) of the analog signal. (Refer to [7. 3]) |
| | - If the motor runs at a low speed, the torque boost value is too large. | - Check if an overcurrent alarm or overload alarm has occurred and adjust <vb: 1="" boost="" manual="" torque=""> and <acc: 1="" acceleration="" time="">. (Refer to [5. 2. 6] and [5. 1. 4])</acc:></vb:> |
| The motor does not accelerate or decelerate smoothly. | - <acc: 1="" acceleration="" time=""> or <dec: 1="" deceleration="" time=""> is set too short.</dec:></acc:> | - Increase the value of each parameter. |
| A too large cur- | - The load is large. | - Reduce the load. |
| rent flows into the motor. | - If the motor runs at a low speed, the torque boost value is too large. | - Check if the value of <vb: 1="" boost="" manual="" torque=""> is too large. (Refer to [5. 2. 6])</vb:> |
| | - The motor has an improper voltage rating. | - Use a motor with a proper voltage rating. |
| | - The motor terminal voltage is too low. | - Check the setting value of <vlv: 1="" base="" frequency="" voltage="">. (Refer to [5. 1. 2])</vlv:> |
| The motor runs at a higher or | | - Change the wire size to large. |
| lower speed than the speci- | - The reduction gear ratio, etc., are not set properly. | - Adjust the reduction gear ratio, etc. |
| fied one. | - The frequency command is not set cor- | - Check the value and range of the frequency command. |
| | rectly. | - Adjust <vl: 1="" base="" frequency=""> to the motor. (Refer to [5. 1. 2])</vl:> |

| Problems | Causes | Measures |
|------------------------------|---|--|
| | - The load is large or small, and load fluctuation is large. | - Reduce the load fluctuation. |
| The motor | - The inverter or motor used does not have a rating large enough to drive the load. | - Change the inverter and motor to large capacity. |
| speed fluctuates during run. | - The frequency command fluctuates. | - Check if the frequency command such as the analog signal changes. |
| | - Vector control is not performed properly when <pt: f="" pattern="" v=""> is set to "3" or "9".</pt:> | - Check the settings and conditions of the motor parameters and vector control. (Refer to [5. 2. 4]) |
| | - <f700: access="" lockout="" parameter="" reading&writing=""> is set to "1" to "4" (Locked).</f700:> | - Set <f700> to "0: Unlocked".</f700> |
| Parameter set- | - The password is set with <f738: password="" setting="">.</f738:> | - Input the password to <f739: password="" verification=""> to clear. (Refer to [6. 34. 1])</f739:> |
| tings cannot be changed. | - Input terminal functions: "200" to "203" (Parameter writing/reading locked) are assigned to one of the digital input terminals, and the input terminal is ON. | - Turn off the applicable input terminal. |
| | - For reasons of safety, some parameters cannot be changed during run. | - Refer to [6. 34. 1]. |

The following is how to deal with parameter setting-related problems.

| Problems | Measures |
|---|---|
| You forget parameters which have been reset. | - You can search for all changed parameters and set. For details, refer to "Changed parameters search & edit <gru>" in [4. 2. 1].</gru> |
| You want to return all changed parameters to their respective default settings. | - You can return all parameters to default settings. For details, refer to [5. 2. 9]. |

Mandatory

Maintenance and inspection

♠ WARNING

· Perform daily inspection and periodic inspection on equipment.

If you use the inappropriate inverter, not only will the three-phase motor not rotate correctly, but it will cause serious accidents such as overheating and burning out.

- · Before inspection, perform the following steps.
 - (1) Turn off the power to the inverter.
- (2) Wait at least 15 minutes and verify that the charge lamp is no longer lit.
- (3) Use a tester that can measure DC voltages (800 VDC or more), and verify that the voltage to the DC main circuits between [PA/+] and [PC/-] is 45V or less.

Performing inspection without carrying out these steps can lead to electric shock.

When using the PM motor, please verify that the PM motor is stopped. While the PM motor is rotating even after the power is turned off, as a high voltage is generated in the output terminals [U/T1], [V/T2] and [W/T3] on the PM motor side, touching the output terminals will result in electric shock.

To prevent a failure due to the influence of the operating environment such as temperature, humidity, dust, or vibration, or to aging or lives of the used parts, perform daily inspection and periodical inspection.

14. 1 Daily inspection and cleaning

The electronic parts are vulnerable to heat. Therefore, be sure to install the inverter in a well-ventilated, dust-free environment with low ambient temperature.

The purpose of the daily inspection is to maintain the environment and to find any sign of abnormal operation before a failure occurs by recording and comparing the operation data.

14. 1. 1 Checkpoints for daily inspection

Perform daily inspection according to the following items and table:

- Are any abnormalities found in the installation environment?
- · Does the cooling system have any problems?
- Is unusual vibration or sound found?
- · Is abnormal overheat or discoloration found?
- Is an unusual smell found?
- Is adhesion or accumulation of foreign substances (conductive substances) found?
- Is unusual vibration, sound, or overheat found in the motor?

Ι

П

L

2

5

4

5

b

/

8

11

12

13

14

15

14. 1. 2 Daily cleaning

To clean the inverter, use a soft cloth to slightly wipe off the dirt or stains on the inverter surface. If the dirt or stains persist, slightly wipe it off with a cloth dampened with neutral detergent or ethanol.



Important

- Do not use the following chemicals and solvents. Failure to do so results in damaged inverter molded parts (unit, plastic covers, etc.) or peeled coating.
 - Acetone
 - Benzen
 - Chloroform
 - Ethylene chloride
 - · Ethyl acetate
 - Glycerin
 - Tetrachloroethane
 - Trichloroethylene
 - Xylene

^{*1} The voltage value may vary depending on the measurement device used. Therefore, be sure to use the same voltmeter for inspection, and record the indicated values.

14. 2 Periodical inspection

Perform periodical inspection once every three to six months depending on the operating conditions.

WARNING

- · Before inspection, perform the following steps.
 - (1) Turn off the power to the inverter.
 - (2) Wait at least 15 minutes and verify that the charge lamp is no longer lit.



(3) Use a tester that can measure DC voltages (800 VDC or more), and verify that the voltage

to the DC main circuits between [PA/+] and [PC/-] is 45V or less. Performing inspection without carrying out these steps can lead to electric shock.

When using the PM motor, please verify that the PM motor is stopped. While the PM motor is rotating even after the power is turned off, as a high voltage is generated in the output terminals [U/T1], [V/T2] and [W/T3] on the PM motor side, touching the output terminals will result in electric shock.

14. 2. 1 Checkpoints for periodical inspection

The periodical inspection items and check methods are shown in the following table.

| Periodical inspection item | Check method and action |
|--|--|
| Check the screw parts of the wiring terminals for looseness. | Tighten the screw parts of the wiring terminals with a screwdriver. |
| Check the caulked parts of the wiring terminals for any poor caulking. | Visually check the caulked parts for any trace of overheat. |
| Check the wiring for any damage. | Visual check |
| Clean dirt or dust. | Clean it with a vacuum cleaner. |
| Perform an insulation resistance test on the power terminal block. | Test only the power terminal block at 500 V mega to check that the insulation resistance is a few $M\Omega$ or more (the value is lower for the built-in noise filter models). |
| Check the input voltage and output voltage | Periodically check the input-side voltage with a moving-iron type AC voltmeter (recommended). |
| Check the input voltage and output voltage. | Periodically check the output-side voltage with a recti- fier type AC voltmeter (recommended). |
| Check the ambient temperature. | Measure the ambient temperature of the inverter every time at startup, during run, and at stop. |

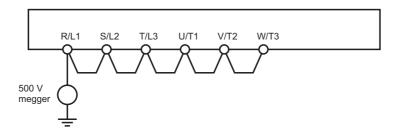
Notes for periodical inspection

When you use a vacuum cleaner for cleaning, pay attention to the vents, printed circuit boards, etc. Keep in mind that adhesion of dirt or dust may result in an unexpected accident. Be sure to keep them dust free.

Perform an insulation resistance test of the power terminal block only on the inverter as shown in the following figure.

 Remove the power supply wiring connected to the power terminal block and the wiring to the motor.

· Wire each power terminal.



Also, remove the wiring of the power circuit output terminals [U/T1], [V/T2], and [W/T3], and perform an insulation resistance test only on the motor. When you perform an insulation resistance test on the peripheral circuits in the parts other than the motor, remove all the wiring connected to the inverter so that a test voltage will not be applied to the inverter.



- Perform an insulation resistance test only on the power terminal block. Do not perform an insulation resistance test on the control terminals in the parts other than the power circuit, or on the circuit terminals mounted on the printed circuit board.
- Do not perform a dielectric test. Failure to do so may result in damaged internal parts.

14. 2. 2 In case of long-term storage

If the smoothing aluminum electrolytic capacitor mounted in the inverter is left unused for a long time without energizing it, the characteristic will deteriorate. When the inverter will not be used for a long time, periodically check the inspection items stated in [14. 2. 1]. Also, energize the inverter for five hours or more once every two years to recover the characteristic of the smoothing aluminum electrolytic capacitor, and check the inverter operation.

When you energize the inverter, it is recommended to gradually increase the voltage with Slidac, etc. before you connect it to the commercial power supply.

| Inspection items for long-term storage | Check method and action | | |
|--|---|--|--|
| Recover the characteristic of smoothing aluminum electrolytic capacitor. | Energize the inverter for five hours or more once every two years. *At this time, it is recommended to gradually increase the voltage with Slidac, etc. before you connect the inverter to the commercial power supply. | | |
| Check inverter operation. | After energizing, check inverter operation. | | |

14. 2. 3 Periodical inspection on the replacement parts

The inverter consists of a large number of electronic parts such as semiconductor devices. The following parts age because of the configurations or the physical properties. If they are left unused for a long time, the performance of the inverter will deteriorate, thus resulting in a failure. Be sure to perform periodical inspection for preventive maintenance.

For replacement of each replacement part, contact your Toshiba distributor. Do not replace the parts on your own for safety.

⚠ WARNING



· Do not replace parts.

This will result in electric shock, fire and other injury. Please call your Toshiba distributor for repairs and replacement of expendable parts.



- The replacement cycle of the parts are influenced by the ambient temperature and the use conditions. The replacement cycle of the parts listed here are based on the assumption that they will be used in an environment (without corrosive gas, oil mist, dust, and metal powder, etc.) at an ambient temperature within the specification.
- The design life expectancies and the standard replacement cycles do not warrant the lives.

■ Cooling fan inspection

The inspection items for the cooling fans are as follows:

- · Are the cooling fans rotating stably?
- Is any unusual sound or vibration found?

The design life expectancies of the cooling fans that cool down the heat-generating parts are as follows:

VFAS3-2004P to 2550P,

VFAS3-4004PC to 4132KPC: Design life expectancy 10 years

VFAS3-4160KPC to 4280KPC: Design life expectancy 10 years (9 years for inner air fan)

* Average ambient temperature 40°C, load factor 80% or less, 24-hour operation per day

Also, replace the fans when unusual sound or vibration is found.

For replacement of the cooling fans, contact your Toshiba distributor.

Smoothing aluminum electrolytic capacitor inspection

The inspection items for the smoothing aluminum electrolytic capacitor are as follows:

- · Is liquid leak found?
- · Is the safety valve lifted?

The design life expectancy of the smoothing aluminum electrolytic capacitor is 10 years.

* Average ambient temperature 40°C, load factor 80% or less, 24-hour operation per day

For replacement of the smoothing aluminum electrolytic capacitor, contact your Toshiba distributor. The inverter unit may need to be replaced depending on the capacity because the smoothing aluminum electrolytic capacitor is mounted on the printed circuit board.

Memo

- · You can check the parts replacement alarm and output signals in [Monitor mode].
- The design life expectancy of the smoothing aluminum electrolytic capacitor becomes shorter at high ambient temperature, and becomes longer at low ambient temperature.

Standard replacement cycle of the other principal parts

The estimated parts replacement cycles are shown in the following figure. They are based on the assumption that they will be used under normal use conditions (average ambient temperature of 40°C, load factor of 80% or less, 24-hour operation per day, with no corrosive gas, oil mist, dust, metal powder, etc. present). These replacement cycles are not the lives of the parts. They are based on the assumption that more parts will become abnormal when they are used over these cycles.

| Part name | Standard replacement cycle*1 | Replacement method |
|--|-----------------------------------|--|
| Relays | - | To be determined by inspection |
| Aluminum electrolytic capacitor on the printed circuit board | 10 years *2 | Replace with a new one. (To be determined by inspection) |
| Battery CR2032 (used in the operation panel) | 7.5 years (20°C, de-energized) | Replace with a new one. |

^{*1} The replacement cycles greatly vary depending on the operating environment.

14. 3 In case of a failure

Should a failure occurs, contact your Toshiba distributor. Before contact, check the information on the name plate attached on the right side of the inverter unit, and presence or absence of the optional parts to inform the distributor of them as well as inverter problems.

14. 4 Cautions for storage

If you store the inverter temporarily or for a long time after purchase, follow the instructions below.

(1) Storage location

Avoid a location with high temperature, high humidity, or lots of dust or metal powder for storage. Store the inverter in a well-ventilated location (storage temperature: -25 to +70°C).

(2) Periodical check

When you store the inverter for two years or more, refer to [14. 2. 2], and energize it for five hours or more once every two years.

^{*2} It is based on the case where the inverter output current is 80% of the inverter rated current.

15 Warranty

Any part of the inverter that proves defective will be repaired and adjusted free of charge under the following conditions:

- (1) This warranty applies only to the inverter main unit.
- (2) Any part of the inverter which fails or is damaged under normal use within twelve months from the date of delivery shall be repaired free of charge.
- (3) For the following kinds of failure or damage, the repair cost shall be borne by the customer even within the warranty period.
 - Failure or damage caused by improper or incorrect use or handling, or unauthorized repair or modification of the inverter
 - Failure or damage caused by the inverter falling or an accident during transportation after the purchase
 - Failure or damage caused by fire, salty damage, corrosive gas, earthquake, storm or flood, lightning, abnormal voltage supply, or other natural disasters
 - Failure or damage caused by the use of the inverter for any purpose or application other than the intended one
- (4) All expenses incurred by Toshiba for on-site services shall be charged to the customer, unless a service contract is signed beforehand between the customer and Toshiba, in which case the service contract has priority over this warranty.

I

П

1

)

2

4

5

6

7

8

9

10

1

L2

13

14

15

16 Disposal

and fire.

A CAUTION



- If you dispose of the inverter, have it done by a specialist in industry waste disposal.*1
 If you dispose of the inverter by yourself, this can result in explosion of capacitor or production of noxious gases, resulting in injury.
- When you dispose of the operation panel, insulate the terminals of the lithium battery by wrapping the terminals with tapes.
 If the terminals contact with other metal or batteries, this will result in heat rising up, explosion,

When you dispose of your old inverter, ask a specialist in industry waste disposal.

Failure to do so results in injuries due to an explosion of the capacitor or generation of noxious gas. Also, when you dispose of the operation panel, wrap the terminals of the lithium battery with tape, etc. to insulate it. If the terminals come in contact with other metal parts or batteries, heat generation, an explosion, or firing may occur.

Ι

П

1

2

3

1

5

6

7

8

9

10

1

L2

13

14

15

^{*1} Persons who specialize in the processing of waste and known as "industrial waste product collectors and transporters" or "industrial waste disposal persons". Please observe any applicable law, regulation, rule or ordinance for industrial waste disposal.

TOSHIBA

TOSHIBA INDUSTRIAL PRODUCTS AND SYSTEMS CORPORATION

Motor Drive Division 580, Horikawa-cho, Saiwai-Ku, Kawasaki, Kanagawa 212-0013 Japan

TEL: +81-44-520-0828 FAX: +81-44-520-0508

TOSHIBA INTERNATIONAL CORPORATION

13131 West Little York RD., Houston TX 77041, U.S.A TEL:+1-713-466-0277 FAX:+1-713-466-8773

TOSHIBA AMERICADO SUL LTDA.

Avenida Ibirapuera, 2332, Torre I, 5° floor City of Sao Paulo Brasil TEL:+55-11-4083-7900 FAX:+55-11-4083-7910

TOSHIBA INDUSTRIAL PRODUCTS AND SYSTEMS SHANGHAI CORPORATION

Room No.906, Raffles City (Office Tower), No. 268, Xizang Middle Road, Huangpu District, Shanghai, P.R.China

TEL:+86-21-6361-3300 FAX:+86-21-6373-1760

TOSHIBA ELECTRONIC COMPONENTS TAIWAN CORPORATION

12F, No.8, Min Sheng E. Rd. Sec. 3, Taipei 10480, Taiwan

TEL:+886-2-2508 9988 FAX:+886-2-2508 9997

TOSHIBA ASIA PACIFIC PTE LTD

20 Pasir Panjang Road #13-27/28, Mapletree Business City, Singapore 117439 TEL:+65-6297-0990

FAX:+65-6305-5561

TOSHIBA INTERNATIONAL CORPORATION PTY. LTD.

11 A Gibbon Road, Winston Hills, Sydney, NSW 2153, Australia

TEL:+61-2-8867-6200 FAX:+61-2-9624-7104

TOSHIBA INDIA PRIVATE LIMITED

3RD Floor, Building No.10, Tower B, Phase-II, DLF Cyber City, Gurgaon-12202, India TEL:+91-124-4996600

FAX:+91-124-4996600 FAX:+91-124-4996665

TOSHIBA GULF FZE

P.O.Box 61028, Jelbel Ali, Free Zone, Dubai, U.A.E TEL:+971-4-8817789 FAX:+971-4-8818985

TOSHIBA RUS LLC

Kievskaya st, 7, entrance 7, floor 12, Moscow, 121059, Russian Federation TEL:+7-495-642-8929 FAX:+7-495-642-8908

TOSHIBA AFRICA (PTY) LTD - SOUTH AFRICA

10th Floor, Sandton Office Towers, 5th Street, Sandton, 2196, South Africa TEL:+27-11-305-2820 FAX:+27-11-326-6074