## TOSHIBA



## I. Safety precautions

The items described in these instructions and on the inverter itself are very important so that you can use the inverter safely prevent injury to yourself and other people around you as well as 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 cautions given.

## Explanation of markings

| Marking | Meaning of marking |
| :---: | :--- |
| $\lfloor$ Warning | Indicates that errors in operation may lead to death or serious injury. |
| $\lfloor$ Caution | Indicates that errors in operation may lead to injury (*1) to people or that these <br> errors may cause damage to physical property. (*2) |

(*1) Such things as injury, burns or shock that will not require hospitalization or long periods of outpatient treatment.
(*2) Physical property damage refers to wide-ranging damage to assets and materials.

## Meanings of symbols

| Marking | Meaning of marking |
| :---: | :--- |
| Indicates prohibition (Don't do it). |  |
| What is prohibited will be described in or near the symbol in either text or |  |
| picture form. |  |

## Limits in purpose

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


## ■ General Operation

|  | - Never disassemble, modify or repair. This can result in electric shock, fire and injury. For <br> repairs, call your sales agency. | Reference |
| :--- | :--- | :--- | :--- |


|  | Caution | Reference |
| :---: | :---: | :---: |
| Prohibited contact | - Do not touch any radiating fins or radiating resistors. They can become very hot, and you may get burned if you touch them. | 3. |

## Transportation \& installation

| Warning |  | Reference |
| :---: | :---: | :---: |
|  | - Do not install or operate the inverter if it is damaged or any component is missing. This can result in electric shock or fire. Please consult your local sales agency for repairs. <br> - Do not place any inflammable objects nearby. If a flame is emitted due to malfunction, it may result in a fire. <br> - Do not install in any location where the inverter could come into contact with water or other fluids. This can result in electric shock or fire. | 2. 1.4.4 $2 .$ |
| Mandatory | - Must be used in the environmental conditions prescribed in the instruction manual. Use under any other conditions may result in malfunction. <br> - Must be installed in non-inflammables such as metals. <br> The rear panel gets very hot. If installation is in an inflammable object, this can result in fire. <br> - Do not operate with the front panel cover removed. Doing so could result in electric shock. <br> - An emergency stop device must be installed that fits with system specifications (e.g. shut off input power then engage mechanical brake). <br> Operation cannot be stopped immediately by the inverter alone, thus risking an accident or injury. <br> - All options used must be those specified by Toshiba. <br> The use of any other option may result in an accident. | $\begin{gathered} \hline 1.4 .4 \\ 1.4 .4 \\ 1.4 .4 \\ 10 . \\ 1.4 .4 \\ \\ 1.4 .4 \end{gathered}$ |


|  | ¢ caution | Reference |
| :---: | :---: | :---: |
| Prohibited | - When operating, do not hold by the front panel covers. <br> The covers may come off and the unit will drop out resulting in injury. <br> - Do not install in any area where the unit would be subject to large amounts of vibration. That could result in the unit falling, resulting in injury. <br> -..Do not expose the drive to halogen group disinfectants. Failure to comply may cause damage to the electrical components in the drive. | 2. 1.4 .4 |
| Mandatory | - Models (20kg or more in weight) designed for $200 \mathrm{~V}-18.5 \mathrm{~kW}$ or larger and $400 \mathrm{~V}-22 \mathrm{~kW}$ or larger should be carried by 2 people more, or it could fall and cause an injury. <br> - Handle large capacity models using a crane. <br> Lifting heavy inverters can cause injury to persons. <br> Taking care of safety for users, handle carefully in order not to damage the inverter. Carefully lift up the inverter, hanging wires on the hanging bolts or holes on the top or bottom of the inverter. <br> Note 1: Always keep the two sling ropes in balance when lifting the inverter, and take care that unexpected force does not apply to the inverter during lifting. <br> Note 2: Always protect the inverter with a cover when transporting it. <br> Note 3: Do not put your hand in the wiring port or do not hold it when transporting the inverter. <br> - The main unit must be installed on a base that can bear the unit's weight. If the unit is installed on a base that cannot withstand that weight, the unit may fall resulting in injury. <br> - Install a mechanical brake whenever the motor requires a brake (device which retains the motor shaft). <br> Failure to do so could lead to injury to persons because the inverter itself has no function of mechanically retaining the brake shaft. | 2. |

## Wiring

| Warning |  | Reference |
| :---: | :---: | :---: |
|  | - Do not connect input power to the output (motor side) terminals (U/T1,V/T2,W/T3). That will destroy the inverter and may result in fire. <br> - Do not connect resistors to the DC terminals (between PA/+ and PC/-, or between PO and PC/-). <br> That may cause a fire. <br> Connect resistors as directed by the instructions for "Installing separate braking resistors." <br> - Within 15 minutes after turning off input power, do not touch wires of devices (MCCB) connected to the input side of the inverter. <br> That could result in electric shock. | $\begin{gathered} \hline 2.2 \\ 2.2 \\ 5.19 \\ 2.2 \end{gathered}$ |
| Mandatory | - Electrical construction work must be done by a qualified expert. <br> Connection of input power by someone who does not have that expert knowledge may result in fire or electric shock. <br> - Connect output terminals (motor side) correctly. If the phase sequence is incorrect, the motor will operate in reverse and that may result in injury. <br> - Wiring must be done after installation. <br> If wiring is done prior to installation that may result in injury or electric shock. <br> - The following steps must be performed before wiring. <br> (1) Turn off all input power to the inverter. <br> (2) Wait at least 15 minutes and check to make sure that the charge lamp is no longer lit. <br> (3) Use a tester that can measure DC voltage 800 VDC or more, and check to make sure that the voltage to the DC main circuits (between $\mathrm{PA} /+$ and $\mathrm{PC} /-$-) is 45 V or less. <br> If these steps are not properly performed, the wiring will cause electric shock. <br> - Tighten the screws on the terminal board to specified torque. If the screws are not tightened to the specified torque, it may lead to fire. <br> - Check to make sure that the input power voltage is $+10 \%,-15 \%$ of the rated power voltage written on the rating label ( $\pm 10 \%$ when the load is $100 \%$ in continuous operation). If the input power voltage is not $+10 \%,-15 \%$ of the rated power voltage $( \pm 10 \%$ when the load is $100 \%$ in continuous operation) this may result in fire. | 2. <br> 2. <br> 2. <br> 2. <br> 2. <br> 1.4.4 |
| Be Grounded | - Ground must be connected securely. If the ground is not securely connected, it could lead to electric shock or fire when a malfunction or current leak occurs. | $\begin{aligned} & 2 . \\ & 2.2 \\ & 10 . \end{aligned}$ |


| - Do not attach equipment (such as noise filters or surge absorbers) that have built-in <br> capacitors to the output (motor side) terminals. <br> That could result in a fire. |  |  |
| :--- | :--- | :---: |

## Caution



- Charged capacitors can present a shock hazard even after source power is removed.
- Drives with EMC filters will retain a charge on the input terminals for up to 15 min . after the power has been removed. To avoid electrical shock, don't touch the connector terminals and uninsulated source cables at either the main circuit disconnect or the drive until the capacitive charge has dissipated.

\begin{tabular}{|c|c|c|}
\hline \& ¢ Warning \& Reference \\
\hline Prohibited \& \begin{tabular}{l}
- Do not touch inverter terminals when electrical power is applied to the inverter even if the motor is stopped. \\
Touching the inverter terminals while power is connected to it may result in electric shock. \\
- Do not touch switches when thands are wet and do not try to clean the inverter with a damp cloth. \\
Such practices may result in electric shock. \\
- Do not go near the motor in alarm-stop status when the retry function is selected. The motor may suddenly restart and that could result in injury. Take measures for safety, e.g. attaching a cover to the motor, against accidents when the motor unexpectedly restarts. \\
- The inverter is tuned automatically (auto-tuning \(F 400=3,3\) ) when the inverter is started for the first time after setup. \\
During auto-tuning, which takes several seconds, the motor is energized, although it is standing still. Noise may be produced by the motor during auto-tuning, which, however, does not indicate that something is wrong with the inverter or the motor. \\
- Do not set the stall prevention level (FGOi) extremely low. If the stall prevention level parameter \((F \Sigma G i)\) is set at or below the no-load current of the motor, the stall preventive function will always be active and increase the frequency when it judges that regenerative braking is taking place. \\
Do not set the stall prevention level parameter (F5月i) below \(30 \%\) under normal use conditions.
\end{tabular} \& 3.
3.
3.
6.22

6.33 .1 <br>

\hline Mandatory \& | - Do not turn on the power before attaching the front cover. When storing inside the cabinet and using with the front cover removed, always close the cabinet doors first and then turn power on. If the power is turned on with the front cover or the cabinet doors open, it may result in electric shock. |
| :--- |
| - Make sure that operation signals are off before resetting the inverter after malfunction. If the inverter is reset before turning off the operating signal, the motor may restart suddenly causing injury. |
| - Provide cranes and hoists with sufficient circuit protection such as mechanical braking. Without sufficient circuit protection, the resulting insufficient motor torque during tuning could create a risk of machine stalling/falling. | \& 3.

10. 
11. 

6.22 <br>
\hline
\end{tabular}

|  | Observe all permissible operating ranges of motors and mechanical equipment. (Refer to <br> the motor's instruction manual) <br> Not observing these ranges may result in injury. | Reference |
| :---: | :--- | :---: |
| Mandatory |  |  |

## When sequence for restart after a momentary failure is selected

| - Stand clear of motors and mechanical equipment. <br> If the motor stops due to a momentary power failure, the equipment will start suddenly <br> when power is restored. <br> This could result in unexpected injury. <br> A Attach cautions about sudden restart after a momentary power failure on inverters, motors <br> and equipment for prevention of accidents in advance. |  |  |  | Reference |
| :--- | :--- | :---: | :---: | :---: |
|  |  |  |  |  |
| Mandatory |  |  |  |  |

## When retry function is selected

|  | A Caution | Reference |
| :---: | :---: | :---: |
| Mandatory | - Stand clear of motors and equipment. <br> If the motor and equipment stop when the alarm is given, selection of the retry function will restart them suddenly after the specified time has elapsed and alarm condition has disappeared. This could result in unexpected injury. <br> - To prevent accidents, stick caution notices that the inverter has a retry function to the inverter, the motor and the machine. | 6.14 .1 |

Maintenance and inspection

| Warning |  | Reference |
| :---: | :---: | :---: |
|  | - Never replace any part by yourself. <br> This could be a cause of electric shock, fire and bodily injury. To replace parts, call the local sales agency. | 14.2 |
| Mandatory | - The equipment must be inspected every day. If the equipment is not inspected and maintained, errors and malfunctions may not be discovered which could lead to accidents. <br> - Before inspection, perform the following steps. <br> (1) Turn off all input power to the inverter. <br> (2) Wait at least 15 minutes and check to make sure that the charge lamp is no longer lit. <br> (3) Use a tester that can measure DC voltage 800VDC or more, and check to make sure that the voltage to the DC main circuits (between PA/+ and PC/-) is 45 V or less. <br> If inspection is performed without performing these steps first, it could lead to electric shock. | $14 .$ <br> 14. $14.2$ |

## Disposal

|  |  |  |  |
| :--- | :--- | :--- | :--- |
|  | - If you throw away the inverter, have it done by a specialist in industry waste disposal*. <br> If you throw away the inverter by yourself, this can result in explosion of capacitor or <br> produce noxious gases, resulting in injury. <br> (*) Persons who specialize in the processing of waste and known as "industrial waste product <br> collectors and transporters" or "industrial waste disposal persons." If the collection, <br> transport and disposal of industrial waste is done by someone who is not licensed for that <br> job, it is a punishable violation of the law. (Laws in regard to cleaning and processing of <br> waste materials) | Reference |  |
| Mandatory | 16. |  |  |

## Attach caution labels

Shown here are examples of caution labels to prevent, in advance, accidents in relation to inverters, motors and other equipment.
If the inverter has been programmed for auto-restart function after momentary power failure or retry function, place caution labels in a place where they can be easily seen and read.

If the inverter has been programmed for restart sequence of momentary power failure, place caution labels in a place where they can be easily seen and read.
(Example of caution label)

## Caution

(Functions programmed for restart)
Do not go near motors and equipment. Motors and equipment that have stopped temporarily after momentary power failure will restart suddenly after recovery.

If the retry function has been selected, place caution labels in a location where they can be easily seen and read.
(Example of caution label)

## § Caution

(Functions programmed for retry)
Do not go near motors and equipment.
Motors and equipment that have stopped temporarily after an alarm will restart suddenly after the specified time has elapsed and alarm condition has disappeared.

## II. Introduction

Thank you for your purchase of the Toshiba "TOSVERT VF-AS1" industrial inverter.

This instruction manual is intended for inverters with CPU version 150 or later.
The CPU version will be frequently upgraded

## - Contents -

I. Safety precautions ..... 1
I I. Introduction ..... 7

1. Read first ..... A-1
1.1 Check the product ..... A-1
1.2 Contents of the product code ..... A-1
1.3 Structure of the main body ..... A-2
1.3.1 Names and functions ..... A-2
1.3.2 Detaching the cover ..... A-9
1.3.3 Grounding capacitor switching method ..... A-12
1.3.4 Installing the DC reactor ..... A-16
1.4 Notes on the application ..... A-17
1.4.1 Motors ..... A-17
1.4.2 Inverters ..... A-19
1.4.3 What to do about the leak current ..... A-20
1.4.4 Installation ..... A-22
2. Connection equipment ..... B-1
2.1 Cautions on wiring. ..... B-1
2.2 Standard connections ..... B-3
2.3 Description of terminals ..... B-10
2.3.1 Main circuit terminals ..... B-10
2.3.2 Control circuit terminal block ..... B-11
2.3.3 Serial RS485 communication connector ..... B-16
3. Operations ..... C-1
3.1 Setting/monitor modes ..... C-2
3.2 Simplified operation of the VF-AS1 ..... C-3
3.2.1 Terminal board operation ..... C-3
3.2.2 Panel operation. ..... C-7
4. Searching and setting parameters. ..... D-1
4.1 How to set parameters ..... D-2
4.1.1 Setting parameters in the selected quick mode ..... D-2
4.1.2 Setting parameters in the standard setting mode ..... D-3
4.2 Functions useful in searching for a parameter or changing a parameter setting ..... D-4
5. Basic parameters ..... E-1
5.1 History function ..... E-1
5.2 Setting acceleration/deceleration time ..... E-2
5.2.1 Automatic acceleration/deceleration ..... E-2
5.2.2 Manually setting acceleration/deceleration time ..... E-3
5.3 Increasing starting torque. ..... E-3
5.4 Setting parameters by operating method ..... E-5
5.5 Selection of operation mode ..... E-6
5.6 Selecting control mode ..... E-11
5.7 Manual torque boost-increasing torque boost at low speeds ..... E-16
5.8 Base frequency ..... E-16
5.9 Maximum frequency ..... E-17
5.10 Upper limit and lower limit frequencies ..... E-17
5.11 Setting frequency command characteristics ..... E-18
5.12 Preset speed operation (speeds in 15 steps)) ..... E-18
5.13 Selecting forward and reverse runs (operation panel only) ..... E-21
5.14 Setting the electronic thermal. ..... E-22
5.15 Changing the display unit \% to A (ampere)/V (volt) ..... E-26
5.16 Meter setting and adjustment ..... E-27
5.17 PWM carrier frequency ..... E-31
5.18 Trip-less intensification ..... E-32
5.18.1 Auto-restart (Restart during coasting) ..... E-32
5.18.2 Regenerative power ride-through control/Deceleration stop during power failure/ Synchronized acceleration/deceleration ..... E-33
5.19 Dynamic (regenerative) braking - For abrupt motor stop ..... E-36
5.20 Standard default setting ..... E-42
5.21 Searching for all reset parameters and changing their settings ..... E-44
5.22 EASY key function ..... E-45
6. Extended parameters ..... F-1
6.1 Input/output parameters ..... F-1
6.1.1 Low-speed signal ..... F-1
6.1.2 Putting out signals of arbitrary frequencies ..... F-2
6.2 Input signal selection ..... F-3
6.2.1 Priority when forward/reverse run commands are entered simultaneously ..... F-3
6.2.2 Assigning priority to the terminal board in the operation panel and operation mode ..... F-4
6.2.3 Analog input signal switching ..... F-5
6.3 Terminal function selection ..... F-6
6.3.1 Keeping an input terminal function always active (ON). ..... F-6
6.3.2 Modifying input terminal functions ..... F-6
6.3.3 Using the servo lock function ..... F-8
6.3.4 Modifying output terminal functions ..... F-8
6.3.5 Response time of input/output terminals. ..... F-9
6.4 Basic parameters 2 ..... F-9
6.4.1 Switching among V/f characteristics $1,2,3$ and 4 from input terminal ..... F-9
6.5 V/f 5-point setting ..... F-11
6.6 Speed command switching ..... F-11
6.6.1 Using two types of frequency (speed) commands ..... F-11
6.7 Operation frequency ..... F-13
6.7.1 Start frequency/Stop frequency ..... F-13
6.7.2 Run/Stop control with frequency setting signals ..... F-13
6.7.3 Frequency setting signal OHz dead zone handling function ..... F-14
6.8 DC braking ..... F-14
6.8.1 DC braking. ..... F-14
6.8.2 Motor shaft fixing control ..... F-16
6.8.3 Function of issuing a OHz command during a halt ..... F-17
6.9 Auto-stop in case of lower-limit frequency continuous operation (Sleep/Wake-up function) ..... F-18
6.10 Jog run mode. ..... F-19
6.11 Setting frequency via external contact input (Up/Down frequency setting) ..... F-20
6.12 Jump frequency - jumping resonant frequencies ..... F-22
6.13 Preset speed operation frequencies ..... F-23
6.13.1 Preset speed operation frequency 8 to 15 ..... F-23
6.13.2 Forced oeration control ..... F-23
6.14 Trip-less intensification ..... F-24
6.14.1 Retry function ..... F-24
6.14.2 Avoiding overvoltage tripping. ..... F-25
6.14.3 Output voltage adjustment/Supply voltage correction ..... F-25
6.14.4 Reverse run prohibition ..... F-27
6.14.5 Output voltage waveform selection ..... F-27
6.15 Drooping control ..... F-27
6.16 Light-load high-speed operation function ..... F-29
6.17 Braking function ..... F-29
6.18 Acceleration/deceleration suspend function ..... F-31
6.19 Commercial power/inverter switching ..... F-32
6.20 PID control ..... F-34
6.21 Stop position control function ..... F-38
6.22 Setting motor constants ..... F-38
6.23 Increasing the motor output torque further in low speed range ..... F-42
6.24 Torque control ..... F-43
6.24.1 Torque command ..... F-43
6.24.2 Speed limits in torque control mode ..... F-43
6.24.3 Torque bias and load sharing gain ..... F-44
6.25 Torque limit ..... F-45
6.25.1 Torque limit switching ..... F-45
6.25.2 Torque limit mode selection at acceleration/deceleration ..... F-47
6.26 Stall prevention function ..... F-49
6.26.1 Power running stall continuous trip detection time ..... F-49
6.26.2 Regenerative braking stall prevention mode selection ..... F-49
6.26.3 Stall prevention control switching ..... F-49
6.27 Current and speed control adjustment ..... F-50
6.27.1 Current and speed control gain ..... F-50
6.27.2 Prevention of motor current oscillation at light load ..... F-50
6.27.3 Max output voltage modulation rate ..... F-50
6.28 Fine adjustment of frequency setting signal ..... F-51
6.29 Operating a synchronous motor ..... F-51
6.30 Acceleration/deceleration 2 ..... F-52
6.30.1 Setting acceleration/deceleration patterns and switching acceleration/decelerationpatterns 1, 2, 3 and 4F-52
6.31 Pattern operation ..... F-55
6.32 Preset speed mode ..... F-57
6.33 Protection functions ..... F-58
6.33.1 Setting of stall prevention level ..... F-58
6.33.2 Inverter trip record retention ..... F-58
6.33.3 Emergency stop ..... F-59
6.33.4 Output phase failure detection ..... F-60
6.33.5 OL reduction starting frequency ..... F-61
6.33.6 Motor 150\%-overload time limit ..... F-61
6.33.7 Input phase failure detections ..... F-61
6.33.8 Control mode for low current ..... F-61
6.33.9 Detection of output short circuit ..... F-62
6.33.10 Overtorque trip ..... F-62
6.33.11 Cooling fan control selection ..... F-63
6.33.12 Cumulative operation time alarm setting ..... F-64
6.33.13 Abnormal speed detection ..... F-64
6.33.14 Overvoltage limit operation ..... F-65
6.33.15 Undervoltage trip ..... F-65
6.33.16 Regenerative power ride-through control level ..... F-65
6.33.17 Braking answer waiting time ..... F-65
6.33.18 $\mathrm{VI} / I \mathrm{I}$ analog input wire breakage detection level ..... F-66
6.33.19 Guide to time of replacement ..... F-66
6.33.20 Rush current suppression relay activation time ..... F-66
6.33.21 Motor thermal protection ..... F-67
6.33.22 Braking resistance overload curve ..... F-67
6.33.23 Selection of a restart condition for the motor stopped with a mechanical brake ..... F-67
6.33.24 Protection against a failure of the control power backup device (optional CPSOO2Z) ..... F-68
6.34 Override ..... F-69
6.35 Adjustment parameters ..... F-71
6.35.1 Pulse train output for meters ..... F-71
6.35.2 Setting of optional meter outputs ..... F-72
6.35.3 Calibration of analog outputs ..... F-72
6.36 Operation panel parameter ..... F-73
6.36.1 Prohibition of key operations and parameter settings ..... F-73
6.36.2 Displaying the rotational speed of the motor or the line speed ..... F-74
6.36.3 Changing the steps in which the value displayed changes ..... F-75
6.36.4 Changing the standard monitor display. ..... F-76
6.36.5 Canceling the operation command ..... F-76
6.36.6 Selection of operation panel stop pattern ..... F-76
6.36.7 Setting of a torque command in panel operation mode ..... F-76
6.36.8 Torque-related parameters for panel operation ..... F-77
6.37 Tracing functions ..... F-77
6.38 Integrating wattmeter ..... F-80
6.39 Communication function ..... F-81
6.39.1 2-wire RS485/4-wire RS485 ..... F-81
6.39.2 Open network option ..... F-88
6.40 My function ..... F-88
6.41 Traverse function ..... F-88
6.42 Instruction manuals for optionally available devices and special functions ..... F-89
7. Operation with external signal ..... G-1
7.1 External operation ..... G-1
7.2 Applied operation with input and output signals (operation by terminal board) ..... G-2
7.2.1 Functions of input terminals (in case of sink logic) ..... G-2
7.2.2 Functions of output terminals (incase of sink logic) ..... G-5
7.2.3 Setup of input terminal operation time ..... G-9
7.2.4 Analog input filter ..... G-9
7.3 Setup of external speed command (analog signal) ..... G-10
7.3.1 Setup by analog input signals (RR/S4 terminal) ..... G-11
7.3.2 Setup by analog input signals (VI/II terminal) ..... G-12
7.3.3 Setup by analog input signals (RX terminal) ..... G-13
8. Monitoring the operation status ..... H-1
8.1 Screen composition in the status monitor mode ..... H-1
8.2 Monitoring the status. ..... H-2
8.2.1 Status monitor under normal conditions. ..... H-2
8.2.2 Display of detailed information on a past trip ..... H-5
8.3 Changing status monitor function. ..... H-6
8.4 Display of trip information ..... H-9
8.4.1 Trip code display. ..... H-9
8.4.2 Monitor display at tripping ..... H-11
8.5 Display of alarm, pre-alarm, etc. ..... H-13
9. Taking measures to satisfy the CE/UL/CSA standards ..... I-1
9.1 How to cope with the CE standard ..... I-1
9.1.1 EMC directive ..... I-1
9.1.2 Measures to satisfy the EMC directive ..... I-2
9.1.3 Low-voltage directive ..... I-7
9.1.4 Measures to be taken to satisfy the low-voltage directive ..... I-7
9.2 Measures to be taken to satisfy the UL/CSA standards ..... 1-8
9.2.1 Caution in installing the inverter- ..... I-8
9.2.2 Caution in wiring and rated current ..... I-8
9.2.3 Caution as to peripheral devices ..... I-8
9.2.4 Caution as to the protection of motors from overload ..... I-9
10. Selection of peripheral devices ..... J-1
10.1 Selection of wiring materials and devices ..... J-1
10.2 Installation of a magnetic contactor ..... J-3
10.3 Installation of an overload relay ..... J-3
10.4 Application and functions of options ..... J-4
10.5 Optional internal devices ..... J-8
10.6 Connection of a DC power supply and other electric units ..... J-11
10.6.1 Connection of a single-phase 200 V power supply ..... J-11
10.6.2 When using the inverter along with a DC power supply ..... J-11
11. Table of parameters ..... K-1
12. Specifications ..... L-1
12.1 Models and their standard specifications ..... L-1
12.2 Outside dimensions and weight ..... L-5
13. Before making a service call- Trip information and remedies ..... M-1
13.1 Trip causes/warnings and remedies ..... M-1
13.2 Method of resetting causes of trip ..... M-7
13.3 If the motor does not run while no trip message is displayed. ..... M-8
13.4 How to check other troubles ..... M-9
14. Inspection and maintenance ..... N-1
14.1 Regular inspection ..... N-1
14.2 Periodical inspection ..... N-2
14.3 Making a call for servicing ..... N-4
14.4 Keeping the inverter in storage ..... N-4
15. Warranty ..... O-1
16. Disposal of the inverter ..... P-1

## 1. Read first

### 1.1 Check the product

Before using the product you have purchased, check to make sure that it is exactly what you ordered.

|  |  |  |  | Use an inverter that conforms to the specifications of the power supply and three-phase induction <br> motor being used. If the inverter being used does not conform to those specifications, not only will <br> the three-phase induction motor not rotate correctly, but it may cause serious accidents through <br> overheating and fire. |
| :---: | :--- | :---: | :---: | :---: |



## 1. 2 Contents of the product code


*1): This code represents the factory default logic setting. You can switch from one input/output logic to the other using slide switch SW1. $\Rightarrow$ For more details, refer to Section 2.3.2.
*2): WN and WP only above 280 kW .
Warning : Always shut power off first then check the ratings label of inverter held in a cabinet.

## 1. 3 Structure of the main body

### 1.3.1 Names and functions

## 1) Outside view


[Front panel]


Note: Remove this cover when installing the inverter side by side with other inverters where the ambient temperature will rise above $40^{\circ} \mathrm{C} . \Rightarrow$ For more details, refer to Section 1.4.4

- Operation panel


Note 1: $\Rightarrow$ For details EASY Key functions, refer to Section 5.22.
Note 2: When parameter $F 730$ is set to $i$, the operation frequency cannot be set even if this lamp is lit.

## 2) Main circuit terminal

```
VFAS1-2004PL~2015PL
VFAS1-4007PL 4022PL
```



```
VFAS1-2022PL, 2037PL
VFAS1-4037PL
```



[^0]Grounding capacitor switching switch


```
VFAS1-2075PL
VFAS1-4110PL
```

Grounding capacitor switching switch


```
VFAS1-2110PM, 2150PM
```

VFAS1-4150PL, 4185PL

Grounding capacitor switching switch


VFAS1-2185PM, 2220PM
VFAS1-4220PL



VFAS1-2300PM~2450PM
VFAS1-4450PL~4750PL
Grounding capacitor switching switch


A: -WN and -WP products.
Use crimped ring lugs of appropriate size on input and output cables. Attach to the top side of the terminal block only. Do not place wires in the hole of the terminal block.


B: -HN products only.
Insert the cables (stripped the appropriate length) directly into the holes in the front of the power terminal block. Tighten to recommended torque using the socket head cap screw provided in the terminal block.


```
VFAS1-2750P
VFAS1-4110KPC
```




## VFAS1-4160KPC



M12 screw

> M12 screw


```
VFAS1-4200KPC~4280KPC
```

 capacitor switching screw


```
VFAS1-4500KPC
```



## 3) Control circuit terminal block

The control circuit terminal block is common to all equipment.


### 1.3.2 Detaching the cover

■ Main circuit terminal cover
To wire the main circuit terminal for models $200 \mathrm{~V}-15 \mathrm{~kW}$ or smaller and $400 \mathrm{~V}-18.5 \mathrm{~kW}$ or smaller, remove the main circuit terminal cover in line with the steps given below.
(A)

(B)


Open the main circuit terminal cover.

* To open the cover, lift it with your finger placed at the part $\downarrow$ on the right side of the cover.

Remove the main circuit terminal cover.
(1) Turn the screw securing the cover counterclockwise by $90^{\circ}$ to release the lock (Do not turn the screw by more than $90^{\circ}$. Or else the screw might be broken.)
(2) Hold the cover by both ends, and then pull up the cover with slightly bending it inward.

For $200 \mathrm{~V} / 0.4 \mathrm{~kW}$ to $200 \mathrm{~V} / 15 \mathrm{~kW}$ models and $400 \mathrm{~V} / 0.75 \mathrm{~kW}$ to $400 \mathrm{~V} / 18.5 \mathrm{~kW}$ models, cut off the tabs (part A in the figure below) on the main circuit terminal cover if necessary for connecting the cables from the power supply.
$200 \mathrm{~V}-5.5 \mathrm{~kW} \sim 15 \mathrm{~kW}$
$400 \mathrm{~V}-5.5 \mathrm{~kW} \sim 18.5 \mathrm{~kW}$


- Front cover

To wire the main circuit terminal for models $200 \mathrm{~V}-18.5 \mathrm{~kW}$ or more and $400 \mathrm{~V}-22 \mathrm{~kW}$ or more, remove the front cover.


Control circuit terminal cover
To wire the control circuit terminal, open the control circuit terminal cover in line with the steps given below.
(A)
(B)


Control circuit terminal
Open the control circuit terminal cover.

* To open the cover, lift it with your finger placed at the $\triangleright$ part on the right side of the cover.


Remove the terminal, if necessary.

* To do so, open the main circuit terminal cover, loosen the screws that fix the terminal, using a (-) screwdriver or torx (T2OH) screwdriver, placed your finger on part $\hat{8}$ and pull out the terminal.

Charge lamp
This lamp is lit when a high voltage remains in the inverter. When removing the main circuit terminal cover or opening the front cover, be sure to check that this lamp is off and follow the instructions about wiring on page 4.
The mounting position of the charge lamp varies from model to model.
VFAS1-2004PL~2150PM
VFAS1-4007PL~4185PL
This lamp is placed behind the main circuit terminal cover.


VFAS1-2185PM~2450PM
VFAS1-4220PL~4750PL


VFAS1-2550P, 2750P VFAS1-4900PC~4500KPC


### 1.3.3 Grounding capacitor switching method

The inverter is grounded through a capacitor. The leakage current from the inverter can be reduced using the selector switch, switching bar or switching screw (depending on the model) on the main circuit terminal board. This switching device is used to detach the capacitor from the grounding circuit or to reduce its capacitance.
Some models have capacitors that can be detached completely, while others have capacitors whose capacitances can be reduced.
Note 1: Please note that, without the capacitor, the inverter does not comply with the EMC directive.
Note 2: When attaching or detaching the capacitor, be sure to turn off power.

■ 200V/45kW-400V/75kW models and smaller: Grounding capacitor switching switch

|  |  |
| :---: | :---: |
|  | -When the grounding capacitor is detached from the inverter with a capacity of $400 \mathrm{~V}-3.7 / 4.0 \mathrm{~kW}$ or less, be sure to set the carrier frequency ( $[\mathcal{L}$ ) at 4 kHz or less. If the carrier frequency is set above 4 kHz , internal parts of the inverter may overheat and become damaged. <br> -When the grounding capacitor is detached from the inverter and the cables connecting the inverter to the motor is 100 m or more in length with a capacity between $400 \mathrm{~V}-5.5 \mathrm{~kW}$ and $400 \mathrm{~V}-18.5 \mathrm{~kW}$, be sure to set the carrier frequency ( $[\mathcal{F}$ ) at 4 kHz or less. If the carrier frequency is set above 4 kHz , internal parts of the inverter may overheat and become damaged. |



L: There are two places according to the model.
$\Rightarrow$ For details, refer to Section 1.3.1.

| 200 V | $18.5 \mathrm{~kW} \sim 45 \mathrm{~kW}$ |
| :--- | :--- |
| 400 V | $22 \mathrm{~kW} \sim 75 \mathrm{~kW}$ |



200V $0.4 \mathrm{~kW} \sim 7.5 \mathrm{~kW}, 18.5 \mathrm{~kW}, 22 \mathrm{~kW}$
$400 \mathrm{~V} 0.75 \mathrm{~kW} \sim 18.5 \mathrm{~kW}$


Pull up this part to detach the capacitor to prevent it from being
*2: For 400V-3.7/4.0kW model and smaller, the switch is fixed with a label saying "CF/SFr $\leqq 4 \mathrm{kHz}$." If such a label is affixed to your inverter, you should set the carrier frequency ( $\mathcal{L} F$ ) at 4 kHz or less according to the instructions when switching.

## $200 \mathrm{~V} 11 \mathrm{~kW}, 15 \mathrm{~kW}, 30 \mathrm{~kW} \sim 45 \mathrm{~kW}$ <br> 400V 22kW~75kW



To change the capacitance from Small to Large, push in the button. (Factory default position)


To change the capacitance from Large to Small, pull up the button.

| 200 V | $18.5 \sim 22 \mathrm{~kW}$ |
| :--- | :--- |
| 400 V | 22 kW |




| 200 V | $30 \mathrm{~kW} \sim 45 \mathrm{~kW}$ |
| :--- | :--- |
| 400 V | $45 \mathrm{~kW} \sim 75 \mathrm{~kW}$ |



- 200V/55kW models and larger $400 \mathrm{~V} / 90 \mathrm{~kW}, 110 \mathrm{~kW}$ models: Grounding capacitor switching bar



## © Warning

QIn case of one phase grounding system (A three-phase supply power is connected in delta), do not change the connection of grounding capacitor before factory setting. If connection
Prohibited changed (this means the capacitance is increased), the capacitor may become damaged.

Note: If a neutral grounding system is used, $400 \mathrm{~V}-90 \mathrm{~kW}$ and 110 kW models meet required EMC directive by changing the connection of the grounding capacitor as shown in the figure at the top (changing the capacitance from Small to Large).

■ 400V/132kW models and larger: Grounding capacitor switching screw «132kW, 160kW»


To change the capacitance from Small to Large, fix to part A shown in the figure on the left with the grounding capacitor switching screw.

To change the capacitance from Large to Small, fix to part B shown in the figure on the left with the grounding capacitor switching screw.
(Factory default position)

|  |  |
| :---: | :---: |
|  | In case of one phase grounding system (A three-phase supply power is connected in delta), do not change the connection of grounding capacitor before factory setting. If connection changed (this means the capacitance is increased), the capacitor may become damaged. |

Note: If a neutral grounding system is used, changing the connection of the grounding capacitor as shown in the figure at the top (changing the capacitance from Small to Large) makes the inverter compliant with the EMC directive.
«200kW~280kW»


## 1 Warning

$\theta$In case of one phase grounding system (A three-phase supply power is connected in delta), do not change the connection of grounding capacitor before factory setting. If connection
Prohibited changed (this means the capacitance is increased), the capacitor may become damaged.

Note: If a neutral grounding system is used, changing the connection of the grounding capacitor as shown in the figure at the top (changing the capacitance from Small to Large) makes the inverter compliant with the EMC directive.
«355kW~500kW»


## § Warning

$\theta$In case of one phase grounding system (A three-phase supply power is connected in delta), do not change the connection of grounding capacitor before factory setting. If connection changed (this means the capacitance is increased), the capacitor may become damaged.

Note: If a neutral grounding system is used, changing the connection of the grounding capacitor as shown in the figure at the top (changing the capacitance from Small to Large) makes the inverter compliant with the EMC directive.

### 1.3.4 Installing the DC reactor

- How to install (Example: VFAS1-4160KPC)
(1)

(2)


Remove the front cover.
Mount the reactor case on an inner wall of the cabinet and secure the reactor unit to the case with screws.
(3)

(4)


Connect the reactor unit to the PO and $\mathrm{PA} /+$ terminals on the main-circuit terminal board. Then connect the supplied earth wire.
$\Rightarrow$ See the figures on the next page. Fix the front cover after connecting.

Secure the cover, front panel and top panel to the reactor case with screws.

■ Example of wiring of each model
«VFAS1-2550P, 2750P»


«VFAS1-4355KPC~4500KPC»


### 1.4 Notes on the application

### 1.4.1 Motors

Keep the following in mind when using the VF-AS1 to drive a motor.

|  |  |  |  |
| :---: | :--- | :---: | :---: |
| Mandatory | Use an inverter that conforms to the specifications of power supply and three-phase induction motor <br> being used. If the inverter being used does not conform to those specifications, not only will the <br> three-phase induction motor not rotate correctly, but it may cause serious accidents through <br> overheating and fire. |  |  |

## Comparisons with commercial power operation

The VF-AS1 Inverter employs the sinusoidal PWM system to supply the motor. This is why compared to operation with a commercial power there will be a slight increase in motor temperature, noise and vibration. The main supply voltage and current will also be distorted due to harmonic distortion while increase the line current.

## Operation in the low-speed area

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 decreased from rated load.
To carry out low-speed operation continuously at the rated torque, we recommend to use a inverter rated motor or a forced cooled motor designed for use with an inverter. When operating in conjunction with a inverter rated motor, you must change the inverter's motor overload protection level to VF motor use ( $\overline{\mathrm{L}} \mathrm{L} \boldsymbol{\Pi}$ ).

## Adjusting the overload protection level

The VF-AS1 Inverter protects against overloads with its electronic thermal overload detection circuits. The electronic thermal's reference current of the inverter must be adjusted in line with the rated current of the motor being used in combination.

High-speed operation at and above $50 \mathrm{~Hz} / 60 \mathrm{~Hz}$ (rated frequency)
Operating at frequencies greater than $50 \mathrm{~Hz} / 60 \mathrm{~Hz}$ will increase noise and vibration. There is also a possibility that such operation will exceed the motor's mechanical strength under these conditions and the bearing limits. You should verify with the motor's manufacturer operating.

## Method of lubricating load mechanisms

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

## Low loads and low inertia loads

The motor may demonstrate instability such as abnormal vibrations or overcurrent trips at light loads of $50 \%$ or under of the rated load, or when the load's moment of inertia is extremely small. If that happens reduce the carrier frequency.

## Occurrence of instability

Unstable phenomena may occur under the load and motor combinations shown below.

- Combined with a motor that exceeds applicable motor ratings recommended for the inverter
- Combined with special motors

To deal with the above lower the settings of inverter carrier frequency. (When performing vector control, set the carrier frequency at 2 kHz or more. If the carrier frequency is set below 2 kHz , it will be automatically corrected to 2 kHz by the inverter.)

- Combined with couplings between load devices and motors with high backlash

In this case, set the S-pattern acceleration/deceleration function and adjust the response time inertial moment setting during vector control or switch to $\mathrm{V} / \mathrm{f}$ control $(\boldsymbol{P} \mathrm{L}=\boldsymbol{\pi})$.

- Combined with loads that have sharp fluctuations in rotation such as piston movements

In this case, adjust the response time inertial moment setting during vector control or switch to V/f control ( $\rho\llcorner=\boldsymbol{L})$. If it is operated in vector control mode (For torque control mode), only a motor whose capacity is same as inverter standard or 1 ranking lower should applied.

Braking a motor when power supply is lost
A motor with its power cut off goes into freewheel, and does not stop immediately. To stop the motor quickly as soon as the power is cut 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.

## Loads that generate negative torque

When combined with loads that generate negative torque the protection for overvoltage and overcurrent on the inverter will go into operation and may cause a trip. For this kind of situation, you must install a dynamic braking resistor, etc. that complies with the load conditions.

## Motor with brake

If a brake motor is used with the braking circuit connected to the output terminals of the inverter, the brake cannot be released because of a voltage drop at startup. Therefore, when using the inverter along with a brake motor, connect the braking circuit to the power supply side of the inverter, as shown in the figure below. In most cases, the use of a brake motor causes an increase in noise at low-speed.


Circuit configuration 1


Circuit configuration 2

In circuit configuration 1, the brake is turned on and off through MC2 and MC3. If the circuit is configured in some other way, the overcurrent trip may be activated because of the locked rotor current when the brake goes into operation.
Circuit configuration 2 uses low-speed signal OUT1 to turn on and off the brake. Turning the brake on and off with a low-speed detection (OUT1 function) may be better in such applications as elevators. Please confer with your supplier before designing the system.

## Measures to protect motors against surge voltages

In a system in which a 400 V -class inverter is used to control the operation of a motor, very high surge voltages may be produced. When applied to the motor coils repeatedly for a long time this can cause deterioration of their insulation, depending on the wire length, wire routing and types of wires used. Here are some examples of measures against surge voltages.
(1) Lower the inverter's carrier frequency.
(2) Set the parameter $F \exists$ i 5 (Carrier frequency control mode selection) to $\Xi$ or 3 .
(3) Use motors with a high dielectric strength.
(4) Insert an reactor or a surge voltage suppression filter between the inverter and the motor.

### 1.4.2 Inverters

## Protecting inverters from overcurrent

The inverter has an overcurrent protection function. The programmed current level is set to the inverter's maximum applicable motor. If the motor used has a small capacity, the stall prevention level, overcurrent level and the motor electronic thermal protection must be readjusted. If adjustment is necessary, refer to Section 5.14, and make adjustments as directed.

## Inverter capacity

Do not operate a large capacity motor with a small capacity (kVA) inverter even with light loads. 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. When a motor is run that has a power factor correction capacitor attached to it, remove the capacitors. This can cause inverter malfunction trips and capacitor destruction.


## 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.

Circuit interrupting when two or more inverters are used on the same power line.


Breaking of selected inverter

There is no fuse in the inverter's main circuit. Thus, as the diagram above shows, when more than one inverter is used on the same power line, you must select interrupting characteristics so that only the MCCB2 will trip and the MCCB1 will not trip when a short occurs in the inverter (INV1). When you cannot select the proper characteristics install a circuit interrupting fuse between the MCCB2 and the INV1.

## 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 waveforms, such as systems with thyristers or large-capacity inverters, install an input reactor to improve the input power factor, to reduce higher harmonics, or to suppress external surges.

## Disposal

If an inverter is no longer usable, dispose of it as industrial waste.

### 1.4.3 What to do about the leak current

## . Caution

Current may leak through the inverter's input/output wires because of insufficient electrostatic capacity on the motor with bad effects on peripheral equipment. The leakage current's value is affected by the carrier frequency and the length of the input/output wires. Test and adopt the following remedies against leakage current.

## (1) Effects of leakage current across ground

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


Remedies: There is the following method for reduce leakage current across ground.

1. Reduce PWM carrier frequency.

The setting of PWM carrier frequency is done with the parameter [F.
2. If there is no radio-frequency interference or similar problem, detach the built-in noise filter capacitor.
$\Rightarrow$ Refer to Section 1.3.3. (For inverters of certain capacities, the PWM carrier frequency ( $\mathcal{L} F$ ) must be set at 4 kHz or below.)
3. Use high frequency remedial products for earth leakage breakers.

If you use equipment like this, there is no need to reduce the PWM carrier frequency.
4. If the sensors and CRT are affected, it can be remedied by reducing the PWM carrier frequency described in 1 above, but if this cannot be remedied because of the increase in the motor's electric magnetic noise, please consult with your supplier.

* Cautions for applying models with a built-in noise filter.

For the models with a built-in noise filter, the leakage current value at power supply of $\Delta$ (delta) connecting wire (single-phase earth) can be larger than normal inverter, so be careful.
<Standard leakage current value (single-phase earth)>
VFAS1-2004PL~2150PM: Approx. 15mA
VFAS1-2185PM~2450PM: Approx. 1mA

## (2) Affects of leakage current across supply lines



Leakage current path across wires
(1) 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 improperly. If the motor cables are more than 50 m long, external thermal relay may operate improperly with models having motors of low rated current, especially the 400 V class low capacity ( $3.7 / 4.0 \mathrm{~kW}$ or less) models, because the leakage current will be high in proportion to the motor rating.

## Remedies:

1. Use the electronic thermal overload built into the inverter.

The setting of the electronic thermal overload is done using parameter 0 L 亿 or t H H .
2. Reduce the inverter's PWM carrier frequency. However, that will increase the motor's acoustic noise.

The setting of PWM carrier frequency is done with the parameter $[F$.
3. This can be improved by installing $0.1 \mu \sim 0.5 \mu \mathrm{~F}-1000 \mathrm{Vdc}$ film capacitor to the input/output terminals of each phase in the thermal overload relay.


Thermal overload relays

## (2) CT and ammeter

 If a CT and ammeter are connected externally to measure inverter output current, the leakage current's high frequency component may destroy the ammeter or CT . If the motor cables are more than 50 m long, it will be easy for the high frequency component to pass through the externally connected CT and be superimposed on and burn the ammeter with models having motors of low rated current, especially the 400 V class low capacity (3.7/4.0kW or less) models, because the leakage current will increase in proportion to the motor's rated current.
## Remedies:

1. Use a meter output terminal in the inverter control circuit.

The output current can be output on the meter output terminal (AM, FM). If the meter is connected, use an ammeter of 1 mAdc full scale or a voltmeter of $7.5 \mathrm{Vdc}-1 \mathrm{~mA}$ full scale.
Inverter output terminal (FM) can be changed to 0-20mAdc (4-20mAdc) with F5日 i.
2. Use the monitor functions built into the inverter.

Use the monitor functions on the panel built into the inverter to check current values.

### 1.4.4 Installation <br> Installation environment

The VF-AS1 Inverter is an electronic control instrument. Take full consideration to installing it in the proper operating environment.

|  |  |  |  | • Do not place any inflammable substances near the VF-AS1 Inverter. <br> If an accident occurs in which flames are emitted, this could lead to fire. |
| :--- | :--- | :---: | :---: | :---: |
| Orohibited |  |  |  |  |$\quad$| Operate under the environmental conditions prescribed in the instruction manual. |
| :--- |
| Operation under any other conditions may result in malfunction. |
| Mandatory |


|  |  |
| :---: | :---: |
|  | - Do not install the VF-AS1 Inverter in any location subject to large amounts of vibration. This could cause the unit to fall, resulting in bodily injury. |
|  | - Check to make sure that the input power supply voltage is $+10 \%,-15 \%$ of the rated supply voltage written on the rating label ( $\pm 10 \%$ when the load is $100 \%$ in continuous operation). If the input power voltage is not $+10 \%,-15 \%$ of the rated power voltage $( \pm 10 \%$ when the load is $100 \%$ in continuous operation) this may result in fire. |



- Do not install in any location of high temperature, high humidity, moisture condensation and freezing.
- Avoid locations where there is exposure to water and/or where there may be large amounts of dust and metallic fragments.
- Do not install the inverter where there are gases that corrode metal or solvents that adversely affect plastic.
- Operate in areas where ambient temperature ranges from $-10^{\circ} \mathrm{C}$ to $60^{\circ} \mathrm{C}$. When installing the inverter where the ambient temperature will rise above $40^{\circ} \mathrm{C}$, remove the protective cover from the top cover (depending on the capacity of the inverter used). When installing the inverter where the ambient temperature will rise above $50^{\circ} \mathrm{C}$, it is necessary to operate in lower current than rated value.


Note: The inverter is a heat-emitting body. Make sure to provide proper space and ventilation when installing in cabinet. When installing inside a cabinet, we recommend the removal of the protective cover.

- Do not install in any location that is subject to large amounts of vibration.


Note: If the VF-AS1 Inverter is installed in a location that is subject to vibration, anti-vibration measures are required.
Please consult with your supplier about these measures.

- If the VF-AS1 Inverter is installed near any of the equipment listed below, provide measures to insure against errors in operation.


Solenoids: Attach surge suppressor on coil. Brakes: Attach surge suppressor on coil. Magnetic contactors: Attach surge suppressor on coil. Fluorescent lamps: Attach surge suppressor on coil. Resistors: Place far away from VF-AS1 Inverter.

- Do not touch the heat sink, because it becomes hot during operation.


How to install

| Warning |  |
| :---: | :---: |
|  | - Do not operate the inverter if it is damaged or any component is missing. This can result in electric shock or fire. Call your local sales agency for repairs. |
| Mandatory | - Must be installed in non-inflammables such as metals. <br> The rear panel gets very hot. If installation is in an inflammable object, this can result in fire. <br> - Do not operate with the front panel cover removed. <br> This can result in electric shock. <br> - An emergency stop device must be installed that fits with system specifications. (e.g. shut off input power then engage mechanical brake) <br> Operation cannot be stopped immediately by the inverter alone, thus risking an accident or injury. <br> - All options used must be those specified by Toshiba. <br> The use of any other option may result in an accident. |


|  | - The main unit must be installed on a base that can bear the unit's weight. <br> If the unit is installed on a base that cannot withstand that weight, the unit may fall resulting in <br> injury. <br> - If braking is necessary (to hold motor shaft), install a mechanical brake. <br> The brake on the inverter will not function as a mechanical hold, and if used for that purpose, injury <br> may result. |
| :--- | :--- |

Install the inverter in a well-ventilated indoor place and mount it on a flat metal plate in portrait orientation. If you are installing more than one inverter, the separation between inverters should be at least 5 cm , and they should be arranged in horizontal rows.
If the inverters are horizontally arranged with no space between them (side-by-side installation), remove of the protective cover on top of the inverter. ( $200 \mathrm{~V}-55 \mathrm{~kW}$ or lager and $400 \mathrm{~V}-90 \mathrm{~kW}$ or larger models dose not need to remove the protective cover)

*1 200V 0.4kW~15kW, 400V 0.75kW~18.5kW
*2 200V $18.5 \mathrm{~kW} \sim 45 \mathrm{~kW}, 400 \mathrm{~V} 22 \mathrm{~kW} \sim 75 \mathrm{~kW}$

|  | $\mathrm{H} 1(\mathrm{~cm})$ | $\mathrm{H} 2(\mathrm{~cm})$ | $\mathrm{H} 3(\mathrm{~cm})$ |
| :--- | :---: | :---: | :---: |
| 200V 75W or smaller <br> 400 V 110 kW or smaller | 10 | 10 (Note1) | 10 (Note1) |
| $400 \mathrm{~V} 132,160 \mathrm{~kW}$ | 15 | 15 (Note1) | 25 (Note1) |
| $400 \mathrm{~V} 200 \sim 280 \mathrm{~kW}$ | 20 | 15 (Note1) | 25 (Note1) |
| $400 \mathrm{~V} 355,400 \mathrm{~kW}$ | 30 | 25 (Note1) | 25 (Note1) |
| 400 V 500 kW | 40 | 25 (Note1) | 25 (Note1) |

The space shown in the diagram is the minimum allowable clearance. Make the space on top and bottom as large as possible to allow for air passage.
Note1: For models designed for $200 \mathrm{~V}-75 \mathrm{~kW}$ and $400 \mathrm{~V}-110 \mathrm{~kW}$ motors or larger, leave a space of 30 cm or more above and below the inverter.
Note2: Do not install in any location where there is high humidity or high temperatures and where there are large amounts of dust and metallic fragments. If you are going to install the equipment in any area that presents a potential problem, please consult with your supplier before doing so.

- Current reduction curve

Depending on the way in which the inverter is installed, the ambient temperature and the carrier frequency setting, you may need to reduce the inverter's continuous output current.
Reduction rates vary depending on the capacity of the inverter. The capacities shown in these diagrams are capacities with the highest reduction rates. Refer to section 12 , you can find $100 \%$ value of output current there. The VFAS1 has the function of adjusting the inverter's overload resistance automatically according to the ambient temperature, as shown in the figure below. This function enhances the inverter's overload resistance when the ambient temperature is low. To use this function, set the parameter $F \Sigma \Xi i$ to $i$.
If $F 5 \beth ;$ is set to $\Omega$ (default setting), protection will be provided by reducing the output current (approximate linear reduction) in 12, "Specifications," by adjusting the PWM carrier frequency or at the occurrence of the event shown in the diagram below, which occurs first.

```
200V 0.4, 1.5, 7.5kW
```

$400 \mathrm{~V} 0.75,1.5 \mathrm{~kW}$













- Side-by-side installation (without top cover)

- Side-by-side installation (without top cover)

- Side-by-side installation (without top cover)


Side-by-side installation (without top cover)




$$
\begin{aligned}
& \text { 400V 132, 200, 280kW } \\
& \text { (See lines shown in --- for 200kW) }
\end{aligned}
$$

- Standard installation / Side-by-side installation


> 400V 355, 400, 500kW
> (See lines shown in --- for 355 kW )

- Standard installation / Side-by-side installation

- Side-by-side installation (without top cover)





## ■ Calorific values of the inverter and the required ventilation

The energy loss when the inverter converts power from AC to DC and then back to AC is about $5 \%$. 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 forced air-cooling ventilation required and the necessary heat exchange surface area when operating in a sealed cabinet according to motor capacity are as follows.

| Voltage class | Applicable Motor (kW) | Calorific values (W) | Part of inside calorific values <br> (W) <br> (note3) | Amount of forced air cooling ventilation required ( $\mathrm{m}^{3} / \mathrm{min}$ ) | Heat exchange surface area required for sealed storage cabinet $\left(\mathrm{m}^{2}\right)$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 200 V | 0.4 | 50 | 25 | 0.29 | 1.0 |
|  | 0.75 | 70 | 28 | 0.40 | 1.4 |
|  | 1.5 | 113 | 32 | 0.65 | 2.3 |
|  | 2.2 | 135 | 39 | 0.78 | 2.7 |
|  | 3.7/4.0 | 191 | 40 | 1.1 | 3.8 |
|  | 5.5 | 307 | 60 | 1.8 | 6.2 |
|  | 7.5 | 408 | 72 | 2.4 | 8.2 |
|  | 11 | 593 | 83 | 3.4 | 11.9 |
|  | 15 | 692 | 91 | 4.0 | 13.9 |
|  | 18.5 | 800 | 120 | 4.6 | 16.0 |
|  | 22 | 865 | 124 | 5.0 | 17.3 |
|  | 30 | 1140 | 152 | 6.6 | 22.8 |
|  | 37 | 1340 | 167 | 7.7 | 26.8 |
|  | 45 | 1570 | 185 | 9.0 | 31.4 |
|  | 55 | 1720 | 154 | 9.9 | 34.4 |
|  | 75 | 2210 | 154 | 12.7 | 44.2 |
| 400V | 0.75 | 57 | 28 | 0.33 | 1.2 |
|  | 1.5 | 82 | 30 | 0.47 | 1.7 |
|  | 2.2 | 112 | 33 | 0.64 | 2.3 |
|  | 3.7/4.0 | 136 | 41 | 0.78 | 2.8 |
|  | 5.5 | 262 | 58 | 1.5 | 5.3 |
|  | 7.5 | 328 | 66 | 1.9 | 6.6 |
|  | 11 | 448 | 77 | 2.6 | 9.0 |
|  | 15 | 577 | 104 | 3.3 | 11.6 |
|  | 18.5 | 682 | 106 | 3.9 | 13.7 |
|  | 22 | 720 | 111 | 4.2 | 14.4 |
|  | 30 | 980 | 134 | 5.6 | 19.6 |
|  | 37 | 1180 | 138 | 6.8 | 23.6 |
|  | 45 | 1360 | 165 | 7.8 | 27.2 |
|  | 55 | 1560 | 179 | 9.0 | 31.2 |
|  | 75 | 2330 | 226 | 13.4 | 46.6 |
|  | 90 | 2410 | 237 | 13.8 | 48.2 |
|  | 110 | 2730 | 261 | 15.6 | 54.6 |
|  | 132 | 3200 | 296 | 18.3 | 64.0 |
|  | 160 | 3820 | 350 | 21.9 | 76.4 |
|  | 200 | 4930 | 493 | 28.2 | 98.6 |
|  | 220 | 5405 | 586 | 30.9 | 108.1 |
|  | 280 | 6830 | 658 | 39.1 | 136.6 |
|  | 355 | 7960 | - | 45.5 | 159.2 |
|  | 400 | 9300 | - | 53.2 | 186.0 |
|  | 500 | 11400 | - | 65.2 | 228.0 |

Note1: The heat loss for the optional external devices (input reactor, DC reactor, radio noise reduction filters, etc.) is not included in the calorific values in the table. With the exception of inverters indented for motors with capacities of 355 kW and more, in which case the calorific value of the DC reactor is included.
Note2: Each calorific value in the table refers to the quantity of heat that an inverter produces when it is operated continuously at the factory default $\mathcal{L} \mathcal{F}$ (carrier frequency) under a load factor of $100 \%$.
Note3: This value is power dissipated inside the enclosure with using heatsink outer option.

## Panel designing taking into consideration the effects of noise

The inverter generates high frequency noise. When designing the control panel setup, consideration must be given to that noise. Examples of measures are given below.

- Wire so that the main circuit wires and the control circuit wires are separated. Do not place them in the same conduit, do not run them parallel, and do not bundle them.
- Provide shielding and twisted wire for control circuit wiring.
- Separate the input (power) and output (motor) wires of the main circuit. Do not place them in the same conduit, do not run them parallel, and do not bundle them.
- Ground the inverter ground terminals ( $\frac{1}{=}$ ).
- Install surge suppressor on any magnetic contactor and relay coils used around the inverter.
- Install noise filters if necessary.


## Installing more than one unit in a cabinet

If you are installing two or more inverters in one cabinet, pay attention to the following.

- Inverters may be installed side by side with each other with no space left between them.
- When installing inverters side by side, remove the protective cover on the top surface of each inverter.

The output current may need to be reduced, depending on the ambient temperature and the carrier frequency, so see "How to install" in this section.

- Ensure a space of at least 20 cm 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.

Ventilation fan


## 2. Connection equipment

|  | Never disassemble, modify or repair. <br> This can result in electric shock, fire and injury. For repairs, call your sales agency. |
| :--- | :--- |
| Prohibited |  |
| Disashembly |  |
| prohited |  |$\quad$| - Don't stick your fingers into openings such as cable wiring hole and cooling fan covers. |
| :--- |
| This can result in electric shock or other injury. |
| Don't place or insert any kind of object into the inverter (electrical wire cuttings, rods, wires). This |
| can result in electric shock or fire. |
| Do not allow water or any other fluid to come in contact with the inverter. |
| That may result in electric shock or fire. |


| Caution |  |
| :---: | :---: |
| Prohibited | - Do not transport the inverter with its front door detached. The covers may come off and the unit will drop out resulting in injury. |
|  | - Models (20kg or more in weight) designed for $200 \mathrm{~V}-18.5 \mathrm{~kW}$ or larger and 400 V -22kW or larger should be carried by at least two persons. <br> Carrying it alone could cause injury. |

### 2.1 Cautions on wiring

| Warning |  |
| :---: | :---: |
|  | - Never remove the front cover when power is on or open door if enclosed in a cabinet. The unit contains many high voltage parts and contact with them will result in electric shock. |
| Mandatory | - Turn power on only after attaching the front cover or closing door if enclosed in a cabinet. <br> If power is turned on without the front cover attached or closing door if enclosed in a cabinet. This can result in electric shock or other injury. <br> - Electrical construction work must be done by a qualified expert. <br> Connection of input power by someone who does not have that expert knowledge may result in fire or electric shock. <br> - Connect output terminals (motor side) correctly. <br> If the phase sequence is incorrect, the motor will operate in reverse and that may result in injury. <br> -Wiring must be done after installation. <br> If wiring is done prior to installation that may result in injury or electric shock. <br> - The following steps must be performed before wiring. <br> (1) Shut off all input power. <br> (2) Wait at least 15 minutes and check to make sure that the charge lamp is no longer lit. <br> (3) Use a tester that can measure DC voltage ( 800 VDC or more), and check to make sure that the voltage to the DC main circuits (between PA/+ and PC/-) is 45 V or less. <br> If these steps are not properly performed, the wiring will cause electric shock. <br> - Tighten the screws on the terminal board to specified torque. <br> If the screws are not tightened to the specified torque, it may lead to fire. |
|  | - Ground must be connected securely. If the ground is not securely connected, it could lead to electric shock or fire when a malfunction or current leak occurs. |

1 Caution

- Do not attach devices with built-in capacitors (such as noise filters or surge absorber) to the output (motor side) terminal.
This could cause a fire.


## - Preventing radio noise

To prevent electrical interference such as radio noise, separately bundle wires to the main circuit's power terminals (R/L1, S/L2, T/L3) and wires to the motor terminals (U/T1, V/T2, W/T3).

## $\square$ Control and main power supply

The control power supply and the main circuit power supply for the VF-AS1 are the same. If a malfunction or trip causes the main circuit to be shut off, control power will also be shut off.
If you want to keep the control circuit alive when the main circuit shuts off due to trouble or tripping, you use an optional control power supply backup unit (CPS002Z).

## 1 Wiring

- Because the space between the main circuit terminals is small use sleeved pressure terminals for the connections. (stripped wires may be connected directly for $200 \mathrm{~V} / 18.5 \mathrm{~kW}$ to $200 \mathrm{~V} / 45 \mathrm{~kW}$ models and $400 \mathrm{~V} / 22 \mathrm{~kW}$ to $400 \mathrm{~V} / 75 \mathrm{~kW}$ models). Connect the terminals so that adjacent terminals do not touch each other.
- For ground terminal G/E use wires of the size that is equivalent to or larger than those given in table below and always ground the inverter.

Use as large and short a ground wire as possible and wire it as close as possible to the inverter.

| Voltage class | Applicable Motor | Grounding wire size (AWG) [Note] | Grounding wire size $\left(\mathrm{mm}^{2}\right)$ [Note] |
| :---: | :---: | :---: | :---: |
| 200V | $0.4 \sim 2.2 \mathrm{~kW}$ | 14 | 2.5 |
|  | $3.7,4.0 \mathrm{~kW}$ | 12 | 4 |
|  | 5.5 kW | 10 | 6 |
|  | 7.5 kW | 10 | 10 |
|  | 11, 15 kW | 10 | 16 |
|  | 18.5, 22 kW | 8 | 16 |
|  | 30 kW | 6 | 25 |
|  | 37, 45 kW | 6 | 35 |
|  | 55 kW | 2 | 70 |
|  | 75 kW | 2 | 95 |
| 400V | 0.75~4.0 kW | 14 | 2.5 |
|  | 5.5 kW | 12 | 2.5 |
|  | 7.5 kW | 12 | 4 |
|  | 11 kW | 10 | 6 |
|  | 15~22 kW | 10 | 10 |
|  | 30 kW | 10 | 16 |
|  | 37, 45 kW | 8 | 16 |
|  | 55 kW | 6 | 25 |
|  | 75 kW | 6 | 35 |
|  | 90 kW | 2 | 70 |
|  | 110 kW | 2 | 95 |
|  | 132 kW | 1/0 | 95 |
|  | 160 kW | 1/0 | 120 |
|  | 200 kW | 1/0 | 150 |
|  | 220 kW | 2/0 | 150 |
|  | 280 kW | 3/0 | $120 \times 2$ |
|  | 355 kW | 4/0 | $120 \times 2$ |
|  | 400 kW | 4/0 | $150 \times 2$ |
|  | 500 kW | 250MCM | $150 \times 2$ |

Note1: The recommended cable size is that of the cable (e.g. 600 V class, HIV cable) with continuous maximum permissible temperature of $75^{\circ} \mathrm{C}$. Ambient temperature is $40^{\circ} \mathrm{C}$ or less and the wiring distance is 30 m or less.

- Refer to the table in Section 10.1 for wire sizes.
- The length of the main circuit wire in Section 10.1 should be no longer than 30 m . If the wire is longer than 30 m , the wire size (diameter) must be increased.
- Tighten the screws on the terminal board to specified torque.

| Recommended tightening torque for screws on <br> the terminal board |  |  |
| :---: | :---: | :---: |
|  | $\mathrm{N} \cdot \mathrm{m}$ | $\mathrm{lb} \cdot \mathrm{ins}$ |
| M3 | 0.6 | 5.3 |
| M4 | 1.4 | 12.4 |
| M5 | 3.0 | 26.6 |
| M6 | 5.4 | 47.8 |
| M8 | 12.0 | 106 |
| M10 | 24.0 | 212 |
| M12 | 41.0 | 360 |

### 2.2 Standard connections

## ① Warning

- Do not connect input power to the output (motor side) terminals (U/T1, V/T2, W/T3). Connecting input power to the output could destroy the inverter or cause a fire.
- Do not connect a regenerative braking resistor to any DC terminal (between PA/+ and PC/-, or between PO and PC/-).
If a braking resistor is connected by mistake, it may overheat extremely and cause a fire.
Connect resistors as directed in the instructions for Section 5.19.
Prohibited
- Within 15 minutes after turning off input power, do not touch wires of devices (MCCB) connected to the input side of the inverter.
That could result in electric shock.
- Ground must be connected securely.

If the ground is not securely connected, it could lead to electric shock or fire when a malfunction or current leak occurs.

Be Grounded
[Standard connection diagram - sink logic]
The figure below shows an example of typical wiring in the main circuit $200 \mathrm{~V} 0.4-45 \mathrm{~kW} / 400 \mathrm{~V} 0.75-75 \mathrm{~kW}$ inverter.

Main circuit power source
200V class:
$0.4 \sim 45 \mathrm{~kW}$ Three-phase $200 \sim 240 \mathrm{~V}-50 / 60 \mathrm{~Hz}$

## 400V class:


*1: The inverter is shipped with the terminals PO and PA/+ shorted with a bar (200V-45kW or smaller, 400V-75kW or smaller). Remove this shorting bar when installing a DC reactor (DCL).
*2: The DC reactor is built in for models $200 \mathrm{~V}-11 \mathrm{~kW} \sim 45 \mathrm{~kW}$ and $400 \mathrm{~V}-18.5 \mathrm{~kW} \sim 75 \mathrm{~kW}$.
*3: The noise filter is built in for models $200 \mathrm{~V}-45 \mathrm{~kW}$ or smaller and all of 400 V .
*4: External braking resistor (option). Dynamic braking drive circuit built-in (GTR7) as standard for models 160 kW or smaller.
*5: To supply a DC power, connect the cables to the PA/+ and PC/- terminals.
*6: If you want to use a DC power supply to operate the inverter ( 200 V : 18.5 kW or more, 400 V : 22 kW or more), be sure to contact your supplier customer support center, because an inrush current limiting circuit is required in such a case.
*7: $\Rightarrow$ Refer to Section 2.3 .2 for chip switch functions.
*8: The functions assigned to terminals OUT1, VI/II and RR/S4 can be switched by changing parameter settings. $\Rightarrow$ For details refer to Section 2.3.2.
*9: To supply control power from an external power supply for backing up the control power supplied from the inverter, an optional control power backup device (CPS002Z) is required. In such a case, the backup device is used at the same time with the internal power supply of the inverter.
The optional control power backup unit can be used with both 200 V and 400 V models.
To back up control power, set the parameter $\boldsymbol{F}$ - 47 (Control power supply backup option failure monitoring) properly. $\Rightarrow$ For more information, refer to 6.33.24.
*10: When RES-CC is shorted and then opened, the inverter protective status is canceled.
[Standard connection diagram - sink logic]
The figure below shows an example of typical wiring in the main circuit $200 \mathrm{~V} 55,75 \mathrm{~kW} / 400 \mathrm{~V} 90-280 \mathrm{~kW}$ inverter.

*1: Be sure to connect the $D C$ reactor.
*2: To supply a DC power, connect the cables to the PA/+ and PC/- terminals.
*3: If you want to use a DC power supply to operate the inverter, be sure to contact your supplier customer support center because an inrush current limiting circuit is required in such a case.
*4: The noise filter is built in for models all of 400 V .
*5: For models $200 \mathrm{~V}-75 \mathrm{~kW}$ and $400 \mathrm{~V}-110 \mathrm{~kW}$ or larger, three-phase power input is necessary to drive the fan if you want to use a DC power supply.
*6: Every 200 V model of any capacity and every 400 V model with a capacity of 160 kW or less come with dynamic braking unit drive circuits (GTR7) built into them as standard equipment, so if your inverter is among these models, connect an external braking resistor (optional) alone.
*7: If you are using a 400V/200kW model or larger, use a braking unit (optional) and an external braking resistor (optional) in combination.
*8: $\Rightarrow$ Refer to Section 2.3 .2 for switch functions.
*9: The functions assigned to terminals OUT1, VI/II and RR/S4 can be switched by changing parameter settings. $\Rightarrow$ For details refer to Section 2.3.2.
*10: To supply control power from an external power supply for backing up the control power supplied from the inverter, an optional control power backup device (CPS002Z) is required. In such a case, the backup device is used at the same time with the internal power supply of the inverter
The optional control power backup unit can be used with both 200 V and 400 V models.
To back up control power, set the parameter $F 547$ (Control power supply backup option failure monitoring) properly. $\Rightarrow$ For more information, refer to 6.33 .24 .
*11: When RES-CC is shorted and then opened, the inverter protective status is canceled.
[Standard connection diagram - sink logic]
The figure below shows an example of typical wiring in the main circuit $400 \mathrm{~V} 355-500 \mathrm{~kW}$ inverter.

*1: Be sure to connect the DC reactor.
*2: To supply a DC power, connect the cables to the PA/+ and PC/- terminals.
*3: If you want to use a DC power supply to operate the inverter, be sure to contact your supplier customer support center, because an inrush current limiting circuit is required in such a case.
*4: Three-phase power input is necessary to drive the fan if you want to use a DC power supply.
*5: Use a braking unit (optional) and an external braking resistor (optional) in combination.
*6: $\Rightarrow$ Refer to Section 2.3.2 for switch functions.
*7: The functions assigned to terminals OUT1, VI/II and RR/S4 can be switched by changing parameter settings.
$\Rightarrow$ For details refer to Section 2.3.2.
*8: To supply control power from an external power supply for backing up the control power supplied from the inverter, an optional control power backup device (CPSOO2Z) is required. In such a case, the backup device is used at the same time with the internal power supply of the inverter.
To back up control power, set the parameter $F 547$ (Control power supply backup option failure monitoring) properly. $\Rightarrow$ For more information, refer to 6.33.24.
*9: When RES-CC is shorted and then opened, the inverter protective status is canceled.

## [Standard connection diagram - source logic]

The figure below shows an example of typical wiring in the main circuit $200 \mathrm{~V} 0.4-45 \mathrm{~kW} / 400 \mathrm{~V} 0.75-75 \mathrm{~kW}$ inverter.
Main circuit power source
200 V class:
$0.4 \sim 45 \mathrm{~kW}$ Three-phase $200 \sim 240 \mathrm{~V}-50 / 60 \mathrm{~Hz}$
400 V class:

*1: The inverter is shipped with the terminals PO and PA/+ shorted with a bar ( $200 \mathrm{~V}-45 \mathrm{~kW}$ or smaller, $400 \mathrm{~V}-75 \mathrm{~kW}$ or smaller). Remove this shorting bar when installing a $D C$ reactor ( $D C L$ ).
*2: The DC reactor is built in for models $200 \mathrm{~V}-11 \mathrm{~kW} \sim 45 \mathrm{~kW}$ and $400 \mathrm{~V}-18.5 \mathrm{~kW} \sim 75 \mathrm{~kW}$.
*3: The noise filter is built in for models $200 \mathrm{~V}-45 \mathrm{~kW}$ or smaller and all of 400 V .
*4: External braking resistor (option). Dynamic braking drive circuit built-in (GTR7) as standard for models 160 kW or smaller.
*5: To supply a DC power, connect the cables to the PA/+ and PC/- terminals.
*6: If you want to use a DC power supply to operate the inverter ( 200 V : 18.5 kW or more, 400 V : 22 kW or more), be sure to contact your supplier customer support center, because an inrush current limiting circuit is required in such a case.
*7: $\Rightarrow$ Refer to Section 2.3.2 for chip switch functions.
*8: The functions assigned to terminals OUT1, VI/II and RR/S4 can be switched by changing parameter settings. $\Rightarrow$ For details refer to Section 2.3.2.
*9: To supply control power from an external power supply for backing up the control power supplied from the inverter, an optional control power backup device (CPSOO2Z) is required. In such a case, the backup device is used at the same time with the internal power supply of the inverter.
The optional control power backup unit can be used with both 200 V and 400 V models.
To back up control power, set the parameter $F 547$ (Control power supply backup option failure monitoring) properly.
$\Rightarrow$ For more information, refer to 6.33.24.
*10: When RES-CC is shorted and then opened, the inverter protective status is canceled.

## [Standard connection diagram - source logic]

The figure below shows an example of typical wiring in the main circuit $200 \mathrm{~V} 55,75 \mathrm{~kW} / 400 \mathrm{~V} 90-280 \mathrm{~kW}$ inverter.

*1: Be sure to connect the DC reactor.
*2: To supply a DC power, connect the cables to the PA/+ and PC/- terminals.
*3: If you want to use a DC power supply to operate the inverter, be sure to contact your supplier customer support center, because an inrush current limiting circuit is required in such a case.
*4: The noise filter is built in for models all of 400 V .
*5: For models 200V-75kW and 400V-110kW or larger, three-phase power input is necessary to drive the fan if you want to use a DC power supply.
*6: Every 200 V model of any capacity and every 400 V model with a capacity of 160 kW or less come with dynamic braking unit drive circuits (GTR7) built into them as standard equipment, so if your inverter is among these models, connect an external braking resistor (optional) alone.
*7: If you are using a $400 \mathrm{~V} / 200 \mathrm{~kW}$ model or larger, use a braking unit (optional) and an external braking resistor (optional) in combination.
*8: $\Rightarrow$ Refer to Section 2.3 .2 for switch functions.
*9: The functions assigned to terminals OUT1, VI/II and RR/S4 can be switched by changing parameter settings. $\Rightarrow$ For details refer to Section 2.3.2.
*10: To supply control power from an external power supply for backing up the control power supplied from the inverter, an optional control power backup device (CPSO02Z) is required. In such a case, the backup device is used at the same time with the internal power supply of the inverter.
The optional control power backup unit can be used with both 200 V and 400 V models.
To back up control power, set the parameter $F 547$ (Control power supply backup option failure monitoring) properly.
$\Rightarrow$ For more information, refer to 6.33.24.
*11: When RES-CC is shorted and then opened, the inverter protective status is canceled.
[Standard connection diagram - source logic]
The figure below shows an example of typical wiring in the main circuit $400 \mathrm{~V} 355-500 \mathrm{~kW}$ inverter.

*1: Be sure to connect the DC reactor.
*2: To supply a DC power, connect the cables to the PA/+ and PC/- terminals.
*3: If you want to use a DC power supply to operate the inverter, be sure to contact your supplier customer support center, because an inrush current limiting circuit is required in such a case.
*4: Three-phase power input is necessary to drive the fan if you want to use a DC power supply.
*5: Use a braking unit (optional) and an external braking resistor (optional) in combination.
*6: $\Rightarrow$ Refer to Section 2.3.2 for switch functions.
*7: The functions assigned to terminals OUT1, VI/II and RR/S4 can be switched by changing parameter settings. $\Rightarrow$ For details refer to Section 2.3.2.
*8: To supply control power from an external power supply for backing up the control power supplied from the inverter, an optional control power backup device (CPSOO2Z) is required. In such a case, the backup device is used at the same time with the internal power supply of the inverter.
To back up control power, set the parameter $F 547$ (Control power supply backup option failure monitoring) properly. $\Rightarrow$ For more information, refer to 6.33.24.
*9: When RES-CC is shorted and then opened, the inverter protective status is canceled.

### 2.3 Description of terminals

### 2.3.1 Main circuit terminals

This diagram shows an example of wiring of the main circuit. Use options if necessary.

- Power supply and motor connections


Connection with peripheral equipment


- Main circuit

| Terminal symbol | Terminal function |
| :---: | :---: |
| $\stackrel{1}{\square}$ | Grounding terminal for inverter casing |
| $\begin{aligned} & \text { R/L1, S/L2, T/L3 } \\ & \text { (R/L1.1, S/L2.1, T/L3.1, } \\ & \text { R/L1.2, S/L2.2, T/L3.2) } \\ & \text { *1 } \end{aligned}$ | Power input terminal    <br> 200V class: <br> $0.4 \sim 75 \mathrm{~kW}$ Three-phase 200~240V-50/60Hz 400 V class: <br>  $0.75 \sim 90 \mathrm{~kW}$ Three-phase $380 \sim 480 \mathrm{~V}-50 / 60 \mathrm{~Hz}$  <br>    <br>    |
| U/T1, V/T2, W/T3 | Connect to a (3-phase induction) motor. |
| $\begin{aligned} & \mathrm{PA} /+, \mathrm{PB} \\ & (\mathrm{PA}, \mathrm{~PB}) * 2 \end{aligned}$ | Connect a braking resistor. <br> Change the parameters $P b, P b r$ and $P b \bar{G}$ if necessary. 200kW models and larger are not equipped with terminal PB. |
| PC/- | This is a negative potential terminal in the internal DC main circuit. DC power supply can be input across the PA/+ terminals (positive potential). (For $200 \mathrm{~V}-18.5 \mathrm{~kW}$ or more models, and $400 \mathrm{~V}-22 \mathrm{~kW}$ or more models, an optional circuit is needed to suppress a rush current.) |
| PO, PA/+ | Terminals for connecting a DC reactor (DCL: optional external device). Shorted by a short bar when shipped from the factory (200V: 45 kW or smaller, 400 V : 75 kW or smaller). Before installing DCL, remove the short bar. (The rating of 400V-355~500 kW have the double terminals of PO.) |
| RO, SO, TO | 200 V class: $75 \mathrm{~kW} \quad 400 \mathrm{~V}$ class: $110 \mathrm{~kW} \sim 500 \mathrm{~kW}$ Inverter's cooling fan power input terminals. When using a DC power supply, connect three-phase power cables. When using DC power for the main circuit, be sure to connect a three-phase power supply to these terminals. For more information, refer to 10.6 .5 . |

*1: Value in () 400V-355~500kW.
*2: Value in () 200V-55kW or larger, 400V-90~160kW.

### 2.3.2 Control circuit terminal block

The control circuit terminal block is common to all equipment.

$\Rightarrow$ How to set input terminal function, refer to section 7 .

| Terminal symbol | Input/ output |  | Function (Sink logic) VFAS1-****-WN, HN | VFAS1-****-WP | S |
| :---: | :---: | :---: | :---: | :---: | :---: |
| F | Inpu |  | Shorting across F-CC causes forward rotation; open causes deceleration stop. (Across ST-CC is short state.) | Shorting across F-P24/PLC causes forward rotation; open causes deceleration stop. | Voltage free contact input <br> $24 \mathrm{Vdc}-5 \mathrm{~mA}$ or less $\qquad$ <br> Lan current signal. Choose low current contacts to avoid poor attaching. <br> *Sink/source selectable with SW1 <br> Sink input <br> ON:Less than DC10V OFF:DC16V or more Source input ON:DC11V or more OFF:Less than DC5V <br> Note: <br> Even when an external power supply is used (in sink logic mode, i.e., when SINK (PLC) is selected), connect the reference potential-side ( OV side) cable from the power supply to the CC terminal. <br> (INT/PLC): <br> hen the internal 24 V an external 24 V power |
| R | Input |  | Shorting across R-CC causes reverse rotation; open causes deceleration stop. (Across ST-CC is short state.) | Shorting across R-P24/PLC causes reverse rotation; open causes deceleration stop. |  |
| S | Input |  | The motor is on standby if ST and CC are connected. It coasts to a stop if this connection is broken. This terminal can be used for interlocking. | The motor is on standby if ST and P24/PLC are connected. It coasts to a stop if this connection is broken. This terminal can be used for interlocking. |  |
| RES | Inpu |  | Shorting and then opening RES-CC cancels the status held by an inverter protective function. When the inverter is operating normally, shorting and then opening RES-CC produces no effect. | Shorting and then opening RESP24/PLC cancels the status held by an inverter protective function. When the inverter is operating normally, shorting and then opening RES-P24/PLC produces no effect. |  |
| S1 | Input |  | Shorting across S1-CC causes preset speed operation. | Shorting across S1-P24/PLC causes preset speed operation. |  |
| S2 | Input |  | Shorting across S2-CC causes preset speed operation. | Shorting across S2-P24/PLC causes preset speed operation. |  |
| S3 | Input |  | Shorting across S3-CC causes preset speed operation. | Shorting across S3-P24/PLC causes preset speed operation. |  |
| RR/S4 | Input |  | SW3: When SW3 is in the S4 position, S4 and CC are shorted and preset speed operation is selected. | SW3: When SW3 is in the S4 position, S4 and P24/PLC are shorted and preset speed operation is selected. |  |
| SW1=SINK (INT): Sink logic (When the internal 24 V power supply is used) <br> SW1=SINK (PLC): Sink logic (When an external 24 V power supply is used) <br> SW1=SOUR <br> Source lo power sup supply is |  |  |  |  |  |


| Terminal symbol | Input/ output | Function (Sink Source logic) | Electrical specifications | Inverter internal circuits |
| :---: | :---: | :---: | :---: | :---: |
| $\begin{aligned} & \text { P24/ } \\ & \text { PLC } \end{aligned}$ | Output | 24 Vdc power output (when SW1 is in any position other than PLC) <br> 24 V internal output terminal | $24 \mathrm{Vdc}-200 \mathrm{~mA}$ | - |
|  | Input | If SW1 is turned to the PLC position, this terminal can be used as a common terminal when an external power supply is used. | - | - |
| CC *1 | Common to input/ output | Digital signal equipotential ( 0 V ) terminal for the control circuit and equipotential ( 0 V ) terminal for an optional control power supply backup. | - | - |
| PP | Output | Analog input setting power output | 10 Vdc <br> (Permissible load current:10mAdc) |  |
| RR/S4 | Input | SW3: Multifunction programmable analog input terminal when SW3 is in the RR position. Standard default setting:0~10Vdc input and $0 \sim 60 \mathrm{~Hz}$ frequency. | 10 Vdc <br> (Internal impedance:30 k ) |  |
| VI/I I | Input | Multifunction programmable analog input. Standard default setting: 0~10Vdc input and $0 \sim 60 \mathrm{~Hz}$ frequency. <br> This terminal can also be used as a 4-20mAdc (0-20mAdc) input terminal, if the parameter F 108 set to $i$. | 10 Vdc <br> (Internal impedance:30 k ) $4 \sim 20 \mathrm{~mA}$ <br> (Internal impedance:242 2 ) |  |
| RX | Input | Multifunction programmable analog input. Standard default setting:0~ $\pm 10 \mathrm{Vdc}$ input and $0 \sim \pm 60 \mathrm{~Hz}$ frequency. | 10 Vdc <br> (Internal impedance:22 k $\Omega$ ) |  |
| FM | Output | Multifunction programmable analog output. Standard default setting: output frequency Use this terminal to connect a 1 mAdc full-scale ammeter. This terminal can also be used as a $0-10 \mathrm{~V}(F 5 日 \quad i=\pi)$ or $0-20 \mathrm{~mA}$ terminal $(F 5 B i=i)$, if the SW2 switch is set to $0-10 \mathrm{~V} / 0-20 \mathrm{~mA}$ side. | 1mA full-scale DC ammeter (Allowable load resistance $7.5 \mathrm{k} \Omega$ or less) or $7.5 \mathrm{Vdc}-1 \mathrm{~mA}$ full-scale DC voltmeter $0-10 \mathrm{~V}$ full-scale DC voltmeter (Allowable load resistance $500 \Omega$ or more) $/ 0-20 \mathrm{~mA}(4-20 \mathrm{~mA})$ Full-scale DC ammeter voltmeter (Allowable load resistance $500 \Omega$ or less) |  |
| AM | Output | Multifunction programmable analog output. Standard default setting: output current Use this terminal to connect a 1 mAdc full-scale ammeter or $7.5 \mathrm{Vdc}(10 \mathrm{Vdc})-1 \mathrm{~mA}$ full-scale voltmeter. | 1mA full-scale DC ammeter ammeter (Allowable load resistance $7.5 \mathrm{k} \Omega$ or less) or $7.5 \mathrm{Vdc}-1 \mathrm{~mA}$ full-scale DC voltmeter |  |
| OUT1 |  | Multifunction programmable open collector output. The default setting is to output a signal when output low speed threshold has been reached. Depending on the SW4 setting, pulses are output with frequencies of 1.00 kHz to 43.20 kHz . Standard default setting: 3.84 kHz | Open collector output $24 \mathrm{Vdc}-50 \mathrm{~mA}$ |  |
| OUT2 <br> NO | Output | Multifunction programmable open collector output. By default, it is set to output a signal indicating the completion of acceleration or deceleration. <br> Digital output signal equipotential (0V) terminal for the control circuit. It is isolated from the CC terminal. | *Sink logic/source logic switchable |  |
| $\begin{aligned} & \text { ©CA } \\ & \hline 1 \end{aligned}$ | Common to input/ output | Analog input/output signal equipotential (0V) terminal for the control circuit. | - | - |

*1: Although the CC terminal and the CCA terminal are not insulated, they should be used separately, one for the logic circuit and the other for the analog circuit

| Terminal symbol | Input/ output | Function (Sink Source logic) | Electrical specifications | Inverter internal circuits |
| :---: | :---: | :---: | :---: | :---: |
| +SU | Input | DC power input terminal for operating the control circuit. Connect a control power backup device (optional) between +SU and CC. | Voltage: $24 \mathrm{Vdc} \pm 10 \%$ Use a power supply with a current rating of 1.05A or more. <br> (In case of not install options, current rating is 300 mA ) |  |
| $\begin{aligned} & \text { FLA } \\ & \text { FLB } \\ & \text { FLC } \end{aligned}$ | Output | Relay contact output. Contact rating Used to detect the activation of the inverter's protective function. Contact across FLA-FLC is closed and FLB-FLC is opened during protection function operation. | 250Vac-2A 30Vdc-1A :at resistance load $250 \mathrm{Vac}-1 \mathrm{~A}$ : $\cos \phi=0.4$ |  |


| SW | SW settings | Default setting (Settings marked with •) | Function |
| :---: | :---: | :---: | :---: |
| SW1 | SOURCE SINK  <br> INT/PLC PLC INT | (-WN, HN) | Setting for using the inverter's internal power supply in sink logic mode |
|  | SOURCE SINK  <br> INT/PLC PLC INT |  | Setting for using the inverter's external power supply in sink logic mode |
|  | SOURCE SINK <br> INT/PLC PLC | $(-W P)$ | Setting for operating the inverter in source logic mode |
| SW2 |  | - | Setting for using the analog output terminal FM to output current of $0-1 \mathrm{~mA}$ |
|  |  |  | Setting for using the analog output terminal FM to output current of 0-10V or $0-20 \mathrm{~mA}(4-20 \mathrm{~mA})$ $0-10 \mathrm{~V}(F 5 B \quad i=\pi)$ or $0-20 \mathrm{~mA}(F 5 B \quad i=i)$ can be selected by changing parameter settings. |
| SW3 |  | - | Setting for using the input terminal RR/S4 as an analog input terminal ( $0-10 \mathrm{Vdc}$ ) |
|  |  |  | Setting for using the input terminal RR/S4 as a contact input terminal |
| SW4 | OUT1 <br> PULS <br> LO <br> $\square$ | - | Setting for using the output terminal OUT1 as a logic output terminal When turning the switch to this position, always set the parameter $\boldsymbol{F} 559$ to $\Omega$ (logic output). |
|  |  |  | Setting for using the output terminal OUT1 as a pulse output terminal <br> When turning the switch to this position, always set the parameter $F 559$ to $;$ (pulse output). |

## ■ Sink logic/source logic (When inverter's internal power supply is used)

Current flowing out turns control input terminals on. These are called sink logic terminals.
The method generally used in Europe is source logic in which current flowing into the input terminal turns it on.
Sink logic terminals and source logic terminals are sometimes referred to as negative logic terminals and positive logic terminals, respectively.

Each logic is supplied with power from either the inverter's internal power supply or an external power supply, and its connections vary depending on the power supply used.
<Examples of connections when the inverter's internal power supply is used>


[^1]
## - Sink logic/source logic (When an external power supply is used)

The P24/PLC terminal is used to connect to an external power supply or to insulate a terminal from other input or output terminals. Use the slide switch SW1 to switch between sink logic and source logic configurations.
<Examples of connections when an external power supply is used>


## Note: Be sure to connect the 0 V terminal on the external power supply to the CC terminal on the inverter.

*When OUT1 is used as a pulse output terminal (when SW4 is in the PULS position), the circuit shown below is always formed regardless of the logic selected (sink or source) and the power supply used (internal or external power supply)


### 2.3.3 RS485 communication connector

The VF-AS1 is equipped with two connectors: a two-wire RS485 connector (on the operation panel) and a four-wire RS485 connector. The two wire RS485 connector is used to connect an external option (such as remote keypad or computer) to the inverter. To connect to a network, use the four-wire RS485 connector, following the instructions below.

2-wire RS485

| Signal <br> name | Pin <br> number | Description |
| :---: | :---: | :--- |
| DA | 4 | Same phase data |
| DB | 5 | Anti-phase data |
| SG | 8 | Ground line of signal data |

This table shows signal line of inverter side.

* Never use pin-1, 2, 3, 6 and 7.

4-wire RS485

| Signal <br> name | Pin <br> number | Description |
| :---: | :---: | :--- |
| RXA | 4 | Same phase reception data (positive line) |
| RXB | 5 | Anti-phase reception data (positive line) |
| TXA | 3 | Same phase transmitting data (positive line) |
| TXB | 6 | Anti-phase transmitting data (positive line) |
| SG | 2,8 | Ground line of signal data |

This table shows signal line of inverter side.
(Example: RXA signal is received by inverter.)

* Never use pin-1 (P24) and pin-7 (P11).

Connecting diagram for 4-wire RS485 communication


- Note
* Separate the communication line and the main circuit wiring by 20 cm or more.
* Never use pin-1 (P24) and pin-7 (P11).
* Connect RXA and RXB, between TXA and TXB using twisted pair cable.
* Connect terminating resistances at both ends of a transmission line.
* When using 2-wire type, short RXB to TXB and RXA to TXA.

When connecting a communications device via the two-wire connector, carefully read the precautions for use in the operating manual for the communications device.

* When connecting the VF-AS1 to other inverters, you do not need to connect the master receive lines (pins 4 and 5) or the slave send lines (pins 3 and 6).


## 3. Operations

This section explains the basics of operation of the inverter.

Check the following again before starting operation.

1) Are all wires and cables connected correctly?
2) Does the supply voltage agree with the rated input voltage?

## \. Warning

- Do not touch inverter terminals when electrical power is applied to the inverter even if the motor is stopped.
Touching the inverter terminals while power is connected to it may 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.
Such practices may result in electric shock.
- Do not go near the motor in alarm-stop status when the retry function is selected.

The motor may suddenly restart and that could result in injury.
Take measures for safety, e.g. attaching a cover to the motor, against accidents when the motor unexpectedly restarts.


Mandatory

- Turn power on only after attaching the front cover or closing door if enclosed in a cabinet. If power is turned on without the front cover attached or closing door may result in electric shock or other injury.
- If the inverter begins to emit smoke or an unusual odor, or unusual sounds, immediately turn power off.
If the equipment is continued in operation in such a state, the result may be fire. Call your local sales agency for repairs.
- Always turn power off if the inverter is not used for long periods of time.
- Do not turn on the power before attaching the front cover.

When enclosed inside a cabinet and using with the front cover removed, always close the cabinet doors first and then turn power on. If the power is turned on with the front cover or with the cabinet doors open, it may result in electric shock.

- Make sure that operation signals are off before resetting the inverter after malfunction. If the inverter is reset before turning off the operating signal, the motor may restart suddenly causing injury.

|  | • Do not touch heat radiating fins or discharge resistors. <br> These devices are hot, and you'll get burned if you touch them. |
| :--- | :--- |
| Prohibited |  |
| contact |  |$\quad$| • Observe all permissible operating ranges of motors and mechanical equipment. (Refer to the |
| :--- |
| motor's instruction manual.) |
| Not observing these ranges may result in injury. |

### 3.1 Setting/monitor modes

The VF-AS1 has the following three setting/monitor modes.

## Standard monitor mode The standard inverter mode. This mode is enabled when inverter power goes on.

This mode is for monitoring the output frequency and setting the frequency reference value. If also displays information about status alarms during running and trips.

- Setting frequency reference values $\Rightarrow$ Refer to Section 3.2.2.
- Status alarm

If there is an error in the inverter, the alarm signal and the frequency will flash alternately in the LED display.
[: When a current flows at or higher than the overcurrent stall prevention level.
$\rho$ : When a voltage is generated at or higher than the over voltage stall prevention level.
$\dot{L}$ : When the cumulative amount of overload reaches $50 \%$ or more of the overload trip value.
H : When temperature inside the inverter rises above overheating protection alarm level (about $95^{\circ} \mathrm{C}$ )

## Setting monitor mode The mode for setting inverter parameters.

$\Rightarrow$ How to set parameters, refer to Section 4. 1.

This mode is divided into two modes according to the parameter readout mode selected.

Quick mode :Eight frequently used basic parameters are just displayed. The maximum 32 parameters that you select by yourselves are displayed.

Standard setting mode :Both basic and extended all parameters are displayed.

## Status monitor mode The mode for monitoring all inverter status.

Allows monitoring of set frequencies, output current/voltage and terminal information.
$\Rightarrow$ Refer to Section 8.
Pressing the key MODE will move the inverter through each of the modes.


### 3.2 Simplified operation of the VF-AS1

On of three operation modes can be selected: terminal board operation, operation panel and combination of both. $\Rightarrow$ For other operation modes, refer to Section 5.5.

## Terminal board mode :Operation by means of external signals

## Operation panel mode

:Operation by pressing keys on the operation panel

## Operation panel + terminal board mode :Frequency, start/stop signals can be

 sent individually from the operating panel and terminal board.
### 3.2.1 Terminal board operation

In this mode, the motor is started or stopped according to the ON/OFF signal to input terminals (such as the ST terminal and the F terminal). Also, the frequency is set according to the potentiometer/voltage/current signals to analog input terminals (such as the RR/S4 terminal, VI/II terminal and RX terminal).
$\Rightarrow$ For more details, refer to Section 7 .

## Example of standard connection



Run/Deceleration stop Selecting a command mode for basic parameters $[\pi \bar{U} d=0$ (standard default setting)


## Frequency setting

1) Setting the frequency using potentiometer

2) Setting the frequency using input voltage ( $0 \sim 10 \mathrm{~V}$ )

3) Setting the frequency using current input (4(0)~20mA)

4) Setting the frequency using input voltage ( $0 \sim 10 \mathrm{Vdc}$ )

5) Setting the frequency using input voltage ( $0 \sim \pm 10 \mathrm{Vdc}$ )

The direction can be changed by switching between positive and negative signals.

 Changing the settings of two speed command parameters at a time, refer to Section 6.6.
[Example of setting: To set the frequency by applying a current of $4(0)$-20mAdc via the VI/II terminal.]

| Key operated | LED display | Operation |
| :---: | :---: | :---: |
|  | 0.0 | Displays the operation frequency. (Perform during operation stopped.) (When standard monitor display selection $F \boldsymbol{F} \boldsymbol{1}=0$ [Output frequency]) |
| MODE | В边 |  |
| (®) | Find | Press either the $\triangle$ or $\nabla$ key to select "Fп昭." |
| (ENT | 2 | Press the ENTER key to display the parameter setting (Default setting: $\Sigma^{7}$ ). |
| V | ' | Press the $\nabla$ key to change the parameter to $\%$. |
| ENT | ' $\Leftrightarrow$ F 70 d | Press the ENTER key to save the changed parameter. Find and the parameter are displayed alternately. |


| Key operated | LED display | Operation |
| :--- | :--- | :--- |
| PNT | Press either the $\triangle$ key or the $\nabla$ key to change to the parameter <br> group $F i-\ldots$ |  |

## 3．2．2 Panel operation

This section describes how to start／stop the motor，and set the operation frequency with the operating panel．


## ■Changing parameter settings

For control panel operation，parameter settings need to be changed in advance．
If you use parameter $\mathrm{Al}_{\mathrm{i}} \boldsymbol{H}$ that makes it possible to select an operation mode in one operation，you can complete this operation by just making settings once．
Here are the steps to be followed to change the setting to 5 （frequency setting and operation by means of the control panel）．

| Key operated | LED display | Operation |
| :---: | :---: | :---: |
|  | 0.0 | Displays the operation frequency（operation stopped）．（When standard monitor display selection $F 7$ ； $\bar{i}=\boldsymbol{O}$［Output frequency］） |
| EASY |  | Press the EASY key． |
| MODE | 804 | $8: 14$（automatic function setting）at the head of the basic parameters available in quick mode is displayed． |
| （ENT | 8 | Press the ENTER key to display the parameter setting（Default setting： $\mathbf{Z}^{2}$ ）． |
|  | 5 | Press the $\triangle$ key to change the parameter to 5 （Frequency setting and operation on operation panel）． |
|  | $5 \Leftrightarrow ⿴ 囗 十$ | Press the ENTER key to save the changed parameter． $8: 14$ and the parameter are displayed alternately． |

＊Pressing the MODE key returns the display to standard monitor mode（displaying operation frequency）．

- Example of operation panel control

| Key operated | LED display | Operation |
| :---: | :---: | :---: |
|  | 0.0 | The running frequency is displayed. (When standard monitor display selection $F 7: 0=0$ [Output frequency]) |
| (®) | 50.0 | Set the operation frequency. |
| (ENT | $50.0 \Leftrightarrow F[$ | Press the ENTER key to save the operation frequency. F[ and the frequency are displayed alternately. |
| RUN | 0.0950 .0 | Pressing the RUN key causes the motor to accelerate to the set frequency in the specified acceleration time. |
| ( $\triangle$ | 50.0 | Pressing the $\triangle$ key or the $\nabla$ key will change the operation frequency even during operation. |
| STOP | 60.0 00.0 | Pressing the STOP key reduces the frequency and causes the motor to decelerate to a stop. |

## - Selecting a stop mode with the operation panel

In addition to deceleration stop by pressing sey (in the specified deceleration time), the operating panel has the following two stop modes.

| Stop mode | Action | Operation, setting, etc. |
| :---: | :---: | :---: |
| Coast stop | In this mode, power supply from the inverter to the motor is shut off instantaneously, which causes the motor to coast stop. | This stop mode is enabled only in modes where the operation panel can be used for operation. <br> To enable the coast stop mode, set the parameter $F 7 \Omega i=1$. <br> $\Rightarrow$ For more details, refer to Section 6.36.6. <br> *Default setting: $\boldsymbol{F} \boldsymbol{7}$ コ $\quad 1=0$ (Deceleration stop) |
| Emergency stop (from the operation panel in modes other than the panel operation mode) | A stop mode can be selected from among: <br> - Coast stop <br> - Deceleration stop <br> - Emergency DC braking <br> - Deceleration stop <br> Note: Default setting:F5日 $3=0$ (Coast stop) | In modes other than the operation panel operation mode, you can stop the motor (emergency stop) by entering a command from the operation panel. (To quickly stop the motor in the operation panel operation mode, set the parameter $\mathcal{F} \boldsymbol{Z}$ i to this mode.) Pressing the STOP key on the panel twice enables emergency stop. <br> (1) Press the STOP key. <br> "EПFF" starts blinking. <br> (2) Press the STOP key again. <br> F 503 (Emergency stop) $=103$ to the motor makes an emergency stop (or trips) according to the setting. " $\boldsymbol{E}$ " will be displayed and a failure detection signal generated (FL activated). Select the output terminal function $134(135)$ to deactivate FL. <br>  " $E \square F F$ " is being displayed. <br> $\Rightarrow$ For more details, refer to Section 6.33.3. <br>  <br> - Warning - <br> The emergency stop function is designed to forcefully stop the motor by pressing the Stop key on the operation panel in modes other than the operation panel control mode. The emergency stop function cannot be disabled by any setting. Every emergency stop is memorized as a trip in the trip history record. |

## 4. Searching and setting parameters

There are two types of setting mode quick mode and standard setting mode.

## Quick mode

: EASY key: ON
Eight frequently used basic parameters are just displayed (Factory default position).

| Title | Function |
| :---: | :---: |
| Qu4 | Automatic function setting |
| $P L$ | V/f control mode selection |
| FH | Maximum frequency |
| REL | Acceleration time 1 |
| dEL | Deceleration time 1 |
| LHI | Motor electronic thermal protection level 1 |
| F月 | FM terminal meter adjustment |
| PSEL | Registered parameter display selection |

Parameters you selected can be displayed by changing the parameter. (Up to 32 parameters)


For reasons of safety, the following parameters have been set up so that they cannot be reprogrammed while the inverter is running.

```
[Basic parameters]
```



```
BUZ (Automatic torque boost)
ROH (Automatic function setting)
[n0d (Command mode selection)
F%0d (Frequency setting mode selection 1)
PE (V/f control mode selection)
uL (Base frequency 1)
uLu (Base frequency voltage 1)
FH (Maximum frequency)
UL5 (Auto-restart control selection)
ULL}\mathrm{ (Regenerative power ride-through control)
pb (Dynamic braking selection)
Pb, (Dynamic braking resistance)
PGF (Allowable continuous braking resistance)
LyP}\mathrm{ (Factory default setting)
```

$\Rightarrow$ To write-protect extended parameters during operation, refer to Section 11.

### 4.1 How to set parameters

This section explains how to set parameters, while showing how parameters are organized in each setting monitor mode.

### 4.1.1 Setting parameters in the selected quick mode

To place the inverter in this mode, press the EASr) key (the LED lights up), and then press the mODE key.
Note that extended parameters are not displayed in the quick mode.


■ How to set basic parameters
(1) Selects parameter to be changed. (Press the $\triangle$ or $\vee$ key.)
(2) Reads the programmed parameter setting. (Press the ENT key.)
(3) Change the parameter value. (Press the $\square$ key.)
(4) Press this key to save the change. (Press the ENT key.)

- Adjustment range and display of parameters
$H$ : An attempt has been made to assign a value that is higher than the programmable range. Or, as a result of changing other parameters, the programmed value of the parameter that is now selected exceeds the upper limit.

ᄂ 亿: An attempt has been made to assign a value that is lower than the programmable range. Or, as a result of changing other parameters, the programmed value of the parameter that is now selected exceeds the lower limit.

If the above alarm is flashing on and off, no setting can be done of values that are equal to or greater than $\boldsymbol{H} \boldsymbol{i}$ or equal to or lower than $: 8$.

### 4.1.2 Setting parameters in the standard setting mode

Press the moos key to place the inverter in this mode.

- How to set basic parameters
(1) Selects parameter to be changed.
(Press the $\triangle$ or $\triangle$ key.)
(2) Reads the programmed parameter setting.

0.0

Standard monitor mode
(Press the ENT) key.)
(3) Change the parameter value.
(Press the $\triangle$ or $\triangle$ key.)
(4) Press this key to save the change. (Press the ENT key.)


Enter key
Used to set values and return to previous menu


* Parameter title and the setting value are displayed alternately.

■ How to set extended parameters
Each extended parameter is composed of an " $F$ " and three figures that follow the f , so first select and read out the heading of the parameter you want "Fi--"~"F g--." ("Fi--":Parameter bearing a number between 100 and 199, "F9--":Parameter bearing a number between 900 and 999)
(1) Select the title of the parameter you want to change. (Press the or key.)
(2) Press the Enter key to activate the selected parameter. (Press the ENT) key.)
(3) Selects parameter to be changed. (Press the $\triangle$ or key.)
(4) Reads the programmed parameter setting. (Press the ENT key.)
(5) Change the parameter value. (Press the $\triangle$ or key.)
(6) Press this key to save the change. (Press the ENT key.)

- Adjustment range and display of parameters
$H$ : An attempt has been made to assign a value that is higher than the programmable range. Or, as a result of changing other parameters, the programmed value of the parameter that is now selected exceeds the upper limit.
L.1. An attempt has been made to assign a value that is lower than the programmable range. Or, as a result of changing other parameters, the programmed value of the parameter that is now selected exceeds the lower limit.

If the above alarm is flashing on and off, no setting can be done of values that are equal to or greater than H ; or equal to or lower than 18.

### 4.2 Functions useful in searching for a parameter or changing a parameter setting

This section explains functions useful in searching for a parameter or changing a parameter setting. To use these functions, a parameter needs to be selected or set in advance.

## Changed parameter search function

Automatically searches for only those parameters that are programmed with values different from the standard default setting. To use this function, select the $\overline{1}$, it parameter.
$\Rightarrow$ For more details, refer to Section 5.21.

## Parameter change history function

Automatically searches for the last five parameters that have been set to values
 parameter.
$\Rightarrow$ For more details, refer to Section 5.1.

## Function of resetting all parameters to their default settings

 $\Rightarrow$ For more details, refer to Section 5.20 .

## 5. Basic parameters

This parameter is a basic parameter for the operation of the inverter.
$\Rightarrow$ Refer to Section 11, Table of parameters.

### 5.1 History function

## RIU : History function

## - Function

Automatically searches for 5 latest parameters that are programmed with values different from the standard default setting and displays them in the Fin it . Parameter setting can also be changed within this group Fi it .
This function comes in very handy when you adjust the inverter repeatedly using the same parameter.

Note 1: If no history information is stored, this parameter is skipped and the next parameter Rid i.
Note 2: $H E R \sigma$ and $E \cap d$ are added respectively to the first and last parameters in a history of changes.

| [Setting methods] |  |  |
| :---: | :---: | :---: |
| Key operated | LED display | Operation |
|  | 0.0 | Displays the operation frequency (operation stopped). (When standard monitor display selection $F 7 ; 10=0$ [Output frequency]) |
| (MOD) | 8: | The first basic parameter "History function (R: $1: H$ )" is displayed. |
| (ENT) | RE: | The parameter that was set or changed last is displayed. |
| (ENT) | 8.0 | Press the ENTER key to display the set value. |
| (®) | 5.0 | Press the $\triangle$ key and $\nabla$ key to change set value. |
| (ENT) | 5.0 AREL | Press the ENTER key to save the changed value. The parameter name and the programmed value will flash on and off alternately. |
| $\triangle(\triangle)$ | **** | Use the same steps as those given above to display parameters that you want to search for or change setting with the $\triangle$ key and $\nabla$ key. |
| $\triangle(\triangle)$ | $\begin{aligned} & H E R d \\ & (E n d) \end{aligned}$ | HERd: First historic record End : Last historic record |
| MODE <br> (MODE) <br> (MODE) | $\begin{gathered} \text { Parameter display } \\ \downarrow \\ \text { R台 } \downarrow \\ \text { F-F } \\ \vdots .0 \\ 0.0 \end{gathered}$ | Press the MODE key to return to the parameter setting mode RiLH. <br> After that you can press the MODE key to return to the status monitor mode or the standard monitor mode (display of operation frequency). |

### 5.2 Setting acceleration/deceleration time

## RU' : Automatic acceleration/deceleration

A[E : Acceleration time 1
dEL : Deceleration time 1

- Function

1) For acceleration time 1 RLI programs the time that it takes for the inverter output frequency to go from OHz to maximum frequency $\stackrel{F}{\mathrm{H}}$.
2) For deceleration time $1 d E[$ programs the time that it takes for the inverter output frequency to got from maximum frequency $\stackrel{F}{\mathrm{H}}$ to OHz .

### 5.2.1 Automatic acceleration/deceleration

This automatically adjusts acceleration and deceleration time in line with load size.
QU: = :

* Adjusts the acceleration/deceleration time automatically within the range of $1 / 8$ to 8 times as long as the time set with the $A[C$ or $d E[$, depending on the current rating of the inverter.
RU: $=2$
*Automatically adjusts speed during acceleration only. During deceleration, speed is not adjusted automatically but reduced at the rate set with $d E[$.



## Set Ri' ; (automatic acceleration/deceleration) to $\boldsymbol{i}$ or $己$.

[Parameter setting]

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| BUi | Automatic acceleration/deceleration | $\square$ Disabled (Manual setting) <br> i:Automatic setting <br> $Z:$ Automatic setting (during <br> acceleration only) | 0 |

When automatically setting acceleration/deceleration time, always change the acceleration/deceleration time so that it conforms with the load.
The acceleration/deceleration time changes constantly with load fluctuations.
For inverters that requires a fixed acceleration/deceleration time, use the manual settings ( $\mathcal{I} \underset{L}{ }$
When using a braking resistor or braking unit, do not set the $\mathcal{F} \dot{i} i=i$. Or the regenerative braking resistor may be overloaded.

Use this parameter after actually connecting the motor.
Setting acceleration/deceleration time ( $\mathcal{F L}, \boldsymbol{f} E \bar{L}$ ) in conformance with mean load allows optimum setting that conforms to further changes in load.
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.

### 5.2.2 Manually setting acceleration/deceleration time

Set acceleration time from $0(\mathrm{~Hz})$ operation frequency to maximum frequency $F \mathrm{H}$ and deceleration time as the time when operation frequency goes from maximum frequency FH to $0(\mathrm{~Hz})$.

[Parameter setting]

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| REL | Acceleration time 1 | 8. 3 [ Note$]-5000 \mathrm{sec}$. | According to model $\Rightarrow$ Refer to page K-46. |
| dEL | Deceleration time 1 | 0. 3 [ Note$]-5000 \mathrm{sec}$. | According to model $\Rightarrow$ Refer to page K-46. |

Note:The minimum setting of acceleration and deceleration times have been set respectively at 0.1 sec . by default, but they can be changed within a range of 0.01 sec . (setting range:0.01~600.0 sec.) by changing the setting of the parameter $t \leq P$ (default setting).
$\Rightarrow$ For details, refer to Section 5.20.
When running under not connect the motor at setting $\mathrm{Pt}=2,3,4,7,8$, it might to not operate normally. , It will be able to running normally by connecting the motor.
If the programmed value is shorter than the optimum acceleration/deceleration time determined by load conditions, overcurrent stall or overvoltage stall function may make the acceleration/deceleration time longer than the programmed time. If an even shorter acceleration/deceleration time is programmed, there may be an overcurrent trip or overvoltage trip for inverter protection.
$\Rightarrow$ For details, refer to Section 13.1.

### 5.3 Increasing starting torque

## RU己 : Automatic torque boost

## - Function

Simultaneously switches inverter output V/f control and programs motor constants automatically (auto-tuning function 1) to improve torque generated by the motor. This parameter integrates the setting of special V/f control selection such as automatic torque boost or vector control.

O Constant torque characteristics (default setting)
O Automatic torque boost+auto-tuning 1
O Sensorless vector control 1+auto-tuning 1

Note: Square reduction torque control, sensor vector control (optional), etc. can be selected using the V/f control mode selection parameter $P L$.
$\Rightarrow$ For details, refer to Section 5.6.
[Parameter setting]

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| RUこ | Automatic torque boost | $\begin{aligned} & \hline 0 \text { : Disabled (Always } 8 \text { is displayed.) } \\ & \text { : Automatic torque boost+auto-tuning } 1 \\ & Z: \text { Sensorless vector control } 1+\text { auto-tuning } 1 \\ & \hline \end{aligned}$ | 0 |

[^2] left.

Ex. 10

## 1）Increasing torque automatically according to the load

## Set the automatic torque boost $R \stackrel{i}{ }{ }^{2} 己=$ ；（automatic torque boost＋auto－tuning 1）

 from inverter．This gives steady torque for stable runs．

Note 1：The same characteristic can be obtained by setting the V／f control mode selection parameter $P$ I to （automatic torque boost）and $F 40$（auto－tuning 1）to $2 . \quad \Rightarrow$ Refer to Section 6．22．

Note 3：If stable operation cannot be achieved with this setting，set the parameters $u$ i（base frequency），ui u （base－frequency voltage）， 5405 （rated capacity of motor），$F 405$（rated current of motor）and 5407 （rated number of revolutions of motor）as specified on the motor nameplate，and then set 5406 to 4 and $Я \ddot{U}^{2}$ to $\dot{\prime}$ again．

2）When using vector control（increasing starting torque and high－precision operations）

## Set the automatic torque boost $R \dot{L} \dot{U}=\boldsymbol{Z}$（sensorless vector control 1＋auto－tuning 1）

Setting automatic torque boost $R \backsim 巳^{\circ}=己$（Sensorless vector control 1＋auto－tuning 1）provides high starting torque bringing out the maximum in motor characteristics from the low－speed range．This suppresses changes in motor speed caused by fluctuations in load to provide high precision operation．This setting is most suitable for transfer and lifting systems that are operated in speed control mode．

Note 1：The same characteristic can be obtained by setting the V／f control mode selection parameter $P \in$ to $\exists$ （Sensorless vector control 1）and $F 400$（Auto－tuning 1）to $2 . \quad \Rightarrow$ Refer to Section 6．22．

Note 3：If stable operation cannot be achieved with this setting，set the parameters uit（base frequency），uitu （base－frequency voltage），$F 405$（rated capacity of motor），$F 405$（rated current of motor）and $F 407$ （rated number of revolutions of motor）as specified on the motor nameplate，and then set $F 400$ to 4 and $\vDash 山 己$ to $こ$ again．

## If vector control cannot be programmed．．．．

First read the precautions about vector control in 5．6，9）．
1）If the desired torque cannot be obtained $\quad \Rightarrow$ Refer to 6.22 selection 3 ．
2）If auto－tuning error＂$E \Sigma \Omega$＂appears $\quad \Rightarrow$ Refer to 13.1 and 6.22 selection 3.

## ■ $R \dot{U} 己$（automatic torque boost）and $P \in$（V／f control mode selection）

Automatic torque boost is the parameter for setting V／f control mode selection $(F L)$ and auto－tuning $1(F 400)$ together．That is why all parameters related to change automatically when $R \| 己$ is changed．


## 3）Increasing torque manually（V／f constant control）

The VF－AS1 inverter is set to this control mode by factory default．
This is the setting of constant torque characteristics that are suited for such things as conveyors．It can also be used to manually increase starting torque．

To return to V／f constant control after changing the $R: \leq 己$ setting：
Set the V／f control mode selection parameter $P_{t}=\tilde{U}$（constant torque characteristic）．
$\Rightarrow$ Refer to Section 5．6．
Note：If you want to increase torque further，raise the setting value of manual torque boost $u b$ ．
How to set manual torque boost parameter $u b$
$\Rightarrow$ Refer to Section 5．7．

## 5．4 Setting parameters by operating method

## RUY ：Automatic function setting

－Function
Automatically programs all parameters（parameters described below）related to the functions by selecting the inverter＇s operating method．
The major functions can be programmed simply．
［Parameter setting］

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| 804 | Automatic function setting | 7：Disabled <br> i：Frequency setting by means of voltage <br> $z$ ：Frequency setting by means of current <br> 3 ：Voltage／current switching from external terminal <br> 4 ：Frequency setting on operation panel and operation by means of terminal <br> 5 ：Frequency setting and operation on operation panel | 0 |

Example：When setting the parameter＂ $8: 4=3$＂，It will be the following indication．


Automatically programmed functions and parameter set values

|  | Default setting | 8：Disabled | f：Frequency setting by means of voltage | Z ：Frequency setting by means of current | 3 ：Voltage／current switching from external terminal | 4：Frequency setting on operation panel and operation by means of terminal | 5：Frequency setting and operation on operation panel |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ［n0 | 7：Terminal board | － | － | － | － | 3：Terminal board | 1：Operation panel |
| F90d | ב：RR／S4 | － | $2: R R / S 4$ | i：VI／II | 2：RR／S4 | $4:$ Operation panel | 4 ：Operation panel |
| $F 98$ | 0 ：Voltage input | － | － | ＇：Current input | ＇：Current input | － | － |
| $\left\lvert\, \begin{array}{llll} F & i & 17 \\ (S 3) \end{array}\right.$ | 14： <br> Preset speed command 3 | － | － | － | 104：Frequency priority switching | － | － |
| F200 | $\begin{aligned} & \hline A: F \cap 0 \quad 1 \\ & F E 07 \\ & \text { terminal } \\ & \text { switching } \\ & \hline \end{aligned}$ | － | 0：Fח日的 F20 7terminal switching |  | $\begin{aligned} & 0: 5 \% 0 a^{1} \\ & \text { F20 } 20 \text { terminal } \\ & \text { switching } \end{aligned}$ | 0：F 70 D F207terminal switching | 0：F 70 A F207terminal switching |
| F20 | 0 \％ | － | － | 20\％ | 20\％ | － | － |
| $F 207$ | i：VI／II | － | $2: R R / S 4$ | i：VI／II | i：VI／II | 4：Operation panel | $4:$ Operation panel |

$\Rightarrow$ Refer to Section 11 for input terminal functions．
Disabled（ $0: 14=0$ ）
No change is made to the parameter setting．
Frequency setting by means of voltage：（ $8: 14=\boldsymbol{i})$
Operation is performed by applying a voltage for setting the RR／S4 terminal 1 frequency．
When sink logic is selected：
ST－CC ON：Standby（ON（short－circuited）by default）
F－CC ON：Forward run
R－CC ON：Reverse run

## Frequency setting by means of current

This setting is used to set the frequency by applying a current of $4-20 \mathrm{~mA}$ to the $\mathrm{VI} / I \mathrm{I}$ terminal．
ST－CC ON：Standby（ON（short－circuited）by default）
F－CC ON：Forward run
R－CC ON：Reverse run

## Voltage/current switching by means of an external terminal

Switching between remote and local (different frequency commands) can be performed by turning on or off the S3 terminal. In that case, apply a voltage via the RR/S4 terminal and a current via the VI/II terminal.
S3-CC OFF: The frequency is set according to the voltage applied to the RR/S4 terminal.
S3-CC ON: The frequency is set according to the current applied to the VI/II terminal.
In sink logic mode: ST-CC ON: Standby (ON (short-circuited) by default), F-CC ON: Forward run, R-CC ON: Reverse run.
Frequency setting with operation panel and operation with terminal board
This setting is used to set the frequency using the operation panel and to perform operation control using the terminal board.
Use the and keys to set the frequency.
In sink logic mode: ST-CC ON: Standby (ON (short-circuited) by default), F-CC ON: Forward run, R-CC ON: Reverse run.

Frequency setting and operation with operation panel:
This setting is used to set the frequency and to perform operation control, using the operation panel.
Use the $\triangle$ and $\boxtimes$ keys to set the frequency.
Use the RUN and STOP keys to perform operation control.

### 5.5 Selection of operation mode

## [nOd : Command mode selection

## Find : Frequency setting mode selection 1

## - Function

These parameters are to program which command to the inverter (from operation panel, terminal board, remote input device or options) will be given priority in running/stopping the operation and in frequency setting (speed).

## <Command mode selection>

[Parameter setting]

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| Endod | Command mode selection | B:Terminal input enabled <br> i: Operation panel input enabled (including LED/LCD option input) <br> 2: 2 -wire RS485 communication input <br> 3:4-wire RS485 communication input <br> 4 :Communication option input | 0 |

## [Programmed value]

$0:$ $\square$ ON and OFF of an external signal Runs and stops operation.
i: Operation panel operation


keys on the operation panel to Run and stop a run. (including LED/LCD option input)
?


Run and stop commands are entered from the 2-wire RS485 communications device. (Communication No.: FAOO)
3: 4-wire RS485 communication operation
Run and stop commands are entered from the 4 -wire RS485 communications device. (Communication No.: FA04)
$4:$

```
Communication option input enabled
```

Signals from an optional communication device are used to start and stop operation.
$\Rightarrow$ For details, refer to Instruction Manual (E6581281, E6581343, E6581288) specified in Section 6.42.

[^3]＜Frequency setting mode selection＞

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| F90d | Frequency setting mode selection 1 | i：VI／II（voltage／current input） <br> こ：RR／S4（potentiometer／voltage input） <br> 3：RX（voltage input） <br> 4 ：Operation panel input enabled（including <br> LED／LCD option input） <br> 5：2－wire RS485 communication input <br> 5：4－wire RS485 communication input <br> 7：Communication option input <br> B：Optional Al1（differential current input） <br> 9：Optional AI2（voltage／current input） <br> i $0:$ Up／Down frequency <br> i ：Optional RP pulse input <br> に己：Optional high－speed pulse input <br> 13：－［Note 1］ | 2 |

［Programmed value］
i：VIIII input Speed setting commands are entered by external signals（ $0 \sim 10 \mathrm{Vdc}$ or $4(0) \sim 20 \mathrm{mAdc}$ ）．
ב．RR／S4 input Speed setting commands are entered by external signals（RR／S4 terminal：0～10Vdc）．

3：RX input Speed setting commands are entered by external signals（RX terminal： $0 \sim \pm 10 \mathrm{Vdc}$ （ $\pm 5 \mathrm{Vdc})$ ）．

4：Operation panel input
Press the $\triangle$ and keys on the operation panel to set the
frequency．
（including LED／LCD option input）
5：2－wire RS485 communication operation
Speed commands are entered from the 2－wire RS485 communications device．（Communication No．：FA01）

5：4－wire RS485 communication operation

7：Communication option input enabled
Speed commands are entered from an optional
communication device． $\Rightarrow$ For details，refer to Instruction Manual（E6581281， E6581343，E6581288）specified in Section 6．42．

日：Al1 input Speed setting commands are entered by external signals（Al1 terminal（option）： $0 \sim \pm 10 \mathrm{Vdc}( \pm 5 \mathrm{Vdc})$ ）．

9：AI2 input Speed setting commands are entered by external signals（Al2 terminal：0～10Vdc or $4(0) \sim 20 \mathrm{mAdc}$ ）（optional）．

19：Up／Down frequency
Speed commands are entered by means of Up／Down frequency signals from the terminal board．$\Rightarrow$ Refer to Section 7．2．
if：RP pulse input Speed commands are entered by means of RP pulses（optional）．
だ：High－speed pulse input

Speed commands are entered by means of high－speed pulses （optional）．

Note 1：For options（unsupported）

The functions assigned to the following control input terminals (contact input: $\Rightarrow$ Refer to Section 7.2) are always activated regardless of the settings of the command mode selection $[80$ and frequency setting mode selection 1F月0』.

- Reset terminal (default setting: RES, valid only for tripping)
- Standby terminal (assigned to ST by default)
- Emergency stop terminal
 stop the inverter temporarily.
No change can be made to them if the inverter is in operation.


## - Preset speed operation

[ $\% 0 \mathrm{~d}$ : Set this parameter at 0 (terminal board).
$F \cap A_{0}$ : Any setting is valid.

## 1) Setting the run, stop and operation frequencies with the operation panel

| Title | Function | Example of setting |
| :--- | :--- | :--- |
| Ln $\sigma^{\prime}$ | Command mode selection | $i$ (Operation <br> panel input) |
| $F \cap \Delta d^{\prime}$ | Frequency setting mode <br> selection 1 | 4 (Operation <br> panel input) |

Run/stop: Press the RUN and STOP keys on the operation panel
To switch between forward run and reverse run, use the forward/reverse run selection $F_{r}$. .


To save the frequency, press the ENTER key. Then, $F_{[ }$ and the set frequency are displayed alternately for a while.

## 2) Setting the run and stop frequencies (forward run, reverse run and coast stop) by means of external signals and setting the operation frequency with the operation panel

| Title | Function | Example of setting |
| :---: | :--- | :--- |
| Fnad | Command mode selection | $\square$ (Terminal <br> input) |
| Fn日 | Frequency setting mode <br> selection 1 | 4 (Operation <br> panel input) |

ON/OFF of terminals F-CC/R-CC (Standby: connection of terminals ST and CC)

Speed command: Set the frequency, using
the $\triangle$ keys on
the operation panel.
«Example of a connection diagram: SW1 set to sink logic»

$p$ The inverter is factoryconfigured so that, if $F$ and $R$ are turned on at the same time, the inverter will stop operation. If
necessary, the direction of rotation can be reversed by changing parameter settings.
$\Rightarrow$ Refer to Section 6.2.1.
To save the frequency, press the ENTER key Then, FI and the set frequency are displayed alternately for a while.
3) Setting the run and stop frequencies (forward run, reverse run and deceleration stop) with the operation panel and setting the operation frequency by means of external signals

| Title | Function | Example of setting |
| :---: | :---: | :---: |
| [n0d | Command mode selection | i (Operation panel input) |
| Fn90 | Frequency setting mode selection 1 | ```i(VI/II (voltage/current input) ) \imath'(RR/S4 (potentiometer/ voltage input) ) Э(RX (voltage input) )``` |

Run/stop: Press the RUN and STOP keys on
the operation panel
To switch between forward run and reverse run, use the forward/reverse run selection $F_{r}$ r
Speed command: External signal input
(1) VI/II terminal: $0 \sim+10 \mathrm{Vdc}$

$$
(0 \sim+5 \mathrm{Vdc}) \text { or }
$$

$$
4(0) \sim 20 \mathrm{mAdc}
$$

(2) RR/S4 terminal: Potentiometer

$$
0 \sim+10 \mathrm{Vdc}(0 \sim+5 \mathrm{Vdc})
$$

(3) RX terminal: $0 \sim \pm 10 \mathrm{Vdc}(0 \sim \pm 5 \mathrm{Vdc})$


## 4) Setting the run, stop and operation frequencies (forward run, reverse run and coast stop) by means of external signals (default setting)

| Title | Function | Example of setting |
| :---: | :---: | :---: |
| [n0d | Command mode selection | Ii:(Terminal input) |
| F\%Sd | Frequency setting mode selection 1 | i(VI/II (voltage/current input) ) <br> $z^{\prime}(R R / S 4$ <br> (potentiometer/voltage input) ) <br> 3 (RX (voltage input) ) |

Run/stop: ON/OFF of terminals F-CC/R-CC Speed command:External signal input
(1) VI/II terminal: $0 \sim+10 \mathrm{Vdc}$

$$
\begin{aligned}
& (0 \sim+5 \mathrm{Vdc}) \text { or } \\
& 4(0) \sim 20 \mathrm{mAdc}
\end{aligned}
$$

(2) RR/S4 terminal: Potentiometer

$$
0 \sim+10 \mathrm{Vdc}(0 \sim+5 \mathrm{Vdc})
$$

(3) RX terminal: $0 \sim \pm 10 \mathrm{Vdc}(0 \sim \pm 5 \mathrm{Vdc})$
«Example of a connection diagram: SW1 set to sink logic»


### 5.6 Selecting control mode

## Pt : V/f control mode selection

## - Function

With "VF-AS1," the V/f controls shown below can be selected.
0 : Constant torque characteristics
1: Voltage decrease curve
2: Automatic torque boost (*1)
3: Sensorless vector control 1 (*1)
4: Sensorless vector control 2
5: V/f 5-point setting
6: PM control (*2)
7: PG feedback control (*3)
8: PG feedback vector control (*3)
(*1) "Automatic control" parameter automatically sets this parameter and auto-tuning 1 at a time.
( 2 ) Use a dedicated motor with permanent magnets.
( 3 ) A PG feedback device (optional) is needed for this control.

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| $P L$ | V/f control mode selection | I: Constant torque characteristics <br> i: Voltage decrease curve <br> Z: Automatic torque boost <br> 3: Sensorless vector control 1 <br> 4 : Sensorless vector control 2 <br> 5: V/f 5-point setting <br> 5: PM control <br> 7: PG feedback control <br> B: PG feedback vector control | 0 |

## 1) Constant torque characteristics (Normal way of use)

Setting of V/f control mode selection $P_{t}=\boldsymbol{U}$ (Constant torque characteristics)
This is applied to loads with equipment like conveyors and cranes that require the same torque at low speeds as at rated speeds.


[^4]
## 2) Decreasing output voltage

## Setting of V/f control mode selection $P\llcorner=\boldsymbol{f}$ (Voltage decrease curve)

This is appropriate for load characteristics of such things as fans, pumps and blowers in which the torque in relation to load rotation speed is proportional to its square.


## 3) Increasing starting torque

## Setting of V/f control mode selection $P L=?$ (Automatic torque boost)

Detects load current in all speed ranges and automatically adjusts voltage output (torque boost) from inverter. This gives steady torque for stable runs.


Note: This control system can oscillate and destabilize runs depending on the load. If that should happen, set $\mathrm{V} / \mathrm{f}$ control mode selection $P L$ to (Constant torque characteristics) and increase torque manually.

## Motor constant must be set.

The motor constant can be set in any of the following two ways:

1) Automatic setting

Enter the following information that is indicated on the motor nameplate, and then execute the auto-tuning 1 command (Set $F 4804$ to and then reset $F 408$ to 2.
<Information indicated on motor nameplate>
 current), $F 407$ (Motor rated rotational speed)
$\Rightarrow$ Refer to 6.22 selection 2.
2) Manual setting

Set each motor constant manually.
$\Rightarrow$ Refer to 6.22 selection 3 .

## 4) Vector control-increasing starting torque and achieving high-precision operation.

## Setting of V/f control mode selection $P_{L=3,4}$ (Sensorless vector control 1, 2)

Using sensorless vector control with a Toshiba standard motor will provide the highest torque at the lowest speed ranges. The effects obtained through the use of sensorless vector control are described below.
(1) Provides large starting torque.
(2) Effective when stable operation is required to move smoothly up from the lowest speeds.
(3) Effective in elimination of load fluctuations caused by motor slippage.
(4) Effective in producing high motor torque at low speed.

Set $P \in$ to $\exists$ (sensorless vector control 1) to operate multiple motors of the same type in parallel or to operate a motor with a two or more notches lower rating.
To perform torque control, set $P_{L}$ to 4 (sensorless vector control 2), which is designed to perform operation control with higher accuracy. In that case, however, the inverter should be used only for operating a single motor with an equal or one notch lower rating.

## Motor constant must be set.

The motor constant can be set in any of the following two ways:

1) Automatic setting

Enter the following information that is indicated on the motor nameplate, and then execute the auto-tuning 1 command (Set $F 400$ to 4 , and then reset $F 400$ to 2 .).
<Information indicated on motor nameplate>
山i (Base frequency), ui (Base frequency voltage), $F 405$ (Motor rated capacity), $F 405$ (Motor rated current), $F 407$ (Motor rated rotational speed)

$$
\Rightarrow \text { Refer to } 6.22 \text { selection } 2 .
$$

2) Manual setting

Set each motor constant manually.
$\Rightarrow$ Refer to 6.22 selection 3 .

## 5) Setting of V/f characteristic arbitrarily

## Setting of V/f control mode selection $P L=5$ (V/f 5-point setting)

In this mode, the base frequency and the base frequency voltage for the V/f control need to be set to operate the motor while switching a maximum of 5 different V/f characteristics.

| Title | Function | Adjustment range |  | Default setting |
| :---: | :---: | :---: | :---: | :---: |
| F190 | V/f 5-point setting VF1 frequency | B.0.F H Hz |  | 0.10 |
| F191 | V/f 5-point setting VF1 voltage | 0.0) - $000 \%$ | * | 0.0 |
| F192 | V/f 5-point setting VF2 frequency | $0.0 \sim F \mathrm{H}^{\text {Hz }}$ |  | 0.0 |
| F193 | V/f 5-point setting VF2 voltage | 0.0) - $100 \%$ | * | 0.0 |
| F194 | V/f 5-point setting VF3 frequency | R.0.FH Hz |  | 0.0 |
| F195 | V/f 5-point setting VF3 voltage | 0.0) - 00 \% | * | 0.0 |
| F195 | V/f 5-point setting VF4 frequency | O. 0.5 FH Hz |  | 0.10 |
| F197 | V/f 5-point setting VF4 voltage | 0.0~100\% | * | 0.0 |
| F198 | V/f 5-point setting VF5 frequency | İ.0~FH Hz |  | 0.0 |
| F199 | V/f 5-point setting VF5 voltage | 0.0) - $100 \%$ | * | 0.0 |

*100\% adjustment value ( 200 V class: $200 \mathrm{~V}, 400 \mathrm{~V}$ class: 400 V )


Note 1: Restrict the amount of torque to boost (ぃ) to $3 \%$ or so. Boosting the torque too much may impair the linearity between points.
Note 2: If the V/f 5-point is set within the diagonally shaded area in the figure below, the V/f 5-point is placed automatically on the boundary line (heavy line in the figure).


## 6) Operating a permanent magnet motor

## Setting of V/f control mode selection PL=5 (PM control)

Permanent magnet motors (PM motors) that are light, small in size and highly efficient, as compared to induction motors, can be operated in sensorless operation mode. Note that this feature can be used only for specific motors.
For more information, contact your supplier.

## 7) Operating the motor at periodic speeds by means of a motor speed sensor

## Setting for V/f control mode selection $P L=7$ (PG feedback contro)

Set $P \succeq$ to $\exists$ to operate the motor at periodic speeds.
A PG feedback device (optional) is needed. In addition, a motor with a speed sensor (encoder) should be used.
Use this setting when operating a motor two or more ranks lower in capacity than the inverter at periodic speeds.
Note that the accuracy obtained by $P L=7$ is lower than that obtained by setting $P L$ to $B$. Also, $P L$ should be set to $\bar{g}$ to perform torque control. $P_{L}$ cannot be set to $\overline{7}$ in such a case.
Output torque decreases considerably in regenerative low speed operation (motor slip frequency or less). Set $P \succeq$ to $B$ if regenerative low speed torque is necessary.

## Motor constant must be set.

The motor constant can be set in any of the following two ways:

1) Automatic setting

Enter the following information that is indicated on the motor nameplate, and then execute the auto-tuning 1 command (Set $F 408$ to 4 , and then reset $F 408$ to 2.
<Information indicated on motor nameplate>
ui (Base frequency), ui u (Base frequency voltage), 545 (Motor rated capacity), $F 405$ (Motor rated current), F407(Motor rated rotational speed) $\Rightarrow$ Refer to 6.22 selection 2.
2) Manual setting

Set each motor constant manually. $\Rightarrow$ Refer to 6.22 selection 3 .

## 8) Performing speed control/torque control with high accuracy using the motor speed sensor

Setting for V/f control mode selection $P\llcorner=B$ (PG feedback vector control)
The torque produced by the motor is controlled by means of specified torque command signals. The rotational speed of the motor depends on the relation between the load torque and the torque produced by the motor. A PG feedback device (optional) is needed. In addition, a motor with a speed sensor (encoder) should be used. Set $P L$ to $Q$ (PG feedback vector control) to perform speed/torque control with high accuracy.

## Motor constant must be set.

The motor constant can be set in any of the following two ways:

1) Automatic setting

Enter the following information that is indicated on the motor nameplate, and then execute the auto-tuning 1 command (Set $F 400$ to 4 , and then reset $F 400$ to 2 .).
<Information indicated on motor nameplate>
ui (Base frequency), ui (Base frequency voltage), $F 405$ (Motor rated capacity), 5405 (Motor rated
current), $F 407$ (Motor rated rotational speed)
$\Rightarrow$ Refer to 6.22 selection 2 .
2) Manual setting

Set each motor constant manually.
$\Rightarrow$ Refer to 6.22 selection 3 .

## 9) Precautions on automatic torque boost mode or vector control

1) When operating a motor in automatic torque boost mode or vector control mode $(P L=\Xi, ~ \exists, ~ 4,7$ or $B)$, enter each motor constant indicated on the nameplate (ui (base frequency), $u \mathfrak{L}$ (base-frequency voltage), $F 405$ (rated capacity of motor), $F 405$ (rated current of motor) and $F 407$ (rated number of revolutions of motor) ), read the precautions on auto-tuning 1 on section 6.22 (1), and then set $F 400$ to 2 (auto-tuning). If the cable length is in excess of 30 m , be sure to perform the auto-tuning $\left(F 400=\Sigma^{7}\right)$ mentioned above, even when using a standard motor recommended by Toshiba.
2) The sensorless vector control exerts its characteristics effectively in frequency areas below the base frequency ( $\omega \mathrm{L}$ ) . The same characteristics will not be obtained in areas above the base frequency.
3) When setting $P \leq$ to 4 or $B$, use the inverter along with a general-purpose motor with an equal or one notch lower rating.
4) Use a motor that has 2 to 16 P .
5) Always operate the motor in single operation (one inverter to one motor). (Except for; $P_{L}=\Xi$ ) Sensorless vector control cannot be used when one inverter is operated with more than one motor.
6) The torque produced by the motor decreases more or less around the rated frequency because of a voltage drop cause motor-generated torque in the vicinity of rated frequency to be somewhat lower.
7) Connecting a reactor or surge voltage suppression filter between the inverter and the motor may reduce motor-generated torque. Setting auto-tuning 1 may also cause a trip $(E L n, E!n ; Z 3)$ rendering sensorless vector control unusable. In the event of a trip, perform auto-tuning with the inverter connected directly to the motor, or enter the motor constant calculated from the motor test results.
8) Connect speed sensor for vector control with sensor to the motor. Connecting via gear, etc. causes motor's oscillating or inverter's trip by lack of rigidity.
9) If running under not connect the motor, please set to $P \succeq=\Omega$ temporarily. There is a possibility not to operate normally when running at setting $\mathrm{Pt}=2,3,4,7,8$ under not connect the motor.

## 5．7 Manual torque boost－increasing torque boost at low speeds

## ub ：Manual torque boost 1



This parameter is valid when $\boldsymbol{\square} L=\boldsymbol{I}$（Constant torque characteristics），i（square reduction torque）， 5 （V／f 5－point setting）．
Note：The optimum value is programmed for each inverter capacity．Boosting torque excessively may cause the inverter to trip because of an overcurrent．If operation is repeated with torque boosted excessively，electronic devices in the main circuit may be damaged，so if high starting torque is needed，it is recommendable to use vector control． $\Rightarrow$ Refer to 5.6 selection 3 ）and 4 ）．
If necessary，set the amount of torque to be boosted，as a guide，within $+2 \%$ of the factory default setting．

## 5．8 Base frequency

| UL | ：Base frequency 1 |
| :---: | :---: |
| uLu | ：Base frequency voltage 1 |

## －Function

Sets the base frequency and the base frequency voltage in conformance with load specifications or the motor＇s rated frequency．

Note：This is an important parameter that determines the constant torque control area．

［Parameter setting］

| Title | Function | Adjustment range | Default setting |  |
| :---: | :---: | :---: | :---: | :---: |
| －1 | Base frequency 1 | $25.0 \sim 500.0 \mathrm{~Hz}$ | Inverter with a model number ending with | －WN，HN： $50 . \square$ －WP： 50.0 |
| いじい | Base frequency voltage 1 | $\begin{aligned} & \text { 200V class: } 50-330 \mathrm{~V} \\ & \text { 400V class: } 50-550 \mathrm{~V} \end{aligned}$ | ```200V models: 230 400 V models: Inverter with a model number ending with``` | －WN，HN： 450 <br> －WP： 400 |

Note：The output frequency is limited to a frequency 10.5 times as high as the base frequency（ $\omega \mathbf{L}$ ）．Even if the maximum frequency（ $F H$ ）or the upper limit frequency（ $L^{\prime} \mathrm{L}$ ）is set above this frequency，this limitation is imposed on the output frequency．

### 5.9 Maximum frequency

## FH : Maximum frequency

## - Function

1) Programs the range of frequencies output by the inverter (maximum output values).
2) This frequency is used as the reference for acceleration/deceleration time.

Output frequency [Hz]


- This function determines the maximum value in line with the ratings of the motor and load.
- Maximum frequency cannot be adjusted during operation. To adjust, first stop the inverter.

Frequency setting signal [\%]
If $F H$ is increased, adjust the upper limit frequency $: i L$ as necessary.
[Parameter setting]

| Title | Function | Adjustment range | Default setting |
| :---: | :--- | :---: | :---: |
| $F H$ | Maximum frequency | $30.0-500.0 \mathrm{~Hz}$ | 80.0 |

Note: The output frequency is limited to a frequency 10.5 times as high as the base frequency ( $\omega \mathbf{i}$ ). Even if the maximum frequency ( $F H$ ) or the upper limit frequency ( $H i L_{\text {a }}$ ) is set above this frequency, this limitation is imposed on the output frequency.

### 5.10 Upper limit and lower limit frequencies

## U' $L$ : Upper limit frequency <br> $L L$ : Lower limit frequency

## - Function

Programs the lower limit frequency that determines the lower limit of the output frequency and the upper limit frequency that determines the upper limit of that frequency.

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| Ui | Upper limit frequency | O.O.F H Hz | Inverter with a model number ending with -WN, HN: 50.0 -WP: 50.0 |
| Li | Lower limit frequency |  | 0.12 |

Note: The output frequency is limited to a frequency 10.5 times as high as the base frequency ( $\omega \boldsymbol{L}$ ). Even if the maximum frequency ( $F H$ ) or the upper limit frequency ( $L i_{L}$ ) is set above this frequency, this limitation is imposed on the output frequency.

## 5．11 Setting frequency command characteristics

|  | R iF F ：VIIII point setting |
| :---: | :---: |
| $F 210 \sim F E 12$ | RuF $:$ RR／S4 point setting |
| F2 16－F2 19 | ：RX point setting |
| F22こ－F225 | ： 7 |
| F228－F231 | It sets up，when using the optional circuit board． |
| $F 234-F 237$ | it sets up，when using the optionar circuit board． |
| F8it－F8i4 | ：Point 1， 2 setting／frequency |

## $\Rightarrow$ For details，refer to Section 7．3．

## －Function

These parameters adjust the output frequency according to the externally applied analog signal（0～10Vdc voltage， $4(0) \sim 20 \mathrm{mAdc}$ current）and the entered command for setting an external contact frequency．

## 5ri $-5 r 7$ ：Preset speed operation frequencies 1～7

## 5．12 Preset speed operation（speeds in 15 steps）

## F2B7－F294：Preset speed operation frequencies 8～15

## F55

## －Function

A maximum of 15 speed steps can be selected just by switching an external contact signal．Preset speed frequencies can be programmed anywhere from the lower limit frequency $L L$ to the upper limit frequency $i: L$ ．
［Setting methods］
1）Run／stop
Run and stop control is experienced by the operation panel（Default setting）．

| Title | Function | Adjustment range | Example of setting |
| :---: | :---: | :---: | :---: |
| ［ 780 | Command mode selection | IT：Terminal input enabled <br> i：Operation panel input enabled（including <br> LED／LCD option input） <br> こ：2－wire RS485 communication input <br> 3：4－wire RS485 communication input <br> 4：Communication option input | 8 |

Note 1：If speed commands（analog signal or digital input）are switched in line with preset speed operations，select the terminal board using the frequency setting mode selection $1 F \% 0$ d．
$\Rightarrow$ Refer to 3）or Section 5．5．

2）Preset speed frequency setting
Set the speed（frequency）of the number of steps necessary．

Setting from speed 1 to speed 7

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| 5riar 7 | Preset speed operation frequencies 1～7 |  | 0.0 |

Setting from speed 8 to speed 15

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| Fこ日7～Fこ94 | Preset speed operation frequencies 8～15 |  | 0.0 |

Example of preset speed contact input signal: SW1 set to sink logic
O: ON -: OFF (Speed commands other than preset speed commands are valid when all are OFF)

| CC | Terminal | Preset speed |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| S1 | S1-CC | 0 | - | 0 | - | 0 | - | 0 | - | $\bigcirc$ | - | $\bigcirc$ | - | 0 | - | 0 |
| S2 | S2-CC | - | $\bigcirc$ | $\bigcirc$ | - | - | 0 | 0 | - | - | $\bigcirc$ | $\bigcirc$ | - | - | $\bigcirc$ | 0 |
| S3 | S3-CC | - | - | - | 0 | 0 | 0 | O | - | - | - | - | $\bigcirc$ | 0 | 0 | 0 |
| -- RR/S4 | RR/S4-CC | - | - | - | - | - | - | - | $\bigcirc$ | $\bigcirc$ | $\bigcirc$ | $\bigcirc$ | $\bigcirc$ | $\bigcirc$ | $\bigcirc$ | $\bigcirc$ |

Terminal functions are as follows. (Default setting)
Terminal S1 ............... Input terminal function selection 5 (S1) $F$; $: 5=10$ (S1)
Terminal S2 ............... Input terminal function selection 6 (S2) $F ;: 5=12$ (S2)
Terminal S3 ............... Input terminal function selection 7 (S3) $F ; i ;=14$ (S3)
Terminal RR/S4 $\ldots \ldots$. Input terminal function selection 8 (S4) $F ;: B=i \sigma$ (S4)

The RR/S4 terminal is set by default as an analog voltage input terminal. To use it as an input terminal for preset speed operation, turn the SW3 switch to the S4 position.
[An example of the connection of terminals] (SW1 set to sink logic)

3) Using other speed commands with preset speed command

When no preset speed command is issued, the inverter accepts an input command from the operation panel or another analog input device.

| $\begin{aligned} & \text { Preset } \\ & \text { speed } \end{aligned}$command | Other speed commands |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
|  | Frequency setting signals from the operation panel |  | Analog signal input command (VIIII, RR/S4, RX, Al1 and AI2) |  |
|  | Entered | Not entered | Entered | Not entered |
| Entered | Preset speed command valid | Preset speed command valid | Preset speed command valid | Preset speed command valid |
| Not painted | Operation panel command valid | - | Analog signal valid | - |

The preset speed command is always given priority when other speed commands are input at the same time. To use the RR/S4 terminal as an analog input terminal, turn the SW4 switch to the RR position. Note that this makes it impossible to use the function assigned to S 4 .

Below is an example of 7-step speed operation.

4) Setting the operation mode

An operation mode can be selected for each preset speed.
Operation mode setting

| Title | Function | Adjustment range | Example of setting |
| :---: | :---: | :---: | :---: |
|  | Preset speed operation mode selection | 7. Preset speed operation with no mode <br> i: Preset speed operation with mode | 8 |

8 : Preset speed operation with no mode
Only frequency commands are governed by the preset speed command (1 to 15) entered.
f: Preset speed operation with mode. The direction of rotation, the V/f control mode, the acceleration and deceleration times and the torque limit can be set individually for each preset speed command.
If you selected "enabled" $(F 5 \Sigma \bar{I}=1)$, the motor runs operation mode setting directions as below without following terminal $F, R$.

Operation mode setting

| Title | Function | Adjustment range | Example of setting |
| :---: | :---: | :---: | :---: |
| F55 1-F575 | Preset speed operation frequency 1~15 operation mode | 71: Forward run <br> $+i$ : Reverse run <br> $+己$ : Acceleration/deceleration switching signal 1 <br> +4 : Acceleration/deceleration switching signal 2 <br> $+B$ : V/f switching signal 1 <br> + I5: V/f switching signal 2 <br> $+3 \Xi$ : Torque limit switching signal 1 <br> +54 : Torque limit switching signal 2 | 0 |

For the settings marked with + , more than one function can be selected at the same time by entering the sum of the numbers of the desired functions.
Ex.) $(+i)+(+\boldsymbol{\Xi})=\beth$
By entering " 3 ", you can activate the reverse run function and the acceleration/deceleration switching signal 1 function at the same time.

## 5．13 Selecting forward and reverse runs（operation panel only）

## $F_{r}$ ：Forward／reverse run selection

## －Function

Program the direction of rotation of the motor when the running and stopping are made using the RUN key and STOP key on the operation panel．


| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| $F_{r}$ | Forward／reverse run selection | 7．Forward run <br> i：Reverse run <br> こ：Forward run（F／R switching possible） <br> 3：Reverse run（F／R switching possible） | 0 |

Check the direction of rotation on the status monitor．

$$
F_{r}-F: \text { Forward run } F_{r}-r: \text { Reverse run }
$$

$\Rightarrow$ For monitoring，refer to Section 8．1．

When the F and R terminals are used for switching between forward run and stop from the terminal board，the $F$ ， forward／reverse run selection parameter is rendered invalid．

Short across the F－CC terminals：forward run
Short across the R－CC terminals：reverse run

If $F$ and CC，as well as R and CC are connected at the same time：Stop（Default setting）
Use the parameter $F$ ； 05 to select between reverse run and stop in this case．
$\Rightarrow$ For more details，refer to Section 6．2．1．

This function is valid only when $[\pi \square$ is set at $i$（Operation panel input enabled）．

To switch between forward run and reverse run from the control panel with parameter $F$ r set to $コ$ or $コ$ ，perform these steps：to switch to forward run，press the key while holding the ENT key down，or to switch to reverse run，press the
key while holding key down．

### 5.14 Setting the electronic thermal

## LHr : Motor electronic thermal protection level 1

## $\bar{U}\llcorner\cap$ : Electronic thermal protection characteristic selection

FSUS : OL reduction starting frequency
FES 7 : Motor 150\%-overload time limit
F53 1 : Temperature detection

```
- Function
This parameter allows selection of the appropriate electronic thermal protection characteristics according to the particular rating and characteristics of the motor.
```

[Parameter setting]

| Title | Function | Adjustment range |  |  |  | Default setting |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| LH, | Motor electronic thermal protection level 1 | 10~ $600 \%$ |  |  |  | 180 |
| 26 6 | Electronic thermal protection characteristic selection | Default setting | Motor type | Overload protection | Overload stall | 0 |
|  |  | 0 | Standard Motor | O (protect) | $\times$ (not stall) |  |
|  |  | i |  | O (protect) | O (stall) |  |
|  |  | 2 |  | $\times$ (not protect) | $\times$ (not stall) |  |
|  |  | 3 |  | $\times$ (not protect) | O (stall) |  |
|  |  | 4 | VF Motor (special motor) | O (protect) | $\times$ (not stall) |  |
|  |  | 5 |  | O (protect) | O (stall) |  |
|  |  | 5 |  | $\times$ (not protect) | $\times$ (not stall) |  |
|  |  | 7 |  | $\times$ (not protect) | O (stall) |  |

1) Setting the motor electronic thermal protection level $1 \boxed{\angle H}$ and electronic thermal protection characteristics selection $O L$

The electronic thermal protection characteristics selection $\Omega i \pi$ is used to enable or disable the motor overload trip function ( $0: L^{2}$ ) and the overload stall function.
The motor overload trip function $\left(\Omega\left\llcorner\Xi^{\prime}\right)\right.$ needs to be selected with the parameter $\Omega L \pi$, while the inverter overload trip function ( $B L \quad i$ ) is always activated.

## Explanation of terms:

Overload stall (Soft stall)
The function of automatically lowering the output frequency before the motor overload trip function $0 L Z$ is activated when the inverter detects that an excessive load is applied to the motor. (Lowers maximum about 48 Hz when basic frequency is 60 Hz .) This function enables the inverter to output a frequency commensurate with the load current so that the motor can keep running without tripping. This function is useful for such loads as fans, pump, and blowers, which have the square reduction torque characteristic that the current passed decreases as the rotating speed falls.

Note: Do not use this overload stall function for loads with a constant torque characteristic (e.g., a belt conveyer to which a constant load current is always passed regardless of their speed).
[Using standard motors (other than motors intended for use with inverters)]
When a motor is used in the lower frequency range than the rated frequency, that will decrease the cooling effects for the motor. This speeds up the start of overload detection operations when a standard motor is used in order to prevent overheating.
$\square$ Setting of electronic thermal protection characteristics selection $O \subset \Pi$

| Default setting | Overload protection | Overload stall |
| :---: | :---: | :---: |
| $\square$ | O (protect) | $\times($ not stall $)$ |
| $i$ | O (protect) | O (stall) |
| $己$ | $\times($ not protect $)$ | $\times($ not stall $)$ |
| $\beth$ | $\times$ (not protect) | $O$ (stall) |

Setting of motor electronic thermal protection level 1 LH
If the capacity of the motor is smaller than the capacity of the inverter, or the rated current of the motor is smaller than the rated current of the inverter, adjust the electronic thermal protection level 1 tHr so that it fits the motor's rated current.


Note: The motor overload starting level is fixed at 30 Hz . If necessary, set 8 Cif to 4,5 , 5 or 7 . (See the following section.) Even if the inverter is used with a Toshiba standard motor, the load may need to be reduced at frequencies of 30 Hz and below in some cases. In such cases, set $0 \mathrm{~L}, \mathrm{n}$ to $4,5,5$ or 7 and set the 0 L reduction starting frequency ( $F 5$ SG) according to the motor.
[Example of setting: When the VFAS1-2007PL is running with a 0.4 kW motor having 2 A rated current]

| Key operated | LED display | Operation |
| :---: | :---: | :---: |
|  | 81.10 | Displays the operation frequency. (Perform during operation stopped.) (When standard monitor display selection $F \overline{7}: \overline{0}=0$ [Output frequency]) |
| MODE | QuH | The first basic parameter "History function (RUH)" is displayed. |
| (1) V | LH\% | Press either the $\Delta$ key or the $\nabla$ key to change the parameter tot H r. |
| ENT | 180 | Press the ENTER key to display the parameter setting (Default setting: 100\%). |
| ( | 48 | Press the $\triangle$ key to change the parameter to $\begin{aligned} 40 & (=\text { motor rated current/inverter output rated current } \times 100 \\ & =2.0 / 5.0 \times 100) \end{aligned}$ |
| ENT | $4 \boldsymbol{S} \Leftrightarrow$ LH | Press the ENTER key to save the changed parameter. $L \boldsymbol{H}, \boldsymbol{r}$ and the parameter are displayed alternately. |

## [Using a VF motor (motor for use with inverter)]

$\square$ Setting of electronic thermal protection characteristics selection $\Omega$

| Default setting | Overload protection | Overload stall |
| :---: | :---: | :---: |
| 4 | O (protect) | $\times($ not stall $)$ |
| 5 | O (protect) | O (stall) |
| 5 | $\times$ (not protect) | $\times($ not stall $)$ |
| 7 | $\times$ (not protect) | $\circ($ stall $)$ |

A VF motor (a motor for use with an inverter) can be used in lower frequency ranges than the standard motor, but if that frequency is extremely low, the effects of cooling on the motor will deteriorate.
In such a case, set the OL reduction start frequency parameter $F 5 G$ according to the characteristics of the motor. (Refer to the figure below.)

As a guide, it is advisable to set this parameter around the default value (VF motor 6 Hz ).
[Parameter setting]

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| F565 | OL reduction starting frequency |  | 5.6 |



Setting of motor electronic thermal protection level 1

```
LHF
```

If the capacity of the motor is smaller than the capacity of the inverter, or the rated current of the motor is smaller than the rated current of the inverter, adjust the electronic thermal protection level 1 LHr so that it fits the motor's rated current

* If the indications are in percentages[\%], then 100\% equals the inverter's rated output current [A].


Setting the motor overload starting level

## 2) Motor 150\%-overload time limit $F \bar{\square} 7$

The motor 150\%-overload time limit parameter $F 5 \overline{7} 7$ is used to set the time elapsed before the motor trips under a load of $150 \%$ (overload trip $\bar{\square} \boldsymbol{L}$ ) within a range of 10 to 2400 sec.


Motor overload protection characteristics
[Parameter setting]

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| $F 5 \Omega 7$ | Motor 150\%-overload time limit | $10 \sim さ 400$ sec. | 300 |

## 3) Inverter overload characteristics

Set to protect the inverter unit. Cannot be turned off by parameter setting.
The inverter has two overload detecting functions, which can be switched from one to another using parameter
Fロコi (temperature detection).
[Parameter setting]

| Title | Function | Adjustment range | Default setting |
| ---: | :--- | :--- | :---: |
| $F \Xi \Xi i$ | Temperature detection | $\boldsymbol{B}:$ Standard (150\%-60 sec.) <br> $i:$ Estimation of temperature | $\vdots$ |

If the inverter overload trip function ( $\bar{L} \mathbf{L}$ ) is activated frequently, this can be improved by adjusting the stall


## ■F53 i=0 (Standard)

Protection is given uniformly regardless of ambient temperature, as shown by the 150\%-60 sec overload curve in the figure below.

## Inverter overload



Inverter overload protection characteristics
■ F $31=1$ (Estimation of temperature)
This parameter adjusts automatically overload protection, predicting the inverter internal temperature rise.
(diagonally shaded area in the figure below)


Inverter overload protection characteristics
Note 1: If the load applied to the inverter exceeds $150 \%$ of its rated load or the operation frequency is less than

Note 2: The inverter is factory-set so that, if the inverter becomes overloaded, it will automatically reduce the
 causes an increase in noise from the motor, but this does not affect the performance of the inverter. If you do not want the inverter to reduce the carrier frequency automatically, set the parameter F3 $5=0$.
Note 3: Overload detection level is variable by condition of output frequency and carrier frequency.

## 5．15 Changing the display unit \％to A（ampere）／V（volt）

## dSP娄 ：Current／voltage unit selection

## －Function

These parameters are used to change the unit of monitor display．
$\% \Leftrightarrow A$ (ampere) $/ \mathrm{V}($ volt $)$
Current $100 \%=$ Inverter's rated current
200V-class voltage $100 \%=200 \mathrm{Vac}$
400 V -class voltage $100 \%=400 \mathrm{Vac}$

1）Display in percentage terms


2）Display in amperes／volts

［Parameter setting］

| Title | Function | Adjustment range | Default setting |
| :---: | :--- | :--- | :---: |
| $\sigma S P u$ | Current／voltage unit selection | $0: \%$ <br> $i: \% \rightarrow \mathrm{~A}($ ampere $) / \mathrm{V}($ volt $)$ | 0 |

[^5]Note：Base frequency voltage 1～4（uLu，Fi7i，Fi75，Fi79）is always displayed in the unit of V ．

### 5.16 Meter setting and adjustment

|  |  <br> operation data is sent to the FM terminal (AM terminal) as analog voltage signals or analog current display inverter's operation data, connect a meter to this terminal. The "FM terminal-connected meter $F \eta^{\prime \prime}$ (AM terminal-connected meter adjustment $\left.\boldsymbol{\beta} \boldsymbol{\eta} \boldsymbol{i}\right)$ parameter is used to calibrate the meter. |  |  |
| :---: | :---: | :---: | :---: |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

Note 1: The signal output from the FM and AM terminal is an analog voltage signal or an analog current signal. (positive (+) side output. In the case of output the signed data, the signal is added offset. Offset level is able to adjust by $F 5 \Omega 5$ and $F 5 日 5$. If monitoring the output data with positive and negative voltage, you need to use "expansion I/O card2 option".
Note 2: To the FM terminal, connect either a full-scale 0~1mAdc ammeter or a full-scale 0~7.5Vdc (or 10Vdc) voltmeter, if necessary. The FM terminal can also be used as a $0(4) \sim 20 m A d c ~ o u t p u t ~ t e r m i n a l . ~$
To the AM terminal, connect either a full-scale 0~1mAdc ammeter or a full-scale $0 \sim 7.5 \mathrm{Vdc}$ (or 10 Vdc ) voltmeter, if necessary.

Connect meters as shown below.
<Connection to terminal FM>


A frequency meter QS60T is optionally available.

- Output modes of the FM terminal

When used with a 0~1mAdc ammeter When used with a DC0~10V voltmeter When used with a 0(4)~20mAdc
(Default setting)


SW2



When the optional frequency meter QS60T is connected, this mode is selected.
<Connection to terminal AM >


[^6][Terminal FM-related parameters]

| Title | Function | Adjustment range | $\begin{gathered} \text { Adjustment } \\ \text { level } \\ \hline \end{gathered}$ | Default setting |
| :---: | :---: | :---: | :---: | :---: |
| F\%5: | FM terminal meter selection | 7: Output frequency <br> i: Frequency command value <br> Z: Output current <br> 3 : Input voltage (DC detection) <br> 4: Output voltage <br> 5: Compensated frequency *2 <br> $\sigma$ : Speed feedback (real-time value) <br> 7: Speed feedback ( 1 second filter) <br> 8: Torque <br> 9: Torque command <br> i : : Torque current <br> 12 : Exiting current <br> 13: PID feedback value <br> i 4 : Motor overload factor (OL2 data) <br> 15 : Inverter overload factor (OL1 data) <br> : 5 : Regenerative braking resistance overload factor (OLr data) <br> i 7: Regenerative braking resistor load factor (\% ED) <br> 18: Input power <br> 19: Output power <br> 23 : Optional AI2 input <br> 4: RR/S4 input <br> 5: VI/II input <br> E: RX input <br> 7: Optional Al1 input <br> B: FM output (Do not select this option.) <br> 9: AM output <br> 3: Fixed output 1 <br> i: Communication data output <br> E. Fixed output 2 <br> 3: Fixed output 3 <br> 34 : Cumulative input power <br> 35 : Cumulative output power <br> 45 : Gain display <br> $45-49$ :My function monitor 1~4 <br> 50 : Signed output frequency <br> i: Signed frequency command value <br> 2 : Signed compensated frequency <br> 3: Signed speed feedback (real-time value) <br> 54 : Signed speed feedback ( 1 second filter) <br> 55 : Signed torque <br> 55 : Signed torque command <br> 59 : Signed torque current <br> 5 9: Signed PID feedback value <br> 50 : Signed RX input <br> 5 : Signed optional AI1 input <br> $5 \cdot 5-5$ :Signed fixed output 1~3 <br> 55~73:Function none <br> 74 : MON1 (Expansion I/O card2 option) <br> 75: MON2 (Expansion I/O card2 option) <br> 75: RP (Expansion I/O card2 option) | (a) <br> (b) <br> (c) <br> (c) <br> (a) <br> (a) <br> (a) <br> (d) <br> (d) <br> (b) <br> (b) <br> (a) <br> (a) <br> (a) <br> (a) <br> (a) <br> (b) <br> (b) <br> (a) <br> (a) <br> (a) <br> (a) <br> (a) <br> (a) <br> (a) <br> - <br> - <br> (a) <br> (a) <br> *1 <br> (a) <br> (a) <br> (a) <br> (a) <br> (a) <br> (d) <br> (d) <br> (b) (a) <br> (a) <br> (a) <br> - <br> (a) <br> (a) <br> (a) | 0 |
| $F \%$ | FM terminal meter adjustment | - |  | *3 |
| F578 | Constant at the time of filtering *4 | $4 \mathrm{msec}, 8 \mathrm{msec} \sim 108 \mathrm{msec}$ |  | 54 |
| F58 : | FM voltage/current output switching | $8:$ Voltage output (0~10V), $f:$ Current output ( $0 \sim 20 \mathrm{~mA}$ ) |  | 0 |
| F582 | FM output gradient characteristic | $\overline{0}$ :Negative gradient (downward-sloping), <br> i:Positive gradient (upward-sloping) |  | ' |
| F583 | FM bias adjustment | - 10.0 - $100.0 \%$ |  | 0.0 |
| F584 | FM output filter |  |  | 0 |

*1: Monitor adjustment level selected.
*2: "Compensated frequency" refers to the frequency actually sent from an inverter to the motor connected.
*3: Default setting value is adjusted for connection of frequency meters "QS60T".
(Between FM and CCA: Approx. 3.6V)
*4: The output current, input voltage, output voltage, compensated frequency, speed feedback (real-time value) torque, torque current and exciting current output (FM/AM/pulse and monitor output) can be filtered.
［Terminal AM－related parameters］

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| 87， 51 | AM terminal meter selection | Same as F\％5：（こ9：AM output disabled） | 2 |
| 8月 | AM terminal meter adjustment | － | ＊1 |
| F585 | AM output gradient characteristic | If：Negative gradient（downward－sloping）， i：Positive gradient（upward－sloping） | ， |
| F685 | AM bias adjustment | －10．0－100．0\％ | 0.0 |

＊1：Default setting value is adjusted for connection of frequency meters＂QS60T＂．
（Between AM and CCA：Approx．3．6V）
－Resolution
Both the terminals FM and AM have a maximum resolution of $1 / 1024$ ．
With the default settings，FM terminal outputs about 4.7 V （external impedance is $\infty$ ）or about 1 mA （external impedance is $0 \Omega$ ），when running frequency is 80 Hz ．AM terminal outputs about 4.7 V or about 1 mA ，when the output current reading on the operation panel is $185 \%$ ．
［Example of the calibration of the frequency meter connected to the terminal FM］
＊Use the meter＇s adjustment screw to pre－adjust zero－point．

| Key operated | LED display | Operation |
| :---: | :---: | :---: |
| － | 50.0 | Displays the operation frequency． <br> （When standard monitor display selection $F 7 ; 0=0$［Output frequency］） |
| MODE | В近 | The first basic parameter＂History function（ $\%$ UiH）＂is displayed． |
| $\triangle \vee$ | $F \%$ | Press either the $\triangle$ or $\nabla$ key to select＂$F \boldsymbol{\Pi}$ ，＂ |
| （ENT | 50.0 | Press the ENTER key to display the operation frequency． |
| （®） | 50.0 | Press either the $\triangle$ key or the $\nabla$ key to adjust the meter． <br> The meter reading will change at this time but be careful because there will be no change in the inverter＇s digital LED（monitor）indication． <br> ［Hint］ <br> It＇s easier to make the adjustment if you push and hold for several seconds． <br> By setup，before the needle of meter beings to sway，it will take time． |
| （ENT） | $50.0 \Leftrightarrow F \%$ | The adjustment is complete．Fif and the frequency are displayed alternately． |
| MOD） | 50.0 | The display returns to its original indications． （When standard monitor display selection $F 7 ; 0=0$［Output frequency］） |

Meter adjustment 1 when the inverter is at rest（adjustment by setting $F \cap 51$（ $8 \cap 5 \mathrm{~L}$ ）to 30 ：Fixed output 1 ， $3 \Xi$ ：Fixed output 2， 33 ：Fixed output 3）
If it is difficult to calibrate a meter because of large fluctuations of its reading，you may put the inverter out of operation to make its calibration easier．
 levels（a）through（d）shown in the table on the previous page change according to the settings of fixed outputs 1 through 3，as shown in the table below．Use this table as a reference when calibrating the meter（s）．
Values adjusted with fixed outputs are put out from the FM（AM）terminal when values in the table are used for operation．For examples of adjustments，see the next page．
Fixed output 1 comes in handy for adjusting items at adjustment level（a）or（c）．
Fixed output 2 comes in handy for adjusting items at adjustment level（b）．
Fixed output 3 comes in handy for adjusting items at adjustment level（d）．

|  | Meter adjustment |  |  |
| :---: | :---: | :---: | :---: |
| Adjustment level | $\begin{gathered} \text { Fixed output } 1 \\ F n 5 i(n \pi 5 i)=30 \end{gathered}$ | $\begin{gathered} \text { Fixed output } 2 \\ F \cap S L(R \cap S L)=32 \end{gathered}$ | $\begin{gathered} \text { Fixed output } 3 \\ F \pi 5 i(8 \pi 5 i)=33 \end{gathered}$ |
| （a） | FH＊2 | 54\％ | 40\％ |
| （b） | 185\％ | 100\％ | 74\％ |
| （c） | 150\％ | 81\％ | 60\％ |
| （d） | 250\％ | 135\％ | 100\％ |

＊1：The $100 \%$ value of input／output power is the product of $\sqrt{3} \times 200 \mathrm{~V}(400 \mathrm{~V}) \times$ inverter＇s rated current．

［Example：Procedure of calibrating the meter connected to the terminal AM to which＂output current＂is assigned．］

| Key operated | LED display | Operation |
| :---: | :---: | :---: |
| － | 0.0 | Displays the operation frequency．（Perform during operation stopped．） （When standard monitor display selection $F 7: 0=0$［Output frequency］） |
| MODE | В近 | The first basic parameter＂History function（ $\mathrm{R} \dot{\mathrm{L}} \mathbf{i} \mathbf{H}$ ）＂is displayed． |
| （1） | 8\％5i | Press either the $\triangle$ or $\nabla$ key to select＂RO5L．＂ |
| （ENT） | 2 | Pressing the ENTER key allows the reading of parameter setting． |
| $\triangle$ | 32 | Set the parameter at $\exists \Xi^{\prime}$（fixed output for meter calibration 2）by pressing the $\triangle$ key． |
| （ENT） | $3 こ \Leftrightarrow R \cap 5$ <br> L | Press the ENTER key to save the change．Then， 8 in 5 L and the set value are displayed alternately． |
| （1） | $8 \%$ | Select the AM terminal meter adjustment $R, \square$ by pressing the $\triangle$ key． |
| （ENT） | 100 | Press the ENTER key to switch to the data display mode． |
| （®） | 180 | Press either the $\triangle$ key or the $\nabla$ key to adjust the meter． Adjust the pointer to the graduation to which you want it to point when the inverter passes a current $100 \%$ larger than its rated output current． <br> （The meter reading will change at this time but be careful because there will be no change in the inverter＇s indication）． <br> ［Hint］ <br> It＇s easier to make the adjustment if you push and hold for several seconds． <br> By setup，before the needle of meter beings to sway，it will take time． |
| （ENT） | 100¢R\％ | Press the ENTER key to save the change．Then $8 \%$ and the set value are displayed alternately． |
| V | 805： | Select the＂AM terminal meter adjustment 8 ．75L＂by pressing the $\nabla$ key． |
| ENT | 32 | Pressing the ENTER key allows the reading of parameter setting． |
| $V$ | $こ$ | Return the parameter setting to $こ$（output current display）． |
| ENT | 8月5：$\Leftrightarrow 2$ | Press the ENTER key to save the change．Then， 8 月5i and the set value are displayed alternately． |
| （MODE | 0.0 | Press the MODE key three times to return to the running frequency display mode．（When standard monitor display selection $F \boldsymbol{F} \boldsymbol{i}=\boldsymbol{0}$ ［Output frequency］） |

## Gradient bias adjustment of analog monitor output

Here is an example of the adjustment of output from $0-20 \mathrm{~mA} \rightarrow 20-0 \mathrm{~mA}, 4-20 \mathrm{~mA}$ using the FM terminal.

$F 582=0, F 5 B 3=100$


F5BE= 1, F5BJ=2?


F5BZ=0,F583=60


The analog output inclination can be adjusted using the parameter $F$ In.

### 5.17 PWM carrier frequency

## [F : PWM carrier frequency

F3 IE : Random mode
F 3 16 : Carrier frequency control mode selection

## , Function

1) The sound tone of acoustic noise can be changed by adjusting the PWM carrier frequency. This parameter is also effective in preventing the motor from resonating with its load machine or its fan cover.
2) In addition, this parameter reduces the electromagnetic noise generated by the inverter. Reduce the carrier frequency to reduce electromagnetic noise. Note: Although the electromagnetic noise level is reduced, the magnetic noise of the motor is increased.
3) The random mode reduces motor magnetic noise by changing the pattern of the reduced carrier frequency.
4) To set the parameter $F \exists i \leq$ to $\Xi$ or $\Xi$ has the effect of suppressing voltage serge to the motor. Reduce the carrier frequency to less than 4 kHz if the wiring between the inverter and motor is long ( 20 to 100 m as a guide).
5) In case of using the sinusoidal filter, set the parameter $F 3$ i 5 to 4 or 5 .

This parameter works at $200 \mathrm{~V}-55 \mathrm{~kW}$ or more and 400 V - 90 kW or more models.
[Parameter setting]

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| [F | PWM carrier frequency |  | According to model <br> $\Rightarrow$ Refer to page K-46 |
| F312 | Random mode | If:Disabled, i: Enabled | 0 |
| F3: 6 | Carrier frequency control mode selection | 7: Not decrease carrier frequency automatically <br> i:Decrease carrier frequency automatically <br> $\Sigma^{2}$ :Not decrease carrier frequency automatically, 400 V class supported <br> 3:Decrease carrier frequency automatically, 400 V class supported <br> 4 :Not decrease carrier frequency automatically, with sinusoidal filter <br> 5 :Decrease carrier frequency automatically, with sinusoidal filter | ' |

Note 1: For $200 \mathrm{~V}-55 / 75 \mathrm{~kW}$ models and $400 \mathrm{~V}-90 \mathrm{~kW}$ to $400 \mathrm{~V}-500 \mathrm{~kW}$ models, the carrier frequency is between 2.5 and 8.0 kHz inclusive.

Note 2: If $[\mathcal{F}$ is set at 2.0 kHz or above, it cannot be decreased below 2.0 kHz during operation. Changes made to decrease $[F$ below 2.0 kHz take effect when operation is restarted after it is stopped.
Note 3: If $[\mathcal{F}$ is 1.9 kHz or less, you cannot change the setting at 2.0 kHz or more. Changes made to increase $[\mathcal{F}$ to 2.0 kHz or above take effect immediately.
Note 4: If $\boldsymbol{P} L$ (V/f control mode selection) is set to $\mathcal{Z}, \exists, 4,7$, or $\Omega$, the inverter sets a lower limit of 2.0 kHz for $[\mathcal{F}$.
Note 5: If $F \mathcal{J} \boldsymbol{\prime}=4$ or 5 is set, it automatically becomes V/f control $(F L=0)$ mode. Moreover, the lower-limit of the career frequency becomes 4 kHz .
Note 6: If you change the carrier frequency, you may need to reduce the inverter's continuous output current. $\Rightarrow$ Refer to Section 1.4.4, "Current reduction curve."
Note 7: If the motor becomes overloaded when $F \exists i 5$ is set to $\Omega$ or $\Xi$ (carrier frequency not decreased automatically), an overload trip occurs.
Note 8: For the setting $F \exists: \sigma=\beth$ or $\Xi$ to take effect, power needs to be turned off and then turned back on. And this parameter is invalidated for the ratings of 90 kW and over.
Note 9: When setting $F \exists i G$ to $\Xi$ or $\Xi$, be sure to set $[F$ at 4.0 kHz or less.
Note 10: When setting the carrier frequency ( $[\mathcal{F}$ ) between $i$ and 1.9 kHz , you are recommended to set $F 50$ i below $130 \%$.

### 5.18 Trip-less intensification

### 5.18.1 Auto-restart (Restart during coasting)

## i'v 5 : Auto-restart control selection

|  |  |
| :--- | :--- |
| Mandatory | - Do not go near motors and equipment. <br> Motors and equipment that have stopped temporarily after momentary power failure will restart <br> suddenly after recovery. This could result in unexpected injury. <br> - Attach warnings about sudden restart after a momentary power failure on inverters, motors and <br> equipment for prevention of accidents in advance. |

## - Function

Auto-restart detect the rotating speed and direction of rotation of the motor during coasting or momentary power failure, to ensure that the motor restarts smoothly (Motor speed search function). This parameter also allows commercial power operation to be switched to inverter operation without stopping the motor. During operation, "r $\mathfrak{t r} \mathbf{y}$ " is displayed.

1) Auto-restart after momentary power failure (Auto-restart function)


Uu5= : This function operates after power has been restored following detection of an undervoltage by the main circuits and control power.

| Title | Function | Adjustment range | Default setting | Setting value |
| :---: | :---: | :---: | :---: | :---: |
| 405 | Auto-restart control selection | I):Disabled <br> i:At auto-restart after momentary stop $\mathcal{Z}$ :When turning ST on or off <br> 3: $1+2$ <br> 4:At start-up | 0 | i or 3 |

* If the motor is restarted in retry mode, this function will operate, regardless of the setting of this parameter.
* The function ( $i \sim \leq 5=\{, 2,3,4$ ) is activated when the reset of trip or the power is turned on.
* The function ( $14 \leq 5=1, \overline{3}$ ) is activated when an undervoltage is detected in the main circuit.

2) Restarting motor during coasting (Motor speed search function)

if $\lrcorner \boldsymbol{L}=\Omega$ : This function operates after the ST-CC terminal connection has been opened first and then connected again.

| Title | Function | Adjustment range | Default setting | Setting value |
| :---: | :---: | :---: | :---: | :---: |
| U45 | Auto-restart control selection | If:Disabled <br> ;:At auto-restart after momentary stop $Z:$ When turning ST on or off <br> 3: $1+2$ <br> 4 :At start-up | 0 | 2 or 3 |

* To restart the inverter in operation panel operation mode, press RUN key after a power failure.
* When $F \exists 75$ (Number of PG input phases) $=\boldsymbol{i}$ (single phase) in PG feedback vector control mode $(P \mathfrak{F}=7, \boldsymbol{\Omega})$, the inverter may trip ( $\mathcal{E - i \exists}$ : speed error) if the direction of rotation of the motor does not agree with.
*The function ( $i \boldsymbol{i} \boldsymbol{\sim} 5=3$ ) is activated when ST signal turning on or restart after a momentary power failure.
*The function ( $1, \sim 5=4$ ) is activated when starting each time.
Operation and application of the auto-restart function
- By using retry function $F 303$ together, auto restart function can be actuated at the time of tripping.


## Application to a crane or hoist

: The crane or hoist may have its load moved downward during the above waiting time from input of the operation starting : command to the restart of the motor. To apply the inverter to such machines, therefore, set the auto-restart control mode : selection parameter $\dot{i} \dot{\prime} 5$ to " 0 " (Disabled). And avoid using the retry function.
: At restart, it takes several seconds. for the inverter to check to see the number of revolutions of the motor. For this reason, the start-up takes more time than usual.
: When the auto restart function is selected, this function is actuated also at time of activation of motor and at the first operation after the reset of tripping. The operation will restart after the waiting time passes.
: - Use this function when operating a system with one motor connected to one inverter. This function may not operate : properly in a system configuration with multiple motors connected to one inverter.
5.18.2 Regenerative power ride-through control/Deceleration stop during power failure/Synchronized acceleration/deceleration

## U'ט [ : Regenerative power ride-through control

F3 10 : Non-stop control time/Deceleration time during power failure
F317 : Synchronized deceleration time
F 3 IB : Synchronized acceleration time
$F 525$ : Under voltage detection level
F529 : Regenerative power ride-through control level
Function

1) Regenerative power ride-through control: When momentary power failure occurs during operation, this
function makes operation continue using the regeneration
energy from a motor.
[Parameter setting]

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| UuL | Regenerative power ride-through control selection | 0:Disabled <br> i:Power ride-through <br> ? Deceleration stop during power failure: <br> 3 :Synchronized deceleration/acceleration (synchronized acceleration/deceleration signal) <br> 4 :Synchronized deceleration/acceleration (synchronized acceleration/deceleration signal+power failure) | 0 |
| F310 | Non-stop control time/Deceleration time during power failure | 0. $1 \sim 320.0 \mathrm{sec}$. | 2.10 |
| F317 | Synchronized deceleration time | D. 1-6000 sec. | 2.6 |
| F3i8 | Synchronized acceleration time | 0. 5 - 50000 sec . | 2.15 |
| Fbe'5 | Under voltage detection level | 50-15\%, 80: Automatic mode | BU |
| F629 | Regenerative power ride-through control level | 55-100\% | 75 |

 deceleration time when $i f L=\Sigma$ depends on the setting of $F=10$
Also, the deceleration time and the acceleration time when $L \dot{L}=3$ or 4 depend on the setting of $F 3 i 7$ and that of $F 3$;
Note 2: Even if these functions are used, a motor may coast according to load conditions.
In this case, use the auto-restart function along with this parameter function.
Note 3: These functions do not operate at the time of torque control.
Note 4: Jog run function doesn't operate at synchronized acceleration/deceleration.
 written when $t u$ is set to $E$ (momentary power failure slowdown stop).
Note 6: For the parameter F 5 E9. 100\% corresponds to 200 V ( 200 V class) or 400 V ( 400 V class).

[When power is interrupted]

The time for which the operation of the motor can be continued depends on the machine inertia and load conditions. Before using this function, therefore, perform verification tests. Use with the retry function allows the motor to be restarted automatically without being brought to an abnormal stop.
*1: Note: If power is interrupted during deceleration stop, power ride-through control will not be performed.
[If momentary power failure occurs]


[^7] ride-through control will not be performed.

Input voltage
－Even after the recovery from an input power failure，the motor continues slowing down to a stop．If the voltage in the inverter main circuit falls below a certain level，however，control will be stopped and the motor will coast．
－The deceleration time varies according to the setting of $F=1$ ．In this case，the deceleration time refers to the time elapsed before a motor running at $F \mathrm{H}$（maximum frequency）comes to a full stop．
－If the voltage in main circuit below $F \boxed{\boxed{O}} 5$（Under voltage detection level）at Non－stop control during power failure， the motor will coast and inverter display is shown＂5上合明（displayed alternately）＂．And then，If recovery from the input power failure，the motor continues coasting．
 signals is assigned to the input terminal S1）
$F$ ： 5 （Input terminal function selection $5(\mathrm{~S} 1))=\boxed{\square}$（Synchronized acceleration／deceleration signal）

－If the parameters $\vDash \exists ; 7, F \exists i g$ are set for same acceleration and deceleration time and if synchronized acceleration／deceleration signals set using the input terminal functions（ 52,53 ）are used，multiple motors can be stopped at about the same time or speed commands can be issued to them at about the same time．
－If a synchronized acceleration／deceleration signal is impressed，the synchronized deceleration function decreases the output frequency to OHz to decelerate the motor linearly within the time specified with $F \Xi i 7$ ．（The S－pattern operation function or the braking sequence cannot be used along with this function．）
When the motor comes to a full stop，the message＂STOP＂appears on the display panel．
－If the synchronized acceleration／deceleration signal is canceled during synchronized deceleration，the synchronized acceleration function increases the output frequency to the frequency at the start of synchronized deceleration or to the command frequency，whichever is lower，to accelerate the motor linearly within the time specified with $F=18$ ． （The S－pattern operation function，the braking sequence or the auto－tuning function cannot be used along with this function．）
When acceleration is started，the message＂STOP＂on the display panel disappears．
－If a forward／reverse switching command or a stop command is issued during synchronized acceleration or deceleration，synchronized acceleration or deceleration will be canceled．
－An example of setting when $\dot{i} \boldsymbol{\sim} \boldsymbol{L}=\boldsymbol{4}$
Synchronized deceleration if a synchronized acceleration／deceleration signal is impressed or if a power failure occurs，or synchronized acceleration if the synchronized acceleration／deceleration signal is canceled．

＊1：Even with $\dot{U} \boldsymbol{\sim}$ In this case，try to adjust the parameter＂Fロこら＂and＂Fロコロ＂．

## 5．19 Dynamic（regenerative）braking－For abrupt motor stop

## $P_{b}$ ：Dynamic braking selection

Pbr ：Dynamic braking resistance
$P b[P$ ：Allowable continuous braking resistance

## F5 79 ：Braking resistance overload time

## －Function

Dynamic braking is used in the following cases：
1）Need to stop the motor quickly．
2）The inverter trips because of an overvoltage（OP）during deceleration．
3）Fluctuation of load condition causes a regenerative power even at a constant speed such as press machine．
［Parameter setting］

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| Pb | Dynamic braking selection | I：Disabled <br> i：Enabled（bracking resistance overload detect） <br> Z：Enabled（bracking resistance overload not detect） | 0 |
| Pbr | Dynamic braking resistance | 8．5－1000 | According to model <br> $\Rightarrow$ Refer to page K－46． |
| PGEP | Allowable continuous braking resistance | 0.0 ： 0.00 .0 kW | $\begin{gathered} \text { According to model } \\ \Rightarrow \text { Refer to page K-46. } \end{gathered}$ |
| F539 | Braking resistance overload time | 8． $1-600.0 \mathrm{sec}$ ． | 5.0 |

＊Protection levels defined by $F$ Gこ5（Refer to Section 6．14．2）．
Note 1：The time set using $F 539$ is the time for which the resistor sustains an overload．（Enter the time elapsed before the inverter trips if a load 10 times as large as the allowable continuous braking resistance specified using $P_{b}[P$ is applied．）There is no need to change resistance settings recommended by Toshiba（except DGP resistance setting）．
Note 2：If the parameter $P_{b}$ is set to $;$ or $己$（regenerative braking selected），the inverter will be set automatically so as to deal with the regenerative energy from the motor by means of a resistor，without taking any action to limit overcurrent．（The same function as $F 355=i$ ）
Note 3：For inverters with ratings of 400V－200kW or more，set $P_{b}$ to $\Omega$ ，because separate dynamic braking units are not included as standard equipment．

All 200 V VF-AS1 and 400 V VF-AS1 with ratings of up to 160 kW have built-in dynamic braking transistors as standard equipment. If the rating of your inverter falls within this range, connect the resistor, as shown in Figure a) below or Figure b) on the next page. If your inverter has a power rating of 200 kW or more, connect a resistor, as shown in Figure c).

## Connecting an external braking resistor (optional)

a) External braking resistor (with a thermal fuse) (optional)

[Parameter setting]

| Title | Function | Adjustment range | Setting value |
| :---: | :---: | :---: | :---: |
| Pb | Dynamic braking selection | IV:Disabled <br> i:Enabled (braking resistance overload detect) <br> $z$ :Enabled (braking resistance overload not detect) | i |

Do not connect an external resistor with a resistance (combined resistance) smaller than the minimum admissible resistance.
For overload protection, be sure to set the parameters $P_{b}$ r and $P_{6}[P$ properly.
[Parameter setting]

| Title | Function | Adjustment range | Setting value |
| :--- | :--- | :--- | :---: |
| Pbr | Dynamic braking resistance | $0.5 \sim 1000 \Omega$ | Any value |
| PbiP | Allowable continuous braking <br> resistance | $0.0:-500.0 \mathrm{~kW}$ | Any value |
| 5.59 | Braking resistance overload <br> time | $0.1 \sim 500.0 \mathrm{sec}$. | Set the parameter to <br> 5.0 <br> to for type PBR $^{*}$ any value for other <br> types. |

b) When a using braking resistor without thermal fuse


Note 1: Connection when using an MCCB with a top coil instead of an MC.
Note 2: A depression transformer is required for 400 V models but not for 200 V models.
[Parameter setting]

| Title | Function | Adjustment range | Setting value |
| :---: | :---: | :---: | :---: |
| Pb | Dynamic braking selection | 0:Disabled <br> f:Enabled (braking resistance overload detect) <br> Z:Enabled (braking resistance overload not detect) | i |
| Pb, | Dynamic braking resistance | $0.5 \sim 1000 \Omega$ | Any value |
| PGLP | Allowable continuous braking resistance | 0.0.0-500.0 kW | Any value |

(When the thermal braking resistor option is not used, be sure to set the parameters Pb, and properly for overload protection.)

* As a last resort to prevent fire, be sure to connect a thermal relay (Be sure to use bimetals method). Although the inverter has a means of preventing overload and overcurrent to protect the braking resistor, the thermal relay is activated in case the protection function fails to work. Select and connect a thermal relay (THR) appropriate to the capacity (wattage) of the braking resistor.


## - Warning -

In the above circuit, the MC in the main circuit is turned off if an inverter's protective function is activated, and consequently no trip message is displayed. The inverter recovers from a trip if it is turned off. So, check the trip history record after turning off the inverter and then on again. $\Rightarrow$ Refer to Section 8.2.1.
To prevent a trip condition from being cleared by turning off the power and then on again, change the setting of the inverter trip retention selection parameter $F 5 \square \Omega \mathrm{Z} . \Rightarrow$ Refer to Section 6.33.2.
c) Capacities of $400 \mathrm{~V}-200 \mathrm{~kW}$ or more


Note 1: Connection when using an MCCB with a top coil instead of an MC.
[Parameter setting]

| Title | Function | Adjustment range | Setting value |
| :---: | :---: | :---: | :---: |
| Pb | Dynamic braking selection | II:Disabled <br> i:Enabled (braking resistance overload detect) <br> $z$ :Enabled (braking resistance overload not detect) | 0 |

* As a last resort to prevent fire, be sure to connect a thermal relay (Be sure to use bimetals method). Although the inverter has a means of preventing overload and overcurrent to protect the braking resistor, the thermal relay is activated in case the protection function fails to work. Select and connect a thermal relay (THR) appropriate to the capacity (wattage) of the braking resistor.


## - Warning -

In the above circuit, the MC in the main circuit is turned off if an inverter's protective function is activated, and consequently no trip message is displayed. The inverter recovers from a trip if it is turned off. So, check the trip history record after turning off the inverter and then on again. $\Rightarrow$ Refer to Section 8.2.1.
To prevent a trip condition from being cleared by turning off the power and then on again, change the setting of the inverter trip retention selection parameter F5:己. $\Rightarrow$ Refer to Section 6.33.2.

■ Selection of braking resistor option and braking unit
Standard braking resistors are listed in the table below．
The usage rate is $3 \%$ ．（Except for type DGP＊＊＊）

| Inverter type | Braking resistor |  |  |
| :---: | :---: | :---: | :---: |
|  | Model number ［Note 2］ | Rating | Continuous regenerative braking allowable capacity <br> ［Note 1］ |
| VFAS1－2004PL， 2007PL | PBR－2007 | 120W－200 | 90W |
| VFAS1－2015PL， 2022PL | PBR－2022 | 120W－75ת | 90W |
| VFAS1－2037PL | PBR－2037 | 120W－40 | 90W |
| VFAS1－2055PL | PBR3－2055 | 240W－20ת | 96W |
| VFAS1－2075PL | PBR3－2075 | 440W－15ת | 130W |
| VFAS1－2110PM | PBR3－2110 | 660W－10ת | 200w |
| $\begin{array}{r} \text { VFAS1-2150PM, } \\ 2185 \mathrm{PM} \\ \hline \end{array}$ | PBR3－2150 | 880W－7．5 | 270W |
| VFAS1－2220PM | PBR3－2220 | 1760W－3．3ת | 610W |
| VFAS1－2300PM | PBR3－2220 | 1760W－3．3ת | 610W |
| $\begin{gathered} \hline \text { VFAS1-2370PM } \\ \sim 2550 \mathrm{P} \\ \hline \end{gathered}$ | PBR－222W002 | 2200W－2ת | 1000W |
| VFAS1－2750P | DGP600W－B1 | $3.4 \mathrm{~kW}-1.7 \Omega$ | 3400W |
| VFAS1－4007PL ～4022PL | PBR－2007 | 120W－200 | 90W |
| VFAS1－4037PL | PBR－4037 | 120W－160ת | 90w |
| VFAS1－4055PL | PBR3－4055 | 240W－80』 | 96W |
| VFAS1－4075PL | PBR3－4075 | 440W－60』 | 130W |
| VFAS1－4110PL | PBR3－4110 | 660W－40 | 190W |
| VFAS1－4150PL， 4185PL | PBR3－4150 | 880W－30 | 270W |
| VFAS1－4220PL | PBR3－4220 | 1760W－15 | 540w |
| VFAS1－4300PL | PBR3－4220 | 1760W－15 | 540W |
| VFAS1－4370PL <br> ～4750PL | PBR－417W008 | 1760W－8ת | 1000W |
| $\begin{array}{\|r\|} \hline \text { VFAS1-4900PC } \\ \sim 4160 \mathrm{KPC} \\ \hline \end{array}$ | DGP600W－B2 | 7．4kW－3．7 | 7400W |
| VFAS1－4200KPC， 4220KPC | $\begin{gathered} \hline \text { PB7-4200K } \\ + \\ \text { DGP600W-B3 } \end{gathered}$ | $8.7 \mathrm{~kW}-1.9 \Omega$ | 8700W |
| VFAS1－4280KPC［Note 3］ | PB7－4200K <br> DGP600W－B4 | $14 \mathrm{~kW}-1.4 \Omega$ | 14000W |
| VFAS1－4355KPC， 4400KPC | PB7－4400K <br> DGP600W－B3 <br> $\times 2$（parallel） | $17.4 \mathrm{~kW}-0.95 \Omega$ | 17400W |
| VFAS1－4500KPC［Note 3］ | PB7－4400K <br> DGP600W－B4 <br> $\times 2$（parallel） | 28kW－0．7 | 28000W |

Note 1：Continuous regenerative braking allowable capacities vary according to the rated capacity and resistance of the resistor for reasons of endurance．
Note 2：PBR－
Note 3：PB7－4aםa：Braking unit（Connected to BU＋，BU－terminal）
Combined braking resistor（Connected to PA／＋，PB terminal of PB7－4םa口）

## Minimum resistance of connectable braking resistors

The minimum allowable resistance values of the externally connectable braking resistors are listed in the table below.
Do not connect braking resistors with smaller resultant resistance than the listed minimum allowable resistance values.
(For 200kW or greater models, a dynamic braking resistor drive unit (optional separate unit) is needed.)

| Inverter <br> Related output capacity <br> $(\mathrm{kW})$ | 200 V Class |  | 400V Class |  |
| :---: | :---: | :---: | :---: | :---: |
|  | Resistance of standard option | Minimum allowable resistance | Resistance of standard option | Minimum allowable resistance |
| 0.4 | $200 \Omega$ | $50 \Omega$ | - | - |
| 0.75 | $200 \Omega$ | $50 \Omega$ | $200 \Omega$ | $60 \Omega$ |
| 1.5 | $75 \Omega$ | $35 \Omega$ | $200 \Omega$ | $60 \Omega$ |
| 2.2 | $75 \Omega$ | $20 \Omega$ | $200 \Omega$ | $60 \Omega$ |
| 3.7/4.0 | $40 \Omega$ | $16 \Omega$ | $160 \Omega$ | $40 \Omega$ |
| 5.5 | $20 \Omega$ | $11 \Omega$ | $80 \Omega$ | $30 \Omega$ |
| 7.5 | $15 \Omega$ | $8 \Omega$ | $60 \Omega$ | $20 \Omega$ |
| 11 | $10 \Omega$ | $5 \Omega$ | $40 \Omega$ | $20 \Omega$ |
| 15 | $7.5 \Omega$ | $5 \Omega$ | $30 \Omega$ | $13.3 \Omega$ |
| 18.5 | $7.5 \Omega$ | $3.3 \Omega$ | $30 \Omega$ | $13.3 \Omega$ |
| 22 | $3.3 \Omega$ | $3.3 \Omega$ | $15 \Omega$ | $13.3 \Omega$ |
| 30 | $3.3 \Omega$ | $2.5 \Omega$ | $13.3 \Omega$ | $10 \Omega$ |
| 37 | $2 \Omega$ | $1.7 \Omega$ | $8 \Omega$ | $6.7 \Omega$ |
| 45 | $2 \Omega$ | $1.7 \Omega$ | $8 \Omega$ | $5 \Omega$ |
| 55 | $2 \Omega$ | $1.7 \Omega$ | $8 \Omega$ | $5 \Omega$ |
| 75 | $1.7 \Omega$ | $1.3 \Omega$ | $8 \Omega$ | $3.3 \Omega$ |
| 90 | - | - | $3.7 \Omega$ | $2.5 \Omega$ |
| 110 | - | - | $3.7 \Omega$ | $1.9 \Omega$ |
| 132 | - | - | $3.7 \Omega$ | $1.9 \Omega$ |
| 160 | - | - | $3.7 \Omega$ | $1.9 \Omega$ |
| 200 | - | - | $1.9 \Omega$ | $1 \Omega$ |
| 220 | - | - | $1.9 \Omega$ | $1 \Omega$ |
| 280 | - | - | $1.4 \Omega$ | $1 \Omega$ |
| 355 | - | - | $0.95 \Omega$ | $0.7 \Omega$ |
| 400 | - | - | $0.95 \Omega$ | $0.7 \Omega$ |
| 500 | - | - | $0.7 \Omega$ | $0.7 \Omega$ |

## 5．20 Standard default setting

## LYP ：Factory default setting

## －Function

This parameter is to set two or more parameters at a time for different commands．Using this parameter，all parameters can be also return to their respective default settings by one operation，and save or set specific parameters individually．

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| EYP | Factory default setting | B：－ <br> ：$: 50 \mathrm{~Hz}$ default setting <br> $2: 60 \mathrm{~Hz}$ default setting <br> 3：Factory default setting <br> 4 ：Trip clear <br> 5 ：Cumulative operation time cleared <br> 5：Initialization of type information <br> 7：Save user－defined parameters <br> $B$ ：Reset of user－defined parameters <br> 9：Cumulative fan operation time record clear <br> 10：Acceleration／deceleration time setting $0.01 \mathrm{sec} . \sim 600.0$ sec．［Note 4］ <br> ；i：Acceleration／deceleration time setting $0.1 \mathrm{sec} . \sim 6000 \mathrm{sec}$ ． | 0 |

Note 1：This parameter is used to change the settings of other parameters．Therefore， $\bar{\sigma}$ is always displayed．
Note 2：$t y^{P}$ cannot be set during the inverter operating．Always stop the inverter first and then program．
Note 3：When parameter $t \leq P$ is invoked，the value set previously is displayed on the left side of the parameter．
 used with the inverter．（The personal computer communications software PCM001Z cannot be used，either．） Furthermore，the copy function of the LED extended panel option（RKP002Z）does not work normally，so use only the parameter setting function and the monitoring function．
Note 5：If the power is turned off while the parameter $\varepsilon \unlhd P$ is being set，an error $\left(E \varepsilon \rho \Xi^{\prime}\right)$ will occur when the power is turned back on．If the $E E P 己$ error occurs，set $\varepsilon y P$ again．

## ［Programmed value］

## 50 Hz default setting（ $L \zeta P=i$ ）

Setting $\longleftarrow \unlhd \mapsto$ at $i$ causes all the following parameters to be set for operation using a base frequency of 50 Hz ．
（This does not change the settings of any other parameters．）
－Maximum frequency $F \mathrm{FH}$
$: 50 \mathrm{~Hz} \cdot \mathrm{VI} / \mathrm{II}$ input point 2 frequency $\boldsymbol{A}$ iF
： 50 Hz
－Base frequency 1 ul
－Base frequency $2 F$ ；70
－Base frequency $3 F: 74$
－Base frequency $4 F$ i 78
－Upper limit frequency $1 i \mathrm{~L}$
－Forward speed limit input level F Hご
－Reverse speed limit input level $F 4 \Omega B$
Comme
$\begin{array}{lrl}\text {－Point } 2 \text { frequency } F g ; 4 & : 50 \mathrm{~Hz} & \text { • PID output upper limit } F 370 \\ \text {－Automatic light－load high－speed operation frequency } F 330: 50 \mathrm{~Hz} & \text { • Motor rated rotational speed } F 4 \text { 分 } 7 \text { ：1400～1480min－1（According to model）}\end{array}$

## 60 Hz default setting（ $L Y P=$ ？$)$

Setting $\longleftarrow \checkmark$ at $\Xi$ causes all the following parameters to be set for operation using a base frequency of 60 Hz ．
（This does not change the settings of any other parameters．）
－Maximum frequency $F \boldsymbol{F}$
－Base frequency 1 uL
－Base frequency $2 F$ in
－Base frequency $3 F$ ：74
－Base frequency $4 F: 78$
－Upper limit frequency íl
－Forward speed limit input level $F 4 \Xi 5$
－Reverse speed limit input level $F 4 \Omega \square$
－Commercial power／inverter switching frequency $\digamma 355$
－Point 2 frequency $F$ ： 4
－Automatic light－load high－speed operation frequency $F 3 \exists \begin{aligned} & \text { I }\end{aligned}$

| ： 60 Hz | －VI／II input point 2 frequency $\boldsymbol{Q}_{\text {i }}$／ | 60 Hz |
| :---: | :---: | :---: |
| ：60Hz | －RR／S4 input point 2 frequency $\beta_{\sim} F_{2}$ | 60 Hz |
| ：60Hz | －RX input point 2 frequency $F \geq 19$ | 60 Hz |
| $: 60 \mathrm{~Hz}$ | －Al1 input point 2 frequency $F こ ゙ 5$ | 60 Hz |
| ：60Hz |  | 60 Hz |
| ： 60 Hz | －RP／high－speed pulse input point 2 frequency $\boldsymbol{F}$ こコ $^{\text {® }}$ | 60 Hz |
| ：60Hz | －PID deviation upper limit F354 | 60 Hz |
| $: 60 \mathrm{~Hz}$ | －PID deviation lower limit $F 355$ | 60 Hz |
| $: 60 \mathrm{~Hz}$ | －Process upper limit F 557 | 60 Hz |
| $: 60 \mathrm{~Hz}$ | －PID output upper limit $F 37$ 亿 | 60 Hz |
| ：60Hz | －Motor rated rotational speed F407 ：1680～1775min－1（A | 0 mod |

## Default setting ( $L$ YP=3)

Setting parameter $\Sigma \leq \square$ to $\exists$ resets all parameters except the following to their default settings.
When this parameter is set to $3, i \mathrm{in}$ is displayed for a while, then switches back to the original display ( $O F F$ or $\square .0$. Note that this setting also clears all trip history records. Trip history data will be cleared at this time.

Following parameters are designed considering maintenance that they cannot be reset to the factory default setting even if you set the parameter $t \exists$ at $\exists$. Following parameters are not displayed on the user parameter group Lir if even if their settings are different from their default settings. So please be careful.

| Title | Function |
| :---: | :---: |
| Fin | History function |
| F\%5i | FM terminal meter selection |
| $F \%$ | FM terminal meter adjustment |
| 8751 | AM terminal meter selection |
| $8 \%$ | AM terminal meter adjustment |
| $F 108$ | Analog VI/VII voltage/current switching |
| $F 969$ | Analog AI2 (optional circuit board) voltage/current switching |
| $F 470$ | VIIII input bias |
| F471 | VI/II input gain |
| $F 472$ | RR/S4 input bias |
| $F 473$ | RR/S4 input gain |
| $F 474$ | RX input bias |
| $F 475$ | RX input gain |
| F476 | Optional Al1 input bias |
| $F 477$ | Optional Al1 input gain |


| Title | Function |
| :---: | :---: |
| F478 | Optional Al2 input bias |
| F479 | Optional Al2 input gain |
| F569 | Logic output/pulse train output selection (OUT1) |
| F572 | MON1 terminal meter selection |
| F573 | MON1 terminal meter adjustment |
| F574 | MON2 terminal meter selection |
| F575 | MON2 terminal meter adjustment |
| F58 i | FM voltage/current output switching |
| F58日 | MON1 voltage/current output switching |
| F59 | MON2 voltage/current output switching |
| $\begin{aligned} & F 75 i \sim \\ & F 782 \\ & \hline \end{aligned}$ | Quick registration parameter 1~32 |
| F880 | Free notes |
| F899 | Network option reset setting |

## Trip clear ( $L Y P=4$ )

Setting $t \unlhd P$ to 4 initializes the past four sets of recorded trip history data.

* (The parameter does not change.)


## Cumulative operation time clear ( $L Y P=5$ )

Setting $\varepsilon y^{\prime} \rho$ to 5 resets the cumulative operation time monitor to the initial value (0 [zero] time).

## Initialization of type information ( $L \unlhd P=6$ )

When a trip occurs because of a type error ( $E L \zeta P$ is displayed), you can clear the trip by setting $\varepsilon \exists P$ to $\sigma$. This function is used to reformat a control circuit board to adapt it to an inverter, for example, when a circuit board is removed from an inverter to use another inverter for maintenance or for other reasons. This setting clears all type data stored in the inverter.

## Save user-defined parameters ( $L \cup P=7$ )

Setting $\xi^{\prime} \boldsymbol{S}^{\circ}$ to 7 causes all the current parameter settings to be stored individually.

## Reset of user-defined parameters ( $L \Psi P=8$ )

Setting $t \leq P$ to $g$ returns all parameters to the settings saved by setting the parameter $\varepsilon \unlhd P=7$.

* The above settings 7 and $B$ allows you to have your own default parameter settings.


## Cumulative fan operation time clear ( $L y P=9$ )

Setting $\varepsilon \leq P$ to 9 resets the cumulative fan operation time to the initial value ( 0 [zero] time). Set this parameter when replacing the cooling fan, and so on.

## Acceleration/deceleration time setting: 0.01 to $\mathbf{6 0 0 . 0} \mathbf{~ s e c}$. ( $\llcorner\cup P=i \hat{U})$

When $t \leq P$ is set to 10 , the acceleration/deceleration time can be set within a range of 0.01 to 600.0 sec .

## Acceleration/deceleration time setting: 0.1 to 6000 sec . $\left(\begin{array}{|}\hline\end{array} \mathbf{P}=\mathbf{i}\right.$ i)

When $t \leq P^{\square}$ is set to $i t$, the acceleration/deceleration time can be set within a range of 0.1 to 6000 sec .

### 5.21 Searching for all reset parameters and changing their settings

## Urit: Automatic edit function

## - Function

Automatically searches for only those parameters that are programmed with values different from the standard default setting and displays them in the user parameter group ín. Parameter setting can also be changed within this group.

Note 1: If you reset a parameter to its factory default, the parameter will no longer appear in 5 ir if .
Note 2: It may take several seconds to display changed parameters because all data stored in the user parameter
 press the MOD key

Note 3: Parameters wnich cannot be reset to the default setting after setting $\llcorner\unlhd \wp$ to $\exists$ are not displayed. $\Rightarrow$ Refer to Section 5.20 for details.

- How to search and reprogram parameters

The operations of search and resetting of parameters are as follows.

| Key operated | LED display | Operation |
| :--- | :--- | :--- |

### 5.22 EASY key function

## PSEL : Registered parameter display selection <br> F75i-F782: <br> Quick registration parameter 1~32

## F 750 : EASY key function selection

## - Function

The following three functions can be assigned to the (EASY) key for easy operation by means of a single key.

- Setting monitor mode switching function
- Shortcut key function
- Operation panel/remote key function
[Parameter setting]

| Title | Function | Adjustment range | Default setting |
| :---: | :--- | :--- | :---: |
| $F 5 E:$ | Registered parameter <br> display selection | I: Standard setting mode at time of activation <br> of motor <br> $i:$ Quick mode at time of activation of motor <br> $2:$ Quick mode only | 0 |
| $F 750$ | EASY key function selection | I: Quick mode/ standard setting mode <br> switching function <br> i:Shortsut key: <br> Pressing for 2 sec. to record the parameter, <br> pressing normally to jump to recorded <br> parameter (first jump to the 1st history) <br> 2:Operation panel/remote key: <br> Operation panel by ON <br> 3: Monitor peak minimum hold trigger | 0 |

## ■ Quick mode/standard setting mode switching function ( $F 75 \boldsymbol{i}=\boldsymbol{i}$ )

The EASY key allows you to switch between quick mode and standard setting mode.
The way parameters are read out and displayed varies according to the mode selected.

## Quick mode

This mode allows you to previously select parameters (max. 32 parameters) whose settings need to be changed frequently and to read them out only. Eight parameters are selected by default; add or remove parameters as required.

## Standard setting mode

Standard setting mode in which all parameters are read out.
[How to read out parameters]
To enter the setting monitor mode, set parameter $F 750$ to 0 , switch to the setting monitor mode using the EASY key, and then press the MODE key.
Press the $\triangle$ key or the $\nabla$ key to read out parameters in ascending or descending order.
The relation between the parameter and the mode selected is shown below.

## P5E: $=0$

* Standard setting mode at time of activation of motor. Press the EASY key to switch to the quick mode.
* Quick mode at time of activation of motor. Press the EASY key to switch to the standard setting mode.


## PSEL $=2$

* Quick mode (fixed).
* How to cancelxk the Quick mode ( $\left.\rho 5 E L=\Xi^{3}\right)$ setting

When this parameter is set to 2 (Quick mode), press and hold down the ENT key for 5 seconds or more.
［How to select parameters］
Select the desired parameters as parameters 1 to $32\left(F 75 i \sim F 7 日 \Sigma^{\prime}\right)$ ．Note that parameters should be specified by communication number．For communication numbers，refer to Table of parameters．
In the quick mode，only parameters registered as parameters 1 to 32 are displayed in order of registration．
By default，parameters are set as shown in the table below．
［Parameter setting］

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| F75i | Quick registration parameter 1 | B－999 |  |
| $F 752$ | Quick registration parameter 2 | 日－999 | $15(0 L)$ |
| F753 | Quick registration parameter 3 | 0－999 | $17(F H)$ |
| $F 754$ | Quick registration parameter 4 | 日－999 | G（GLE） |
| F755 | Quick registration parameter 5 | －1～999 | 1可（GEL） |
| F756 | Quick registration parameter 6 | 0－999 | 5007 （L） |
| F757 | Quick registration parameter 7 | 日－999 | E（F\％） |
| $\begin{aligned} & F 758 \\ & \tilde{F} 78 i \end{aligned}$ | Quick registration parameter 8 Quick registration parameter 31 | 0－999 | 999 |
| $F 782$ | Quick registration parameter 32 | 日 0999 | $50(\square 5 E L)$ |

Note：If any number other than communication numbers is specified，it is
Continuous 999 ：Disabled regarded as 999 （no function assigned）．

■ Shortcut key function（F750＝i）
This function allows you to register，in a shortcut list，parameters whose settings need to be changed frequently so that you can read them out easily in a single operation．
The shortcut is usable in the frequency monitor mode only．
［Operation］
Set the parameter $F 750$ to $i$ ，read out the setting of the parameter you want to register，and press and hold down the EASY key for 2 sec ．or more．The registration of the parameter in a shortcut list has been completed． To read out the parameter，just press the EASY key．

## ■ Operation panel／remote key function（ $F 75 \boldsymbol{0}=$ こ）

This function allows you to easily switch control devices（operation panel and terminal board）used to start and stop operation and to set the frequency．
To switch between control device，set the parameter $F 75 \Omega$ to $コ$ ，and then select the desired control device， using the EASY key．
［When using the terminal board］
If $[\cap \Omega=0$ ，no switching operation is required．
［When using the operation panel］
Turn on the EASY key．

## Peak hold function（F750＝3）

This function allows you to set peak hold and minimum hold triggers for parameters $F 709, F 955, F 958$ ， $F 970$ and $F 972$ ，using the EASY key．The measurement of the minimum and maximum values set for $F 709$ ， $F 956, F 958, F 970$ and $F 972$ starts the instant when you press the EASY key after setting parameter F 750 to 3 ．
The peak hold and minimum hold values are displayed in absolute values．

## 6. Extended parameters

Extended parameters are provided for sophisticated operation, fine adjustment and other special purposes.
$\Rightarrow$ Refer to Section 11, Table of parameters.

### 6.1 Input/output parameters

### 6.1.1 Low-speed signal

\section*{| $F$ IS | : Low-speed signal output frequency |
| :--- | :--- | :--- |}

## - Function

When the output frequency exceeds the setting of $F 100$ an ON signal will be generated. This signal can be used as an electromagnetic brake excitation/release signal.

Through the open collector terminal OUT1 or OUT2 (24Vdc-50mA [max.]).
[Parameter setting]

| Title | Function | Adjustment range | Default setting |
| :---: | :--- | :--- | :---: |
| $F, ~ 亿 ~$ |  |  |  |


[Connection diagram (SW1 set to sink logic)]


- Output terminal setting

The low-speed signal (ON signal) output function has been assigned to the terminal OUT1 by default. This setting must be changed to invert the polarity of the signal.
[Parameter setting]

| Title | Function | Adjustment range | Example of setting |
| :---: | :---: | :---: | :---: |
| F'30 | Output terminal function selection 1(OUT1) | 8-255 | 4 (ON signal) or 5 (OFF signal) |

[^8]
### 6.1.2 Putting out signals of arbitrary frequencies

| $F$ I : Speed reach setting frequency |
| :--- | :--- | :--- |
| $F$ in |

FiAD : Speed reach detection band

## - Function

When the output frequency becomes equal to the frequency set by $F i \Omega: \pm F: \Omega 己$, an ON or OFF is generated.
[Parameter setting of frequency and detection band]

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| $F 101$ | Speed reach setting frequency |  | \%1.17 |
| $F 102$ | Speed reach detection band | 可. $1 \sim 12 \mathrm{~Hz}$ | 2.5 |

[Parameter setting of output terminal selection]

| Title | Function | Adjustment range | Example of setting |
| :---: | :---: | :---: | :---: |
| Fi3i | Output terminal function selection 2 (OUT2) | 8-255 | ```G(RCH (specified speed ON signal) ) or G(RCH (specified speed OFF signal) )``` |

Note:To put out signals to OUT1, select the parameter $F: 30$.

## 1) If the detection band value + the set frequency is less than the designated frequency


2) If the detection band value + the set frequency is more than the designated
frequency


### 6.2 Input signal selection

### 6.2.1 Priority when forward/reverse run commands are entered simultaneously

Fins : Priority when forward/reverse run commands are entered simultaneously

- Function

This parameter allows you to select the direction in which the motor runs when a forward run ( $F$ ) command and a reverse run ( $R$ ) command are entered simultaneously.

1) Reverse run
2) Deceleration stop
[Parameter setting]

| Title | Function | Adjustment range | Default setting |
| :---: | :--- | :--- | :---: |
| $F i 05$ | Priority when forward/reverse run <br> commands are entered <br> simultaneously | 0 :Reverse run, $i:$ Stop | $i$ |




\section*{6．2．2 Assigning priority to the terminal board in the operation panel and operation mode | $F$ | 0 |
| :--- | :--- |}

## －Function

This parameter is used to give priority to certain external commands entered from the terminal board in operation panel and operation mode．
For example，when jogging the motor by giving signals externally．
［Parameter setting］

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| F105 | Input terminal priority selection | 0 ：Disabled，i：Enabled | 0 |

［ 8 ：Deselect（terminal board has no priority）］
Priority is always given to commands（operation commands）entered from the operation panel．To give priority to commands from the terminal board，it is necessary to switch from control panel operation to terminal board operation by sending signals through the terminal board．

［ i ：Select（terminal board has priority）］
Priority is given to commands entered from the terminal board even in operation panel operation mode．


Priority command from terminal board（Operation command）
Jog run ：input terminal selection $: 8 / 9$
DC braking ：input terminal selection ここここコ
An example of switching to jog run in operation panel operation mode．
［In case that terminals S3 and CC are assigned to jog run］
Assign control terminal S3（［ 14 ：preset speed 3］in default setting）as the jog run setting terminal．

| Title | Function | Adjustment range | Example of setting |
| :---: | :--- | :--- | :---: |
| $F:: 7$ | Input terminal function <br> selection $7(\mathrm{~S} 3)$ | $\Delta \sim: 35$ | $i B$（Jog run settin g terminal） |



### 6.2.3 Analog input signal switching

## $F$ INB : Analog input VI/VII voltage/current switching

Fing : Analog input AI2 (optional circuit board) voltage/current switching

## - Function

These parameters are used to switch signals to be sent to the analog input terminals VI/II and AI2 (optional).


When using the analog input terminal $\mathrm{VI} / \mathrm{II}$ as a voltage input terminal (VI) F $108=0$


When using the analog input terminal $\mathrm{VI} / \mathrm{II}$ as a voltage input terminal (II)
$F$ 行 $B=$;

$\Rightarrow$ For an explanation of input gain and bias adjustments, refer to Section 6.28.

## 6．3 Terminal function selection

6．3．1 Keeping an input terminal function always active（ON）
Fi in ，Fi己 7，FiZg：Always ON function selection 1～3
－Function
This parameter specifies an input terminal function that is always kept active（ON）．（Only one function selectable）
［Parameter setting］

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| $F: 18$ | Always ON function selection 1 | 日 135 | Inverter with a model number ending with －WN，HN： $\boldsymbol{\Omega}$ |
| $F 127$ | Always ON function selection 2 | 日 135 | 8 |
| $F 1 \Xi \square$ | Always ON function selection 3 | 日 135 | $\square$ |

＊The selected function is always kept active regardless of the type of logic（positive or negative）in the table of function settings in 7．2．1．

6．3．2 Modifying input terminal functions

| Fili | ：Input terminal function selection 1 （F） | Fi：7 ：Input terminal function selection 7 （S3） |
| :---: | :---: | :---: |
| F；12 | ：Input terminal function selection 2 （R） | Fi 1 B ：Input terminal function selection 8 （RR／S4） |
| F：13 | ：Input terminal function selection 3 （ST） | $F: 19-F i 25$ |
| F：14 | ：Input terminal function selection 4 （RES） | Input terminal function selection 9－16 |
| Fi：5 | ：Input terminal function selection 5 （S1） | Fi64－Fi67 |
| F：16 | ：Input terminal function selection 6 （S2） | Input terminal function selection 17－20 |

$\Rightarrow$ For details，refer to Section 7．2．1．

```
- Function
    Use the above parameters to send signals from an external programmable controller to various control input
    terminals to operate and/or set the inverter.
    The desired contact input terminal functions can be selected from 120 types (0-i弓5). This gives system
    design flexibility.
    Using the SW3 switch, the function of the RR/S4 terminal can be selected between analog input and contact
    input. By default, the RR/S4 terminal is set as an analog input terminal (voltage input terminal). To use it as a
    contact input terminal, therefore, you need to turn the SW3 switch to the S4 position.
```

■ Setting of contact input terminal function

| Terminal symbol | Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: | :---: |
| － |  | Always ON function selection 1～3 | $\begin{aligned} & 0 \sim 135 \\ & (\Rightarrow \text { Refer to } \\ & \text { Section 11. }) \end{aligned}$ | 0 |
| F | $F i t i$ | Input terminal function selection 1 （F） |  | 2 （F） |
| R | $F: 12$ | Input terminal function selection 2 （R） |  | 4 （R） |
| ST | $F$ i 10 ［Note 4］，F i 13 | Input terminal function selection 3 （ST） |  | 5 （ST） |
| RES | $F: 14$ | Input terminal function selection 4 （RES） |  | $B$（RES） |
| S1 | Fit5 | Input terminal function selection 5 （S1） |  | 10 （S1） |
| S2 | $F: 15$ | Input terminal function selection 6 （S2） |  | 12 （S2） |
| S3 | $F i 17$ | Input terminal function selection 7 （S3） |  | $14(\mathrm{~S} 3)$ |
| The terminal below is operative only when SW3 is in the S4 position． |  |  | － | － |
| RR／S4 | $F i f B$ | Input terminal function selection 7 （S4） | 2－ 135 ［Note 2］ | i5（S4） |

Note 1：The function that has been selected using $F: 10, F: \mathcal{Z}$ and $F: 己 马$（always ON function selection 1～3 parameter）are always activated．
Note 2：When using the RR／R4 terminal as a contact input terminal（sink logic），always turn the SW3 slide switch to the S4 position．
Note 3：VFAS1－＊＊＊＊－WN，HN
Note 4：VFAS1－＊＊＊＊－WP

## - Connection method

1) a-contact input

2) Connection with transistor output


* Interface between programmable controller and inverter

Note: When using a programmable controller with open collector outputs for control, connect it to the P24/PLC terminal, as shown in the figure below, to prevent the inverter from malfunctioning because of current flowing in.
Also, be sure to turn the SW1 slide switch to the PLC position.

Programmable controller

3) Sink logic/source logic input

Sink logic/source logic (input/output terminal logic) switching is possible.
$\Rightarrow$ For details, refer to Section 2.3.2.

## 6．3．3 Using the servo lock function

| $F$ i $]$ ：Input terminal function selection 3 （ST） |
| :--- | :--- |
| $F$ |

$F 240$ ：Starting frequency setting

```
－Function
As with the operation of a server motor，these parameters allow you to operate the motor at OHz by simply issuing an operation signal．These parameters are used to hold the motor at a standstill．
```

［Parameter setting］

| Title | Function | Adjustment range | Example of setting |
| ---: | :--- | :--- | :---: |
| $F ; 13$ | Input terminal function selection 3（ST） | $0 \sim 135$ | 70 |
| $F E 40$ | Starting frequency setting | $0.0 \sim \sim 10.0 \mathrm{~Hz}$ | 0.0 |

Note 1：This function is enabled only when parameter $P L$ is set to $g$（PG feedback vector control）．
Note 2：To activate servo lock，parameter $F 240$（starting frequency setting）needs to be set to 0 ［ Hz ］．
Note 3：These parameters are not intended for position control，and if a load larger than the holding power of the motor is applied，the motor rotates．Keep this in mind．

If parameter $F: 13$（for selecting a function for the ST terminal）is set to 70 ，a servo lock signal is added to the ST signal．In that case，turning on the signal to the ST terminal activates the servo lock function．Note that even when the servo lock function is activated，or the operations can be performed normally by inputting an F or R signal．


Even if the motor is started with servo lock activated，a starting torque of $150 \%$ or more can be produced．
In such a case，however，the thermal protection level is lowered just as is the case with low－speed operation．
Therefore，the following parameters

- $\quad$ 倍（Thermal protection characteristic selection）
- LH，（Motor electronic－thermal protection level 1），Fiフラ，Fi77，Fi日i
－F505（OL reduction starting frequency）
－F 57 （Motor $150 \%$－overload time limit）
need to be adjusted according to the motor．


## 6．3．4 Modifying output terminal functions

F ；ヨV ：Output terminal function selection 1 （OUT1）
Fi3 ：Output terminal function selection 2 （OUT2）
FiJ2 ：Output terminal function selection 3 （FL）
Fi33－Fi3g ：Output terminal function selection 4～9
F 15
$\Rightarrow$ For details，refer to Section 7．2．2．

### 6.3.5 Response time of input/output terminals

| F 140 | 1 response time selection |
| :---: | :---: |
| F141 | : Input terminal 2 response time selection |
| F 142 | : Input terminal 3 response time selection |
| F143 | : Input terminal 4 response time selection |
| F 144 | : Input terminal 5~12 response time selection |
| $F 145$ | : Input terminal 13~20 response time selec |

$\Rightarrow$ For details, refer to Section 7.2.3.
The output terminal and the response time can be set with "My function."
$\Rightarrow$ For details, refer to Section 6.39.

### 6.4 Basic parameters 2

6.4.1 Switching among V/f characteristics 1, 2, 3 and 4 from input terminal | $F$ i | : Base frequency 2 |
| :--- | :--- |
| $F i 75$ | : Manual torque boost 3 |

 Fi72 : Manual torque boost $2 \quad$ Fi78: Base frequency 4 \begin{tabular}{|l|l|}
\hline$F$ i 7 : \& Thermal protection level 2 Fi79: : Base frequency voltage 4

 

\hline$F$ I74 : Base frequency 3 \& $F$ 18 <br>
\hline$F$ : \& Manual torque boost 4
\end{tabular}



```
- Function
Use the above parameters to switch the operation of 4 motors with a single inverter and to select motor \(\mathrm{V} / \mathrm{f}\) characteristics (1 to 4) according to the particular needs or operation mode.
[Switching methods]
Terminals are used for this switching.
Note: The setting of parameter \(\boldsymbol{O}_{L}\) (V/f control mode selection) is valid only when \(\mathrm{V} / \mathrm{f} 1\) is selected. If \(\mathrm{V} / \mathrm{f} 2, \mathrm{~V} / \mathrm{f} 3\) or \(\mathrm{V} / \mathrm{f} 4\) is selected, \(\mathrm{V} / \mathrm{f}\) control is performed in constant torque mode. Do not switch motors when the parameter \(P L\) (V/f control mode selection) is set at \(\boldsymbol{7}, \boldsymbol{B}\). For parameters selected when changing V/f characteristics (1 to 4), refer to table on the next page.
```

[^9]- Setting of switching terminals

The V/f1, V/f2, V/f3 and V/f4 switching function is not yet assigned to any terminal. Therefore, it is necessary to assign them to unused terminals.

Ex.) Assigning the V/f switching 1 function to S 1 and the V/f switching 2 function to S 2 .

| Title | Function | Adjustment range | setting value |
| :---: | :---: | :---: | :---: |
| Fit5 | Input terminal function selection 5 (S1) | D-135 | こB (V/f switching 1) |
| $F: 15$ | Input terminal function selection 6 (S2) | 0-135 | 30 (V/f switching 2) |

«An example of the connection of terminals: SW1 set to sink logic»


| S1-CC | S2-CC | V/f | Parameters selected |
| :---: | :---: | :---: | :---: |
| OFF | OFF | 1 | Base frequency 1 $: u t$ <br> Base frequency voltage 1 $: u L$ <br> Manual torque boost 1 $: u b$ <br> Thermal protection 1 $:\llcorner, \quad$, |
| ON | OFF | 2 | Base frequency 2 $: F: 70$ <br> Base frequency voltage 2 $: F: 7:$ <br> Manual torque boost 2 $: F: 72$ <br> Thermal protection 2 $: F: 73$ |
| OFF | ON | 3 | Base frequency 3 :F 774  <br> Base frequency voltage 3 :F 75 <br> Manual torque boost 3 :F 75 <br> Thermal protection 3 $: F: 77$  |
| ON | ON | 4 | Base frequency 4 $: F: 78$ <br> Base frequency voltage 4 $: F: 79$ <br> Manual torque boost 4 $: F: B 0$ <br> Thermal protection 4 $: F: B:$ |

Note1:V/f switching is not able to change during the inverter running,. Always stop the inverter and then switch.
It is necessary to wait for 0.1 second and over until start up inverter from switch the V/f switching.
Note2:Select V/f1 when using the vector control and the V/f-5 point setting.
Selecting V/f2,.V/f3, or V/f4 disables vector control but enables the V/f constant control.
Note3:By using "My function," torque limits and acceleration/deceleration modes can be switched along with V/f switching.
Note4:With the operation panel or communication, the panel acceleration/deceleration selection $(F 504)$ can be set.

* This function is active only in operation panel operation mode.


### 6.5 V/f 5-point setting

| F 190 | : Vlf 5-point setting VF1 frequency | $F 195$ | : V/f 5-point setting VF4 frequency |
| :---: | :---: | :---: | :---: |
| Fi91 | : V/f 5-point setting VF1 voltage | $F 197$ | : V/f 5-point setting VF4 voltage |
| F192 | : VIf 5-point setting VF2 frequency | F 198 | : V/f 5-point setting VF5 frequency |
| F193 | : V/f 5-point setting VF2 voltage | F 199 | : V/f 5-point setting VF5 voltage |
| F 194 | : VIf 5-point setting VF3 frequency |  |  |
| F 195 | : V/f 5-point setting VF3 voltage |  |  |

### 6.6 Speed command switching

### 6.6.1 Using two types of frequency (speed) commands

Find : Frequency setting mode selection 1
$F 20 \mathrm{E}$ : Frequency priority selection
$F 2 \cap 7$ : Frequency setting mode selection 2
F2NB : Speed command priority switching frequency

## - Function

These parameters switch two types of frequencies

- Automatic switching by parameter setting
- Automatic switching by means of switching frequencies
- Switching with input terminal

1) Switching with input terminal board ( $F \mathcal{\sim} \mathcal{U}=\Omega$ )

Reference can be switched if the frequency priority switching function is assigned to a terminal.


A : Selects the command set with parameter $F$ ח0d. - Operation frequency command switching terminal OFF
B : Selects the command set with parameter $F \geq 07$. - Operation frequency command switching terminal ON

Ex.) When the frequency priority switching function is assigned to terminal S3.

| Title | Function | Adjustment range | Example of setting |
| :---: | :---: | :---: | :---: |
| $F 1: 7$ | Input terminal function selection 7 (S3) | 8-135 | 104(Operation frequency command switching) |

«An example of the connection of terminals: SW1 set to sink logic»

|  |  | Speed command |
| :---: | :---: | :---: |
| s3 | OFF | Command selected with Find |
| cc | ON | Command selected with F207 |

2）Automatic switching by means of switching frequencies（ $F \mathcal{\sim} \hat{\mathcal{U}=\text { i）}}$


A：If the frequency set with $F \pi 0$ d is higher than that set with $F 20 B$
Priority is given to the command set with $F \boldsymbol{F} \boldsymbol{\square}$
B：If the frequency set with $\mathcal{F} 98$ is equal to or lower than that set with $F \mathscr{2} 8$
Priority is given to the command set with $F \underset{\sim}{2} 7$ ．

［ Parameter setting］

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| Fnid | Frequency setting mode selection 1 | ！VIIII（voltage／current input） <br> Z：RR／S4（potentiometer／voltage input） <br> 3：RX（voltage input） <br> 4 ：Operation panel input enabled <br> （including LED／LCD option input） <br> $5: 2$－wire RS485 communication input <br> $5: 4$－wire RS485 communication input <br> 7：Communications option input <br> B：Optional Al1（differential current input） <br> 9：Optional A12（voltage／current input） <br> i $0:$ Up／Down frequency <br> i ：Optional RP pulse input <br> I己：Optional high－speed pulse input <br> 13：－（Unsupported） | 2 |
| 5200 | Frequency priority selection | ```0:F \% Od/F 207 terminal switching (input terminal function selection 104 , 105) i:Fの日dFごロ7 frequency switching (switching with \(F こ \square g\) )``` | 0 |
| F207 | Frequency setting mode selection 2 |  | 1 |
| $F 208$ | Speed command priority switching frequency | O．i～F H Hz | 0.1 |

### 6.7 Operation frequency

### 6.7.1 Start frequency/Stop frequency

## $F 240$ : Start frequency setting <br> $F 243$ : Stop frequency setting

> - Function
> The frequency set with the parameter $F 240$ is put out as soon as operation is started. Use the $F 240$ parameter when a delay in response of starting torque according to the acceleration/deceleration time is probably affecting operation. Setting the starting frequency to a value from 0.5 to 2.0 Hz (max. 5Hz) is recommended. The occurrence of an overcurrent can be suppressed by setting this frequency below the rated slippage of the motor. If 0 speed torque is needed $(P t=7, g$ ), set $F 240$, $F 243$ at 0.0 Hz .
> • At start up : frequency set with $F 240$ is put out immediately.
> • At stop : The output frequency drops to 0 Hz immediately by the frequency set with $F 243$.
[Parameter setting]

| Title | Function | Adjustment range | Default setting |
| :---: | :--- | :--- | :---: |
| $F Z 40$ | Starting frequency setting | $0.0-10.0 \mathrm{~Hz}$ | 0.1 |
| $F 243$ | Stop frequency setting | $0.0-30.0 \mathrm{~Hz}$ | 0.0 |



Note: Set these parameters so that the start frequency $F 240$ is higher than the stop frequency $F 243$. If the $F 240$-set frequency is lower than the $F 243$-set frequency, the reference frequency must be higher than the $F=43$-set frequency to start the motor.
If both $F 240$ and $F 243$ are set to 0.0 Hz , the motor will start even if the frequency set is 0.0 Hz .

### 6.7.2 Run/Stop control with frequency setting signals

$F 241$ : Operation start frequency
$F 242$ : Operation start frequency hysteresis

## - Function

The Run/Stop of operation can be controlled simply with frequency setting signals.
[Parameter setting]

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| F24; | Operation starting frequency | 0.0-F H | 0.0 |
| $F 242$ | Operation starting frequency hysteresis | $0.01030 .0{ }^{\text {Hz }}$ | 0.0 |



## 6．7．3．Frequency setting signal 0 Hz dead zone handling function

F244 ：Frequency command dead band



Note 1：This function is invalid to preset the speed operation frequency command．
Note 2：It is effective as frequency instruction is to the frequency
 F卫召 7 ，communication，etc．
Note 3：The addition and multiplication of the override function is carried out to the frequency in which this function operated．

## 6．8 DC braking

## 6．8．1 DC braking

$F 250$ ：DC braking start frequency F25 i ：DC braking current

## F252 ：DC braking time F253 ：Forward／reverse DC braking priority control

## －Function

A large braking torque can be obtained by applying a direct current to the motor．These parameters set the direct current applied to the motor，the application time and the start frequency．
［Parameter setting］

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| F250 | DC braking start frequency | 0．0．$-120.0 \mathrm{~Hz}^{\text {a }}$ | 0.0 |
| F25 | DC braking current | 0～1可 \％ | 50 |
| $F 252$ | DC braking time | 0．01－20．0 sec． | 1.0 |
| F253 | Forward／reverse DC braking priority control | 7：Disabled，i：Enabled | 3 |


<DC braking start conditions>
The forward/reverse DC braking priority control function $F 53$ recognizes certain conditions such as stop commands from the inverter, and is activated when the output frequency goes down below the DC braking start frequency set with $F=5$. In this case, the conditions under which DC braking starts include not only the issue of a start or stop command from the operation panel or an external input device, but also a fall in the reference frequency below the value set with $F こ \vdash コ$ (stop frequency setting) or a fall in the output frequency below the operation stop frequency setting $F \underset{5}{2} 4$.
[DC braking under normal conditions] (Forward/reverse run DC braking priority control $\vDash \supseteq 5 \exists=\Omega$ [Disabled])

(1) If $F 255$ and $F 243>$ reference frequency
(2) If $F 250>$ reference frequency $>F 243$ If $F 250$ and $F 243>$ reference frequency
(3) If an operation command is entered during DC braking
: DC braking
: Operation at the command frequency
: DC braking
: DC braking is discontinued to restart the operation.
［Priority to DC braking during forward／reverse operation］（Forward／reverse run DC braking priority control Fこちコ＝（［Enabled］）

«SW1 set to sink logic»
（4）During normal forward／reverse run $(F こ 5 \Xi=\pi)$
：Not recognized as a stop command，so that the DC braking is not active．
（5）If a reverse run（or forward）command is entered during forward run（or reverse）$(F こ 5 \Xi=i)$ ：
DC braking when the frequency set with $F こ 50$ decreases below the reference frequency during deceleration．
（6）If an operation command is entered during DC braking：RUN command has a priority．
（7）If an operation command is changed from ON to OFF during DC braking，DC braking is discontinued to stop the operation．

## 6．8．2 Motor shaft fixing control

F254 ：Motor shaft fixing control

## －Function

This function is used to prevent the motor from running unexpectedly after the motor is stopped because it＇s shaft is not restrained or to preheat the motor．
［Parameter setting］

| Title | Function | Adjustment range | Default setting |
| :---: | :--- | :--- | :---: |
| $F \Xi 54$ | Motor shaft fixing control | $\square \square$ |  |

If the motor shaft fixing control parameter $F 254$ is set at $:$ ，DC braking continue at half a braking rate of that set with $\vDash こ 5 ;$ to retain the motor after it has come to a full stop by DC braking．To terminate the motor shaft fixing control cut off the standby signal（ST signal）．
Note：This function doesn＇t operate after a DC braking command is entered by control input terminal signal．


Note 1：If the motor shaft fixing control parameter $\mathcal{F} 54$ is set at $i$（enabled）when the output frequency is below the DC braking start frequency $F 250$ and terminals ST－CC are closed（ON），the DC braking function is activated and the motor shaft fixing control continues regardless of the setting of the DC braking time parameter $F 255$ ．
Note 2：If a power failure occurs during motor shaft fixing control and the motor starts to a coast，motor shaft fixing control will be canceled．Also，if the inverter trips during motor shaft fixing control and is restored to working order by the retry function，motor shaft fixing control will be canceled．

## 6．8．3 Function of issuing a 0 Hz command during a halt

## F255：0Hz command output selection

## －Function

This function controls the motor in the zero－speed state at the time of stop．If this function is set up，the OHz command will be put out instead of DC braking at the time of a stop，and a motor will be controlled in the setting time stop state．The monitor display serves as $\sigma^{\prime} t$ during this control operation．This function operates only at the time of vector control with a sensor $(\square L=7, B)$ ．
Refer to DC braking（Section 6．8．1）for conditions of operation．The position of DC braking is served as an operation which sets the operation frequency command to OHz ．
［Parameter setting］

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| F255 | OHz command output selection | 7：Standard（DC braking） <br> ： OHz command | 0 |
| $F 250$ | DC braking starting frequency |  | 21．0 |
| $F 25 \Omega$ | DC braking time |  | 1.2 |

Note 1：This function doesn＇t operate when $F=5 \Omega=$ 亿． 2 亿．
Note 2：If this function is set up，motor shaft fixing control $F 254$ cannot be used．
Note 3：This function doesn＇t operate at the time of a torque control．
Note 4：This function doesn＇t operate except $\boldsymbol{Q}$ ：$=\overline{7}, \boldsymbol{B}$ of the vector control mode with a sensor．In order to use this function，the option board for PG feedback is required．When expect vector control with a sensor $P L=7, B$ ， this function operate as DC braking mode（It is the same as $F=55=0$ setting）．
Note 5：Since the reference frequency that will suspend the motor abruptly from the state of high rotation if（ $F 25 \Omega$ ） is set up highly，please be careful．A trip may occur according to load conditions．
Note 6：This parameter has a function similar to the DC braking function，which is activated by a command from the terminal board or an external control device（input terminal function $\mathcal{Z}$ こ or $コ コ コ$ ，or command from external control device）．To the DC braking function which will be activated if $F \Sigma \square i$（jog run stop pattern）is set to 2 （DC braking），and to the DC braking function which will be activated if $F \boxed{5} 9$（emergency stop pattern）is set to $コ$（DC braking），but it issues 0 Hz commands instead of DC braking commands．

### 6.9 Auto-stop in case of lower-limit frequency continuous operation (Sleep/Wake-up function)

## F255 : Time limit for lower-limit frequency operation

## - Function

If operation is carried out continuously at a frequency below the lower-limit frequency ( $L \dot{L}$ ) for the period time set $F こ 55$, theinverter will automatically slow down the motor to a stop.
" $\llcorner 5\llcorner\boldsymbol{\square}$ " is always displayed on the operation panel. (Blinking alternately)
The auto-stop function will be disabled when the frequency command value reaches over the lower limit frequency $(L, L)+0.2 \mathrm{~Hz}$ or the operation command is turned to off.
[Parameter setting]

| Title | Function | Adjustment range | Default setting |
| :---: | :--- | :--- | :---: |
| $F こ 55$ | Auto-stop in case of lower-limit frequency <br> continuous operation | $0.0:$ None <br> $0.7-500.0$ |  |



Note: This function is enabled even at the start of operation and during switching between forward and reverse run.

### 6.10 Jog run mode

## F250 : Jog run frequency

F25 i : Jog run stop pattern
$F 252$ : Operation panel jog run mode

## - Function

Use the jog run parameters to operate the motor in jog mode. Input of a jog run signal generates a jog run frequency output at once, irrespective of the designated acceleration time.
Also, you can choose an operation panel start/stop mode between the ordinary start/stop mode and the jog run start/stop mode.

The jog run function needs to be assigned to an input terminal. When assigning it to the S 3 terminal, set $F: i 7$ to $; B$.
The motor can be operated in jog run mode while the jog run setting terminals are connected (S3-CC: ON).
[Parameter setting]

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| F260 | Jog run frequency | $F 240 \sim 20.0 \mathrm{~Hz}^{\text {F }}$ | 5.0 |
| F26: | Jog run stop pattern | I:Deceleration stop, i: Coast stop, $z$ :DC braking stop | 0 |
| F26こ | Operation panel jog run mode | I:Disabled, <br> i:Operation panel jog run mode enabled | 0 |

<Examples of jog run (SW1 set to sink logic) >

## S3-CC (JOG) ON + F-CC ON: Forward jog run

S3-CC (JOG) ON + R-CC ON: Reverse jog run
Normal operation frequency signal input + F-CC ON: Forward run, Normal operation frequency signal input + R-CC ON: Reverse run


- The jog run setting terminal (S3-CC) is enabled when the operation frequency is below the jog run frequency. This connection does not function at an operation frequency exceeding the jog run frequency.
- The motor can be operated in jog mode while the jog run setting terminals are connected (S3-CC: ON).
- Jog run has priority, even when a new operation command is given during operation.
- Even during panel operation ( $\left[80 \sigma^{\prime}=i\right.$ ), the inverter can be switched forcibly to jog run mode by turning on or off the input terminal if parameter $F ; B G$ (input terminal priority selection) is set to $i$ and the jog run setting function ( 18,19 ) is assigned to the input terminal.
- Even for $F こ \Sigma \quad i=\Omega$ or $i$, an emergency $D C$ braking becomes enabled when setting $F 5 \Omega \Xi=\Omega$.
- If a forward run command and a reverse run command are entered simultaneously while $F$ i 05 (priority selection (both F-CC and R-CC are ON) is set to $\Pi$ (reverse run), operation modes are switched as follows: forward jog run $\rightarrow$ deceleration stop (jog frequency $\rightarrow 0 \mathrm{~Hz}$ ) $\rightarrow$ reverse jog run. Keep this in mind.
- The jog frequency is not restricted by the upper limit frequency ( $i i^{i} \mathrm{~L}$ ).
[Setting of jog run setting terminal (S3-CC)]
Assign control terminal S3 ([ $; 4$ : preset speed 3 ] in default setting) as the jog run setting terminal.

| Title | Function | Adjustment range | Example of setting |
| :---: | :---: | :---: | :---: |
| $F i: 7$ | Input terminal function selection 7(S3) | $\square \sim i 35$ | $i B$ (Jog run setting terminal) |

Note: During the jog run mode, there is LOW (low speed detection signal) output but no RCH (designated frequency reach signal) output, and PID control does not work.
-When the inverter is in panel jog mode, pressing the key displays $F 40$
 -When r, 0 it is displayed, the inverter will be placed in reverse jog run mode as long as the RUN key is held down. -During jog run, the direction of rotation can be changed using the the motor in the forward direction, or press the $\square$ key to run it in the reverse direction.
-If you press and hold down the RUN key for 20 seconds or more, the key failure alarm " $E$ - 17 " will be displayed.
The figure below shows the relationship between the operation panel jog run mode and each of the other modes.
Pressing the MODEkey, which will move the inverter through each of the modes.


Note1: When the inverter is in operation (RUN key lamp is lit) or when an operation command is issued (RUN key lamp is lit), the inverter cannot be switched to operation panel jog run mode.
Note 2: When parameter $F 105$ (input terminal priority selection) is set to $i$, the inverter does not display any message saying that it is in panel jog run mode.

### 6.11 Setting frequency via external contact input (Up/Down frequency setting)

## F254 : Input from external contacts - Up response time

F255 : Input from external contacts - Up frequency step
F255: Input from external contacts - Down response time
F25 7 : Input from external contacts - Down frequency step
F25B : Initial Up/Down frequency
F259 : Initial Up/Down frequency rewriting

## - Function

These parameters are used to set the output frequency by means of a contact signal from the external control device.
[Parameter setting]

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| $F 254$ | Input from external contacts - Up response time | 宕. 0 - 18.0 s | O. 1 |
| $F 255$ | Input from external contacts - Up frequency step | B. $0 \cdot 5 \sim \mathrm{HHz}$ | O. $i$ |
| F256 | Input from external contacts - Down response time |  | O. 1 |
| $F E \square$ | Input from external contacts - Down frequency step | B. 0 - FH Hz | O. 1 |
| $F 258$ | Initial Up/Down frequency | L L - H L Hz | 8.8 |
| F259 | Initial Up/Down frequency rewriting | II:Not changed f:Setting of $F 25 B$ changed when power is turned off. | $i$ |

These functions are operative when parameter $F$ 行 (frequency setting mode selection 1 ) is set to 18 or parameter $F \mathscr{I} 7$ (frequency setting mode selection 2) is set to 10.

■ Adjustment with continuous signals（Parameter setting example 1）
Set parameters as follows to adjust the output frequency up or down in proportion to the frequency adjustment signal input time：

Panel frequency incremental gradient $=F 255 / F 254$ setting time
Panel frequency decremental gradient $=F こ \square 7 / F こ 5 \sigma$ setting time
Set parameters as follows to adjust the output frequency up or down almost in synchronization with the adjustment by the panel frequency command：

$$
\begin{aligned}
& \text { (REL (or F500)/FH) } \leqq(F 255 / F 254 \text { setting time) } \\
& \text { ( } \sigma E[\text { (or } F 50 i) / F H \text { ) } \leqq(F 2 G 7 / F 2 \sigma G \text { setting time) }
\end{aligned}
$$

«Sample sequence diagram 1：Adjustment with continuous signals»


Adjustment with pulse signals（Parameter－setting example 2）
Set parameters as follows to adjust the frequency in steps of one pulse：
$F 254, F 255 \leqq$ Pulse ON time
$F こ G 5, F こ G 7=\quad$ ；Frequency obtained with each pulse
＊The inverter does not respond to any pulses with an ON time shorter than set with $F こ 54$ or $F \Xi 5.12 \mathrm{~ms}$ or more of clearing signal is allowed．
«Sample sequence diagram 2：Adjustment with pulse signals»


- If two signals are input simultaneously
- If a clear single and an up or down signal are input simultaneously, priority will be given to the clear signal.
- If up and down signals are input simultaneously, the frequency will be increased or reduced by the difference between the settings of $F 255$ and $F 257$. For example, if the $F 255$ setting is larger, the frequency will be increased by the value obtained by subtracting the setting of $F 255$ from that of $F \Xi \Sigma 7$.


## - Setting of the initial Up/Down frequency

To adjust the frequency start at a specified frequency other than 0.0 Hz (default initial frequency) after turning on the inverter, specify the desired frequency using $F 25 \square$ (initial Up/Down frequency).

- Change of the initial Up/Down frequency

To make the inverter automatically save the frequency immediately before it is turned off and start operation at that frequency next time power is turned on, set $F 259$ (change of initial Up/Down frequency) to $i$ (which changes the setting of $F \sum 5 \Omega$ when power is turned off).
Keep in mind that the setting of $F \Sigma 5 B$ is changed each time power is turned off.

## - Frequency adjustment range

The frequency can be set from 0.0 Hz to FH (Maximum frequency). The lower limit frequency will be set as soon as the set frequency clearing function (function number 9 こ, 93 ) is entered from the input terminal.

## - Minimum unit of frequency adjustment

If $F 70 己$ (Frequency free unit magnification) is set to 1.00 , the output frequency can be adjusted in steps of 0.01 Hz .

### 6.12 Jump frequency - jumping resonant frequencies

## - Function

Resonance due to the natural frequency of the mechanical system can be avoided by jumping the resonant frequency during operation. During jumping, hysteresis characteristics with respect to the jump frequency are given to the motor.

［Parameter setting］

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| $F こ 70$ | Jump frequency 1 | 0.0 .5 HHz | 0.0 |
| $F 271$ | Jumping width 1 | $0.0-30.0 \mathrm{~Hz}^{\text {O }}$ | 0.0 |
|  | Jump frequency 2 | $0.0 \sim$ F H Hz | 0.10 |
| $F 273$ | Jumping width 2 | $0.0030 .0 \mathrm{~Hz}^{\text {a }}$ | 0.0 |
| $F こ 74$ | Jump frequency 3 | $0.0 \sim$ F H Hz | 0.10 |
| FE75 | Jumping width 3 | 0．0．0 30.01 Hz | 0.10 |

If the upper limit frequency（ $1: 12$ ）is within jump frequency range，
it is limited to the lowest frequency in the jump frequency range．

If the lower limit frequency（ $\mathcal{L}, \begin{aligned} & \text { ）is within jump frequency range，}\end{aligned}$

it is limited to the highest frequency in the jump frequency range．


Do not overlap upper limit frequency（ $\mathrm{L}, \mathrm{L}$ ）and lower limit frequency（ $\mathrm{L} \dot{L}$ ） within jump frequency range．
If they are overlapped，it is operated lowest jump frequency．

Do not overlap two or more jump frequency ranges，or it cannot be operated within normal range．

During acceleration or deceleration，
the jumping function is disabled for the operation frequency．


## 6．13 Preset speed operation frequencies

## 6．13．1 Preset speed operation frequency 8 to 15

## $F 2 B 7-F 294$ ：Preset speed operation frequencies 8 to 15

$\Rightarrow$ For details，refer to Section 5．12．

## 6．13．2 Forced operation control

## F294：Preset speed operation frequency 15 （Forced operation frequency）

## －Function

Forced operation control is used when operating the motor at the specified frequency in case of an emergency．If forced operation control is assigned to the terminal board selection parameter and a forced operation control signal is given，the motor will be operated at the frequency specified with $F こ 94$（preset speed operation frequency 15）．（When the input terminal board selection parameter is set to $5 \Omega$ or 59 ．）

## 6．14 Trip－less intensification

## 6．14．1 Retry function

## F303 ：Retry selection（selecting the no．of times）

## § Warning

Mandatory
－Stand clear of motors and equipment．
The motor and equipment stop when the alarm is given，selection of the retry function will restart them suddenly after the specified time has elapsed．This could result in unexpected injury．
－Take measures for safety，e．g．attach a cover to the motor，to prevent accidents if the motor suddenly restarts．

## －Function

This parameter resets the inverter automatically when the inverter gives a trip．During the retry mode，the motor speed search function operated automatically as required and thus allows smooth motor restarting．
［Parameter setting］

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| F303 | Retry selection（selecting the no．of times） | 亿13：Deselect，i～ 10 times | $\square$ |

The likely causes of tripping and the corresponding retry processes are listed below．

| Cause of tripping | Retry process | Canceling conditions |
| :---: | :---: | :---: |
| Momentary power failure <br> Overcurrent <br> Overvoltage <br> Overload | Up to 10 times in succession <br> 1st retry ：About 1 sec after tripping <br> 2nd retry ：About 2 sec after tripping <br> 3rd retry ：About 3 sec after tripping <br> 10th retry：About 10 sec．after tripping | The retry function will be canceled at once if tripping is caused by an unusual event other than momentary power failure， overcurrent，overvoltage or overload． This function will also be canceled if a retry is not successful within the specified number of times． |

Trips covered by the retry function


The retry function is disabled in the following unusual events：
－ILA $1, \Xi, ~ \exists$ ：Arm overcurrent at start－up
－EEPi，コ，コ：EEPROM error

－EPH ：Output phase failure $\cdot$ Err $\quad$ ：Main ROM error
－RLL ：Loaded side overcurrent at start time
－Erry ：CPU trip
－ OH ：External thermal error $\operatorname{Er} 5$ ：Interruption of operation command from
－ $\mathrm{HL}_{\mathrm{L}}$ ：Low current external control device
－ LI $^{\prime}$ ：Voltage drop in main circuit $\quad$ Err $\quad$ ：Gate array fault
－It ：Overtorque $\cdot E r-7$ ：Output current detector error
－$E F$ i，$E \mathcal{E}$ ：Ground fault $\operatorname{Er} \boldsymbol{E} \boldsymbol{G}$ ：Optional unit error
－$E \quad$ ：Emergency stop
－$E$－10～2 6
－Others（Other than trips covered by the retry function）

Protective operation detection relay signals（FLA，FLB，FLC terminal signals）are not sent during use of the retry function．（factory default setting）

$\Rightarrow$ See Section 13.2 for the virtual cooling time．
In this case，the retry function operates after the virtual cooling time and retry time．
In the event of overvoltage tripping（ predetermined level．
In the event of overheating－caused tripping（ 1 H ），re－tripping may result unless the internal temperature decreases below a predetermined level，since the internal temperature detection function of the inverter works．
 During retry the blinking display will alternate between $\boldsymbol{- L} \boldsymbol{\zeta}$ and the monitor display specified by parameter monitor display selection parameter $F 7 \boldsymbol{i}$

The number of retries will be cleared if the inverter is not tripped for the specified period of time after a successful retry． ＂A successful retry＂means that the inverter output frequency reaches the command frequency without causing the inverter to re－trip．
At the occurrence of a trip，the rotational speed of the motor is measured and，after the motor is restarted，it＇s speed is regulated to the speed measured．

## 6．14．2 Avoiding overvoltage tripping

## F 3NS ：Overvoltage limit operation <br> F459：Overvoltage limit constant F3 19：Regenerative over－excitation upper F525：Overvoltage limit operation limit level



Overvoltage limit operation level

［Parameter setting］

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| $F 305$ | Overvoltage limit operation | 7 ：Enabled <br> f：Disabled <br> $\zeta$ ：Enabled（quick deceleration） <br> 3 ：Enabled（dynamic quick deceleration） | 2 |
| F319 | Regenerative over－excitation upper limit | 1分合～15氝\％［Note］ | 140 |
| F459 | Overvoltage limit constant |  | $\stackrel{\square}{1}$ |
| $F 5 \mathrm{~F}$ F | Overvoltage limit operation level | 1分号 $150 \%$［Note］ | 134 |

Note： $100 \%$ corresponds to an input voltage of 200 V for 200 V models or to in an input voltage of 400 V for 400 V models．
If $F 3 \Omega 5$ is set to $\Omega$（quick deceleration），the inverter will increase the voltage to the motor（over－excitation control）to increase the amount of energy consumed by the motor when the voltage reaches the overvoltage protection level，and therefore the motor can be decelerated more quickly than normal deceleration．
If $F 305$ is set to $\Xi$（dynamic quick deceleration），the inverter will increase the voltage to the motor （over－excitation control）to increase the amount of energy consumed by the motor as soon as the motor begins to slow down，and therefore the motor can be decelerated still more quickly than quick deceleration．
The parameter $\wp 319$ is used to adjust the maximum energy that the motor consumes during deceleration，and if the inverter is tripped during deceleration because of an overvoltage，specify a larger value．When $F 305$ is set 2 to 3，this function works．
Parameter $F 459$ is able to adjust the filter time constant of the overvoltage limitation．
This parameter is effective at only V／f control mode（ $\left.F_{L}=0,1,5\right)$ ．
Parameter FEDG serves also as a parameter for setting the regenerative braking level（see section 5．19．）．

## 6．14．3 Output voltage adjustment／Supply voltage correction

$\nu L \cup$ ：Base frequency voltage 1 （output voltage adjustment） F 307 ：Base frequency voltage selection（supply voltage correction）

## －Function

Base frequency voltage 1 （output voltage adjustment）
This parameter is used to set the voltage for the base frequency 1 u ．．It can also be used to prevent the base frequency over $u \boldsymbol{L}$ from being put out even if the voltage is higher than the voltage set is applied． （This parameter is operative when $F 307$ is 2 or 3 ．） Base frequency voltage selection（correction of supply voltage）
The $F 307$ parameter maintains a constant V／f ratio，even when the input voltage decreases．The torque during low－speed operation is prevented from decreasing．

OSupply voltage correction ....... Maintains a constant V/f ratio, even when the input voltage fluctuates.
OOutput voltage adjustment ...... Limits the voltage at frequencies exceeding the base frequency. Note that no limit is imposed on the output voltage if the supply voltage is not compensated.
[Parameter setting]

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| LLu | Base frequency voltage <br> 1 <br> (output voltage <br> adjustment) | 200V class:50~330 V <br> 400 V class:50~650 V | $\begin{gathered} \hline \hline \text { 200V class: } \\ 200 \\ 400 \mathrm{~V} \text { class: } \\ 400 \\ \hline \end{gathered}$ |
| 5307 | Base frequency voltage selection (correction of supply voltage) | $Z:$ Without voltage compensation (limitless output voltage) <br> $i$ : With voltage compensation (limitless output voltage) <br> $\Xi$ : Without voltage compensation (limited output voltage) <br> 3: With voltage compensation (limited output voltage) | 8 |

If $F 307$ is set to 27 or 2 , the output voltage will change in proportion to the input voltage.
Even if the base frequency voltage ( $\omega$ Lu) is set above the input voltage, the output voltage will not exceed the input voltage.
The rate of voltage to frequency can be adjusted according to the rated motor capacity. For example, setting $F 307$ to 3 prevents the output voltage from increasing, even if the input voltage changes when the operation frequency exceeds the base frequency.
When the V/f control mode selection parameter $(\mathscr{F})$ is set to any number between $\Xi \sim 4$ or $\Xi \sim B$, the supply voltage is corrected regardless of the setting of $F 307$.
[ $F \boldsymbol{F} \boldsymbol{\sim} \boldsymbol{7}=\boldsymbol{B}$ : Supply voltage uncorrected, output voltage unlimited]


* The above applies when V/f control mode selection parameter $P L$ is set to $\Omega, t$ or $\bar{\sigma}$.
 $>1$
$\frac{\text { Rated voltage }}{}$
the output voltage can be prevented from exceeding the input voltage.
[F3 T $7=\boldsymbol{2}$ : Supply voltage uncorrected, output voltage limited]

* The above applies when V/f control mode selection parameter $\rho_{L}$ is set to $\overline{0}, \boldsymbol{i}$ or $\bar{\square}$.
[F3 T $7=1$ : Supply voltage corrected, output voltage unlimited]

* Note that a voltage higher than $u \dot{L} u$ is applied at output frequencies over the base frequency $u \boldsymbol{L}$, even if $u \mathcal{L} u$ is set below the input voltage.
[ $F 3 \cap 7=3$ : Supply voltage corrected, output voltage limited]


Note: Rated voltage is fixed for 200 V class at 200 V and 400 V class at 400 V .

### 6.14.4 Reverse run prohibition

F3 : 1 : Reverse run prohibition selection

## - Function

This function prevents the motor from running in the forward or reverse direction when it receives the wrong operation signal.

## [Parameter setting]

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :--- | :---: |
| $\boldsymbol{F} \boldsymbol{\prime}$ i | Reverse-run prohibition selection | $\begin{array}{l}\boldsymbol{\Omega}: \text { Permit all, }: \text { :Prohibit reverse run } \\ \Xi\end{array}$ Prohibit forward run |  |$]$

## Warning!!

- If an operation command is entered to rotate the motor in the direction prohibited for the preset speed operation with the mode or forced jog operation, this parameter will cancel the command regardless of operation mode.
- If the motor constant is not set properly while vector control mode or automatic torque boost mode is selected, the motor may turn in the reverse direction. The number of revolutions that correspond to the slip frequency, in these modes, therefore, the stop frequency $(F \Xi 4 \Xi)$ should be set at the same level as the
 restarted may rotate in the direction opposite to the prohibited direction regardless of the setting of this parameter.


### 6.14.5 Output voltage waveform selection

## F 3 i3 : Output voltage waveform selection

```
- Function
It is an effective function only to the capacity of VFAS1-2550P and above, VFAS1-4900PC and above. The loss of the inverter is reduced a little by setting it to \(F \mathcal{Z} \boldsymbol{\exists}=\boldsymbol{i}\), when using it with the career frequency raised (only as a guide 4 kHz and above. However, some magnetic sounds from the motor is different and use it after confirming whether there is problem in noise.
```

[Parameter setting]
Parameter setting]

| Title | Function | Adjustment range | Default setting |
| :---: | :--- | :---: | :---: |
| $F \Xi: \Xi$ | Output voltage waveform <br> selection | $\square:$ PWM carrier frequency control 1 <br> $i:$ PWM carrier frequency control 2 | 0 |

### 6.15 Drooping control

## $F 320$ : Drooping gain

F 32 i : Speed at drooping gain 0\%
$F \exists 2$ : Speed at drooping gain $F \exists \mathcal{U}$
$F \exists 2 \exists$ : Drooping insensitive torque
F 324 : Drooping output filter

## - Function

When multiple inverters and motors are used to operate a system, the load can distribute to them using this function. These parameters allow you to adjust the frequency range, and also insensitive torque and gain.

［Parameter setting］

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| $F 320$ | Drooping gain［Note］ | 式． | 27．01 |
| Fココ1 | Speed at drooping gain 0\％ |  | 0.0 |
| $F コ こ 己$ | Speed at drooping gain $\mathcal{F}$ こ |  | 0.0 |
| Fヨこう | Drooping insensitive torque | 日～1氙\％ | 10 |
| F3コ4 | Drooping output filter |  | 100.0 |

Note：Drooping gain can be changed within a range of 0.1 to $100.0 \%$ during operation．When changing the setting to 0.0 （no drooping）or 0．0，stop operation．
－Drooping control can be performed only when $\boldsymbol{P}_{L}$ is set to $\beth, 4,7$ or 8 ．
－When torque over the insensitive torque is applied，the frequency is decreased（during power running）or increased（during regenerative braking）．
－The drooping function is operative at frequencies over the frequency set with $F \exists \mathcal{Z}$ ．
－In the frequency range between the frequencies set with $F \Xi \Xi$ ；and $\mathcal{F} コ \supseteq$ ，the degree of drooping changes according to the magnitude of frequency．
－The error in drooping insensitive torque increases in the frequency range above the base frequency，and it is therefore recommended that these functions be used at frequencies below the base frequency．
－During drooping control，the output frequency is not restricted by the maximum frequency $(F, H)$ ．
The change in frequency at the time of drooping can be calculated，as described below：
a）Gain by internal torque reference（Gain1）
If internal torque reference $(\%) \geqq 0$
Gain1＝（internal torque reference－dead band FJこJ）／ 100
Gain1 needs to be set at 0 or a positive number．
If internal torque reference（\％）＜ 0
Gain1 $=$（internal torque reference + dead band $F \Xi 5$ ）$/ 100$
Gain1 needs to be set at 0 or a negative number．
b）Gain by frequency after acceleration（Gain2）
If $F 3 E^{2}$ i $F 3 E^{2} E$
｜Frequency after acceleration $\mid \leqq$ Frequency 1 set with $F=\mathbb{I}$ i Gain2 $=0$
｜Frequency after acceleration｜＞Frequency 2 set with Fココ己 Gain2＝Drooping gain $F 32 \pi / 100$

If frequency 1 FIET＜｜Frequency after acceleration $\mid \leqq$ Frequency $2 F 3 己 己$ Gain2 $=\frac{\text { Drooping gain } F \exists \Omega \Omega}{100} \times\left\{\frac{(\mid \text { Frequency after acceleration } \mid- \text { Frequency } 1 \sqrt[F J I I]{ })}{\text {（Frequency } 2 \sqrt{F J \Omega \Omega}-\text { Frequency } 1 \sqrt{F I I})}\right\}$

If $F 3 E$ i $\geqq$ F $2 T$
｜Frequency after acceleration $\mid \leqq$ Frequency 1 set with $F \vec{J}$ i Gain2 $=0$
If｜Frequency after acceleration｜＞Frequency $1 \sim \mathcal{F}$ i Gain2＝Drooping gain F3ET 100
c）Drooping speed
Drooping speed $=$ base frequency $\quad$ L Note $\times$ Gain1 $\times$ Gain2
Note：If the base frequency exceeds 100 Hz ，count it as 100 Hz ．

## 6．16 Light－load high－speed operation function

| F328 | ：Light－load high－speed operation selection | $F 335$ | ：Switching load torque during power running |
| :---: | :---: | :---: | :---: |
| F329 | ：Light－load high－speed learning function | $F 335$ | ：Heavy－load torque during power running |
| $F 330$ | ：Automatic light－load high－speed operation frequency | $F 337$ | ：Heavy－load torque during constant－speed power running |
| $F 331$ | ：Light－load high－speed operation switching lower limit frequency | $F 338$ | ：Switching load torque during regenerative braking |
| F332 | ：Light－load high－speed operation load waiting time |  |  |
| 5333 | ：Light－load high－speed operation load detection time |  |  |
| F334 | ：Light－load high－speed operation heavy load detection time |  |  |
| $\Rightarrow$ For details， | refer to Instruction Manual（E6581327）sp | cified in Sectio | 6．42． |
| Brakin | g function |  |  |

## 6． 17 Braking function

$F 340$ ：Creeping time $1 \quad F 344$ ：Lowering torque bias multiplier
$F 341$ ：Braking mode selection
$F 345$ ：Brake release time
$F 342$ ：Load portion torque input selection
F343 ：Hoisting torque bias input
$F 345$ ：Creeping frequency
$F 347$ ：Creeping time 2
$F 348$ ：Braking time learning function

## －Function

These parameters can be used as brake sequences for lifts and similar equipment．
To ensure smooth operation，the motor produces enough torque before the brake is released．

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| F340 | Creeping time 1 | 0．00－2．50 sec． | 0 |
| F34i | Braking mode selection | 0 ：Disabled <br> i：Forward winding up $こ$ ：Reverse winding up 3：Horizontal operation | 0 |
| $F 342$ | Load portion torque input selection | I）：Disabled <br> i：VIIII（voltage／current input） <br> こ：RR／S4（potentiometer／voltage input） <br> 3 ：RX（voltage input） <br> 4：F343 enabled <br> 5：2－wire RS485 input enabled <br> E：4－wire RS485 input enabled <br> 7：Communications option input enabled <br> B：Optional Al1（differential current input） | 4 |
| F343 | Hoisting torque bias input（valid only when $F=34 己=4$ ） | －250～こ50\％ | 100 |
| F344 | Lowering torque bias multiplier | 日～10日\％ | 100 |
| F345 | Brake release time | $0.00-2.50 \mathrm{sec}$ ． | 0.155 |
| F346 | Creeping frequency | $F 240 \sim 20.0 \mathrm{~Hz}^{\text {F }}$ | 3.10 |
| F347 | Creeping time2 | 0．00－2．50 sec． | 0． 10 |
| F348 | Braking time learning function | 0 ：Disabled <br> $:$ ：Brake signal learning（ 0 after adjustment ） | 0 |

## - Starting procedure

At the run command, the inverter makes the motor produce the torque specified with parameter $F 343$. As soon as a torque output command is issued, a brake release request signal is put out through the brake output terminal. Upon expiration of the brake release time set with $F \Xi 45$, the motor starts to accelerate.
■ Stopping procedure
At the stop command, the operation frequency is decreased to the creep frequency set with parameter $F 345$, and put out the braking request after the creep time 1 set with $F 340$. And then, the creep frequency is maintained for the creep time set with $F \exists 47$. While the creep frequency is maintained, the brake release signal is put out through the braking signal output terminal to apply the brake.


Ex.) When using the OUT1 terminal as the brake signal output terminal

| Title | Function | Adjustment range | Example of setting |
| :---: | :---: | :---: | :---: |
| F 130 | Output terminal function selection 1 (OUT1) | 2-255 | 58 |

- Learning function [ 1538 ]

Using this function, rough settings can be made automatically and also parameters $F 345, F 345$ and $F 347$
can be set automatically.
After the learning function is set, $F 34 \Omega$ will be set automatically to 4 and $F 343$ to 10 . If necessary, fine adjust the parameter setting manually.

## [Learning operation]

Set parameter $F 34 \Omega$ to $i$ and enter an operation command to start learning. (The frequency and " $\llcorner\mathfrak{L} \boldsymbol{\prime}$ displayed alternately.)
Parameter $F 343$ (torque) is set, the brake release timing is calculated, and parameter 5345 (release time) is set based on the calculation result. $F 345$ is set automatically according to the motor constant calculated. At the stop of operation, $F 347$ (creep time) are set.
Note1: Learning should be performed under light-load conditions.
Note2: For the braking functions, the pre-excitation time is automatically determined by the inverter from motor-related constants.
When the VFAS1-2037PL is used in combination with a Toshiba $4 \mathrm{P}-3.7 \mathrm{~kW}-60 \mathrm{~Hz}-200 \mathrm{~V}$ standard motor, the preliminary excitation time is approximately 0.1 to 0.2 seconds.
Depending on the motor used, the preliminary excitation time may be prolonged.
 auto-tuning 1) or set motor-related parameters $F 418$ to $F 4$ i
Note 4: If a counterweight is provided, a learning error may occur. If so, make an adjustment manually.
Note 5: Brake learning $(F \Xi 4 \Omega=i$ ) should be carried out for normal rotation if $F=3 ;$ is set to $i$ (forward winding), or for reverse rotation if $F 34 i$ is set to $\Xi$ (reverse winding).

- Torque bias function

Using this function, the load can be started
smoothly, by the motor produces enough torque for load portion before the brake is released,
[Selection of external signals]
$\square \begin{aligned} & \text { RR/S4-CCA }-0 \sim 10 \mathrm{~V} \\ & \text { RX-CCA }-0 \sim \pm 10 \mathrm{~V} \\ & \text { VI/II-CCA }-0 \sim 10 \mathrm{~V} \\ & \text { VIIII-CCA }-4(0) \sim 20 \mathrm{~mA}\end{aligned}$
Current signals $-\square$


### 6.18 Acceleration/deceleration suspend function

## F349: Acceleration/deceleration suspend function <br> F352 : Deceleration suspend frequency F353: Deceleration suspend time

## $F 350$ : Acceleration suspend frequency

F35 i : Acceleration suspend time

## - Function

Using these parameters, acceleration or deceleration can be suspended to let the motor run at a constant speed. There are two ways to suspend acceleration or deceleration: suspending it automatically by setting the suspend frequency and time using parameters, and suspending it by means of a signal from an external control device.
These parameters are useful in starting and stopping transfer equipment, textile machines (winders), and so on.
[Parameter setting]

| Title | Function | Adjustment range | Setting value |
| :---: | :---: | :---: | :---: |
| $F 349$ | Acceleration/deceleration suspend function | 7: Disabled <br> i:Parameter setting <br> $\Sigma$ :Terminal input | 0 |
| $F 350$ | Acceleration suspend frequency |  | 21.0 |
| F35i | Acceleration suspend time |  | 21.0 |
| $F 352$ | Deceleration suspend frequency | D1. 0 - F H Hz | ก1. 0 |
| $F 353$ | Deceleration suspend time | 万1. 0 - 10.0 sec. | 0.10 |

Note1: The acceleration suspend frequency $(F 350)$ should not be set below the starting frequency $(F 240)$.

Note3: If the output frequency is lowered by a stall prevention function, the acceleration suspend function may be activated.

1) To suspend acceleration or deceleration automatically

Set the desired frequency with $F 350$ or $F 35 \Omega$ and the desired time with $F 35$ i or $F 353$, and then set $F 349$ to 1.
When the frequency set is reached, the motor stops accelerating or decelerating to rotate at a constant speed.

2) To suspend acceleration or deceleration by means of a signal from an external control device

Set $\sigma \Omega$ for the desired external signal input terminal. As long as ON signals are inputted, the motor continues to rotate at a constant speed.


Ex.) When using the RR/S4 terminal as the acceleration/deceleration suspend terminal

| Title | Function | Adjustment range | Example of setting |
| :---: | :---: | :---: | :---: |
| $F i!B$ | Input terminal function selection 8 (RR/S4) | $\square \sim 135$ | 60 |

If the stall control function is activated during constant-speed rotation
The frequency drops momentarily as a result of stall control, but the time for which the frequency drops is included in the suspend time.


FヨS (Momentary acceleration (deceleration) suspend time) $=(\mathrm{t} 1+\mathrm{t} 2+\mathrm{ts})$

## - Stall control

Refers to the inverter's function of automatically changing the operation frequency when it detects an overcurrent, overload or overvoltage. Using the following parameters, you can specify the way, the stall control is performed for each kind of stall.
Overcurrent stall : F5 $\boldsymbol{i}$ (Stall prevention level 1)
Overload stall : $\cap \mathrm{L} \Pi$ (Electronic thermal protection characteristic selection)
Overvoltage stall : $F 305$ (Overvoltage limit operation)
Note: Setting the frequency command at the same frequency as the acceleration suspend frequency ( $F=35 \pi$ ) disables the acceleration suspend function.
Similarly, setting the frequency command at the same frequency as the deceleration suspend frequency ( $F \Xi 5$ こ ) disables the deceleration suspend function.

### 6.19 Commercial powerlinverter switching

## F354 : Commercial power/inverter switching output selection

F355 : Commercial powerlinverter switching frequency

## F355 : Inverter-side switching waiting time

## F357 : Commercial power-side switching waiting time

## F 35 B : Commercial power switching frequency holding time

[^10]| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| F354 | Commercial power/inverter switching output selection | B:Disabled <br> f:Automatic switching in the event of a trip <br> 2:Commercial power switching frequency setting <br> 3:Commercial power switching frequency setting + automatic switching in the event of a trip [Note1] | 0 |
| $F 355$ | Commercial power/inverter switching frequency | S~呺 Hz | [Note.3] |
| $F 356$ | Inverter-side switching waiting time | 0. $100 \sim 10.00 \mathrm{sec}$ | According to model $\Rightarrow$ Refer to page K-46. |
| $F 357$ | Commercial power-side switching waiting time | 0.40~ 60.00 sec | 8.62 |
| $F 358$ | Commercial power switching frequency holding time | 0.10~ 10.00 sec | 2.00 |

Note1: For trips whose causes are displayed with $\cap[\mathcal{L}, E F\{, E F \mathcal{Z}$ or $E$, switching is not done automatically.
Note2: Braking function $\digamma 34$; doesn't operate.
Note3: Inverter with a model number ending with -WN, HN: 50.0 -WP: 50.0
[Timing chart (example)]


Commercial power switching signal S3-CC ON : Commercial power operation
Commercial power switching signal S3-CC OFF : Inverter operation
Note:If ST-CC is opened, switching cannot be operated normally.

| Title | Function | Adjustment range | Example of setting |
| :---: | :---: | :---: | :---: |
| F354 | Commercial power/inverter switching output selection | B-3 | 2 or 3 |
| $F 355$ | Commercial power/inverter switching frequency | O-1it Hz | Power supply frequency etc. |
| F356 | Inverter-side switching waiting time | 2. 180 - 10.00 sec . | According to model $\Rightarrow$ Refer to page K-46. |
| $F 357$ | Commercial power-side switching waiting time | 2.40-10.00 sec. | 0.52 |
| $F 358$ | Commercial power switching frequency holding time | 2.10-10.00 sec. | 2.00 |
| Fit 7 | Input terminal function selection 7 (S3) | 8~ 35 | 102 (Commercial power switching) |
| $F 130$ | Output terminal function selection 1 (OUT1) | 8-255 | 45 (Commercial power/inverter switching output 1) |
| Fi3i | Output terminal function selection 2 (OUT2) | $0 \sim 255$ | 48 (Commercial power/inverter switching output 2) |

- When switching to commercial power, make sure that the direction in which the motor rotates when operated on commercial power agrees with the forward direction when operated via the inverter.
- Do not select any option $(F \exists i t=\bar{Z})$ of $F \exists i t$ (reverse rotation prohibition selection) that prohibits forward rotation. Or it becomes impossible to switch to commercial power, because the motor cannot rotate in the forward direction.


### 6.20 <br> PID control

F359 : PID control switching
F35: : PID control feedback control signal selection
$F 35$ i : Delay filter
$F$ F5 2 : Proportional ( P ) gain
$F 353$ : Integral (I) gain
$F 354$ : PID deviation upper limit
F355 : PID deviation lower limit
$F 355$ : Differential (D) gain
F35 7 : Process upper limit

F358 : Process lower limit
F359 : PID control waiting time
F370 : PID output upper limit
F 371 : PID output lower limit
F372: Process increasing rate (speed type PID control) F 373 : Process decreasing rate (speed type PID control) F379: PID output dead band

## -Function

Using feedback signals ( 4 to $20 \mathrm{~mA}, 0$ to 10 V ) from a detector, process control can be exercised, for example, to keep the airflow, amount of flow or pressure constant.
$\Rightarrow$ For details, see instruction Manual(E6581329)specified in Section.

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| $F 359$ | PID control switching | 0: No PID control i:Process type PID control (temp./pressure, etc.) operation 2:Speed type PID control (potentiometer, etc.) operation | 0 |
| $F 360$ | PID control feedback control signal selection | 0 : Deviation input (no feedback input) <br> $: \mathrm{VI} / I I$ (voltage/current input) <br> Z:RR/S4 (potentiometer/voltage input) <br> 3:RX (voltage input) <br> 4 :Optional Al1 (differential current input) <br> 5 : Optional AI2 (voltage/current input) <br> Б: PG feedback option | 0 |
| F35 | Delay filter | $0.00 \sim 25.0$ | 0.1 |
| $F 362$ | Proportional (P) gain | 0.01~ 10.0 .0 | 0.10 |
| F363 | Integral (I) gain | 0.0. $1 \sim 100.0$ | 0.10 |
| $F 364$ | PID deviation upper limit | LL~Li Hz | *1 |
| $F 355$ | PID deviation lower limit | Li-Lit Hz | *1 |
| $F 356$ | Differential (D) gain | 0.00-2.55 | 0.00 |
| $F 367$ | Process upper limit | Li-Li Hz | *1 |
| F368 | Process lower limit | Li-Lit Hz | Li |
| F369 | PID control waiting time | 日~2400 sec. | $\square$ |
| $F 370$ | PID output upper limit | Li-Lit Hz | *1 |
| F37i | PID output lower limit | L: - it Hz | ! 1 |
| $F 372$ | Process increasing rate (speed type PID control) | 0.1~608.0 | 10.0 |
| $F 373$ | Process decreasing rate (speed type PID control) | 0.1~6080.0 | 10.0 |
| F379 | PID output dead band | 日~100 | 0 |

[^11]1) External connection


## 2) Types of PID control interface

Process value (frequency) and feedback value can be combined as follows for the PID control of the VF-PS1.

| (1)Process value(frequency setting) | (2) Feedback value |
| :---: | :---: |
| Frequency setting mode selection F\%Od/F207 | PID control feedback control signal selection $F 360$ |
| ```!:VIIII (voltage/current input) Z:RR/S4 (potentiometer/voltage input) I:RX (voltage input) 4 :Operation panel input enabled (including LED/LCD option input) \(5: 2\)-wire RS485 communication input 5:4-wire RS485 communication input 7:Communication option input B: Optional Al1 (differential current input) 9:Optional AI2 (voltage/current input) if:UP/DOWN frequency ; :Optional RP pulse input \(\mathfrak{i L}^{2}\) :Optional high-speed pulse input``` | 7: Deviation input (no feedback input) <br> f:VIIII (voltage/current input) <br> Z:RR/S4 (potentiometer/voltage input) <br> 3:RX (voltage input) <br> 4:Optional Al1 (differential current input) <br> 5 : Optional AI2 (voltage/current input) <br> 5: PG feedback option |

Note 1: About the setting of $F \cap G$ and $F 卫 \Omega 7$ : Do not select the same terminal that is used feedback terminal.
Note 2: The voltage/current changeover of the analog input VIIII and the option AII can be set by the parameter $F: 08$ or $F 109$.

$$
F: 0 B, F \text { iS9 } \begin{aligned}
& 0: \text { Voltage input (DC:0~10V) } \\
& \text { 1:current input (DC:4~20mA) }
\end{aligned}
$$

## 3) Setting the PID control

In case of controlling the airflow, water flow and pressure, please set the parameter $\digamma 359$ to" ${ }^{\prime \prime}$ "(Process type PID control operation)
(1)Please set the parameter $R[$ (Acceleration time), $d E[$ (deceleration time) to the suitable time for the system.
(2)Please set the following parameters to place limits to the setting value and the control value.

Placing a limit to the process value : The parameter $F=57$ (Process upper limit), $F 558$ (Process lower limit) Placing a limit to the PID deviation : The parameter $F 354$ (PID deviation upper limit), $F 355$ (PID deviation lower limit )
Placing a limit to the PID output : The parameter $F \exists 70$ (PID output upper limit ), $F \exists 7$ ( (PID output lower limit ) Placing a limit to the output frequency : The parameter $1: L$ (Upper limit frequency), $L 亡$ (Lower limit frequency )

## 4) Adjust PID control gain

Adjust PID control gains according to the process value, the feedback input signal and the item to be controlled. Here are the parameters used to adjust PID control gains.

| Title | Function | Adjustment range | Default setting |
| :--- | :--- | :--- | :---: |
| $F 35 \Omega$ | Proportional (P) gain | $0.0: 1-100.0$ | 0.10 |
| $F 353$ | Integral (I) gain | $0.0:-100.0$ | 0.10 |
| $F 355$ | Differential (D) gain | $0.000-2.55$ | 0.00 |

## $F 352$ Proportional (P) gain

The proportional ( P ) gain set with f 362 is the proportional $(\mathrm{P})$ gain obtained by PID control.
A proportional $(P)$ gain, a factor by which the deviation (difference between the process value and the feedback value) is multiplied, is used to perform control in such a way as to make a correction in proportion to the deviation. Although setting this gain high is effective in increasing the response speed, setting it excessively high may cause an unstable operation, such as vibration.


## F 353 Integral (I) gain

The integral (I) gain set with $f 363$ is the integral (I) gain obtained by PID control.
The integral gain reduces the deviation remaining after proportional control to zero (offsetting of residual deviation). Although setting this gain high is effective in reducing the residual deviation, setting it excessively high may cause an unstable operation, such as vibration.


## $F 355$ : Differential (D) gain

The differential (D) gain set with f366 is the differential (D) gain obtained by PID control.
The differential gain increases the speed of response to rapid changes in deviation. If this gain is set excessively high, a phenomenon in which the output frequency greatly fluctuates may occur.


If one of input terminals is assigned input terminal function 52/53 (PID differentiation/integration reset), differential and integral values are always 0 (zero) during the input terminal on.

## 5) Adjusting the analog command voltage and current

For items which can be adjusted by reference and feedback input, such as voltage/current input (VI/II input),voltage input (RR/S4 input) and voltage input (RX input), adjust scaling factor of the voltage/current if necessary. When feedback signals are very low, the gain can be increased by this adjustment.

When VI/II used as a voltage input terminal (Default setting)


When RR/S4 used as a voltage input terminal (Default setting)


When $\mathrm{VI} / \mathrm{II}$ used as a current input terminal ( $F \in \Omega$ needs to be set to 1 )


When RX used as a voltage input terminal (Default setting)


The characteristic of the feedback value can also be reversed by means of a signal from an external device.
Example: To use the S3 terminal as a PID normal/reverse characteristic switching signal input terminal

| Title | Function | Adjustment range | Default setting |
| :---: | :--- | :--- | :--- |
| $F: i 7$ | Input terminal function selection7(S3) | $0 \sim 135$ | 54 (positive logic) |

## 6) Setting the time elapsed before PID control starts

You can specify a waiting time for PID control to prevent the inverter from starting PID control before the control system becomes stable, for example, after start-up.
The inverter ignores feedback input signals, carries out operation at the frequency determined by the value of processing for the time specified by $\boldsymbol{F} \exists \overline{9}$ and enters the PID control mode after a lapse of the specified time.

### 6.21 Stop position control function

| Pt | ntrol mode selection | $F 375$ | ber of PG input pulses |
| :---: | :---: | :---: | :---: |
| $F 359$ | : PID control switching | $F 376$ | : Selection of number of PG |
| $F 350$ | : PID control feedback cont |  | input phases |
|  | signal selection | $F 381$ | : Simple positioning |
| F362 | : Proportional (P) gain |  | completion range |

$\Rightarrow$ For details, see Instruction Manual (E6581319) specified in Section 6.42.

### 6.22 Setting motor constants

| $F 400$ | : Auto-tuning 1 |
| :---: | :---: |
| F40 | : Slip frequency gain |
| F402 | : Auto-tuning 2 |
| $F 405$ | : Motor rated capacity (motor nameplate) |
| F405 | : Motor rated current (motor nameplate) |


| $F 407$ | : Motor rated rotational speed (motor nameplate) |
| :---: | :---: |
| $F 410$ | : Motor constant 1 (torque boost) |
| F4it | : Motor constant 2 (no-load current) |
| $F 412$ | : Motor constant 3 (leak inductance) |
| F4i3 | : Motor constant 4 (rated slip) |

When selecting automatic torque boost and vector control (i.e., when setting the parameter $P_{L}$ to $\Xi, \exists, 4,7$ or $\Omega$. By default, $P L$ is set to $\Omega$ (v/f constant control)), be sure to set every parameter concerned in accordance with the flowchart on the next page.

|  |  |  |  |  |  |  | The inverter is tuned automatically (auto-tuning $F 400=\Omega^{\prime}$ ) when the inverter is started for the first time <br> after setup. During auto-tuning, which takes about 3 minutes from several seconds as each model, the <br> motor is energized, although it is standing still. |
| :--- | :--- | :---: | :---: | :---: | :---: | :---: | :---: |
| Prohibited | Provide cranes and hoists with sufficient circuit protection such as mechanical braking. <br> Without sufficient circuit protection, the resulting insufficient motor torque during tuning could create a risk <br> of machine stalling/falling. <br> Be sure to set every parameter concerned in accordance with the flowchart on the next page. Failure to <br> do this may cause the inverter not to control the motor properly, and therefore cause the motor not to <br> deliver the desired performance. |  |  |  |  |  |  |

*1:

| Motor used |  |  | Tuning required or not <br> Type |
| :--- | :---: | :--- | :---: |
| No. of motor poles | Capacity | (Yes in flowchart: Tuning required, No: Tuning not required) |  |$|$

[^12]
## （1）Setting auto－tuning

This auto tuning function allows you to set the motor constant easily，which needs to be set when operating in auto torque boost mode or vector control mode（ $P\llcorner=\Xi, \Xi, 4,7$ or $B$ ）．
There are two parameters（ $F 400$ and $F 402$ described below）for auto tuning．For the steps to be followed when setting these parameters，see the flowchart on the previous page．This section provides an explanation of $F 400$ and $F 402$ ．
［Parameter setting］

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| F400 | Auto－tuning 1 | 8 ：No auto－tuning <br> i：Initialize motor constant（ 0 after execution） <br> $\tau^{2}$ ：Continue operation continued after auto－tuning <br> （ 0 after execution） <br> 3 ：Auto－tuning by input terminal signal（ 0 after execution） <br> 4 ：Motor constant auto calculation（ 03 after execution） | 0 |

 F4i引（motor constant 4）to their factory default settings（constant of a Toshiba standard four－pole motor with the same capacity as the inverter）．
$F 40 \Omega=\Omega$ ：Makes the inverter tune the motor constant，considering how the motor is connected，when it is started for the first time after this setting is made．Connect the motor to the inverter in advance when selecting this setting．
$F 40 \Omega=3$ ：Makes the inverter only tune the motor constant，unlike $F 40 \square=\Omega$ ．Connect the motor to the inverter in advance when selecting this setting．
This function operates when＂ST＂signal and＂Auto－tuning＂signal became active．
（Use this setting if the machine cannot be started as－is after tuning for some reason on the part of the machine．）
$F 400=4$ ：If you select this setting after entering the information indicated on the motor nameplate（ $\omega \mathrm{L}$（base frequency），$u$ L（base frequency voltage），$F 405$（rated current of motor），$F 407$（rated speed of rotation of motor）），the inverter will calculate the motor constant and set the parameters $F 4$ i 0 through $54 ; 3$ automatically． There is no need to connect the motor when making this setting．
［Parameter setting］

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :--- | :---: |
| $F 40 こ$ | Auto－tuning 2 | $\square:$ Disabled <br> i：Self－cooled motor <br> $Z:$ Forced－air－cooled motor | $\vdots$ |

Auto－tuning 2 refers to the function of adjusting the motor constant automatically，while estimating the increase in the motor temperature．
If your inverter is equipped with a self－cooling fan（fan connected directly to the motor shaft），set $F 4$ 亿元 to $\boldsymbol{i}$ ．
When using a motor with a cooling fan（forced air－cooling type），set $F 402$ to 2 ．
－Perform auto－tuning 2 along with auto－tuning 1.
－Perform auto－tuning when the motor is cold（temperature equal to the ambient temperature）．

[^13]- Examples of setting the motor constants
a) Combination with a Toshiba standard motor (4P motor with the same capacity as the inverter)
Inverter : VFAS1-2037PL
Motor : 3.7kW-4P-60Hz

1) Set the $V / f$ control mode selection $P L$ at $\Xi$ (Sensorless vector control).
2) Set the auto-tuning $1(F 40$ ) at 2 . (When the cable length is 30 m or over.)
b) Combination with a standard motor other than the above Toshiba motor Inverter : VFAS1-2037PL
Motor : 2.2kW-2P-50Hz
3) Set the V/f control mode selection $P L$ at $\exists$ (Sensorless vector control).

4) Set the auto-tuning $1(F 400)$ at 4 .
5) Set the auto-tuning $1(F 400)$ at 2 .

## (2) Setting sensorless vector control and manual independently Setting motor constants

Perform all operations in the flowchart on the previous page. If the motor specifications are unknown, enter only the motor capacity ( $F 405$ ) and set parameter $F 400$ to 4 . After that, run the motor and set other parameters with the following explanation about parameter adjustments as a guide.
Setting motor parameters are necessary when Pt is set at $2,3,4,7$ or 8 .
(1) Slip frequency gain $F 40$;

This parameter is to adjust the slippage of the motor.
Setting this parameter at a larger number can reduce the slippage of the motor. However, setting it at an excessively large number may result in hunting, etc., and thus cause an unstable operation.
(2) Motor constant $1 F 418$ (Torque boost) (Motor test reports may be useful.) This parameter is to adjust the primary resistance of the motor. Setting this parameter at a larger value can prevent the drop of the motor torque in low speed ranges due to a voltage drop. However, setting it at an excessively large number may result in large current in low speed range and appearance of an overload trip, etc.
(3) Motor constant $2 \mathbb{F}$; i (No-load current) (Motor test reports may be useful.) This parameter is to adjust the exciting inductance of the motor. The larger the set value, the more exciting current can be increased. Note that specifying a too large value for the motor constant may cause hunting.
 This parameter is to adjust the leakage inductance of the motor. The larger the set value, the larger torque the motor can produce in high-speed ranges.
(5) Motor constant 4 F 4 i (Rated slip)

This parameter is to adjust the secondary resistance of the motor. The amount of compensation for slip increases with increase in this value.
(6) 5450 (Speed loop proportional gain)

This parameter is to adjust the gain responsive to speed. Specifying a large gain increases the speed of response, but specifying an excessively large gain may result in the occurrence of hunting. If operation is unstable and hunting occurs, operation can be stabilized in most cases by reducing the gain.
(7) $F 45 \Sigma$ (Moment of inertia of load)

This parameter is used to adjust the excess response speed. Specifying a large value reduces the amount of overshoot at the completion of acceleration. So, specify a value appropriate to the actual moment of inertia of the load.

### 6.23 Increasing the motor output torque further in low speed range

## F4 15 : Exciting strengthening coefficient <br> F4 i6 : Stall prevention factor

The output torque of the motor can adjusted using the parameters described in 6.22 in most cases, but if a finer adjustment is required, use these parameters.

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| F4:5 | Exciting strengthening coefficient | 10可 $130 \%$ | 100 |
| F415 | Stall prevention factor |  | 100 |

If the torque needs to be increased in low speed range ( 10 Hz or less as a guide)
Perform auto-tuning according to the instructions in 6.22, and if the torque needs to be increased further in low speed range, first increase the slip frequency gain ( 54018 ) to a degree ( $80 \%$ or so as a guide) that hunting of the motor does not occur. Then, increase motor constant $1(F 4 ; 7)$ by 1.1 times the current value as a guide. If the torque needs to be increased even further, increase the exciting current factor ( $F 4 ; 5$ ) to a maximum of $130 \%$. $F 4 i 5$ is a parameter that increases the magnetic flux of the motor at low speeds, so specifying a higher value for $F 4$; 5 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 above the base frequency
Adjust $F 4$ i 5 (stall prevention factor).
If a heavy load is applied momentarily (transiently), the motor may stall before the load current reaches the stall prevention level $\left(\begin{array}{ll}F & 5 \\ \hline\end{array}\right)$. In such a case, a motor stall may be avoided by reducing the value of $F 4$ i 5 gradually.

### 6.24 Torque control

$\Rightarrow$ For details, refer to Instruction Manual (E6581331) specified in Section 6.42.

### 6.24.1 Torque command

| Pt | : V/f control mode selection |  |  |
| :---: | :---: | :---: | :---: |
| F42n | : Torque command selection |  |  |
| F20 | : VIIII input point 1 setting | F205 | : VIIII input point 1 rate |
| F203 | : VIIII input point 2 setting | F2, | : VIIII input point 2 rate |
| FEin | : RRIS4 input point 1 setting | F214 | : RRIS4 input point 1 rate |
| F2iz | : RR/S4 input point 2 setting | F2 15 | : RR/S4 input point 2 rate |
| F216 | : RX input point 1 setting | F220 | : RX input point 1 rate |
| F2i8 | : RX input point 2 setting | F22 | : RX input point 2 rate |
| F228 | : Al2 input point 1 setting | F42 | : Torque reference filter |
| F230 | : Al2 input point 2 setting | $F 455$ | : Torque reference polarity selectio |

$F 435$ : Prohibition of rotation in any direction other than the specified one (F or R)
$F 725$ : Opelation panel torque command
$\Rightarrow$ For details, refer to Instruction Manual (E6581331) specified in Section 6.42.
6.24.2 Speed limits in torque control mode

| $F 425$ | Forward speed limit input selection $F 430$ | Speed limit (torque=0) center value |
| :---: | :---: | :---: |
| $F 425$ | : Forward speed limit input level | reference selection |
| $F 427$ | : Reverse speed limit input selection $F 431$ | : Speed limit (torque=0) center value |
| $F 428$ | : Reverse speed limit input level $F 432$ | : Speed limit (torque=0) band |

$\Rightarrow$ For details, refer to Instruction Manual (E6581331) specified in Section 6.42.

## 6．24．3 Selection of tension torque bias input and load sharing gain input


［Parameter setting］

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| 5423 | Tension torque bias input selection | 71：Disabled <br> i：VIIII（voltage／current input） <br> こ：RR／S4（potentiometer／voltage input） <br> 3：RX（voltage input） <br> 4 ：Operation panel input enabled（including <br> LED／LCD option input） <br> 5 ：2－wire RS485 input enabled <br> 5：4－wire RS485 input enabled <br> 7：Communication option input enabled <br> B：Optional AI1（Differential current input） | 8 |
| F72 | Control panel tension torque bias | －25句～こ5召\％ | 0 |
| 5424 | Load sharing gain selection | 71：Disabled <br> i：VIIII（voltage／current input） <br> こ：RR／S4（potentiometer／voltage input） <br> $3:$ RX（voltage input） <br> 4 ：Operation panel input enabled（including <br> LED／LCD option input） <br> 5 ：2－wire RS485 input enabled <br> $5: 4$－wire RS485 input enabled <br> 7：Communication option input enabled <br> B：Optional AI1（Differential current input） | 8 |
| $F 728$ | Control panel load sharing gain | 日～25景\％ | 100 |

［Selection of external signals］

| Voltage signals | RR／S4－CCA－0～10V | （0～250\％） | $コ$ |
| :---: | :---: | :---: | :---: |
|  | RX－CCA－0～さ10V | （－250～250\％） | 3 |
|  | VIIII－CCA－0～10V | （0～250\％） | ＇ |
| Current signals | VI／II－CCA－4（0）20m | （0～250\％） | 1 |

### 6.25 Torque limit

### 6.25.1 Torque limit switching

## $F 44 \pi$ : Power running torque limit $1 \longdiv { F 4 4 5 }$ selection <br> Power running torque limit 3 level

$F 441$ : Power running torque limit $1 \boxed{F 4 \%}$ level
$F 442$ : Regenerative braking torque $F 448$ limit 1 selection
$F 443$ : Regenerative braking torque $F 449$ limit 1 level level

## Regenerative braking torque limit 3 level

: Power running torque limit 4 level
: Regenerative braking torque limit 4 level

## $F 444$ : Power running torque limit $2 \boxed{F 454}$

 limit selection
## $F 445$ : Regenerative braking torque

 limit 2 level
## - Function

This function is to decrease or increase the output frequency according to the loading condition when the motor torque reaches the limit level. Setting a torque limit parameter at $250 \%$ means "Invalid."
With this function, you can also select from between limiting the constant output or limiting the constant torque in the constant output zone.
This function is not operate when the parameter $P L=\pi, i, 5$ setting.

Setting methods
(1) When setting limits to torque, use internal parameters (Torque limits can also be set with an external control device.)


With the parameter $F 454$, you can select the item that is limited in the constant output zone (somewhat weak magnetic field) from between constant output ( $F 454=\pi$ default setting) and constant torque $(5454=1)$. When you select the constant torque limit option, you should preferably select the output voltage limit option ( $F 307=3$ ) with the parameter $F 307$ (base frequency voltage selection).

Torque limits can be set with the parameters 544 iand $F 443$.
[Setting of power running torque]
$F 44 \pi$ (Power running torque limit 1 selection) : Set at $4(\boldsymbol{F} 44$ i)
F44i (Power running torque limit 1) : Set a desirable torque limit level.
[Setting of regenerative torque]

F443 (Regenerative braking torque limit 1) : Set a desirable torque limit level.
[Parameter setting]

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| 5440 | Power running torque limit 1 selection | i:VI/II (voltage/current input) <br> Z:RR/S4 (potentiometer/voltage input) <br> 3: RX (voltage input) <br> 4:F44: | 4 |
| F44i | Power running torque limit 1 level |  | $250.14 \%$ |
| F442 | Regenerative braking torque limit 1 selection | i:VI/II (voltage/current input) <br> $\Xi$ :RR/S4 (potentiometer/voltage input) <br> 3: RX (voltage input) <br> $4: 5443$ | 4 |
| 5443 | Regenerative braking torque limit 1 level |  | 25分. 0 |
| 5454 | Constant output zone torque limit selection | 17 : Constant output limit <br> i : Constant torque limit | 8 |

Using parameters, four different torque limits can be set for each operating status: power running and regenerative braking. Refer to Section 7.2 .1 for the setting for switching from the terminal board.

Power running torque limit $1-\boldsymbol{F} 4 \boldsymbol{\prime} \quad$ Regenerative braking torque limit $1-\boldsymbol{F}$
Power running torque limit $2-5444$
Power running torque limit $3-F 445$
Regenerative braking torque limit $2-5445$

Power running torque limit $4-F 44 B$
Regenerative braking torque limit $3-5447$
Regenerative braking torque limit $4-\boldsymbol{F} 44$
Note: If the value set with $\bar{F} \bar{\square}$ i (stall prevention level) is smaller than the torque limit, then the value set with FEG F acts as the torque limit.
(2) When setting limits to torque, using external signals


The torque limits can be changed arbitrarily by means of external signals.
[Selection of external signals]
$F 440,5442$

|  | RR/S4-CCA - 0~10V | 2 |
| :---: | :---: | :---: |
| Voltage signals | RX-CCA - 0 $\pm \pm 10 \mathrm{~V}$ | 3 |
|  | VI/II-CCA - 0~10V | ' |
| Current signals | $\mathrm{VI} / \mathrm{II}-\mathrm{CCA}-4(0) \sim 20 \mathrm{~mA}$ | ' |


[Parameter setting]

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| 5440 | Power running torque limit 1 selection | ```i:VI/II (voltage/current input) \imath`:RR/S4 (potentiometer/voltage input) 3:RX (voltage input) 4:F44:``` | 4 |
| 5442 | Regenerative braking torque limit 1 selection | : $\mathrm{VI} / \mathrm{II}$ (voltage/current input) $こ:$ RR/S4 (potentiometer/voltage input) <br> 3:RX (voltage input) <br> 4:F443 | 4 |

In torque control mode, the values set with these parameters limit torque command values.

### 6.25.2 Torque limit mode selection at acceleration/deceleration

 F45 i : Acceleration/deceleration operation after torque limit
## -Function

Using this function in combination with the mechanical brake of the lifting gear (such as a crane or hoist) makes it possible to minimize the delay before the brake starts working, and thus prevents the load from falling because of a decrease in torque.
Moreover, it improves the motor's response during inching operation and keeps the load from sliding down.
[Parameter setting]

| Title | Function | Adjustment range | Default setting |
| :---: | :--- | :--- | :---: |
| $;$ | Acceleration/deceleration operation after <br> torque limit | $0:$ In sync with <br> acceleration/deceleration <br> I: In sync with min. time | 0 |

(1) $F 45$ : $=0$ (In sync with acceleration/deceleration)

The increase in operation frequency is inhibited by the activation of the torque limit function. In this control mode, therefore, the actual speed is always kept in sync with the operation frequency. The operation frequency restarts to increase when torque decreases as a result of the release of the mechanical brake, so the time required for the specified speed to be reached is the sum of the delay in operation of the mechanical brake and the acceleration time.

(2) $F 45 i=i($ In sync with min. time)

The operation frequency keeps increasing, even if the torque limit function is activated.
In this control mode, the actual speed is kept in sync with the operation frequency, while torque is held at a limit level when it decreases as a result of the release of the mechanical brake. The use of this function prevents the load from failing and improves the motor's response during inching operation.


### 6.26 Stall prevention function

### 6.26.1 Power running stall continuous trip detection time

## $F 452$ : Power running stall continuous trip detection time

## - Function

A function for preventing lifting gear from failing accidentally. If the stall prevention function is activated in succession, the inverter judges that the motor has stalled and trips.
[Parameter setting]

| Title | Function | Adjustment range | Default setting |
| :---: | :--- | :--- | :---: |
| $F 45 \Omega$ | Power running stall continuous trip detection time | $0.0 \sim-1.0$ sec. | 0.0 |



### 6.26.2 Regenerative braking stall prevention mode selection

## $F 453$ : Regenerative braking stall prevention mode selection

## - Function

A function for preventing lifting gear from stopping in the wrong position. Only the function of preventing a stall by maintaining the current constant during regenerative braking (deceleration stop) is deactivated.
[Parameter setting]

| Title | Function | Adjustment range | Default setting |
| :---: | :--- | :--- | :---: |
| $\boldsymbol{F} 53$ | Regenerative braking stall prevention <br> mode selection | nistall during regenerative braking <br> $i:$ Not stall during regenerative braking | $\boxed{3}$ |

### 6.26.3 Stall prevention control switching

## F46B : Stall prevention control switching

```
- Function
The operation of the stall prevention control can be switched. Set }F458=;\mathrm{ when the overvoltage trip etc. are
displayed when acceleration and the deceleration are switched.
    This parameter is effective at only V/f control mode(FL=0,1,5).
```

[Parameter setting]

| Title | Function | Adjustment range | Default setting |
| :---: | :--- | :--- | :---: |
| $F 458$ | Stall prevention control switching | $I:$ Stall prevention control <br> $i:$ Stall prevention control 2 | 0 |

### 6.27 Current and speed control adjustment

### 6.27.1 Current and speed control gain

## $F 458-F 455$ : Current and speed control gain

$\Rightarrow$ For details, refer to Instruction Manual (E6581333) specified in Section 6.42.

### 6.27.2 Prevention of motor current oscillation at light load

## F467: Motor oscillation control

## - Function

When a motor is in unstable with light load, this parameter can change the motor gain to make motor condition stable. First set $\mathcal{F} \mathbf{4} \boldsymbol{7}=\boldsymbol{i}$ and check the motor condition. Please set $\bar{Z}$ to $\overline{3}$ in case motor needs more stable condition. This parameter is effective only in V/F control mode ( $F \underline{G}=\boldsymbol{0}, \boldsymbol{i}, 5$ )
[Parameter setting]

| Title | Function | Adjustment range | Default setting |
| :---: | :--- | :--- | :---: |
| 57 | Motor oscillation control | 0:Disabled <br> 1:Enabled(Low gain) <br> 2:Enabled(Middle gain) <br> 3:Enabled(High gain) | 0 |

### 6.27.3 Max output voltage modulation rate

## F495 : Max output voltage modulation rate

- Function

In the case that Inverter output voltage drops and output current exceeds motor rating current at the frequency higher than base frequency, Change this parameter setting and check whether the output current is reduced.
[Parameter setting]

| Title | Function | Adjustment range | Default setting |
| :---: | :--- | :--- | :---: |
| 545 | Max output voltage modulation rate | $0:$ Standard | $1: 100 \%$ |
|  | $2: 102.5 \%$ |  |  |
|  |  | $3: 105 \%$ | $\square$ |

### 6.28 Fine adjustment of frequency setting signal

$F 470$ : VIIII input bias
F47 : VIIII input gain
F472: RRIS4 input bias
F473: RR/S4 input gain
F 474 : RX input bias
$F 475$ : RX input gain
$F 475$ : Optional Al1 input bias
F477: Optional Al1 input gain
F478: Optional Al2 input bias
F479: Optional Al2 input gain

## - Function

These parameters are used to fine adjust the relation between the frequency setting signal input through the analog input terminal and the output frequency.
Use these parameters to make fine adjustments after making rough adjustments using the parameters


The figure below shows the characteristic of the frequency setting signal input through the analog input terminal and that of the output frequency.


Bias adjustment of analog input terminals (F470,F472,F474,F476,F47日)
To give leeway, the inverter is factory-adjusted by default so that it will not produce an output until a certain amount of voltage is applied to the analog input terminals.
To reduce leeway, decrease the bias of the analog terminal in use.
Note that specifying a too large value may cause an output frequency to be output, even though the operation frequency is 0 (zero) Hz .

Gain adjustment of analog input terminals (F47i,F473,5475,F477,5479)
The inverter is factory-adjusted by default so that the operation frequency can reach the maximum frequency, even though the voltage and current to the analog input terminals are below the maximum levels.
To make an adjustment so that the frequency reaches its peak value at the maximum voltage and current, decrease the gain of the analog terminal in use.
Note that specifying a too small value may cause the operation frequency not to reach the maximum frequency, even though the maximum voltage and current are applied.

### 6.29 Operating a synchronous motor

## $F 490$, F 499 : PM motor constant 1

$F 54$, F54i : Step-out detection current level/ detection time
This parameter is used only when the inverter is used with a synchronous motor. If you intend to use your inverter with a synchronous motor, contact us at the your supplier.

### 6.30 Acceleration/deceleration 2

6.30.1 Setting acceleration/deceleration patterns and switching acceleration/deceleration patterns 1, 2, 3 and 4
F50
F50 1 : Deceleration time 2
F5O2 : Acceleration/deceleration 1 pattern
F503: Acceleration/deceleration 2 pattern
F504 : Panel acceleration/deceleration selection
F509 : Deceleration S-pattern upper limit adjustment
F5 ID : Acceleration time 3
F5 11 : Deceleration time 3
F5:2 : Acceleration/deceleration 3 pattern
F5:3 : Acceleration/deceleration switching frequency 2
F505 : Acceleration/deceleration switching frequency 1
F5 14 : Acceleration time 4
F505: Acceleration S-pattern lower limit adjustment F5 15: Deceleration time 4
F507 : Acceleration S-pattern upper limit adjustment F516: Acceleration/deceleration 4 pattern F5OB : Deceleration S-pattern lower limit adjustment F5 17: Acceleration/deceleration switching frequency 3

## - Function

Four acceleration times and four deceleration times can be specified individually. The selection/switching mode can be selected from the following 3 options:

1) Selection by means of parameters
2) Switching by means of frequencies
3) Switching by means of terminals
[Parameter setting]

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| F500 | Acceleration time 2 |  | According to model |
| F50 | Deceleration time 2 | 0. 1 [ Note$] 5000 \mathrm{sec}$. | According to model |
| $F 504$ | Panel acceleration/deceleration selection | t:Acceleration/deceleration 1 <br> z: Acceleration/deceleration 2 <br> 3: Acceleration/deceleration 3 <br> 4: Acceleration/deceleration 4 | i |
| F510 | Acceleration time 3 | 0. 3 [ Note$]-5000 \mathrm{sec}$. | According to model |
| F5it | Deceleration time 3 | O. 3 [ Note$]-6000 \mathrm{sec}$. | According to model |
| F5:4 | Acceleration time 4 |  | According to model |
| F5: 5 | Deceleration time 4 | D. [ Note] 50000 sec . | According to model |

Note:The minimum setting of acceleration and deceleration times have been set respectively at 0.1 sec . by default, but they can be changed within a range of 0.01 sec . (setting range: $0.01 \sim 600.0 \mathrm{sec}$.) by changing the setting of the parameter $\left\llcorner\unlhd コ^{9}\right.$ (default setting).
$\Rightarrow$ For details, refer to Section 5.20.

1) Selection using parameters


Acceleration/deceleration time 1 is initially set as the default. Acceleration/deceleration time 2,3 and 4can be selected by changing the setting of the $F 504$.

2) Switching by frequencies - Automatically switching acc/dec times at certain frequencies

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| $F 565$ | Acceleration/deceleration switching frequency 1 |  | ก1. 0 |
| F513 | Acceleration/deceleration switching frequency 2 | 可. 0 - 5 HHz | 8.18 |
| F5i7 | Acceleration/deceleration switching frequency 3 | O.O~FH Hz | ก1. 0 |

Note:Regardless of the sequence of input of frequencies, acc/dec times are switched from 1 to 2 at the lowest frequency, from 2 to 3 at the middle frequency and from 3 to 4 at the highest frequency. (For example, if the frequency set with $F 505$ is higher than that set with $F 513$, the acc/dec time 1 is selected in the frequency range below the $F 513$-set frequency, while the acc/dec time 2 is selected in the frequency range of the $F 513$-set frequency to the $F 505$-set frequency.)

(1) Acceleration at the gradient corresponding to acceleration time RLL
(5) Deceleration at the gradient corresponding to deceleration time $F 5 ; 5$
(2) Acceleration at the gradient corresponding to acceleration time $F 500$
(3) Acceleration at the gradient corresponding to acceleration time $F 5$ 1 0
(4) Acceleration at the gradient corresponding to acceleration time $F 5$; 4
(6) Deceleration at the gradient corresponding to deceleration time $F 5$; ;
(7) Deceleration at the gradient corresponding to deceleration time 550 i
(8) Deceleration at the gradient corresponding to deceleration time $\sigma E[$
3) Switching using external terminals - Switching the acceleration/deceleration time via external terminals

(1) Acceleration at the gradient corresponding to acceleration time RIL
(5) Deceleration at the gradient corresponding to deceleration time $F 5$; 5
(2) Acceleration at the gradient corresponding to acceleration time $F 500$
(6) Deceleration at the gradient corresponding to deceleration time $F 5$; ;
(3) Acceleration at the gradient corresponding to acceleration time $F 5$ in
(7) Deceleration at the gradient corresponding to deceleration time 550 i
(4) Acceleration at the gradient corresponding to acceleration time $F 5$; 4
(8) Deceleration at the gradient corresponding to deceleration time $d E I$

■ Setting parameters
a）Operating method：Terminal input
Set the command mode selection 등 to
b）Use the S2 and S3 terminals for switching．（Instead，other terminals may be used．）
S2：Acceleration／deceleration switching signal 1
S3：Acceleration／deceleration switching signal 2

| Title | Function | Adjustment range | Example of setting |
| :---: | :---: | :---: | :---: |
| $F 175$ | Input terminal function selection 6 （S2） | 0～135 | 24 （Acceleration／deceleration switching signal 1） |
| $F: 17$ | Input terminal function selection 7 （S3） | B－135 | 25 （Acceleration／deceleration switching signal 2） |

■ Acceleration／deceleration pattern
Acceleration／deceleration patterns can be selected individually，using the acceleration／deceleration 1，2， 3 and 4 parameters．

1）Straight acceleration／deceleration
2）S－pattern acceleration／deceleration 1
3）S－pattern acceleration／deceleration 2

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| F502 | Acceleration／deceleration 1 pattern | 亿：Straight，$\quad$ ：S－pattern 1，こ：S－pattern 2 | －1 |
| $F 503$ | Acceleration／deceleration 2 pattern | B：Straight，$i: S$－pattern 1，〕：S－pattern 2 | $\square$ |
| F506 | Acceleration S－pattern lower limit adjustment | 8－5 0 \％ | 18 |
| F507 | Acceleration S－pattern upper limit adjustment | 8－5 0 \％ | 18 |
| $F 508$ | Deceleration S－pattern lower limit adjustment | 8－5 0 \％ | 18 |
| $F 509$ | Deceleration S－pattern upper limit adjustment | 6－5 0.7 | 10 |
| 5512 | Acceleration／deceleration 3 pattern | A：Straight，i：S－pattern 1，こ：S－pattern 2 | 0 |
| F515 | Acceleration／deceleration 4 pattern | 几：Straight，$\quad$ ：S－pattern 1，こ：S－pattern 2 | $\square$ |

1）Straight acceleration／deceleration
A general acceleration／deceleration pattern．
This pattern can usually be used．
Output frequency［ Hz ］
Maximum frequency $F \boldsymbol{F H}$


2）S－pattern acceleration／deceleration 1
Select this pattern to accelerate／decelerate the motor rapidly to a high－speed region with an output frequency of 60 Hz or more or to minimize the shocks applied during acceleration／deceleration．This pattern is suitable for conveyer machines．


Both the S－pattern lower－limit setting（F505，F5日B）and the S－pattern upper limit setting（ $F 507$ ，
$F 509)$ affect all acceleration／deceleration pattern settings．

3）S－pattern acceleration／deceleration 2
Select this pattern to obtain slow acceleration in a demagnetizing region with a small motor acceleration torque．
This pattern is suitable for high－speed spindle operation．


## 6．31 Pattern operation

## $F 520$ ：Pattern operation selection

## $F 5 \mathcal{I}$ ：Pattern operation mode

## $F 5 \mathcal{F}$ ，F53 ：Number of repetitions of pattern group 1， 2

$F 523-F 53 \cap$ ：Pattern group 1 selection 1～8
F532－F539：Pattern group 2 selection 1～8
F54O～F554 ：Speed 1～15 operation time

## －Function

These parameters allow you to combine a maximum of 30 operation frequencies，operation time and acceleration／deceleration time（ 15 combinations of parameters $\times 2$ patterns）for automatic pattern operation by means of the terminal board．
［Parameter setting］

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| $F 520$ | Pattern operation selection | $\begin{aligned} & \hline 0: \text { Disabled, } \\ & 1: \text { Enabled (setting in seconds) } \\ & Z: \text { Enabled (setting in minutes) } \\ & \hline \end{aligned}$ | 0 |
| F52i | Pattern operation mode | $\bar{f}$ ：Pattern operation reset when system stops operation i：Pattern operation continued even after system stops operation | 0 |
| F5こ2 | Number of repetitions of pattern group 1 | i～254，255：Successive | 1 |
| F5こう～F530 | Pattern group 1 selection 1～8 | $0:$ Skip，i～ 15 | 0 |
| F531 | Number of repetitions of pattern group 2 | i～254，255：Successive | i |
| F532～F539 | Pattern group 2 selection 1～8 | 0：Skip，i－15 | 0 |
| F540～F554 | Speed 1～15 operation time | 0．1～5000（The unit depends on the setting of $F 5$ 20．） 5000：Infinite（depends on the stop trigger entered） | 5.0 |

＊Forward／reverse，acc／dec time 1，2，V／f 1， 2 can be set with $F 550$～F5 75 （Preset speed operation frequency 1～15 operation modes）．$\Rightarrow$ For details，refer to Section 5．12．
Note：When the function of auto－restart is active，the time spent for speed search is added to the operation time set for pattern operation．Consequently，the effective operation time sometimes becomes shorter than the settled operation time．
<Basic operating>


■ Pattern operation switching output (output terminal function: $\exists 5, \Xi 7$ )
If the pattern operation switching output function is selected (activated), a signal is put out on completion of all the predetermined patterns of operation. When there is no operation command left to be entered or the pattern operation selection signal changes, the output terminals are turned off.

| Terminal <br> symbol | Title | Function | Adjustment <br> range | Example of setting |
| :--- | :---: | :---: | :---: | :---: |
| OUT1 | $F: 30$ | Output terminal <br> function selection 1 | $0 \sim 255$ | 35 (Pattern operation finished - ON signal) <br> or |
| 7 (Pattern operation finished - OFF signal) |  |  |  |  |

Note:To put out signals to the terminal OUT2, select the parameter $F i \Xi \mathrm{i}$.

Note: •Pattern operation groups should be selected by terminal input.

- If no signal is put out from any pattern operation signal (all terminals are turned off), or after the pattern operation is completed, the system returns to the normal operation mode.
- When two or more pattern group numbers are entered simultaneously, the pattern group operations are performed in ascending order and automatically switched to one another. In this case, it may take about 0.06 seconds to search for each pattern.
- Do not turn on the operation signal in 10 ms after turning on pattern operation selections 1 and 2 when the machine is at rest. Or the normal operation frequency may be output.

Pattern run operation

| $(1)$ | $(2)$ |
| :--- | :--- |
| $(2)$ | : Pattern group 1 in operation |

Pattern operation input 1 (S1-CC)
Pattern operation input 2 (S2-CC)

<Parameter setting>
$F: 15=38$ (Pattern operation selection 1)
Fi: $15=40$ (Pattern operation selection 2)

### 6.32 Preset speed mode

## F55A-F575: Preset speed operation modes

$\Rightarrow$ For more details, refer to Section 5.12.

### 6.33 Protection functions

### 6.33.1 Setting of stall prevention level

FKO i : Stall prevention level

| \! Warning |  |
| :---: | :---: |
|  | - Do not set the stall prevention level ( $F 5$ 保i) extremely low. <br> If the stall prevention level parameter $(F \sigma S i)$ is set at or below the no-load current of the motor, the stall preventive function will be always active and increase the frequency when it judges that regenerative braking is taking place. <br> Do not set the stall prevention level parameter ( $F$ G 0 i) below $30 \%$ under normal use conditions. |

## - Function

This parameter reduces the output frequency by activating a current stall prevention function against a current exceeding the $F 50$ i-specified level.
[Parameter setting]

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| $F 50$ i | Stall prevention level | $0 \sim 154 \%, 155:$ Deactivated | 150 |

[Display during the alarm $O[$ ]
During an $0[$ alarm status, (that is, when there is a current flow in excess of the stall prevention level), the output frequency changes. At the same time, to the left of this value, "L" is displayed flashing on and off.

Example of display

$$
\because 50
$$

### 6.33.2 Inverter trip record retention

## F6O2 : Inverter trip record retention selection

## - Function

If the inverter trips, this parameter will retain the corresponding trip information. Trip information that has thus been stored into memory can be displayed, even after power has been reset.
[Parameter setting]

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| F582 | Inverter trip record retention selection | 7:Clear when power is turned off. <br> : Retain even after power is turned off. | 8 |

Up to four sets of latest trip records displayed in status monitor mode can be stored into memory.
Data (current, voltage, etc.) displayed in status monitor mode when the inverter is tripped is cleared when power is turned off.

- Flow of operation when $F 5 \Omega=1$


If the cause of tripping or that of another failure is not yet removed.

Be sure to select this setting if the main power supply is turned on and off endlessly for reasons of sequence, as shown below, in the event the control power supply backup device fails or not connected.

In case of
3 - 200~240V
$-50 / 60 \mathrm{~Hz}$

Control power supply backup device (option)

<Example of a situation in which the main power supply is turned on and off endlessly> In the example of connection shown above, if the control power supply 4backup device (optional) fails or not connected and becomes incapable of supplying control power, control power is supplied from the inverter's main circuit and operation is continued without interruption. If the inverter is tripped under these circumstances because of a ground fault or overcurrent :
(1) The FL relay is triggered and the main power supply is shut off by the MC.
$\downarrow$
(2) As a result of shutoff by the MC, the voltage in the inverter's main circuit and control circuit drop.
$\downarrow$
(3) As a result of a drop in control voltage, the FL relay recovers from a trip.
$\downarrow$
(4) The release of the FL relay turns the MC back on.
$\downarrow$
(5) Operation is restarted and if the problem causing the inverter to be tripped is not eliminated, the inverter is tripped again, the situation in (1) arises again, and thus the above cycle of operation is repeated endlessly.

### 6.33.3 Emergency stop

## F5И3 : Emergency stop

## F504 : Emergency DC braking control time

## - Function

Emergency stop mode can be selected. At emergency stop, a trip message (" $\boldsymbol{E}$ ") is displayed. FL relay can be deactivated using the output function selection.

1) Emergency stop by terminal operation

Emergency stop can be performed with the a or b-contact. Assign the emergency stop function to a terminal as described below, and select a stop mode.

2) Emergency stop

FGOJ= $:$ : The motor is brought to a stop within the time specified with $d E[$
$F 5 \Omega \Xi=\Omega$ : DC braking is performed at the current specified with $F こ 5$ i (DC braking current) for the time specified with $F 504$ (emergency DC braking control time).
$F 503=3$ : The motor is brought to a stop within the time specified with $F 5$; 5 (deceleration time 4). Use this setting to bring the motor to a stop within time different from the normal deceleration time specified with $d E L$.

3）Selecting the operation of the FL relay
Using the output terminal selection parameter，you can specify whether or not to operate the FL relay．
$F: \Xi \Xi$（output terminal selection 3 ）$=10$（default）：Operates the FL relay in the event of an emergency stop．
$F: 3 \Xi$（output terminal selection 3 ）$=134$ ：Does not operate the FL relay in the event of an emergency stop．
［Parameter setting］

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| F503 | Emergency stop | 71：Coast stop <br> i：Deceleration stop <br> $こ$ ：Emergency DC braking <br> 3：Deceleration stop（deceleration <br> 4） | 0 |
| $F 504$ | Emergency DC braking control time | 0．0．0－270．0 sec． | 1.4 |
| FE5 | DC braking current | 8－100\％ | 50 |

（Example of terminal assignment）：Assigning the emergency stop function to the S3 terminal．

| Title | Function | Adjustment range | setting value |
| :---: | :---: | :---: | :---: |
| Fiti | Input terminal function selection 7（S3） | 8－935 | 20 （Emergency stop） |

Note 1：Emergency stopping via the specified terminal is possible，even during operation panel operation．
Note 2：If $F \boxed{\square} \Xi=\Omega$（Emergency DC braking）and DC braking is not required for normal stopping，set the DC braking time $\stackrel{F}{2} 5 \Omega$ to 10.0 ［s］．

4）Emergency stopping from the operation panel is possible
Pressing the STOP key on the operation panel twice enables emergency stop．
（1）Press the STOP key $\qquad$ ＂E GFF＂will blink．
（2）Press the STOP key again — If $F 50.3$（Emergency stop）$=0 \sim 3$ ，the motor makes an emergency stop（or trips）according to the setting． If＂ $\boldsymbol{E}$＂is displayed an error detection signal（FL）is issued（FL is activated）．

## 6．33．4 Output phase failure detection

FSA5 ：Output phase failure detection mode selection

## －Function

This parameter detects inverter output phase failure．If the inverter detects an open phase failure，the tripping function and the FL relay will be activated．At the same time，the trip information $E \rho H$ will also be displayed．
Detection errors may occur for special motors such as high－speed motors．

## F5日5＝0：No tripping

F $505=1$ ：With the power on，the phase failure detection is enabled only at the start of the first operation．The inverter will trip if the inverter detects an open phase failure．
$F 5 \Omega 5=\Omega$ ：The inverter checks for output phase failures each time it starts operation．The inverter will trip if the inverter detects an open phase failure．
F $505=3$ ：The inverter checks for output phase failures during operation．The inverter will trip if the inverter detects an open phase failure．
$F 505=4$ ：The inverter checks for output phase failures at the start of and during operation．The inverter will trip if the inverter detects an open phase failure．
$F 505=5$ ：If the inverter detects an open phase failure in every phase，it does not trip but restarts operation when every phase is reconnected．
The inverter does not check for output phase failures when restarting after a momentary power failure． This function $(F 505=5)$ doesn＇t operate at $200 \mathrm{~V}-55 \mathrm{~kW} / 75 \mathrm{kw}$ and $400 \mathrm{~V}-90 \mathrm{~kW}$ or more models．
Note：A check for output phase failures is made during auto－tuning $1(F 400=2,3)$ ，regardless of the setting of this parameter $F 605$ ．
［Parameter setting］

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| F605 | Output phase failure detection mode selection | 7：Deselect <br> i：At starting（only one time after power is turned on） $己$ ：At starting（each time power is turned on） <br> 3：During operation <br> 4 ：At starting＋during operation <br> 5 ：Output cut－off detection enabled | 0 |

## 6．33．5 OL reduction starting frequency

F5O5：OL reduction starting frequency
$\Rightarrow$ For more details，refer to Section 5.14 ．

## 6．33．6 Motor $150 \%$－overload time limit

 F5S 7 ：Motor 150\％－overload time limit$\Rightarrow$ For more details，refer to Section 5.14 ．

## 6．33．7 Input phase failure detections

## FGAB ：Input phase failure detection mode selection

## －Function

This parameter detects inverter input phase failure．At the occurrence of a phase failure，the $\boldsymbol{E} \boldsymbol{F} \boldsymbol{f}$ protection message is displayed．
$F 5 B=B$ ：No tripping（Failure signal FL deactivated）．
$F \boxed{\sigma} \boldsymbol{\sigma}=1$ ：This parameter detects inverter input phase failure．If the inverter detects an open phase failure，it trips．
［Parameter setting］

| Title | Function | Adjustment range | Default setting |
| :---: | :--- | :--- | :---: |
| $F G B G$ | Input phase failure detection mode selection | $\boldsymbol{B}:$ Disabled，$i:$ Enabled | $i$ |

Note 1：Setting $F G B$ to（input phase failure detection：disabled）may result in a breakage of the capacitor in the inverter main circuit if operation is continued under a heavy load in spite of the occurrence of an input phase failure．
Note 2：When using a single－phase direct current to operate the inverter，disable this function $(\mathbb{F} \square \Omega=\Omega)$

## 6．33．8 Control mode for low current

## F5 S9 ：Low current detection hysteresis width

FS in ：Low current trip selection
FS I I ：Low current detection current
F5 i己 ：Low current detection time

## －Function

If the current is lower than $F 5 ;$ ；level and passes for a time longer than $F \underset{F}{ } \boldsymbol{i}$ ，the inverter trips． Trip information is displayed as＂$u\left[\begin{array}{l}L \\ \hline\end{array}\right.$ ．＂
$F 5: \Omega=0$ ：No tripping（Failure signal FL deactivated）．
A low current alarm can be put out by setting the output terminal function selection parameter．
$F \sigma: G=t$ ：The inverter will trip（the failure signal FL will be activated）if a current below the current set with $F \sigma ;$ ；flows for the period of time specified with F $F$ i己．

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| F609 | Low current detection hysteresis width | i－20\％ | 10 |
| F510 | Low current trip selection | $\begin{aligned} & \text { 0: No trip } \\ & \text { i:Trip } \\ & \hline \end{aligned}$ | 0 |
| FS i | Low current detection current | 日～100\％ | 0 |
| $F 512$ | Low current detection time | $0 \sim 255 \mathrm{sec}$ ． | 0 |

## <Example of operation>

Output terminal function: $\mathbf{2 6}$ (UC) Low current detection
$F 5: 0=0$ (No trip)

Ex.) When outputting low current detection signals through output terminal OUT1

| Title | Function | Adjustment range | Example of setting |
| :---: | :---: | :---: | :---: |
| $F: 30$ | Output terminal function selection 1(OUT1) | $0-255$ | 25 |

Note:To put out signals to the terminal OUT2, select the parameter $F i \Xi i$.

 After tripping, the low current signal remains ON.

### 6.33.9 Detection of output short circuit

\section*{| F 13 : Selection of short circuit detection at starting |
| :--- | :--- |}

```
- Function
Detects a short-circuit on the output side of the inverter.
```

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| F6:3 | Selection of short circuit detection at starting | 0 : Each time (standard pulse) <br> $i$ : Only one time after power is turned on <br> $\Xi$ :Each time (short pulse) <br> 3:Only one time after power is turn on (short pulse) <br> 4 :Each time (Extremely shot-time pulse) <br> 5 : Only one time after power is turn on (Extremely shot-time pulse) | 0 |

F5:
B, 2, 4: Standard —— detecting at starting
$i, 3,5$ : A check is made once at the first start of operation after the power is turned on or the inverter is reset.
Note: If the input voltage is rather high ( 480 V as a guide) or the inverter is used to operate a high-speed motor, set $F 5 i \exists$ to $\beth$ or $Э$. Any other setting may cause the motor to malfunction, because a high-speed motor has a very low impedance. If the inverter malfunctions for reasons of impedance even though $\mathcal{F}$ I is set to $\beth$ or 3 , then set $F 5$ i 3 to 4 or 5 .

### 6.33.10 Overtorque trip

F5 IS : Overtorque trip selection
F5 i5 : Overtorque detection level during power running
F5 i 7 : Overtorque detection level during regenerative braking
F5 iB : Overtorque detection time
F5 ig : Overtorque detection hysteresis

## - Function

Trips the inverter or issues an alarm if the total time for which torque is above the level set with $F 5: 5 / F 5: 7$ reaches the time set with $F \sigma: B$. Trip information is displayed as " $B t$."

FE $15=0$ (No trip) No tripping (FL is not active).
F5:5=i(Tripping)
The inverter will trip (the failure signal FL will be activated) if a torque larger than $F E: 5$ (during power running) or $F 5: 7$ (during regeneration) passes for a time longer than the time set with $F 6 ; 8$

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| F5: 5 | Overtorque trip selection | If:No trip, 1 :Trip | $\square$ |
| F516 | Overtorque detection level during power running | D~250\% | 150 |
| FS:7 | Overtorque detection level during regenerative braking | 0~こ50 \% | 150 |
| $F 5: 8$ | Overtorque detection time | 0.00~ 10.00 sec . | 0.50 |
| F5:9 | Overtorque detection hysteresis | 可 - $100 \%$ | 10 |

Note:Using the output terminal function selection parameter, the inverter can be set so that it outputs overtorque detection signals regardless of the setting of $\boldsymbol{F} \boldsymbol{5} \boldsymbol{5} . \Rightarrow$ Refer to Section 7.2.2.

## <Example of operation>

Output terminal function: $\mathbf{2 8}$ Overtorque detection
$F 5$ i $5=0$ (No trip)

Ex.) When outputting overtorque detection signals through output terminal OUT1

| Title | Function | Adjustment range | Example of setting |
| :---: | :---: | :---: | :---: |
| F 130 | Output terminal function selection 1(OUT1) | 0-255 | $2 \square$ |

Note: To put out signals to the terminal OUT2, select the parameter $F i \Xi i$


When $F 5: 5=i$ (tripping), the inverter will trip if overtorque lasts for the period of time set with $F 5$ ig. In such a case, the overtorque signal remains ON.

### 6.33.11 Cooling fan control selection

## $F 52 \pi$ : Cooling fan control selection

## - Function

With this parameter, you can set the condition of cooling fan so that it operates only when the inverter requires cooling, and thus it can be used for a longer period.
$F G \Xi \Omega=0$ : Automatic control of cooling fan, enabled. Operates only when the inverter is in operation.
$F E \Sigma \Omega=\{$ : Automatic control of cooling fan, disabled. The cooling fan always operates when the inverter is energized.

The cooling fan automatically operates whenever the ambient temperature is high, even when the inverter is out of operation.

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| F52号 | Cooling fan control selection | 0 :Auto, i:Always ON | $\square$ |

### 6.33.12 Cumulative operation time alarm setting

## F5E I : Cumulative operation time alarm setting

## - Function

This parameter is to make a setting so that the inverter puts out a signal when its cumulative operation time has reached the time set with $F \underset{5}{ } \boldsymbol{I}^{\prime}$.

* Indication of $\Omega$. ; represents 10 hours. Ex.: If $\Xi \Omega .5$ is displayed, the cumulative operation time is 3850 hours.

| Title | Function | Adjustment range | Default setting |
| :---: | :--- | :--- | :---: |
| $F E Z ;$ | Cumulative operation time alarm setting | $0.1-999.9$ | 510.0 |

- Setting of output signal

Ex.) When assigning the cumulative operation alarm signal output function to the OUT2 terminal

| Title | Function | Adjustment range | Example of setting |
| :---: | :--- | :--- | ---: |
| Fi3i | Output terminal function selection 2 (OUT2) | $\boxed{\square} \sim 255$ | 55 (Negative logic 5 7) |

### 6.33.13 Abnormal speed detection

## $F$ FEZ : Abnormal speed detection time

$F 523$ : Overspeed detection frequency upper band
F524 : Overspeed detection frequency lower band

## - Function

When use at speed control mode with sensor $(P L=7, B)$, it always monitors the rotational speed of the motor, even when the motor is at rest, and if the speed remains out of the specified limits for the specified length of time, it outputs an error signal.
When use at speed control mode without sensor $(P L=\square \sim \square)$, it always monitors the estimated rotational speed of the motor.

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| F6EZ | Abnormal speed detection time | 0.0 : 100.0 sec. | 0.01 |
| F623 | Overspeed detection frequency upper band | 0.0.0. Disabled, $0.1 \sim 30.0 . \mathrm{Hz}$ | 0.0 |
| F6E4 | Overspeed detection frequency lower band | 01.0. Disabled, $0.1-30.0$ Hz | 0.0 |



Note 1: This function doesn't operate at the time of a torque control.
Note 2: It is advisable to set the parameter $F 45$; (Acceleration/deceleration operation after torque limit) to $i$ when this function is set.

## 6．33．14 Overvoltage limit operation

## F525 ：Overvoltage limit operation level

$\Rightarrow$ For more details，refer to Section 6．14．2．

## 6．33．15 Undervoltage trip

## $F 525$ ：Undervoltage detection level

$F 5 \mathcal{F} 7$ ：Undervoltage trip selection
F52B ：Undervoltage（trip alarm）detection time

## －Function

This parameter is used for selecting the control mode when an undervoltage is detected．（Invalid，while the inverter stops．）When selecting＂tripping enabled，＂you can also specify the time elapsed before the inverter trips．

| $F 5 \Sigma 7=\square$ ：（Disabled） | Inverter stops，but does not trip．（FL is not active．） |
| :---: | :---: |
| F L ב $7=1$ ：（Enabled） | The inverter trips $: \square$ ；if an undervoltage passes for the time set with $F 5 \mathcal{G}$ or over．（FL is activated．） |


| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| F525 | Undervoltage detection level | $50 \sim 79 \%, 80 \%$（auto mode） | 80 |
| $F 627$ | Undervoltage trip selection | O：Disabled， f ：Enabled | 0 |
| F6こ日 | Undervoltage（trip alarm）detection time | 0.0 i 10.00 sec ． | 0.03 |

Note：For $F 5$ こ55，100\％corresponds to a voltage of 200 V （for 200 V class）or 400 V （for 400 V class）

## 6．33．16 Regenerative power ride－through control level

F529 ：Regenerative power ride－through control level

## －Function

This parameter is used to set the operation level of the regenerative power ride－through control and the deceleration stop．（Refer to Section 5．18．2．）

| Title | Function | Adjustment range | Default setting |
| ---: | :--- | :--- | :---: |
| $F 5 \Omega 9$ | Regenerative power ride－through control level | $55 \sim 100 \%$ | 75 |

Note1：$\quad$ Set this parameter at a value of $F \Sigma こ 5+5 \%$ or more．Or the braking time of regenerative power ride－though control could be extremely shorter．This setting is not necessary if $F 5 \Omega 5$ is set to $g 0$（auto mode）．
Note2：When power on or reset operation，the power supply voltage is detected．If the setting value of parameter $F 5 こ 9$ is too low，the setting value is automatically adjusted to stabilize the performance．
Note3：For $F 5 \mathcal{F} 9,100 \%$ corresponds to a voltage of 200 V （for 200 V class）or 400 V （for 400 V class）

## 6．33．17 Braking answer waiting time

## F530 ：Braking answer waiting time

## －Function

This parameter is used to set the waiting time for answer from system（Input terminal function setting： System supporting sequence（BA：Braking answer $130,13 i)$ ）．After start of operation，if no answer is received in set time（ $F \sigma \exists \mathbf{O}$ ），the inverter trips（ $\mathcal{E}-\mathrm{i}$ i）．

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| F530 | Braking answer waiting time | B． 0 ：Disabled 0．i～ 10.0 sec ． | 0.0 |

### 6.33.18 VI/II analog input wire breakage detection level

## F533: VIIII analog input wire breakage detection level

| - Function <br> The inverter will trip if the VIIII value remains below the specified value for 0.3 seconds or moreThe message " $E-i G$ " is displayed. |  |  |  |
| :---: | :---: | :---: | :---: |
| $\begin{aligned} & \text { F5 } 3 J=0 \text { : Disabled …..... The detection function is disabled. } \\ & \text { F } 53=1 \sim 100 \text {........... The inverter will trip if the VI/II value remains below the specified value for } 0.3 \\ & \text { seconds or more. } \end{aligned}$ |  |  |  |
| Title | Function | Adjustment range | Default setting |
| F533 | VI/II analog input wire breakage detection level | 17:None $1 \sim 100 \%$ | 0 |

### 6.33.19 Guide to time of replacement

## F534 : Annual average ambient temperature

## - Function

You can set the inverter so that it will calculate the remaining useful life of the cooling fan, main circuit capacitor and on-board capacitor from the ON time of the inverter, the operating time of the motor, the output current (load factor) and the setting of 5534 and that it will display and send out an alarm through output terminals when each component is approaching the end of its useful life.

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| F634 | Annual average ambient temperature | $\begin{aligned} & \hline:-10 \sim+10^{\circ} \mathrm{C} \\ & 3:+11+20^{\circ} \mathrm{C} \\ & 3:+21 \sim+30^{\circ} \mathrm{C} \\ & 4:+31 \sim+40^{\circ} \mathrm{C} \\ & 5:+41 \sim+50^{\circ} \mathrm{C} \\ & 5:+51 \sim+60^{\circ} \mathrm{C} \end{aligned}$ | 3 |

Note 1: Using $F 5 \Xi 4$, enter the annual average temperature around the inverter. Be careful not to enter the annual highest temperature.
Note 2: Set $F 534$ at the time of installation of the inverter, and do not change its setting after the start of use. Changing the setting may cause a part replacement alarm calculation error.

### 6.33.20 Rush current suppression relay activation time

## F535: Rush current suppression relay activation time

## - Function

This parameter is used to control the rush current suppressing resistor shorting relay when a direct current is passed or multiple inverters are used with their DC sections connected to each other.

| Title | Function | Adjustment range | Default setting |
| :---: | :--- | :--- | :---: |
| $F 5.5$ | Rush current suppression relay <br> activation time | $\boxed{0.0}-\beth .5 \mathrm{sec}$. | $\boxed{0} .0$ |

The rush current suppressing relay is activated on the expiration of the time limit set with parameter $F 535$ after the voltage in the DC section of the inverter has reached the specified level.


### 6.33.21 Motor thermal protection

## F537-F53日 : PTC thermal selection

$\Rightarrow$ For details, refer to Instruction Manual (E6581339) specified in Section 6.42.

### 6.33.22 Braking resistance overload curve

## F539 : Braking resistance overload time

$\Rightarrow$ Refer to 5.19 for details.

### 6.33.23 Selection of a restart condition for the motor stopped with a mechanical brake F543: Brake-equipped motor restart condition selection

```
- Function
    With this function, the motor can be restarted immediately after a stop if it is operated at a frequency of more
    than 10Hz (20Hz or less) and stopped with a mechanical brake.
    Use this function only when a mechanical brake is used to stop the motor. Using this function for a motor
    without a mechanical brake, the inverter may be tripped or fail.
```

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| 5643 | Brake-equipped motor restart condition selection | $\overline{7}$ : Default (no waiting time for frequencies of 10 Hz and less) $i$ : Conditional (no waiting time for frequencies of 20 Hz and less) | 0 |

The timing chart in the figure below shows how the motor is operated and stopped with a mechanical brake. By default, restart waiting time is set to prevent the inverter from being tripped because of the immediate restart of the motor which started coasting at a frequency of more than 10 Hz and stopped (when the ST function is assigned to the S3 terminal, S3 signal is cut off).
This waiting time, however, is not necessary if a mechanical brake is used to stop the motor more reliably. When using a mechanical brake to stop the motor, set this parameter $F 543$ to $i$ to allow the motor to restart immediately after a stop if it started coasting at a frequency of 20 Hz or less and stopped.
$<$ Ex. : When parameter $F 543$ is set to i.>


When assigning the ST function to the S3 terminal,
Set $F$ : $1 / 2$ to (to cancel its factory default setting: $\sigma=$ ST always active), and Set $F ; i$ to $\bar{\square}$ (to assign the ST function to the S3 terminal).

Note 1: By default, the restart waiting time shown in the figure is set, and the restart of the motor is delayed by the time indicated by the dashed line.
Note 2: If the motor started coasting at a frequency of more than 20 Hz , it will restart after the expiration of the waiting time.

### 6.33.24 Protection against a failure of the control power backup device (optional CPS002Z) F547 : Control power supply backup option failure monitoring

| $1 \cdot$ Function <br> If the control power backup device (optional CPSO02Z) fails to supply power for some reason or other for fifteen minutes and over, the inverter will put out an alarm signal or a trip signal depending on the setting. Leaving this parameter disabled may cause the main power supply to be turned on and off endlessly if something unusual occurs, depending on your sequence etc., so you should set this parameter $F 547$ properly I when using the optional power backup device. |  |  |  |
| :---: | :---: | :---: | :---: |
| Title | Function | Adjustment range | Default setting |
| F547 | Control power supply backup option failure monitoring | a: Control power supply not backed up <br> i: Control power supply backed up (alarm in the event of a failure) <br> Z': Control power supply backed up (tripping in the event of a failure) | 0 |

■ $F 547=\Omega$ : If control power is not backed up with an external backup device:
Select this setting if an external backup device is not connected to the inverter's control terminals +SU and CC.
Note: Even if $F 547$ is set to $\Omega$ while control power is backed up, the inverter will cut off the power supply and issue $[0 F F$ alarm in the event the backup device fails during operation. If the backup device is already faulty when it is turned on, it will not be recognized to be faulty even if this setting is selected.

■ $F 547=\{$ : If control power is backed up with an external backup device (alarm signal output):
 alarm in the event something unusual (voltage drop) occurs with the power supplied through the +SU and CC terminals.
Once the $\mathbb{L} \boldsymbol{I F F}$ alarm has been raised, the inverter is not reset even if the control voltage returns to its normal level. To reset the inverter, turn off the main circuit power supply.

■ F $547=$ ? : If control power is backed up with an external backup device (trip signal output):
This setting trips the inverter in the event something unusual (voltage drop) occurs with the external control power backup device. Trip code $E-29$ is displayed.
In the event of this trip, unlike ordinary trips, the inverter is held tripped regardless of the setting of $F 50$ ? (inverter trip retention selection).
This setting is effective only when the inverter is used in a standard connection shown in Chapter 2.
If reset the trip, operate with $F 547=0$ or $i$ setting.
Note: Be sure to set the parameter $F \Sigma \Omega 2$ to 1 if the main power supply is turned on and off endlessly for reasons of sequence, as shown below, in the event the control power backup device fails.
$\Rightarrow$ For details, refer to section 6.33.2

$$
3 \phi-200 \sim 240 \mathrm{~V}
$$

$-50 / 60 \mathrm{~Hz}$

Control power supply backup option (CPS002Z)


### 6.34 Override

## $F 56:$ : Override addition input selection

## F5S i : Override multiplication input selection

## - Function

These parameters are used to adjust reference frequencies by means of external input.

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| F550 | Override addition input selection [Hz] | 0:Disabled <br> i:VI/II (voltage/current input) <br> Z:RR/S4 (potentiometer/voltage input) <br> 3:RX (voltage input) <br> 4 :Operation panel input enabled (including <br> LED/LCD option input) <br> 5:2-wire RS485 input enabled <br> 5:4-wire RS485 input enabled <br> 7:Communication option input enabled <br> B:Optionl AI1 (differential current input) <br> 9:Optionl AI2 (voltage/current input) <br> in:Up/Down frequency <br> i : Optionl RP pulse input <br> 1こ:Optionl high-speed pulse input <br> 13:Optionl binary/BCD input | 0 |
| F55 | Override multiplication input selection <br> [\%] | 7: Disabled <br> i: VI/II (voltage/current input) <br> ב:RR/S4 (potentiometer/voltage input) <br> 3:RX (voltage input) <br> 4:F729 <br> 5 :Optionl AII | 0 |

The override functions calculate output frequency by the following expression:
Frequency command value $\times\left(1+\frac{\text { Value [\%] selected with } F \Sigma 5 i}{100}\right)+$ Value $[\mathrm{Hz}$ ] selected with $F \Sigma \Sigma$ G

1) Additive override

In th1is mode, an externally input override frequency is added to operation frequency command.
[Ex.1: RR/S4 (Reference frequency), VI/II (Override input)] [Ex.2:RX (Reference frequency), VI/II (Override input)]


Ex.1:
$F 5 \sigma \Omega=i$ (VIIII input), $F 5 \sigma i=0$ (disabled)

## Output frequency = Reference frequency + Override (VIIII input [Hz])

Ex.2:
$F 55 \Omega=1$ (VI/II input), F55 $i=\Omega$ (disabled)

## Output frequency = Reference frequency + Override (VIIII input [Hz])

2) Multiplicative override

In this mode, each output frequency is multiplied by an externally override frequency.
[Ex.1: RR/S4 (Reference frequency), VI/II (Override input)] [Ex.2: RX (Reference frequency), VI/II (Override input)]



Ex.1:


VIII input (F20 $:=0, F 205=0, F 203=100, F 206=100$ )
$\Rightarrow$ Setting of RR/S4 input: Refer to Section 7.3.1, Setting of $\mathrm{VI} / \mathrm{II}$ input: Refer to Section 7.3.2.

## Output frequency $=$ Reference frequency $\times\{1+$ Override (VIIII input [\%]/100) $\}$

## Ex.2:



VIII input ( $F 20$ : $=0, F 202=0, F 203=100, F 205=100)$
$\Rightarrow$ Setting of RX input: Refer to Section 7.3.3, Setting of VI/II input: Refer to Section 7.3.2.
Output frequency $=$ Reference frequency $\times\{1+$ Override (VI/II input [\%]/100) $\}$

Ex.3:

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| F729 | Operation panel override multiplication gain | - 10 可 $100 \%$ | 8 |

[^14]
### 6.35 Adjustment parameters

### 6.35.1 Pulse train output for meters

F559 : Logic output/pulse output selection (OUT1)
$F 575$ : Pulse output function selection
F5 77 : Selection of number of pulses

## -Function

Pulse trains can be sent out through the OUT1-CC output terminals.
To do so, it is necessary to select a pulse output mode and specify the number of pulses.
This function output the pulse is based on $F 577$ setting when each selection is suitable for the fixed output 1 level (refer to selection 5.16).

Set the SW4 to pulse output (PULS).
Ex.) When operations frequencies ( 0 to 60 Hz ) are put out by means of 0 to 10 kHz
$F H=60.0, F 5 \sigma 马=1, F 575=0, F 577=10.00$
The pulse will change between 0 and 10 kHz according to the operations frequencies between 0 and 60 Hz . $\Rightarrow$ See the circuit diagram shown at the bottom of page B-15.

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| F569 | Logic output/pulse output selection (OUT1) | 0:Logic output i:Pulse output | 0 |
| F575 | Pulse output function selection | 3:Output frequency <br> i:Frequency command value <br> 2 :Output current <br> 3:Input voltage (DC detection) <br> 4 :Output voltage <br> 5 :Compensated frequency <br> 5 :Speed feedback (realtime value) <br> 7:Speed feedback (1-second filter) <br> B:Torque <br> 9:Torque command <br> i ::Torque current <br> 12 :Exiting current <br> 1 3 :PID feedback value <br> i 4 :Motor overload factor (OL2 data) <br> i5:Inverter overload factor (OL1 data) <br> i 5 : Regenerative braking resistance <br> overload factor (OLr data) <br> i 7 :Regenerative braking resistor load factor (\% ED) <br> i $B$ :Input power <br> 19:Output power <br> 23:Optional Al2 input <br> $24: R R / S 4$ input <br> 25:VI/II input <br> 25:RX input <br> 27 :Optional AI1 input <br> 28:FM output <br> 29:AM output <br> 30 :Fixed output 1 <br> 3 i:Communication data output <br> 32 :Fixed output 2 <br> 33 :Fixed output 3 <br> 34 :Cumulative input power <br> 35 :Cumulative output power <br> 45 :My function monitor 1 <br> 4 7:My function monitor 2 <br> $48:$ My function monitor 3 <br> 49 :My function monitor 4 | 0 |
| F577 | Selection of number of pulses | 1.00-43.20 kHz | 3.84 |

Note: The pulse length is fixed. Therefore, the duty is variable.

### 6.35.2 Setting of optional meter outputs

## F572-F675,F6日B-F593: Meter output settings

$\Rightarrow$ For details, refer to Instruction Manual (E6581341) specified in Section 6.42.

### 6.35.3 Calibration of analog outputs

F5B i : FM voltage/current output switching
F5B2, F5B3: FM output gradient characteristic and bias adjustment FSB5, FSB5 : AM output gradient characteristic and bias adjustment

[^15][Parameter setting]

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| F58 | FM voltage/current output switching | 6: Voltage 0~10V output i: Current 0~20mA output | 0 |
| F582 | FM output gradient characteristic | 0: Negative gradient (descending) <br> f: Positive gradient (ascending) | i |
| F683 | FM bias adjustment | - $60.0 \sim 100.0 \%$ | 0.0 |
| $F 585$ | AM output gradient characteristic | 0 : Negative gradient <br> (descending) <br> f: Positive gradient (ascending) | i |
| F685 | AM bias adjustment | - $10.0 \sim 100.0 \%$ | 0.0 |

Note: To switch to $0-20 \mathrm{mAdc}(4-20 \mathrm{mAdc})$, set $F 5 B$; to $i$.

## ■ FM terminals setting example



The analog output inclination can be adjusted using the parameter $F$ if
For code data 50 to 64 , negative inclination is invalid.

## 6．36 Operation panel parameter

## 6．36．1 Prohibition of key operations and parameter settings

$F 7 \bar{U}$ ：Parameter write protect selection
$F 730$ ：Operation panel frequency setting prohibition selection
$F 734$ ：Operation panel emergency stop operation prohibition selection
$F 735$ ：Operation panel reset operation prohibition selection

F 737 ：All key operation prohibition

```
- Function
These parameters allow you to prohibit the operation of the RUN and STOP keys on the operation panel and the change of parameters．Using these parameters，you can also prohibit various key operations．
```

［Parameter setting］

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| $F 709$ | Parameter write protect selection | 7 7 ：Permit，i：Prohibit | $\square$ |
| $F 730$ | Operation panel frequency setting prohibition selection | 亿18：Permit，i：Prohibit | $\square$ |
| $F 734$ | Operation panel emergency stop operation prohibition selection | 8 （Permit， 1 ：Prohibit | 0 |
| $F 735$ | Operation panel reset operation prohibition selection | 7 7 ：Permit， $1:$ Prohibit | 0 |
| $F 735$ |  | 勾：Permit，i：Prohibit | 1 |
| F737 | All key operation prohibition | 分：Permit，i：Prohibit | $\square$ |

Note：For the setting of $\boldsymbol{F} \boldsymbol{7} \boldsymbol{J}$ to take effect，the inverter needs to be turned off and turned back on after the setting．

## －Resetting method

1）Canceling the $F 700$ prohibition setting
The setting of only parameter $F 700$ can be changed at any time，even if it is set to $i$ ．
2）Canceling the $F 7 \Xi 7$ prohibition setting
When this parameter is set to 1 （key operation prohibited），press and hold down the ENT key for 5 seconds or more．The message Undo appears and this setting is canceled temporarily to enable key operation．
To cancel this setting permanently，change the setting of $\vDash 7 \exists 7$ directly．

### 6.36.2 Displaying the rotational speed of the motor or the line speed

F 7US : Frequency free unit display magnification
F703: Frequency free unit conversion selection
F 705 : Free unit display gradient characteristic
F 705 : Free unit display bias

## -Function

The frequency or any other item displayed on the monitor can be converted freely into the rotational speed of the motor, the operating speed of the load, and so on. Using these parameters, the units of the amounts of processing and feedback in PID control can also be changed.

The value obtained by multiplying the displayed frequency by the $F 70 己$ set value will be displayed as follows:

## Value displayed $=$ Monitor-displayed or parameter-set frequency $\times F 7 \mathrm{BZ}$

1) Displaying the motor speed

To switch the display mode from 60 Hz (default setting) to $1800 \mathrm{~min}^{-1}$ (the rotating speed of the 4 P motor)

2) Displaying the speed of the loading unit

To switch the display mode from 60 Hz (default setting) to $6 \mathrm{~m} / \mathrm{min}^{-1}$ (the speed of the conveyer)


Note:This parameter displays the inverter output frequency as the value obtained by multiplying it by a positive number. Even when the actual speed of the motor changes according to the particular changes in load, the output frequency will always be displayed.

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| F702 | Frequency free unit display magnification | $\begin{aligned} & \hline 0.00: O F F \\ & 0.0: 20.00 .0 \\ & \hline \end{aligned}$ | 0.00 |
| $F 703$ | Frequency free unit conversion selection | O:All frequencies display free unit conversion ; PID frequencies free unit conversion | 0 |
| $F 705$ | Free unit display gradient characteristic | 0 : Negative gradient (descending) f:Positive gradient (ascending) | ' |
| $F 706$ | Free unit display bias | O.O日-F H Hz | 0.00 |

> * The $F 702$ converts the following parameter settings:
> In case of $F 703=0$
> - Free unit Frequency monitor display




6.36.3 Changing the steps in which the value displayed changes
$F 707$ : Changing step selection 1 (pressing a panel key once)
F 7 OB : Change step selection 2 (panel display)

## -Function

These parameters are used to specify steps in which the command value or standard monitor output frequency displayed on the panel changes each time you press the up or down key to set a frequency on the operation panel.

Note: The settings of these parameters have no effect when the free unit selection $(F \mathcal{\sim} \mathcal{\sim})$ is enabled.

## 

Under normal conditions, the panel frequency command value increases in steps of 0.1 Hz each time you press the (ヘ) key. If $F 7 \boldsymbol{T} \boldsymbol{T}$ is not 0.00 , the frequency command value will increase by the value with $\mathcal{F} \boldsymbol{7} \boldsymbol{\Omega} \boldsymbol{7}$ each time you press the key. Similarly, it will decrease by the value set with $F 7 \boldsymbol{7} 7$ each time you press the ( $\checkmark$ key.

In this case, the output frequency displayed in standard monitor mode changes in steps of 0.1 Hz , as usual.

## $\square$ When $F 707$ is not $0.0 \cdot$, and $F 78 B$ is not 0 .

The value displayed on the panel also can be changed in steps.
Output frequency displayed in standard monitor $=$ Internally output frequency $\times \frac{F 7 \pi B}{F 7 \pi}$

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| 5787 | Changing step selection 1 (pressing a panel key once) | 2.00:Disabled O. 0 i~F H Hz | 8.88 |
| $F 708$ | Changing step selection 2 (panel display) | If:Disabled i-255 | 0 |

## ■ Example of setting 1

Set $F 707=10.00[\mathrm{Hz]}$ :
Each time you press the key, Each time the frequency setting FI changes in steps of $10.0 \mathrm{~Hz}: 0.0 \rightarrow 10.0 \rightarrow$ $20.0 \rightarrow \ldots \rightarrow 60.0[\mathrm{~Hz}]$. This function comes in very handy when operating the load at limited frequencies that change in steps of $1 \mathrm{~Hz}, 5 \mathrm{~Hz}, 10 \mathrm{~Hz}$, and so on.

## ■ Example of setting 2


Each time you press the key, the frequency setting $\mathcal{F} \mathcal{L}_{\text {c }}$ changes in steps of $1 \mathrm{~Hz}: 0 \rightarrow 1 \rightarrow 2 \rightarrow \ldots \rightarrow 60$
$[\mathrm{Hz}]$ and also the value displayed on the operation panel changes in steps of 1 . Use these settings to hide decimal fractions. And also the value displayed on the operation panel changes in steps of 1 . Use these settings to hide decimal fractions.

## 6．36．4 Changing the standard monitor display

| $F 7$ | ：Standard monitor display selection |
| :--- | :--- |
| $F 7 / 1$ |  |

F7it－F7i日 ：Status monitor 1～8 display selection
These parameters are used to select the item to be displayed when the power turned on and also to change items displayed in status monitor mode．$\quad \Rightarrow$ For details，refer to Section 8．3．

## 6．36．5 Canceling the operation command

## F 7 i9：Operation command clear selection when input terminal function ST （ Refer to section 7．2．1）is OFF

## －Function

You can use this function when driving with the RUN key on the operation panel．
When it turns on again after turning off the input terminal which assigned the standby＂ST＂function（Refer to 7．2．1）during driving the inverter，the inverter will drive again without pushing the RUN key．
Using this function，the inverter is not driven again unless the RUN key is pushed on after turning on the ST signal．

| Title | Function | Adjustment range | Default setting |
| ---: | :---: | :---: | :---: |
| $F 7: 9$ | Operation command clear selection <br> when standby terminal（ST）is OFF | $\cap:$ Clear operation command <br> $i:$ Retain operation command | $i$ |

## 6．36．6 Selection of operation panel stop pattern

## F 72 I ：Operation panel stop pattern selection

## －Function

This parameter are used to select a mode in which the motor started by pressing the RUN key on the operation panel is stopped when the STOP key is pressed．

1）Deceleration stop

2）Coast stop
The output of the inverter is cut off．The motor comes to a stop after coasting for a while by inertia．Depending on the load，the motor may keep running for a good long time．
［Parameter setting］

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :--- | :---: |
| $\boldsymbol{F} \boldsymbol{I}$ i | Operation panel stop pattern selection | $\boldsymbol{\Omega}$ ：Deceleration stop <br> $i:$ Coast stop | $\boxed{B}$ |

## 6．36．7 Setting of a torque command in panel operation mode

F 725 ：Operation panel torque command（reference value in \％）

## －Function

This parameter allows you to set a torque command value when torque is controlled with the operation panel．
 set with this parameter is used as the command value（\％）for each function．

Operation panel operation：Torque command selection $F 4$ 名 is set at 4 （Panel input）．

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| $F 7 こ 5$ | Operation panel torque command | $-250 \sim 250 \%$ | 0 |

$\Rightarrow$ For details，refer to Instruction Manual（E6581331）specified in Section 6．42．

### 6.36.8 Torque-related parameters for panel operation

$F 7 \mathcal{F} 7$ : Operation panel tension torque bias
$F$ I2B : Operation panel load sharing gain

These parameters are used to specify the torque bias and how to share the load.
$\Rightarrow$ For details, refer to Instruction Manual (E6581331) specified in Section 6.42.

### 6.37 Tracing functions

| $F 740$ | : Trace selection <br> : Trace cycle | $F 742$ | : Trace data 1 |
| :---: | :---: | :---: | :---: |
| F74 |  | $F 743$ | : Trace data 2 |
|  |  | $F 744$ | : Trace data 3 |
|  |  | $F 745$ | : Trace data 4 |

## -Function

These parameters are used to memorize and read out the data collected at the time of tripping or triggering. Up to 4 kinds of data can be selected from 64 kinds of data, and the data collected at 100 consecutive points can be stored in memory as trace data.
Here is the time at which trace data is acquired.

- Tripping: Data collected before the occurrence
- Triggering: Data collected after triggering

Note: To read data on a PC.

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| F740 | Trace selection | 0:Deselect <br> f:At tripping <br> Z:At triggering | i |
| F74i | Trace cycle | 7:4ms : $: 20 \mathrm{~ms}$ $2: 100 \mathrm{~ms}$ $3: 1 \mathrm{~s}$ $4: 10 \mathrm{~s}$ | 2 |
| $F 742$ | Trace data 1 | 0-49 | 0 |
| F743 | Trace data 2 | 0-49 | $i$ |
| $F 744$ | Trace data 3 | 0-49 | 2 |
| $F 745$ | Trace data 4 | $0-49$ | 3 |

(Note1): For saving trace data, do not disconnect the control power supply or the main circuit power supply during 15 second after inverter tripped.
(Note2): When $F 74 i=1$ or $i$ setting, set the value of $F \mathscr{F} 7$ (Constant at the time of filtering) lower than $F 74$ i setting time (trace cycle time).

1) To acquire trace data at the occurrence of tripping: $F 740=$ i
(Examples of current date output)


Failure FL signal $\qquad$

2) To acquire trace data at the time of triggering: $F 740=2$


Ex.) When using the RR/S4 terminal as the tracing back trigger signal terminal

| Title | Function | Adjustment range | Example of setting |
| :---: | :---: | :---: | :---: |
| $F i ; B$ | Input terminal function selection 8 (RR/S4) | $\Omega \sim 135$ | 75 |

Note 1: If the inverter trips when no trigger signal is given, trace data is overwritten with tripping data.
Note 2: Trace data is overwritten each time a trigger signal is given.
[Setup values of $F$ 74こ~F 745]

| Default setting | Communication No. | Trace (monitor) function | Communication unit at tracing |
| :---: | :---: | :---: | :---: |
| 0 | FD00 | Output frequency | 0.01 Hz |
| 1 | FD02 | Frequency command value | 0.01 Hz |
| 2 | FD03 | Output current | 0.01\% |
| 3 | FD04 | Input voltage (DC detection) | 0.01\% |
| 4 | FD05 | Output voltage | 0.01\% |
| 5 | FD15 | Compensated frequency | 0.01 Hz |
| 5 | FD16 | Speed feedback (real-time value) | 0.01 Hz |
| 7 | FD17 | Speed feedback (1-second filter) | 0.01 Hz |
| 8 | FD18 | Torque | 0.01\% |
| 9 | FD19 | Torque command | 0.01\% |
| ; | FD20 | Torque current | 0.01\% |
| 12 | FD21 | Exciting current | 0.01\% |
| 13 | FD22 | PID feedback value | 0.01 |
| 14 | FD23 | Motor overload factor (OL2 data) | 0.01\% |
| 15 | FD24 | Inverter overload factor (OL1 data) | 0.01\% |
| '6 | FD25 | Regenerative braking resistance overload factor (OLr data) | 1\% |
| 17 | FD28 | Regenerative braking resistor load factor (\% ED) | 1\% |
| 19 | FD29 | Input power | 0.01 kW |
| 19 | FD30 | Output power | 0.01 kW |
| 23 | FE39 | Optional Al2 input | 0.01\% |
| 24 | FE35 | RR/S4 input | 0.01\% |
| 25 | FE36 | VI/II input | 0.01\% |
| 25 | FE37 | RX input | 0.01\% |
| 27 | FE38 | Optional Al1 input | 0.01\% |
| 28 | FE40 | FM output | 0.01\% |
| 29 | FE41 | AM output | 0.01\% |
| 34 | FE76 | Integral input power | 0.01 kWhr |
| 35 | FE77 | Integral output power | 0.01 kWhr |
| 45 | FE60 | My function monitor 1 | 1c |
| 47 | FE61 | My function monitor 2 | 1 c |
| 48 | FE62 | My function monitor 3 | 1c |
| 49 | FE63 | My function monitor 4 | 1c |

## Acquisition of trace data

Trace data is acquired through a communication device.
The VF-AS1 supports the protocols listed below.
-RS485 (Standard protocol)

■ Trace data communication number

| Communication No． | Function | Minimum setting ／readout unit | Setting／readout range | Default setting |
| :---: | :---: | :---: | :---: | :---: |
| E000 | Trace data 1～4 pointer | i／i | 亿－99 | 8 |
| E100 | Data 1 of trace data 1 | 1／ 1 | S－FFFF | $\square$ |
|  | Data 2～99 of trace data 1 | ！／ 1 | 可 FFFF | 8 |
| E199 | Data 100 of trace data 1 | $1 / 1$ | 鸟 FFFF | $\square$ |
| E200 | Data 1 of trace data 2 | ！／ 1 | S－FFFF | $\square$ |
|  | Data 2－99 of trace data 2 | $1 / 1$ | S～FFFF | $\square$ |
| E299 | Data 100 of trace data 2 | $1 / 1$ | 召 FFFF | 8 |
| E300 | Data 1 of trace data 3 | ！／I | S～FFFF | 8 |
|  | Data 2～99 of trace data 3 | ！／ 1 | S～FFFF | $\square$ |
| E399 | Data 100 of trace data 3 | ［／ 1 | 合 $-F F F$ | $\square$ |
| E400 | Data 1 of trace data 4 | 1／ 1 | S～FFFF | $\square$ |
|  | Data 2～99 of trace data 4 | 1／ 1 | 可～FFFF | $\square$ |
| E499 | Data 100 of trace data 4 | i／i | B－FFFF | $\square$ |

Ex．）When operation frequency data is acquired through a communication device
Data acquired $(i F 4 G) \mathrm{h}=8000 \Rightarrow 8000 \times 0.01 \mathrm{~Hz}=80.0 \mathrm{~Hz}$
■ Relationship between pointer and data
The table below shows the relationship between pointer（E000 set value）and trace data（1 to 4）．

| Pointer（E000 set value） | $\square$ | $i$ | 2 | $\sim$ | 98 | 99 |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: |
| Trace data 1（E100～E199） | E100 | E101 | E102 | $\sim$ | E198 | E199 |
| Trace data 2（E200～E299） | E200 | E201 | E202 | $\sim$ | E298 | E299 |
| Trace data 3（E300～E399） | E300 | E301 | E302 | $\sim$ | E398 | E399 |
| Trace data 4（E400～E499） | E400 | E401 | E402 | $\sim$ | E498 | E499 |

＜Example of setting＞If E000 is set to $\bar{\Omega}$ ：
（Earliest data）（Latest data）
Trace data 1 E102～E199，E100，E101
Trace data 2 E202～E299，E200，E201
Trace data 3 E302～E399，E300，E301
Trace data 4 E402～E499，E400，E401
Note 1：Use the parameters $F 742$ through $F 745$ to specify the types of trace data（1 to 4）．
Note 2：Communication numbers E000 is automatically incremented by the inverter when data is traced continuously．
＊In ordinary cases，these parameters do not need to be rewritten．

## 6．38 Integrating wattmeter

## F748：Integrating wattmeter retention selection

$F 749$ ：Integrating wattmeter display unit selection

## －Function

At the main power off ，it is selectable whether retention of integral output power values or not．
And also，the display unit is selectable．
The integrating wattmeter display can be cleared by external input signal by assignment of the terminal function．Input terminal function 74， 75 （Integrating wattmeter display clear）

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| $F 748$ | Integrating wattmeter retention selection | I：Disabled f：Enabled | 0 |
| $F 749$ | Integrating wattmeter display unit selection | $\begin{aligned} & 0: 1=1 \mathrm{kWh} \\ &: 1=10 \mathrm{kWh} \\ & 3: 1=100 \mathrm{kWh} \\ & 3: 1=1000 \mathrm{kWh} \\ & 4: 1=10000 \mathrm{kWh} \\ & \hline \end{aligned}$ | Accoding to model $\Rightarrow$ Refer to page K－46． |

### 6.39 Communication function

### 6.39.1 2-wire RS485/4-wire RS485

| F8OS | : Communication speed (2-wire RS485) |
| :---: | :---: |
| F80 | : Parity (common to 2-wire RS485 and 4-wire RS485) |
| F8O2 | : Inverter number (common) |
| F803 | : Communications time-out time (common to 2-wire RS485 and 4-wire RS485) |
| F804 | : Communications time-out action (common to 2-wire RS485 and 4-wire RS485) |
| F8O5 | : Send waiting time (2-wire RS485) |
| F805 | : Master/slave setting for Inverter-to-inverter communications ( 2-wire RS485) |
| F807 | : Protocol selection (2-wire RS485) |
| F8SB | : Communication1 time-out condition selection |
| F8in | : Frequency point selection |
| F8i 1 | : Point 1 setting |
| F8i2 | : Point 1 frequency |
| F813 | : Point 2 setting |
| F8 14 | : Point 2 frequency |
| F82号 | : Communication speed (4-wire RS485) |
| F825 | : Send waiting time (4-wire RS485) |
| F825 | : Inverter-to-inverter communication setting (4-wire RS485) |
| F829 | : Protocol selection (4-wire RS485) |
| F870 | FB 71 : Block write data 1, 2 |
| $F 875$ | F879 : Block read data 1~5 |
| F880 | : Free notes |

$\Rightarrow$ For details, see Instruction Manual (E6581315) specified in Section 6.42.
$\qquad$

``` Designed to detect broken communications cables. If no data is sent to the inverter within the specified time, this function trips the inverter (" \(\Sigma,-5\) " is displayed on the display panel) or gives an alarm (" \(\llcorner\) " is displayed).
Broadcast function ........................................ Refers to the function of issuing a command (data writing) to multiple inverters in one session.
f Inverter-to-inverter communication function .. Refers to the function that enables the master inverter to send the data selected with a parameter to all slave inverters on the same network. This function allows you to set up a network that makes it possible to carry out synchronized operation or proportional operation (setting of point frequencies) in an abbreviated manner.
```



```
- Function
```

- Function
These parameters allow you to connect the inverter to a higher-level system (host) and to set up a network
These parameters allow you to connect the inverter to a higher-level system (host) and to set up a network
for data communications between inverters. They make it possible for the inverter to be linked to a
for data communications between inverters. They make it possible for the inverter to be linked to a
computer and to carry out data communications with other inverters.
computer and to carry out data communications with other inverters.
<Computer link function>
<Computer link function>
This function allows the inverter to carry out data communications with a higher-level system (host).
This function allows the inverter to carry out data communications with a higher-level system (host).
(1) Monitoring inverter status (such as the output frequency, current, and voltage)
(1) Monitoring inverter status (such as the output frequency, current, and voltage)
(2) Sending RUN, STOP and other control commands to the inverter
(2) Sending RUN, STOP and other control commands to the inverter
(3) Reading, editing and writing inverter parameter settings
(3) Reading, editing and writing inverter parameter settings
<Inverter-to-inverter communication function>
<Inverter-to-inverter communication function>
This function allows you to set up a network that makes it possible to carry out proportional operation of
This function allows you to set up a network that makes it possible to carry out proportional operation of
multiple inverters (without using a computer).
multiple inverters (without using a computer).
f Timer function

```
f Timer function
```


## 1）2－wire RS485

The 2－wire RS485 device on the operation panel and the 4－wire RS485 device on the control circuit terminal block are intended for data communications between inverters．To use an optional part for the RS485 device，it should be connected to the communication connector（RJ45）on the operation panel．Through the 2－wire RS485 device and a USB device（optional），the inverter can be linked to a computer．

Here are the parts optionally available for the 2－wire RS485 device．
－Optional USB－to－Serial conversion unit（Model：USB001Z） Inverter－to－RS485／USB device interconnect cable（Model：CAB0011（1m），CAB0013（3m），CAB0015（5m）） RS485／USB device－to－computer interconnect cable．Use a commercially available USB1．1 or 2.0 cable．（Type： A－B，Cablelength：0．25～1．5m）
－Optional LED Remote Keypad（Model：RKP002Z）
Communication cable（Model：CAB0011（1m），CAB0013（3m），CAB0015（5m））
－Optional LCD Remote Keypad（Model：RKP004Z） LCD special cable（Model：CAB0071（1m），CAB0073（3m），CAB0075（5m），CAB00710（10m））
Note：Do not connect the cable（CAB0011， 0013 or 0015）from the communication device to the optional LCD Remote Keypad．Or the inverter or the optinol LCD Remote Keypad could be damaged．
－Setting for issuing run／stop commands from an external control device

| Title | Function | Adjustment range | Default setting | Example of setting |
| :---: | :---: | :---: | :---: | :---: |
| ¢ 780 | Command mode selection | 8－4 | （Terminal input enabled） | こ （2－wire RS485） |

Note：When parameter $F 806$（setting for communications between inverters）is used，the setting 178 cannot be used for slave inverters．
－Setting for issuing speed commands from an external control device

| Title | Function | Adjustment range | Default setting | Example of setting |
| :---: | :---: | :---: | :---: | :---: |
| F98d | Frequency setting mode selection 1 | i～ 13 | $\stackrel{\rightharpoonup}{2}$ （RR／S4 input） | $\begin{gathered} \hline 5 \\ \text { (2-wire RS485) } \end{gathered}$ |

－Communication parameters（2－wire RS485）
These parameters allow you to change the communication speed，parity check setting，inverter number， communication error trip timer setting，etc．from the operation panel or an external control device．

| Title | Function | Adjustment range |  |  | Default setting |
| :---: | :---: | :---: | :---: | :---: | :---: |
| F8日号 | Communication speed（2－wire RS485） | II： $9600 \mathrm{bps}, 1: 19200 \mathrm{bps}, \underline{2}: 38400 \mathrm{bps}$ |  |  | i |
| F80 | Parity （common to 2－wire RS485 and 4－wire RS485） | 亿in：Non parity， $\boldsymbol{i}$ ：Even parity $z$ ：Odd parity |  |  | i |
| F802 | Inverter number（common） | B～247 |  |  | 4 |
| $F 803$ | Communications time－out time （common to 2－wire RS485 and 4－wire RS485） | $\begin{aligned} & 0: \text { OFF } \\ & i \sim 108 \mathrm{sec} . \end{aligned}$ |  |  | 0 |
| $F 804$ | Communications time－out action＊ （common to 2－wire RS485 and 4－wire RS485） | Setting | $\begin{aligned} & \hline \text { 2-wire } \\ & \text { RS485 } \end{aligned}$ | $\begin{aligned} & \hline \text { 4-wire } \\ & \text { RS485 } \end{aligned}$ | 8 |
|  |  | $\square$ | No action | No action |  |
|  |  | ！ | Alarm | No action |  |
|  |  | $L^{2}$ | Trip | No action |  |
|  |  | 3 | No action | Alarm |  |
|  |  | 4 | Alarm | Alarm |  |
|  |  | 5 | Trip | Alarm |  |
|  |  | 5 | No action | Trip |  |
|  |  | 7 | Alarm | Trip |  |
|  |  | 8 | Trip | Trip |  |
| F805 | Send waiting time （2－wire RS485） | 근 17 ：Normal communications 0.0 i $\sim 2.0 \square \mathrm{sec}$ ． |  |  | 81.08 |
| F885 | Master／slave setting for Inverter－to－inverter communications （2－wire RS485） | 0 ：Slave（issues a 0 Hz command if something goes wrong with the master） <br> i：Slave（continues operation if something goes wrong with the master） <br> こ’：Slave（trips for emergency stop if something goes wrong with the master） <br> 3：Master（sends a frequency command） <br> 4 ：Master（sends an output frequency） <br> 5 ：Master（sends a torque command） <br> 5 ：Master（sends an output torque command） |  |  | 0 |
| F887 | Protocol selection（2－wire RS485） | 7－TOSHIBA，$i: M O D B U S$ |  |  | $\square$ |


| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| F808 | Communication1 time－out condition selection | $\bar{I}$ ：Disconnection detection $i:$ When communication mode enable <br> こ：1＋Driving operation | 0 |
| F810 | Frequency point selection | 0：Disabled <br> f：2－wire RS485 <br> 2：4－wire RS485 <br> 3：Communication add option | 0 |
| F8； | Point 1 setting | 0－100\％ | 0 |
| FBiz | Point 1 frequency |  | 0.13 |
| F8i3 | Point 2 setting | 可 10 \％ | 100 |
| F8：4 | Point 2 frequency | 0．0～F H Hz | Inverter with a model number ending with <br> －WN，HN： 50.0 －WP： 50.0 |
| F870 | Block write data 1 | 0：Disabled <br> f：Command information 1 <br> Z：Command information 2 <br> 3 ：Frequency command <br> 4：Terminal board output data <br> 5 ：Communication analog output <br> E：Rotational speed instruction | 0 |
| F871 | Block write data 2 | Ditto | 0 |
| F875 | Block read data 1 | 7：Deselect <br> i：Status information <br> 2 ：Output frequency <br> 3：Output current <br> 4：Output voltage <br> 5 ：Alarm information <br> 6：PID feedback value <br> 7：Input terminal board monitor <br> 8 ：Output terminal board monitor <br> $9: \mathrm{VI} / \mathrm{II}$ terminal board monitor <br> i $0:$ RR／S4 terminal board monitor <br> i $:$ ：RX terminal board monitor <br> i $こ$ ：Input voltage（DC detection） <br> i 3 ：Speed feedback frequency <br> 14：Torque <br> 15：MY monitor 1 <br> 16：MY monitor 2 <br> 17：MY monitor 3 <br> 18：MY monitor 4 <br> 19：Free notes <br> 20 ：Rotational speed | 0 |
| F876 | Block read data 2 | Ditto | 0 |
| F877 | Block read data 3 | Ditto | 0 |
| F878 | Block read data 4 | Ditto | 0 |
| F879 | Block read data 5 | Ditto | 4 |
| F880 | Free notes | Q FFFF | 0 |

＊：No action ．．．No action is taken even if a timeout occurs．
Alarm ．．．．．．．．．An alarm goes off if a timeout occurs．
The message＂$L$＂blinks at the left end of the operation panel．
Trip $\qquad$ The inverter trips when a communication time－over occurs．
The message＂$\Sigma,-5$＂blinks on the operation panel．
Note：Changes to the parameters $F 900, F 80$ i and $F 805$ do not take effect until the power is turned off and then on again．

## 2) 4-wire RS485

The 4-wire RS485 device included as standard equipment, allows you to connect the inverter to a higher-level system (host) and to set up a network for data communications between inverters. It makes it possible for the inverter to be linked to a computer and to carry out data communications with other inverters.
The connector (RJ45) for the 4-wire RS485 device on the control circuit terminal block is used to connect to other inverters.

- Transmission specifications

| Item |  |
| :--- | :--- |
| Interface | Compliant with RS485 |
| Transmission path <br> specification | Half-duplex type [Buss type (terminator resistor required at each end of system)] |
| Wiring type | Compatible with both 4-wire and 2-wire types |
| Transmission distance | Up to 500m (overall length of the cable) |
| Number of connectable <br> units | Up to 32 units (including the host computer) <br> Number of inverters that can be connected in a system: Up to 32 units |
| Synchronization scheme | Asynchronous |
| Transmission rate | Default: 19200 baud (parameter setting) <br> Selectable from $9600 / 19200 / 38400$ baud |
| Character transmission | ASCII mode : JIS $\times 0201$ 8-bit (ASCII) <br> Binary code : Binary, 8-bit (fixed) |
| Stop bit length | Inverter receiving: 1 bit, Inverter sending: 2 bits |
| Error detection | Parity: Even, Odd, or None selectable by parameter setting; check sum method |
| Error correction | Not provided |
| Response monitoring | Not provided |
| Character transmission <br> format | Reception: 11 bit, Sending: 12 bit (with parity) |
| Transmission waiting time <br> setting | Possible |
| Others | Inverter's action at the occurrence of a communication timeout selectable from <br> tripping/raising an alarm/doing nothing <br> $\rightarrow$ When alarm is selected, " " blinks at the left end of the operation panel <br> When tripping is selected, " -5 " is displayed on the operation panel |

Example of the connection of inverters linked to a computer
<Independent communication>
Perform computer-inverter connection as follows to send operation frequency commands from the host computer to inverter No. 3 :

"Given 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 board 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 by communicating independently.
<Broadcast>
When an operation frequency command is broadcasted from the host computer to inverters

: Use the terminal board 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) Data with an asterisk (*) in the inverter number position is taken as broadcast data and the command is deciphered and executed.
(4) To avoid collisions between data, only the inverter with the asterisk (*) replaced with a zero (0) returns data to the host computer.
(5) As a result, all inverters connected are operated at the operation frequency specified by the command broadcasted.
Note: If an inverter number is assigned to each group of inverters, data can be broadcasted on a group-by-group basis.
(This function is usable only in ASCII mode. For binary mode, see Instruction Manual (E6581315) specified in Section 6.42.)
Ex.) When the inverter number *1 is specified, data is broadcasted to inverters Nos. $01,11,21,31, \ldots 91$. At that time, data is returned by the inverter bearing number 01.

Inverter-to-inverter communication
When all slave inverters are connected they operat at the same frequency as the master inverter (no setting of point frequencies in this case)

: Use the terminal board to branch the cable.
(1) The master inverter transmits frequency command data to its slave inverters.
(2) The slave inverter calculate a frequency reference from the data received and save the frequency calculated.
(3) As a result, all slave inverters operate at the same frequency as the master inverter.

Note: The master inverter always sends frequency command data to its slave inverters.
The slave inverters are always on standby so that they can receive an frequency command from the master inverter at anytime.

- Setting for issuing run/stop commands from an external control device

| Title | Function | Adjustment range | Default setting | Example of setting |
| :---: | :---: | :---: | :---: | :---: |
| [ 780 | Command mode selection | 8-4 | (Terminal input enabled) | $Э$ (4-wire RS485) |

 cannot be used for slave inverters.

- Setting for issuing speed commands from an external control device

| Title | Function | Adjustment range | Default setting | Example of setting |
| :---: | :---: | :---: | :---: | :---: |
|  | Frequency setting mode selection 1 | i~ 13 | $\begin{gathered} \hline 2 \\ \text { (RR/S4 input) } \end{gathered}$ | E (4-wire RS485) |

Communication parameters (4-wire RS485)
These parameters allow you to change the communication speed, parity, inverter number, communication error trip timer setting, etc. from the operation panel or an external control device.

| Title | Function | Adjustment range |  |  | Default setting |
| :---: | :---: | :---: | :---: | :---: | :---: |
| F80: | Parity (common to 2-wire RS485 and 4-wire RS485) | I: Non parity <br> i:Even parity <br> 2:Odd parity |  |  | i |
| F802 | Inverter number (common) | $0 \sim 247$ |  |  | 0 |
| F803 | Communications time-out time (common to 2-wire RS485 and 4-wire RS485) | $\begin{aligned} & \text { 0:OFF } \\ & i \sim 100 \mathrm{sec} . \end{aligned}$ |  |  | 0 |
| $F 804$ | Communications time-out action * (common to 2-wire RS485 and 4-wire RS485) | Setting | $\begin{aligned} & \text { 2-wire } \\ & \text { RS485 } \end{aligned}$ | $\begin{aligned} & \text { 4-wire } \\ & \text { RS485 } \end{aligned}$ | 8 |
|  |  | 0 | No action | No action |  |
|  |  | i | Alarm | No action |  |
|  |  | 2 | Trip | No action |  |
|  |  | 3 | No action | Alarm |  |
|  |  | 4 | Alarm | Alarm |  |
|  |  | 5 | Trip | Alarm |  |
|  |  | 5 | No action | Trip |  |
|  |  | 7 | Alarm | Trip |  |
|  |  | 8 | Trip | Trip |  |
| F808 | Communication1 time-out condition selection | ```7}:Disconnection detectio i:When communication mode enable Z:1+Driving operation``` |  |  | 0 |
| F8i0 | Frequency point selection | 7:Disabled1:2-wire RS4852:4-wire RS4853:Communication add option |  |  | 0 |
| FBi: | Point 1 setting | B-100\% |  |  | 0 |
| FBiz | Point 1 frequency | D.İ~FH Hz |  |  | 0.10 |
| F813 | Point 2 setting | 日~100\% |  |  | 100 |
| F8:4 | Point 2 frequency | D.0.0 \% Hz |  |  | Inverter with a model number ending with -WN, HN: 50.0 -WP: 50.0 |
| F820 | Communication speed (4-wire RS485) | $\begin{aligned} & 0: 9600 \mathrm{bps}, \quad: 19200 \mathrm{bps}, \\ & Z: 38400 \mathrm{bps} \\ & \hline \end{aligned}$ |  |  | i |
| F825 | Send waiting time (4-wire RS485) |  |  |  | 0.00 |
| F825 | Inverter-to-inverter communication setting (4-wire RS485) | 0 : Slave (issues a OHz command if something goes wrong with the master) <br> i:Slave (continues operation if something goes wrong with the master) <br> Z:Slave (trips for emergency stop if something goes wrong with the master) <br> 3:Master (sends a frequency command) <br> 4 :Master (sends an output frequency) <br> 5 :Master (sends a torque command) <br> 5 :Master (sends an output torque command) |  |  | 0 |
| F829 | Protocol selection (4-wire RS485) | I:TOSHIBA i:MODBUS |  |  | 0 |


| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| F876 | Block write data 1 | I):Disabled <br> i:Command information 1 <br> z:Command information 2 <br> 3 :Frequency command <br> 4:Terminal board output data <br> 5 :Communication analog output | 0 |
| Fg7i | Block write data 2 | Ditto | 0 |
| F875 | Block read data 1 | B:Deselect <br> f:Status information <br> 2:Output frequency <br> 3:Output current <br> 4 :Output voltage <br> 5 :Alarm information <br> 5:PID feedback value <br> 7:Input terminal board monitor <br> G:Output terminal board monitor <br> $9: \mathrm{VI} / \mathrm{II}$ terminal board monitor <br> i $9: R R / S 4$ terminal board monitor <br> i $:$ :RX terminal board monitor <br> iz:Input voltage (DC detection) <br> ; 3 :Speed feedback frequency <br> i4:Torque <br> 15:MY monitor 1 <br> 15:MY monitor 2 <br> 17:MY monitor 3 <br> 18:MY monitor 4 <br> 19:Free notes | 0 |
| F875 | Block read data 2 | Ditto | 0 |
| F877 | Block read data 3 | Ditto | 0 |
| F878 | Block read data 4 | Ditto | $\square$ |
| F879 | Block read data 5 | Ditto | 0 |
| F880 | Free notes | B-FFFF | 0 |

*: No action ... No action is taken even if a timeout occurs.
Alarm ......... An alarm goes off if a timeout occurs.
The message " $L$ " blinks at the left end of the operation panel.
Trip $\qquad$ The inverter trips when a communication time-over occurs.
The message " $E,-5$ " blinks on the operation panel.
Note: Changes to the parameters $F G 0$ i, $F Q 2 G$ and $F B 25$ do not take effect until the power is turned off and then on again.

### 6.39.2 Open network option

| F575-F594 | : For Ethernet Communication option |
| :---: | :---: |
| F784-F789 | : MAC address data 1~6 |
| F 792-F799 | : Device name data 1~8 |
| F8i5 | : Address monitor (Modbus plus) |
| F816 | : Command selection (Modbus plus) |
| FBi7 | : Number of command (Modbus plus) |
| F8i8 | : Number of monitors (Modbus plus) |
| F8i9 | : Command station (Modbus plus) |
| F82 | : Baud rate (Ethernet) |
| F822 | : Baud rate monitor right port (Ethernet) |
| F823 | : Baud rate monitor left port (Ethernet) |
| F824 | : - (Reservation) |
| F830 F838 | : Communication option settings 1 to 7 |
| F84 1-F848 | : Communication option settings 8 to 13 |
| $F 849$ | : Disconnection detection extended time |
| F850 | : Disconnection detection extended time |
| F85 | : Inverter operation at disconnection |
| F852 | : Preset speed operation selection |
| F853, F854 | : Selection of monitoring |
| F855 | : Motor pairs of poles for communication |

### 6.40 My function

## F90]: Input function target 11-F977: My function selection

$\Rightarrow$ For details, refer to Instruction Manual (E6581335) specified in Section 6.42.

### 6.41 Traverse function

| F980 | : Traverse selection | $F 983$ | : Traverse step |
| :---: | :---: | :---: | :---: |
| F98i | : Traverse acceleration time | $F 984$ | : Traverse jump step |
| F982 | : Traverse deceleration time |  |  |

### 6.42 Instruction manuals for optionally available devices and special functions

| For details, refer to the instruction manual for each optional device or function. |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| No. | Description | Model number | Instruction Manual No. | Remarks |
| 1 | Light-load high-speed operation function | - | E6581327 | - |
| 2 | PID control operation function | - | E6581329 | - |
| 3 | Torque control operation function | - | E6581331 | - |
| 4 | Current and speed control gain adjustment method | - | E6581333 | - |
| 5 | My function | - | E6581335 | - |
| 6 | Traverse function | - | E6581337 | - |
| 7 | Switching between commercial power and inverter | - | E6581364 | - |
| 8 | RS485 communication function | - | E6581315 | - |
| 9 | Combination of the VFAS1 and a DC power supply | - | E6581432 | - |
| 10 | Expansion I/O card 1 option | ETB003Z | E6581339 | Attached to expansion I/O card 1 option |
| 11 | Expansion I/O card 2 option | ETB004Z | E6581341 | Attached to expansion I/O card 2 option |
| 12 | PG feedback option | $\begin{array}{\|l\|} \hline \text { VEC004Z~ } \\ \text { VEC007Z } \\ \hline \end{array}$ | E6581319 | Attached to PG feedback option |
| 13 | DeviceNet option | DEV002Z | E6581295 | Attached to DeviceNet option |
| 14 | DeviceNet option function | DEV002Z | E6581281 | Detailed instruction manual |
| 15 | PROFIBUS-DP option | PDP002Z | E6581279 | Attached to PROFIBUS -DP option |
| 16 | PROFIBUS-DP option function | PDP002Z | E6581343 | Detailed instruction manual |
| 17 | CC-Link option | CCL001Z | E6581286 | Attached to CC-Link option |
| 18 | CC-Link option function | CCL001Z | E6581288 | Detailed instruction manual |
| 19 | LCD Remote Keypad | RKP004Z | E6581323 | Attached to LCD Remote Keypad |
| 20 | LED Remote Keypad | RKP002Z | E6581277 | Attached to LED Remote Keypad |
| 21 | Control power supply backup option | CPS002Z | E6581289 | Attached to control power supply backup option |
| 22 | USB-to-Serial conversion unit | USB001Z | E6581282 | Attached to USB-to-Serial conversion unit |
| 23 | USB-to-Serial conversion unit | USB001Z | E6581299 | Attached in the strage device of USB-to-Serial conversion unit |
| 24 | Optional braking unit PB7 | $\begin{aligned} & \hline \text { PB7-4200K } \\ & \text { PB7-4400K } \end{aligned}$ | E6581436 | For 200kW or more units |
| 25 | Fin outside mounting kit (optional) | FOT*** | $\begin{aligned} & \text { E6581399 } \\ & \text { E6581400 } \\ & \text { E6581365 } \\ & \hline \end{aligned}$ | 200V-15kW, 400V-18.5kW 200V-18.5~45kW, 400V-22~75kW 200V-55kW~, 400V-90kW~ |

## 7. Operation with external signal

### 7.1 External operation

The inverter can be freely controlled externally.
Parameters must be differently set depending on the operation method. Make sure of the operation method before setting parameters, and set parameters properly to the operation mode according to the procedure mentioned below.
[Steps in setting parameters]
Check of external signal conditions


### 7.2 Applied operation with input and output signals (operation by terminal board)

### 7.2.1 Functions of input terminals (in case of sink logic)

Use the above parameters to send signals from an external programmable controller to various control input terminals to operate and/or set the inverter.
The desired contact input terminal functions can be selected from 120 types. This gives system design flexibility. [Control terminal board]


- Setting of contact input terminal function

| Terminal symbol | Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: | :---: |
| - |  | Always ON function selection 1~3 | $\begin{gathered} 8 \sim 135 \\ \Rightarrow \text { Refer to } \\ \text { Section } \\ \text { 7.2.1. } \end{gathered}$ | 0 (No function is assigned) |
| F | Fiti | Input terminal function selection 1 (F) |  | $\geq$ (Forward run) |
| R | $F: 12$ | Input terminal function selection 2 (R) |  | 4 (Reverse run) |
| ST | $F: 10$ [Note 6], F : $: 3$ | Input terminal function selection 3 (ST) |  | 5 (Standby) |
| RES | Fi: ${ }^{\text {F }}$ | Input terminal function selection 4 (RES) |  | 8 (Reset) |
| S1 | Fi: 5 | Input terminal function selection 5 (S1) |  | 10 (Preset speed 1) |
| S2 | F i ib | Input terminal function selection 6 (S2) |  | 12 (Preset speed 2) |
| S3 | Fiti | Input terminal function selection 7 (S3) |  | 14 (Preset speed 3) |
| RR/S4 | $F: 18$ | Input terminal function selection 8 (RR/S4) |  | 15 (Preset speed 4) |
| LI1~L18 | F:19-F :26 | Input terminal function selection 9~16 |  | 0 |
| B12~B15 | F 154~F i5 | Input terminal function selection 17~20 |  | 0 |

Note 1:RR/S4 terminal become enable when SW3 is switch to S4.
Note 2: When $F i: G, F i I^{\prime} 7$ and $F i 2 g$ (Always ON function selection 1~3) are selected, selected function is generally activated regardless of positive or negative logic.
Note 3: $F:$ : $9 \sim F: 25$ is for use of expansion terminal board option unit.
Note 4: $F: 54 \sim ; i 57$ is not supported (for options).
Note 5: VFAS1-****-WN, HN Note 6: VFAS1-****-WP
■ Connection method (An example of the connection of terminals: SW1 set to sink logic)

1) In case of positive logic (a-contact) input

2) In case of negative logic (b-contact) input

3) Connection with transistor output


* Interface between programmable controller and inverter

When using an open-collector output type programmable control device to control the operation of a motor, connect cables, as shown in the schematic diagram for sink/source logic (when an external power supply is used) on page B-15. When using the internal power supply of the inverter, connect cables, as shown in the schematic diagram on page B-14. If the programmable control device is turned off with the inverter left on, an incorrect signal will flow into the inverter, as shown in the figure below, because there is a potential difference between the control power supplies. Be sure to provide an interlock so that the programmable controller cannot be turned off when the inverter is on.


■ Example of use- three-wire operation (SW1 set to sink logic)
The three-wire operation function allows you to make the inverter self-hold its operation, without setting up a sequential circuit, so that the inverter can be operated by means of external signals (reset contact signals).


Forward run (F): If you press the Forward (F) button, the motor rotates in the forward direction at the frequency specified with a command.
Reverse run (R): If you press the Reverse (R) button, the motor rotates in the reverse direction at the frequency specified with a command.
HD (S3): If you press the HD (S3) button, the motor decelerates and comes to a stop.
[Parameter setting]

| Terminal symbol | Title | Function | Adjustment range | Example of setting |
| :---: | :---: | :---: | :---: | :---: |
| S3 | $F: 17$ | Input terminal function selection 7(S3) | $8 \sim 135$ | 50 (HD operation retention) |

- Table of setting of contact input terminal function

| Parameter setting |  | Function | Parameter setting |  | Function |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Positive logic | Negative logic |  | Positive logic | Negative logic |  |
| 0 | i | No function is assigned | 70 | 71 | Servo lock signal |
| 2 | 3 | F: Forward run command | 72 | 73 | Simple positioning (positioning loop) |
| 4 | 5 | R: Reverse run command | 74 | 75 | Integrating wattmeter display clear |
| 5 | 7 | ST: Standby | 76 | 77 | Trace back trigger signal |
| 8 | 9 | RES: Reset | 78 | 79 | Light-load high-speed operation prohibitive signal |
| 10 | 1 i | S1: Preset speed 1 | 80 | Bi | No function assigned |
| 12 | 13 | S2: Preset speed 2 | 82 | 83 | No function assigned |
| 14 | 15 | S3: Preset speed 3 | 84 | 85 | No function assigned |
| 15 | 17 | S4: Preset speed 4 | 85 | 87 | Binary data write |
| 18 | 19 | Jog run | 88 | 89 | Up/down frequency (up) *1 |
| 20 | 21 | Emergency stop | 90 | 91 | Up/down frequency (down) *1 |
| ここ | 23 | DC braking | 92 | 93 | Up/down frequency (clear) |
| 24 | 25 | Acceleration/deceleration switching 1 *2 | 94 | 95 | No function assigned |
| 25 | 27 | Acceleration/deceleration switching 2 *2 | 96 | 97 | No function assigned |
| 28 | 29 | V/f switching signal 1 | 98 | 99 | Forward/reverse selection |
| 30 | 31 | V/f switching signal $2<* 2$ | 100 | 101 | Run/stop command *3 |
| 32 | 33 | Torque limit switching signal $1 \times$ *2 | 102 | 103 | Commercial power/INV switching |
| 34 | 35 | Torque limit switching signal $2 \quad * 2$ | 104 | 105 | Frequency reference priority switching |
| 35 | 37 | PID control OFF selection | 105 | 107 | VI/II terminal priority |
| 38 | 39 | Pattern operation group 1 | 108 | 109 | Command terminal board priority |
| 40 | 41 | Pattern operation selection 2 | 110 | 1 1 | Permission of parameter editing |
| 42 | 43 | Pattern operation continuation signal | 112 | 1:3 | Speed/Torque switching |
| 44 | 45 | Pattern operation trigger signal | 1:4 | 1:5 | No function assigned |
| 45 | 47 | External thermal error | 1:6 | 117 | No function assigned |
| 48 | 49 | Communication priority cancel | 1:8 | 1:9 | No function assigned |
| 50 | 5 ; | HD operation retention | 120 | 121 | No function assigned |
| 52 | 53 | PID differentiation/integration clear | 12 L | 123 | Rapidest deceleration command |
| 54 | 55 | PID forward/reverse switching | 124 | 125 | Preliminary excitation *4 |
| 55 | 57 | Forced continuous operation | 125 | 127 | Braking request |
| 58 | 59 | Specified speed operation | 128 | 129 | No function assigned |
| 50 | 51 | Acceleration/deceleration suspend signal | 130 | 13i | Brake answer back input |
| 52 | 53 | Power failure synchronized signal | 132 | 133 | No function assigned |
| 54 | 55 | My function RUN signal | 134 | 135 | Traverse permission signal |
| 55 | 57 | Auto-tuning signal |  |  |  |
| 58 | 59 | Speed gain switching |  |  |  |

*1: Valid when $F$ ind (Frequency setting mode selection 1) is set at 10 (Up/down frequency).
The frequency setting range is between $=0.0 \sim 2, i L$ (Upper limit frequency). The acceleration/deceleration time with respect to the frequency setting remains $\operatorname{AEL/dEL}$, unless switching between acceleration and deceleration is performed.
*2: To switch acceleration/deceleration pattern, V/f pattern, torque limit 1~4, give the following signals to switching functions.

|  | Switching signal 1 | Switching signal 2 |
| :--- | :---: | :---: |
| Acceleration/deceleration1, V/f 1, torque limit 1 | OFF | OFF |
| Acceleration/deceleration2, V/f 2, torque limit 2 | ON | OFF |
| Acceleration/deceleration3, V/f 3, torque limit 3 | OFF | ON |
| Acceleration/deceleration4, V/f 4, torque limit 4 | ON | ON |

*3: If 2,3 (F: Forward run command) or 4,5 (R: Reverse run command) is assigned the same time, this function has a priority.
*4: After the motor slows down and comes to a full stop at a pre-excitation command, the motor is set free momentarily to bring it into a pre-excitation state.
This function should not be used when $F 5 \Omega 5$ is set to 2 or 4 . Or the inverter might malfunction.
 and $: 54 \sim \mathcal{i} \cdot \mathbf{7}$. If it is setted, can not reset the setting.

- Sink logic/source logic

Switching between sink logic and source logic (input/output terminal logic) is possible.
$\Rightarrow$ For details, refer to the Section 2.3.2.

### 7.2.2 Functions of output terminals (incase of sink logic)

Use the above parameters to send various signals from the inverter to external equipment.
By setting parameters for the OUT1, OUT2 and FL (FLA, FLB and FLC) terminals on the terminal board, you can use $0 \sim 255$ functions and functions obtained by combining them.
[Control terminal board]


- How to use

Function of OUT1 $\cdots \cdots . . .$. To be set by parameter $F: 30$
Function of OUT2 $\cdots \cdots . . .$. To be set by parameter $F ; 3$ i
Functions of FLA, FLB, and FLC..........To be set by parameter $F$ : $\exists$ ?


- Setting of output terminal function

| Terminal symbol | Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: | :---: |
| OUT1 | $F 130$ | Output terminal function selection 1 | $0 \sim 255$ | (Low-speed signal) |
| OUT2 | Fi3i | Output terminal function selection 2 | $0 \sim 255$ | 5 <br> (Acceleration/decele ration completion) |
| FL | F 3 こ | Output terminal selection 3 | $0 \sim 255$ | $10$ <br> (Failure FL) |
| $\begin{gathered} \text { OUT3~OUT6 } \\ \text { R1~R2 } \\ \hline \end{gathered}$ | F133~, 138 | Output terminal function selection 4~9 | $0 \sim 255$ | 254 |
| R3, R4 | F 158,F159 | Output terminal function selection 10~11 | $0 \sim 255$ | 254 |

Note1: $F: \Xi \Xi \sim$ : $\boldsymbol{F} 5$ is for use of expansion terminal board 1 option unit.
Note2: $F: 35 \sim, F i B$ is for use of expansion terminal board 2 option unit.
Note3: $F i 58, F$ i 59 is not supported (for options).
Note4: When use OUT1 terminal for pulse output function, refer to Section 6.35.1.
－Output terminal function（open collector，relay outputs）setting and detection levels
For the open connector output terminals（OUT1，OUT2）and the relay output terminals（FLA，FLB and FLC）， functions can be selected from 0 to 255 functions．The selectable functions and detection levels are listed in the table below．
Up to 7 output terminals can be used if add－on options are used in combination with the inverter，while up to 3 output terminals can be used if no add－on option is used．
＜Technical terms＞
－Alarm ．．．．．．．Alarm output beyond a certain setting value．
－Pre－alarm ．．．．．．Alarm output of the state where the inverter may carry out a trip by continuation．
－Serious failure
．．．．．．．Output signal in a serious failure of the protection function of the inverter．

 （Err T）
－Light failure $\quad \cdots \cdots$ Output signal in a slight failure of the protection function of the inverter．


－Emergency stop ．．．．．．．Output signal when the inverter comes into emergency stop．
Stopping manner is set with $F 65$（emergency stop）．

Table of output terminal functions and detection levels

| Parameter setting |  | Function | Operation output specifications（in case of positive logic） |
| :---: | :---: | :---: | :---: |
| Positive logic | Negative logic |  |  |
| 8 | 1 | Lower limit frequency （LL） | ON：The running frequency is equal to or higher than the setting of $L i$（Lower limit frequency） OFF：The running frequency is lower than the setting of $L L$ ． |
| 2 | 3 | Upper limit frequency <br> （UL） | ON：The running frequency is equal to or higher than the setting of $i: L$（Upper limit frequency） <br> OFF：The running frequency is lower than the setting of $\because i L$ ． |
| 4 | 5 | Low－speed signal | ON：The running frequency is equal to or higher than the setting of $F$ 分 0 （low－speed signal output frequency） <br> OFF：The running frequency is lower than the setting of F 100 ． |
| 5 | 7 | Acceleration／decelerati on completion | ON：The difference between the frequency command and the running frequency is within the setting of $F, ~ 亿 \Omega$ ． OFF：In acceleration or deceleration． |
| 8 | 9 | Speed reach signal | $\mathrm{ON}:$ The running frequency is in the range of $F i \overline{0} i \pm F 10 \overline{0}$ ． OFF：The running frequency is out of the range of $F: 1: \pm$ F 102 ． |
| 18 | ＇ 1 | Failure FL <br> （All trips） | ON：Inverter is tripped． OFF：Inverter trip is canceled． |
| 12 | 13 | Failure FL <br> （Except EF，OCL） | ON：Inverter is tripped（except $E F$ and $\overline{O L} L$ ） OFF：Inverter trip is canceled．（reset） |
| 14 | 15 | Overcurrent（OC） pre－alarm | ON：Inverter output current is over the F 5 it i（Stall prevention level）set value． <br> OFF：Inverter output current is under the $56 \pi i$ |
| 15 | 17 | Inverter overload （OL1）pre－alarm | ON：A certain rate of inverter overload（ $\mathrm{CL} \mathbf{L}$ ）detection time is over． <br> OFF：The detection time is within a certain limit． |
| 18 | 19 | Motor overload（OL2） pre－alarm | ON：A certain rate of inverter overload（ $O L \Sigma^{\prime}$ ）detection time is over． <br> OFF：The detection time is within a certain limit． |
| 29 | 21 | Overheat pre－alarm | ON：The temperature of the cooling fin is $95^{\circ} \mathrm{C}$ or higher inside the inverter． <br> OFF：The temperature drops to $90^{\circ} \mathrm{C}$ or lower after overheat pre－alarm was on． |
| $こ こ$ | こコ | Overvoltage pre－alarm | Overvoltage control operation or PB operation in progress．ON： PB operation level $+3 \%$ <br> （200V class：Approx． $370 \mathrm{Vdc}, 400 \mathrm{~V}$ class ：Approx． 740 Vdc ） |
| 24 | 25 | Undervoltage in main circuit（MOFF） detection | ON：The main circuit voltage is lower than the main circuit undervoltage detection（Fロこ5）level． <br> （ 200 V class：Approx． $170 \mathrm{Vdc}, 400 \mathrm{~V}$ class：Approx． 340 Vdc ） |
| 25 | 27 | Low current detection | ON：The state that inverter output current is F5；；set value or larger continued more than $F 5$ II set value． |


| Parameter setting |  | Function | Operation output specifications (in case of positive logic) |
| :---: | :---: | :---: | :---: |
| $\begin{aligned} & \text { Positive } \\ & \text { logic } \end{aligned}$ | Negative logic |  |  |
| 28 | 29 | Over-torque detection | ON:The state that torque component is F5 15, F5 77 set value or larger continued more than $F 5 ; B$ set value. |
| 30 | 31 | Braking resistor overload pre-alarm | ON:A certain rate of braking resister overload trip ( $\boldsymbol{D L} \mathrm{L}$, ) detection time is over. <br> OFF:The detection time is within a certain limit. |
| $3 \underbrace{3}$ | 33 | In emergency stop | ON:In emergency stop operation ( $E$ is indicated). OFF:The detection time is within a certain limit. |
| 34 | 35 | In retry | ON:In retry operation ( $r$ try is indicated). OFF:No retry operation is performed. |
| 35 | 37 | Pattern operation switching output | ON:In normal operation or pattern operation has finished. OFF:In pattern operation. |
| 38 | 39 | PID deviation limit | ON:PID deviation is in $F 354$ or $\digamma 355$ set value. |
| 40 | 41 | Run/Stop | ON:Running frequency is output or DC injection breaking ( $\sigma^{\prime}$ b) is performed. |
| 42 | 43 | Serious failure (OCA, $\mathrm{OCL}, \mathrm{EF}$, phase failure, etc.) | ON:Serious failure ( $D[B, D[L, E F$, phase failure, abnormal output, short-circuit) is detected. <br> OFF:Inverter has recovered from serious failure. (Serious failure has been reset) |
| 44 | 45 | Light failure (OL, OC1, $2,3, \mathrm{OP})$ $2,3, O P)$ |  OFF:Inverter has recovered from light failure. (Light failure has been reset) |
| 45 | 47 | Commercial power/inverter switching output 1 | Refer to Section 6.19. |
| 48 | 49 | Commercial power/inverter switching output 2 | Refer to Section 6.19. |
| 50 | 51 | Cooling fan ON/OFF | ON:Cooling fan is in operation. OFF:Cooling fan is off operation. |
| 52 | 53 | In jogging operation (In jog run) | ON:In jog run OFF:In normal operation |
| 54 | 55 | Operation panel/terminal board operation switching | ON:In operation by terminal board. OFF:In operation by operation panel. |
| 55 | 57 | Cumulative operation time alarm | ON:Cumulative operation time is beyond the $F 5 \underline{2}$; set value. OFF:Cumulative operation time is less than the $F \Sigma \Sigma$ iset value. |
| 58 | 59 | PROFIBUS/DeviceNet/CCLink communication error | ON:Communication error occurred. OFF:Communication error is canceled (reset). |
| 50 | 51 | Forward/reverse switching | OFF:In forward operation. ON:In reverse operation. It output command status while operation is stopped. (When command status is not active, It will be "OFF") |
| 52 | 53 | Ready for operation 1 | ON:In operable status or operation can be started with frequency command input as an operation switching answer-back. OFF:In inoperable status. |
| 54 | 55 | Ready for operation 2 | ON:In operable status or operation can be started with ST and RUN signals and frequency command input. OFF:In inoperable status. |
| 58 | 59 | Brake release (BR) | Output the braking signal according to the brake sequence. |
| 70 | 71 | In (pre-)alarm status | ON:More than one of alarm, pre-alarm, undervoltage, low current over-torque, poor control power supply, PID deviation limit, abnormal frequency setting or torque limit have occurred or detected. <br> OFF:All the alarms above are canceled. |
| 72 | 73 | Forward speed limit (torque control) | ON:Forward operation speed is $F 425$ set value or over. OFF:Forward operation speed is less than $F 425$ set value. |
| 74 | 75 | Reverse speed limit (torque control) | ON:Reverse operation speed is $F 43 B$ set value or over. OFF:Reverse operation speed is less than $F 42 B$ set value. |
| 75 | 77 | Inverter healthy output | ON and OFF are alternately output at intervals of 1 second. |
| 78 | 79 | RS485 communication error | ON:Communication error occurred. OFF:Communication error is canceled (reset). |
| 80 | 81 | Error code output 1 | Output the error code in 6-bit. |
| 82 | 83 | Error code output 2 |  |
| 84 | 85 | Error code output 3 |  |
| 85 | 87 | Error code output 4 |  |
| 88 | 89 | Error code output 5 |  |
| 90 | 91 | Error code output 6 |  |


| Parameter setting |  | Function | Operation output specifications（in case of positive logic） |
| :---: | :---: | :---: | :---: |
| Positive logic | Negative logic |  |  |
| 92 | 93 | Specified data output 1 | Output of the designated data in 7－bit． |
| 94 | 95 | Specified data output 2 |  |
| 95 | 97 | Specified data output 3 |  |
| 98 | 99 | Specified data output 4 |  |
| 100 | 101 | Specified data output 5 |  |
| 182 | 103 | Specified data output 6 |  |
| 184 | 105 | Specified data output 7 |  |
| 105 | 107 | Light load output | ON：Load is equal to $F=35 \sim 5358$ set values or less． |
| 108 | 109 | Heavy load output | ON：Load is larger than F－35 F 3 S |
| 19 | 111 | Positive torque limit | ON：Positive torque is over the positive torque limit level． |
| 16 | 113 | Negative torque limit | ON：Negative torque is over the positive torque limit level． |
| 184 | 115 | Output for external rush suppression relay | ON：External rush suppression relay is actuated． |
| 188 | 197 | Completion of stop positioning | ON：Stop positioning has been completed． |
| 120 | 12 | L－STOP | ON：Operation at the lower limit frequency is performed continuously． |
| 12こ | 1こコ | Power failure synchronized operation | ON：Power failure synchronized operation is performed． |
| 124 | 125 | Traverse in progress | ON：Traverse operation is performed． |
| 125 | 127 | Traverse deceleration in progress | ON：Traverse deceleration operation is performed． |
| 129 | 129 | Part replacement alarm | Alarm：The time of replacement of parts is approaching． |
| 130 | 131 | Over－torque pre－alarm |  |
| 13こ | 133 | Frequency command 1／ 2 selection | $\mathrm{ON}:$ Frequency command selection 2 is selected． |
| 134 | 135 | Failure FL（Except emergency stop） | ON：A trip other than emergency stop has occurred． |
| こここ | ここコ | My function output 1 | ON：My function output 1 is ON． |
| 224 | 205 | My function output 2 | ON：My function output 2 is ON． |
| ここら | ここ7 | My function output 3 | ON：My function output 3 is ON． |
| ここ日 | 2こ9 | My function output 4 | ON：My function output 4 is ON． |
| 230 | 231 | My function output 5 | ON：My function output 5 is ON． |
| こ3こ | 233 | My function output 6 | ON：My function output 6 is ON． |
| 234 | 235 | My function output 7 | ON：My function output 7 is ON． |
| 235 | 237 | My function output 8 | ON：My function output 8 is ON． |
| 238 | 239 | My function output 9 | ON：My function output 9 is ON． |
| 240 | 24i | My function output 10 | ON：My function output 10 is ON． |
| 242 | 243 | My function output 11 | ON：My function output 11 is ON． |
| 244 | 245 | My function output 12 | ON：My function output 12 is ON． |
| 245 | 247 | My function output 13 | ON：My function output 13 is ON． |
| 248 | 249 | My function output 14 | ON：My function output 14 is ON． |
| 250 | 251 | My function output 15 | ON：My function output 15 is ON． |
| 253 | 253 | My function output 16 | ON：My function output 16 is ON． |
| こち4 | 255 | Always OFF（for terminal signal tests） | Output signal always OFF |

Note 1：＂ON＂in positive logic ：Open collector output transistor or relay is turned on． ＂OFF＂in positive logic ：Open collector output transistor or relay is turned off． ＂ON＂in negative logic ：Open collector output transistor or relay is turned off． ＂OFF＂in negative logic ：Open collector output transistor or relay is turned on．
Note 2：Alarm output check conditions are as follows．
（1）Undervoltage detected ：To be checked during operation．
（2）Low current detected ：To be checked during operation command．
（3）Overtorque detected ：To be checked always．
■ Sink logic／source logic
Sink logic and source logic（logic of input／output terminal）can be switched to each other．
$\Rightarrow$ For details，refer to Section 2．3．2．

## 7．2．3 Setup of input terminal operation time

## －Function

The input／output terminal operation time setup function is used to extend response time if there is something malfunctioning because of noise or chattering of input relay．
－Setup of response time

| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| F140 | Input terminal 1 response time selection（F） | 2－200ms | 8 |
| $F 141$ | Input terminal 2 response time selection（R） | こ－200 ms | 8 |
| F142 | Input terminal 3 response time selection （ST） | $2 \sim 208 \mathrm{~ms}$ | 8 |
| F143 | Input terminal 4 response time selection （RES） | 2－208 ms | 8 |
| F144 | Input terminal 5～12 response time selection | こーこ00 ms | 8 |
| F145 | Input terminal 13－20 response time selection | $5-200 \mathrm{~ms}$ | 8 |

Setting when vector option unit or expansion terminal board option is used．
Note：Response time is time to receive the terminal signal．The reflection to the inverter output in actual has the delay of several further ms．

## 7．2．4 Analog input filter

| －Function <br> This function is effective to remove noise from the frequency setting circuit．If operation is unstable because of noise，increase the time constant of the analog input filter． |  |  |  |
| :---: | :---: | :---: | :---: |
| －Response time setting |  |  |  |
| Title | Function | Adjustment range | Default setting |
| F209 | Analog input filter | 6：No filter <br> ：Filter approx． 10 ms <br> Z：Filter approx． 15 ms <br> 3 ：Filter approx． 30 ms <br> 4 ：Filter approx． 60 ms | 0 |

## 7．3 Setup of external speed command（analog signal）

Function of analog input terminals can be selected from four functions（external potentiometer， 0 to $10 \mathrm{Vdc}, 4$（0）to $20 \mathrm{mAdc},-10$ to $+10 \mathrm{Vdc})$ ．The selective function of analog input terminals gives system design flexibility． $\Rightarrow$ Refer to Section 6.28 for fine adjustment of analog setting signal and output frequency．
［Control terminal board］

－Setting of analog input terminal functions

| Terminal symbol | Title | Function | Adjustment range | Default <br> setting |
| :---: | :---: | :---: | :---: | :---: |
| － | F200 | Frequency priority selection |  <br> switching（input terminal <br> function selection 104 ， <br> 105） <br> A：F月0』1F 207 <br> frequency switching <br> （switch by FこO日） | 0 |
| VI／II | F20 | VI／II input point 1 setting | B－ $100 \%$ | 0 |
|  | F202 | VI／II input point 1 frequency | D．0．F H Hz | 0.0 |
|  | F203 | VI／II input point 2 setting | 日～100\％ | 100 |
|  | A $1 F 2$ | VI／II input point 2 frequency |  | ＊1 |
| － | F207 | Frequency setting mode selection 2 | Same as Fn0d（i～13） | ＇ |
| － | F20日 | Speed command priority switching frequency | B．i～FH | 0.1 |
| All | F209 | Analog input filter | 0 （No filter） 3 （Max．filter） | 0 |
| RR／S4 | $F 210$ | RR／S4 input point 1 setting | 日～10日 \％ | 0 |
|  | FE： | RR／S4 input point 1 frequency | B．O～FH Hz | 0.0 |
|  | $F_{2}$ iz | RR／S4 input point 2 setting | B～100\％ | 100 |
|  | $\mathrm{H}_{\sim} \mathrm{FE}^{2}$ | RR／S4 input point 2 frequency | D．0．5～FH Hz | ＊1 |
| RX | FE ib | RX input point 1 setting | － 10 － $100 \%$ | 0 |
|  | FE： 7 | RX input point 1 frequency |  | 0.0 |
|  | $F E ; B$ | RX input point 2 setting | －10日～10日\％ | 100 |
|  | FE＇g | RX input point 2 frequency | B．O～FH Hz | ＊1 |
| Option | $\begin{aligned} & F こ 2 Z \\ & \sim F 23 i \end{aligned}$ | Al1，Al2 input point setting | For details，see Instruction Manual （E6581341）specified in Section 6．41． |  |
|  | $\begin{aligned} & F 234 \\ & -F 237 \end{aligned}$ | RP／high speed pulse input point setting | For details，see Instruction Manual （E6581319）specified in Section 6．41． |  |

＊1：Inverter with a model number ending with－WN，HN： 60.0 －WP： 50.0
Note 1：Input terminals of AI1 and AI2 are at expansion TB option unit．
Note 2：Input terminals of RP／high speed pulse is at PG feedback device option unit．

### 7.3.1 Setup by analog input signals (RR/S4 terminal)

If a potentiometer $(1 \sim 10 \mathrm{k} \Omega-1 / 4 \mathrm{~W})$ for setting up frequency is connected with the RR/S4 terminal, the inverter can be run and stopped with external commands.
For bringing this function into practice, connect a potentiometer to the terminals of PP, RR/S4 and CC so as to divide the reference voltage $(10 \mathrm{Vdc})$ at the terminal PP and to input 0 to 10 Vdc of divided voltage between the RR/S4 and CC terminals.
If analog voltage signal of 0 to 10 Vdc is input between the terminals of RR/S4 and CC, frequency can be set up without connection of a potentiometer.

| Title | Function | Adjustment range | Default setting | Example of setting |
| :---: | :---: | :---: | :---: | :---: |
| [n0d | Command mode selection | B-4 | 0 (Terminal) | 0 (Terminal) |
| Fn0d | Frequency setting mode selection <br> 1 | 1~13 | 2 (RR/S4) | $2(\mathrm{RR} / \mathrm{S} 4)$ |
| Fn5i | FM terminal meter selection | 2-54 | 0 | i |
| $F \%$ | FM terminal meter adjustment | - | - | - |
| F200 | Frequency priority selection | B, i | 0 | 0 |
| F209 | Analog input filter | $\begin{aligned} & \square \text { (No filter) } \exists^{3} \text { (Max. } \\ & \text { filter) } \end{aligned}$ | 0 | 0 |
| $F 210$ | RR/S4 input point 1 setting | 日~100\% | 0 | 0 |
| FE i | RR/S4 input point 1 frequency | O.O~FH Hz | 0.0 | 0.0 |
| $\mathrm{FE}_{2} \mathrm{C}$ | RR/S4 input point 2 setting | 日~ 60 \% | 100 | 100 |
| $\mathrm{HLF}_{\sim} \mathrm{F}$ | RR/S4 input point 2 frequency | B.O~FH Hz | *1 | *1 |

*1: Inverter with a model number ending with $-W N, H N: 60.0$-WP: 50.0
«An example of the connection of terminals: SW1 set to sink logic»


## 7．3．2 Setup by analog input signals（VI／II terminal）

Connect current signal（4）（0）to 20 mAdc ）or voltage signal（ 0 to 10 Vdc ）to the terminal II so that the inverter can be run and stopped with external commands．

| Title | Function | Adjustment range | Default setting | Example of setting |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | 4 （0）－20mAdc | $0 \sim 10 \mathrm{Vdc}$ |
| ［n0d | Command mode selection | 0－4 | 0 （Terminal） | 0 （Terminal） | 0 （Terminal） |
| Find | Frequency setting mode selection 1 | i－ 13 | $こ$（RR／S4） | i（VIIII） | ＇（VI／II） |
| Fn5i | FM terminal meter selection | 0－54 | $\square$ | i | 1 |
| $F \%$ | FM terminal meter adjustment | － | － | － | － |
| $F 108$ | Analog VVII voltage／current switching | 0：Voltage input <br> i：Current input | $\square$ | i | i |
| F200 | Frequency priority selection | O，i | $\square$ | 0 | $\square$ |
| FこG | VIII input point 1 setting | 日～100\％ | $\square$ | 20.0 | 17.0 |
| F202 | VVII input point 1 frequency | O．O～FH Hz | 0.0 | 0.0 | 0.0 |
| F203 | VIII input point 2 setting | 日～100\％ | 100 | 100 | 100 |
| R1F2 | VIII input point 2 frequency | O．O～FH Hz | ＊1 | ＊1 | ＊1 |
| $F 209$ | Analog input filter | $\begin{aligned} & \hline 0 \text { (No filter) }-3 \\ & \text { (Max. filter) } \\ & \hline \end{aligned}$ | 8 | 0 | 0 |

＊1：Inverter with a model number ending with $-W N, H N: 60.0-W P: 50.0$
«An example of the connection of terminals：SW1 set to sink logic»


### 7.3.3 Setup by analog input signals (RX terminal)

Connect voltage signal ( 0 to $\pm 10 \mathrm{Vdc}$ ) to the terminal RX so that the inverter can be run and stopped with external commands.

| Title | Function | Adjustment range | Default setting | Example of setting |
| :---: | :---: | :---: | :---: | :---: |
| Cn0d | Command mode selection | O-4 | 0 (Terminal) | 0 (Terminal) |
| Fngo | Frequency setting mode selection 1 | i~ 13 | 2 (RR/S4) | 3 (RX) |
| F月5i | FM terminal meter selection | 0-64 | 0 | ; |
| $F$ F | FM terminal meter adjustment | - | - | - |
| $F 200$ | Frequency priority selection | O, 1 | 0 | 0 |
| F209 | Analog input filter | 0 (No filter) 3 (Max. filter) | $\square$ | 0 |
| FE i 6 | RX input point 1 setting | - 100~100\% | 4 | 0 |
| FE 17 | RX input point 1 frequency | B.0~F H Hz | 0.0 | 0.0 |
| $F E ; B$ | RX input point 2 setting | - 100 - $100 \%$ | 100 | 108 |
| FE 19 | RX input point 2 frequency | O.0.F H Hz | *1 | *1 |

*1: Inverter with a model number ending with $-W N, H N: 60.0$-WP: 50.0
«An example of the connection of terminals: SW1 set to sink logic»
(
*: Regardless of open/closed circuit between R and CC terminals, run and stop operation is controllable.
Switching between forward run and reverse run is controllable by the terminals F/R and RX if reverse run prohibition selection $F \exists i ;$ is properly set up.
$\Rightarrow$ For details, refer to Section 6.14.4.

## 8. Monitoring the operation status

### 8.1 Screen composition in the status monitor mode

The status monitor mode is used to monitor the operation status of the inverter. $\Rightarrow$ For modes available and instructions about how to switch them, refer to section 3.1.
Here is the screen composition in the status monitor mode.


## 8．2 Monitoring the status

## 8．2．1 Status monitor under normal conditions

In this mode，you can monitor the operation status of the inverter．
To monitor the inverter when it is normally running，press the MODE key twice and the current status is indicated on the LED display．

Setting procedure（EX．：operation at 60 Hz ）

| Commun ication No． | Item displayed | Key operated | $\begin{aligned} & \text { LED } \\ & \text { display } \end{aligned}$ | Description |
| :---: | :---: | :---: | :---: | :---: |
| － | Standard monitor mode |  | 50.0 | The output frequency is displayed（during operation）． （When standard monitor display selection $F 7 \boldsymbol{1}$ is set to $\overparen{0}$［Output frequency］） |
| FE01 | Setting monitor mode | MODE | RuH |  displayed． |
| FE01 | Status monitor mode （Rotating direction） | MODE | $F, F$ | The rotating direction is displayed．（ $F$ ：Forward run， r－：Reverse run） |
| － | Frequency command value | $\wedge$ | 58.10 | The operation frequency command value is displayed． （When $F \boldsymbol{F}$ i $i=i$ ，Frequency command） |
| － | Output current |  | 180 | The inverter output current（load current）is displayed． （When $F 7$ ！こ＝こ ，Output current） |
| － | Input voltage（DC detection） |  | 3180 | The Inverter DC voltage（default setting：unit \％）is displayed．（When $\boldsymbol{F} \boldsymbol{i}$ ：$\Xi=3$ ，Input voltage）［Note 3］ |
| － | Output voltage | $\wedge$ | 9808 | The inverter output voltage（default setting：unit \％）is displayed．（When F7： $\boldsymbol{F}=4$ ，output voltage） |
| － | Torque | $\wedge$ | 9180 | The torque is displayed． （When $F 7$ i5＝ 8 torque） |
| － | Regenerative braking resistance overload factor （PBrOL data） | $\wedge$ | 10 | The regenerative braking resistance overload factor is displayed． <br> （When $F 7 ; 5=i 5$ ，regenerative braking resistance overload factor） |
| － | Inverter overload factor （OL1 data） |  | $\square 8$ | The inverter overload factor is displayed． （When $\boldsymbol{F} \boldsymbol{7}$ ： $\mathbf{7}=15$ ，inverter overload factor） |
| － | Motor overload factor | $\wedge$ | 1208 | The motor overload factor（default setting：unit \％）is displayed． <br> （When $F 7$ ；$B=\{4$ ，Motor overload factor） |
| FE00 | Output frequency | $\wedge$ | 50.0 | The output frequency is displayed． |
| FE06 | Input terminal information 1 | $\wedge$ | ＇i＇itit | The ON／OFF status of each of the control signal input terminals（F，R，ST，RES，S1，S2，S3，RR／S4）is displayed in bits． |
|  | Input terminal information 2 |  | 日 11it | The ON／OFF status of each of the optional control signal input terminals（LI1，LI2，LI3，LI4）is displayed in bits． |
|  | Input terminal information 3 | $\wedge$ | b 1iti | The ON／OFF status of each of the optional control signal input terminals（LI5，LI6，LI7，LI8）is displayed in bits． |
| FE07 | Output terminal information 1 |  | 合 iit | The ON／OFF status of each of the control signal output terminals（OUT1，OUT2，FL）is displayed in bits． |
|  | Output terminal information 2 | $\wedge$ | ＇i＇i＇i＇i | The ON／OFF status of each of the optional control signal output terminals（OUT3，OUT4，R1，OUT5，OUT6，R2， $R 3, R 4$ ）is displayed in bits． |

[^16]|  | (Continued) |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\begin{array}{\|c} \hline \begin{array}{c} \text { Commun } \\ \text { ication } \\ \text { No. } \end{array} \\ \hline \end{array}$ | Item displayed | Key operated | LED display | Description |
|  | FE08 | CPU1 version | (ヘ) | -108 | The version of the CPU1 is displayed. |
|  | FE73 | CPU2 version | ( | c 108 | The version of the CPU2 is displayed. |
| [Note 5] | FE10 | Past trip 1 | $\triangle$ | O[3 ${ }_{\text {c }}$ i | Past trip 1 (displayed alternately at 0.5-sec. intervals) |
| [Note 5] | FE11 | Past trip 2 | $\triangle$ | OH $\Leftrightarrow$ S | Past trip 2 (displayed alternately at 0.5-sec. intervals) |
| [Note 5] | FE12 | Past trip 3 | $\triangle$ | $0 \square 3 \Leftrightarrow 3$ | Past trip 3 (displayed alternately at 0.5-sec. intervals) |
| [Note 5] | FE13 | Past trip 4 | (1) | nErrat | Past trip 4 (displayed alternately at 0.5-sec. intervals) |
| [Note 6] | FE79 | Part replacement alarm information | (1) | \% , , 1 | The ON/OFF status of each of the cooling fan, circuit board capacitor, main circuit capacitor or part replacement alarm of cumulative operation time is displayed in bits. <br> ON: : <br> OFF: , |
| [Note 7] | FE14 | Cumulative operation time | (1) | $t \quad 0.10$ | The cumulative operation time is displayed. (Indication of 0.1 represents 10 hours.) |
|  |  | Default display mode |  | 50.0 | The operation frequency is displayed (during operation). |

Note 1: Press the
Note 2: Contents of status indications of *1, *2, *3, *4, *5, *6, *7, *8, and *9 can be selected from 44 kinds of information.
Contents of status indications that are set up at $F 710$ (standard monitor display selection) and $F 7$ i i~F 7 i $B$ (status monitor 1 to 8 display selection) are displayed.
Unit of current and voltage indications can be changed from \% to A (ampere)/V (volt) and vice versa respectively. $\Rightarrow$ Refer to Section 5.15.
Note 3: Indicated input voltage is DC voltage just after input voltage is rectified multiplied by $1 \sqrt{2}$.
Note 4: The number of bars displayed varies depending on the setting of $F 559$ (logic output/pulse train output selection.)
The bar representing the OUT1 terminal is displayed only when logic output function is assigned to it.
If $F 559=0$ : The bar representing OUT1 is displayed.
If $F 559=t$ : The bar representing OUT1 is not displayed.
Note 5: Past rip records are displayed in the following sequence: 1 (latest trip record) $\Leftrightarrow 2 \Leftrightarrow 3 \Leftrightarrow 4$ (oldest trip record). If there is no trip record, $n E_{r} r$ is displayed.
Details on past trip record 1, 2, 3 or 4 can be displayed by pressing the ENT key when past trip 1, 2, 3 or 4 is displayed. $\Rightarrow$ For more details, refer to Section 8.2.2
Note 6: The part replacement alarm is displayed based on the value calculated from the annual average ambient temperature, operation time and load current specified using $F 534$.
Use this alarm as a guide only, since it is based on a rough estimation.
Note 7: The cumulative operation time increments only when the machine is in operation.

- Input terminal information


Output terminal information


- Cumulative operation time

For indication of cumulative operation hours, running hours are counted up when the output frequency monitor reads a frequency other than 0.0 Hz .10 hours is indicated as 0.1 (unit of Indication).


Note 1: Press the $\triangle$ or key to change items displayed in the status monitor mode.
Note 2: You can switch between \% and A (ampere) $/ \mathrm{V}$ (volt), using the parameter $\boldsymbol{d}^{\prime} 5 \mathrm{P}: \mathrm{i}$ (current/voltage unit selection).
Note 3: The input voltage displayed is $1 / \sqrt{ } 2$ times as large as the rectified DC input voltage.
Note 4: The number of bars displayed varies depending on the setting of $F \sigma \boxed{\sigma}$ (logic output/pulse train output selection). The bar representing the OUT1 terminal is displayed only when logic output function is assigned to it.
If $F 5 \sigma G=0 \quad$ :The bar representing OUT1 is displayed.
If $F 559=1$ :The bar representing OUT1 is not displayed.
Note 5: If there is no trip record, $n E r r$ is displayed.
Note 6: The cumulative operation time increments only when the machine is in operation.

### 8.3 Changing status monitor function

- Changing the display format while power is on

The item displayed in the standard monitor mode ( $* 1$ on the left side of table on page $\mathrm{H}-2$ ), for example, operation frequency which is displayed by default in this way: " $=\boldsymbol{\Omega} .0$ " when power is on or " $\boldsymbol{O} F \boldsymbol{F}$ " when power is off, can be changed to any item shown on page $\mathrm{H}-7$. This new format, however, will not display an assigned prefix such as $t$ or 5 .

- Standard monitor mode $\Rightarrow$ Standard monitor display selection $(F ; i=1)$

| Title | Function | Adjustment range | Default setting |
| :---: | :--- | :--- | :---: |
| $F 709$ | Standard monitor hold <br> function | $\square$ Real time <br> $\vdots:$ Peak hold <br> $Z:$ Minimum hold | 0 |
| $F 7: 0$ | Standard monitor <br> display selection | $0 \sim 70$ <br> $\Rightarrow$ Refer to page H-7. | 0 |

Specify how to output the monitored values that are assigned to status monitors 1 through 8 .
If $F 709$ is set to 0 , the monitored values selected with $F 7$ i (standard monitor display selection parameter) are displayed one after another.
For peak hold values and minimum hold values, the minimum values in each operation mode 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 turned on or after the reset with the EASY key are always displayed no matter whether the motor is in operation or at a standstill.

- Changing contents of status monitor indication

Regarding contents of status monitor indications appearing in the left column of the table on page $\mathrm{H}-2$, those marked with *2 to *9 can be changed for others. Select a desirable monitor function from among optional monitor functions appearing on page $\mathrm{H}-7$.

| *2 Frequency command | $\Rightarrow$ Changeable by status monitor 1 display selection ( $F \boldsymbol{F} \boldsymbol{i}$ i $)$. |
| :---: | :---: |
| *3 Output current |  |
| *4 Input voltage | $\Rightarrow$ Changeable by status monitor 3 display selection ( $\mathcal{F} \boldsymbol{7}$, ). |
| *5 Output voltage | $\Rightarrow$ Changeable by status monitor 4 display selection ( $F 7$; 4). |
| *6 Torque | $\Rightarrow$ Changeable by status monitor 5 display selection ( $F 7$; 5 ) |
| *7 Regenerative braking resistance overload factor | $\Rightarrow$ Changeable by status monitor 6 display selection ( $F 7$ i5). |
| *8 Inverter overload factor | $\Rightarrow$ Changeable by status monitor 7 display selection ( $F ; 17$ ). |
| *9 Motor overload factor | $\Rightarrow$ Changeable by status monitor 8 display selection ( $F ; 18$ ). |


| Title | Function | Adjustment range | Default setting |
| :---: | :---: | :---: | :---: |
| F7i | Status monitor 1 display selection | D-70 $\Rightarrow$ Refer to page $\mathrm{H}-7$. | ; |
| F7:2 | Status monitor 2 display selection | Ditto | 2 |
| F713 | Status monitor 3 display selection | Ditto | 3 |
| F714 | Status monitor 4 display selection | Ditto | 4 |
| F715 | Status monitor 5 display selection | Ditto | 8 |
| F716 | Status monitor 6 display selection | Ditto | 15 |
| F717 | Status monitor 7 display selection | Ditto | 15 |
| F7: ${ }^{\text {F }}$ | Status monitor 8 display selection | Ditto | 14 |

*If $F 7$; to $F 7$ ig are set at " $\Omega$ " (Output frequency) the operation frequency is not held in trip status.


|  | Communication <br> No． | Default setting | Item displayed | Marking | Unit（Panel） | Unit （Communication） |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | FD00 | $\square$ | Output frequency | 50.0 | 0.1 Hz ［note 4］ | 0.01 Hz |
|  | FE02 |  | Frequency command value | 50.4 | 0.1 Hz ［note 4］ | 0.01 Hz |
|  | FE03 | 2 | Output current | － 0 | 1\％or ${ }^{\text {d }} 5 P \mathrm{P}$ | 0．01\％ |
|  | FE04 | 3 | Input voltage（DC detection） | $3 \quad 17$ | 1\％ord5Pu | 0．01\％ |
|  | FE05 | 4 | Output voltage | $\bigcirc$ | 1\％ord5Pu | 0．01\％ |
|  | FE15 | 5 | Compensated frequency | 50.0 | 0.1 Hz ［note 4］ | 0.01 Hz |
|  | FE16 | 5 | Speed feedback（real－time value） | $\square$ | 0.1 Hz ［note 4］ | 0.01 Hz |
|  | FE17 | 7 | Speed feedback（1－second filter） | $\square$ | 0.1 Hz ［note 4］ | 0.01 Hz |
| ［Note 5］ | FE18 | 8 | Torque | $7 \quad 0$ | 1\％ | 0．01\％ |
| ［Note 5］ | FE19 | 9 | Torque command | $9 \quad 3$ | 1\％ | 0．01\％ |
| ［Note 5］ | FE20 | i 1 | Torque current | c $\quad 0$ | 1\％ | 0．01\％ |
|  | FE21 | 12 | Exciting current | $[\square$ | 1\％ | 0．01\％ |
|  | FE22 | 13 | PID feedback value | 0 | 0．1Hz［note 4］ | 0.01 Hz |
|  | FE23 | 14 | Motor overload factor（OL2 data） |  | 1\％ | 0．01\％ |
|  | FE24 | 15 | Inverter overload factor（OL1 data） | $\square$ | 1\％ | 0．01\％ |
|  | FE25 | 15 | Regenerative braking resistance overload factor（OLr data） | $\cdots$ | 1\％ | 1\％ |
|  | FE28 | 17 | Regenerative braking resistance load factor（\％ED） | $\cdots$ | 1\％ | 1\％ |
| ［Note 5］ | FE29 | 18 | Input power | $\bigcirc$ | 0.1 kW | 0.01 kW |
| ［Note 5］ | FE30 | 19 | Output power | H | 0.1 kW | 0.01 kW |
|  | FE39 | 23 | Optional Al2 input | U | 1\％ | 0．01\％ |
|  | FE35 | 24 | RR／S4 input | $\cdots$ | 1\％ | 0．01\％ |
|  | FE36 | 25 | VI／II input | $\cdots$ | 1\％ | 0．01\％ |
|  | FE37 | 26 | RX input | $\cdots$ | 1\％ | 0．01\％ |
|  | FE38 | 27 | Optional Al1 input | $\cdots$ | 1\％ | 0．01\％ |
|  | FE40 | $2 \square$ | FM output | $\square \quad \square$ | 1 | 0.01 |
|  | FE41 | 29 | AM output |  | 1 | 0.01 |
|  | （FA65） | 31 | Communication data output | ［Note 3］ | ［Note 3］ | ［Note 3］ |
|  | FE66 | 32 | Attached to expansion I／O card 1 CPU version | 1．10 | － | － |
|  | FE67 | 33 | Attached to expansion I／O card 2 CPU version | 1．10 | － | － |
| ［Note 5］ | FE76 | 34 | Integral input power |  | Depends on $F 749$ | Depends on F749 |
| ［Note 5］ | FE77 | 35 | Integral output power | $H \quad 8$ | Depends on F749 | Depends on F749 |
| ［Note 2］ | FE00 | 50 | Signed output frequency | 50.0 | 0.1 Hz ［note 4］ | 0.01 Hz |
| ［Note 2］ | FE02 | 51 | Signed frequency command value | 50.4 | 0.1 Hz ［note 4］ | 0.01 Hz |
| ［Note 2］ | FE15 | 52 | Signed compensated frequency | 50.0 | 0.1 Hz ［note 4］ | 0.01 Hz |
| ［Note 2］ | FE16 | 53 | Signed speed feedback（real－time value） | 0 | 0.1 Hz ［note 4］ | 0.01 Hz |
| ［Note 2］ | FE17 | 54 | Signed speed feedback（1－second filter） | 0 | 0.1 Hz ［note 4］ | 0.01 Hz |
| ［Note 2，5］ | FE18 | 55 | Signed torque |  | 1\％ | 0．01\％ |
| ［Note 2，5］ | FE19 | 55 | Signed torque command | $7 \quad 0$ | 1\％ | 0．01\％ |
| ［Note 2．5］ | FE20 | 58 | Signed torque current | $\square \quad \square$ | 1\％ | 0．01\％ |
| ［Note 2］ | FE22 | 59 | Signed PID feedback value | 0 | 0．1Hz［note 4］ | 0.01 Hz |
| ［Note 2］ | FE37 | 50 | Signed RX input | $\cdots$ | 1\％ | 0．01\％ |
| ［Note 2］ | FE38 | 51 | Signed optional AI2 input | い | 1\％ | 0．01\％ |
|  | FD50 | 54 | Light－load high－speed load torque monitor 1 | L | 1\％ | 0．01\％ |
|  | FD51 | 55 | Light－load high－speed load torque monitor 2 | H | 1\％ | 0．01\％ |
|  | FE31 | 55 | Pattern operation group number | 91.0 | 0.1 | 0.1 |
|  | FE32 | 57 | Remaining no．of cycles for which pattern operation is continued | ก1こう | 1 | 1 |
|  | FE33 | 58 | Pattern operation preset speed numbers | Fi | 1 | 1 |
|  | FE34 | 59 | Remaining time for which pattern operation is continued | 123.4 | 0.1 | 0.1 |
|  | FE71 | 70 | Rated voltage | 4400 | 1 | 0.1 |
|  | FE90 | 71 | Rotational speed | 1234 | 1 | 1 |
|  | FA15 | 72 | Communication reception counter | \％123 | 1 | 1 |
|  | FA16 | 73 | Communication abnormal counter | ก123 | 1 | 1 |
|  | FE43 | 74 | MON1 | $\square$ | 1\％ | 0．01\％ |
|  | FE44 | 75 | MON2 | $\square$ | 1\％ | 0．01\％ |

（Continued overleaf）
(Continued)

| Communication <br> No. | Default <br> setting | Item displayed | Marking | Unit (Panel) | Unit <br> (Communication) |
| :---: | :---: | :--- | :---: | :---: | :---: |
| FE56 | 75 | RP | 0 | $0.1 \%$ | $0.01 \%$ |
| FD85 | 77 | COUNT1 | 1234 | 1 | 1 |
| FD86 | 78 | COUNT2 | 1234 | 1 | 1 |
| FD52 | 79 | PID result frequency | 50.0 | 0.1 Hz | 0.01 Hz |
| FE84 | 80 | Synchronous speed frequency <br> command | 50.0 | 0.1 Hz | 0.01 Hz |

Note 1: If any value other than the values in the above table is specified, the number "9999" is displayed.
Note 2: If a negative value of signed signal is specified, the negative sign " - " is displayed. When the negative sign " - " is displayed, do not display " 9 ", "โ", " $\mathbf{L}$ ". When read through by communications device, the negative sign is affixed only FE18~FE20, FE37 and FE38 values..
Note 3: Data set with FA65-FA79 is displayed.
$\Rightarrow$ For details, refer to Instruction Manual (E6581315) specified in Section 6.42.
Note 4: Unit of display is able to change depends on $F 70 \Omega \sim F 708$ setting.
Note 5: If monitor this item, operate a motor in automatic torque boost mode or vector control $\bmod (P L=\Xi, 3,4,7$ or B)

## 8．4 Display of trip information

## 8．4．1 Trip code display

If the inverter trips，an error code is displayed to suggest the cause．In the status monitor mode，the status when the inverter trip is held．
－Display of trip information

| Error code | Description | Communication／Error code Communication No．：FC90 |
| :---: | :---: | :---: |
| OLI | Overcurrent during acceleration | 1 |
| OL2 | Overcurrent during deceleration | 2 |
| OL 3 | Overcurrent during fixed speed operation | 3 |
| OLIP | Overcurrent flowing in element during acceleration （Overheat） | 37 |
| OLEP | Overcurrent flowing in element during deceleration （Overheat） | 38 |
| OL39 | Overcurrent flowing in element during fixed speed （Overheat） | 39 |
| OLA | U－phase arm overcurrent | 5 |
| OLRE | V－phase arm overcurrent | 6 |
| O¢R3 | W－phase arm overcurrent | 7 |
| OLL | Overcurrent（Loaded side overcurrent at start time） | 4 |
| OLT | Dynamic braking element overcurrent（200V－55kW or larger，400V－90kW or larger） | 36 |
| 加 | Overheating | 16 |
| OHE | Thermal trip stop command from external device | 46 |
| OL | Inverter overload | 13 |
| OLこ | Motor overload | 14 |
| OL | Dynamic braking resistor overload | 15 |
| OP | Overvoltage during acceleration | 10 |
| 吅碞 | Overvoltage during deceleration | 11 |
| 093 | Overvoltage during fixed speed operation | 12 |
| Ot | Overtorque | 32 |
| UL | Low current operation | 29 |
| UP ； | Undervoltage（main circuit power supply） | 30 |
| $E$ | Emergency stop | 17 |
| EEP； | E E P ROM fault（writing error） | 18 |
| $E E P E$ | Initial read error（parameter initialization） | 19 |
| EEPJ | Initial read error（parameter initialization） | 20 |
| EF ； | Ground fault | 33 |
| $E F E$ | Ground fault | 34 |
| EPHO | Output phase failure | 9 |
| EPH | Input phase failure | 8 |
| Erre | Inverter RAM fault | 21 |
| Erra | Inverter ROM fault | 22 |
| Er，r ${ }^{\text {r }}$ | CPU fault | 23 |
| Err 5 | Communication time－out error | 24 |
| Errb | Gate array fault | 25 |
| Err 7 | Output current detector error | 26 |
| Errb | Optional unit fault | 27 |
| EEn | Tuning error except Etn1～3 | 40 |
| Etn ！ | $F 4 i 8$ tuning error | 84 |
| Etのこ | $F 4,12$ tuning error | 85 |
| Etn3 | UL，いLu，F405－407 setting error | 86 |
| EヒらP | Inverter type error | 41 |
| $E-10$ | Analog input terminal overvoltage | 42 |
| $E-1 ;$ | Sequence error | 43 |
| $E-12$ | Encoder error | 44 |


| Error code | Description | Communication/Error code Communication No.:FC90 |
| :---: | :---: | :---: |
| E-13 | Speed error (Over speed) | 45 |
| E-i 6 | Terminal input error | 50 |
| E-19 | Abnormal CPU2 communication | 51 |
| E-20 | V/f control error | 52 |
| $E-21$ | CPU1 fault | 53 |
| $E-2 马$ | Abnormal logic input voltage | 54 |
| E-23 | Option 1 error | 55 |
| $E-24$ | Option 2 error | 56 |
| E-25 | Stop position retaining error | 57 |
| E-25 | Internal circuit error | 58 |
| E-29 | Control power backup undervoltage | 61 |
| 5006 | Step-out (for PM motors only) | 47 |
| nErr (*) | No error | 0 |

Note: Past trip records (trip records retained or trips that occurred in the past) can be called up.
$\Rightarrow$ See Section 8.2.1
${ }^{(*)}$ This is not a trip code. This code is displayed to show the absence of error when the past trip monitor mode is selected.

## 8．4．2 Monitor display at tripping

At the occurrence of a trip，the same information as that displayed in the mode described in 8．2．1，＂Status monitor under normal conditions，＂can be displayed，as shown in the table below，if the inverter is not turned off or reset． To display trip information after turning off or resetting the inverter，follow the steps described in 8．2．2，＂Display of detailed information a past trip．＂
－Example of call－up of trip information

| ［Note 3］ | Commun ication No． | Item displayed | Key operated | $\begin{aligned} & \text { LED } \\ & \text { display } \end{aligned}$ | Description |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | FC90 | Trip information |  |  | Status monitor mode（The code blinks if a trip occurs．） The motor coasts and comes to a stop（coast stop）． |
|  | － | Setting monitor mode |  | R号 |  displayed． |
|  | FE01 | Direction of rotation | MODE | $F, F$ | The direction of rotation when the trip occurred is displayed．（ $\boldsymbol{F}$ ：Forward run， $\boldsymbol{r}$ ：Reverse run） |
| ＊1 | － | Frequency command value |  | 58.0 | The operation command value when the trip occurred is displayed． |
| $\begin{gathered} {[\text { Note 4] }} \\ { }^{2} 2 \end{gathered}$ | － | Output current |  | ［13合 | The inverter output current at tripping（load current）is displayed． |
| $\begin{gathered} {[\text { Note } 4]} \\ {[\text { Note } 5]} \\ * 3 \end{gathered}$ | － | Input voltage（DC detection） |  | 314i | The inverter DC voltage at the occurrence of a trip is displayed． |
| $\begin{gathered} {[\text { Note } 4]} \\ * 4 \\ * 5 \end{gathered}$ | － | Output voltage |  | 980 | The inverter output voltage at the occurrence of a trip is displayed． |
|  | － | Torque |  | 9180 | The torque when the trip occurred is displayed． |
| ＊6 | － | Regenerative braking resistance overload factor（PbrOL data） |  | $\bigcirc$ | The regenerative braking resistance overload factor at tripping is displayed． |
|  | － | Inverter overload factor（OL1 data） |  | $\square 8$ | The inverter overload factor at tripping is displayed． |
| ＊8 | － | Motor overload factor （OL2 data） |  | 180 | The motor overload factor at tripping is displayed． |
|  | FE00 | Output frequency |  | 48.0 | The output frequency when the trip occurred is displayed． |
|  | FE06 | Input terminal information 1 | $\triangle$ | ＇iitiit | The ON／OFF status of each of the control input terminals at tripping（F，R，ST，RES，S1，S2，S3， $R R / S 4$ ）is displayed in bits． |
|  |  | Input terminal information 2 | $\triangle$ | 日 ilit | The ON／OFF status of each of the optional control input terminals at tripping（LII，LI2，LI3，LI4）is displayed in bits． |
|  |  | Input terminal information 3 | $\wedge$ | $b$ iiti | The ON／OFF status of each of the optional control input terminals at tripping（LI5，LI6，LI7，LI8）is displayed in bits． |
| ［Note 6］ | FE07 | Output terminal information 1 |  | 合 i i | The ON／OFF status of each of the control output terminals at tripping（OUT1，OUT2 and FL）is displayed in bits． |
|  |  | Output terminal information 2 | $\triangle$ | ＇iitiit | The ON／OFF status of each of the optional control output terminals（OUT3，OUT4，R1，OUT5，OUT6，R2， R3，R4）is displayed in bits． |
|  | FE08 | CPU1 version |  | － 180 | The version of the CPU1 is displayed． |
|  | FE73 | CPU2 version | $\triangle$ | ᄃ 100 | The version of the CPU2 is displayed． |

[^17]

Note 1: If trouble occurs while the CPU is being initialized after the inverter is turned on or reset, the trip record retaining function does not record it but displays a status monitor item.
Note 2: Contents of status indications of *1, *2, *3, *4, *5, *6, *7, and *8 can be selected from 44 kinds of information. Contents of status indications that are set up at $F 7$ i iNF $\mathcal{T}$ i (status monitor 1 to 8 display mode) are displayed.

Note 3: Items displayed when a trip occurs can be changed by pressing
 key.
 selection).
Note 5: The input voltage displayed is $1 / \sqrt{2}$ times as large as the rectified DC input voltage.
Note 6: The number of bars displayed varies depending on the setting of $F 559$ (logic output/pulse train output selection). The bar representing the OUT-NO terminal is displayed only when logic output function is assigned to it.
If $F 559=9$ :The bar representing OUT-NO is displayed.
If $F 559=1$ :The bar representing OUT-NO is not displayed.
Note 7: Past rip records are displayed in the following sequence: 1 (latest trip record) $\Leftrightarrow 2 \Leftrightarrow 3 \Leftrightarrow 4$ (oldest trip record). If there is no trip record, $n E_{r} r$ is displayed.
Details on past trip record 1, 2, 3 or 4 can be displayed by pressing the ENT key when past trip 1, 2, 3 or 4 is displayed. $\Rightarrow$ For more details, refer to Section 8.2.2.
Note 8: The time elapsed before an end of part replacement alarm is issued is calculated from the average yearly ambient temperature, operation time and load current entered using $F 5.54$, and it is no more than an estimation, and therefore it should be used for reference purposes only.
Note 9: The cumulative operation time increments only when the machine is in operation.
Note 10: At the occurrence of a trip, maximum values are not always recorded and displayed for reasons of detecting time.

### 8.5 Display of alarm, pre-alarm, etc.

When the inverter alarm, pre-alarm, etc. occurred, the contents are displayed. (Some are not displayed.)
Listed below ones can be monitored via communication (FC91). Refer to 13.1 for the other alarms.

| Bit | Description | Panel indication |
| :---: | :---: | :---: |
| 0 | Overcurrent pre-alarm | L |
| 1 | Inverter overload pre-alarm | L |
| 2 | Motor overload pre-alarm | L |
| 3 | Overheat pre-alarm | H |
| 4 | Overvoltage pre-alarm achieving PBR operation level | P |
| 5 | Main circuit undervoltage detected | noff |
| 6 | (Reservation area) | - |
| 7 | Low current alarm | - |
| 8 | Overtorque pre-alarm | - |
| 9 | Braking resistor overload pre-alarm | - |
| 10 | Cumulative operation time alarm | - |
| 11 | PROFIBUS/DeviceNet/CC-Link communication error | ti |
| 12 | RS485 communication error | L2 |
| 13 | (Reservation area) | - |
| 14 | Forced deceleration stop because of a momentary power failure | 5tg |
| 15 | Pre-alarm stop because of prolonged lower-limit frequency operation | 15tP |

Note: For each bit, " 0 " indicates normal condition and " 1 " indicates appearance of alarm, etc.

## 9. Taking measures to satisfy the CE/UL/CSA standards

### 9.1 How to cope with the CE standard

In Europe, the EMC directive and the low-voltage directive, which took effect in 1996 and 1997, respectively, make 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 or systems which control them, so they themselves are not considered to be subject to the EMC directive. However, the CE mark must be put on all inverters because they are subject to 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. It is the responsibility of the manufacturers of such final products to put the CE mark on each one. If they are "final" products, they might also be subject to machine-related directives. It is the responsibility of the manufacturers of such final products to put the CE mark on each one. In order to make machines and systems with built-in inverters compliant with the EMC directive and the low-voltage directive, this section explains how to install inverters and what measures should be taken to satisfy the EMC directive.

We have tested representative models with them installed as described later in this manual to check for conformity with the EMC directive. However, we cannot check all inverters for conformity because whether or not they conform to the EMC direction depends on how they are installed and connected. Applicable EMC standards vary depending on the composition of the control panel in which the inverter is installed, the relationship with other electrical devices installed in the control panel, wiring conditions, equipment layout, and so on, so you should check whether your machine or system complies with EMC standards as a whole. Therefore, please verify for yourself whether your machine or system conforms to the EMC directive.

### 9.1.1 EMC directive

The CE mark must be put on every final product that includes an inverter(s) and a motor(s). The VF-AS1 series of inverters complies with the EMC directive if an EMC filter recommended by Toshiba is connected to it and wiring is carried out correctly.
The EMC standards are broadly divided into two categories; immunity- and emission-related standards, each of which is further categorized according to the operating environment of each individual machine. Since inverters are intended for use with industrial systems under industrial environments, they fall within the EMC categories listed in Table 1 below. The tests required for machines and systems as final products are almost the same as those required for inverters.

Table 1 (EMC standards)

| Category | Subcategory | Product standards | Test standard |
| :---: | :---: | :---: | :---: |
| Emission | Radiated | IEC61800-3 | CISPR11(EN55011) |
|  | Conducted |  |  |
| Immunity | Electrostatic discharge |  | IEC61000-4-2 |
|  | Radiated, radio-frequency, electromagnetic field |  | IEC61000-4-3 |
|  | Electrical fast transient burst |  | IEC61000-4-4 |
|  | Surge |  | IEC61000-4-5 |
|  | Conducted disturbances, induced by radio-frequency field |  | IEC61000-4-6 |
|  | Voltage dips, short interruptions and voltage variations |  | IEC61000-4-11 |

### 9.1.2 Measures to satisfy the EMC directive

Concrete measures for EMC directive of CE markings are shown below.
■ Models with a built-in EMC filter
(1) 200 V class: VFAS1-2004PL~2075PL

400V class: VFAS1-4007PL~4500KPC
The above mentioned models install EMC noise filter inside. So the conducted and radiated noise can be reduced, optional EMC noise filters are not needed.
(If a further noise reduction is required, insert an additional filter described in I-4 on the input side of the inverter.)

Table 2 EMC directive compliance

| Inverter type | EMC plate type | Requirements |  | Conducted noise IEC61800-3 category C2 (EN55011 classA Group1) | Conducted noise IEC61800-3 category C3 (EN55011 classA Group2) |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | PWM carrier frequency [F (kHz) |  |  |  |
| VFAS1-2004PL~ <br> VFAS1-2015PL | EMP101Z | 4 | 10 | Built-in filter |  |
|  |  | 16 | 5 |  |  |
| VFAS1-2022PL | EMP102Z | 4 | 10 |  |  |
|  |  | 16 | 5 |  |  |
| VFAS1-2037PL |  | 4 | 10 | - | Built-in filter |
|  |  | 16 | 5 |  |  |
| VFAS1-2055PL, <br> VFAS1-2075PL | EMP103Z | 4 | 10 |  |  |
|  |  | 16 | 5 |  |  |
| VFAS1-4007PL~ | EMP101Z | 4 | 10 | Built-in filter | - |
| VFAS1-4022PL |  | 16 | 5 |  |  |
| VFAS1-4037PL | EMP102Z | 4 | 10 |  |  |
|  |  | 16 | 5 |  |  |
| VFAS1-4055PL~ VFAS1-4110PL | EMP103Z | 4 | 10 | - | Built-in filter |
|  |  | 16 | 5 |  |  |
| VFAS1-4150PL | EMP104Z | 4 | 10 |  |  |
|  |  | 16 | 5 |  |  |
| VFAS1-4185PL |  | 2.5 | 25 |  |  |
|  |  | 16 | 25 |  |  |
| VFAS1-4220PL | EMP105Z | 2.5 | 50 |  |  |
|  |  | 16 | 25 |  |  |
| VFAS1-4300PL, | EMP106Z | 2.5 | 50 |  |  |
| VFAS1-4370PL |  | 16 | 25 |  |  |
| VFAS1-4450PL~ <br> VFAS1-4750PL | EMP108Z | 2.5 | 50 |  |  |
|  |  | 16 | 25 |  |  |
| VFAS1-4900PC | - | 2.5 | 50 |  |  |
| VFAS1-4110KPC | - | 2.5 | 50 |  |  |
| VFAS1-4132KPC | - | 2.5 | 50 |  |  |
| VFAS1-4160KPC | - | 2.5 | 50 |  |  |
| VFAS1-4200KPC | - | 2.5 | 50 |  |  |
| VFAS1-4220KPC | - | 2.5 | 50 |  |  |
| VFAS1-4280KPC | - | 2.5 | 50 |  |  |
| VFAS1-4355KPC, VFAS1-4400KPC, | - | 2.5 | 50 |  |  |
| VFAS1-4500KPC, | - | 2.5 | 50 |  |  |

( ): An optional regenerative braking unit PB7 is used.
(2) Use shielded power cables and control signal cables for the input and output lines of the inverter. Route the cables and wires so as to minimize their lengths. Keep a distance between the power cable and the control cable and between the input and output wires of the power cable. Do not route them in parallel or bind them together, instead cross at right angle.
(3) Install the inverter in an enclosed steel cabinet, it is more effective in limiting the radiation. Using wires as thick and short as possible, earth the control panel securely with a distance kept between the earth cable and the power cable.
(4) To limit the radiation noise from cables, earth each shielded cable to the EMC plate. It is effective to earth shielded cables in the vicinity of the inverter and filter (within a radius of 10 cm from each of them). Inserting a ferrite core in a shielded cable is even more effective in limiting the radiation noise.
(5) To further limit the radiation noise, insert a zero-phase reactor in the inverter output line and insert ferrite cores in the earth cables of the EMC and cabinet.

## [Ex. Countermeasure - inverter wiring]



Fig. 1

- When an external EMC filter is added
(1) Additional external EMC filters have the further effect of suppressing conduction and radiation noises. Use the recommended EMC noise filter specified in Table 3. This combination of inverter and filter was used when examining the inverter for compliance with the EMC directive.
Table 3 lists noise filters recommended for the inverters.

Table 3 Combinations of inverter and EMC filter

| Inverter type | Requirements |  | Conducted noise IEC61800-3 category C2 (EN55011 classA Group1) Applicable filters | Conducted noise IEC61800-3 category C1 (EN55011 classB Group1) Applicable filters |
| :---: | :---: | :---: | :---: | :---: |
|  | PWM carrier frequency [ 5 (kHz) | Length of motor connecting cable (m) |  |  |
| VFAS1-2004PL~ <br> VFAS1-2015PL | 3.5~4 | 50 | EMF3-4012A | EMF3-4012A |
|  |  | 100 | EMF3-4012A | - |
|  | 4.1~16 | 20 | EMF3-4012A | EMF3-4012A |
|  |  | 50 | EMF3-4012A | - |
| VFAS1-2022PL, VFAS1-2037PL | 3.5~4 | 50 | EMF3-4026B | EMF3-4026B |
|  |  | 100 | EMF3-4026B | - |
|  | 4.1~16 | 25 | EMF3-4026B | EMF3-4026B |
|  |  | 50 | EMF3-4026B | - |
| VFAS1-2055PL | 3.5~4 | 50 | EMF3-4035C | EMF3-4035C |
|  |  | 100 | EMF3-4035C | - |
|  | 4.1~16 | 25 | EMF3-4035C | EMF3-4035C |
|  |  | 50 | EMF3-4035C | - |
| VFAS1-2075PL | 3.5~4 | 50 | EMF3-4046D | EMF3-4046D |
|  |  | 100 | EMF3-4046D | - |
|  | 4.1~16 | 25 | EMF3-4046D | EMF3-4046D |
|  |  | 50 | EMF3-4046D | - |
| VFAS1-2110PM, VFAS1-2150PM | 2~4 | 50 | EMF3-4072E | EMF3-4072E |
|  |  | 100 | EMF3-4072E | - |
|  | 4.1~12 | 25 | EMF3-4072E | EMF3-4072E |
|  |  | 50 | EMF3-4072E | - |
| VFAS1-2185PM, VFAS1-2220PM | 2~2.5 | 50 | EMF3-4090F | EMF3-4090F |
|  |  | 100 | EMF3-4090F | - |
|  | 2.6~12 | 25 | EMF3-4090F | EMF3-4090F |
|  |  | 50 | EMF3-4090F | - |
| VFAS1-2300PM~ <br> VFAS1-2450PM | 2~2.5 | 50 | EMF3-4180H | EMF3-4180H |
|  |  | 100 | EMF3-4180H | - |
|  | 2.6~12 | 25 | EMF3-4180H | EMF3-4180H |
|  |  | 50 | EMF3-4180H | - |
| VFAS1-2550P, <br> VFAS1-2750P | 2.5 | 100 | EMF3-43001 | - |
| VFAS1-4007PL~ <br> VFAS1-4022PL | 3.5~4 | 50 | EMF3-4012A | EMF3-4012A |
|  |  | 100 | EMF3-4012A | - |
|  | 4.1~16 | 20 | EMF3-4012A | EMF3-4012A |
|  |  | 50 | EMF3-4012A | - |
| VFAS1-4037PL | 3.5~4 | 50 | EMF3-4026B | EMF3-4026B |
|  |  | 100 | EMF3-4026B | - |
|  | 4.1~16 | 25 | EMF3-4026B | EMF3-4026B |
|  |  | 50 | EMF3-4026B | - |
| VFAS1-4055PL, <br> VFAS1-4075PL | 3.5~4 | 50 | EMF3-4035C | EMF3-4035C |
|  |  | 100 | EMF3-4035C | - |
|  | 4.1~16 | 25 | EMF3-4035C | EMF3-4035C |
|  |  | 50 | EMF3-4035C | - |
| VFAS1-4110PL | 3.5~4 | 50 | EMF3-4046D | EMF3-4046D |
|  |  | 100 | EMF3-4046D | - |
|  | 4.1~16 | 25 | EMF3-4046D | EMF3-4046D |
|  |  | 50 | EMF3-4046D | - |
| VFAS1-4150PL, <br> VFAS1-4185PL | 2~4 | 100 | EMF3-4072E | EMF3-4072E |
|  |  | 300 | EMF3-4072E | - |
|  | 4.1~12 | 100 | EMF3-4072E | EMF3-4072E |
|  |  | 200 | EMF3-4072E | - |

(Continued overleaf)

| (Continued) |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| Inverter type | Requirements |  | Conducted noise IEC61800-3 category C2 (EN55011 classA Group1) Applicable filters | Conducted noise IEC61800-3 category C1 (EN55011 classB Group1) Applicable filters |
|  | PWM carrier frequency [F (kHz) | Length of motor connecting cable (m) |  |  |
| VFAS1-4220PL | 2~4 | 100 | EMF3-4090F | EMF3-4090F |
|  |  | 300 | EMF3-4090F | - |
|  | 4.1~12 | 100 | EMF3-4090F | EMF3-4090F |
|  |  | 200 | EMF3-4090F | - |
| VFAS1-4300PL <br> VFAS1-4370PL | 2~2.5 | 100 | EMF3-4092G | EMF3-4092G |
|  |  | 300 | EMF3-4092G | - |
|  | 2.6~12 | 100 | EMF3-4092G | EMF3-4092G |
|  |  | 200 | EMF3-4092G | - |
| VFAS1-4450PL~ <br> VFAS1-4750PL | 2~2.5 | 100 | EMF3-4180H | EMF3-4180H |
|  |  | 300 | EMF3-4180H | - |
|  | 2.6~12 | 100 | EMF3-4180H | EMF3-4180H |
|  |  | 200 | EMF3-4180H | - |
| $\begin{aligned} & \text { VFAS1-4900PC~ } \\ & \text { VFAS1-4132KPC } \end{aligned}$ | 2.5 | 100 | EMF3-43001 | - |
| $\begin{aligned} & \text { VFAS1-4160KPC~ } \\ & \text { VFAS1-4280KPC } \end{aligned}$ | 2.5 | 100 | EMF3-4600J | - |
| VFAS1-4355KPC~ <br> VFAS1-4500KPC | 2.5 | 100 | EMF3-4600J $\times 2$ | - |

(2) Use shielded cables for the power and control cables, including filter input cables and inverter output cables. Route the cables and wires so as to minimize their lengths. Keep a distance between the power cable and the control cable and between the input and output wires of the power cable. Do not route them in parallel or bind them together, instead cross at right angle.
(3) Install the filter and the inverter in an enclosed steel cabinet, it is more effective in limiting the radiation. Earth the cabinet body securely with the thickest and shortest possible electric wire installed away from the power cables.
(4) Route the EMC filter input and output wires apart from each other.
(5) To limit the radiation noise from cables, earth each shielded cable to the EMC plate. It is effective to earth shielded cables in the vicinity of the inverter and filter (within a radius of 10 cm from each of them). Inserting a ferrite core in a shielded cable is even more effective in limiting the radiation noise.
(6) To further limit the radiation noise, insert a zero-phase reactor in the inverter output line and insert ferrite cores in the earth cables of the EMC plate and cabinet.
[Ex. Countermeasure - inverter wiring]


Fig. 2

## [Operation with external signals]

When using signals from an external control device to operate the inverter, take the measures shown in Figure 3. Ex.) When using the potentiometer and forward run/reverse run terminals


Fig. 3

```
[Accessories for countermeasure]
\squareRecommended shield cable : Showa electric Wire & Cable Co., LTD
    Type : CV-S
    Rating: 600V or less
    Cross-sectional area: 2~1000mm
    If it is difficult to procure shielded cables, protect cables with conduit tubes.
\square[Note 1] Recommended shield : SUMITOMO 3M Limited, Electromagnetic wave guard shielding sleeve
    Type : DS-5, 7, 10, 14
\squareEMC filter Type : EMF3 series
\squareRecommended ferrite core 1 : TDK Corporation
                            Type : ZCAT3035-1330
    Use the following, as required.
Recommended ferrite core : NEC TOKIN Corporation
    Type : ESD-R-47D-1
\squareZero-phase reactor : Soshin Electric Co., Ltd.
    Type : RC5078 or RC9129
\squareHigh-attenuation radio noise reduction filter : Soshin Electric Co., Ltd.
    Type : NF series
```


### 9.1.3 Low-voltage directive

The low-voltage directive provides for the safety of machines and systems. All Toshiba 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 imported without a problem to European countries.

Applicable standard: IEC61800-5-1
Adjustable speed electrical power drive system
Pollution level: 2
Overvoltage category: 3

### 9.1.4 Measures to be taken to satisfy the low-voltage directive

When incorporating the inverter into a machine or system, it is necessary to take the following measures so that the inverter satisfies the low-voltage directive.
(1) 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 and capacity of the inverter used.
(2) Do not connect two or more wires to the main circuit earth terminal of the inverter. If necessary, install an additional earth terminal on the EMC plate on which the inverter is installed and connect another cable to it. (Refer to Fig. 4.) See the table of section 10.1.
(3) Install a non-fuse circuit breaker on the input side of the inverter.


Fig. 4

### 9.2 Measures to be taken to satisfy the ULICSA standards

All VF-AS1 series inverters are certified by UL and CSA, and have nameplates with UL and CSA markings.

### 9.2.1 Caution in installing the inverter

A UL certificate was granted on the assumption that the inverter would be installed in a cabinet. Therefore, install the inverter in a cabinet and if necessary, take measures to maintain the ambient temperature (temperature in the cabinet) within the specified temperature range.
For models designed for 15 kW motors or smaller, if the cover on the top of the inverter is removed, the ambient temperature can rise to $50^{\circ} \mathrm{C}$ in some cases, although the maximum allowable ambient temperature is $40^{\circ} \mathrm{C}$. Incidentally, models (with no cover on the top) designed for 18.5 kW motors or larger can be used at ambient temperatures of up to $50^{\circ} \mathrm{C}$.

### 9.2.2 Caution in wiring and rated current

Use the UL conformed cables (Rating $75^{\circ} \mathrm{C}$ or more, Use the copper conductors only.) to the main circuit terminals (R/L1, S/L2, T/L3, U/T1, V/T2, W/T3). For FLA, FLB and FLC terminals, the round solderless terminal "V1.25-3" has to be used with UL-certified electric wire.
For instruction in the United States, Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electrical Code and any additional local codes.
For instruction in the Canada, Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the Canadian Electrical Code and any additional local codes.
$\Rightarrow$ For recommended electric wire sizes, see Tables 5.
UL-certified rated output current is not the same as inverter unit rated current. Refer to Table 5.

### 9.2.3 Caution as to peripheral devices

Use the UL listed fuses at connecting to power supply.
The UL certification test on this inverter was conducted under the AIC* conditions shown in Table 4 (*: current that flows in the event of a short-circuit in the power supply). Note that AIC currents vary depending on the capacity of the motor used.

Table 4 Power supply short-circuit current and maximum input voltage

| Input voltage | Drive motor | Power supply short-circuit and maximum input voltage |
| :---: | :---: | :---: |
| 240V | 0.4 kW | Suitable For Use On A Circuit Capable Of Delivering Not More Than 5,000A rms Symmetrical Amperes, 240 Volts Maximum When Protected by CC Class Fuses. |
|  | 0.75 kW to 37 kW | 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. |
|  | 45kW and over | 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. |
| 480 V | 0.75 kW to 1.5 kW | Suitable For Use On A Circuit Capable Of Delivering Not More Than 5,000A rms Symmetrical Amperes, 480 Volts Maximum When Protected by CC Class Fuses. |
|  | 2.2kW to 37 kW | 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. |
|  | 45 kW to 132 kW | 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. |
|  | 160 kW to 220 kW | 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. |
|  | 280kW | 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. |
|  | 355 kW to 400kW | Suitable For Use On A Circuit Capable Of Delivering Not More Than 30,000A rms Symmetrical Amperes, 480 Volts Maximum When Protected by J Class Fuses. |
|  | 500kW | Suitable For Use On A Circuit Capable Of Delivering Not More Than 42,000A rms Symmetrical Amperes, 480 Volts Maximum When Protected by J Class Fuses. |

Table $5 \quad$ AIC, Fuse and Wire sizes

| Voltage class |  | Inverter model | UL output current <br> (A) *2, *3 | $\begin{gathered} \hline \text { AIC (A) } \\ \text { (Interrupting } \\ \text { capacity) } \\ \hline \hline \end{gathered}$ | Fuse class and current (A) | Input wire sizes of power circuit *4 | Output wire sizes of power circuit *4 | $\begin{gathered} \text { Earth } \\ * 4 \end{gathered}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{aligned} & 200 \mathrm{~V} \\ & \text { class } \end{aligned}$ | 0.4 | VFAS1-2004PL | 2.5 ( $[F=4)$ | AIC 5000A | CC 7Amax. | AWG 14 | AWG 14 | AWG 14 |
|  | 0.75 | VFAS1-2007PL | 4.8 ( $[F=4)$ | AIC 5000A | J 15Amax. | AWG 14 | AWG 14 | AWG 14 |
|  | 1.5 | VFAS1-2015PL | $7.8([F=4)$ | AIC 5000A | J 25Amax. | AWG 14 | AWG 14 | AWG 14 |
|  | 2.2 | VFAS1-2022PL | 11.0 ( $[F=4)$ | AIC 5000A | J 25A max. | AWG 12 | AWG 12 | AWG 14 |
|  | 3.7/4.0 | VFAS1-2037PL | $17.5([F=4)$ | AIC 5000A | J 45Amax. | AWG 10 | AWG 10 | AWG 12 |
|  | 5.5 | VFAS1-2055PL | 25.3 ( $[F=4)$ | AIC 5000A | J 60Amax. | AWG 8 | AWG 8 | AWG 10 |
|  | 7.5 | VFAS1-2075PL | $32.2([F=4)$ | AIC 5000A | J 70Amax. | AWG 8 | AWG 8 | AWG 10 |
|  | 11 | VFAS1-2110PM | 48.3 ( $[F=4)$ | AIC 5000A | J 90Amax. | AWG 4 | AWG 4 | AWG 10 |
|  | 15 | VFAS1-2150PM | $62.1([F=4)$ | AIC 5000A | J 110Amax. | AWG 4 | AWG 4 | AWG 10 |
|  | 18.5 | VFAS1-2185PM | $74.8([F=2.5)$ | AIC 5000A | J 125Amax. | AWG 3 | AWG 3 | AWG 8 |
|  | 22 | VFAS1-2220PM | $88(\Gamma F=2.5)$ | AIC 5000A | J 150Amax. | AWG 2 | AWG 2 | AWG 8 |
|  | 30 | VFAS1-2300PM | $114([F=2.5)$ | AIC 5000A | J 200Amax. | AWG $2 / 0$ | AWG $2 / 0$ | AWG 6 |
|  | 37 | VFAS1-2370PM | 143 ([F=2.5) | AIC 5000A | J 225Amax. | AWG $3 / 0$ | AWG $3 / 0$ | AWG 6 |
|  | 45 | VFAS1-2450PM | 169 ( $[F=2.5$ ) | AIC 10000A | J 300Amax. | AWG 4/0 | AWG 4/0 | AWG 6 |
|  | 55 | VFAS1-2550P | 221 ( $[F=2.5$ ) | AIC 10000A | J 350Amax. | AWG $3 / 0 \times 2$ | AWG $3 / 0 \times 2$ | AWG 2 |
|  | 75 | VFAS1-2750P | 285 ( $[F=2.5$ ) | AIC 10000A | J 450Amax. | AWG 4/0 $\times 2$ | $250 \mathrm{MCM} \times 2$ | AWG 2 |
| $\begin{aligned} & 400 \mathrm{~V} \\ & \text { class } \end{aligned}$ | 0.75 | VFAS1-4007PL | $2.1(\Gamma F=4)$ | AIC 5000A | CC 6Amax. | AWG 14 | AWG 14 | AWG 14 |
|  | 1.5 | VFAS1-4015PL | 3.4 ( $[F=4)$ | AIC 5000A | CC 12Amax. | AWG 14 | AWG 14 | AWG 14 |
|  | 2.2 | VFAS1-4022PL | $4.8(\Gamma F=4)$ | AIC 5000A | J 15Amax. | AWG 14 | AWG 14 | AWG 14 |
|  | 3.7/4.0 | VFAS1-4037PL | 7.6 ( $[F=4)$ | AIC 5000A | J 25Amax. | AWG 12 | AWG 12 | AWG 14 |
|  | 5.5 | VFAS1-4055PL | $11.0([F=4)$ | AIC 5000A | J 40Amax. | AWG 10 | AWG 10 | AWG 12 |
|  | 7.5 | VFAS1-4075PL | 14.0 0 ( $¢ F=4)$ | AIC 5000A | J 40Amax. | AWG 10 | AWG 10 | AWG 12 |
|  | 11 | VFAS1-4110PL | 21.0 ([F=4) | AIC 5000A | J 60Amax. | AWG 8 | AWG 8 | AWG 10 |
|  | 15 | VFAS1-4150PL | 27.0 ( $[F=4)$ | AIC 5000A | J 70Amax. | AWG 6 | AWG 6 | AWG 10 |
|  | 18.5 | VFAS1-4185PL | 34.0 ( $[F=4)$ | AIC 5000A | J 70Amax. | AWG 6 | AWG 6 | AWG 10 |
|  | 22 | VFAS1-4220PL | 40.0 ( $[F=4)$ | AIC 5000A | J 80Amax. | AWG 6 | AWG 6 | AWG 10 |
|  | 30 | VFAS1-4300PL | 52.0 ( $[F=4$ ) | AIC 5000A | J 90Amax. | AWG 4 | AWG 4 | AWG 10 |
|  | 37 | VFAS1-4370PL | 65.0 ( $[F=2.5)$ | AIC 5000A | J 110Amax. | AWG 3 | AWG 3 | AWG 8 |
|  | 45 | VFAS1-4450PL | 77.0 ( $[F=2.5)$ | AIC 10000A | J 150Amax. | AWG 1 | AWG 1 | AWG 8 |
|  | 55 | VFAS1-4550PL | 96.0 ( $[F=2.5)$ | AIC 10000A | J 175Amax. | AWG 1/0 | AWG 1/0 | AWG 6 |
|  | 75 | VFAS1-4750PL | 124.0 ( $[F=2.5)$ | AIC 10000A | J 225Amax. | AWG $3 / 0$ | AWG $3 / 0$ | AWG 6 |
|  | 90 | VFAS1-4900PC | $179.0([F=2.5)$ | AIC 10000A | J 250Amax. | $\begin{gathered} \text { AWG } 1 / 0 \times 2 \\ 250 \mathrm{MCM} \times 2 \text { *1 } \\ \hline \end{gathered}$ | $\begin{gathered} \text { AWG } 1 / 0 \times 2 \\ 250 \mathrm{MCM} \times 2 \text { * } 1 \\ \hline \end{gathered}$ | AWG 2 250 MCM *1 |
|  | 110 | VFAS1-4110KPC | $215.0([F=2.5)$ | AIC 10000A | J 300Amax. | $\begin{gathered} \text { AWG } 3 / 0 \times 2 \\ 250 \mathrm{MCM} \times 2 \text { *1 } \\ \hline \end{gathered}$ | $\begin{gathered} \text { AWG } 3 / 0 \times 2 \\ 250 \mathrm{MCM} \times 2 \text { *1 } \\ \hline \end{gathered}$ | AWG 2 250 MCM *1 |
|  | 132 | VFAS1-4132KPC | $259.0([F=2.5)$ | AIC 10000A | J 350Amax. | $\begin{gathered} \text { AWG } 4 / 0 \times 2 \\ 250 \mathrm{MCM} \times 2 * 1 \\ \hline \end{gathered}$ | $\begin{gathered} \text { AWG } 4 / 0 \times 2 \\ 250 \mathrm{MCM} \times 2{ }^{*} 1 \\ \hline \end{gathered}$ | AWG 1 250 MCM *1 |
|  | 160 | VFAS1-4160KPC | $314.0([F=2.5)$ | AIC 18000A | J 400A max. | $\begin{gathered} 300 \mathrm{MCM} \times 2 \\ 350 \mathrm{MCM} \times 2 \text { *1 } \\ \hline \end{gathered}$ | $\begin{gathered} 300 \mathrm{MCM} \times 2 \\ 350 \mathrm{MCM} \times 2 \text { *1 } \\ \hline \end{gathered}$ | AWG 1 250 MCM *1 |
|  | 200 | VFAS1-4200KPC | 387.0 ( 5 F=2.5) | AIC 18000A | J 500Amax. | $\begin{gathered} \text { AWG } 4 / 0 \times 3 \\ 350 \mathrm{MCM} \times 3 * 1 \end{gathered}$ | $\begin{gathered} \text { AWG } 4 / 0 \times 3 \\ 350 \mathrm{MCM} \times 3 * 1 \\ \hline \end{gathered}$ | $\begin{gathered} \text { AWG } 1 / 0 \\ 250 \mathrm{MCM} \times 2 * 1 \\ \hline \end{gathered}$ |
|  | 220 | VFAS1-4220KPC | $427.0([F=2.5)$ | AIC 18000A | J 500Amax. | $\begin{gathered} 250 \mathrm{MCM} \times 3 \\ 350 \mathrm{MCM} \times 3 \star 1 \end{gathered}$ | $\begin{gathered} 250 \mathrm{MCM} \times 3 \\ 350 \mathrm{MCM} \times 3 \text { * } \\ \hline \end{gathered}$ | AWG $2 / 0$ $250 \mathrm{MCM} \times 2 * 1$ |
|  | 280 | VFAS1-4280KPC | $550.0(\Gamma F=2.5)$ | AIC 18000A | T 700Amax. | $\begin{gathered} 350 \mathrm{MCM} \times 3 \\ 350 \mathrm{MCM} \times 3 * 1 \\ \hline \end{gathered}$ | $\begin{gathered} 350 \mathrm{MCM} \times 3 \\ 350 \mathrm{MCM} \times 3 * 1 \\ \hline \end{gathered}$ | $\begin{gathered} \hline \text { AWG } 3 / 0 \\ 250 \mathrm{MCM} \times 2 * 1 \end{gathered}$ |
|  | 355 | VFAS1-4355KPC | $671.0([F=2.5)$ | AIC 30000A | J 450A $\times 2$ max. | $\begin{aligned} & 400 \mathrm{MCM} \times 2 \times 2 \\ & 500 \mathrm{MCM} \times 2 \times 2 \star 1 \\ & \hline \end{aligned}$ | $\begin{gathered} 400 \mathrm{MCM} \times 4 \\ 500 \mathrm{MCM} \times 4 \text { *1 } \\ \hline \end{gathered}$ | $\begin{gathered} \text { AWG 4/0 } \\ 500 \mathrm{MCM}{ }^{1} \end{gathered}$ |
|  | 400 | VFAS1-4400KPC | 759.0 ( $5 F=2.5$ ) | AIC 30000A | J 500A $\times 2$ max. | $\begin{aligned} & 500 \mathrm{MCM} \times 2 \times 2 \\ & 500 \mathrm{MCM} \times 2 \times 2 * 1 \end{aligned}$ | $\begin{gathered} 500 \mathrm{MCM} \times 4 \\ 500 \mathrm{MCM} \times 4 \text { *1 } \\ \hline \end{gathered}$ | $\begin{gathered} \text { AWG 4/0 } \\ 500 \text { MCM }{ }^{1} \end{gathered}$ |
|  | 500 | VFAS1-4500KPC | 941.0 ( 5 F=2.5) | AIC 42000A | J 600A $\times 2$ max. | $\begin{aligned} & 400 \mathrm{MCM} \times 3 \times 2 \\ & 500 \mathrm{MCM} \times 3 \times 2 * 1 \\ & \hline \end{aligned}$ | $\begin{gathered} 400 \mathrm{MCM} \times 5 \\ 500 \mathrm{MCM} \times 5 \text { * } \\ \hline \end{gathered}$ | $\begin{gathered} 250 \mathrm{MCM} \\ 500 \mathrm{MCM} * 1 \end{gathered}$ |

*1: This part shows the wiring size with using the Lug terminal.
The Lug terminals are an option.
*2: UL output current is different from unit rating output current.
*3: The value of the UL rated output current is applicable when the carrier frequency ( $\mathbb{L} \boldsymbol{F}$ ) is less than the value shown in the table.
*4: The cables used must be $75^{\circ} \mathrm{C}$ copper cables within $40^{\circ} \mathrm{C}$ ambient temperature.

### 9.2.4 Caution as to the protection of motors from overload

When using the inverter's thermal protection function to protect the motor from overload, read the instruction manual included with the inverter carefully and set parameters according to the specifications of the motor used.
When using the inverter to control the operation of multiple motors, install an overload relay for each individual motor.

## 10. Selection of peripheral devices

| ¢ Warning |  |
| :---: | :---: |
|  | - When using the inverter without the front cover, be sure to place the inverter unit inside a cabinet. If they are used outside the cabinet, it may cause electric shock. |
|  | - Be sure to ground every unit. If not, it may cause electric shock or fire on the occasion of failure, short-circuit or electric leak. |

### 10.1 Selection of wiring materials and devices

| Voltage class | $\begin{gathered} \text { Applicable } \\ \text { motor } \\ {[k W]} \end{gathered}$ | Inverter model | Wire size |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | Main circuit |  |  |  | DC terminal |  | $\begin{array}{\|c\|} \hline \text { Braking resistor/ } \\ \text { Braking unit } \\ \text { (optional) (*4) } \\ \hline \end{array}$ |  | Earth cable |  |
|  |  |  | Input terminal (R, S, T) |  | Output terminal ( $\mathrm{U}, \mathrm{V}, \mathrm{W}$ ) |  |  |  |  |  |  |  |
|  |  |  | $\begin{aligned} & \text { AWG } \\ & (* 7) \end{aligned}$ | $\mathrm{mm}_{(* 8)}^{2}$ | $\begin{aligned} & \text { AWG } \\ & (* 7) \\ & \hline \end{aligned}$ | $\begin{gathered} \mathrm{mm}^{2} \\ (* 8) \end{gathered}$ | $\begin{aligned} & \text { AWG } \\ & (* 7) \end{aligned}$ | $\begin{gathered} \mathrm{mm}^{2} \\ (* 8) \\ \hline \end{gathered}$ | $\begin{gathered} \text { AWG } \\ (* 7) \\ \hline \end{gathered}$ | $\begin{gathered} \mathrm{mm}^{2} \\ (* 8) \end{gathered}$ | $\begin{aligned} & \text { AWG } \\ & (* 7) \\ & \hline \end{aligned}$ | $\begin{gathered} \mathrm{mm}^{2} \\ \left({ }^{*} 9\right) \end{gathered}$ |
| $\begin{aligned} & 200 \mathrm{~V} \\ & \text { class } \end{aligned}$ | 0.4 | VFAS1-2004PL | 14 | 1.5 | 14 | 1.5 | 14 | 1.5 | 14 | 1.5 | 14 | 2.5 |
|  | 0.75 | VFAS1-2007PL | 14 | 1.5 | 14 | 1.5 | 14 | 1.5 | 14 | 1.5 | 14 | 2.5 |
|  | 1.5 | VFAS1-2015PL | 14 | 1.5 | 14 | 1.5 | 12 | 1.5 | 14 | 1.5 | 14 | 2.5 |
|  | 2.2 | VFAS1-2022PL | 12 | 1.5 | 12 | 1.5 | 10 | 2.5 | 14 | 1.5 | 14 | 2.5 |
|  | 3.7/4.0 | VFAS1-2037PL | 10 | 4 | 10 | 4 | 8 | 6 | 14 | 1.5 | 12 | 4 |
|  | 5.5 | VFAS1-2055PL | 8 | 6 | 8 | 6 | 6 | 10 | 14 | 1.5 | 10 | 6 |
|  | 7.5 | VFAS1-2075PL | 8 | 10 | 8 | 10 | 4 | 16 | 12 | 2.5 | 10 | 10 |
|  | 11 | VFAS1-2110PM | 4 | 16 | 4 | 16 | 3 | 16 | 10 | 4 | 10 | 16 |
|  | 15 | VFAS1-2150PM | 4 | 25 | 4 | 25 | 1 | 25 | 8 | 6 | 10 | 16 |
|  | 18.5 | VFAS1-2185PM | 3 | 25 | 3 | 25 | 1/0 | 35 | 8 | 10 | 8 | 16 |
|  | 22 | VFAS1-2220PM | 2 | 25 | 2 | 25 | 2/0 | 35 | 6 | 16 | 8 | 16 |
|  | 30 | VFAS1-2300PM | 2/0 | 50 | 2/0 | 50 | 4/0 | 70 | 4 | 25 | 6 | 25 |
|  | 37 | VFAS1-2370PM | 3/0 | 70 | 3/0 | 70 | 250MCM | 95 | 3 | 35 | 6 | 35 |
|  | 45 | VFAS1-2450PM | 4/0 | 70 | 4/0 | 70 | 300MCM | 95 | 2 | 50 | 6 | 35 |
|  | 55 | VFAS1-2550P | $3 / 0 \times 2$ | $70 \times 2$ | $3 / 0 \times 2$ | 120 | $4 / 0 \times 2$ | 95×2 | 1/0 | 50 | 2 | 70 |
|  | 75 | VFAS1-2750P | $4 / 0 \times 2$ | $95 \times 2$ | $250 \mathrm{MCM} \times 2$ | $70 \times 2$ | 300MCM $\times 2$ | $120 \times 2$ | 1/0 | $35 \times 2$ | 2 | 95 |
| $\begin{aligned} & 400 \mathrm{~V} \\ & \text { class } \end{aligned}$ | 0.75 | VFAS1-4007PL | 14 | 1.5 | 14 | 1.5 | 14 | 1.5 | 14 | 1.5 | 14 | 2.5 |
|  | 1.5 | VFAS1-4015PL | 14 | 1.5 | 14 | 1.5 | 14 | 1.5 | 14 | 1.5 | 14 | 2.5 |
|  | 2.2 | VFAS1-4022PL | 14 | 1.5 | 14 | 1.5 | 14 | 1.5 | 14 | 1.5 | 14 | 2.5 |
|  | $3.7 / 4.0$ | VFAS1-4037PL | 12 | 1.5 | 12 | 1.5 | 10 | 2.5 | 14 | 1.5 | 14 | 2.5 |
|  | 5.5 | VFAS1-4055PL | 10 | 2.5 | 10 | 2.5 | 8 | 4 | 14 | 1.5 | 12 | 2.5 |
|  | 7.5 | VFAS1-4075PL | 10 | 4 | 10 | 4 | 8 | 6 | 14 | 1.5 | 12 | 4 |
|  | 11 | VFAS1-4110PL | 8 | 6 | 8 | 6 | 6 | 10 | 14 | 1.5 | 10 | 6 |
|  | 15 | VFAS1-4150PL | 6 | 10 | 6 | 10 | 4 | 16 | 12 | 2.5 | 10 | 10 |
|  | 18.5 | VFAS1-4185PL | 6 | 10 | 6 | 10 | 4 | 16 | 10 | 2.5 | 10 | 10 |
|  | 22 | VFAS1-4220PL | 6 | 10 | 6 | 10 | 4 | 16 | 10 | 4 | 10 | 10 |
|  | 30 | VFAS1-4300PL | 4 | 16 | 4 | 16 | 2 | 25 | 8 | 6 | 10 | 16 |
|  | 37 | VFAS1-4370PL | 3 | 25 | 3 | 25 | 1 | 35 | 8 | 10 | 8 | 16 |
|  | 45 | VFAS1-4450PL | 1 | 35 | 1 | 35 | 2/0 | 50 | 6 | 16 | 8 | 16 |
|  | 55 | VFAS1-4550PL | 1/0 | 50 | 1/0 | 50 | 3/0 | 70 | 6 | 16 | 6 | 25 |
|  | 75 | VFAS1-4750PL | 3/0 | 70 | 3/0 | 70 | 250MCM | 95 | 3 | 35 | 6 | 35 |
|  | 90 | VFAS1-4900PC | $1 / 0 \times 2$ | $70 \times 2$ | $1 / 0 \times 2$ | 95 | $1 / 0 \times 2$ | $95 \times 2$ | 1/0 | 35 | 2 | 70 |
|  | 110 | VFAS1-4110KPC | $3 / 0 \times 2$ | $95 \times 2$ | $3 / 0 \times 2$ | 120 | $2 / 0 \times 2$ | $120 \times 2$ | 1/0 | 50 | 2 | 95 |
|  | 132 | VFAS1-4132KPC | $4 / 0 \times 2$ | 95×2 | $4 / 0 \times 2$ | 150 | $4 / 0 \times 2$ | $120 \times 2$ | 4/0 | 70 | 1/0 | 95 |
|  | 160 | VFAS1-4160KPC | $300 \mathrm{MCM} \times 2$ | $120 \times 2$ | $300 \mathrm{MCM} \times 2$ | $95 \times 2$ | 350MCM $\times 2$ | $150 \times 2$ | 4/0 | 95 | 1/0 | 120 |
|  | 200 | VFAS1-4200KPC | 4/0×3 | $150 \times 2$ | $4 / 0 \times 3$ | $120 \times 2$ | $3 / 0 \times 3$ | $150 \times 3$ | 300MCM | 150 | 1/0 | 150 |
|  | 220 | VFAS1-4220KPC | $250 \mathrm{MCM} \times 3$ | $150 \times 3$ | 250MCM $\times 3$ | $120 \times 2$ | $4 / 0 \times 3$ | $150 \times 3$ | 300MCM | 150 | 2/0 | 150 |
|  | 280 | VFAS1-4280KPC | $350 \mathrm{MCM} \times 3$ | $150 \times 3$ | 350MCM×3 | $185 \times 2$ | 300MCM $\times 3$ | $150 \times 4$ | 300MCM | 150 | 3/0 | $120 \times 2$ |
|  | 355 | VFAS1-4355KPC | $\begin{array}{r} 400 \mathrm{MCM} \\ \times 2 \times 2(* 9) \\ \hline \end{array}$ | $\begin{gathered} 120 \times 2 \times 2 \\ (* 9) \\ \hline \end{gathered}$ | 400MCM $\times 4$ | $150 \times 3$ | 500MCM $\times 3$ | $185 \times 4$ | 350MCM×2 | $185 \times 2$ | 4/0 | $120 \times 2$ |
|  | 400 | VFAS1-4400KPC | $\begin{array}{r} \hline 500 \mathrm{MCM} \\ \times 2 \times 2(* 9) \\ \hline \end{array}$ | $\begin{gathered} 150 \times 2 \times 2 \\ (* 9) \\ \hline \end{gathered}$ | 500MCM $\times 4$ | $185 \times 3$ | 500MCM $\times 4$ | $\begin{gathered} 185 \times 4 \\ (* 8) \\ \hline \end{gathered}$ | 350MCM×2 | $185 \times 2$ | 4/0 | $150 \times 2$ |
|  | 500 | VFAS1-4500KPC | $\begin{array}{r} 400 \mathrm{MCM} \\ \times 3 \times 2(* 9) \\ \hline \end{array}$ | $150 \times 3 \times 2$ <br> (*9) | 400MCM×5 | $185 \times 4$ | 500MCM $\times 4$ | $\begin{gathered} 180 \times 4 \\ (* 8) \end{gathered}$ | 350MCM 2 | $185 \times 2$ | 250MCM | $150 \times 2$ |

(*1): The recommended cable size is that of the cable (e.g. 600 V class, HIV cable) with continuous maximum permissible temperature of $75^{\circ} \mathrm{C}$. Ambient temperature is $40^{\circ} \mathrm{C}$ or less and the wiring distance is 30 m or less.
(*2): For the control circuit, use shielded wires whose size (cross-section) is $0.75 \mathrm{~mm}^{2}$ or more.
(*3): For the earth cable, use wires larger than the specified ones in size (cross-section).
(*4): Recommended wire size for an optional braking resistor. Refer to 5.19 for use of external braking resistor.
(*5): This cable size is conformity to UL508C.
(*6): This cable size is conformity to IEC60364-5-52.
(*7): This cable size is conformity to IEC60364-5-54.
(*8): The recommended cable is 600 V class HIV cable with permissible temperature of $90^{\circ} \mathrm{C}$
(*9): The number refers to a cable composition. For example, in the case of " $120 \times 2 \times 2$ ": $120 \times 2 \times 2$
Number of cables connected in parallel on the terminal board Number of cables connected to each terminal board Wire size $120 \mathrm{~mm}^{2}$

## Selection of wiring equipment

| Voltage class | Applicable motor [kW] | Inverter model | Input current[A] |  | No-fuse breaker (MCCB) |  | Magnetic contactor $\qquad$ <br> (MC) |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  | Without Reactor | With <br> Reactor | Without Reactor | With <br> Reactor |
|  |  |  | Without <br> Reactor | With Reactor | Rated current [A] | Rated current <br> [A] | Operationl current [A] AC-1 | Operationl current [A] AC-1 |
| $\begin{aligned} & 200 \mathrm{~V} \\ & \text { class } \end{aligned}$ | 0.4 | VFAS1-2004PL | 3.5 | 2.1 | 5 | 5 | 25 | 25 |
|  | 0.75 | VFAS1-2007PL | 6.1 | 3.2 | 10 | 5 | 25 | 25 |
|  | 1.5 | VFAS1-2015PL | 11.5 | 6.4 | 15 | 10 | 25 | 25 |
|  | 2.2 | VFAS1-2022PL | 15 | 9.3 | 20 | 15 | 25 | 25 |
|  | 3.7/4.0 | VFAS1-2037PL | 26.0 | 15.5 | 30 | 30 | 32 | 25 |
|  | 5.5 | VFAS1-2055PL | 35 | 22.5 | 50 | 40 | 40 | 25 |
|  | 7.5 | VFAS1-2075PL | 45 | 34.5 | 60 | 40 | 50 | 40 |
|  | 11 | VFAS1-2110PM | - | 53.5 | - | 75 | - | 80 |
|  | 15 | VFAS1-2150PM | - | 72 | - | 100 | - | 80 |
|  | 18.5 | VFAS1-2185PM | - | 77 | - | 100 | - | 80 |
|  | 22 | VFAS1-2220PM | - | 88 | - | 125 | - | 125 |
|  | 30 | VFAS1-2300PM | - | 125 | - | 150 | - | 125 |
|  | 37 | VFAS1-2370PM | - | 140 | - | 175 | - | 250 |
|  | 45 | VFAS1-2450PM | - | 165 | - | 200 | - | 250 |
|  | 55 | VFAS1-2550P | - | 200 | - | 250 | - | 275 |
|  | 75 | VFAS1-2750P | - | 270 | - | 350 | - | 350 |
| $\begin{aligned} & 400 \mathrm{~V} \\ & \text { class } \end{aligned}$ | 0.75 | VFAS1-4007PL | 3.7 | 2.1 | 5 | 4 | 25 | 25 |
|  | 1.5 | VFAS1-4015PL | 5.8 | 3.8 | 10 | 6.3 | 25 | 25 |
|  | 2.2 | VFAS1-4022PL | 8.2 | 5.7 | 14 | 10 | 25 | 25 |
|  | 3.7/4.0 | VFAS1-4037PL | 14.0 | 8.7 | 18 | 14 | 25 | 25 |
|  | 5.5 | VFAS1-4055PL | 20.5 | 12.7 | 32 | 25 | 25 | 25 |
|  | 7.5 | VFAS1-4075PL | 27 | 16.3 | 32 | 25 | 32 | 25 |
|  | 11 | VFAS1-4110PL | 36.5 | 21.5 | 50 | 30 | 40 | 32 |
|  | 15 | VFAS1-4150PL | 48 | 33.5 | 60 | 40 | 50 | 40 |
|  | 18.5 | VFAS1-4185PL | - | 45.5 | - | 60 | - | 50 |
|  | 22 | VFAS1-4220PL | - | 50 | - | 60 | - | 50 |
|  | 30 | VFAS1-4300PL | - | 66 | - | 100 | - | 80 |
|  | 37 | VFAS1-4370PL | - | 84 | - | 100 | - | 125 |
|  | 45 | VFAS1-4450PL | - | 105 | - | 125 | - | 125 |
|  | 55 | VFAS1-4550PL | - | 120 | - | 150 | - | 125 |
|  | 75 | VFAS1-4750PL | - | 165 | - | 200 | - | 250 |
|  | 90 | VFAS1-4900PC | - | 170 | - | 200 | - | 250 |
|  | 110 | VFAS1-4110KPC | - | 200 | - | 250 | - | 275 |
|  | 132 | VFAS1-4132KPC | - | 240 | - | 300 | - | 315 |
|  | 160 | VFAS1-4160KPC | - | 290 | - | 350 | - | 350 |
|  | 200 | VFAS1-4200KPC | - | 360 | - | 500 | - | 500 |
|  | 220 | VFAS1-4220KPC | - | 395 | - | 500 | - | 500 |
|  | 280 | VFAS1-4280KPC | - | 495 | - | 700 | - | 700 |
|  | 355 | VFAS1-4355KPC | - | 637 | - | 1000 | - | 1000 |
|  | 400 | VFAS1-4400KPC | - | 709 | - | 1000 | - | 1000 |
|  | 500 | VFAS1-4500KPC | - | 876 | - | 1200 | - | 1600 |

(*1): Selections for use of the Toshiba 4-pole standard motor with power supply voltage of $200 \mathrm{~V} / 400 \mathrm{~V}-50 \mathrm{~Hz}$.
(*2): Choose the MCCB according to the power supply capacity.
For comply with UL and CSA standard, use the fuse certified by UL and CSA.
(*3): When using on the motor side during commercial-power supply operation, choose the MC with class AC-3 rated current for the motor rated current.
(*4): Attach surge killers to the magnetic contactor and exciting coil of the relay.
(*5): In the case the magnetic contactor (MC) with 2a-type auxiliary contacts is used for the control circuit, raise the reliability of the contact by using 2a-type contacts in parallel connection.
(*6): For $200 \mathrm{~V} / 55 \mathrm{~kW}$ model and larger and $400 \mathrm{~V} / 90 \mathrm{~kW}$ model and larger, be sure to install a DC reactor.

### 10.2 Installation of a magnetic contactor

If using the inverter without installing a magnetic contactor (MC) in the primary circuit, use an MCCB (with a power cutoff device) to open the primary circuit when the inverter protective circuit is activated.
If using a braking resistor or braking resistor unit, install a magnetic contactor ( MC ) or no-fuse breaker with a power cutoff device to the power supply of the inverter, so that the power circuit opens when the failure detection relay (FL) in the inverter or the external overload relay is activated.

## ■ Magnetic contactor in the primary circuit

To detach the inverter from the power supply in any of the following cases, insert a magnetic contactor (primary-side magnetic contactor) between the inverter and the power supply.
(1) If the motor overload relay is tripped
(2) If the protective detector (FL) built into the inverter is activated
(3) In the event of a power failure (for prevention of auto-restart)
(4) If the resistor protective relay is tripped when a braking resistor or braking resistor unit is used When using the inverter with no magnetic contactor (MC) on the primary side, install a no-fuse breaker with a voltage tripping coil instead of an MC and adjust the no-fuse breaker so that it will be tripped if the protective relay referred to above is activated. To detect a power failure, use an undervoltage relay or the like.


Example of connection of a magnetic contactor in the primary circuit

## Note on wiring

- When frequently switching between start and stop, do not use the magnetic contactor on the primary side as an on-off switch for the inverter.
Instead, stop and start the inverter by using terminals F and CC (forward run) or R and CC (reverse run).
- Be sure to attach a surge killer to the exciting coil of the magnetic contactor (MC).


## Magnetic contactor in the secondary circuit

A magnetic contactor may be installed on the secondary side to switch controlled motors or supply commercial power to the load when the inverter is out of operation.

## Note on wiring

- Be sure to interlock the magnetic contactor on the secondary side with the power supply to prevent commercial power from being applied to the inverter output terminals.
- When installing a magnetic contactor (MC) between the inverter and the motor, avoid turning the magnetic contactor on or off during operation. Turning the magnetic contactor on or off during operation causes a current to rush into the inverter which could lead to malfunction.


### 10.3 Installation of an overload relay

1) The VF-AS1 inverter has an electronic-thermal overload protective function.

In the following cases, however, an overload relay suitable for the adjustment of the motor electronic thermal protection level ( $L H_{r}$ ) or appropriate to the motor used should be installed between the inverter and the motor.

- When using a motor with a current rating different to that of the corresponding Toshiba general-purpose motor
- When operating a single motor with an output smaller than that of the applicable standard motor.

When operating multiple motors at a time, be sure to install an overload relay for each individual motor.
2) When using the VF-AS1 inverter to operate a constant-torque motor, such as the Toshiba VF motor, adjust the protection characteristic of the electronic thermal protection unit ( $\bar{\square} \boldsymbol{L} \boldsymbol{\Pi})$ ) to the VF motor use.
3) It is recommended to use a motor with a thermal relay embedded in the motor coil to give sufficient protection to the motor, especially when it runs in a low-speed range.

### 10.4 Application and functions of options

Separate type options shown below are prepared for the inverter VF-AS1


Sorts of separate-type options


The DC reactor is superior to the input AC reactor in power-factor improvement. For the inverter system that is required to be high reliable, it is recommended to use the input AC reactor that effectually suppresses external surge together with the DC reactor.
$200 \mathrm{~V} / 11$ to 45 kW models and $400 \mathrm{~V} / 18.5$ to 75 kW models come with a built-in DC rector as standard equipment.

* If you are using a $200 \mathrm{~V} / 55 \mathrm{~kW}$ model or larger or a $400 \mathrm{~V} / 90 \mathrm{~kW}$ model or larger, be sure to connect a DC reactor. (No DC reactor is required when the inverter is powered from a DC power supply.)
(3)

EMC Directive
If EMC filter is installed in proper connection, the inverter has consistency with EMC commands. $200 \mathrm{~V} / 0.4 \mathrm{~kW}$ to $200 \mathrm{~V} / 7.5 \mathrm{~kW}$ models and $400 \mathrm{~V} / 0.75$ to $400 \mathrm{~V} / 500 \mathrm{~kW}$ models come standard with built-in noise filters. The effectiveness of the built-in filter can, however, be increased by adding an EMC filter.
To be used to shorten deceleration time for the reason of frequently operated quick deceleration and suspension or high inertia load. This increases consumption of regenerative energy in dynamic braking. For 200 kW more inverter, it requires the braking unit.

| $(5)$ | Motor end surge voltage <br> suppression filter <br> (for 400 V models only) | In a system in which 400 V class general motor is driven by a voltage PWM type inverter <br> using a high-speed switching device (IGBT, etc.), surge voltage depending on cable constant <br> may cause deterioration in insulation of motor winding. Take measures against surge voltage <br> such as use of insulation-reinforced motor, installation of AC reactor, surge voltage <br> suppression filter, sine wave filter and so on in the inverter's output side. <br> Note) Set the carrier frequency to 4.0~8.0kHz when sine wave filter is used. |
| :--- | :--- | :--- | :--- |
| $(6)$ | Control power supply <br> backup option | The VF-AS1 supplies control power from the main circuit power supply in it. The optional <br> backup unit is designed to supply control power in the event the main circuit power supply <br> shuts down. <br> The optional backup unit can be used with both 200 V and 400 V models. <br> Unit type: CPS002Z |


| No. | Option name | Function, purpose. |
| :---: | :---: | :---: |
| (7) | LED Remote Keypad option (with parameter copy function) | Extention operation panel unit with parameter copy function. Includes LED display, RUN/STOP key, UP/DOWN key, MODE key, ENT key, EASY key, and COPY MODE key. (When using this unit, set as follows: $F 805$ (common serial transmission waiting time) $=$ 0.00 (default setting). Use communication cable No. 10 to connect to the inverter. <br> Panel type: RKP002Z <br> Cable type: CAB0011 (1m), CAB0013 (3m), CAB0015 (5m) |
| (8) | LCD Remote Keypad option | This LCD operation panel unit can be installed to the inverter unit. Includes LCD display, RUN key, STOP/RESET key, job dial, ESC key, FWD/REV key and F1 to F4 key. <br> Special cable is needed to connect the inverter and LCD panel. <br> Panel type: RKP004Z <br> LCD cable type: CAB0071 (1m), CAB0073 (3m), CAB0075 (5m) , CAB00710 (10m) |
| (9) | USB communication converter unit (for communication with multiple inverters) | More than one inverter can be controlled with a personal computer and so on if this unit is used for connection between inverters and personal computer. <br> - Computer link: Since this unit makes it possible to connect inverters with higher-class computer, FA computer, etc., a data communication network can be constructed among multiple inverters. <br> Unit type: USB001Z |
| (10) | Communication cable | For RS485/USB communication (between inverter and RS485/USB communication conversion unit) <br> Cable type: CAB0011 (1m), CAB0013 (3m), CAB0015 (5m) |
| (11) | Operation panel | A frequency meter, frequency setup device, RUN/STOP (forward, reverse) switch are built in this operation panel. (Model: CBVR-7B1) |
| (12) | heat sink outside protrusion option | This allows is heat generated inside panels to be reduced |

Selection table of separate-type options (1/2)

| Voltage class | Applicable motor [kW] | Inverter model | EMC filter (*1) | DC reactor (DCL) | Dynamic brake drive circuit (GTR7) (*2) | Control power supply backup |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{aligned} & 200 \mathrm{~V} \\ & \text { class } \end{aligned}$ | 0.4 | VFAS1-2004PL | Built-in | Option | Built-in | Option |
|  | 0.75 | VFAS1-2007PL | Built-in | Option | Built-in | Option |
|  | 1.5 | VFAS1-2015PL | Built-in | Option | Built-in | Option |
|  | 2.2 | VFAS1-2022PL | Built-in | Option | Built-in | Option |
|  | 3.7/4.0 | VFAS1-2037PL | Built-in | Option | Built-in | Option |
|  | 5.5 | VFAS1-2055PL | Built-in | Option | Built-in | Option |
|  | 7.5 | VFAS1-2075PL | Built-in | Option | Built-in | Option |
|  | 11 | VFAS1-2110PM | Option | Built-in | Built-in | Option |
|  | 15 | VFAS1-2150PM | Option | Built-in | Built-in | Option |
|  | 18.5 | VFAS1-2185PM | Option | Built-in | Built-in | Option |
|  | 22 | VFAS1-2220PM | Option | Built-in | Built-in | Option |
|  | 30 | VFAS1-2300PM | Option | Built-in | Built-in | Option |
|  | 37 | VFAS1-2370PM | Option | Built-in | Built-in | Option |
|  | 45 | VFAS1-2450PM | Option | Built-in | Built-in | Option |
|  | 55 | VFAS1-2550P | Option | Attached as standard | Built-in | Option |
|  | 75 | VFAS1-2750P | Option | Attached as standard | Built-in | Option |
| $\begin{aligned} & 400 \mathrm{~V} \\ & \text { class } \end{aligned}$ | 0.75 | VFAS1-4007PL | Built-in | Option | Built-in | Option |
|  | 1.5 | VFAS1-4015PL | Built-in | Option | Built-in | Option |
|  | 2.2 | VFAS1-4022PL | Built-in | Option | Built-in | Option |
|  | 3.7/4.0 | VFAS1-4037PL | Built-in | Option | Built-in | Option |
|  | 5.5 | VFAS1-4055PL | Built-in | Option | Built-in | Option |
|  | 7.5 | VFAS1-4075PL | Built-in | Option | Built-in | Option |
|  | 11 | VFAS1-4110PL | Built-in | Option | Built-in | Option |
|  | 15 | VFAS1-4150PL | Built-in | Option | Built-in | Option |
|  | 18.5 | VFAS1-4185PL | Built-in | Built-in | Built-in | Option |
|  | 22 | VFAS1-4220PL | Built-in | Built-in | Built-in | Option |
|  | 30 | VFAS1-4300PL | Built-in | Built-in | Built-in | Option |
|  | 37 | VFAS1-4370PL | Built-in | Built-in | Built-in | Option |
|  | 45 | VFAS1-4450PL | Built-in | Built-in | Built-in | Option |
|  | 55 | VFAS1-4550PL | Built-in | Built-in | Built-in | Option |
|  | 75 | VFAS1-4750PL | Built-in | Built-in | Built-in | Option |
|  | 90 | VFAS1-4900PC | Built-in | Attached as standard | Built-in | Option |
|  | 110 | VFAS1-4110KPC | Built-in | Attached as standard | Built-in | Option |
|  | 132 | VFAS1-4132KPC | Built-in | Attached as standard | Built-in | Option |
|  | 160 | VFAS1-4160KPC | Built-in | Attached as standard | Built-in | Option |
|  | 200 | VFAS1-4200KPC | Built-in | Attached as standard | Option | Option |
|  | 220 | VFAS1-4220KPC | Built-in | Attached as standard | Option | Option |
|  | 280 | VFAS1-4280KPC | Built-in | Attached as standard | Option | Option |
|  | 355 | VFAS1-4355KPC | Built-in | Attached as standard | Option | Option |
|  | 400 | VFAS1-4400KPC | Built-in | Attached as standard | Option | Option |
|  | 500 | VFAS1-4500KPC | Built-in | Attached as standard | Option | Option |

(*1): For the types and effects of EMC filters, refer to section 9.1.
(*2): An optional braking resistor is required for every model of any capacity (see Selection table of separate-type options (2/2)).

Selection table of separate-type options (2/2)

(*1): Model in square brackets is fitted with top cover
(*2): To use a $400 \mathrm{~V} / 200 \mathrm{~kW}$ inverter or larger in combination with an external braking resistor (DGP600 series), a braking unit (PB7) with a built-in braking resistor drive circuit is also needed.
(*3): The options are selected based on the premise that 600 V HIV insulated wires (continuous allowable temperature: $75^{\circ} \mathrm{C}$ ) are used.
(*4): Each MSF-****Z model is composed of a reactor, a resistor and a capacitor, and as a guide, use a cable 300 m or less in length to connect the inverter to the motor.
Each MSL-****T model is an output-dedicated surge suppression reactor, and as a guide, use a cable 100 m or less in length (or 50 m or less for a shielded cable) to connect the inverter to the motor, although allowable cable lengths vary according to the input voltage.)
(*5): These reactors are usable for each of 200 V class and 400 V class.
(*6): Be sure to connect DC reactor to $200 \mathrm{~V}-55 \mathrm{~kW}$ or more or $400 \mathrm{~V}-90 \mathrm{~kW}$ or more inverter. (Not necessary for DC power input.) When a $200 \mathrm{~V}-55 \mathrm{~kW}$ or more inverter or $400 \mathrm{~V}-90$ to 280 kW inverter is replaced with new one, the reactor (model: DCL-****) used with the current inverter can be used as-is with the new inverter. In such cases, therefore, you do not need to purchase any reactors in this table.

### 10.5 Optional internal devices

Here are the internal devices optionally available. There are two types of optional devices: Add-on type and Plug-in type.

## ■ Table of optional devices

| Option name |  | Function, purpose | Model | Type of installation |
| :---: | :---: | :---: | :---: | :---: |
|  | (1) Expansion I/O card1 option (Logic input/output + PTC input) | Used to extend input and output terminals. | ETB003Z | Add-on |
|  | (2) Expansion I/O card2 option (Function of the above optional card 1 <br> + Analogue input/output + Pulse input) |  | ETB004Z | Add-on |
|  | (3) CC-Link communication option | Used to connect to a CC-Link network for control. | CCL001Z | Add-on |
|  | (4) DeviceNet communication option | Used to connect to a DeviceNet network for control. | DEV002Z | Add-on |
|  | (5) PROFIBUS-DP communication option | Used to connect to a PROFIBUS-DP network for control. | PDP002Z | Add-on |
|  | (6) PG feedback option (Push-pull 12V) | Used to issue motor pulse train rate commands or used for sensor vector control. | VEC004Z | Plug-in |
|  | (7) PG feedback option (Push-pull 15V) |  | VEC005Z | Plug-in |
|  | (8) PG feedback option (Push-pull 24V) |  | VEC006Z | Plug-in |
|  | (9) PG feedback option (RS422-5V) |  | VEC007Z | Plug-in |

## ■ Functions of Add-on type options

| Function | Description |
| :---: | :---: |
| Multifunction programmable contact input (4 points) | No-voltage contact input ( $24 \mathrm{Vdc}-5 \mathrm{~mA}$ or less) <br> Sink logic input (at a common voltage of 24 V ) <br> Source logic input <br> ON: Less than 10 Vdc <br> ON: 11Vdc or more <br> OFF: 16 Vdc or more |
| Multifunction programmable open collector output (2 points) | Driving current: Max. 50 mA when an external power source is used <br> Max. 20mA when the internal power source is used <br> Driving voltage: 12 V (min) to 30 V (max) |
| Multifunction programmable relay contact output | 1C contact configuration $250 \mathrm{Vac}-2 \mathrm{~A}(\cos \phi=1), 250 \mathrm{Vac}-1 \mathrm{~A}(\cos \phi=0.4), 30 \mathrm{Vdc}-1 \mathrm{~A}$ |
| External thermal trip input | Resistance between TH+ and TH- <br> Error: Approx. $70 \Omega$ or less or approx. $3 \mathrm{k} \Omega$ or more <br> Recovery from error: Approx. 1.6k $\Omega$ |
| 24 V power output | 24 Vdc - 60 mA max |
| -10V power output | -10Vdc -10mA |
| Contact input common terminal | Common terminals for contact input |

(2) Expansion I/O card2 option (Function of optional card $1+$ Analogue input/output + Pulse input)

| Function | Description |
| :---: | :---: |
| Multifunction programmable contact input (4 points) | No-voltage contact input (24Vdc-5mA or less)  <br> Sink logic input (at a common voltage of 24 V ) Source logic input <br> ON: Less than 10 Vdc ON: 11 Vdc or more <br> OFF: 16 Vdc or more OFF: Less than 5 Vdc |
| Multifunction programmable open collector output (2 points) | Driving current: Max. 50 mA when an external power source is used Max. 20 mA when the internal power source is used Driving voltage: $12 \mathrm{~V}(\mathrm{~min})$ to $30 \mathrm{~V}(\mathrm{max})$ |
| Multifunction programmable relay contact output | 1C contact configuration $250 \mathrm{Vac}-2 \mathrm{~A}(\cos \phi=1), 250 \mathrm{Vac}-1 \mathrm{~A}(\cos \phi=0.4), 30 \mathrm{Vdc}-1 \mathrm{~A}$ |
| Differential current input | Current input: 20mA or less <br> Voltage input: Differential voltages 5 V or less, -10 V or more, +10 V or less |
| Analog input | Current input: 20mA or less Voltage input: 0 V to 10 V |
| Monitor output | Voltage output: -10 V to $10 \mathrm{~V}, 0 \mathrm{~V}$ to 10 V Current output: OmA to 20 mA |
| Pulse train input | Input pulse specifications <br> Voltage: Max. 5V Current: Max. 15mA Frequency: Max. 30kHz <br> Duty: $50 \pm 10 \%$ |
| External thermal trip input | Resistance between TH+ and TH- <br> Error: Approx. $70 \Omega$ or less or approx. $3 \mathrm{k} \Omega$ or more Recovery from error: Approx. 1.6k $\Omega$ |
| 24 V power output | 24 Vdc - 60 mA max |
| -10V power output | $-10 \mathrm{Vdc}-10 \mathrm{~mA}$ |
| Contact input common terminal | Common terminals for contact input |

Functions of Plug-in type options

|  | PG feedback option (6) (7) (8) | PG feedback option (9) |
| :---: | :---: | :---: |
| Model | VEC004Z, VEC005Z, VEC006Z | VEC007Z |
| Sensor vector control operation | Speed control operation: Zero-speed $-150 \%$ torque <br> Speed control range: $1: 1000(1000$ ppr PG) <br> Torque control operation: Torque control accuracy $\pm 10 \%$ <br> Torque control range: $-100 \%$ to $+100 \%$ |  |
| PG method | Complementary method, open collector method | Line drive method |
| PG cable length | Max. 100m (complementary method) | Max. 30m |
| PG supply power | VEC004Z: 12V-160mA <br> VEC005Z: 15V-150mA <br> VEC006Z: 24V-90mA | 5V-160mA |
| Maximum pulse input frequency | 300 kHz or less <br> * If a two-phase open collector is used, a study needs to be made to determine the derating factor. For details, refer to the operating manual for the optional device. <br> Pulse duty: $50 \pm 10 \%$ |  |
| Pulse input voltage | 12 Vdc to 24 Vdc | Line driver (LTC485 or equivalent) |
| Recommended encoder | Manufacturer: Sumtak Corporation <br> Model: IRS360 series <br> Supply voltage: 10.8 to 26.4 V <br> Output method: Complementary output | Manufacturer: Sumtak Corporation <br> Model: IRS320 series <br> Supply voltage: 5 V <br> Output method: Line driver method |
| Wiring of encoder | Cable type: Twisted-pair shielded cable <br> Conductor resistance: Conductor resistance $(\Omega / m) \times$ cable length $(m) \times 2 \times$ current consumption (A) < $V_{D}(V)$ $\mathrm{V}_{\mathrm{D}}(\mathrm{~V}): 1.0 \mathrm{~V} \text { (VEC004Z, VEC005Z, VEC006Z), } 0.3 \mathrm{~V} \text { (VEC007Z) }$ <br> Applicable cable: 0.2 to $0.75 \mathrm{~mm}^{2}$ <br> * When a power cable $0.2 \mathrm{~mm}^{2}$ in cross sectional area is used, the encoder cable length should be: <br> Max. 30m (VEC004Z, VEC005Z, VEC006Z) <br> Max. 10m (VEC007Z) <br> Recommended cable: Kuramo Electric KVC-36SB, Furukawa Electric ROVV-SB |  |

## How to install

Add-on type devices and insertion type devices are installed in different ways. Install them correctly, as shown in the figures below.


Depending on the capacity, the installation of an Add-on type device may increase the depth of the inverter.

200V 0.4~45kW
400V 0.75~37kW


200V 55, 75kW
400V 90~500kW

Note: The inverters of these capacities come equipped with an Add-on type option case as standard. When installing an optional Add-on type device, remove the case.


Standard type


Standard type one Add-on


Standard type wo Add-on

### 10.6 Connection of a DC power supply and other electric units

Besides a three-phase commercial power supply, a single-phase 200 V power supply ( 5.5 kW or less) and a DC power supply can be connected to the VFAS1 inverter.
When connecting each of these units, keep in mind the points described in the following sections.

### 10.6.1 Connection of a single-phase 200V power supply

The table below shows which model to select when operating a three-phase induction motor, using a single-phase 200 V power supply $(200-240 \mathrm{~V}, 50 / 60 \mathrm{~Hz})$.

| Input power | Applicable motor (kW) | Inverter type |
| :--- | :---: | :---: |
| Single phase <br> $200 \sim 240 \mathrm{~V}$ <br> $50 / 60 \mathrm{~Hz}$ | 0.4 | VFAS1-2007PL |
|  | 0.75 | VFAS1-2015PL |
|  | 1.5 | VFAS1-2022PL |
|  | 2.2 | VFAS1-2037PL |
|  | 3.7 | VFAS1-2055PL |
|  | 5.5 | VFAS1-2075PL |

Note: Set the parameter $F \sigma \Omega B$ to 0 (input phase failure detection mode selection: disabled).

### 10.6.2 When using the inverter along with a DC power supply

Keep the following in mind when connecting a DC power supply to the VFAS1 (PA/+ and PC/- terminals).
Note 1: An optional initial charger (MCR-2550) is needed for middle- and large-capacity models.
Note 2: $200 \mathrm{~V}-75 \mathrm{~kW}$ and $400 \mathrm{~V}-110 \mathrm{~kW}$ or more models are needed to change the connecting for the cooling fan.
Note 3: A DC reactor does not need to be connected to the inverter.
$\Rightarrow$ For details about use in combination with a DC power supply, refer to the instruction manual (E6581432) specified in section 6.42.

| Voltage class | Inverter model | Initial charger (optional) | Change to connection of cooling fan power supply | DC reactor |
| :---: | :---: | :---: | :---: | :---: |
| 200 V class | VFAS1-2004PL~ <br> VFAS1-2150PM | No required | No required | No required |
|  | VFAS1-2185PM~ VFAS1-2550P | MCR-2550×1 | No required | No required |
|  | VFAS1-2750P | MCR-2550×2 (parallel) | Required | No required |
| 400V class | VFAS1-4007PL~ VFAS1-4185PL | No required | No required | No required |
|  | VFAS1-4220PL~ VFAS1-4900PC | MCR-2550×1 | No required | No required |
|  | VFAS1-4110KPC | MCR-2550×1 | Required | No required |
|  | VFAS1-4132KPC~ VFAS1-4220KPC | MCR-2550×2 (parallel) | Required | No required |
|  | VFAS1-4280KPC | MCR-2550×3 (parallel) | Required | No required |
|  | VFAS1-4355KPC, <br> VFAS1-4400KPC | MCR-2550×4 (parallel) | Required | No required |
|  | VFAS1-4500KPC | MCR-2550×5 (parallel) | Required | No required |

Note: Set the parameter $F \Sigma \bar{\sigma} \boldsymbol{\sigma}$ to $\overline{0}$ (input phase failure detection mode selection: disabled).

- Power consumed by the fans

| VFAS1 | Power consumed by the fans |
| :--- | :---: |
| $2750 \mathrm{P}, 4110 \mathrm{KPC} \sim 4160 \mathrm{KPC}$ | 700 VA |
| $4200 \mathrm{KPC} \sim 4280 \mathrm{KPC}$ | 1300 VA |
| $4355 \mathrm{KPC}, 4400 \mathrm{KPC}$ | 1900 VA |
| 4500 KPC | 2500 VA |

## Connecting fans for a separate power supply

In order to remove the link between the fans and the transformer power supply and relocate it at terminals RO, SO, TO, connectors X1 and X4 must be crossed as indicated on the diagrams below.

```
VFAS1-2750P, 4110KPC~4160KPC
```



```
VFAS1-4200KPC~4280KPC
```



## VFAS1-4355KPC, 4400KPC, 4500KPC


11. Table of parameters

| 1. User parameter |  |  |  |  |  | 3 Sensorless vector/vector with sensor ( $:$ :Effective, -:Ineffective) |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Title | Communi | Function | Adjustment range | Minimumsetting unit(Panel/Communication) | Default setting | Write during running | Vector control |  | $\begin{gathered} \text { PM } \\ \text { control } \\ * 2 \end{gathered}$ | $\begin{aligned} & \text { V/f } \\ & *_{1} \end{aligned}$ | Reference |
|  | cation No. |  |  |  |  |  | Speed control | Torque control |  |  |  |
| $F E$ | - | Operation frequency of operation panel | LL ~FH Hz | 0.1/0.01 | 0 | Enabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | 3. 2 |
| *1: V/f: Any setting of $P \succeq=0, i, 5$ *2: PM control : $P\llcorner=6$ setting *3: Sensorless vector: Any setting of $P \succeq=2,3,4 / \mathrm{Vector}$ with sensor : Any setting of $P$ <br> 2. Basic parameter [1/4] <br> Sensorless vector/vector |  |  |  |  |  |  |  |  |  |  |  |
|  | Communi |  |  |  |  |  | Vecto | control | PM | V/f |  |
| Title | cation No. | Function | Adjustment range | setting unit (Panel/Communi cation) | Default setting | Write during running | Speed control | Torque control | control |  | Reference |
| BUH | - | History function |  | 1/1 | - | - | $\bullet / \bullet$ | $\bullet / \bullet$ | $\bullet$ | $\bullet$ | 5.1 |
| RU' | 0000 | Automatic acceleration/deceleration | 0:Disabled <br> 1:Automatic setting <br> 2:Automatic setting (during acceleration only) | 1/1 | 0 | Disabled | $\bullet$ - | - | $\bullet$ | $\bullet$ | 5. 2 |
| RUC | 0001 | Automatic torque boost | 0 :Disabled <br> 1:Automatic torque boost + auto-tuning 1 <br> 2:Sensorless vector control 1+ auto-tuning 1 | 1/1 | 0 | Disabled | $\bullet$ - | - | $\bullet$ | $\bullet$ | 5. 3 |
| 8:4 | 0040 | Automatic function setting | 0:Disabled <br> 1:Frequency setting by means of voltage <br> 2:Frequency setting by means of current <br> 3:Voltage/current switching from external terminal <br> 4: Frequency setting on operation panel and operation by means of terminals <br> 5: Frequency setting and operation on operation panel | 1/1 | 0 | Disabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | 5. 4 |
| [ก0才 | 0003 | Command mode selection | 0:Terminal input enabled <br> 1:Operation panel input enabled (including LED/LCD option input) <br> 2:2-wire RS485 communication input <br> 3:4-wireRS485 communication input <br> 4:Communication option input | 1/1 | 0 | Disabled | $\bullet$ - | $\bullet$ - | $\bullet$ | - | 5. 5 |
| Fת80 | 0004 | Frequency setting mode selection 1 | 1:VI/II (voltage/current input) <br> 2:RR/S4 (potentiometer/voltage input) <br> 3:RX (voltage input) <br> 4:Operation panel input enabled (including LED/LCD option input) <br> 5:2-wire RS485 communication input <br> 6:4-wire RS485 communication input <br> 7:Communication option input <br> 8: Optional AI1 (differential current input) <br> 9:Optional AI2 (voltage/current input) <br> 10:UP/DOWN frequency <br> 11:Optional RP pulse input <br> 12: Optional high-speed pulse input <br> 13:- (Unsupported option) | 1/1 | 2 | Disabled | $\bullet$ - | - | $\bullet$ | $\bullet$ | 5. 5 |


| 2. Basic parameter [2/4] |  |  |  |  |  | Sensorless vector/vector with sensor ( : Effective, -:Ineffective) $^{\text {a }}$ |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Title | Communi cation No. | Function | Adjustment range | Minimumsetting unit(Panel/Communication) | Default setting | Write during running | Vector control |  | PM control | V/f | Reference |
|  |  |  |  |  |  |  | Speed control | Torque control |  |  |  |
| $P L$ | 0015 | V/f control mode selection | 0:Constant torque characteristics <br> 1:Voltage decrease curve <br> 2:Automatic torque boost <br> 3:Sensorless vector control 1 (speed) <br> 4:Sensorless vector control 2 (speed/torque) <br> 5:V/f 5-point setting <br> 6:PM control <br> 7:PG feedback control <br> 8:PG feedback vector control | 1/1 | 0 | Disabled | $\begin{aligned} & \hline-/- \\ & \hline /- \\ & \bullet /- \\ & \bullet /- \\ & \bullet /- \\ & -/- \\ & -/- \\ & -/ \bullet \\ & -/ \bullet \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline-/- \\ & -/- \\ & -/- \\ & -/- \\ & 0 /- \\ & -/- \\ & -/- \\ & -/- \\ & -/- \\ & \hline \end{aligned}$ | - |  | 5. 6 |
| ub | 0016 | Manual torque boost 1 | 0.0~30.0\% | 0.1/0.1 | *1 | Enabled | - | - | $\bullet$ | $\bullet$ | 5.7 |
| uí | 0014 | Base frequency 1 | $25.0 \sim 5000 \mathrm{~Hz}$ | 0.1/0.01 | *3 | Disabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | 5.8 |
| ULu | 0409 | Base frequency voltage 1 | 200 V class:50~330V 400 V class:50~660V | 1/0.1 | *1 | Disabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | 5. 8 |
| $F \mathrm{FH}$ | 0011 | Maximum frequency | $30.0 \sim 500.0 \mathrm{~Hz}$ | 0.1/0.01 | 80.0 | Disabled | $\bullet$ - | $\bullet \cdot \stackrel{ }{\bullet}$ | $\bullet$ | $\bullet$ | 5.9 |
| U'i | 0012 | Upper limit frequency | 0.0~F H Hz | 0.1/0.01 | *3 | Enabled | $\bullet \cdot$ | - | $\bullet$ | $\bullet$ | 5. 10 |
| Li | 0013 | Lower limit frequency | 0.0~ L'i' Hz | 0.1/0.01 | 0.0 | Enabled | $\bullet \cdot$ | - | $\bullet$ | $\bullet$ | 5. 10 |
| BLE | 0009 | Acceleration time 1 | 0.1~6000 sec. | 0.1/0.1 *2 | *1 | Enabled | $\bullet \cdot$ | - | $\bullet$ | $\bullet$ | 5.2 |
| $\square^{\prime} E L$ | 0010 | Deceleration time 1 | $0.1 \sim 6000 \mathrm{sec}$. | 0.1/0.1 *2 | *1 | Enabled | $\bullet$ - | - | - | $\bullet$ | 5.2 |
| $B_{u} F_{2}$ | 0213 | RR/S4 input point 2 frequency | 0.0~ F H Hz | 0.1/0.01 | *3 | Enabled | $\bullet$ - | - | - | $\bullet$ | 5. 11 |
| AIF? | 0204 | $\mathrm{VI} / \mathrm{ll}$ input point 2 frequency | 0.0~FH Hz | 0.1/0.01 | *3 | Enabled | $\bullet$ - | - | $\bullet$ | $\bullet$ | 5.11 |
| Sri | 0018 | Preset speed operation frequency 1 | Li ~UL Hz | 0.1/0.01 | 0.0 | Enabled | $\bullet$ - | - | - | - | 5. 12 |
| 512 | 0019 | Preset speed operation frequency 2 | Li U U Hz | 0.1/0.01 | 0.0 | Enabled | $\bullet$ - | - | - | - | 5. 12 |
| $5 \cdot 3$ | 0020 | Preset speed operation frequency 3 | Li ~U' Hz | 0.1/0.01 | 0.0 | Enabled | $\bullet$ - | - | - | $\bullet$ | 5. 12 |
| 5.4 | 0021 | Preset speed operation frequency 4 | Li ~UL Hz | 0.1/0.01 | 0.0 | Enabled | $\bullet$ - | - | - | $\bullet$ | 5. 12 |
| 5.5 | 0022 | Preset speed operation frequency 5 | Li ~UL Hz | 0.1/0.01 | 0.0 | Enabled | $\bullet$ - | - | $\bullet$ | $\bullet$ | 5. 12 |
| 515 | 0023 | Preset speed operation frequency 6 | Li ~UL Hz | 0.1/0.01 | 0.0 | Enabled | $\bullet$ - | - | - | $\bullet$ | 5. 12 |
| $5 r 7$ | 0024 | Preset speed operation frequency 7 | Li ~UL Hz | 0.1/0.01 | 0.0 | Enabled | $\bullet$ - | - | - | $\bullet$ | 5. 12 |
| $F_{r}$ | 0008 | Forward run/reverse run selection (operation panel operation) | 0:Forward run 1:Reverse run 2:Forward run (Forward/reverse switchable on operation panel) 3:Reverse run (Forward/reverse switchable on operation panel) | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet$ - | - | - | 5. 13 |

1: Default values vary depending on the capacity. $\Rightarrow$ See the table of K-46.
*2: Changing the parameter $\varsigma 4 P$ enables to set to 0.01 sec . (adjustment range: $0.01 \sim 600.0 \mathrm{sec}$.)
*3: Inverter with a model number ending with $-W N$. HN: 60.0 -WP. 50.0

| Title | Communi cation No. | Function | Adjustment range |  |  |  | Minimum |  | - Vector control |  |  | $\begin{gathered} \text { PM } \\ \text { control } \end{gathered}$ | V/f | Reference |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  | setting unit (PanelCommuni cation) | Default setting | Write during running | Speed control | Torque control |  |  |  |
| EH\% | 0600 | Motor electronic thermal protection level 1 | 10~100\% |  |  |  | 1/1 | 100 | Enabled | $\bullet \bullet$ | $\bullet \bullet$ | - | - | 5. 14 |
| OLi | 0017 | Electronic thermal protection characteristic selection | Setting | Motor type | Overload protection | OL stall | 1/1 | 0 | Enabled | $\bullet$ - | 5. 14 | $\bullet$ | - | 5. 14 |
|  |  |  | 0 | Standard Motor | - (protect) | $\times$ (not stall) |  |  |  |  |  |  |  |  |
|  |  |  | 1 |  | - (protect) | - (stall) |  |  |  |  |  |  |  |  |
|  |  |  | 2 |  | $\times$ (not protect | $\times$ (not stall) |  |  |  |  |  |  |  |  |
|  |  |  | 3 |  | $\times$ (not protect) | - (stall) |  |  |  |  |  |  |  |  |
|  |  |  | 4 | VF Motor | - (protect) | $\times$ (not stall) |  |  |  |  |  |  |  |  |
|  |  |  | 5 |  | - (protect) | - (stall) |  |  |  |  |  |  |  |  |
|  |  |  | 6 |  | $\times$ (not protect | $\times$ (not stall) |  |  |  |  |  |  |  |  |
|  |  |  | 7 |  | $\times$ (not protect | - (stall) |  |  |  |  |  |  |  |  |
| dSPU | 0701 | Current/voltage unit selection | 0:\%, 1:A (ampere)/V (volt) |  |  |  | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet$ - | - | - | 5. 15 |
| Fn5i | 0005 | FM terminal meter selection | 0~76 *1 |  |  |  | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet$ - | - | - | 5. 16 |
| $F$ f | 0006 | FM terminal meter adjustment | - |  |  |  | 1/1 | *4 | Enabled | $\bullet$ - | $\bullet$ - | - | - | 5. 16 |
| 8月5i | 0670 | AM terminal meter selection | 0~76 *1 |  |  |  | 1/1 | 2 | Enabled | $\bullet$ - | $\bullet$ - | - | - | 5. 16 |
| 8.7 | 0671 | AM terminal meter adjustment | ${ }^{-}$ |  |  |  | 1/1 | *4 | Enabled | $\bullet$ - | $\bullet \cdot$ | - | - | 5. 16 |
| EF | 0300 | PWM carrier frequency | $1.0 \sim 16.0 \mathrm{kHz}(2.5 \sim 8.0 \mathrm{kHz}) * 2$ |  |  |  | 0.1/0.1 | *3 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | - | - | 5. 17 |
| Uu 5 | 0301 | Auto-restart control selection | 0:Disabled1:At auto-restart after momentary stop2:When turning ST on or off3:1+24:At start-up |  |  |  | 1/1 | 0 | Disabled | $\bullet$ - | $\bullet$ - | - | - | 5. 18.1 |
| Uut | 0302 | Regenerative power ride-through control | 0:Disabled <br> 1:Power ride-through <br> 2:Deceleration stop during power failure <br> 3:Synchronized deceleration/acceleration (synchronized acceleration/deceleration signal) <br> 4:Synchronized deceleration/acceleration (synchronized acceleration/deceleration signal+power failure) |  |  |  | 1/1 | 0 | Disabled | $\bullet$ - | -/- | - | - | 5. 18. 2 |
| Pb | 0304 | Dynamic braking selection | 0:Disabled <br> 1:Enabled (braking resistance overload detect) <br> 2:Enabled (braking resistance overload not detect) |  |  |  | 1/1 | 0 | Disabled | $\bullet$ - | $\bullet$ - | - | - | 5. 19 |
| Pbr | 0308 | Dynamic braking resistance | 0.5~1000 $\Omega$ |  |  |  | 0.1/0.1 | *3 | Disabled | $\bullet \cdot$ | $\bullet 1 \bullet$ | - | - | 5. 19 |
| Pbip | 0309 | Allowable continuous braking resistance | 0.01~600.0kW |  |  |  | 0.01/0.01 | *3 | Disabled | $\bullet$ - | $\bullet \cdot$ | - | - | 5. 19 |

*1: $\Rightarrow$ For the adjustment range, see the table on page K-39. W .
*2: For $200 \mathrm{~V}-55 / 75 \mathrm{~kW}$ models and $400 \mathrm{~V}-90 \mathrm{~kW}$ to $400 \mathrm{~V}-500 \mathrm{~kW}$ models, the carrier frequency is between 2.5 and 8.0 kHz inclusive.
*4: Default setting value is adjusted for connection of frequency meters "QS60T". (Between FM and CCA: Approx. 3.6V) (Between AM and CCA: Approx. 3.6V)

| 2. Basic parameter [4/4] |  |  |  |  |  | Sensorless vector/vector with sensor (•:Effective, -:Ineffective) |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Title | Communi | Function | Adjustment range | Minimumsetting unit(Panel/Communication) | Default setting | Write during running | Vector control |  | PM control | V/f | Reference |
|  | cation No. |  |  |  |  |  | Speed control | Torque control |  |  |  |
| $\angle 30$ | 0007 | Factory default setting | 0: - <br> 1:50 Hz default setting <br> 2:60 Hz default setting <br> 3:Factory default setting <br> 4:Trip clear <br> 5:Cumulative operation time cleared <br> 6:Initialization of type information <br> 7:Save user-defined parameters <br> 8:Reset of user-defined parameters <br> 9:Cumulative fan operation time record clear <br> $10:$ Acceleration/deceleration time setting 0.01 sec. $\sim 600.0 \mathrm{sec}$. <br> 11:Acceleration/deceleration time setting 0.1 sec. $\sim 6000 \mathrm{sec}$. | 1/1 | 0 | Disabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | 5. 20 |
| PSEL | 0050 | Registered parameter display selection | 0 :Standard setting mode at time of activation of motor 1:Quick mode at time of activation of motor <br> 2:Quick mode only | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | 5. 22 |
|  | - | Extended parameters | Set detailed parameters shown in the following pages. | - | - | - | $\bullet$ - | $\bullet$ - | - | $\bullet$ | - |
| Erí | - | Automatic edit function | - | - | - |  | $\bullet / \bullet$ | $\bullet / \bullet$ | $\bullet$ | $\bullet$ | 4. 2 |

3. Extended parameters

| [1] Frequency signal |  |  |  |  |  | Sensorless vector/vector with sensor ( $\bullet$ :Effective, -:Ineffective) |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Communi |  | Adjustment range | Minimum |  |  | Vector control |  | PM control | V/f | Reference |
| Title | cation No. | Function |  | setting unit (Panel/Communi cation) | $\begin{aligned} & \text { Default } \\ & \text { setting } \end{aligned}$ | $\begin{gathered} \text { Witet during } \\ \text { running } \end{gathered}$ | Speed control | Torque control |  |  |  |
| F100 | 0100 | Low-speed signal output frequency | 0.0~i'i Hz | 0.1/0.01 | 0.0 | Enabled | $\bullet$ - | $\bullet$ - | - | - | 6. 1. 1 |
| F 10 i | 0101 | Speed reach setting frequency | 0.0~ $\sim_{i} \mathrm{~L}$ Hz | 0.1/0.01 | 0.0 | Enabled | $\bullet$ - | $\bullet$ - | - | - | 6. 1. 2 |
| $F 102$ | 0102 | Speed reach detection band | 0.0~i ${ }^{\text {a }}$ Hz | 0.1/0.01 | 2.5 | Enabled | $\bullet$ - | $\bullet$ - | - | - | 6. 1. 2 |


| [2] Input signal selection |  |  |  |  |  | Sensorless vector/vector with sensor ( $\bullet$ :Effective, -:Ineffective) |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Communi |  | Adjustment range | Minimum |  |  | Vecto | control |  |  |  |
| Title | cation No. | Function |  | $\begin{aligned} & \text { setting unit } \\ & \text { (Panel/Communi } \\ & \text { cation) } \end{aligned}$ | Default setting | Write during running | Speed control | Torque control | PM control | V/f | Reference |
| $F 105$ | 0105 | Priority when forward/reverse run commands are entered simultaneously | $0:$ Reverse run 1:Stop | 1/1 | 1 | Disabled | $\bullet$ - | $\bullet$ - | - | - | 6. 2.1 |
| $F 106$ | 0106 | Input terminal priority selection | 0:Disabled 1:Enabled | 1/1 | 0 | Disabled | $\bullet$ - | $\bullet \bullet \bullet$ | - | - | 6. 2.2 |
| $F 107$ | 0107 | Unsupported |  | 1/1 | 0 | Disabled | $\bullet$ - | $\bullet$ - | - | - | *1 |
| F108 | 0108 | Analog VI/VII voltage/current switching | 0:Voltage input <br> 1:Current input | 1/1 | 0 | Disabled | $\bullet$ - | $\bullet$ - | - | - | 6. 2. 3 |
| $F 109$ | 0109 | Analog AI2 (optional circuit board) voltage/current switching | 0 :Voltage input 1:Current input | 1/1 | 0 | Disabled | $\bullet$ - | $\bullet \bullet$ | - | - | 6. 2. 3 |

*1: Unsupported option

[4] Terminal response time setup

| 4] Terminal response time setup |  |  |  |  |  | Sensorless vector/vector with |  |  | Sor |  | ) |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Title | Communi cation No. | Function | Adjustment range | Minimum |  |  |  |  | PM control | V/f |  |
|  |  |  |  | $\qquad$ | Default setting | Write during running | Speed control | Torque control |  |  | Reference |
| $F 140$ | 0140 | Input terminal 1 response time selection (F) | 2~200ms | 1/1 | 8 | Disabled | $\bullet$ - $\bullet$ | $\bullet$ - | $\bullet$ | $\bullet$ | 7. 2. 3 |
| $F 141$ | 0141 | Input terminal 2 response time selection (R) | 2~200ms | 1/1 | 8 | Disabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | 7. 2. 3 |
| $F: 42$ | 0142 | Input terminal 3 response time selection (ST) | 2~200ms | 1/1 | 8 | Disabled | $\bullet$ - | $\bullet$ • | $\bullet$ | $\bullet$ | 7. 2. 3 |
| $F 143$ | 0143 | Input terminal 4 response time selection (RES) | 2~200ms | 1/1 | 8 | Disabled | $\bullet$ - | $\bullet$ - | $\bullet$ | - | 7. 2. 3 |
| $F 144$ | 0144 | Input terminal 5~12 response time selection | 2~200ms | 1/1 | 8 | Disabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | 7. 2. 3 |
| $F 145$ | 0145 | Input terminal 13~20 response time selection | 5~200ms | 1/1 | 8 | Disabled | $\bullet / \bullet$ | $\bullet$ - | $\bullet$ | $\bullet$ | 7. 2. 3 |
| $F \cdot 154$ | 0164 | Input terminal selection 17(B12) | 0~135 *1 | 1/1 | 0 | Disabled | $\bullet \cdot$ | $\bullet$ - 0 | - | $\bullet$ | 7. 2. 1 |
| $F 155$ | 0165 | Input terminal selection 18(B13) | 0~135 *1 | 1/1 | 0 | Disabled | $\bullet \cdot$ | $\bullet \cdot$ | $\bullet$ | $\bullet$ | 7. 2. 1 |
| $F i 55$ | 0166 | Input terminal selection 19(B14) | 0~135 *1 | 1/1 | 0 | Disabled | $\bullet \cdot \stackrel{ }{\bullet}$ | $\bullet \cdot \stackrel{ }{\bullet}$ | $\bullet$ | $\bullet$ | 7. 2. 1 |
| $F 167$ | 0167 | Input terminal selection 20(B15) | 0~135 *1 | 1/1 | 0 | Disabled | $\bullet \cdot$ | $\bullet 1 \cdot$ | $\bullet$ | $\bullet$ | 7. 2. 1 |
| $F 158$ | 0168 | Output terminal function selection 10 (R3) *5 | 0~255 *2 | 1/1 | 254 | Disabled | $\bullet$ - $\bullet$ | $\bullet$ - | $\bullet$ | $\bullet$ | 7. 2. 2 |
| $F 159$ | 0169 | Output terminal function selection 11 (R4) *5 | 0~255 *2 | 1/1 | 254 | Disabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | 7. 2. 2 |
| $F \cdot 70$ | 0170 | Base frequency 2 | $25.0 \sim 500 \mathrm{~Hz}$ | 0.1/0.01 | *4 | Disabled | - | - | - | $\bullet$ | 6.4.1 |
| $F i 71$ | 0171 | Base frequency voltage 2 | 50~330V/660V | 1/0.1 | *3 | Disabled | - | - | - | $\bullet$ | 6.4.1 |
| Fi72 | 0172 | Manual torque boost 2 | 0.0~30.0\% | 0.1/0.1 | *3 | Enabled | - | - | - | $\bullet$ | 6.4.1 |
| $F: 73$ | 0173 | Thermal protection level 2 | 10~100\% | 1/1 | 100 | Enabled | - | - | - | $\bullet$ | 6.4.1 |
| Fi74 | 0174 | Base frequency 3 | $25.0 \sim 500 \mathrm{~Hz}$ | 0.1/0.01 | *4 | Disabled | - | - | - | $\bullet$ | 6.4.1 |
| F:75 | 0175 | Base frequency voltage 3 | 50~330V/660V | 1/0.1 | *3 | Disabled | - | - | - | $\bullet$ | 6.4.1 |
| Fi76 | 0176 | Manual torque boost 3 | 0.0~30.0\% | 0.1/0.1 | *3 | Enabled | - | - | - | $\bullet$ | 6.4.1 |
| $F i 77$ | 0177 | Thermal protection level 3 | 10~100\% | 1/1 | 100 | Enabled | - | - | - | $\bullet$ | 6.4.1 |
| F i 78 | 0178 | Base frequency 4 | $25.0 \sim 500 \mathrm{~Hz}$ | 0.1/0.01 | *4 | Disabled | - | - | - | $\bullet$ | 6.4.1 |
| $F i 79$ | 0179 | Base frequency voltage 4 | 50~330V/660V | 1/0.1 | *3 | Disabled | - | - | - | $\bullet$ | 6.4.1 |
| $F \cdot 80$ | 0180 | Manual torque boost 4 | 0.0~30.0\% | 0.1/0.1 | *3 | Enabled | - | - | - | $\bullet$ | 6.4.1 |
| $F i 81$ | 0181 | Thermal protection level 4 | 10~100\% | 1/1 | 100 | Enabled | - | - | - | $\bullet$ | 6.4.1 |

$* 1: \Rightarrow$ For the adjustment range, see the table on page K-41
*3: Default values vary depending on the capacity. $\Rightarrow$ See the table of K-46.
*4: Inverter with a model number ending with - WN, HN: $60.0-$ WP: 50.0

| [5] V/f 5-point setting |  |  |  |  |  | Sensorless vector/vector with sensor ( $\bullet$ :Effective, -:Ineffective) |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Title | Communi cation No. | Function | Adjustment range | Minimum setting unit (Panel/Communi cation) | Default setting | Write duringrunning | Vector control |  | $\begin{gathered} \text { PM } \\ \text { control } \end{gathered}$ | V/f | Reference |
|  |  |  |  |  |  |  | Speed control | Torque control |  |  |  |
| $F 190$ | 0190 | V/f 5-point setting VF1 frequency | $0.0 \sim F \mathrm{H} \mathrm{Hz}^{\text {H }}$ | 0.1/0.01 | 0.0 | Disabled | - | - | - | - | 5. 6 |
| F19i | 0191 | V/f 5-point setting VF1 voltage | 0.0~100.0\% | 0.1/0.01 | 0.0 | Disabled | - | - | - | - | 5.6 |
| F 192 | 0192 | V/f 5-point setting VF2 frequency | $0.0 \sim F \mathrm{H} \mathrm{Hz}^{\text {H }}$ | 0.1/0.01 | 0.0 | Disabled | - | - | - | - | 5. 6 |
| F193 | 0193 | V/f 5-point setting VF2 voltage | 0.0~100.0\% | 0.1/0.01 | 0.0 | Disabled | - | - | - | - | 5.6 |
| F 194 | 0194 | V/f 5-point setting VF3 frequency | $0.0 \sim \sim \mathrm{H} \mathrm{Hz}^{\text {d }}$ | 0.1/0.01 | 0.0 | Disabled | - | - | - | - | 5. 6 |
| $F 195$ | 0195 | V/f 5-point setting VF3 voltage | 0.0~100.0\% | 0.1/0.01 | 0.0 | Disabled | - | - | - | - | 5.6 |
| F 196 | 0196 | V/f 5-point setting VF4 frequency | 0.0~F H Hz | 0.1/0.01 | 0.0 | Disabled | - | - | - | - | 5. 6 |
| $F 197$ | 0197 | V/f 5-point setting VF4 voltage | 0.0~100.0\% | 0.1/0.01 | 0.0 | Disabled | - | - | - | $\bullet$ | 5.6 |
| $F 198$ | 0198 | V/f 5-point setting VF5 frequency | $0.0 \sim \sim \mathrm{H} \mathrm{Hz}^{\text {d }}$ | 0.1/0.01 | 0.0 | Disabled | - | - | - | - | 5.6 |
| $F 199$ | 0199 | V/f 5-point setting VF5 voltage | 0.0~100.0\% | 0.1/0.01 | 0.0 | Disabled | - | - | - | - | 5.6 |


| [6] Speed/torque reference gain/bias setup [1/2] |  |  |  |  |  | Sensorless vector/vector with sensor ( $\bullet$ :Effective, --Ineffective) |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Title | Commun cation No. | Function | Adjustment range | Minimumsetting unit(Panel/Communication) | Default setting | Write during running | Vector control |  | PM control | V/f | Reference |
|  |  |  |  |  |  |  | Speed control | Torque control |  |  |  |
| 5200 | 0200 | Frequency priority selection | $0: F \cap \mathrm{Gd} / \mathrm{FCD} 7$ terminal switching (input terminal function selection 104, 105) 1:F \% Od/F20 7 frequency switching (switching with $F 208$ ) | 1/1 | 0 | Enabled | $\bullet \bullet$ | - | - | - | 6.6.1 |
| F20i | 0201 | VI/II input point 1 setting | $0 \sim 100 \%$ | 1/1 | 0 | Enabled | $\bullet \cdot$ | -1• | - | - | 7.3.2 |
| $F 202$ | 0202 | VI/II input point 1 frequency | $0.0 \sim$ F H Hz | 0.1/0.01 | 0.0 | Enabled | -1/ | - | - | - | 7.3.2 |
| F203 | 0203 | VI/II input point 2 setting | 0~100\% | 1/1 | 100 | Enabled | -10 | $\bullet \cdot$ | - | - | 7.3.2 |
| P if ? | 0204 | VIIII input point 2 frequency | $0.0 \sim F \mathrm{H} \mathrm{Hz}^{\text {d }}$ | 0.1/0.01 | *1 | Enabled | $1 \cdot$ | - | - | - | 5. 11 |
| F205 | 0205 | VI/II input point 1 rate | 0~250\% (for torque control etc.) | 1/0.01 | 0 | Enabled | -10 | $\bullet \cdot$ | - | - | *2 |
| F205 | 0206 | VI/II input point 2 rate | 0~250\% (for torque control etc.) | 1/0.01 | 100 | Enabled | -1/ | $\bullet \cdot$ | - | - | *2 |
| $F 207$ | 0207 | Frequency setting mode selection 2 | Same as F Пी do (1~13) | 1/1 | 1 | Disabled | $\bullet \cdot$ | - | - | - | 6.6.1 |
| $F 208$ | 0208 | Speed command priority switching frequency | 0.1~FH Hz | 0.1/0.01 | 0.1 | Enabled | $\bullet$ - | - | - | - | 6.6.1 |
| F209 | 0209 | Analog input filter | 0:No filter <br> 1:Filter approx. 10 ms 2:Filter approx. 15 ms 3:Filter approx. 30ms 4:Filter approx. 60 ms | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet / \bullet$ | - | - | 7.2. 4 |
| F2if | 0210 | RR/S4 input point 1 setting | 0~100\% | 1/1 | 0 | Enabled | $\bullet 10$ | -1• | - | - | 7.3.1 |
| FE; | 0211 | RR/S4 input point 1 frequency | $0.0 \sim$ F H Hz | 0.1/0.01 | 0.0 | Enabled |  | - | - | - | 7.3.1 |
|  | parameter with a mod | moves to a fundamental param del number ending with -WN, to Instruction Manual (E6581331) | : 60.0 -WP: 50.0 specified in Section 6.42. |  |  |  |  |  |  | *1: Inverter with a model number ending with -WN, HN: 60.0 -WP: 50.0 |  |


| Title | Communi cation No. | Function | Adjustment range | Minimumsetting unit(Pane//Communication) | Default setting | Write during running | Vector control |  | $\begin{gathered} \text { PM } \\ \text { control } \end{gathered}$ | V/f | Reference |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  | Speed control | Torque control |  |  |  |
| F2: 2 | 0212 | RR/S4 input point 2 setting | 0~100\% | 1/1 | 100 | Enabled | $\bullet / \bullet$ | $\bullet$ - | $\bullet$ | $\bullet$ | 7.3.1 |
| RuF? | 0213 | RR/S4 input point 2 frequency | $0.0 \sim$ F H Hz | 0.1/0.01 | *4 | Enabled | $1 \cdot$ | - | - | - | 5. 11 |
| F2:4 | 0214 | RR/S4 input point 1 rate | 0~250\% (for torque control etc.) | 1/0.01 | 0 | Enabled | -10 | $\bullet$ | - | - | *1 |
| F2: 5 | 0215 | RR/S4 input point 2 rate | 0~250\% (for torque control etc.) | 1/0.01 | 100 | Enabled | -10 | \% | - | - | *1 |
| $F 2$ is | 0216 | RX input point 1 setting | -100~100\% | 1/1 | 0 | Enabled |  | $\bullet$ | - | - | 7.3.3 |
| $F F^{5}$; 7 | 0217 | RX input point 1 frequency | $0.0 \sim$ F ${ }^{\text {H Hz }}$ | 0.1/0.01 | 0.0 | Enabled | -10 | - | - | - | 7.3.3 |
| F2:8 | 0218 | RX input point 2 setting | -100~100\% | 1/1 | 100 | Enabled | -10 | -1• | - | - | 7.3.3 |
| F2;9 | 0219 | RX input point 2 frequency | $0.0 \sim$ F H Hz | 0.1/0.01 | *4 | Enabled | -10 | - | - | - | 7.3.3 |
| $F 220$ | 0220 | RX input point 1 rate | -250~250\% (for torque control etc.) | 1/0.01 | 0 | Enabled | -10 | -10 | - | - | *1 |
| $F 2 \bar{\prime}$ | 0221 | RX input point 2 rate | -250~250\% (for torque control etc.) | 1/0.01 | 100 | Enabled | $\bullet \cdot$ | -10 | - | - | *1 |
| $F 22 ?$ | 0222 | Al1 input point 1 setting | -100~100\% | 1/1 | 0 | Enabled | -10 | - | - | - | *2 |
| $\mathrm{FC2}^{2}$ | 0223 | Al1 input point 1 frequency | $0.0 \sim$ F H Hz | 0.1/0.01 | 0.0 | Enabled | -10 | - | - | - | *2 |
| $F 224$ | 0224 | Al1 input point 2 setting | -100-100\% | 1/1 | 100 | Enabled | -1/ | $\bullet \cdot$ | - | - | *2 |
| $F 2 C 5$ | 0225 | Al1 input point 2 frequency | $0.0 \sim$ F H Hz | 0.1/0.01 | *4 | Enabled | -10 | - | - | - | *2 |
| F225 | 0226 | Al1 input point 1 rate | -250~250\% (for torque control etc.) | 1/0.01 | 0 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | - | - | *2 |
| $F 227$ | 0227 | Al1 input point 2 rate | -250~250\% (for torque control etc.) | 1/0.01 | 100 | Enabled | -10 | -10 | - | - | *2 |
| F228 | 0228 | Al2 input point 1 setting | 0~100\% | 1/1 | 0 | Enabled | -10 | $\bullet \cdot$ | - | - | *2 |
| F229 | 0229 | Al2 input point 1 frequency | $0.0 \sim$ F H Hz | 0.1/0.01 | 0.0 | Enabled | $\bullet \cdot$ | - | - | - | *2 |
| F230 | 0230 | Al2 input point 2 setting | 0~100\% | 1/1 | 100 | Enabled | -10 | -10 | - | - | *2 |
| F231 | 0231 | Al2 input point 2 frequency | $0.0 \sim$ F ${ }^{\text {H Hz }}$ | 0.1/0.01 | *4 | Enabled |  | - | - | - | *2 |
| $F 234$ | 0234 | RP/high speed pulse input point 1 setting | 0~100\% | 1/1 | 0 | Enabled | $\bullet \cdot$ | - | - | - | *3 |
| F235 | 0235 | RP/high speed pulse input point 1 frequency | 0.0~F H Hz | 0.1/0.01 | 0.0 | Enabled | $\bullet$ - | - | - | - | *3 |
| $F 236$ | 0236 | RP/high speed pulse input point 2 setting | 0~100\% | 1/1 | 100 | Enabled | $\bullet \cdot$ | - | - | - | *3 |
| F237 | 0237 | RP/high speed pulse input point 2 frequency | $0.0 \sim F H^{\text {Hz }}$ | 0.1/0.01 | *4 | Enabled | $\bullet / \bullet$ | - | - | - | *3 |

*1: $\Rightarrow$ This parameter moves to a fuils, refer to Instruction Manental (E6581331) specified in Section 6.42.
*: $\Rightarrow$ For details, refer to Instruction Manual (E6581341) specified in Section 6.42.
*3: $\Rightarrow$ For details, refer to Instruction Manual (E6581319) specified in Section 6.42.
*4: Inverter with a model number ending with
-WN, HN: 60.0 -WP: 50.0


| [8] DC braking |  |  |  |  |  | Sensorless vector/vector with Vector control |  |  | or | ectiv | neffective) |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Title | $\begin{aligned} & \text { Communi } \\ & \text { cation } \\ & \text { No. } \end{aligned}$ | Function | Adjustment range |  |  |  |  |  | $\begin{gathered} \text { PM } \\ \text { control } \end{gathered}$ | V/f | Reference |
|  |  |  |  | $\begin{gathered} \text { setting unit } \\ \text { (Panel/Communi } \\ \text { cation) } \end{gathered}$ | Default setting | Write during running | Speed control | Torque control |  |  |  |
| F250 | 0250 | DC braking start frequency | 0.0~120.0Hz | 0.1/0.01 | 0.0 | Enabled | $\bullet \cdot$ | - | $\bullet$ | - | 6.8.1 |
| F25 | 0251 | DC braking current | 0~100\% | 1/1 | 50 | Enabled | -10 | - | - | - | 6.8.1 |
| F25? | 0252 | DC braking time | 0.0~20.0 sec. | 0.1/0.1 | 1.0 | Enabled |  | - | - | - | 6.8.1 |
| F253 | 0253 | Forward/reverse DC braking priority control | 0:Disabled, 1:Enabled | 1/1 | 0 | Enabled | $\bullet$ - | - | - | - | 6.8.1 |
| F254 | 0254 | Motor shaft fixing control | 0:Disabled, 1:Enabled | 1/1 | 0 | Enabled | $\bullet \cdot$ | - | - | - | 6.8.2 |
| $F 255$ | 0255 | OHz command output selection | 0:Default (DC braking) <br> 1:0Hz command | 1/1 | 0 | Enabled | -/• | - | - | - | 6. 8. 3 |
| F256 | 0256 | Time limit for lower-limit frequency operation | $\begin{aligned} & \text { 0.0:Disabled } \\ & 0.1 \sim 600.0 \text { sec. } \end{aligned}$ | 0.1/0.1 | 0.0 | Enabled | $\bullet$ - | $\bullet \bullet$ | $\bullet$ | - | 6. 9 |


| [9] Jogging operation |  |  |  |  |  | Sensorless vector/vector with Vector control |  |  | $\begin{gathered} \text { PM } \\ \text { control } \end{gathered}$ | V/f | -Ineffective)Reference |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Title | Communi cation No. | Function | Adjustment range | Minimum |  |  |  |  |  |  |  |
|  |  |  |  | $\begin{aligned} & \text { setting unit } \\ & \text { (Panel/Communi } \\ & \text { cation) } \end{aligned}$ | Default setting | Write during running | Speed control | Torque control |  |  |  |
| F250 | 0260 | Jog run frequency | F240-20.0Hz | 0.1/0.01 | 5.0 | Enabled | $\bullet 1 \cdot$ | - | - | - | 6. 10 |
| F25 i | 0261 | Jog run stop pattern | 0:Deceleration stop <br> 1:Coast stop <br> 2:DC braking stop | 1/1 | 0 | Disabled | $\bullet / \bullet$ | - | - | - | 6. 10 |
| $F 252$ | 0262 | Operation panel jog run mode | 0:Disabled 1:Operation panel jog run mode enabled | 1/1 | 0 | Enabled | $\bullet / \bullet$ | - | - | - | 6. 10 |
| $F 254$ | 0264 | Input from external contacts UP response time | 0.0~10.0 sec. | 0.1/0.1 | 0.1 | Enabled | $\bullet / \bullet$ | - | - | - | 6. 11 |
| F255 | 0265 | Input from external contacts UP frequency step | 0.0~F H Hz | 0.1/0.01 | 0.1 | Enabled | $\bullet / \bullet$ | - | - | - | 6. 11 |
| F256 | 0266 | Input from external contacts DOWN response time | 0.0~10.0 sec. | 0.1/0.1 | 0.1 | Enabled | $\bullet / \bullet$ | - | - | - | 6. 11 |
| $F 267$ | 0267 | Input from external contacts DOWN frequency step | ${ }^{0.0 \sim F H ~ H z}$ | 0.1/0.01 | 0.1 | Enabled | $\bullet / \bullet$ | - | - | - | 6. 11 |
| F258 | 0268 | Initial UP/DOWN frequency | Li - LiL Hz | 0.1/0.01 | 0.0 | Enabled | -10 | - | - | - | 6. 11 |
| F259 | 0269 | Initial up/down frequency rewriting | 0:Not changed <br> 1:Setting of $₹ 258$ changed when power is turned off | 1/1 | 1 | Enabled | $\bullet$ - | . | - | - | 6. 11 |


| (1) |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Title | cation No. | Function | Adjustment range | setting unit (Panel/Communi cation) | Default setting | running | Speed control | Torque control | control | V/f | Reference |
| $F 287$ | 0287 | Preset speed operation frequency 8 | L L ~UL Hz | 0.1/0.01 | 0.0 | Enabled | $\bullet \bullet$ | - | - | - | 5. 12 |
| $F 288$ | 0288 | Preset speed operation frequency 9 | Li ~ Ui ${ }^{\text {Hz }}$ | 0.1/0.01 | 0.0 | Enabled | $\bullet \bullet$ | - | - | - | 5. 12 |
| $F 289$ | 0289 | Preset speed operation frequency 10 | Li ~UL Hz | 0.1/0.01 | 0.0 | Enabled | $\bullet$ | - | - | - | 5. 12 |
| $F 290$ | 0290 | Preset speed operation frequency 11 | Li ~UL Hz | 0.1/0.01 | 0.0 | Enabled | $\bullet$ - | - | - | - | 5. 12 |
| F29: | 0291 | Preset speed operation frequency 12 | Li~U ${ }^{\text {Li Hz }}$ | 0.1/0.01 | 0.0 | Enabled | $\bullet$ - | - | - | - | 5. 12 |
| $F 292$ | 0292 | Preset speed operation frequency 13 | Li ~Ui Hz | 0.1/0.01 | 0.0 | Enabled | $\bullet$ - | - | - | - | 5. 12 |
| F293 | 0293 | Preset speed operation frequency 14 | Li ~US Hz | 0.1/0.01 | 0.0 | Enabled | $\bullet \bullet \bullet$ | - | $\bullet$ | - | 5. 12 |
| $F 294$ | 0294 | Preset speed operation frequency 15 <br> (Forced operation frequency) | i i ~ U ${ }^{\text {L }} \mathrm{Hz}$ | 0.1/0.01 | 0.0 | Enabled | $\bullet$ - | - | - | - | 5. 12 |


| [12] Tripless intensification setup [1/2] |  |  |  |  |  | Sensorless vector/vector with Vector control |  |  | or | ectiv | neffective) |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Communi cation No. | Function | Adjustment range | Minimumsetting unit(Panel/Communication) | Default setting |  |  |  | PM contro | V/f | Reference |
| Title |  |  |  |  |  | Write during running | Speed control | Torque control |  |  |  |
| IF | 0300 | PWM carrier frequency | $1.0 \sim 16.0 \mathrm{kHz}(2.5 \sim 8.0 \mathrm{kHz})^{\star 1}$ | 0.1/0.1 | *2 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | - | - | 5. 17 |
| Uu5 | 0301 | Auto-restart control selection | 0:Disabled, 1:At auto-restart <br> 2:ST ON/OFF switching, $3: 1+2,4:$ Starting | 1/1 | 0 | Disabled | $\bullet$ - | $\bullet \cdot$ | - | - | 5. 18.1 |
| UuL | 0302 | Regenerative power ride-through control | 0:Disabled, 1:Power ride-through <br> 2:Deceleration stop during power failure <br> 3:Synchronized deceleration/acceleration (synchronized acceleration/deceleration signal) <br> 4:Synchronized deceleration/acceleration (synchronized acceleration/deceleration signal+power failure) | 1/1 | 0 | Disabled | $\bullet$ - | -/- | - | - | 5. 18. 2 |
| F303 | 0303 | Retry selection | 0:Deselect, 1-10 times | 1/1 | 0 | Enabled | $\bullet / \bullet$ | $\bullet 1 \cdot$ | - | - | 6.14.1 |
| Pb | 0304 | Dynamic braking selection | 0 :Disabled <br> 1:Enabled (braking resistance overload detect) <br> 2:Enabled (braking resistance overload not detect) | 1/1 | 0 | Disabled | $\bullet$ - | $\bullet$ - | - | $\bullet$ | 5. 19 |
| $F 305$ | 0305 | Overvoltage limit operation | 0:Enabled 1:Disabled 2:Enabled (quick deceleration) 3:Enabled (dynamic quick deceleration) | 1/1 | 2 | Disabled | $\bullet / \bullet$ | $\bullet / \bullet$ | - | - | 6. 14. 2 |


| [12] Tripless intensification setup [2/2] |  |  |  |  |  | Sensorless vector/vector with Vector control |  |  | PM control | V/f | neffective) |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Title | Communi | Function | Adjustment range | Minimumsetting unit(Pane/Ccommunication) | Default setting |  |  |  | Reference |  |
|  | cation No. |  |  |  |  | Write during running | Speed control | Torque control |  |  |
| $F 307$ | 0307 | Base frequency voltage selection (correction of supply voltage) | $0:$ Without voltage compensation (limitless output voltage) $1:$ With voltage compensation (limitless output voltage) 2:Without voltage compensation (limited output voltage) 3:With voltage compensation (limited output voltage) | 1/1 | 0 | Disabled | Parameter "with voltac 1 internally. When $F 3$ 3 internally. | hangeable ompensatio is set to 0 <br> is set to 2 | but fixed to internally. <br> 1, fixed at <br> 3, fixed at | - | 6. 14.3 |
| Pbr | 0308 | Dynamic braking resistance | 0.5~1000 | 0.1/0.1 | *1 | Disabled | -10 | $\bullet$ | - | $\bullet$ | 5. 19 |
| Pbip | 0309 | Allowable continuous braking resistance | 0.01~600.0kW | 0.01/0.01 | *1 | Disabled | $\cdots$ | -10 | $\bullet$ | - | 5. 19 |
| F310 | 0310 | Non-stop control time/deceleration time during power failure | 0.1~320.0 sec. | 0.1/0.1 | 2.0 | Enabled ${ }^{*} 3$ Disabled | $\bullet \cdot$ | -/- | - | - | 5. 18. 2 |
| F3i | 0311 | Reverse-run prohibition selection | 0:Permit all, 1:Prohibit reverse run 2:Prohibit forward run | 1/1 | 0 | Disabled | $\bullet$ - | $\bullet \cdot$ | - | - | 6. 14.4 |
| F3i2 | 0312 | Random mode | 0:Disabled, 1:Enabled | 1/1 | 0 | Disabled | $\bullet \cdot$ | $\bullet$ - | - | - | 5. 17 |
| F3:3 | 0313 | Output voltage waveform selection *4 | 0:PWM carrier frequency control 1 1:PWM carrier frequency control 2 | 1/1 | 0 | Disabled | $\bullet$ - | $\bullet$ - | - | - | 6. 14.5 |
| F3:6 | 0316 | Carrier frequency control mode selection | 0:Not decrease carrier frequency automatically <br> 1:Decrease carrier frequency automatically <br> 2:Not decrease carrier frequency automatically, 400 V class supported <br> 3:Decrease carrier frequency automatically, 400V class supported <br> 4:Not decrease carrier frequency automatically, with sinusoidal filter <br> 5:Decrease carrier frequency automatically, with sinusoidal filter | 1/1 | 1 | Disabled | $\bullet$ - | $\bullet$ - | - | - | 5. 17 |
| F3:7 | 0317 | Synchronized deceleration time (time elapsed between start of deceleration to stop) | 0.1~6000 sec. | 0.1/0.1 *2 | 2.0 | Enabled | $\bullet$ - | -/- | - | - | 5. 18. 2 |
| F3:8 | 0318 | Synchronized acceleration time (time elapsed between start of acceleration to achievement of specified speed) | 0.1~6000 sec. | 0.1/0.1 *2 | 2.0 | Enabled | $\bullet$ - | -/- | - | - | 5. 18. 2 |
| F3:9 | 0319 | Regenerative over-excitation upper limit | 100~160\% | 1/1 | 140 | Disabled | $\bullet$ | $\bullet$ | - | - | 6. 14. 2 |
| $\square$ <br> This parameter moves to a fundamental parameter. *1: Default values vary depending on the capacity. $\Rightarrow$ See the table of K-46. <br> *2: Changing the parameter $t y_{9} P$ enables to set to 0.01 sec . (adjustment range: $0.01 \sim 600.0 \mathrm{sec}$.). <br>  <br> *4: F 3 i 3 is available for VFAS1-2550P, VFAS1-4900PC and above. <br> [13] Drooping control <br> Sensorless vector/vector |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  | Minimum |  |  | Vecto | ontrol |  |  |  |
| Title | cation No. | Function | Adjustment range | $\begin{gathered} \text { setting unit } \\ \text { (Panel/Communi } \\ \text { cation) } \end{gathered}$ | Default setting | Write during running | Speed control | Torque control | $\begin{gathered} \text { PM } \\ \text { control } \end{gathered}$ | V/f | Reference |
| F320 | 0320 | Drooping gain | 0.0~100.0\% (Enabled if $P$ P = 3, 4, 7 or 8) | 0.1/0.1 | 0.0 | Enabled *1 | $\bullet 1 \cdot$ | - | - | - | 6.15 |
| F 321 | 0321 | Speed at drooping gain 0\% | $0.0 \sim 320.0 \mathrm{~Hz}$ (Enabled if $P_{t}=3,4,7$ or 8 ) | 0.1/0.01 | 0.0 | Enabled | -10 | - | - | - | 6.15 |
| $F 322$ | 0322 | Speed at drooping gain $F 320$ | $0.0 \sim 320.0 \mathrm{~Hz}$ (Enabled if $P_{L}=3,4,7$ or 8 ) | 0.1/0.01 | 0.0 | Enabled | -10 | - | - | - | 6.15 |
| $F 323$ | 0323 | Drooping insensitive torque | 0~100\% (Enabled if $P_{L}=3,4,7$ or 8) | 1/1 | 10 | Enabled | -/• | - | - | - | 6.15 |

14] Functions for lift [1/2]

| Title | $\begin{array}{c}\text { Communi } \\ \text { cation }\end{array}$ |  |
| :--- | :--- | :--- |


| [14] Functions for lift [1/2] |  |  |  |  |  | Sensorless vector/vector with <br> Vector control |  |  | $\begin{gathered} \text { PM } \\ \text { control } \end{gathered}$ | V/f | Reference |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Title | Communi cation No. | Function | Adjustment range | Minimumsetting unit(Panel/Communication) | Default setting |  |  |  |  |  |  |
|  |  |  |  |  |  | Write during running | Speed control | Torque control |  |  |  |
| F324 | 0324 | Drooping output filter | 0.1~200.0 rad/s (Enabled if $P_{L}=3,4,7$ or 8 ) | 0.1/0.1 | 100.0 | Enabled | $\bullet 1 \bullet$ | - | - | - | 6.15 |
| $F 328$ | 0328 | Light-load high-speed operation selection | 0:Disabled <br> 1:High-speed operation speed set automatically (Power running at F command: Increase) <br> 2:High-speed operation speed set automatically (Power running at R command: Increase) <br> 3:High-speed operation speed set with $F 330$ (Power running at F command: Increase) <br> 4:High-speed operation speed set with $F 330$ (Power running at R command: Increase) | 1/1 | 0 | Disabled | $\bullet$ - | - | - | - | *1 |
| F329 | 0329 | Light-load high-speed learning function | $0:$ No learning, 1:Forward run learning 2:Reverse run learning | 1/1 | 0 | Disabled | $\bullet$ - | - | - | - | *1 |
| F 330 | 0330 | Automatic light-load high-speed operation frequency | 30.0~ i' L Hz | 0.1/0.01 | *2 | Enabled | $\bullet \cdot$ | - | - | - | *1 |
| F33i | 0331 | Light-load high-speed operation switching lower limit frequency | 5.0~ i' Hz | 0.1/0.01 | 40.0 | Enabled | $\bullet \cdot \bullet$ | - | - | - | *1 |
| F332 | 0332 | Light-load high-speed operation load waiting time | 0.0~10.0 sec. | 0.1/0.1 | 0.5 | Enabled | $\bullet \cdot$ | - | - | - | *1 |
| F333 | 0333 | Light-load high-speed operation load detection time | 0.0~10.0 sec. | 0.1/0.1 | 1.0 | Enabled | $\bullet \cdot$ | - | - | - | *1 |
| F334 | 0334 | Light-load high-speed operation heavy load detection time | 0.0~10.0 sec. | 0.1/0.1 | 0.5 | Enabled | $\bullet \cdot$ | - | - | - | *1 |
| F 335 | 0335 | Switching load torque during power running | -250~250\% | 1/0.01 | 50 | Enabled | $\bullet$ - | - | - | - | *1 |
| 7335 | 0336 | Heavy-load torque during power running | -250~250\% | 1/0.01 | 100 | Enabled | $\bullet \cdot$ | - | - | - | *1 |
| F 337 | 0337 | Heavy-load torque during constant power running | -250~250\% | 1/0.01 | 50 | Enabled | $\bullet \cdot$ | - | - | - | *1 |
| F 338 | 0338 | Switching load torque during regenerative braking | -250~250\% | 1/0.01 | 50 | Enabled | $\bullet \cdot$ | - | - | - | *1 |
| $F 340$ | 0340 | Creeping time 1 | $0.00 \sim 2.50 \mathrm{sec}$. | 0.01/0.01 | 0 | Enabled | $\bullet \cdot$ | - | - | - | 6.17 |
| F34i | 0341 | Braking mode selection | 0:Disabled, 1:Forward winding up 2:Reverse winding up, $3:$ Horizontal operation | 1/1 | 0 | Disabled | $\bullet \cdot$ | - | - | - | 6. 17 |
| $F 342$ | 0342 | Load portion torque input selection | 0:Disabled, 1:VI/II (voltage/current input) <br> 2:RR/S4 (potentiometer/voltage input) <br> 3:RX (voltage input) <br> 4:F 34 Jenabled <br> 5:2-wire RS485 communication input <br> 6:4-wire RS485 communication input <br> 7:Communications option input enabled <br> 8:Optional AI1 (differential current input) | 1/1 | 4 | Enabled | $\bullet$ - | - | - | - | 6. 17 |
| F343 | 0343 | Hoisting torque bias input (valid only when $F 34 己=4$ ) | -250~250\% | 1/0.01 | 100 | Enabled | $\bullet \cdot$ | - | - | - | 6. 17 |
| 7344 | 0344 | Lowering torque bias multiplier | 0~100\% | 1/0.01 | 100 | Enabled | $\bullet$ | - | - | - | 6.17 |
| F345 | 0345 | Brake release time | 0.00~2.50 sec. | 0.01/0.01 | 0.05 | Enabled |  | - | - | - | 6.17 |
| F346 | 0346 | Creeping frequency |  | 0.1/0.01 | 3.0 | Disabled | $\bullet \cdot$ | - | - | - | 6.17 |
| $F 347$ | 0347 | Creeping time 2 | 0.00~2.50 sec. | 0.01/0.01 | 0.10 | Enabled | $\bullet \cdot$ | - | - | - | 6. 17 |


| [14] Functions for lift [2/2] |  |  |  |  |  | Sensorless vector/vector with Vector control |  |  | nsor (e:PMcontrol | V/f | -:Ineffective)Reference |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Title | Communi cation No. | Function | Adjustment range | Minimum |  |  |  |  |  |  |  |
|  |  |  |  | setting unit (Panel/Communi cation) | Default setting | Write during running | Speed control | Torque control |  |  |  |
| F348 | 0348 | Braking time learning function | 0:Disabled1:Brake signal learning ( 0 after adjustment) | 1/1 | 0 | Enabled | $\bullet \cdot 1$ | - | - | - | 6. 17 |
| F349 | 0349 | Acceleration/deceleration suspend function | 0:Disabled, 1:Parameter setting, 2:Terminal input | 1/1 | 0 | Disabled | $\bullet \cdot$ | - | - | - | 6. 18 |
| $F 350$ | 0350 | Acceleration suspend frequency | $0.0 \sim$ F H Hz | 0.1/0.01 | 0.0 | Enabled | $\bullet 10$ | - | - | - | 6.18 |
| F35i | 0351 | Acceleration suspend time | $0.0 \sim 10.0 \mathrm{sec}$. | 0.1/0.1 | 0.0 | Enabled | $\bullet 1 \cdot$ | - | - | - | 6.18 |
| F352 | 0352 | Deceleration suspend frequency | $0.0 \sim F H \mathrm{~Hz}$ | 0.1/0.01 | 0.0 | Enabled | $\bullet / \bullet$ | - | - | - | 6. 18 |
| F353 | 0353 | Deceleration suspend time | $0.0 \sim 10.0 \mathrm{sec}$. | 0.1/0.1 | 0.0 | Enabled | $\bullet \cdot$ | - | - | - | 6. 18 |



| [16] PID control [1/2 |  |  | Sensorless vector/vector with sensor ( $:$ :Effective, -:Ineffective) |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Communi |  |  | Minimum |  |  | Vecto | ontrol |  |  |  |
| Title | cation No. | Function | Adjustment range | setting unit (Panel/Communi cation) | Default setting | Write during running | Speed control | Torque control | PM control | V/f | Reference |
| $F 359$ | 0359 | PID control switching | 0:No PID control <br> 1:Process type PID control (temp./pressure, etc.) operation <br> 2:Speed type PID control (potentiometer, etc.) operation <br> 3:Stop retaining $P$ control <br> 4.Dancer control | 1/1 | 0 | Disabled | $\bullet$ - | - | - | $\bullet$ | *1, *2 |


| [16] PID control [2/2] |  |  |  |  |  | Sensorless vector/vector with Vector control |  |  | nsor ( | ective | -Ineffective) |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Title | Communi cation No. | Function | Adjustment range | Minimum <br> setting unit <br> (Panel/Communi <br> cation) | Default setting |  |  |  | $\begin{gathered} \text { PM } \\ \text { control } \end{gathered}$ | V/f | Reference |
|  |  |  |  |  |  | Write during running | Speed control | Torque control |  |  |  |
| F 360 | 0360 | PID control feedback control signal selection | 0:Deviation input (no feedback input) <br> 1:VI/II (voltage/current input) <br> 2:RR/S4 (potentiometer/voltage input) <br> 3: RX (voltage input) <br> 4:Optional Al1 (differential current input) <br> 5: Optional AI2 (voltage/current input) <br> 6: PG feedback option | 1/1 | 0 | Disabled | $\bullet$ - | - | - | - | *1, *2 |
| F36 | 0361 | Delay filter | 0.0~25.0 | 1/1 | 0.1 | Enabled | -1• | - | - | $\bullet$ | *2 |
| F 362 | 0362 | Proportional ( P ) gain | 0.01~100.0 | 0.01/0.01 | 0.10 | Enabled | $1 / 0$ | - | - | - | *1, *2 |
| F 363 | 0363 | Integral (1) gain | 0.01~100.0 | 0.01/0.01 | 0.10 | Enabled | $\bullet \cdot$ | - | - | - | *2 |
| $F 354$ | 0364 | PID deviation upper limit | Li Líl Hz | 0.1/0.01 | 60.0 | Enabled | $\bullet \cdot$ | - | - | - | *2 |
| $F 365$ | 0365 | PID deviation lower limit | Li - Li ${ }_{\text {L }} \mathrm{Hz}$ | 0.1/0.01 | 60.0 | Enabled |  | - | - | - | *2 |
| F356 | 0366 | Differential (D) gain | 0.00~2.55 | 0.01/0.01 | 0.00 | Enabled | $1 \cdot$ | - | - | - | *2 |
| $F 357$ | 0367 | Process upper limit | Li - U L L Hz | 0.1/0.01 | 60.0 | Enabled | -10 | - | - | - | *2 |
| F368 | 0368 | Process lower limit | Li-UL Hz | 0.1/0.01 | 0.0 | Enabled | $\bullet \cdot$ | - | - | - | *2 |
| F359 | 0369 | PID control waiting time | 0~2400 sec. | 1/1 | 0 | Enabled | $\bullet \cdot$ | - | - | $\bullet$ | *2 |
| $F 370$ | 0370 | PID output upper limit | Li-UL Hz | 0.1/0.01 | 60.0 | Enabled |  | - | - | - | *2 |
| F371 | 0371 | PID output lower limit | Li-UL Hz | 0.1/0.01 | 0.0 | Enabled | $\bullet \cdot$ | - | - | - | *2 |
| F372 | 0372 | Process increasing rate (speed type PID control) | 0.1~600.0 | 0.1/0.1 | 10.0 | Enabled | $\bullet$ - | - | - | - | *2 |
| F373 | 0373 | Process decreasing rate (speed type PID control) | 0.1~600.0 | 0.1/0.1 | 10.0 | Enabled | $\bullet \cdot$ | - | - | - | *2 |


| [17] Speed feedback/positioning control |  |  |  |  |  | Sensorless vector/vector wit   <br> Write during Vector control  |  |  | nsor |  | effec |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Communi |  |  |  |  |  |  |  | $\begin{gathered} \text { PM } \\ \text { control } \end{gathered}$ | V/f | Reference |
| Title | cation No. | Function | Adjustment range | (Panel/Communi cation) | setting | running | Speed control | Torque control |  |  |  |
| $F 375$ | 0375 | Number of PG input pulses | 12~9999 | 1/1 | 500 | Disabled | -/• | -/• | - | - | *1 |
| F376 | 0376 | Selection of number of PG input phases | 1:Single-phase input <br> 2:Two-phase input <br> 3:Two-phase input (Inversion of polarity) | 1/1 | 2 | Disabled | -/• | -/• | - | - | *1 |
| F377 | 0377 | PG disconnection detection | 0 :Disabled <br> 1:Enabled (with filter) <br> 2:Enabled (Detection of momentary power failure) | 1/1 | 0 | Disabled | -/• | -/• | - | - | *1 |
| F378 | 0378 | Number of RP terminal input pulses | 12~9999 | 1/1 | 500 | Disabled | $\bullet \cdot$ | $\bullet \cdot$ | - | - | *2 |
| $F 379$ | 0379 | PID output dead band | 0~100\% | 1/1 | 0 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | - | - | *3 |
| F38 | 0381 | Simple positioning completion range | 1~4000 | 1/1 | 100 | Enabled | -/• | - | - | - | *1 |

[^18]| [18] Motor constant |  |  |  |  |  | Sensorless vector/vector with Vector control |  |  | $\begin{gathered} \text { PM } \\ \text { control } \end{gathered}$ | VIf Constart | Reference |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Communi | Function | Adjustment range | Minimumsetting unit(PanellCommunication) | Default setting |  |  |  |  |  |  |
| Title | cation No. |  |  |  |  | Write during running | Speed control | Torque control |  |  |  |
| F400 | 0400 | Auto-tuning 1 | 0:No auto-tuning <br> 1:Initialize motor constant (0 after execution) <br> 2:Continue operation continued after auto-tuning ( 0 after execution) <br> 3:Auto-tuning by input terminal signal <br> 4:Motor constant auto calculation ( 0 after execution) | 1/1 | 0 | Disabled | $\bullet / \bullet$ | $\bullet / \bullet$ | - | - | 6. 22 |
| F40, | 0401 | Slip frequency gain | 0~150\% | 1/1 | 70 | Enabled | -/- | - | - | - | 6.22 |
| 5482 | 0402 | Auto-tuning 2 | 0:Disabled <br> 1:Self-cooled motor <br> 2:Forced air-cooled motor | 1/1 | 0 | Disabled | $\bullet$ - | $\bullet$ - | - | - | 6. 22 |
| F405 | 0405 | Motor rated capacity (motor name plate) | 0.10~630.0kW | 0.01/0.01 | *1 | Disabled | $\bullet$ - | $\bullet / \bullet$ | - | - | 6. 22 |
| F406 | 0406 | Motor rated current (motor name plate) | 0.1~2000A | 0.1/0.1 | *1 | Disabled | $\bullet \bullet$ | $\bullet \cdot$ | - | - | 6. 22 |
| F407 | 0407 | Motor rated rotational speed (motor name plate) | 100~60000min-1 *2 | 1/1 | *1 | Disabled | $\bullet$ - | $\bullet / \bullet$ | - | - | 6. 22 |
| F4i0 | 0410 | Motor constant 1 (torque boost) | 0.0~30.0\% | 0.1/0.1 | *1 | Enabled | -1/ | -10 | - | - | 6. 22 |
| F4: | 0411 | Motor constant 2 (no load current) | 10~90\% | 1/1 | *1 | Disabled | $\bullet$ - | $\bullet$ - | - | - | 6. 22 |
| F4: 2 | 0412 | Motor constant 3 (leak inductance) | 0~200( $\times 0.1 \%$ ) | 1/1 | *1 | Disabled | $\bullet / \bullet$ | $\bullet / \bullet$ | - | - | 6. 22 |
| F4:3 | 0413 | Motor constant 4 (rated slip) | 0.1~25.0\% | 0.1/0.1 | *1 | Disabled | -10 | -10 | - | - | 6.22 |
| F4:5 | 0415 | Exciting strengthening coefficient | 100~130\% | 1/1 | 100 | Disabled | $\bullet$ - | $\bullet / \bullet$ | - | - | 6. 23 |
| F4i5 | 0416 | Stall prevention factor | 10~250 | 1/1 | 100 | Disabled | -10 | -10 | - | - | 6. 23 |
| *1: Default *2: If the s | values vary eed of rota <br> ue control | depending on the capacity. $\Rightarrow$ Se tion is set at $10,000 \mathrm{~min}^{-1}$ or more, 1/2] | e the table of K-46. the error messages $i \delta \delta S$ and $E$ (if the speed | otation is | $\text { at } 10,00$ | Sensorless vector/vector with sensor (e:Effective, -:Ineffective) |  |  |  |  |  |
| Title | Communi cation No. | Function | Adjustment range | Minimum <br> setting unit <br> (PanelCommuni <br> cation) | Default setting | Write during running | Vecto | Torque control | $\begin{gathered} \text { PM } \\ \text { control } \end{gathered}$ | VFFConstart | Reference |
| $F 420$ | 0420 | Torque command selection | 1:VI/II (voltage/current input) <br> 2:RR/S4 (potentiometer/voltage input) <br> 3:RX (voltage input) <br> 4:Operation panel input enabled (including <br> LED/LCD option input) <br> 5:2-wire RS485 communication input <br> 6:4-wire RS485 communication input <br> 7:Communications option input enabled <br> 8: Optional AI1 (differential current input) | 1/1 | 3 | Enabled | - | $\bullet$ - | - | - | *1 |
| F42 | 0421 | Torque reference filter | 0~1000ms | 1/1 | 0 | Enabled | - | $\bullet / \bullet$ | - | - | *1 |
| F423 | 0423 | Tension torque bias input selection (torque control) | 0:Disabled, 1~8 (same as F 4 こ | 1/1 | 0 | Enabled | - | $\bullet$ - | - | - | 6. 24.3 |

Sensorless vector／vector with sensor（•：Effective，－：Ineffective）

|  | Communi |  |  |  |  |  | Vecto | ontrol |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Title | cation No． | Function | Adjustment range | $\begin{gathered} \begin{array}{c} \text { setting unit } \\ \text { (Panel/Communi } \\ \text { cation) } \end{array} \\ \hline \hline \end{gathered}$ | Default setting | Write during running | Speed control | Torque control | PM control | VIf Corstatt | Reference |
| $F 424$ | 0424 | Load sharing gain input selection | 0：Disabled，1～8（same as F 430 ） | 1／1 | 0 | Enabled | － | $\bullet \bullet \bullet$ | － | － | 6． 24.3 |
| $F 425$ | 0425 | Forward speed limit input selection | 0：Disabled <br> 1：VI／II（voltage／current input） <br> 2：RR／S4（potentiometer／voltage input） <br> 3：RX（voltage input） <br> 4：$F 425$ enabled | 1／1 | 0 | Enabled | － | $\bullet$－ | － | － | ＊1 |
| F425 | 0426 | Forward speed limit input level | $0.0 \sim$ UiL Hz | 0．1／0．01 | ＊2 | Enabled | － | $\bullet \cdot$ | － | － | ＊1 |
| $F 427$ | 0427 | Reverse speed limit input selection | 0：Disabled <br> 1： $\mathrm{VI} / \mathrm{II}$（voltage／current input） <br> 2：RR／S4（potentiometer／voltage input） <br> 3：RX（voltage input） <br> 4：F 428 enabled | 1／1 | 0 | Enabled | － | $\bullet$－ | － | － | ＊1 |
| $F 428$ | 0428 | Reverse speed limit input level | $0.0 \sim$ 说 Hz | 0．1／0．01 | ＊2 | Enabled | － | $\bullet \cdot$ | － | － | ＊1 |
| F430 | 0430 | Speed limit（torque $=0$ ）center value reference selection | 0：Disabled <br> 1： $\mathrm{VI} / \mathrm{II}$（voltage／current input） <br> 2：RR／S4（potentiometer／voltage input） <br> 3：RX（voltage input） <br> 4：F43ienabled | 1／1 | 0 | Enabled | － | $\bullet \bullet$ | － | － | ＊1 |
| F43i | 0431 | Speed limit（torque $=0$ ）center value | $0.0 \sim F \mathrm{H} \mathrm{Hz}^{\text {d }}$ | 0．1／0．01 | 0.0 | Enabled | － | $\bullet$－ | － | － | ＊1 |
| $F 432$ | 0432 | Speed limit（torque $=0$ ）band | $0.0 \sim$ F H Hz | 0．1／0．01 | 0.0 | Enabled | － | $\bullet \cdot$ | － | － | ＊1 |
| F435 | 0435 | Prohibition of rotation in any direction other than the specified one（ $F$ or R） | 0：Disabled 1：Enabled | 1／1 | 0 | Enabled | － | $\bullet \cdot$ | － | － | ＊1 |

$\star 1: \Rightarrow$ For details，refer to Instruction Manual（E6581331）specified in Section 6．42．$\quad \star$ 2：Inverter with a model number ending with $-\mathrm{WN}, \mathrm{HN}: 60.0 \quad-\mathrm{WP}: 50.0$

| โ＇sて＇9 | － | － | $\bullet / \bullet$ | $\bullet / \bullet$ | рə｜¢セuヨ | 0＇092 | T0＇0／T「0 | pə｜qes！a：0＇0sz＇\％6＇6ちて～0＇0 |  | toto | hhh」 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| โ＇Sて＇9 | － | － | $\bullet / \bullet$ | $\bullet$－$\bullet$ | рə｜qセuヨ | 0098 | T0＇0／T＊0 | рә｜qes！a：0＇0sz＇\％6＇6tz～0＇0 |  | Etto | Ehh」 |
| L＇¢Z＇9 | － | $\bullet$ | $\bullet / \bullet$ | $\bullet$－$\bullet$ | рә｜¢еиヨ | $\dagger$ | $\tau / \tau$ |  |  әnbıoł бu！̣енq әл！̣еләиәбิәу | でちO | 2hh」 |
| ¢ ¢¢＇9 | － | $\bullet$ | $\bullet$－$\bullet$ | $\bullet$－$\bullet$ | рə｜¢セuヨ | 000s2 | T0＇0／T＊0 | pəlqes！a：0＇0sz＇\％6＇6tz～0＇0 |  | Lちt0 | ＇hhコ＇ |
| 〕＇¢Z＇9 | － | － | $\bullet$－$\bullet$ | $\bullet$－$\bullet$ | рə｜¢еuヨ | $\dagger$ | $\tau / \tau$ | （Indul ә <br>  <br>  |  | Otto | Ohhs |
| әэиәдəəપ | Messos in | ןодиот Wd | ןодиот әnb．ı○」 <br> ｜01дй | ןодиоэ pəəds Оㄲ» | $\left\lvert\, \begin{gathered} \text { 6uиuunu } \\ \text { бuụn әụм } \end{gathered}\right.$ | 6uməs みпеəәの |  |  | uoḷoun」 | $\begin{gathered} \text { on } \\ \text { uọ!ev } \\ \text { !unumos } \end{gathered}$ | ว） |
| （әл！̣วәдәu｜： | ニ！ | ） 105 | ｜017 |  | Hosuas |  |  |  |  | ［z／t］ |  |

Sensorless vector/vector with sensor (•:Effective, -:Ineffective)

| (1) |  | $\begin{gathered} \stackrel{\rightharpoonup}{i} \\ \stackrel{\rightharpoonup}{0} \end{gathered}$ | $\begin{aligned} & \stackrel{-}{n} \\ & \stackrel{i}{\sim} \\ & \dot{0} \end{aligned}$ | $\stackrel{-1}{\sim}$ | $\begin{gathered} \stackrel{-}{\circ} \\ \stackrel{1}{+} \\ \dot{0} \end{gathered}$ | $\begin{aligned} & \stackrel{-}{\dot{1}} \\ & \stackrel{\rightharpoonup}{\dot{0}} \end{aligned}$ | $\stackrel{\sim}{\sim}$ | $\stackrel{\underset{\sim}{\dot{N}}}{\stackrel{+}{\dot{\sim}}}$ | $\begin{aligned} & \underset{\sim}{\sim} \\ & \dot{\sim} \\ & \dot{\varphi} \end{aligned}$ | $\begin{aligned} & \stackrel{-}{n} \\ & \stackrel{i}{\sim} \\ & \dot{0} \end{aligned}$ | $\stackrel{\rightharpoonup}{*}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | ' | ' | ' | ' | ' | ' | - | - | ' | ' |


| $\sum_{\alpha} \stackrel{\overline{0}}{\substack{0}}$ | - | $\bullet$ | - | - | - | $\bullet$ | - | - | $\bullet$ | - |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | $\bullet$ | $\bullet$ | $\bullet$ | $\div$ | $\div$ | ' | ' | ' | $\stackrel{\bullet}{-}$ | $\stackrel{\bullet}{\circ}$ |
|  | $\div$ | $\div$ | $\div$ | $\div$ | $\div$ | $\div$ | $\div$ | $\stackrel{\bullet}{-}$ | $\div$ | $\stackrel{\square}{-}$ |
|  |  |  |  |  |  |  |  |  |  | $\overline{0}$ <br> $\stackrel{0}{0}$ <br> $\stackrel{\pi}{0}$ <br> $\stackrel{0}{0}$ |
|  | $\begin{aligned} & \mathrm{O} \\ & \text { in } \end{aligned}$ | $\begin{aligned} & \mathrm{O} \\ & \stackrel{0}{\mathrm{~N}} \end{aligned}$ | $\begin{aligned} & \mathrm{O} \\ & \text { in } \end{aligned}$ | $\begin{aligned} & \circ \\ & \stackrel{0}{N} \\ & \hline \end{aligned}$ | $\begin{aligned} & \mathrm{O} \\ & \stackrel{1}{N} \end{aligned}$ | $\bigcirc$ | $0$ | $\bigcirc$ | $\bigcirc$ | $\bigcirc$ |


|  | $\begin{aligned} & \text { Ho } \\ & 0 \\ & \text { j} \\ & 0 \end{aligned}$ |  | $\begin{aligned} & \text {-1 } \\ & 0 \\ & 0 \\ & \hline- \end{aligned}$ | $\begin{aligned} & \text {-1. } \\ & 0 \\ & \stackrel{0}{7} \\ & 0 \end{aligned}$ | -1 0 -1 0 0 | $\stackrel{\text { H }}{ }$ | 7 $\stackrel{1}{7}$ $\cdots$ 0 0 | \# | $\overline{7}$ |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |

*1: $\Rightarrow$ For details, refer to Instruction Manual (E6581331) specified in Section 6.42

|  |  | $\underset{*}{-1}$ | $\stackrel{-}{*}$ | $\stackrel{-}{*}$ | * | $\stackrel{-}{*}$ | $\stackrel{-1}{ }$ | $\stackrel{-1}{*}$ | ${ }_{*}^{-1}$ | $\begin{gathered} N \\ N \\ \end{gathered}$ | N $\stackrel{+}{+}$ $\stackrel{0}{0}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\begin{aligned} & \hline \text { E⿹ㅣ } \\ & 0 \\ & 0 \\ & > \\ & \hline \end{aligned}$ | ' | ' | , | , | ' | ' | ' | ' | $\bullet$ | $\bullet$ |
|  | $\sum_{\mathrm{a}} \underset{\overline{0}}{\overline{0}}$ | ' | , | ' | - | ' | - | $\bullet$ | ' | ' | ' |
|  |  | $\stackrel{\bullet}{\bullet}$ | ' | ' | ' | ' | ' | ' | , | $\dagger$ | $\stackrel{\text { ' }}{ }$ |
|  |  | $\stackrel{\bullet}{\bullet}$ | $\stackrel{\circ}{-}$ | $\stackrel{\bullet}{\bullet}$ | $\div$ | $\stackrel{\bullet}{-}$ | $\stackrel{\bullet}{\bullet}$ | $\stackrel{\bullet}{-}$ | $\stackrel{\circ}{-}$ | $\div$ | $\stackrel{1}{\dagger}$ |
|  | 은 인 흔 은 를 | $\begin{array}{\|c\|} \hline \frac{0}{0} \\ \frac{0}{0} \\ \hline 0 \\ \hline \end{array}$ |  |  | $\begin{array}{\|l\|} \hline \stackrel{\rightharpoonup}{\mathrm{e}} \\ \stackrel{\rightharpoonup}{\hat{0}} \\ \stackrel{\rightharpoonup}{\bar{\omega}} \\ \hline \end{array}$ |  |  |  |  | $\begin{aligned} & \text { O} \\ & \frac{0}{0} \\ & \text { O} \\ & \underline{0} \\ & \hline \end{aligned}$ | $\begin{aligned} & \overline{0} \\ & \frac{0}{0} \\ & \widetilde{O} \\ & \stackrel{y}{0} \end{aligned}$ |
|  |  | - | $\underset{\sim}{\sim}$ | 악 | $\mid \mathrm{m}$ | $\cdots$ | O | $\|\mathrm{m}\|$ | $0$ | $\bigcirc$ | $\bigcirc$ |
|  |  | $\stackrel{\rightharpoonup}{7}$ | $\underset{A}{A}$ | $\stackrel{\rightharpoonup}{\lambda}$ | $\|\underset{\lambda}{-1}\|$ | $\stackrel{-1}{7}$ | $\stackrel{\rightharpoonup}{\lambda}$ | $\left\|\begin{array}{c} -\lambda \\ \lambda \end{array}\right\|$ | $\stackrel{-1}{\lambda}$ | $\stackrel{\rightharpoonup}{\lambda}$ | ت | [21] Adjustment parameters [1/2] Adjustment range

0: Stall prevention control 1
$0.0 \sim \digamma \mathrm{H} \mathrm{Hz}$
1:Enabled(Low gain)
2:Enabled(Middle gain)
3:Enabled(High gain)
Stalified in Section 6.42.
$* 1: \Rightarrow$ For details, refer to Instruction Manual (E6581333) specified in Secion
$* 2: \Rightarrow$ Settings vary from unit to unit. Even if $t y P$ is set to 3 , no change is made to these values.
[21] Adjustment parameters [2/2]

| Title | Communi cation No. | Function | Adjustment range | Minimumsetting unit(Panel/Communication) | Default setting | Write duringrunning | Vector control |  | $\begin{gathered} \text { PM } \\ \text { control } \end{gathered}$ | Vf Corstart | Reference |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  | Speed control | Torque control |  |  |  |
| $F 459$ | 0469 | Overvoltage limit constant | 0: Automatic, 1~1000ms | 1/1 | 0 | Disabled | -/- | -/- | - | $\bullet$ | 6.14 .2 |
| $F 470$ | 0470 | VI/II input bias | 0~255 | 1/1 | *2 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | - | - | 6. 28 |
| F471 | 0471 | VI/II input gain | 0~255 | 1/1 | *2 | Enabled | $\bullet \cdot$ | -10 | - | - | 6. 28 |
| $F 472$ | 0472 | RR/S4 input bias | 0~255 | 1/1 | *2 | Enabled | \% 1 | \% 1 | - | - | 6. 28 |
| 5473 | 0473 | RR/S4 input gain | 0-255 | 1/1 | *2 | Enabled | \% 1 | -10 | - | - | 6. 28 |
| 6474 | 0474 | RX input bias | 0~255 | 1/1 | *2 | Enabled | $\bullet \cdot$ | \% 1 | - | - | 6.28 |
| F475 | 0475 | RX input gain | 0~255 | 1/1 | *1 | Enabled | $\bullet \cdot$ | -10 | - | - | 6.28 |
| $F 475$ | 0476 | Optional Al1 input bias | 0-255 | 1/1 | *1 | Enabled | \% 1 | -10 | - | - | 6. 28 |
| 6477 | 0477 | Optional Al1 input gain | 0~255 | 1/1 | *1 | Enabled | $\bullet \cdot$ | -10 | - | - | 6. 28 |
| $F 478$ | 0478 | Optional AI2 input bias | 0~255 | 1/1 | *1 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | - | - | 6. 28 |
| F479 | 0479 | Optional Al2 input gain | 0-255 | 1/1 | *1 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | - | - | 6.28 |
| F495 | 0495 | Max output voltage modulation rate | 0:Standard 1:Straight 100\% 2:102.5\% 3:105\% | 1/1 | 0 | Disabled | $\bullet \cdot \bullet$ | $\bullet / \bullet$ | - | - | 6.27 .3 |
| $F 498$ | 0498 | PM motor constant 1 (d axis inductance) | 0~100\% | 0.1/0.1 | 10.0 | Disabled | - | - | - | - | 6. 29 |
| F499 | 0499 | PM motor constant 2 ( $q$ axis inductance) | 0~100\% | 0.1/0.1 | 10.0 | Disabled | - | - | - | - | 6. 29 |

*1: $\Rightarrow$ Settings vary from unit to unit. Even if $\succeq \breve{J}^{\circ}$ is set to 3 , no change is made to these values.
[22] Acceleration/deceleration 2 [1/2]

| [22] Acceleration/deceleration 2 [1/2] |  |  |  |  |  | Sensorless vector/vector with sensor (•:Effective, -:Ineffective) |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Title | Communi cation No. | Function | Adjustment range | Minimum |  |  | Vecto | ontrol |  |  |  |
|  |  |  |  | setting unit (Panel/Communi cation) | Default setting | Write during running | Speed control | Torque control | PM control | Vficonstant | Reference |
| F50n | 0500 | Acceleration time 2 | 0.1~6000 sec. | 0.1/0.1 *2 | *1 | Enabled | $\bullet$ - | - | $\bullet$ | $\bullet$ | 6.30.1 |
| F501 | 0501 | Deceleration time 2 | 0.1~6000 sec. | 0.1/0.1 *2 | *1 | Enabled | $\bullet \cdot$ | - | $\bullet$ | $\bullet$ | 6.30.1 |
| F502 | 0502 | Acceleration/deceleration 1 pattern | 0:Straight, 1:S-pattern 1, 2:S-pattern 2 | 1/1 | 0 | Enabled | $\bullet$ - | - | $\bullet$ | $\bullet$ | 6.30. 1 |
| $F 503$ | 0503 | Acceleration/deceleration 2 pattern | 0:Straight, 1:S-pattern 1, 2:S-pattern 2 | 1/1 | 0 | Enabled | $\bullet$ - | - | $\bullet$ | $\bullet$ | 6.30. 1 |
| F504 | 0504 | Panel acceleration/deceleration selection | 1:Acceleration/deceleration 1 2:Acceleration/deceleration 2 3:Acceleration/deceleration 3 4:Acceleration/deceleration 4 | 1/1 | 1 | Enabled | $\bullet$ - | - | $\bullet$ | $\bullet$ | 6.30. 1 |
| $F 505$ | 0505 | Acceleration/deceleration switching frequency 1 | 0.0~F H Hz | 0. 1/0.01 | 0.0 | Enabled | $\bullet$ - | - | $\bullet$ | $\bullet$ | 6. 30. 1 |
| F506 | 0506 | Acceleration S-pattern lower limit adjustment | 0~50\% | 1/1 | 10 | Enabled | $\bullet$ - | - | $\bullet$ | $\bullet$ | 6.30. 1 |
| F507 | 0507 | Acceleration S-pattern upper limit adjustment | 0~50\% | 1/1 | 10 | Enabled | $\bullet$ - | - | $\bullet$ | $\bullet$ | 6.30. 1 |
| $F 508$ | 0508 | Deceleration S-pattern lower limit adjustment | 0~50\% | 1/1 | 10 | Enabled | $\bullet$ - | - | $\bullet$ | $\bullet$ | 6. 30. 1 |

[^19]| [22] Acceleration/deceleration 2 [2/2] |  |  |  |  |  | Sensorless vector/vector with Vector control |  |  | r | ctiv | neffective) |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Title | $\begin{array}{\|l} \text { Communi } \\ \text { cation } \\ \text { No. } \end{array}$ | Function | Adjustment range | $\qquad$ | Default setting |  |  |  | PM control | ViConstant | Reference |
|  |  |  |  |  |  | Write during running | Speed control | Torque control |  |  |  |
| F509 | 0509 | Deceleration S-pattern upper limit adjustment | 0~50\% | 1/1 | 10 | Enabled | $\bullet \cdot$ | - | - | - | 6. 30. 1 |
| F510 | 0510 | Acceleration time 3 | 0.1~6000 sec. | 0.1/0.1 *2 | *1 | Enabled | \% $1 \cdot$ | - | $\bullet$ | $\bullet$ | 6.30.1 |
| FSit | 0511 | Deceleration time 3 | $0.1 \sim 6000 \mathrm{sec}$. | 0.1/0.1 *2 | *1 | Enabled | -1/ | - | - | - | 6.30.1 |
| F5ic | 0512 | Acceleration/ deceleration 3 patterm | 0:Straight, 1:S-pattern 1, 2:S-pattern 2 | 1/1 | 0 | Enabled | $\bullet \cdot \bullet$ | - | - | - | 6. 30. 1 |
| F5 i3 | 0513 | Acceleration/deceleration switching frequency 2 | $0.0 \sim F H^{\text {Hz }}$ | 0.1/0.01 | 0.0 | Enabled | $\bullet \cdot$ | - | $\bullet$ | - | 6. 30. 1 |
| F514 | 0514 | Acceleration time 4 | 0.1~6000 sec. | 0.1/0.1 *2 | *1 | Enabled | \% 1 | - | - | - | 6.30.1 |
| F5 is | 0515 | Deceleration time 4 | 0.1~6000 sec. | 0.1/0.1 *2 | *1 | Enabled | -10 | - | - | - | 6.30.1 |
| F5 i6 | 0516 | Acceleration/ deceleration 4 pattern | 0:Straight, 1:S-pattern 1, 2:S-pattern 2 | 1/1 | 0 | Enabled | $\bullet \cdot$ | - | - | - | 6.30. 1 |
| F5i7 | 0517 | Acceleration/deceleration switching frequency 3 | $0.0 \sim$ H Hz | 0.1/0.01 | 0.0 | Enabled | $\bullet \bullet$ | - | - | - | 6.30. 1 |
| *1: Default *2: Changin | values vary ing the para | depending on the capacity. $\Rightarrow$ meter $t 4 \rho$ enables to set to 0 | e the table of K-46. sec. (adjustment range: 0.01~600.0 se |  |  |  |  |  |  |  |  |


[23] Pattern operation [2/3]

|  |  |  | $\begin{aligned} & \text { F } \\ & \text { é } \end{aligned}$ | $\cdots$ |  | - | cr | $\left\|\begin{array}{c\|c} -1 & - \\ ल \\ 0 & 0 \\ 0 \end{array}\right\|$ | $\begin{array}{c\|c} \substack{c \\ 0 \\ 0} \\ \hline \end{array}$ | $\begin{gathered} n \\ i n \\ 0 \\ 0 \end{gathered}$ |  | $\begin{array}{c\|c} -1 & \underset{c}{e} \\ 0 \\ 0 \end{array}$ | $\begin{gathered} -1 \\ \substack{-1 \\ 0 \\ 0 \\ 0} \\ \hline \end{gathered}$ |  | $\begin{aligned} & \underset{\sim}{N} \\ & \text { in } \end{aligned}$ |  | $\underset{\text { N゙ }}{\substack{\text { N }}}$ |  |  |  |  |  |  |  | $\begin{aligned} & \underset{7}{N} \\ & \text { in } \end{aligned}$ | $\stackrel{\text { N }}{\substack{\text { ® }}}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | - •• | - | - ${ }^{-}$ |  |  | - |  |  |  | - | - | - |  | - |  | - |  |  |  |  |  |  |  | - | $\bullet$ |
|  |  | - •• | - |  |  | - | - | - |  |  |  | - | - |  | - |  | - |  |  |  |  |  |  |  | - | $\bullet$ |
|  |  |  |  |  |  |  |  |  |  |  |  | ' ' | ' |  | ' |  | ' |  |  |  |  |  |  |  | , | , |
|  |  |  | $\stackrel{\square}{-}$ | $\div$ | - | $\div$ | $\div$ | $\div$ |  | $\stackrel{\bullet}{-}$ | $\div$ | $\div$ | $\div$ |  | $\div$ |  | $\div$ |  |  |  |  |  |  |  | $\stackrel{\bullet}{-}$ | $\div$ |
|  |  |  |  |  |  |  |  |  |  |  |  |  | Br |  | $\begin{array}{\|l\|} \hline \frac{\overline{0}}{0} \\ \overline{0} \\ \stackrel{\rightharpoonup}{0} \\ \hline \end{array}$ |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 000 | 웅 | on on | م\| |  | 앙 | 운운 | $\stackrel{\rightharpoonup}{n}\|\stackrel{\rightharpoonup}{i}\|$ | pis | Bo | -\| | ) |  | $\bigcirc$ |  | $\bigcirc$ |  |  |  |  |  |  |  | $\bigcirc$ | - |
|  |  | $\left\lvert\, \begin{aligned} -7 \\ y \end{aligned}\right.$ | $\begin{aligned} & \text { H-1 } \\ & \underset{O}{-1} \end{aligned}$ | $\stackrel{-1}{2}$ |  | : | 0 |  | $\begin{gathered} a \\ \hline \end{gathered}$ |  |  |  | $3$ |  | $\stackrel{\text { H }}{ }$ |  | $\stackrel{\text { H }}{ }$ |  |  |  |  |  |  |  | $\stackrel{\text { H }}{ }$ | H |
|  |  |  |  |  |  | O | 웅 |  | on | $5$ | $0$ |  | $0$ |  |  |  |  |  |  | O | O |  |  |  | 谷 | 은 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | Nin | 앙 | 궁 |  |  | $\mathfrak{c}$ |  | Col | $\mathfrak{b l}$ | $0$ |  | $\underset{n}{n}$ |  | $\begin{aligned} & \stackrel{\circ}{\circ} \\ & \text { O} \end{aligned}$ |  | $\begin{aligned} & \text { İ } \\ & 0 \end{aligned}$ |  |  |  |  |  |  |  | $\begin{aligned} & \infty \\ & \hline 0 \\ & \hline 0 \\ & \hline \end{aligned}$ | $\begin{aligned} & 00 \\ & 0 \\ & 0 \end{aligned}$ |
|  | $\stackrel{ \pm}{ \pm}$ |  | $\begin{aligned} & 6 \\ & 9 \\ & 4 \\ & 4 \end{aligned}$ |  |  | $\begin{aligned} & 1 \\ & r \end{aligned}$ |  |  |  |  |  |  |  |  | $\begin{aligned} & 69 \\ & 60 \\ & 60 \\ & 4 \end{aligned}$ |  | $\begin{aligned} & - \\ & 60 \\ & 40 \end{aligned}$ |  |  |  |  |  |  |  | 60 60 6 | (10n |


| [23] Pattern operation [3/3] |  |  |  |  |  | Sensorless vector/vector with sensor ( : Effective, -:Ineffective) $^{\text {a }}$ |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Communi cation No. | Function | Adjustment range | Minimumsetting unit(Panel/Communication) | Default setting | Write during running | Vector control |  | PM control | Vff Constant | Reference |
| Title |  |  |  |  |  |  | Speed control | Torque control |  |  |  |
| F570 | 0570 | Preset speed operation frequency 10 operation mode | Ditto | 1/1 | 0 | Disabled | $\bullet$ - | - | - | - | 5. 12 |
| F57i | 0571 | Preset speed operation frequency 11 operation mode | Ditto | 1/1 | 0 | Disabled | $\bullet$ - | - | $\bullet$ | - | 5. 12 |
| $F 572$ | 0572 | Preset speed operation frequency 12 operation mode | Ditto | 1/1 | 0 | Disabled | $\bullet$ - | - | $\bullet$ | $\bullet$ | 5. 12 |
| F573 | 0573 | Preset speed operation frequency 13 operation mode | Ditto | 1/1 | 0 | Disabled | $\bullet$ - | - | $\bullet$ | $\bullet$ | 5. 12 |
| F574 | 0574 | Preset speed operation frequency 14 operation mode | Ditto | 1/1 | 0 | Disabled | $\bullet$ - | - | $\bullet$ | - | 5. 12 |
| F575 | 0575 | Preset speed operation frequency 15 operation mode | Ditto | 1/1 | 0 | Disabled | $\bullet$ - | - | $\bullet$ | - | 5. 12 |


[25] Protection functions [1/2]

| [25] Protection functions [1/2] |  |  |  |  |  | Sensorless vector/vector with <br> Vector control |  |  | PMcontrol | Vfconstant | :Ineffect |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Communi |  |  | Minimum |  |  |  |  | Reference |  |
| Title | cation No. | Function | Adjustment range | $\begin{aligned} & \text { setting unit } \\ & \text { (Panel/Communi } \\ & \text { cation) } \end{aligned}$ | $\begin{aligned} & \text { Default } \\ & \text { setting } \end{aligned}$ | Write during <br> running | Speed control | Torque control |  |  |
| F50 ! | 0601 | Stall prevention level | 10~164\%, 165:Deactivated | 1/1 | 150 | Enabled | $\bullet \cdot$ | - | - | - | 6.33.1 |
| F602 | 0602 | Inverter trip record retention selection | 0:Clear when power is turned off 1:Retain even after power is turned off | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet \bullet$ | - | - | 6. 33.2 |
| F503 | 0603 | Emergency stop | 0:Coast stop <br> 1:Deceleration stop <br> 2:Emergency DC braking <br> 3:Deceleration stop (deceleration 4) | 1/1 | 0 | Disabled | $\bullet \bullet$ | $\bullet \bullet$ | - | - | 6. 33.3 |
| $F 504$ | 0604 | Emergency DC braking control time | 0.0~20.0 sec. | 0.1/0.1 | 1.0 | Enabled | $\bullet \bullet$ | $\bullet \bullet$ | - | - | 6. 33.3 |
| F505 | 0605 | Output phase failure detection mode selection | $0:$ Deselect <br> 1:At starting (only one time after power is turned on) <br> 2:At starting (each time power is turned on) <br> 3:During operation <br> 4:At starting + during operation <br> 5:Output cut-off detection enabled | 1/1 | 0 | Disabled | $\bullet \bullet$ | $\bullet$ - | - | - | 6. 33.4 |
| F505 | 0606 | OL reduction starting frequency | $0.0 \sim 60.0 \mathrm{~Hz}$ | 0.1/0.01 | 6.0 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | - | $\bullet$ | 5. 14 |
| $F 507$ | 0607 | Motor 150\%-overload time limit | $10 \sim 2400 \mathrm{sec}$. | 1/1 | 300 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | - | - | 5. 14 |
| $F 508$ | 0608 | Input phase failure detection mode selection | 0:Disabled 1:Enabled | 1/1 | 1 | Disabled | $\bullet \cdot \bullet$ | $\bullet \cdot$ | - | - | 6. 33.7 |
| F609 | 0609 | Low current detection hysteresis width | 1~20\% | 1/1 | 10 | Enabled | $\bullet \bullet$ | $\bullet \bullet$ | - | - | 6. 33.8 |
| F 510 | 0610 | Low current trip selection | 0:No trip <br> 1:Trip | 1/1 | 0 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | - | - | 6. 33.8 |
| F5: | 0611 | Low current detection current | 0~100\% | 1/1 | 0 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | - | - | 6.33.8 |
| FS ic | 0612 | Low current detection time | 0~255 sec. | 1/1 | 0 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | - | - | 6.33. 8 |
| F5:3 | 0613 | Selection of short circuit detection at starting | $0:$ Each time (standard pulse) <br> 1:Only one time after power is turned on <br> 2:Each time (short pulse) <br> 3.Only one time after power is turn on (short pulse) <br> 4:Each time (Extremely shot-time pulse) <br> 5. Only one time after power is turn on (Extremely shot-time pulse) | 1/1 | 0 | Disabled | $\bullet$ - | $\bullet \bullet \bullet$ | - | - | 6. 33.9 |
| F5i5 | 0615 | Overtorque trip selection | $\begin{aligned} & \text { 0:No trip } \\ & \text { 1:Trip } \\ & \hline \end{aligned}$ | 1/1 | 0 | Enabled | $\bullet \cdot$ | $\bullet$ - | - | - | 6. 33. 10 |
| F5 6 | 0616 | Overtorque detection level during power running | 0~250\% | 1/0.01 | 150 | Enabled | $\bullet$ - | $\bullet \bullet$ | - | - | 6. 33.10 |
| F6:7 | 0617 | Overtorque detection level during regenerative braking | 0~250\% | 1/0.01 | 150 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | - | - | 6. 33. 10 |
| F5 18 | 0618 | Overtorque detection time | 0.00~10.00 sec. | 0.01/0.01 | 0.50 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | - | - | 6. 33. 10 |
| F519 | 0619 | Overtorque detection hysteresis | 0~100\% | 1/0.01 | 10 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | - | - | 6. 33. 10 |
| F520 | 0620 | Cooling fan control selection | $\begin{array}{\|l\|} \hline \text { 0:Auto } \\ \text { 1:Always ON } \\ \hline \end{array}$ | 1/1 | 0 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | - | - | 6. 33. 11 |
| F52 ${ }^{\text {c }}$ | 0621 | Cumulative operation time alarm setting | 0.1~999.9 (x100h) | 0.1/0.1 | 610.0 | Enabled | $\bullet \bullet$ | $\bullet \cdot \bullet$ | - | - | 6. 33.12 |


| [25] Protection functions [2/2] |  |  |  |  |  | Sensorless vector/vector with sensor ( $\bullet$ :Effective, -:Ineffective) |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Title | Communi cation No. | Function | Adjustment range | Minimum setting unit (Panel/Communi cation) | Default setting | Write during running | Vector control |  | PM control | Vficonstant | Reference |
|  |  |  |  |  |  |  | Speed control | Torque control |  |  |  |
| $F 62]$ | 0622 | Abnormal speed detection time | 0.01~100.0 sec. | 0.01/0.01 | 0.01 | Enabled | $\bullet$ - | $\bullet$ - | $\bullet$ | - | 6. 33. 13 |
| F623 | 0623 | Overspeed detection frequency upper band | 0.00:Disabled, 0.01~30.0Hz | 0.01/0.01 | 0.0 | Enabled | $\bullet$ - | $\bullet$ - | $\bullet$ | - | 6. 33.13 |
| $F 524$ | 0624 | Overspeed detection frequency lower band | 0.00:Disabled, $0.01 \sim 30.0 \mathrm{~Hz}$ | 0.01/0.01 | 0.0 | Enabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | 6. 33. 13 |
| 5625 | 0625 | Undervoltage detection level | 50~79\%, 80: (auto mode) | 1/1 | 80 | Disabled | $\bullet / \bullet$ | $\bullet$ - | $\bullet$ | $\bullet$ | 6. 33.15 |
| $F 625$ | 0626 | Overvoltage limit operation level | 100~150\% | 1/1 | 134 | Disabled | $\bullet$ - | - | $\bullet$ | $\bullet$ | 6.14. 2 |
| $F 627$ | 0627 | Undervoltage trip selection | 0:Disabled <br> 1:Enabled | 1/1 | 0 | Disabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | 6. 33. 15 |
| $F 628$ | 0628 | Undervoltage (trip alarm) detection time | 0.01~10.00 sec. | 0.01/0.01 | 0.03 | Disabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | 6. 33.15 |
| $F 529$ | 0629 | Regenerative power ride-through control level | 55~100\% | 1/1 | 75 | Disabled | $\bullet$ - | $\bullet$ - | - | - | 6. 33. 16 |
| F630 | 0630 | Braking answer waiting time | 0.0:Disabled, 0.1~10.0 sec. | 0.1/0.1 | 0.0 | Enabled | $\bullet$ • | - | - | - | 6. 33.17 |
| F63i | 0631 | Temperature detection | 0:Standard ( $150 \%-60 \mathrm{sec}$. ) <br> 1:Estimation of temperature | 1/1 | 0 | Disabled | - | - | - | - | 5. 14 |
| F633 | 0633 | VI/II analog input wire breakage detection level | $\begin{array}{\|l\|} \hline \text { 0:None } \\ \text { 1~100\% } \\ \hline \end{array}$ | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | 6. 33. 18 |
| F634 | 0634 | Annual average ambient temperature (calculation for part replacement alarms) | $\begin{aligned} & 1:-10 \sim+10^{\circ} \mathrm{C} \\ & 2:+11 \sim+20^{\circ} \mathrm{C} \\ & 3:+21 \sim+30^{\circ} \mathrm{C} \\ & 4:+31 \sim+40^{\circ} \mathrm{C} \\ & 5:+41 \sim+50^{\circ} \mathrm{C} \\ & 6:+51 \sim+60^{\circ} \mathrm{C} \end{aligned}$ | 1/1 | 3 | Enabled | $\bullet$ - | $\bullet$ - | - | - | 6. 33. 19 |
| F635 | 0635 | Rush current suppression relay activation time | 0.0~2.5 sec. | 0.1/0.1 | 0.0 | Disabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | 6. 33.20 |
| F637 | 0637 | PTC1 thermal selection | $0:$ Deselect 1:Select | 1/1 | 0 | Disabled | $\bullet$ - | $\bullet$ - | - | - | *1 |
| F638 | 0638 | PTC2 thermal selection | 0:Deselect 1:Select | 1/1 | 0 | Disabled | $\bullet$ - | $\bullet$ - | - | - | *1 |
| $F 539$ | 0639 | Braking resistance overload time (10 times of rated torque) | 0.1~600.0 sec. | 0.1/0.1 | 5.0 | Disabled | $\bullet$ - | $\bullet$ - | - | - | 5. 19 |
| F640 | 0640 | Step-out detection current level (for PM motors) | 10~150 | 1/1 | 100 | Disabled | - | - | - | - | 6. 29 |
| F64i | 0641 | Step-out detection time (for PM motors) | $\begin{aligned} & \text { 0.0:Not detect } \\ & \text { 0.1~25.0 } \end{aligned}$ | 0.1/0.1 | 0.0 | Disabled | - | - | - | - | 6. 29 |
| 5643 | 0643 | Brake-equipped motor restart condition selection | 0:Default (no waiting time for frequencies of 10 Hz and less) 1:Conditional (no waiting time for frequencies of 20Hz and less) | 1/1 | 0 | Disabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | 6. 33. 23 |
| 5647 | 0647 | Control power supply backup option failure monitoring | 0:Control power supply not backed up <br> 1:Control power supply backed up (alarm in the event of a failure) <br> 2:Control power supply backed up (tripping in the event of a failure) | 1/1 | 0 | Disabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | 6. 33.24 |


| [26] Override |  |  |  |  |  | Sensorless vector/vector with   |  |  | sor | fective, | neffective) |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Title | CommunicationNo. | Function | Adjustment range | Minimumsetting unit(Panel/Communication) | Default setting |  |  |  | $\begin{gathered} \text { PM } \\ \text { control } \end{gathered}$ | VFConstant | Reference |
|  |  |  |  |  |  | Write during running | Speed control | Torque control |  |  |  |
| F560 | 0660 | Override addition input selection | 0:Disabled <br> 1:VI/II (voltage/current input) <br> 2:RR/S4 (potentiometer/voltage input) <br> 3:RX (voltage input) <br> 4:Operation panel input enabled (including <br> LED/LCD option input) <br> 5:2-wire RS485 input enabled <br> 6:4-wire RS485 input enabled <br> 7:Communications option input enabled <br> 8:Optional AI1 (differential current input) <br> 9:Optional AI2 (voltage/current input) <br> 10:UP/DOWN frequency <br> 11:Optional RP pulse input <br> 12: Optional high-speed pulse input <br> 13:- | 1/1 | 0 | Enabled | -/• | - | - | - | 6. 34 |
| F56; | 0661 | Override multiplication input selection | 0:Disabled, 1:VI/II, 2:RR/S4, 3:RX, 4:F 729, <br> 5: Optional AI1 | 1/1 | 0 | Enabled | $\bullet$ - | - | - | - | 6. 34 |
| F569 | 0669 | Logic output/pulse output selection (OUT1) | 0:Logic output 1:Pulse output | 1/1 | 0 | Disabled | $\bullet \cdot \bullet$ | $\bullet$ - | - | - | 6. 35.1 |
| 8\%5: | 0670 | AM terminal meter selection | 0~64*1 | 1/1 | 2 | Enabled | $\bullet$ | $\bullet$ | - | - | 5.16 |

${ }^{*} 1: \Rightarrow$ For the adjustment range, see the table on page $\mathrm{K}-39$.

| [27] Meter output [1/2] |  |  |  |  |  | Sensorless vector/vector with sensor ( $\bullet$ :Effective, -:Ineffective) |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Title | $\begin{array}{\|l} \text { Communi } \\ \text { cation } \\ \text { No. } \end{array}$ | Function | Adjustment range | Minimumsetting unit(Panel/Communication) | Default setting | Write during running | Vector control |  | $\begin{gathered} \text { PM } \\ \text { control } \end{gathered}$ | Viconstant | Reference |
|  |  |  |  |  |  |  | Speed control | Torque control |  |  |  |
| 8 \% | 0671 | AM terminal meter adjustment |  | 1/1 | - | Enabled | \% | \% | - | - | 5. 16 |
| F572 | 0672 | MON1 terminal meter selection | 0~76*1 | 1/1 | 4 | Enabled | -10 | $\bullet \cdot$ | - | - | *2 |
| F673 | 0673 | MON1 terminal meter adjustment | - | 1/1 | - | Enabled | $\bullet \cdot$ | $\bullet \cdot \bullet$ | - | - | *2 |
| F574 | 0674 | MON2 terminal meter selection | 0~76*1 | 1/1 | 5 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | - | - | *2 |
| F575 | 0675 | MON2 terminal meter adjustment | - | 1/1 | - | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | - | - | *2 |
| F576 | 0676 | Pulse output function selection | 0~49*1 | 1/1 | 0 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | - | - | 6.35.1 |
| F577 | 0677 | Selection of number of pulses | $1.00 \sim 43.20 \mathrm{kHz}$ | 0.01/0.01 | 3.84 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | - | - | 6. 35.1 |
| F578 | 0678 | Constant at the time of filtering | $4 \mathrm{msec}, 8 \mathrm{msec} \sim 100 \mathrm{msec}$ | 1/1 | 64 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | - | - | 5. 16 |
| F68 ; | 0681 | FM voltage/current output switching | 0 :Voltage $0 \sim 10 \mathrm{~V}$ output 1:Current 0~20mA output | 1/1 | 0 | Disabled | $\bullet$ - | $\bullet \cdot \bullet$ | - | - | 6. 35.3 |
| F582 | 0682 | FM output gradient characteristic | 0:Negative gradient (descending) <br> 1:Positive gradient (ascending) | 1/1 | 1 | Enabled | $\bullet / \bullet$ | $\bullet \cdot$ | - | - | 6. 35.3 |
| $F 683$ | 0683 | FM bias adjustment | -10.0~100.0\% | 0.1/0.1 | 0.0 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | - | - | 6. 35.3 |

[^20]$\star 2: \Rightarrow$ For details, refer to Instruction Manual (E6581341) specified in Section 6.42.

| [27] Meter output [2/2] |  |  |  |  |  | Sensorless vector/vector with Vector control |  |  | or | ctive | neffective) |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Title | Communi | Function | Adjustment range | Minimumsetting unit(Panel/Communication) | Default setting |  |  |  | PM control | VifConstant | Reference |
|  | cation No. |  |  |  |  | Write during running | Speed control | Torque control |  |  |  |
| $F 584$ | 0684 | FM output filter | 0:No filter <br> 1:Filter approx. 10 ms <br> 2:Filter approx. 15 ms <br> 3:Filter approx. 30 ms <br> 4:Filter approx. 60ms <br> 5:Filter approx. 120ms <br> 6:Filter approx. 250ms <br> 7:Filter approx. 500ms <br> 8:Filter approx. 1s | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | 5. 16 |
| $F 585$ | 0685 | AM output gradient characteristic | 0:Negative inclination (downward slope) <br> 1:Positive inclination (upward slope) | 1/1 | 1 | Enabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | 6. 35.3 |
| F685 | 0686 | AM bias adjustment | -10.0~100.0\% | 0.1/0.1 | 0.0 | Enabled | $\bullet \cdot \stackrel{ }{\bullet}$ | $\bullet$ - $\bullet$ | $\bullet$ | $\bullet$ | 6.35.3 |
| F688 | 0688 | MON1 voltage/current output switching | 0:Voltage -10~10V output <br> 1:Voltage 0~10V output <br> 2:Current 0~20mA output | 1/1 | 1 | Disabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | *2 |
| $F 589$ | 0689 | MON1 output gradient characteristic | 0:Negative inclination (downward slope) <br> 1:Positive inclination (upward slope) | 1/1 | 1 | Enabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | *2 |
| $F 590$ | 0690 | MON1 bias adjustment | -10.0~100.0\% | 0.1/0.1 | 0.0 | Enabled | $\bullet \cdot \stackrel{ }{\bullet}$ | $\bullet$ - | - | $\bullet$ | *2 |
| F69i | 0691 | MON2 voltage/current output switching | 0 :Voltage -10~10V output <br> 1:Voltage 0~10V output <br> 2:Current 0~20mA output | 1/1 | 1 | Disabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | *2 |
| F592 | 0692 | MON2 output gradient characteristic | 0:Negative inclination (downward slope) <br> 1:Positive inclination (upward slope) | 1/1 | 1 | Enabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | *2 |
| F593 | 0693 | MON2 bias adjustment | -10.0~100.0\% | 0.1/0.1 | 0.0 | Enabled | $\bullet$ - | $\bullet \cdot$ | $\bullet$ | - | *2 |

$\star 1: \Rightarrow$ For the adjustment range, see the table on page K-39
$\star 2: \Rightarrow$ For details, refer to Instruction Manual (E6581341) specified in Section 6.42.
[28] Operation panel parameters [1/3]

| [28] Operation panel parameters [1/3] |  |  |  |  |  | Sensorless vector/vector witVector control |  |  | $\begin{gathered} \text { PM } \\ \text { control } \end{gathered}$ | VfConstant | neffe |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Communi |  |  |  |  |  |  |  | Reference |  |
| Title | cation No. | Function | Adjustment range | $\begin{aligned} & \text { setting unit } \\ & \text { (Panel/Communi } \\ & \text { cation) } \end{aligned}$ | Default setting | Write during running | Speed control | Torque control |  |  |
| F700 | 0700 | Parameter write protect selection | 0:Permit 1:Prohibit | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet \cdot$ | - | - | 6. 36.1 |
| d5Pu | 0701 | Current/voltage unit selection | 0:\%, 1:A (ampere)/ N (volt) | 1/1 | 0 | Enabled | $\%$ | $1 /$ | - | - | 5.15 |
| $F 702$ | 0702 | Frequency free unit display magnification | 0.00:OFF, 0.01~200.0 | 0.01/0.01 | 0.00 | Enabled | $\bullet \cdot$ | $\bullet$ | - | - | 6. 36. 2 |
| $F 703$ | 0703 | Frequency free unit conversion selection | $0:$ All frequencies display free unit conversion 1:PID frequencies free unit conversion | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet \cdot$ | - | - | 6. 36.2 |
| F705 | 0705 | Free unit display gradient characteristic | 0:Negative inclination (downward slope) <br> 1:Positive inclination (upward slope) | 1/1 | 1 | Enabled | $\bullet$ - | $\bullet \cdot$ | - | - | 6. 36. 2 |
| $F 705$ | 0706 | Free unit display bias | $0.00 \sim F \cdot \mathrm{H} \mathrm{Hz}$ | 0.01/0.01 | 0.00 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | - | - | 6. 36.2 |
| $F 707$ | 0707 | Changing step selection 1 | 0.00 Disabled, $0.01 \sim \leftarrow \mathrm{H} \mathrm{Hz}$ | 0.01/0.01 | 0.00 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | - | - | 6.36.3 |
| $F 708$ | 0708 | Changing step selection 2 | 0:Disabled, 1~255 | 1/1 | 0 | Enabled | -10 | -1• | - | $\bullet$ | 6. 36.3 |
| $F 709$ | 0709 | Standard monitor hold function | 0:Real time, 1:Peak hold, 2:Minimum hold | 1/1 | 0 | Enabled | -10 | $\bullet \cdot$ | - | - | 8.3 |
| $F 710$ | 0710 | Standard monitor display selection | 0~80 *1 | 1/1 | 0 | Enabled | $\bullet \cdot$ | $\bullet$ | - | - | 8.3 |
| F7: | 0711 | Status monitor 1 display selection | Ditto | 1/1 | 1 | Enabled | $\bullet \bullet$ | $\bullet$ | $\bullet$ | - | 8.3 |
| F7:2 | 0712 | Status monitor 2 display selection | Ditto | 1/1 | 2 | Enabled | $\bullet$ - | $\bullet$ | - | - | 8.3 |
| F7:3 | 0713 | Status monitor 3 display selection | Ditto | 1/1 | 3 | Enabled | $\bullet$ | $\bullet \cdot$ | - | - | 8.3 |
| F7,4 | 0714 | Status monitor 4 display selection | Ditto | 1/1 | 4 | Enabled | $\bullet$ - | $\bullet \cdot$ | - | - | 8.3 |
| F7:5 | 0715 | Status monitor 5 display selection | Ditto | 1/1 | 8 | Enabled | $\bullet / \bullet$ | $\bullet \cdot$ | - | - | 8.3 |
| F7:6 | 0716 | Status monitor 6 display selection | Ditto | 1/1 | 16 | Enabled | $\bullet$ - | $\bullet$ - | - | - | 8.3 |
| F7:7 | 0717 | Status monitor 7 display selection | Ditto | 1/1 | 15 | Enabled | $\bullet$ - | $\bullet$ - | - | - | 8.3 |
| F7:8 | 0718 | Status monitor 8 display selection | Ditto | 1/1 | 14 | Enabled | $\bullet$ - | $\bullet$ - | - | - | 8.3 |
| F719 | 0719 | Operation command clear selection when standby terminal (ST) is OFF | 0:Clear operation command 1:Retain operation command | 1/1 | 1 | Enabled | $\bullet$ - | $\bullet \bullet$ | - | - | 6. 36.5 |
| F72 | 0721 | Operation panel stop pattern selection | 0:Deceleration stop 1:Coast stop | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet$ - | - | - | 6. 36.6 |
| $F 725$ | 0725 | Operation panel torque command | -250~250\% | 1/0.01 | 0 | Enabled | - | $\bullet$ - | - | - | 6. 36.7 |
| $F 727$ | 0727 | Operation panel tension torque bias | -250~250\% | 1/0.01 | 0 | Enabled | - | $\bullet \cdot$ | - | - | 6. 36.8 |
| $F 728$ | 0728 | Operation panel load sharing gain | 0~250\% | 1/0.01 | 100 | Enabled | - | $\bullet \bullet$ | - | - | 6. 36.8 |
| F 729 | 0729 | Operation panel override multiplication gain | -100~100\% | 1/0.01 | 0 | Enabled | $\bullet$ - | - | - | - | 6. 34 |


| [28] Operation panel parameters [2/3] |  |  |  |  |  | Sensorless vector/vector with sensor (•:Effective, -:Ineffective) |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Communi | Function | Adjustment range | Minimumsetting unit(Panel/Communication) | Default setting | Write during running | Vector control |  | PM control | Vficonstant | Reference |
| Title | cation No. |  |  |  |  |  | Speed control | Torque control |  |  |  |
| $F 730$ | 0730 | Operation panel frequency setting prohibition selection | 0:Permit <br> 1:Prohibit | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | 6. 36.1 |
| $F 734$ | 0734 | Operation panel emergency stop operation prohibition selection | 0 :Permit 1:Prohibit | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet$ - $\bullet$ | $\bullet$ | $\bullet$ | 6. 36.1 |
| $F 735$ | 0735 | Operation panel reset operation prohibition selection | 0:Permit <br> 1:Prohibit | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | 6. 36.1 |
| $F 736$ | 0736 | Prohibition of change of <br>  operation | 0 :Permit <br> 1:Prohibit | 1/1 | 1 | Enabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | 6. 36.1 |
| $F 737$ | 0737 | All key operation prohibition | 0:Permit <br> 1:Prohibit | 1/1 | 0 | Enabled | $\bullet / \bullet$ | $\bullet$ - | $\bullet$ | $\bullet$ | 6. 36.1 |
| $F 740$ | 0740 | Trace selection | 0:Deselect, 1:At tripping, 2:At triggering | 1/1 | 1 | Enabled | $\bullet \cdot$ | $\bullet$ - $\bullet$ | - | - | 6.37 |
| $F 741$ | 0741 | Trace cycle | $0: 4 \mathrm{~ms}, 1: 20 \mathrm{~ms}, 2: 100 \mathrm{~ms}, 3: 1 \mathrm{~s}, 4: 10 \mathrm{~s}$ | 1/1 | 2 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | $\bullet$ | - | 6.37 |
| $F 742$ | 0742 | Trace data 1 | 0~49 | 1/1 | 0 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | $\bullet$ | $\bullet$ | 6. 37 |
| $F 743$ | 0743 | Trace data 2 | 0~49 | 1/1 | 1 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | $\bullet$ | $\bullet$ | 6.37 |
| $F 744$ | 0744 | Trace data 3 | 0~49 | 1/1 | 2 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | $\bullet$ | $\bullet$ | 6. 37 |
| $F 745$ | 0745 | Trace data 4 | 0~49 | 1/1 | 3 | Enabled | $\bullet$ • | $\bullet$ • | $\bullet$ | - | 6. 37 |
| $F 748$ | 0748 | Integrating wattmeter retention selection | 0 :Disabled 1:Enabled | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | 6. 38 |
| $F 749$ | 0749 | Integrating wattmeter display unit selection | $\begin{aligned} & \hline 0: 1=1 \mathrm{kWh} \\ & 1: 1=10 \mathrm{kWh} \\ & 2: 1=100 \mathrm{kWh} \\ & 3: 1=1000 \mathrm{kWh} \\ & 4: 1=10000 \mathrm{kWh} \\ & \hline \end{aligned}$ | 1/1 | *2 | Enabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | 6. 38 |
| $F 750$ | 0750 | EASY key function selection | 0:Quick mode/standard setting mode switching function <br> 1:Shortcut key:Pressing for 2 sec . to record the parameter, pressing normally to jump to recorded parameter (first jump to the 1st history) <br> 2:Operation panel/remote key:Operation panel by ON <br> 3:Monitor peak minimum hold trigger | 1/1 | 0 | Disabled | $\bullet$ - | $\bullet$ - | - | $\bullet$ | 5. 22 |
| F75i | 0751 | Quick registration parameter 1 | 0~999 *1 | 1/1 | $\begin{gathered} 40 \\ (\mathrm{~A} \cup 4) \\ \hline \end{gathered}$ | Enabled | $\bullet$ - | $\bullet$ - | - | - | 5. 22 |
| $F 752$ | 0752 | Quick registration parameter 2 | 0~999 *1 | 1/1 | $\begin{aligned} & 15 \\ & (\mathrm{pt}) \end{aligned}$ | Enabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | 5. 22 |
| $F 753$ | 0753 | Quick registration parameter 3 | 0~999 *1 | 1/1 | $\begin{gathered} 11 \\ (\mathrm{FH}) \end{gathered}$ | Enabled | $\bullet$ - | $\bullet$ - | - | $\bullet$ | 5. 22 |
| $F 754$ | 0754 | Quick registration parameter 4 | 0~999 *1 | 1/1 | $\begin{gathered} 9 \\ (\mathrm{ACC}) \end{gathered}$ | Enabled | $\bullet$ • | $\bullet$ - | $\bullet$ | $\bullet$ | 5. 22 |
| F 755 | 0755 | Quick registration parameter 5 | 0~999 *1 | 1/1 | $\begin{gathered} 10 \\ (\mathrm{dEC}) \end{gathered}$ | Enabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | 5. 22 |

*1: The communication number of the parameter is used for this setting

[^21][28] Operation panel parameters [3/3]

| [28] Operation panel parameters [3/3] |  |  |  |  |  | Sensorless vector/vector with  <br>  Vector control |  |  | sor ( | fective, | :Ineffective) |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Communi |  |  | Minimum |  |  |  |  | PM control | Vficonstant | Reference |
| Title | cation No. | Function | Adjustment range | $\begin{gathered} \text { setting unit } \\ \text { (Panel/Communi } \\ \text { cation) } \\ \hline \hline \end{gathered}$ | Default setting | Write during running | Speed control | Torque control |  |  |  |
| $F 756$ | 0756 | Quick registration parameter 6 | 0~999 *1 | 1/1 | $\begin{aligned} & \hline \hline 600 \\ & (\mathrm{tHr}) \end{aligned}$ | Enabled | $\bullet \bullet$ | $\bullet$ - | $\bullet$ | - | 5. 22 |
| $F 757$ | 0757 | Quick registration parameter 7 | 0~999 *1 | 1/1 | $\begin{gathered} 6 \\ (F M) \\ \hline \end{gathered}$ | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | - | - | 5. 22 |
| $F 758$ | 0758 | Quick registration parameter 8 | 0~999 *1 | 1/1 | 999 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | - | - | 5. 22 |
| $F 759$ | 0759 | Quick registration parameter 9 | 0~999 *1 | 1/1 | 999 | Enabled | $\bullet$ | $\bullet \cdot$ | - | - | 5. 22 |
| $F 760$ | 0760 | Quick registration parameter 10 | 0~999 *1 | 1/1 | 999 | Enabled | $\bullet \cdot$ | -1. | - | - | 5. 22 |
| $F 75$ i | 0761 | Quick registration parameter 11 | 0~999*1 | 1/1 | 999 | Enabled | $1 \cdot$ | $1 \cdot$ | - | - | 5. 22 |
| $F 76{ }^{\text {F }}$ | 0762 | Quick registration parameter 12 | 0~999 *1 | 1/1 | 999 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | - | - | 5. 22 |
| $F 763$ | 0763 | Quick registration parameter 13 | 0~999 *1 | 1/1 | 999 | Enabled | $\cdots$ | $\bullet \cdot$ | - | - | 5. 22 |
| $F 754$ | 0764 | Quick registration parameter 14 | 0~999 *1 | 1/1 | 999 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | - | - | 5. 22 |
| $F 765$ | 0765 | Quick registration parameter 15 | 0~999 *1 | 1/1 | 999 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | - | - | 5. 22 |
| $F 765$ | 0766 | Quick registration parameter 16 | 0~999 *1 | 1/1 | 999 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | - | - | 5. 22 |
| F767 | 0767 | Quick registration parameter 17 | 0~999 *1 | 1/1 | 999 | Enabled | $1 \cdot$ | $1 \cdot$ | - | - | 5. 22 |
| $F 768$ | 0768 | Quick registration parameter 18 | 0~999 *1 | 1/1 | 999 | Enabled | $\bullet \cdot$ | -10 | - | - | 5. 22 |
| $F 769$ | 0769 | Quick registration parameter 19 | 0~999 *1 | 1/1 | 999 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | - | - | 5. 22 |
| $F 770$ | 0770 | Quick registration parameter 20 | 0~999 *1 | 1/1 | 999 | Enabled | $1 \cdot$ | $1 \cdot$ | - | - | 5. 22 |
| F771 | 0771 | Quick registration parameter 21 | 0~999*1 | 1/1 | 999 | Enabled | $1 \cdot$ | $1 \cdot$ | - | - | 5. 22 |
| F772 | 0772 | Quick registration parameter 22 | 0~999 *1 | 1/1 | 999 | Enabled | $\bullet$ | -10 | - | - | 5. 22 |
| $F 773$ | 0773 | Quick registration parameter 23 | 0~999*1 | 1/1 | 999 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | - | - | 5. 22 |
| F774 | 0774 | Quick registration parameter 24 | 0~999 *1 | 1/1 | 999 | Enabled | $1 \cdot$ | $1 \cdot$ | - | - | 5. 22 |
| $F 775$ | 0775 | Quick registration parameter 25 | 0~999 *1 | 1/1 | 999 | Enabled | -10 | $\cdots$ | - | - | 5. 22 |
| $F 775$ | 0776 | Quick registration parameter 26 | 0~999 *1 | 1/1 | 999 | Enabled | $\cdots$ | $\bullet \cdot$ | - | - | 5. 22 |
| F777 | 0777 | Quick registration parameter 27 | 0~999 *1 | 1/1 | 999 | Enabled | $1 \cdot$ | $1 \cdot$ | - | - | 5. 22 |
| $F 778$ | 0778 | Quick registration parameter 28 | 0~999 *1 | $1 / 1$ | 999 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | $\bullet$ | $\bullet$ | 5. 22 |
| $F 779$ | 0779 | Quick registration parameter 29 | 0~999 *1 | 1/1 | 999 | Enabled | $1 /$ | $\bullet \cdot$ | - | - | 5. 22 |
| $F 780$ | 0780 | Quick registration parameter 30 | 0~999 *1 | 1/1 | 999 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | - | - | 5. 22 |
| $F 78$ i | 0781 | Quick registration parameter 31 | 0~999 *1 | 1/1 | 999 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | - | - | 5. 22 |
| $F 782$ | 0782 | Quick registration parameter 32 | 0~999 *1 | 1/1 | $\begin{gathered} 50 \\ \text { (PSEL) } \\ \hline \end{gathered}$ | Enabled | $\bullet \bullet$ | $\bullet \bullet$ | - | - | 5. 22 |



|  | Communi |  |  | Minimum |  |  | Vecto | ontrol |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Title | cation No. | Function | Adjustment range | setting unit (Pane/Communi cation) | Default setting | $\left.\begin{gathered} \text { Write during } \\ \text { running } \end{gathered} \right\rvert\,$ | Speed control | Torque control | control | VIf Constant | Reference |
| F808 | 0808 | Communication1 time-out condition selection | 0:Disconnection detection <br> 1:When communication mode enable <br> 2:1+Driving operation | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet \bullet \bullet$ | - | - | *1 |
| F8is | 0810 | Frequency point selection | 0:Disabled <br> 1:2-wire RS485 <br> 2:4-wire RS485 <br> 3:Communication add option | 1/1 | 0 | Enabled | $\bullet$ - | - | - | - | 6. 39.1 |
| F8it | 0811 | Point 1 setting | 0-100\% | 1/1 | 0 | Enabled *2 | $\bullet \cdot$ | - | - | - | 6.39.1 |
| F8i? | 0812 | Point 1 frequency | $0.0 \sim$ F H Hz | 0.1/0.01 | 0.0 | Enabled *2 | $\bullet \cdot$ | - | - | - | 6.39.1 |
| F8:3 | 0813 | Point 2 setting | 0~100\% | 1/1 | 100 | Enabled *2 | $\cdots$ | - | - | - | 6.39.1 |
| F814 | 0814 | Point 2 frequency | $0.0 \sim 6 \mathrm{H} \mathrm{Hz}$ | 0.1/0.01 | 60 | Enabled *2 | $\bullet \cdot$ | - | - | - | 6.39.1 |
| F8:5 | 0815 | Address monitor (Modbus puls) | 1~64 | 1/1 | 1 | *5 | $\bullet$ - | $\bullet$ - | - | - | *3 |
| F8i6 | 0816 | Command selection (Modbus puls) | 0: Prohibit 1: Permit | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet \bullet$ | - | - | *3 |
| F8:7 | 0817 | Number of command (Modbus puls) | 0~8 | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet \bullet$ | - | - | *3 |
| F8:8 | 0818 | Number of monitors (Modbus puls) | 0~8 | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet$ - | - | - | *3 |
| F8:9 | 0819 | Command station (Modbus puls) | 0~64 | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet \cdot$ | - | - | *3 |
| F820 | 0820 | Communication speed (4-wire RS485) | $0: 9600 \mathrm{bps}$ 1:19200 bps 2:38400 bps | 1/1 | 1 | Enabled | $\bullet / \bullet$ | $\bullet$ - | - | - | 6. 39.1 |
| F82 | 0821 | Baud rate (Ethernet) | 0 :Automatic detection <br> 1:10Mbps Full <br> 2:10Mbps Half <br> 3:100Mbps Full <br> 4:100Mbps Half | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet$ - | - | - | *4 |
| 5822 | 0822 | Baud rate monitor right port (Ethernet) | $\begin{array}{\|l\|} \hline \text { 0:Automatic detection } \\ \text { 1:10Mbps Full } \\ \text { 2:10Mbps Half } \\ \text { 3:100Mbps Full } \\ \text { 4:100Mbps Half } \\ \hline \end{array}$ | 1/1 | - | *5 | $\bullet$ - | $\bullet \bullet$ | - | - | *4 |
| F823 | 0823 | Baud rate monitor left port (Ethernet) | 0 :Automatic detection <br> 1:10 Mbps Full <br> 2:10Mbps Half <br> 3:100Mbps Full <br> 4:100Mbps Half | 1/1 | - | *5 | $\bullet$ - | $\bullet \bullet \bullet$ | - | - | *4 |
| 5824 | 0824 | (Reservation) | $\begin{aligned} & \text { 0:- } \\ & \text { 1:- } \\ & 2:- \\ & 3:- \end{aligned}$ | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet$ - | - | - | *4 |

[^22]| [29] Communication function [3/4] |  |  |  |  |  | Sensorless vector/vector with sensor ( $\bullet$ :Effective, -:Ineffective) |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Communi cation No. | Function | Adjustment range | Minimumsetting unit(Pane/Communication) | Default setting | Write during running | Vector control |  | PM control | Vff Constant | Reference |
| Title |  |  |  |  |  |  | Speed control | Torque control |  |  |  |
| $F 825$ | 0825 | Send waiting time (4-wire RS485) | 0.00:Default, 0.01~2.00 sec. | 0.01/0.01 | 0.00 | Enabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | 6. 39. 1 |
| F825 | 0826 | Inverter-to-inverter communication setting (4-wire RS485) | 0 :Slave (issues a 0 Hz command if something goes wrong with the master) <br> 1:Slave (continues operation if something goes wrong with the master) <br> 2:Slave (trips for emergency stop if something goes wrong with the master) <br> 3:Master (sends a frequency command) <br> 4:Master (sends an output frequency) <br> 5:Master (sends a torque command) <br> 6:Master (sends an output torque command) | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | 6. 39. 1 |
| $F 829$ | 0829 | Protocol selection (4-wire RS485) | $\begin{aligned} & \text { 0:TOSHIBA } \\ & \text { 1:MODBUS } \end{aligned}$ | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | 6. 39. 1 |
| $F 830$ | 0830 | Communication option setting 1 | 0~7 | 1/1 | 0 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | $\bullet$ | $\bullet$ | *1 |
| F83i | 0831 | Communication option setting 2 | 0000~FFFF | 1/1 | 0000 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | $\bullet$ | $\bullet$ | *1 |
| F832 | 0832 | Communication option setting 3 | 0000~FFFF | 1/1 | 0000 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | $\bullet$ | $\bullet$ | *1 |
| F833 | 0833 | Communication option setting 4 | 0000~F F FF | 1/1 | 0000 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | $\bullet$ | $\bullet$ | *1 |
| F834 | 0834 | Communication option setting 5 | 0000~FFFF | 1/1 | 0000 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | $\bullet$ | $\bullet$ | *1 |
| F835 | 0835 | Communication option setting 6 | 0000~FFFF | 1/1 | 0000 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | $\bullet$ | - | *1 |
| F835 | 0836 | Communication option setting 7 | 0000~F FFF | 1/1 | 0000 | Enabled |  |  | $\bullet$ | $\bullet$ | *1 |
| F837 | 0837 | Communication option setting 8 | 0000~FFFF | 1/1 | 0 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | $\bullet$ | $\bullet$ | *1 |
| F838 | 0838 | Communication option setting 9 | 0000~FFFF | 1/1 | 0 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | - | $\bullet$ | *1 |
| F84i | 0841 | Communication option setting 10 | 0000~F FFF | 1/1 | 0000 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | $\bullet$ | $\bullet$ | *1 |
| $F 842$ | 0842 | Communication option setting 11 | 0000~F F FF | 1/1 | 0000 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | $\bullet$ | $\bullet$ | *1 |
| F843 | 0843 | Communication option setting 12 | 0000~FFFF | 1/1 | 0000 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | $\bullet$ | $\bullet$ | *1 |
| F844 | 0844 | Communication option setting 13 | 0000~F FFF | 1/1 | 0000 | Enabled | $\bullet \cdot$ | $\bullet 10$ | $\bullet$ | $\bullet$ | *1 |
| F845 | 0845 | Communication option setting 14 | 0000~F FFF | 1/1 | 0000 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | $\bullet$ | $\bullet$ | *1 |
| F845 | 0846 | Communication option setting 15 | 0000~FFFF | 1/1 | 0000 | Enabled | $\bullet \cdot$ | $\bullet 10$ | $\bullet$ | $\bullet$ | *1 |
| F847 | 0847 | Communication option setting 16 | 0000~FFFF | 1/1 | 0 | Enabled | $\bullet \cdot$ | $\bullet 1 \cdot$ | $\bullet$ | $\bullet$ | *1 |
| $F 848$ | 0848 | Communication option setting 17 | 0000~FF FF | 1/1 | 0 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | $\bullet$ | $\bullet$ | *1 |
| F849 | 0849 | Communication2 time-out condition selection | 0:Disconnection detection <br> 1:When communication mode enable <br> 2:1+Driving operation | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | *1 |
| F850 | 0850 | Disconnection detection extended time | 0.0~100.0 sec. | 0.1/0.1 | 0.0 | Enabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | *1 |
| F85 | 0851 | Inverter operation at disconnection | $0:$ Inverter stop, communication command, frequency mode open (by $[\cap \mathcal{O} d, F \cap \mathcal{S} d)$ <br> 1:None (continued operation) <br> 2:Deceleration stop <br> 3:Coast stop <br> 4:Network error ( $E,-8$ trip) <br> 5:Preset speed operation (by $F 852$ setting) | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | *1 |
| F852 | 0852 | Preset speed operation selection | 0:None <br> 1~15:Preset speed operation (by parameter setting) | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | *1 |

[29] Communication function [4/4]

|  | Communi |  |  | Minimum |  |  | Vecto | ontrol |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Title | cation No. | Function | Adjustment range | $\begin{aligned} & \text { setting unit } \\ & \text { (Pane/Communi } \\ & \text { cation) } \end{aligned}$ | Default setting | Write during running | Speed control | Torque control | PM control | VfConstant | Reference |
| F853 | 0853 | Communication option station address monitor | 0~255 | 1/1 | 0 | Enabled | $\bullet \bullet$ | $\bullet \bullet$ | $\bullet$ | $\bullet$ | *1 |
| F854 | 0854 | Communication option speed switch monitor <br> DeviceNet/CC-Link | 0~255 | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet$ - | - | - | *1 |
| F856 | 0856 | Motor pairs of poles for communication | 1:2 Poles, 2:4 Poles <br> 3:6 Poles, $4: 8$ Poles <br> 5:10 Poles, 6:12 Poles <br> 7:14 Poles, $8: 16$ Poles | 1/1 | 2 | Enabled | $\bullet$ - | $\bullet$ - | - | - | *1 |
| F870 | 0870 | Block write data 1 | 0:Disabled <br> 1:Command information 1 <br> 2:Command information 2 <br> 3:Frequency command <br> 4:Terminal board output data <br> 5:Communication analog data <br> 6:Rotational speed instruction | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet / \bullet$ | - | $\bullet$ | 6. 39. 1 |
| F871 | 0871 | Block write data 2 | Ditto | 1/1 | 0 | Enabled | -1* | $\bullet$ • | - | - | 6. 39.1 |
| F875 | 0875 | Block read data 1 | 0:Deselect <br> 1:Status information <br> 2:Output frequency <br> 3:Output current <br> 4:Output voltage <br> 5:Alarm information <br> 6:PID feedback value <br> 7:Input terminal board monitor <br> 8: Output terminal board monitor <br> 9:VI/II terminal board monitor <br> 10:RR/S4 terminal board monitor <br> 11:RX terminal board monitor <br> 12:Input voltage (DC detection) <br> 13:Speed feedback frequency <br> 14:Torque <br> 15:MY monitor 1 <br> 16:MY monitor 2 <br> 17:MY monitor 3 <br> 18:MY monitor 4 <br> 19:Free notes <br> 20:Rotational speed | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet$ - | - | - | 6. 39. 1 |
| 6875 | 0876 | Block read data 2 | Ditto | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet / \bullet$ | $\bullet$ | $\bullet$ | 6.39.1 |
| F877 | 0877 | Block read data 3 | Ditto | 1/1 | 0 | Enabled | -10 | $\bullet \cdot$ | - | - | 6. 39.1 |
| F878 | 0878 | Block read data 4 | Ditto | 1/1 | 0 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | - | - | 6.39.1 |
| F879 | 0879 | Block read data 5 | Ditto | 1/1 | 0 | Enabled | -10 | -10 | - | - | 6.39.1 |
| $F 880$ | 0880 | Free notes | 0-FFFF | 1/1 | 0 | Enabled | $\bullet \cdot$ | -10 | - | - | 6.39.1 |
| F899 | 0899 | Network option reset setting | 0:None <br> 1:Reset option circuit board and inverter | 1/1 | 0 | Disabled | $\bullet \cdot$ | $\bullet$ - | - | - | *1 |


| [30] My function [1/5 |  | Function | Sensorless vector/vector with sensor ( $\bullet$ :Effective, -:Ineffective) |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Title | Communi cation No. |  | Adjustment range | Minimum setting unit (Panel/Communi cation) | Default setting | Write during running | Vector control |  | PM control | Vif Constant | Reference |
|  |  |  |  |  |  |  | Speed control | Torque control |  |  |  |
| $F 908$ |  |  |  | 1/1 | 0 |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  | Disabled | $\bullet$ | $\bullet \cdot$ | $\bullet$ | $\bullet$ | *1 |
|  |  |  |  |  |  | Disabled | - | - | - | - | * |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |


| [30] My function [2/5 |  | Sensorless vector/vector with sensor ( $\bullet$ :Effective, --:Ineffective) |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Title | Communi | Function | Adjustment range | Minimumsetting unit(Panel/Communication) | Default setting | Write during running | Vector control |  | PM control | VifConstant | Reference |
|  | cation No. |  |  |  |  |  | Speed control | Torque control |  |  |  |
| F901 | 0901 | Input function command 12 | ```0:NOP (not operation) 1:ST (move) 2:STN 3:AND (logical product) 4:ANDN 5:OR (logical sum) 6:ORN 7:EQ (equal) 8:NE (not equal) 9:GT (greater than) 10:GE (greater or equal) 11:LT (less than) 12:LE (less or equal) 13:ASUB (absolute) 14:ON (on delay timer) 15:OFF (off delay timer) 16:COUNT 1 (counter 1) 17:COUNTR 2 (counter 2) 18:HOLD (hold) 19:SET (set) 20:RESET (reset) 21:CLR 22:CLRN``` | 1/1 | 0 | Disabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | *1 |
| $F 902$ | 0902 | Input function target 12 | Same as F900 | 1/1 | 0 | Disabled | $\bullet$ • $\bullet$ | $\bullet$ • | - | - | *1 |
| $\% 903$ | 0903 | Input function command 13 | Same as F901 | 1/1 | 0 | Disabled | $\bullet \cdot$ | $\bullet \cdot$ | $\bullet$ | $\bullet$ | *1 |
| $F 904$ | 0904 | Input function target 13 | Same as F900 | 1/1 | 0 | Disabled | $\bullet$ - | $\bullet \cdot$ | $\bullet$ | $\bullet$ | *1 |
| F985 | 0905 | Output function assigned object 1 | Same as $F 900$ | 1/1 | 0 | Disabled | $\bullet$ - | $\bullet$ - | - | - | *1 |
| $F 906$ | 0906 | Input function target 21 | Same as F900 | 1/1 | 0 | Disabled | $\bullet \cdot$ | $\bullet \cdot$ | $\bullet$ | $\bullet$ | *1 |
| F907 | 0907 | Input function command 22 | Same as F901 | 1/1 | 0 | Disabled | $\bullet \cdot$ | $\bullet \cdot$ | $\bullet$ | $\bullet$ | *1 |
| F908 | 0908 | Input function target 22 | Same as F900 | 1/1 | 0 | Disabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | *1 |
| $F 909$ | 0909 | Input function command 23 | Same as F90i | 1/1 | 0 | Disabled | $\bullet$ - | $\bullet$ - | - | - | *1 |
| F910 | 0910 | Input function target 23 | Same as F900 | 1/1 | 0 | Disabled | $\bullet$ - | $\bullet / \bullet$ | $\bullet$ | $\bullet$ | *1 |
| F91i | 0911 | Output function assigned object $2$ | Same as $F 900$ | 1/1 | 0 | Disabled | $\bullet$ - | $\bullet$ - | - | $\bullet$ | *1 |
| F912 | 0912 | Input function target 31 | Same as F90̆ | 1/1 | 0 | Disabled | $\bullet \cdot$ | $\bullet \cdot$ | $\bullet$ | - | *1 |
| F913 | 0913 | Input function command 32 | Same as F901 | 1/1 | 0 | Disabled | $\bullet \cdot$ | $\bullet \cdot$ | $\bullet$ | $\bullet$ | *1 |
| F914 | 0914 | Input function target 32 | Same as F900 | 1/1 | 0 | Disabled | $\bullet$ - | $\bullet \cdot$ | $\bullet$ | $\bullet$ | *1 |

[^23]| [30] My function [3/5] |  | Sensorless vector/vector with sensor (•:Effective, -:Ineffective) |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Communi |  |  |  |  |  | Vecto | ontrol |  |  |  |
| Title | cation No. | Function | Adjustment range | setting unit (Panel/Communi cation) | Default setting | Write during running | Speed control | Torque control | PM control | VifConstant | Reference |
| F915 | 0915 | Input function command 33 | Same as F90i | 1/1 | 0 | Disabled | $\bullet$ - $\bullet$ | $\bullet$ - | $\bullet$ | $\bullet$ | *1 |
| F915 | 0916 | Input function target 33 | Same as 6900 | 1/1 | 0 | Disabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | *1 |
| F917 | 0917 | Output function assigned object 3 | Same as 7900 | 1/1 | 0 | Disabled | $\bullet$ - | $\bullet$ - | - | - | *1 |
| F918 | 0918 | My output percent data 1 | 0.00~200.0\% | 0.01/0.01 | 0.00 | Enabled | $\bullet$ - | $\bullet$ - | - | - | *1 |
| F919 | 0919 | My output percent data 2 | 0.00~200.0\% | 0.01/0.01 | 0.00 | Enabled | $\bullet \cdot$ | -10 | $\bullet$ | $\bullet$ | *1 |
| $F 929$ | 0920 | My output percent data 3 | 0.00~200.0\% | 0.01/0.01 | 0.00 | Enabled | $\bullet \cdot$ | $\bullet$ - | $\bullet$ | $\bullet$ | *1 |
| $F 921$ | 0921 | My output percent data 4 | 0.00~200.0\% | 0.01/0.01 | 0.00 | Enabled | $\bullet \cdot$ | $\bullet$ - | $\bullet$ | $\bullet$ | *1 |
| $F 922$ | 0922 | My output percent data 5 | 0.00~200.0\% | 0.01/0.01 | 0.00 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | $\bullet$ | $\bullet$ | *1 |
| F923 | 0923 | My output frequency data 1 | $0.0 \sim 500.0 \mathrm{~Hz}$ | 0.1/0.1 | 0.0 | Enabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | *1 |
| $F 924$ | 0924 | My output frequency data 2 | $0.0 \sim 500.0 \mathrm{~Hz}$ | 0.1/0.1 | 0.0 | Enabled | $\bullet \cdot$ | -10 | $\bullet$ | $\bullet$ | *1 |
| F925 | 0925 | My output frequency data 3 | $0.0 \sim 500.0 \mathrm{~Hz}$ | 0.1/0.1 | 0.0 | Enabled | $\bullet$ - | $\bullet \cdot$ | $\bullet$ | $\bullet$ | *1 |
| F926 | 0926 | My output frequency data 4 | $0.0 \sim 500.0 \mathrm{~Hz}$ | 0.1/0.1 | 0.0 | Enabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | *1 |
| F927 | 0927 | My output frequency data 5 | $0.0 \sim 500.0 \mathrm{~Hz}$ | 0.1/0.1 | 0.0 | Enabled | $\bullet \cdot$ | -10 | $\bullet$ | $\bullet$ | *1 |
| $F 928$ | 0928 | My output time data 1 | 0.01~600.0sec | 0.01/0.01 | 0.01 | Enabled | $\bullet \cdot$ | $\bullet$ - | $\bullet$ | $\bullet$ | *1 |
| F929 | 0929 | My output time data 2 | 0.01~600.0sec | 0.01/0.01 | 0.01 | Enabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | *1 |
| F930 | 0930 | My output time data 3 | 0.01~600.0sec | 0.01/0.01 | 0.01 | Enabled | $\bullet \cdot$ | -10 | - | $\bullet$ | *1 |
| F931 | 0931 | My output time data 4 | 0.01~600.0sec | 0.01/0.01 | 0.01 | Enabled | $\bullet$ - | $\bullet$ - | - | $\bullet$ | *1 |
| F932 | 0932 | My output time data 5 | 0.01~600.0sec | 0.01/0.01 | 0.01 | Enabled | $\bullet \cdot$ | $\bullet$ - | $\bullet$ | $\bullet$ | *1 |
| F933 | 0933 | No. of times of My output data 1 | 0~9999 times | 1/1 | 0 | Enabled | $\bullet \cdot$ | -10 | $\bullet$ | $\bullet$ | *1 |
| F934 | 0934 | No. of times of My output data 2 | 0~9999 times | 1/1 | 0 | Enabled | $\bullet / \bullet$ | -1/ | $\bullet$ | $\bullet$ | *1 |
| F935 | 0935 | Input function target 41 | Same as F900 | 1/1 | 0 | Enabled | $\bullet$ - | -10 | $\bullet$ | $\bullet$ | *1 |
| F935 | 0936 | Input function command 42 | Same as 6901 | 1/1 | 0 | Enabled | -10 | $\bullet \cdot$ | $\bullet$ | - | *1 |
| F937 | 0937 | Input function target 42 | Same as 7900 | 1/1 | 0 | Enabled | $\bullet / \bullet$ |  | - | - | *1 |
| $F 938$ | 0938 | Input function command 43 | Same as F90i | 1/1 | 0 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | - | $\bullet$ | *1 |
| $F 939$ | 0939 | Input function target 43 | Same as 7900 | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | *1 |
| F940 | 0940 | Output function assigned object 4 | Same as F900 | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet$ - | - | $\bullet$ | *1 |
| F94i | 0941 | Input function target 51 | Same as F900 | 1/1 | 0 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | $\bullet$ | $\bullet$ | *1 |
| 5942 | 0942 | Input function command 52 | Same as $\% 901$ | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet \cdot$ | - | - | *1 |
| F943 | 0943 | Input function target 52 | Same as 7900 | 1/1 | 0 | Enabled | $\bullet / \bullet$ | $\bullet / \bullet$ | $\bullet$ | $\bullet$ | *1 |
| F944 | 0944 | Input function command 53 | Same as F901 | 1/1 | 0 | Enabled | $\bullet \cdot$ | -1/ | $\bullet$ | $\bullet$ | *1 |
| F945 | 0945 | Input function target 53 | Same as 7900 | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet$ • | - | $\bullet$ | *1 |
| $F 945$ | 0946 | Output function assigned object $5$ | Same as 7900 | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet$ - | - | - | *1 |
| F947 | 0947 | Output function target 61 | Same as F900 | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | *1 |

*1: $\Rightarrow$ For details refer to the Instruction Manual (E6581335) for this parameter.

| [30] My function [4/5] |  |  |  |  |  | Sensorless vector/vector with sensor (•:Effective, -:Ineffective) |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Title | Communi cation No. | Function | Adjustment range |  |  |  | Vector | ontrol |  |  |  |
|  |  |  |  | setting unit (Panel/Communi cation) | Default setting | Write during running | Speed control | Torque control | control | Vficonstant | Reference |
| $F 948$ | 0948 | Input function command 62 | Same as F901 | 1/1 | 0 | Enabled | $\bullet$ •• | $\bullet$ •• | $\bullet$ | $\bullet$ | *1 |
| 6949 | 0949 | Input function target 62 | Same as F900 | 1/1 | 0 | Enabled | $\bullet / \bullet$ | $\bullet \cdot$ | $\bullet$ | $\bullet$ | *1 |
| $F 950$ | 0950 | Input function command 63 | Same as F90i | 1/1 | 0 | Enabled | $\bullet \cdot$ | $\bullet$ - | $\bullet$ | $\bullet$ | *1 |
| F95i | 0951 | Input function target 63 | Same as F900 | 1/1 | 0 | Enabled | $\bullet 1 \cdot$ | $\bullet$ - | $\bullet$ | $\bullet$ | *1 |
| $F 952$ | 0952 | Output function assigned object 6 | Same as $F 900$ | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet$ - | $\bullet$ | - | *1 |
| 16953 | 0953 | Input function target 71 | Same as F900 | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet$ - | $\bullet$ | - | *1 |
| F954 | 0954 | Input function command 72 | Same as F901 | 1/1 | 0 | Enabled | $\bullet / \bullet$ | $\bullet \cdot$ | $\bullet$ | $\bullet$ | *1 |
| F955 | 0955 | Input function target 72 | Same as 780 | 1/1 | 0 | Enabled | -10 | -10 | $\bullet$ | $\bullet$ | *1 |
| F956 | 0956 | Input function command 73 | Same as F90i | 1/1 | 0 | Enabled | $\bullet \cdot$ | $\bullet \cdot$ | $\bullet$ | $\bullet$ | *1 |
| F957 | 0957 | Input function target 73 | Same as F900 | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | *1 |
| $F 958$ | 0958 | Output function assigned object 7 | Same as 7900 | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | *1 |
| $F 959$ | 0959 | Analog input function target 11 | 0:Disabled 1:VI/II 2:RR/S4 3:RX 4:Optional Al1+, Optional AI1- 5:Optional Al2 6:Internal memory1 | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | *1 |
| F96i | 0961 | Analog function assigned object 11 | $0:$ Disabled <br> 1: Acceleration <br> 2: Upper limit frequency ( $\mathrm{i} \mathrm{i}^{\mathrm{L}} \mathrm{L}$ ) <br> 3:Acceleration multiplication factor <br> 4:Deceleration multiplication factor <br> 5: Manual torque boost ( 4 b) <br> 6:OC stall ( $F$ G 5 <br> 7:Thermal protection ( $\llcorner\mathrm{H} \boldsymbol{\mathrm { H }}$ ) <br> 8:Speed loop P gain ( $F 45$ ) <br> 9:Drooping gain ( $F 320)$ <br> 10:PID P gain ( $F 352$ ) | 1/1 | 0 | Disabled | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | *1 |


| [30] My function [5/5] |  |  |  |  |  | Sensorless vector/vector w Vector control |  |  | PM control | VIfCorstant | Reference |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Title |  | Function | Adjustment range | $\qquad$ | Default setting |  |  |  |  |  |  |
|  | cation No. |  |  |  |  | Write during running | Speed control | Torque control |  |  |  |
| F962 | 0962 | Analog input function target 21 | 0:Disabled 1:VI/II 2:RR/S4 3:RX 4:Optional Al1+, Optional AI1- 5:Optional A2 6:Internal memory2 | 1/1 | 0 | Enabled | $\bullet$ - | -/• | - | - | *1 |
| F964 | 0964 | Analog function assigned object 21 | 0~10 | 1/1 | 0 | Disabled | $\bullet$ - | $\bullet$ - | - | - | *1 |
| F955 | 0965 | Monitor output function target 11 | $\begin{aligned} & \text { 2000~2099:FD00~FD99 } \\ & \text { 3000~3099:FE00~FE99 } \end{aligned}$ | 1/1 | 2000 | Enabled | $\bullet$ - | $\bullet$ - | $\bullet$ | - | *1 |
| F965 | 0966 | Monitor output function command 11 | 0:Normal monitor, 1:Max. value, 2:Min. value | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet$ - | - | - | *1 |
| F957 | 0967 | 21 <br> Monitor output function target | $\begin{aligned} & \text { 2000~2099:FD00~FD99 } \\ & \text { 3000~3099:FE00~FE99 } \\ & \hline \end{aligned}$ | 1/1 | 2000 | Enabled | $\bullet$ - | $\bullet$ - | - | - | *1 |
| F958 | 0968 | Monitor output function command 21 | 0:Normal monitor, 1:Max. value, 2:Min. value | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet$ - | - | - | *1 |
| F969 | 0969 | Monitor output function target 31 | $\begin{aligned} & \text { 2000~2099:FD00~FD99 } \\ & \text { 3000~3099:FE00~FE99 } \end{aligned}$ | 1/1 | 2000 | Enabled | $\bullet$ • | $\bullet$ - | - | - | *1 |
| F970 | 0970 | Monitor output function command 31 | $0:$ Normal monitor, 1:Max. value, 2:Min. value | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet$ - | - | - | *1 |
| F97i | 0971 | Monitor output function target 41 | 2000~2099:FD00~FD99 3000~3099:FE00~FE99 | 1/1 | 2000 | Enabled | $\bullet / \bullet$ | $\bullet$ - | - | - | *1 |
| F972 | 0972 | Monitor output function command 41 | 0:Normal monitor, 1:Max. value, 2:Min. value | 1/1 | 0 | Enabled | $\bullet$ - | $\bullet$ - | - | - | *1 |
| $F 973$ | 0973 | Virtual input terminal selection 1 | 0~135*2 | 1/1 | 0 | Disabled | -10 | \% 0 | - | - | *1 |
| F974 | 0974 | Virtual input terminal selection 2 | 0~135*2 | 1/1 | 0 | Disabled | -10 | \% 1 | - | - | *1 |
| F975 | 0975 | Virtual input terminal selection 3 | 0~135 *2 | 1/1 | 0 | Disabled | \% | \% | - | - | *1 |
| F976 | 0976 | Virtual input terminal selection 4 | 0~135*2 | 1/1 | 0 | Disabled | -1. | -10 | - | - | *1 |
| F977 | 0977 | My function selection | 0:Disabled 1:My function + permission signal 2:My function always ON | 1/1 | 0 | Disabled | $\bullet$ - | $\bullet$ - | - | - | *1 |

$\star 1: \Rightarrow$ For details, refer to Instruction Manual (E6581335) specified in Section 6.42. $\quad \star 2$ : $\Rightarrow$ For the adjustment range, see the table on page K-41

| Title | Communi cation No. | Function | Adjustment range | Minimumsetting unit(Panel/Communication) | Default setting | Write during running | Vector control |  | $\begin{gathered} \text { PM } \\ \text { control } \end{gathered}$ | Vifconstant | Reference |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  | Speed control | Torque control |  |  |  |
| F980 | 0980 | Traverse selection | 0:Disabled 1:Enabled | 1/1 | 0 | Disabled | $\bullet \cdot$ | - | - | - | *1 |
| F98 1 | 0981 | Traverse acceleration time | $0.1 \sim 120.0 \mathrm{sec}$. | 0.1/0.1 | 25.0 | Enabled | $\bullet \cdot$ | - | - | - | *1 |
| $F 987$ | 0982 | Traverse deceleration time | $0.1 \sim 120.0 \mathrm{sec}$. | 0.1/0.1 | 25.0 | Enabled | -10 | - | - | - | *1 |
| $F 983$ | 0983 | Traverse step | 0.0~25.0\% | 0.1/0.1 | 10.0 | Enabled | - 1 | - | - | - | *1 |
| $F 984$ | 0984 | Traverse jump step | 0.0~50.0\% | 0.1/0.1 | 10.0 | Enabled | $\bullet \cdot$ | - | - | - | *1 |

[^24]
*1: Status in a trip may not be held depending on selected function. Refer to next page; $\Rightarrow$ [Monitor FM/AM/pulse output function selection].

| [Monitor FM/AM/pulse output function selection (1/3)] |  |  |  |  |  |  | Sensorless vector/vector with sensor •: valid, -: invalid) |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| FM/AM/pulse output |  | Monitor output |  | Function | $\qquad$ | Trip retention | Speed control | Torque control | PM control | V/f | Reference |
| Option No. | $\begin{gathered} \text { Communicati } \\ \text { on No. } \end{gathered}$ | Option No. | $\begin{array}{\|c\|} \hline \text { Communicati } \\ \text { on No. } \end{array}$ |  |  |  |  |  |  |  |  |
| 0 | FD00 | 0 | FE00 | Output frequency | 0.01 Hz | $\bigcirc$ | $\bullet$ • | $\bullet$ - | $\bullet$ | $\bullet$ |  |
| 1 | FD02 | 1 | FE02 | Frequency command value | 0.01 Hz | $\bigcirc$ | $\bullet$ - | - | - | - |  |
| 2 | FD03 | 2 | FE03 | Output current | 0.01\% | $\bigcirc$ | $\bullet$ - | $\bullet$ - | - | - |  |
| 3 | FD04 | 3 | FE04 | Input voltage (DC detection) | 0.01\% | - | $\bullet$ - | $\bullet$ - | - | - |  |
| 4 | FD05 | 4 | FE05 | Output voltage | 0.01\% | - | $\bullet$ - | $\bullet$ - | - | $\bullet$ |  |
| 5 | FD15 | 5 | FE15 | Compensated frequency | 0.01 Hz | $\bigcirc$ | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ |  |
| 6 | FD16 | 6 | FE16 | Speed feedback (real-time value) *1 | 0.01 Hz | $\bigcirc$ | -/0 | -/0 | - | - |  |
| 7 | FD17 | 7 | FE17 | Speed feedback (1-second filter) *1 | 0.01 Hz | $\bigcirc$ | -/0 | -/0 | - | - |  |
| 8 | FD18 | 8 | FE18 | Torque | 0.01\% | $\bigcirc$ | $\bullet$ - | $\bullet$ - | $\bullet$ | -*2 |  |
| 9 | FD19 | 9 | FE19 | Torque command | 0.01\% | - | - | $\bullet$ - | - | - |  |
| 11 | FD20 | 11 | FE20 | Torque current | 0.01\% | $\bigcirc$ | $\bullet / \bullet$ | $\bullet$ - | - | -*2 |  |
| 12 | FD21 | 12 | FE21 | Exciting current | 0.01\% | - | $\bullet$ - | $\bullet$ - | - | -*2 |  |
| 13 | FD22 | 13 | FE22 | PID feedback value | 0.01 Hz | O | $\bullet$ - | - | $\bullet$ | $\bullet$ |  |
| 14 | FD23 | 14 | FE23 | Motor overload factor (OL2 data) | 0.01\% | $\bigcirc$ | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ |  |
| 15 | FD24 | 15 | FE24 | Inverter overload factor (OL1 data) | 0.01\% | - | $\bullet$ - | $\bullet$ - | - | - |  |
| 16 | FD25 | 16 | FE25 | Regenerative braking resistance overload factor (OLr data) | 1\% | $\bigcirc$ | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | 5.16 |
| 17 | FD28 | 17 | FE28 | Regenerative braking resistor load factor (\% ED) | 1\% | $\bigcirc$ | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | $8.3$ |
| 18 | FD29 | 18 | FE29 | Input power | 0.01 kW | - | $\bullet$ • | $\bullet \cdot$ | - | - |  |
| 19 | FD30 | 19 | FE30 | Output power | 0.01 kW | $\bigcirc$ | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ |  |
| 23 | FE39 | 23 | FE39 | Optional AI2 input | 0.01\% | $\times$ | $\bullet$ •吅 | $\bullet$ - | $\bullet$ | $\bullet$ |  |
| 24 | FE35 | 24 | FE35 | RR/S4 input | 0.01\% | $\times$ | $\bullet$ - | $\bullet$ - | - | - |  |
| 25 | FE36 | 25 | FE36 | VI/II input | 0.01\% | $\times$ | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ |  |
| 26 | FE37 | 26 | FE37 | RX input | 0.01\% | $\times$ | $\bullet$ - | $\bullet \cdot$ | $\bullet$ | - |  |
| 27 | FE38 | 27 | FE38 | Optional AI1 input | 0.01\% | $\times$ | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ |  |
| 28 | FE40 | 28 | FE40 | FM output | 0.01 | $\times$ | $\bullet$ • | $\bullet$ - | $\bullet$ | $\bullet$ |  |
| 29 | FE41 | 29 | FE41 | AM output | 0.01 | $\times$ | $\bullet$ - | $\bullet$ - | - | $\bullet$ |  |
| 30 | FE51 | - | - | Fixed output 1 | 0.01\% | $\times$ | $\bullet$ - | $\bullet$ - | - | $\bullet$ |  |
| 31 | FA51 *3 | - | - | Communication data output | 1 | $\times$ | $\bullet$ - | $\bullet$ - | - | $\bullet$ |  |
| 32 | FE50 | - | - | Fixed output 2 | 0.01\% | $\times$ | $\bullet$ - $\bullet$ | $\bullet$ - | $\bullet$ | - |  |
| 33 | FE52 | - | - | Fixed output 3 | 0.01\% | $\times$ | $\bullet$ - | $\bullet / \bullet$ | $\bullet$ | - |  |
| - | - | 32 | FE66 | Attached to expansion I/O card 1 CPU version | - | $\times$ | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ |  |
| - | - | 33 | FE67 | Attached to expansion I/O card 2 CPU version | - | $\times$ | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ |  |

2: Reference data FA51 is used for FM, FA52 for AM, FA53 for MON1 and FA54 for MON2 and pulse output, respectively. 3. For details, refer to Section 5.16; [Terminal FM-related parameters]
$\Rightarrow$ For monitor indications, refer to Section 8.3; [Set up values of monitor indication parameters].
[Monitor FM/AM/pulse output function selection (2/3)]


[^25]$\Rightarrow$ For details, refer to Section 5.16; [Terminal FM-related parameters]
$\Rightarrow$ For monitor indications, refer to Section 8.3; [Set up values of monitor indication parameters].

| [Input terminal function setting (1/2)] |  |  |  |  | Sensorless vector/vector with sensor (•: valid, -: invalid) |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{gathered} \text { Positive } \\ \text { logic } \\ \hline \hline \end{gathered}$ | Negative logic | Function | Speed control | Torque control | PM control | V/f | [ $108=1$ | $F i \hat{S}=1$ | Reference |
| 0 | 1 | No function is assigned | $\bullet$ - | $\bullet$ • | $\bullet$ | $\bullet$ | - | - | 7.2.1 |
| 2 | 3 | F: Forward run command | $\bullet \cdot$ | $\bullet \cdot$ | $\bullet$ | $\bullet$ | $\bullet$ | - |  |
| 4 | 5 | R: Reverse run command | $\bullet \cdot$ | $\bullet \cdot$ | $\bullet$ | $\bullet$ | $\bullet$ | - |  |
| 6 | 7 | ST: Standby | $\bullet$ - | $\bullet$ - | - | $\bullet$ | *1 | - |  |
| 8 | 9 | RES: Reset | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | *2 | - |  |
| 10 | 11 | S1: Preset speed 1 | $\bullet \cdot$ | - | $\bullet$ | $\bullet$ | $\bullet$ | - |  |
| 12 | 13 | S2: Preset speed 2 | -1• | - | $\bullet$ | $\bullet$ | $\bullet$ | - |  |
| 14 | 15 | S3: Preset speed 3 | $\bullet$ - | - | $\bullet$ | $\bullet$ | $\bullet$ | - |  |
| 16 | 17 | S4: Preset speed 4 | $\bullet$ - | - | $\bullet$ | $\bullet$ | $\bullet$ | - |  |
| 18 | 19 | Jog run | $\bullet$ - | - | $\bullet$ | $\bullet$ | $\bullet$ | - |  |
| 20 | 21 | Emergency stop | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | *2 | - |  |
| 22 | 23 | DC braking | $\bullet \cdot$ | - | $\bullet$ | $\bullet$ | - | $\bullet$ |  |
| 24 | 25 | Acceleration/deceleration switching 1 | $\bullet \cdot$ | - | $\bullet$ | $\bullet$ | $\bullet$ | - |  |
| 26 | 27 | Acceleration/deceleration switching 2 | -/ | - | $\bullet$ | $\bullet$ | $\bullet$ | - |  |
| 28 | 29 | V/f switching signal 1 | $\bullet$ - | - | $\bullet$ | $\bullet$ | $\bullet$ | - |  |
| 30 | 31 | V/f switching signal 2 | $\bullet \cdot$ | - | $\bullet$ | $\bullet$ | $\bullet$ | - |  |
| 32 | 33 | Torque limit switching signal 1 | $\bullet \cdot$ | $\bullet$ - | $\bullet$ | - | $\bullet$ | - |  |
| 34 | 35 | Torque limit switching signal 2 | $\bullet \cdot$ | $\bullet / \bullet$ | $\bullet$ | $\bullet$ | $\bullet$ | - |  |
| 36 | 37 | PID control OFF selection | $\bullet \cdot$ | - | $\bullet$ | $\bullet$ | $\bullet$ | - |  |
| 38 | 39 | Pattern operation selection 1 | $\bullet \cdot$ | - | $\bullet$ | $\bullet$ | $\bullet$ | - |  |
| 40 | 41 | Pattern operation selection 2 | $\bullet \cdot$ | - | $\bullet$ | $\bullet$ | $\bullet$ | - |  |
| 42 | 43 | Pattern operation continuation signal | $\bullet \cdot$ | - | $\bullet$ | $\bullet$ | $\bullet$ | - |  |
| 44 | 45 | Pattern operation trigger signal | $\bullet$ - | - | - | - | $\bullet$ | - |  |
| 46 | 47 | External thermal error | $\bullet$ - | - | $\bullet$ | $\bullet$ | $\bullet$ | - |  |
| 48 | 49 | Communication priority cancel | $\bullet \cdot$ | - | $\bullet$ | $\bullet$ | $\bullet$ | - |  |
| 50 | 51 | Holding of HD operation (stop of three-wire operation) | $\bullet$ - | - | $\bullet$ | - | $\bullet$ | - |  |
| 52 | 53 | PID differentiation/integration reset | $\bullet$ - | - | $\bullet$ | $\bullet$ | $\bullet$ | - |  |
| 54 | 55 | PID forward/reverse switching | $\bullet \cdot$ | - | $\bullet$ | $\bullet$ | $\bullet$ | - |  |
| 56 | 57 | Forced continuous operation | $\bullet \cdot$ | - | - | - | - | - |  |
| 58 | 59 | Specified speed operation | $\bullet$ - | - | $\bullet$ | $\bullet$ | $\bullet$ | - |  |
| 60 | 61 | Acceleration/deceleration suspend signal | $\bullet \cdot$ | - | - | - | $\bullet$ | - |  |
| 62 | 63 | Power failure synchronized signal | $\bullet \cdot$ | - | $\bullet$ | $\bullet$ | $\bullet$ | - |  |
| 64 | 65 | My function RUN signal | $\bullet$ - | $\bullet$ •• | $\bullet$ | $\bullet$ | $\bullet$ | - |  |
| 66 | 67 | Auto-tuning signal | $\bullet$ - | - | $\bullet$ | $\bullet$ | $\bullet$ | - |  |
| 68 | 69 | Speed gain switching | $\bullet$ - | - | $\bullet$ | $\bullet$ | - | - |  |


| 68 | 69 |
| :---: | :---: |
| *1: Valid any time |  |

*2: Independent of $\subset \in \overbrace{0}^{\prime}$, and all command are valid.

| [Input terminal function setting (2/2)] |  |  |  |  | Sensorless vector/vector with sensor (e: valid, -: invalid) |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Positive logic | Negative logic | Function | Speed control | Torque control | PM control | V/f | [ $100=1$ | F $606=1$ | Reference |
| 70 | 71 | Servo lock signal | $\bullet$ - | - | $\bullet$ | $\bullet$ | $\bullet$ | - |  |
| 72 | 73 | Simple positioning (positioning loop) | $\bullet$ • | - | - | $\bullet$ | $\bullet$ | - |  |
| 74 | 75 | Integrating wattmeter display clear | $\bullet$ - | - | $\bullet$ | $\bullet$ | $\bullet$ | - |  |
| 76 | 77 | Trace back trigger signal | $\bullet$ - | - | $\bullet$ | $\bullet$ | $\bullet$ | - |  |
| 78 | 79 | Light-load high-speed operation prohibitive signal | $\bullet$ • | - | $\bullet$ | $\bullet$ | $\bullet$ | - |  |
| 86 | 87 | Binary data write | $\bullet$ - | $\bullet$ - | $\bullet$ | - | $\bullet$ | - |  |
| 88 | 89 | Up/Down frequency (up)*1 | -/ | - | $\bullet$ | $\bullet$ | $\bullet$ | - |  |
| 90 | 91 | Up/Down frequency (down)*1 | $\bullet$ - | - | $\bullet$ | $\bullet$ | $\bullet$ | - |  |
| 92 | 93 | Up/Down frequency (clear) | $\bullet$ • | - | $\bullet$ | - | $\bullet$ | - |  |
| 94 | 95 | Dancer Correction OFF | $\bullet$ - | - | $\bullet$ | $\bullet$ | $\bullet$ | - |  |
| 98 | 99 | Forward/reverse selection | -/• | $\bullet$ - | $\bullet$ | $\bullet$ | $\bullet$ | - |  |
| 100 | 101 | Run/Stop command | $\bullet$ - | $\bullet$ - | - | $\bullet$ | $\bullet$ | - | 7.2.1 |
| 102 | 103 | Commercial power/INV switching | -10 | - | $\bullet$ | $\bullet$ | $\bullet$ | - |  |
| 104 | 105 | Frequency reference priority switching | -10 | - | $\bullet$ | $\bullet$ | $\bullet$ | - |  |
| 106 | 107 | VI/II terminal priority | -10 | $\checkmark$ | $\bullet$ | - | $\bullet$ | - |  |
| 108 | 109 | Command terminal board priority | -10 | $\bullet \cdot$ | $\bullet$ | $\bullet$ | $\bullet$ | - |  |
| 110 | 111 | Parameter editing enabling | $\bullet \cdot$ | $\bullet \cdot$ | $\bullet$ | - | - | - |  |
| 112 | 113 | Speed/Torque switching | $\bullet$ - | $\bullet$ - | - | - | *2 | - |  |
| 122 | 123 | Rapidest deceleration command | $\bullet \cdot$ | - | - | - | - | - |  |
| 124 | 125 | Preliminary excitation | $\bullet \cdot$ | $\bullet / \bullet$ | $\bullet$ | $\bullet$ | - | - |  |
| 126 | 127 | Braking request | $\bullet$ - | - | $\bullet$ | - | - | - |  |
| 130 | 131 | Brake answer back input | $\bullet$ - | - | $\bullet$ | - | $\bullet$ | - |  |
| 134 | 135 | Traverse permission signal | $\bullet$ - | - | $\bullet$ | $\bullet$ | $\bullet$ | - |  |

*1: The deceleration/deceleration time depends on the $R[\mathcal{L} / \sigma E L$ setting, unless switching between acceleration and deceleration is performed.


| [Output | , | ion setting (1/3)] | Sensorless vector/vector with sensor (e: valid, -: invalid) |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{array}{\|l} \hline \begin{array}{c} \text { Positive } \\ \text { logic } \end{array} \\ \hline \end{array}$ | Negative logic | Function | Speed control | Torque control | PM control | V/f | Reference |
| 0 | 1 | LL | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ | 7.2.2 |
| 2 | 3 | UL | $\bullet \cdot$ | $\bullet \cdot$ | $\bullet$ | $\bullet$ |  |
| 4 | 5 | LOW | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ |  |
| 6 | 7 | Acceleration/deceleration completion | $\bullet$ - | - | $\bullet$ | $\bullet$ |  |
| 8 | 9 | Specified speed arrival | $\bullet$ • | $\bullet$ - | $\bullet$ | $\bullet$ |  |
| 10 | 11 | Failure FL (all trip) | $\bullet$ - | $\bullet$ • | $\bullet$ | $\bullet$ |  |
| 12 | 13 | Failure FL (except for EF, OCL, EPHO and OL2) | $\bullet$ - | $\bullet \cdot$ | $\bullet$ | $\bullet$ |  |
| 14 | 15 | Overcurrent pre-alarm | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ |  |
| 16 | 17 | Inverter overload pre-alarm | $\bullet \cdot$ | $\bullet \cdot$ | $\bullet$ | $\bullet$ |  |
| 18 | 19 | Motor overload pre-alarm | -/• | $\bullet \cdot$ | $\bullet$ | - |  |
| 20 | 21 | Overheat pre-alarm | $\bullet$ - | $\bullet \cdot$ | $\bullet$ | $\bullet$ |  |
| 22 | 23 | Overvoltage pre-alarm | $\bullet$ • | $\bullet \cdot$ | $\bullet$ | $\bullet$ |  |
| 24 | 25 | Main circuit undervoltage alarm | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ |  |
| 26 | 27 | Low current alarm | $\bullet$ - | $\bullet / \bullet$ | $\bullet$ | $\bullet$ |  |
| 28 | 29 | Overtorque alarm | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ |  |
| 30 | 31 | Braking resistor overload pre-alarm | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ |  |
| 32 | 33 | In emergency stop | $\bullet$ - | $\bullet \cdot$ | $\bullet$ | $\bullet$ |  |
| 34 | 35 | In course of retry | $\bullet$ • | $\bullet$ • | $\bullet$ | $\bullet$ |  |
| 36 | 37 | Pattern operation switching output | $\bullet$ - | - | $\bullet$ | $\bullet$ |  |
| 38 | 39 | PID deviation limit | $\bullet \cdot$ | - | $\bullet$ | $\bullet$ |  |
| 40 | 41 | Run/Stop | $\bullet \cdot$ | $\bullet$ • | $\bullet$ | $\bullet$ |  |
| 42 | 43 | Serious failure (OCA, OCL, EF, phase failure, etc.) | $\bullet \cdot$ | $\bullet \cdot$ | $\bullet$ | $\bullet$ |  |
| 44 | 45 | Light failure (OL, OC1, 2, 3, OP) | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ |  |
| 46 | 47 | Commercial/INV switching output 1 (for inverter operation output) | $\bullet$ - | - | $\bullet$ | $\bullet$ |  |
| 48 | 49 | Commercial/INV switching output 2 (for commercial operation output) | $\bullet$ - | - | $\bullet$ | $\bullet$ |  |
| 50 | 51 | Cooling fan ON/OFF | $\bullet$ - | $\bullet$ - | $\bullet$ | $\bullet$ |  |
| 52 | 53 | In Jog run | $\bullet \cdot$ | - | $\bullet$ | $\bullet$ |  |
| 54 | 55 | Panel operation/terminal board operation switching | $\bullet \cdot$ | $\bullet$ • | - | $\bullet$ |  |
| 56 | 57 | Cumulative operation time alarm | $\bullet \cdot$ | $\bullet \cdot$ | $\bullet$ | $\bullet$ |  |
| 58 | 59 | PROFIBUS/DeviceNet/CC-Link communication error | $\bullet \cdot$ | $\bullet \cdot$ | $\bullet$ | $\bullet$ |  |
| 60 | 61 | Forward/reverse run | $\bullet$ • | $\bullet$ • | - | $\bullet$ |  |
| 62 | 63 | Ready for operation 1 | $\bullet \cdot$ | $\bullet \cdot$ | $\bullet$ | $\bullet$ |  |
| 64 | 65 | Ready for operation 2 | $\bullet \cdot$ | $\bullet$ - | $\bullet$ | $\bullet$ |  |
| 68 | 69 | Braking release signal | $\bullet \cdot$ | - | $\bullet$ | $\bullet$ |  |
| 70 | 71 | In (pre-)alarm status | $\bullet$ - | $\bullet$ • | $\bullet$ | $\bullet$ |  |
| 72 | 73 | Forward speed limit (torque control) | - | $\bullet \cdot$ | - | - |  |
| 74 | 75 | Reverse speed limit (torque control) | - | $\bullet$ - | - | - |  |


| [Output te | rminal fun | ction setting (2/3)] | Sensorless vector/vector with sensor (e: valid, -: invalid) |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{gathered} \text { Positive } \\ \text { logic } \end{gathered}$ | Negative logic | Function | Speed control | Torque control | PM control | V/f | Reference |
| 76 | 77 | Inverter healthy output | $\bullet$ - | $\bullet$ - | - | - | 7.2.2 |
| 78 | 79 | RS485 communication error | -/ | -/ | $\bullet$ | $\bullet$ |  |
| 80 | 81 | Error code output 1 (6-bit output) | \% 10 | -/ | $\bullet$ | $\bullet$ |  |
| 82 | 83 | Error code output 2 (6-bit output) | -10 | -/• | $\bullet$ | $\bullet$ |  |
| 84 | 85 | Error code output 3 (6-bit output) | -10 | -/• | - | $\bullet$ |  |
| 86 | 87 | Error code output 4 (6-bit output) | -10 | -10 | - | $\bullet$ |  |
| 88 | 89 | Error code output 5 (6-bit output) | -10 | -/ | $\bullet$ | $\bullet$ |  |
| 90 | 91 | Error code output 6 (6-bit output) | -10 | -/ | $\bullet$ | $\bullet$ |  |
| 92 | 93 | Designated data output 1 (7-bit output) | -1/ | -/ | $\bullet$ | $\bullet$ |  |
| 94 | 95 | Designated data output 2 (7-bit output) | -1/ | -/ | $\bullet$ | - |  |
| 96 | 97 | Designated data output 3 (7-bit output) | \% 1 | -/ | $\bullet$ | $\bullet$ |  |
| 98 | 99 | Designated data output 4 (7-bit output) | \% | -/0 | $\bullet$ | $\bullet$ |  |
| 100 | 101 | Designated data output 5 (7-bit output) | \% 1 | -10 | - | $\bullet$ |  |
| 102 | 103 | Designated data output 6 (7-bit output) | -10 | \% 0 | - | $\bullet$ |  |
| 104 | 105 | Designated data output 7 (7-bit output) | -10 |  | $\bullet$ | $\bullet$ |  |
| 106 | 107 | Light load signal | -10 | -/- | - | $\bullet$ |  |
| 108 | 109 | Heavy load signal | $\bullet /$ | -1- | $\bullet$ | $\bullet$ |  |
| 110 | 111 | Positive torque limit | -/ | $\bullet$ - | $\bullet$ | $\bullet$ |  |
| 112 | 113 | Negative torque limit | -10 | -/• | - | $\bullet$ |  |
| 114 | 115 | Output for external rush suppression relay | -10 | -10 | $\bullet$ | $\bullet$ |  |
| 118 | 119 | Completion of stop positioning (for simple positioning) | -1- | -1- | - | - |  |
| 120 | 121 | L-STOP | -10 | -/ | - | - |  |
| 122 | 123 | Power failure synchronized operation | -1/ | -/• | $\bullet$ | $\bullet$ |  |
| 124 | 125 | Traverse motion | -10 | -10 | - | - |  |
| 126 | 127 | Traverse deceleration in progress | -/ | -/ | - | $\bullet$ |  |
| 128 | 129 | Part replacement alarm | -10 | -/ | - | $\bullet$ |  |
| 130 | 131 | Overtorque pre-alarm | \% 1 | \%/0 | $\bullet$ | - |  |
| 132 | 133 | Operation frequency command 1/2 selection | -10 | -/ | - | $\bullet$ |  |
| 134 | 135 | Failure FL (except emergency stop) | \% 1 | -/ | - | - |  |
| 164 | 165 | Motor oscillation contro1 (VFA7 Compatibility) | $\bullet$ - | -/- | - | - |  |
| 222 | 223 | My function output 1 | -/ | -/• | - | $\bullet$ |  |
| 224 | 225 | My function output 2 | -/ | -/ | $\bullet$ | $\bullet$ |  |
| 226 | 227 | My function output 3 | -10 | -/ | $\bullet$ | $\bullet$ |  |
| 228 | 229 | My function output 4 | -10 | -/ | $\bullet$ | $\bullet$ |  |
| 230 | 231 | My function output 5 | -10 | -/ | - | $\bullet$ |  |
| 232 | 233 | My function output 6 | -1/ | -/• | $\bullet$ | $\bullet$ |  |
| 234 | 235 | My function output 7 | -10 | -/ | - | - |  |
| 236 | 237 | My function output 8 | -10 | -/ | $\bullet$ | - |  |
| 238 | 239 | My function output 9 | $\bullet /$ | -/ | $\bullet$ | - |  |



## 12. Specifications

### 12.1 Models and their standard specifications

1) Standard specifications (small/medium capacity types)

| Item | Specification |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Voltage class | 200V class |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Applicable motor (kW) | 0.4 | 0.75 | 1.5 | 2.2 | 3.7/4.0 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 | 45 |
| Applicable motor (HP) | 0.5 | 1 | 2 | 3 | 5 | 7.5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 |
| Type | VFAS1- |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Form | 2004PL | 2007PL | 2015PL | 2022PL | 2037PL | 2055PL | 2075PL | 2110PM | 2150PM | 2185PM | 2220PM | 2300PM | 2370PM | 2450PM |
| $\begin{aligned} & \begin{array}{l} \text { Output capacity ( (NA) } \\ \text { [Note 1] } \\ \hline \end{array} \\ & \hline \end{aligned}$ | 1.1 | 1.8 | 3.0 | 4.2 | 6.7 | 10 | 13 | 21 | 25 | 29 | 34 | 46 | 55 | 67 |
| 荢Output current <br> (A) <br> [Note 2] | $\begin{gathered} \hline 3.0 \\ (3.0) \\ \hline \end{gathered}$ | $\begin{gathered} \hline 4.8 \\ (4.5) \\ \hline \end{gathered}$ | $\begin{gathered} \hline 8.0 \\ (8.0) \\ \hline \end{gathered}$ | $\begin{gathered} 11 \\ (10.5) \\ \hline \end{gathered}$ | $\begin{gathered} \hline 17.5 \\ (16.6) \\ \hline \end{gathered}$ | $\begin{gathered} 27.5 \\ (25.0) \\ \hline \end{gathered}$ | $\begin{gathered} 33 \\ (33) \\ \hline \end{gathered}$ | $\begin{gathered} \hline 54 \\ (49) \\ \hline \end{gathered}$ | $\begin{gathered} 66 \\ (64) \\ \hline \end{gathered}$ | $\begin{gathered} 75 \\ (66) \\ \hline \end{gathered}$ | $\begin{gathered} 88 \\ (75) \\ \hline \end{gathered}$ | $\begin{aligned} & 120 \\ & (88) \\ & \hline \end{aligned}$ | $\begin{gathered} \hline 144 \\ (120) \\ \hline \end{gathered}$ | $\begin{array}{c\|} \hline 176 \\ (140) \\ \hline \end{array}$ |
| Output voltage | Three-phase $200 \mathrm{~V} \sim 240 \mathrm{~V}$ (The maximum output voltage is equal to the input supply voltage.) |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Overload current rating | 150\%-1 minute, 165\%-2 sec. |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $$ | Built-in dynamic braking drive circuit |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\begin{array}{\|l\|l\|l\|} \hline \text { 중 } & \text { Dynamic braking } \\ \text { resistor } \\ \hline \end{array}$ | An external braking resistor (optional) $\Rightarrow$ Rating: Refer to 5.19. |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\checkmark 3$ Voltage-frequency | Three-phase 200~240V-50/60Hz [Note 3] |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\begin{array}{\|l\|l} \hline 0< & \text { Allowable } \\ \text { fluctuation } \\ \hline \end{array}$ | Voltage + 10\%-15\% [ Note 4] Frequency $\pm 5 \%$ |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Protective method | IP20 Enclosed type (JEM1030) |  |  |  |  |  |  |  |  | IP00 Open type (JEM1030) [Note 5] |  |  |  |  |
| Cooling method | Forced air-cooled |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Cooling fan noise (dBA) | 43 | 43 | 43 | 55 | 55 | 56 | 58 | 60 | 60 | 60 | 60 | 64 | 64 | 64 |
| Color | RAL7016 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| EMC filter | Built-in |  |  |  |  |  |  | Basic filter (Not complies with the European EMC Directive) |  |  |  |  |  |  |
| DC reactor | External DC reactor (option) |  |  |  |  |  |  | Built-in |  |  |  |  |  |  |


| Item | Specification |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Voltage class | 400 V class |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Applicable motor (kW) | 0.75 | 1.5 | 2.2 | 3.7/4.0 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 | 45 | 55 | 75 |
| Applicable motor (HP) | 1 | 2 | 3 | 5 | 7.5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 75 | 100 |
| Type | VFAS1- |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Form | 4007PL | 4015PL | 4022PL | 4037PL | 4055PL | 4075PL | 4110PL | 4150PL | 4185PL | 4220PL | 4300PL | 4370PL | 4450PL | 4550PL | 4750PL |
| $\therefore \begin{aligned} & \hline \text { Output capacity (NNA) } \\ & \text { [Note 1] } \\ & \hline \end{aligned}$ | 1.8 | 3.1 | 4.4 | 8.0 | 11 | 13 | 21 | 25 | 31 | 37 | 50 | 60 | 72 | 88 | 122 |
|  Output current <br> (A) <br> [Note 2] <br>  Out | $\begin{gathered} \hline 2.3 \\ (2.3) \\ \hline \end{gathered}$ | $\begin{gathered} \hline 4.1 \\ (4.0) \\ \hline \end{gathered}$ | $\begin{gathered} \hline 5.8 \\ (4.6) \\ \hline \end{gathered}$ | $\begin{array}{l\|} \hline 10.5 \\ (8.6) \end{array}$ | $\begin{aligned} & \hline 14.3 \\ & (13) \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 17.6 \\ & (17) \\ & \hline \end{aligned}$ | $\begin{aligned} & 27.7 \\ & (25) \\ & \hline \end{aligned}$ | $\begin{gathered} 33 \\ (32) \\ \hline \end{gathered}$ | $\begin{gathered} 41 \\ (37) \\ \hline \end{gathered}$ | $\begin{gathered} \hline 48 \\ (38) \\ \hline \end{gathered}$ | $\begin{gathered} 66 \\ (53) \\ \hline \end{gathered}$ | $\begin{gathered} 79 \\ (60) \\ \hline \end{gathered}$ | $\begin{gathered} 94 \\ (75) \\ \hline \end{gathered}$ | $\begin{aligned} & \hline 116 \\ & (93) \\ & \hline \end{aligned}$ | $\begin{gathered} \hline 160 \\ (120) \\ \hline \end{gathered}$ |
| Output voltage | Three-phase $380 \mathrm{~V} \sim 480 \mathrm{~V}$ (The maximum output voltage is equal to the input supply voltage.) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Overload current rating | 150\%-1 minute, 165\%-2 sec. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Built-in dynamic braking drive circuit |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\begin{array}{\|l\|l} \text { 들ㄹㄹㄹ } & \text { Dynamic braking } \\ \text { resistor } \\ \hline \end{array}$ | An external braking resistor (optional) <br> $\Rightarrow$ Rating: Refer to 5.19. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $$ | Three-phase 380~480V-50/60Hz [Note 3] |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\begin{array}{\|l\|l} \hline 0 & \begin{array}{l} \text { Allowable } \\ \text { fluctuation } \end{array} \\ \hline \end{array}$ | Voltage + 10\%-15\% [Note 4] Frequency $\pm 5 \%$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Protective method | IP20 Enclosed type (JEM1030) |  |  |  |  |  |  |  |  | IP00 Open type (JEM1030) [Note 5] |  |  |  |  |  |
| Cooling method | Forced air-cooled |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Cooling fan noise (dBA) | 43 | 43 | 43 | 55 | 56 | 56 | 58 | 60 | 60 | 60 | 64 | 64 | 64 | 64 | 64 |
| Color | RAL7016 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| EMC filter | Built-in |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| DC reactor | External DC reactor (option) |  |  |  |  |  |  |  | Built-in |  |  |  |  |  |  |

Note 1: Capacity is calculated at 220 V for the 200 V models and at 440 V for the 400 V models.
Note 2: Rated output current when the PWM carrier frequency (parameter $\mathcal{L} F$ ) is 4 kHz or less.
The values between parentheses refer to rated output currents when set to 12 kHz .
$\Rightarrow$ Refer to 1.4.4 "Current reduction curve" for details.
Note 3: If you are using a $200 \mathrm{~V}-15 \mathrm{~kW}$ or $400 \mathrm{~V}-2.2 \mathrm{~kW}$ inverter and the ambient temperature is $40^{\circ} \mathrm{C}$ or more, decrease the PWM carrier frequency to 8 kHz . Setting $F 5 \boldsymbol{F}$; to $i$ enables you to protect the overload caused by ambient temperature described in page A-23.
An external power supply backup available (optional) (Type: CPS002Z)
Note 4: $\pm 10 \%$ when the inverter is used continuously (load of $100 \%$ ).
Note 5: Models, $200 \mathrm{~V}-18.5 \mathrm{~kW}$ or more and $400 \mathrm{~V}-22 \mathrm{~kW}$ or more, do not have wiring port covers. They have large openings, but there is no space to bend the external cables inside the unit.
2) Standard specifications (large capacity types) [Note 1]


| Item | Specification |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Voltage class | 400 V class |  |  |  |  |  |  |  |  |  |
| Applicable motor (kW) | 90 | 110 | 132 | 160 | 200 | 220 | 280 | 355 | 400 | 500 |
| Applicable motor (HP) | 125 | 150 | 200 | 250 | 300 | 350 | 450 | 550 | 600 | 700 |
| Type | VFAS1- |  |  |  |  |  |  |  |  |  |
| Form | 4900PC | 4110KPC | 4132KPC | 4160KPC | 4200KPC | 4220KPC | 4280KPC | 4355KPC | 4400KPC | 4500KPC |
|  | 136 | 164 | 197 | 239 | 295 | 325 | 419 | 511 | 578 | 717 |
| 荨Output current <br> (A) | 179 | 215 | 259 | 314 | 387 | 427 | 550 | 671 | 759 | 941 |
| Output voltage | Three-phase $380 \mathrm{~V} \sim 480 \mathrm{~V}$ (The maximum output voltage is equal to the input supply voltage.) |  |  |  |  |  |  |  |  |  |
| Overload current rating | 150\%-1 minute, 165\%-2 sec. |  |  |  |  |  |  |  |  |  |
|  | Built-in dynamic braking drive circuit |  |  |  | External dynamic braking circuit (optional) |  |  |  |  |  |
| $\begin{array}{ll} \text { Dynamic braking } \\ \text { resistor } \end{array}$ | An external braking resistor (optional)$\quad \Rightarrow$ Rating: Refer to 5.19 . $\Rightarrow$ Rating: Refer to 5.19. |  |  |  |  |  |  |  |  |  |
| Voltage-frequency $\qquad$ <br> [Note 3] | [Note 6] | Three-phase $380 \sim 440 \mathrm{~V}-50 \mathrm{~Hz}$ <br> Three-phase $380 \sim 480 \mathrm{~V}-60 \mathrm{~Hz}$ |  |  |  |  |  |  |  |  |
| $\bigcirc$ 은 $\begin{aligned} & \text { Allowable } \\ & \text { fluctuation }\end{aligned}$ | Voltage + 10\%-15\% [Note 4] Frequency $\pm 5 \%$ |  |  |  |  |  |  |  |  |  |
| Protective method | IP00 Open type (JEM1030) [Note 5] |  |  |  |  |  |  |  |  |  |
| Cooling method | Forced air-cooled |  |  |  |  |  |  |  |  |  |
| Cooling fan noise (dBA) | 61 | 72 | 73 | 73 | 76 | 76 | 76 | 76 | 76 | 78 |
| Color | RAL7016 |  |  |  |  |  |  |  |  |  |
| EMC filter | Built-in |  |  |  |  |  |  |  |  |  |
| DC reactor | Attached DC reactor |  |  |  |  |  |  |  |  |  |

Note 1: For 200 V - $55 \mathrm{~kW}, 400 \mathrm{~V}$ - 90 kW or larger model, be sure to install DC reactor.
However, this is unnecessary for DC input specifications.
Note 2: Capacity is calculated at 220 V for the 200 V models and at 440 V for the 400 V models.
Note 3: An external power supply backup available (optional) (Type: CSP002Z)
Note 4: $\pm 10 \%$ when the inverter is used continuously (load of $100 \%$ ).
Note 5: Models, $200 \mathrm{~V}-18.5 \mathrm{~kW}$ or more and $400 \mathrm{~V}-22 \mathrm{~kW}$ or more, do not have wiring port covers. They have large openings, but there is no space to bend the external cables inside the unit.
Note 6: Three-phase 380~480V-50/60Hz for 4900PC
3) Common specification

| Item |  | Specification |
| :---: | :---: | :---: |
|  | Control system | Sinusoidal PWM control |
|  | Output voltage adjustment | Main circuit voltage feedback control. (Switchable between automatic adjustment/fix/control off) |
|  | Output frequency range | Setting between 0.01 to 500 Hz . Default max. frequency is set to 0.01 to 60 Hz . Maximum frequency adjustment ( 30 to 500 Hz ) |
|  | Minimum setting steps of frequency | 0.01 Hz : operation panel input ( 60 Hz base), <br> 0.03 Hz : analog input ( 60 Hz base, 11 bit/0 to 10 Vdc ) |
|  | Frequency accuracy | Analog input: $\pm 0.2 \%$ of the maximum output frequency (at $25 \pm 10^{\circ} \mathrm{C}$ ) Digital input: $\pm 0.01 \% \pm 0.022 \mathrm{~Hz}$ of the output frequency |
|  | Voltage/frequency characteristics | V/f constant, square reduction torque control, automatic torque boost, vector calculation control, base frequency adjustment $1,2,3$, and $4(25$ to 500 Hz$)$, V/f 5-point arbitrary setting, torque boost adjustment ( 0 to $30 \%$ ), start frequency adjustment ( 0 to 10 Hz ), stop frequency adjustment ( 0 to 30 Hz ) |
|  | Frequency setting signal | $3 \mathrm{k} \Omega$ potentiometer (possible to connect to 1 to $10 \mathrm{k} \Omega$-rated potentiometer) <br> 0 to 10 Vdc (input impedance $\mathrm{Zin}: 30 \mathrm{k} \Omega$ ) <br> 0 to $\pm 10 \mathrm{Vdc}(\mathrm{Zin}: 22 \mathrm{k} \Omega$ ) <br> 4 to 20mAdc (Zin:242 $)$ |
|  | Terminal board base frequency | The characteristic can be set arbitrarily by two-point setting. Compliant with 6 types of input; analog input (RR, VIIII, RX, AI1, AI2), and pulse input. (*AI1, AI2, pulse input: optional) |
|  | Frequency jump | 3 places. 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 | $200 \mathrm{~V}-45 \mathrm{~kW}$ or less, adjustable between 1.0 to 16 kHz for $400 \mathrm{~V}-75 \mathrm{~kW}$ or less $200 \mathrm{~V}-55 \mathrm{~kW}$ or less, adjustable between 2.5 to 8 kHz for $400 \mathrm{~V}-90 \mathrm{~kW}$ or more |
|  | PID control | Adjustment of proportional gain, integral time, differential time and delay filter |
|  | Torque control | Voltage command input specification: DC 0 to $\pm 10 \mathrm{~V}$ |
|  | Acceleration/deceleration time | 0.01 to 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 to 120 Hz ), braking ( 0 to $100 \%$ ) and braking time ( 0 to 20 sec.). With emergency stop braking function and motor shaft fix control function. |
|  | Forward run/reverse run [Note 1] | With F-CC closed to forward run, with R-CC closed to reverse run, with both closed to reverse run. With ST-CC opened to coast stop. Emergency stop by panel operation or terminal board. |
|  | $\begin{array}{\|l\|} \hline \text { Jog run } \\ {[\text { Note 1] }} \\ \hline \end{array}$ | Jog mode, if selected, allows jog operation from the operation panel Jog run operation by terminal board is possible by setting the parameters. |
|  | Preset speed operation [Note 1] | By changing the combination of open/close between S1, S2, S3, RR/S4-CC, set frequency +15 -speed operation. <br> Selectable between acceleration/deceleration time, torque limit and V/f by set frequency. |
|  | Retry | Capable of restarting after a check of the main circuit elements in case the protective function is activated. Max. 10 times selectable arbitrarily. Waiting time adjustment ( 0 to 10 sec .) |
|  | Soft stall | Automatic load reduction control at overloading. (Default: OFF) |
|  | Cooling fan ON/OFF | The cooling fan will be stopped automatically to assure long life when unnecessary. |
|  | Operation panel key operation ON/OFF control | Key prohibition selectable between STOP key only, MODE key only, etc. All key operations can be prohibited. |
|  | 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 board operation/repeat operation possible. |
|  | Commercial inverter switching | Possible to switch operation by commercial power source 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. |
|  | Drooping 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 | Stall prevention, current limit, overcurrent, overvoltage, short circuit on the load side, ground fault on the load side [Note 5], undervoltage, momentary power failure (15ms 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 dynamic braking resistance, overheat, emergency stop |
|  | Electronic thermal characteristic | Switchable between standard motor/constant torque VF motor, adjustment of overload protection and stall prevention level. |
|  | Reset | Reset by 1a contact closed (or 1b contact opened), or by operation panel. Or power source OFF/ON. This function is also used to save and clear trip records. |

(Continued overleaf)

| (Continued) |  |  |  |
| :---: | :---: | :---: | :---: |
| Item |  |  | Specification |
|  | 4-digit <br> and <br> 7-segme <br> nt LED | Alarms | Stall prevention during operation, overload limit, overload, undervoltage on power source 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 error, EEPROM error, RAM error, ROM error, communication error, (dynamic braking resistor overcurrent/overload), (emergency stop), (undervoltage), (low current), (overtorque), (motor overload), (input phase failure), (output phase failure) <br> The items in the parentheses are selectable. |
|  |  | Monitoring function | Operation frequency, operation frequency command, forward run/reverse run, output current, DC voltage, output voltage, compensated frequency, terminal board input/output information, CPU version, past trip history, cumulative operation time, speed feedback, 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/S4 input, VI/II input, RX input, AI1 input, AI2 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 standard 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 main circuit capacitor charging. |
| Input/output terminal input function |  |  | Possible to select positive logic or negative logic with programmable input/output terminal function menu. <br> [Note 1] [Note 2] <br> (Default setting: positive logic) |
| Sink/source switching |  |  | Possible to switch between minus common (CC) and plus common (P24) for control terminal. (Default setting: minus common (CC)) |
|  | Failure detection signal |  | 1c contact output (250Vac-2A-cos $\Phi=1,250 \mathrm{Vac}-1 \mathrm{~A}-\cos \Phi=0.4,30 \mathrm{Vdc}-1 \mathrm{~A})$ |
|  | Low speed/speed reach signal output [Note 2] |  | Open collector output (24Vdc, max. 50 mA , output impedance: $33 \Omega$ ) |
|  | Upper/lower limit frequency signal output [Note 2] |  | Open collector output ( 24 Vdc , max. 50 mA , output impedance: $33 \Omega$ ) |
|  | Output for frequency <br> meter/ <br> Output for ammeter <br> [Note 3] <br> Puin |  | Analog output. 1mAdc full-scale DC ammeter or $7.5 \mathrm{Vdc}-1 \mathrm{~mA}$ voltmeter |
|  | Pulse train frequency output |  | Open collector output ( 24 Vdc , max. 50 mA ) |
| Communication function |  |  | RS-485 standard 2-channel equipped (connector: modular 8P) CC-Link, DeviceNet and PROFIBUS-DP are optional. |
|  | Use environments |  | Indoor use. Altitude: 3000 m or less (current reduction necessary if 1000 m or more.) Place not exposed to direct sunlight and free of corrosive and explosive gases. |
|  | Ambient temperature |  | -10 to $+60^{\circ} \mathrm{C}$ (Remove the upper cover if $40^{\circ} \mathrm{C}$ or more, max. $60^{\circ} \mathrm{C}$ ) [Note 4] |
|  | Storage temperature |  | -25 to $+70^{\circ} \mathrm{C}$ |
|  | Relative humidity |  | 20 to $93 \%$ (free from condensation) |
|  | Vibration |  | $5.9 \mathrm{~m} / \mathrm{s}^{2}\{0.6 \mathrm{G}\}$ or less (10 to 55 Hz ) (Compliant with JIS C60068-2-6) |

Note 1: 16 contact input terminals (of which 8 are options) are programmable contact input terminals, and they make it possible to arbitrarily select from 136 types of signals.
Note 2: Programmable ON/OFF output terminals make it possible to arbitrarily select from 150 types of signals.
Note 3: Programmable analog output terminals make it possible to arbitrarily select from 55 types of signals.
Note 4: When using inverters where the ambient temperature will rise above $50^{\circ} \mathrm{C}$, remove the upper cover and operate each inverter at a current lower than the rated one.
(200V-55kW or lager and 400V-90kW or larger models dose not need remove the upper cover)
Note 5: This function protects inverters from overcurrent due to output circuit ground fault.

### 12.2 Outside dimensions and weight

- Outside dimensions and weight

| Voltage class | Applicable motor (kW) | Applicable motor (HP) | Inverter type | Dimensions (mm) |  |  |  |  |  |  |  |  | Drawing | Approx. weight (kg) |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | W | H | D | W1 | H1 | W2 | H2 | H3 | H4 |  |  |
| 200 V | 0.4 | 0.5 | VFAS1-2004PL | 130 | 230 | 152 | 114 | 220 | - | - | - | - | A | 3 |
|  | 0.75 | 1 | VFAS1-2007PL |  |  |  |  |  |  |  |  |  |  |  |
|  | 1.5 | 2 | VFAS1-2015PL |  |  |  |  |  |  |  |  |  |  |  |
|  | 2.2 | 3 | VFAS1-2022PL | 155 | 260 | 164 | 138 | 249 | - | - | - | - | B | 4 |
|  | 3.7/4.0 | 5 | VFAS1-2037PL |  |  |  |  |  |  |  |  |  |  |  |
|  | 5.5 | 7.5 | VFAS1-2055PL | 175 | 295 | 164 | 158 | 283 | - | - | - | - | C | 5.5 |
|  | 7.5 | 10 | VFAS1-2075PL | 210 | 295 | 191 | 190 | 283 | - | - | - | - | D | 7.5 |
|  | 11 | 15 | VFAS1-2110PM | 230 | 400 | 191 | 210 | 386 | - | - | - | - | E | 14 |
|  | 15 | 20 | VFAS1-2150PM |  |  |  |  |  |  |  |  |  |  |  |
|  | 18.5 | 25 | VFAS1-2185PM | 240 | 420 | 212 | 206 | 403 | - | - | - | - | F | 21 |
|  | 22 | 30 | VFAS1-2220PM |  |  |  |  |  |  |  |  |  |  |  |
|  | 30 | 40 | VFAS1-2300PM | 320 | 550 | 242 | 280 | 525 | - | - | - | - | H | 41 |
|  | 37 | 50 | VFAS1-2370PM |  |  |  |  |  |  |  |  |  |  |  |
|  | 45 | 60 | VFAS1-2450PM |  |  |  |  |  |  |  |  |  |  |  |
|  | 55 | 75 | VFAS1-2550P | 310 | $\begin{gathered} \hline 680 \\ (920) \end{gathered}$ | 370 | 250 | 650 | 320 | 75 | 150 | 30 | J | $\begin{gathered} \hline 59 \\ (87) \end{gathered}$ |
|  | 75 | 100 | VFAS1-2750P | 350 | $\begin{array}{\|c} \hline 782 \\ (1022) \\ \hline \end{array}$ | 370 | 298 | 758 | 360 | 72 | 150 | 30 | K | $\begin{gathered} 72 \\ (103) \\ \hline \end{gathered}$ |
|  | 0.75 | 1 | VFAS1-4007PL | 130 | 230 | 152 | 114 | 220 | - | - | - | - | A | 3 |
|  | 1.5 | 2 | VFAS1-4015PL |  |  |  |  |  |  |  |  |  |  |  |
|  | 2.2 | 3 | VFAS1-4022PL |  |  |  |  |  |  |  |  |  |  |  |
|  | 3.7/4.0 | 5 | VFAS1-4037PL | 155 | 260 | 164 | 138 | 249 | - | - | - | - | B | 4 |
|  | 5.5 | 7.5 | VFAS1-4055PL | 175 | 295 | 164 | 158 | 283 | - | - | - | - | C | 5.5 |
|  | 7.5 | 10 | VFAS1-4075PL |  |  |  |  |  |  |  |  |  |  |  |
|  | 11 | 15 | VFAS1-4110PL | 210 | 295 | 191 | 190 | 283 | - | - | - | - | D | 8 |
|  | 15 | 20 | VFAS1-4150PL | 230 | 400 | 191 | 210 | 386 | - | - | - | - | E | 13 |
|  | 18.5 | 25 | VFAS1-4185PL |  |  |  |  |  |  |  |  |  |  | 16 |
|  | 22 | 30 | VFAS1-4220PL | 240 | 420 | 212 | 206 | 403 | - | - | - | - | F | 21 |
|  | 30 | 40 | VFAS1-4300PL | 240 | 550 | 242 | 206 | 529 | - | - | - | - | G | 29 |
|  | 37 | 50 | VFAS1-4370PL |  |  |  |  |  |  |  |  |  |  |  |
|  | 45 | 60 | VFAS1-4450PL | 320 | 630 | 290 | 280 | 605 | - | - | - | - | 1 | 48 |
|  | 55 | 75 | VFAS1-4550PL |  |  |  |  |  |  |  |  |  |  |  |
|  | 75 | 100 | VFAS1-4750PL |  |  |  |  |  |  |  |  |  |  |  |
| 400 V | 90 | 125 | VFAS1-4900PC | 310 | $\begin{aligned} & \hline(680 \\ & (920) \end{aligned}$ | 370 | 250 | 650 | 320 | 75 | 150 | 30 | J | $\begin{array}{r} 59 \\ (89) \\ \hline \end{array}$ |
|  | 110 | 150 | VFAS1-4110KPC | 350 | $\begin{array}{\|c} \hline 782 \\ (1022) \\ \hline \end{array}$ | 370 | 298 | 758 | 360 | 72 | 150 | 30 | K | $\begin{gathered} 74 \\ (108) \\ \hline \end{gathered}$ |
|  | 132 | 200 | VFAS1-4132KPC | 330 | $\begin{array}{\|c} \hline 950 \\ (1190) \\ \hline \end{array}$ | 370 | 285 | 920 | 340 | 75 | 150 | 30 | L | $\begin{gathered} \hline 82 \\ (118) \\ \hline \end{gathered}$ |
|  | 160 | 250 | VFAS1-4160KPC | 430 | $\begin{array}{\|c} \hline 950 \\ (1190) \end{array}$ | 370 | 350 | 920 | 440 | 75 | 150 | 30 | M | $\begin{gathered} \hline 104 \\ (161) \\ \hline \end{gathered}$ |
|  | 200 | 300 | VFAS1-4200KPC | 585 | $\left\|\begin{array}{c} 950 \\ (1190) \end{array}\right\|$ | 370 | 540 | 920 | 598 | 75 | 150 | 30 | N | $\begin{gathered} 134 \\ (194) \end{gathered}$ |
|  | 220 | 350 | VFAS1-4220KPC |  |  |  |  |  |  |  |  |  |  | 136 |
|  | 280 | 450 | VFAS1-4280KPC |  |  |  |  |  |  |  |  |  |  |  |
|  | 355 | 550 | VFAS1-4355KPC | 880 | $\begin{array}{\|l\|} \hline 1150 \\ (1390) \end{array}$ | 370 | 418 | 1120 | 890 | 75 | 150 | 30 | 0 | $\begin{gathered} 260 \\ (370) \\ \hline \end{gathered}$ |
|  | 400 | 600 | VFAS1-4400KPC |  |  |  |  |  |  |  |  |  |  |  |
|  | 500 | 700 | VFAS1-4500KPC | 1108 | $\begin{aligned} & \hline 1150 \\ & (1390) \end{aligned}$ | 370 | 533 | 1120 | 1120 | 75 | 150 | 30 | P | $\begin{gathered} \hline 330 \\ (462) \end{gathered}$ |

12

Note: Value in ( ) includes attached DC reactor.

## ■ Outline drawing



Fig. A



Fig. C


Fig. E


Fig. B


Fig.D


Fig. F


Fig. G



Fig. H


12

Fig. J


Fig. K
Fig. L


Fig. M
Fig. N


Fig. O


Fig. $P$

## 13．Before making a service call－Trip information and remedies

## 13．1 Trip causes／warnings and remedies

When a problem arises，diagnose it in accordance with the following table．
If it is found that replacement of parts is required or the problem cannot be solved by any remedy described in the table，contact your supplier．
［Trip information］

| Error code | Description | Possible causes | Remedies |
| :---: | :---: | :---: | :---: |
|  | Overcurrent during acceleration | －The acceleration time RIL is too short． <br> －The V／f setting is improper． <br> －A restart signal is input to the rotating motor after a momentary stop，etc． <br> －A special motor（e．g．motor with a small impedance）is used． <br> －Manual torque boost value（ $\omega$ b）is large． | －Increase the acceleration time RIL． <br> －Check the V／f parameter setting． <br>  power ride－though control）． <br> －Increase the carrier frequency $[F$ ． <br> －Decrease ub setting value． <br> －Decreaser 5 ， （（stall prevention level）to 130 as a guide． <br> －Increase［F（carrier frequency）setting value if it is set at lower value（ 2 kHz or less）． |
| $\therefore \frac{A L}{2} 2$ | Overcurrent during deceleration | －The deceleration time $\sigma E L$ is too short．（in deceleration） | $\bullet$ Increase the deceleration time dEL $^{\prime}$ ． |
|  | Overcurrent during fixed speed | －The load fluctuates abruptly． －The load is in an abnormal condition． | －Reduce the load fluctuation． <br> －Check the load（operated machine）． |
| ［Note］ BE 70 causes o mentione | L $P, A C E P$, originate from ther than those above． | －A main circuit elements is defective． －Overheat protection is activated． | －Make a service call． <br> －Check operation of cooling fan． <br> －Check cooling fan control mode parameter FEZ合． |
| ＊分 2 i | U－phase arm short－circuit | －A main circuit elements is defective （U－phase）． | －Make a service call． |
| ＊¢ ¢ ¢ | V－phase arm short－circuit | －A main circuit elements is defective （V－phase）． | －Make a service call． |
| ＊ 0 ¢ 23 | W－phase arm short－circuit | －A main circuit elements is defective （W－phase）． | －Make a service call． |
| BEL | Loaded side overcurrent at start time | －The insulation of the output main circuit or motor is defective． <br> －The motor has too small impedance． <br> －The drive circuit board in the inverter was damaged． | －Check the cables and wires for defective insulation． <br> －Selection of short circuit detection at starting parameter F $5: 3$ ． <br> －If this error message appears when a motor is not connected to the inverter，the inverter itself may be faulty，so make a service call． |
| 约 | Dynamic braking element overcurrent （200V－55kW or larger， $400 \mathrm{~V}-90 \mathrm{~kW}$ or larger） | －PB－PC／＋circuit is shorted． <br> －A resistor with resistance smaller than the minimum allowable resistance is connected． <br> －Parameter $\boldsymbol{P}$ L was set to $\boldsymbol{i}$ or without connecting regenerative brake or with wire disconnected （with dynamic braking）． | －Check the impedance wiring for the resistor，etc． <br> －Make a service call． <br> －Check if regenerative brake is connected． <br> －If regenerative brake is not necessary，set parameter 9 to 8 ． |
| 8 H | Overheating | －The cooling fan does not rotate． <br> －The ambient temperature is too high． <br> －The vent is blocked up． <br> －A heat generating device is installed close to the inverter． <br> －The thermistor in the unit is disconnected． | －Restart the operation by resetting the inverter after it has cooled down enough． <br> －The fan requires replacement if it does not rotate during operation． <br> －Secure sufficient space around the inverter． <br> －Do not place any heat generating device near the inverter． <br> －Make a service call． |
| 合吅 | Thermal trip stop command from external device | －An input signal is impressed at control input terminal PTG for optional add－on cards． <br> －A thermal trip command（input terminal function： 45 or 47 ）is issued by an external control device． | －The motor is overheated，so check whether the current flowing into the motor exceeds the rated current． |

 circuit component has most probably failed，the only way to reset the inverter is to turn power off and back on． （Continued overleaf）

| （Continued） |  |  |  |
| :---: | :---: | :---: | :---: |
| Error code | Description | Possible causes | Remedies |
| BL | Inverter overload | －Rapid acceleration is operated． <br> －The DC braking amount is too large． <br> －The V／f setting is improper． <br> －A restart signal is input to the rotating motor after a momentary stop，etc． <br> －The load is too large． | －Increase the acceleration time AL L ． <br> －Reduce the DC braking amount $F=5 i$ and the DC braking time $F こ ゙ ら$ ． <br> －Check the V／f parameter setting． <br> －Use íus（Auto－restart）and 说した（Regenerative power ride－though control）． <br> －Use an inverter with a larger rating． |
| 代 2 | Motor overload | －The V／f parameter is improperly set． <br> －The motor is locked up． <br> －Low－speed operation is performed continuously． <br> －An excessive load is applied to the motor during operation． | －Check the V／f parameter setting． <br> －Check the load（operated machine）． <br>  according to the sustainable overload in the motor low－speed range． <br> －Reduce the DC braking amount $F 25 i$ and the DC braking time $-こ$ ここ |
| BL | Dynamic braking resistor overload | －Rapid deceleration is operated． <br> －Dynamic braking is too large． | －Increase the deceleration time $\sigma E L$ ． <br> －Increase the capacity of dynamic braking resistor （wattage）and adjust PBR capacity parameter PLD． |
| 分 | Overvoltage during acceleration | －The input voltage fluctuates abnormally． <br> （1）The power supply has a capacity of 500kVA or more． <br> （2）A power factor improvement capacitor is opened and closed． <br> （3）A system using a thyrister is connected to the same power distribution line． <br> －A restart signal is input to the rotating motor after a momentary stop，etc． | －Insert a suitable input reactor． <br>  power ride－though control）． |
| 分口 | Overvoltage during deceleration | $\cdot$ The deceleration time $\sigma E L$ is too short（regenerative energy is too large）． <br> －The dynamic braking resistor has a considerably large resistance． <br> －$O$ b（Dynamic braking resistor）is OFF． Overvoltage limit operation $F 305$ is OFF． <br> －The input voltage fluctuates abnormally． <br> （1）The power supply has a capacity of 500kVA or more． <br> （2）A power factor improvement capacitor is opened and closed． <br> （3）A system using a thyrister is connected to the same power distribution line． | －Increase the deceleration time $\sigma E L$ ． <br> －Install a dynamic braking resistor． <br> －Decrease dynamic braking resistance．（Also reset the Pbr．） <br> －Set dynamic braking mode parameter $P$ properly． <br> －Set overvoltage limit operation $F 305$ properly． －Insert a suitable input reactor． |
| 893 | Overvoltage during fixed speed operation | －The input voltage fluctuates abnormally． <br> （1）The power supply has a capacity of 500 kVA or more． <br> （2）A power factor improvement capacitor is opened and closed． <br> （3）A system using a thyrister is connected to the same power distribution line． <br> －The motor is in a regenerative state because the load causes the motor to run at a frequency higher than the inverter output frequency． | －Insert a suitable input reactor． <br> －Install a dynamic braking resistor． |
| ＊$\underbrace{\text { a }}$ | Overtorque | －Overtorque reaches to a detection level during operation． <br> －Stall prevention operation was performed continuously for a length of time longer than that set with $F 452$ ． | －Check system error． <br> －Check whether the motor is overloaded or the brake is engaged． |
| ＊！2 | Low current | －The output current decreased to a low－current detection level during operation． | －Check the suitable detection level for the system （F5 i i）． <br> －Make a service call if the setting is correct． |
| ＊吕口 | Voltage drop in main circuit | －The input voltage（in the main circuit）is too low． <br> －Momentary power failure occurs because undervoltage continues longer than undervoltage detection time FEこ日． | －Check the input voltage． <br> －To cope with a momentary stop due to undervoltage，enable $1: \omega \mathrm{L}$（Regenerative power ride－through control），iu 5 （auto－restart control）， and $F 5 \Omega G$（Undervoltage detection time）． |

＊Presence or absence of parameter trip can be selected．
（Continued overleaf）

| （Continu |  |  |  |
| :---: | :---: | :---: | :---: |
| Error code | Description | Possible causes | Remedies |
| $E$ | Emergency stop | －Inverter is stopped by panel operation during automatic or remote operation． <br> －A stop command（input terminal function：$\overline{2} 0$ or 2 ）is issued by an external control device． | －Reset the inverter． |
| EEP： | EEPROM error | －A data writing error occurs． | －Turn off the inverter，then turn it again．If it does not recover from the error，make a service call． |
| $E E P E$ | Initial read error | －Some internal data is corrupted． －Power was turned off while $\llcorner\unlhd 口$ was being set． | －Make a service call． <br> －Set $\llcorner\unlhd \uparrow$ again．If the inverter does not recover from the error，make a service call． |
| EEPJ | Initial read error | －Some internal data is corrupted． | －Make a service call． |
| $E F$ | Ground fault | －A current leaked from an output cable or the motor to ground． | －Check the cable and the motor for ground faults． |
| EPH | Output phase failure | －A phase failure occurred in the output line of the main circuit． | －Check the main circuit output line，motor，etc．for phase failure． <br> －Select output phase failure detection parameter $F 505$ ． |
| EFHi | Input phase failure | －A phase failure occurred in the input line of the main circuit． | －Check the main circuit input line for phase failure． |
| Erre | Main unit RAM fault | －The control RAM is defective． | －Make a service call． |
| Err 3 | Main unit ROM fault | －The control ROM is defective． | －Make a service call． |
| $E r, 4$ | CPU fault | －The control CPU is defective． | －Make a service call． |
| Er， 5 | Interruption of operation command from external control device | －A normal communication was not possible for the time or longer set by $F 803$ ． | －Check the remote control device，cables，etc． |
| Er， 5 | Gate array fault | －Main gate array is defective． | －Make a service call． |
| Err 7 | Output current detector error | －The main output current detector is defective． | －Make a service call． |
| $E r-B$ | Optional unit fault | －An optional device has failed． （such as a communication device ［add－on option］） | －Check the connection of optional board（s）． <br> －Refer to instructions of options concerned specified in Section 6．42． |
| ELヵ | Tuning error | －The capacity of the motor connected is 2 notches or more smaller than the inverter capacity． <br> －The motor connected is not a three－phase inductive motor． <br> －Tuning is performed while the motor is running． | －Make sure that a motor is connected． <br> －Make sure that the motor is at standstill． <br> －Perform auto－tuning 1 again and if the error persists，perform tuning manually． |
| ELn | Tuning detection error | －Some of F4 iñ， F4iこ and F4 J（＊2）were not to be detected during auto tuning． <br> －The capacity of the motor connected is 2 notches or more smaller than the inverter capacity． <br> －The motor connected is not a three－phase inductive motor． <br> －Tuning is performed while no motor is connected． <br> －The cables connecting the inverter to the motor are too long；they are more than 30 m in length． <br> －Tuning is performed while the motor is running． | －Make sure that a motor is connected． <br> －Make sure that the motor is at standstill． <br> －Perform auto－tuning 1 again and if the error persists，perform tuning manually． |
| ELのこ | Motor constant value error | －Some detection values of F4in，F4it（＊2），F4i己 and F4： 3 （＊2）were beyond the limits of normal value． <br> －The capacity of the motor connected is 2 notches or more smaller than the inverter capacity． <br> －The motor connected is not a three－phase inductive motor． <br> －The cables connecting the inverter to the motor are too long；they are more than 30 m in length． <br> －Tuning is performed while the motor is running． | －Make sure that the motor is at standstill． －Perform auto－tuning 1 again and if the error persists，perform tuning manually． |

＊Presence or absence of parameter trip can be selected．
（Continued overleaf）

| （Continued） |  |  |  |
| :---: | :---: | :---: | :---: |
| Error code | Description | Possible causes | Remedies |
| $\operatorname{Eta3}$ | Motor constant setting error | Some items indicated on the motor nameplate are not entered correctly． <br> －Base frequency if <br> －Base frequency voltage 1 Li $u$ <br> －Motor rated capacity $F 405$ <br> －Motor rated current $F 406$ <br> －Motor rated speed $F 407$ | －Make sure that all items on the motor nameplate are entered correctly． |
| ELSP | Inverter type error | －Is circuit board（or main circuit／drive circuit board） replaced？ | －When board has been replaced，input $\bar{\sigma}$ for ヒyロ． |
| $E-10$ | Analog input terminal overvoltage | －Overrated voltage is applied to analog input． | －Apply voltage within the rated voltage． |
| $E-1 ;$ | Sequence error | －The signal from system is not inputted into input terminals． <br> －The input terminal function（ $i 30$ ， （ $3 i$ ）is not set up． <br> －A value other than 0.0 is specified for $F 530$ ，although the brake answer function is not used． | －Please check if the sequence is normal or not． <br> －Please set 130 or 13 as the input terminal to use． <br> －Please set up 0.0 ，when you do not use system－supporting sequence． |
| $E-12$ | Encoder error | －Disconnection of encoder circuit． <br> －The encoder is not connected correctly． | －Check connection of encoder． Connect encoder correctly． <br> －Check whether the setting of $F 375$ matches the phase－A and phase－B connections of the encoder． |
| E－13 | Speed error （Over speed） | －Speed error（Inverter error， Encoder error） <br> －Over speed by overvoltage limit operation <br> －Using braking function in not connect a motor |  <br> －Check connection of encoder． <br> －In the case of overvoltage limit operation，install a dynamic braking resistor． <br> －Operation in connect a motor． |
| $E-18$ | Terminal input error | －Braking down of a wire for VI／II input signal． <br> －Terminal circuit board comes off and falls <br> －P24 overcurrent | －Check VIIII input signal． <br> －Install the control terminal board to the inverter． <br> －Check P24 terminal short circuit to CC or CCA． |
| $E-19$ | Abnormal CPU2 communication | －An error arises during CPU2 communication． | －Make a service call． |
| $E-20$ | V／f control error | －Output voltage／Output frequency ratio is too high compared to motor rating． <br> －It was run in vector control mode $(P L=2,3,4,7$ or 8$)$ without setting parameters（Auto－tuning） concerning the motor． <br> －Motor was in over－excitation state during deceleration． <br> －Motor constant 1 （Torque boost） $F 4 i 0$ is too large． <br> －Motor was started under the brake closed． | －Set Base frequency voltage $1 \boldsymbol{u} u$ and Base frequency $u \mathrm{~L}$ in accordance with motor rating． <br> －When operating a motor in V／f control mode selection $P L=Z, \Xi, 4,7$ or 8 ，follow section 6．22， and then set the parameters（Auto－tuning） concerning the motor． <br> －If the inverter is tripped during deceleration because of V／f control error $(\bar{E}-\Sigma \bar{G})$ when $F 305$（Over voltage limit operation）is set to 2 or 3，decrease the value for $F 3 i 9$（Regenerative over－excitation upper limit）．． <br> －If the inverter is tripped during low frequency， decrease the value for 5410 ． <br> －If the inverter is tripped during braking，make the brake release timing early． |
| $E-\Sigma ;$ | CPU1 fault | －A software error occurs in the control CPU． | －Make a service call． |
| $E-こ こ$ | Abnormal logic input voltage | －An abnormal voltage is applied to the control logic input terminal． | －Check the signal given to the logic connected with the input terminal． |
| $E-23$ | Option 1 error | －Option card 1 is defective． （Installed option at lower side） | －Make a service call． |
| $E-24$ | Option 2 error | －Option card 2 is defective． （Installed option at upper side） | －Make a service call． |
| $E-25$ | Stop position retaining error | －A deviation error occurs during stop position retaining control． <br> －The stop position adjustment range specified with $F \exists B ;$ is too narrow． <br> －Creeping speed is too fast． | －Check connection of encoder． <br> －Adjust the proportional P gain $\digamma 352$ ． －Increase $F=38$ t． <br> －Lower the creeping speed． |

[^26]| （Continued） |  |  |  |
| :---: | :---: | :---: | :---: |
| E－2 5 | Internal circuit error | －Motor control CPU is defective． <br> －The drive circuit board in the inverter was damaged． <br> －Power device is defective． <br> －Using braking function in not $P L=Z, 3,4,7,8$ mode | －Make a service call． <br> －If the braking function is used，operate a motor in $\boldsymbol{P} L=\Xi, \exists, 4,7, B$ mode |
| E－29 | Control power backup undervoltage error | －The control voltage between＋SU and CC terminals is too low． <br> －Control power is not supplied through＋SU and CC terminals． <br> －The parameter F 547 is not set correctly． | －Check whether the voltage between＋SU and CC terminals is DC20V or more． <br> －Set F 547 to 0 if a control power backup device is not connected to +SU and CC terminals． <br> To reset the inverter that has been tripped because of this error，turn it off and then back on． |
|  | Step－out（for PM motors only） | －The motor shaft is locked． －One output phase is open． <br> －An impact load is applied． | －Unlock the motor shaft． <br> －Check the interconnect cables between the inverter and the motor． |

Note：Please contact us if you find any trips other than the above．
［Alarm］The following are messages only．No trip is developed．

| Error code | Problem | Possible causes | Remedies |
| :---: | :---: | :---: | :---: |
| 㫙F | ST signal OFF | －ST terminal is in open－circuit． | －Check SW1 select <br> －Close ST－CC circuit（Sink logic） <br> －Close ST－P24／PLC circuit（Source logic） |
| EAFF | Control power backup undervoltage | －The control voltage between＋SU and CC terminals is too low． <br> －Control power is not supplied through +SU and CC terminals． <br> －The parameter 5547 is not set correctly． | $\cdot$ Check whether the voltage between＋SU and CC terminals is DC2OV or more． <br> －Set $F 547$ to 8 if a control power backup device is not connected to +SU and CC terminals． In the event of a be reset automatically even if the control voltage between＋SU and CC terminals returns to its normal level．To reset the inverter，turn it off and then back it on． |
| 90FF | Undervoltage in main circuit | －The supply voltage between R，S and T is under voltage． <br> －Trouble of rush current restraint circuit or DC circuit fuse． | －Measure the main circuit supply voltage． If the voltage is at a normal level，the inverter requires repairing． <br> －Make a service call． |
| ーヒrコ | Retry | －The inverter is in the process of retry． <br> －A momentary stop occurred． | －The inverter is normal if it restarts after several tens of seconds．The inverter restarts automatically．Be careful of the machine because it may suddenly restart． |
| Erri | Point setting alarm | －The frequency setting signals at points 1 and 2 are set too close to each other． | －Set the frequency setting signals at points 1 and 2 apart from each other． |
| E－i 7 | Key failure alarm | －The same key is input continuously more than 20 seconds． | $\bullet$ Check the operation panel． |
| ELr | Clear enabling indication | －This message is displayed when pressing the STOP key while an error code is displayed． <br> －Input terminal RES signal is ON during trip display． | －Press the STOP key again to clear the trip． <br> －Turn off the input terminal RES signal． |
| ESFF | Emergency stop enabling indication | －The operation panel is used to stop the operation in automatic control or remote control mode． | －Press the STOP key for an emergency stop．To cancel the emergency stop，press any other key． |
| H \％ 12 | Setting error alarm An error code and data are displayed alternately twice each． | －An error is found in a setting when data is reading or writing． | $\bullet$ Check whether the setting is made correctly． |
| db | DC braking | －DC braking in process | －The message goes off in several tens of seconds if no problem occurs．［Note］ |
| －68\％ | Shaft fixing in control | －Motor shaft fixing control is in process． | －If the message disappears by stop command （ST－CC open），it is normal． |
| $\begin{aligned} & E \\ & E \\ & E \\ & Z \end{aligned}$ | Panel indication overflow | －The digit number of the item displayed，e．g．，frequency，is in excess of the specified digit number． <br> （Number of overflowing digits is indicated．） | －For indication of frequency，set multiplying rate （F7日己）lower．（Parameter setting that results in overflow is of course valid．） |

（Continued overleaf）


Note: In the case of DC injection breaking ON/OFF function is selected for an input terminal; if " $\sigma$ ' $\quad$ " disappears as a result of open-circuit between the terminal and CC , it is normal.
[Pre-alarm display]

| Error code | Description | Possible causes | Remedies |
| :---: | :---: | :---: | :---: |
| $\underline{L}$ | Overcurrent pre-alarm |  | Same as Mí (Overcurrent) |
| $\rho$ | Overvoltage pre-alarm Achieving PBR operation level | Same as $\square_{0}^{P}$ (Overvoltage) $P$ blink while PBR is operating is not an error. | Same as $\overbrace{0}^{P}$ (Overvoltage) $P$ blink while PBR is operating is not an error. |
| 1 | Overload pre-alarm | Same as $\bar{\square} \mathrm{L}$ i and $\bar{\square} L \underline{Z}$ (Overload) |  |
| H | Overheat pre-alarm | Same as | Same as $\bar{\square} \boldsymbol{H}$ (Overheat) |
| $t$ | Communication error | -Various transmission errors occur when computer is linked up with inverter system. <br> - Various transmission errors occur in inverter to inverter communication (slave side). Time-out or trip in master side. | -For measures to correct various kinds of data transmission errors, refer to the instruction manual for the communications device used specified in Section 6.42. <br> -Check the master inverter. |

If two or more problems arise simultaneously, one of the following alarms appears and blinks.
FP, PL, LH, FPL, , F., IPLH
The blinking alarms $\mathscr{L}, \boldsymbol{P}, L, H, L$ are displayed in this order from left to right.

### 13.2 Method of resetting causes of trip

Do not reset the inverter when tripped because of a failure or error before eliminating the cause. Resetting the tripped inverter before eliminating the problem causes it to trip again.

For recovering inverter from trip status,
(1) By turning off the power (Keep the inverter off until the LED turns off.) $\Rightarrow$ Refer to Section 6.33 .2 (inverter trip retention selection $F 560^{2}$ ) for details.
(2) By means of an external signal (shorting RES and CC on control terminal board $\rightarrow$ release)
(3) By operation panel operation
(4) By means of a communication
$\Rightarrow$ For details, refer to the instruction manual for the communications device used
specified in section 6.41.

## reset it in one of the following ways.

To reset the inverter by operation panel operation, follow these steps.

1. Check whether the LED on the control panel indicates that tripping has occurred. If the occurrence of tripping is not indicated, press the MODE key to display it.
2. Press the STOP key and make sure that $[\underline{L}$; is displayed.
3. Pressing the STOP key again will reset the inverter if the cause of the trip has already been eliminated.
 overload] is active, the inverter cannot be reset by inputting a reset signal from an external device or by operation panel operation before the virtual cooling time has passed.

Standard virtual cooling time ... In case of 0 L : $:$ for about 30 seconds after trip In case of $0 \mathrm{~L} Z$ : for about 120 seconds after trip In case of 0 LL, : for about 20 seconds after trip

Note: $O L$ i or $O L Z$ can be reset during virtual cooling time if the CPU1 version is Ver. 106 or successor. However, note that the inverter is in a state easy to trip during virtual cooling time.

If the inverter trips because of overheat ( O H ), reset it after a considerably long time enough for cooling it down completely, because overheat is detected based on its internal temperature.

- Caution -

For quickly recovering inverter from trip status, turn it off once and reset it. However, this measure is taken frequently, it may cause damage to the motor and other component units.

### 13.3 If the motor does not run while no trip message is displayed...

If the motor does not run while no trip message is displayed, follow these steps to track down the cause.



Determine the cause, using the parameter display function and the status monitoring function. $\Rightarrow$ Refer to Section 11 for the parameter display function or Section 8 for the status motoring function.

### 13.4 How to check other troubles

The following table provides a listing of other troubles, their possible causes and remedies.

| Troubles | Causes and remedies |
| :---: | :---: |
| The motor runs in the wrong direction. | -Invert the phases of the output terminals $\mathrm{U}, \mathrm{V}$ and W . <br> -Invert the forward/reverse run signal terminals of the external input device. $\Rightarrow$ Refer to Section 7.2, Assignment of functions to control terminals. |
| The motor runs but its speed does not change normally. | -The load is too heavy. <br> -Reduce the load. <br> - Soft stall function is activated. <br> Switch off soft stall function. $\Rightarrow$ Refer to Section 5.14. <br> -The maximum frequency $F H$ and the upper limit frequency $\mathrm{i}_{\mathrm{i}} \mathrm{L}$ are set too low. Increase the maximum frequency $F H$ and the upper limit frequency $\quad \mathrm{U} \mathrm{L}$. <br> -The frequency setting signal is too low. <br> Check the signal set value, circuit, cables, etc. <br> -Check the setting characteristics (point 1 and point 2 settings) of the frequency setting signal parameters. $\Rightarrow$ Refer to Section 7.3. <br> -The base frequency voltage $1 u \mathrm{~L} u$ is too low. <br> -If the motor runs at a low speed, check to see that the stall prevention function is activated because the torque boost amount is too large. <br> Adjust the torque boost amount ( $\omega b$ ) and the acceleration time ( $B[\mathcal{L}$ ). <br> $\Rightarrow$ Refer to Section 5.7 and 5.2. |
| The motor does not accelerate or decelerate smoothly. | -The acceleration time ( $B[C$ ) or the deceleration time ( $\sigma E[$ ) is set too short. Increase the acceleration time ( $B E[$ ) or the deceleration time ( $\sigma E L$ ). |
| A too large current flows into the motor. | -The load is too heavy. <br> Reduce the load. <br> -If the motor runs at a low speed, check whether the torque boost amount is too large. $\Rightarrow$ Refer to Section 5.7. |
| The motor runs at a higher or lower speed than the specified one. | -The motor has improper voltage rating. <br> Use a motor with a proper voltage rating. <br> -The motor terminal voltage is too low. <br> Check the setting of the base frequency voltage parameter ( $\omega \mathrm{L} u$ ). <br> $\Rightarrow$ Refer to Section 5.8. <br> Change the cable for thicker one. <br> -The reduction gear ratio, etc., is not set properly. <br> Adjust the reduction gear ratio, etc. <br> -The output frequency is not set correctly. <br> Check the output frequency range. <br> -Adjust the base frequency. $\Rightarrow$ Refer to Section 5.8. |
| The motor speed varies during operation. | -The load is too heavy or too light. <br> Reduce the load fluctuation. <br> -The inverter or motor used does not have a rating large enough to drive the load. Use an inverter or motor with a rating large enough. <br> -Check whether the frequency setting signal changes. <br> -If the V/f control selection parameter $P L$ is set at $\Xi$ or larger $(5$ and $\Sigma$ are removed.), check the vector control setting, operation conditions, etc. $\Rightarrow$ Refer to Section 5.6. |
| Some or all of seven keys on operation panel don't work. | -Change panel operation prohibition parameter F730~F737. <br> * Parameter is occasionally set for key operation prohibition mode. Cancel key |
| Access to parameter results in failure. | operation prohibition mode according to the following procedure. <br> To cancel the setting, press and hold down the ENTER key for 5 seconds or more. |
| Parameter settings cannot be changed. | (1)If parameter write protect selection parameter $F 70 \Omega$ is set at $i$ (prohibited), |
| Monitor (Display) is uncontrollable. | (2)If there is an input terminal that is set for itic (or iti) (parameter editing enabling ) by input terminal function parameter, turn on the terminal. |

How to cope with parameter setting-related problems

| If you forget parameters <br> which have been reset | $\bullet$ You can search for all reset parameters and change their settings. <br> $\Rightarrow$ Refer to Section 5.21 for details. |
| :--- | :--- |
| If you want to return all <br> reset parameters to their <br> respective default settings | $\bullet$ You can return all parameters which have been reset to their default settings. <br> $\Rightarrow$ Refer to Section 5.20 for details. |

## 14. Inspection and maintenance



- The equipment must be inspected every day. If the equipment is not inspected and maintained, errors and malfunctions may not be discovered which could lead to accidents.
- Before inspection, perform the following steps.
(1) Shut off all input power to the inverter.
(2) Wait at least 15 minutes and check to make sure that the charge lamp is no longer lit.
(3) Use a tester that can measure DC voltages ( 800 V DC or more), and check that the voltage to the DC main circuits (between PA/+ and PC/-) does not exceed 45 V .
Performing an inspection without carrying out these steps first could lead to electric shock.
Be sure to inspect the inverter regularly and periodically to prevent it from breaking down because of the environment of use, such as temperature, humidity, dust and vibration, or deterioration of its components with aging.


### 14.1 Regular inspection

Electronic parts are easily affected by heat. Install the Inverter in a cool, well-ventilated, dust-free area for achieving the original performance for a prolonged amount of time in demonstrate its original performance for a long time. The purpose of regular inspections is to maintain the correct environment of use and to find any sign of failure or malfunction by comparing current operation data with past operation records.

| Subject of inspection | Inspection procedure |  |  | Criteria for judgment |
| :---: | :---: | :---: | :---: | :---: |
|  | Inspection item | Inspection cycle | Inspection method |  |
| 1.Indoor environment | 1) Dust, temperature and gas <br> 2) Drooping of water and other liquid <br> 3) Room temperature | Occasionally <br> Occasionally <br> Occasionally | 1) Visual check, check by means of a thermometer, smell check <br> 2) Visual check <br> 3) Check by means of a thermometer | 1) Improve bad points. <br> 2) Check for any trace of water condensation. <br> 3) Max. temperature: $60^{\circ} \mathrm{C}$ |
| 2.Component parts and units | 1) Vibration and noise | Occasionally | Tactile check of the cabinet | Is something unusual is found, open the door and check the transformer, reactors, contactors, relays, cooling fan, etc., inside. If necessary, stop the operation. |
| 3.Operation data (output side) | 1) Load current <br> 2) Voltage (*) | Occasionally Occasionally | Moving-iron type AC ammeter Rectifier type AC voltmeter | To be within the rated current, voltage and temperature. <br> No significant difference from data collected in a normal state. |

*: The voltage measured may slightly vary from voltmeter to voltmeter. When measuring the voltage, always take readings from the same circuit tester or voltmeter.

## Check points

1. Something unusual in the installation environment
2. Something unusual in the cooling system
3. Unusual vibration or noise
4. Overheating or discoloration
5. Unusual odor
6. Unusual motor vibration, noise or overheating
7. Adhesion or accumulation of foreign substances (conductive substances)

## Cautions about cleaning

To clean the inverter, wipe dirt off only its surface with a soft cloth but do not try to remove dirt or stains from any other part. If stubborn stains persist, remove them by wiping gently with a cloth dampened with neutral detergent or ethanol.
Never use any of the chemicals in the table below; the use of any of them may damage or peel the coating away from molded parts (such as plastic covers and units) of the inverter.

| Acetone | Ethylene chloride | Tetrachloroethane |
| :--- | :--- | :--- |
| Benzen | Ethyl acetate | Trichloroethylene |
| Chloroform | Glycerin | Xylene |

### 14.2 Periodical inspection

Make a periodical inspection at intervals of 3 or 6 months depending on the operating conditions.

|  | Before inspection, perform the following steps. <br> (1) Shut off all input power to the inverter. <br> (2) Wait at least 15 minutes and check to make sure that the charge lamp is no longer lit. <br> (3) Use a tester that can measure DC voltages (800VDC or more), and check that the voltage to the DC <br> main circuits (between PA/+ and PC/-) does not exceed 45V. <br> Performing an inspection without carrying out these steps first could lead to electric shock. |
| :--- | :--- |
| Mandatory |  |
| This could be a cause of electric shock, fire and bodily injury. To replace parts, call the local sales agency. |  |
| Prohibited |  |

## Check items

1. Check to see if all screwed terminals are tightened firmly. If any screw is found loose, tighten it again with a screwdriver.
2. Check to see if all caulked terminals are fixed properly. Check them visually to see that there is no trace of overheating around any of them.
3. Check all cables and wires for damage. Check them visually.
4. Clean up dust and soil. With a vacuum cleaner, remove dirt and dust. When cleaning, clean the vents and the printed circuit boards. Always keep them clean to prevent a damage due to dirt or dust.
5. If no power is supplied to the inverter for a long time, the performance of its large-capacity electrolytic capacitor declines. When leaving the inverter unused for a long time, supply it with electricity once every two years, for 5 hours or more each, to check the operation of the inverter. Supply electricity for at least 5 hours with the motor disconnected. It is advisable not to supply the commercial power directly to the inverter but to gradually increase the power supply voltage with a transformer.
6. If insulation test is needed, conduct it for the main circuit terminal board using a 500 V insulation resistance tester only. Never conduct an insulation test on control terminals other than terminals on the printed circuit board or on control terminals. When testing the motor for insulation performance, separate it from the inverter in advance by disconnecting the cables from the inverter output terminals $\mathrm{U}, \mathrm{V}$ and W . When conducting an insulation test on peripheral circuits other than the motor circuit, disconnect all cables from the inverter so that no voltage is applied to the inverter during the test.

Note: Before an insulation test, always disconnect all cables from the main circuit terminal board and test the inverter separately from other equipment.

7. Never test the inverter for pressure. A pressure test may cause damage to its components.
8. Voltage and temperature check

Recommended voltmeter Input side ... Moving-iron type voltmeter ( )
Output side ... Rectifier type voltmeter (
It will be very helpful for detecting a defect if you always measure and record the ambient temperature before, during and after the operation.

## Replacement of expendable parts

The inverter is composed of a large number of electronic parts including semiconductor devices. The following parts deteriorate with the passage of time because of their composition or physical properties. The use of aged or deteriorated parts leads to degradation in the performance or a breakdown of the inverter. To avoid such trouble, the inverter should be checked periodically.

Note: Generally, the life of a part depends on the ambient temperature and the conditions of use. The life spans listed below are applicable to parts when used under normal environmental conditions.

## 1) Cooling fan

The fan, which cools down heat-generating parts, has a service life of about 30,000 hours (about 7 years) (average ambient temperature: $40^{\circ} \mathrm{C}$, operation time: 12 hours per day). The fan also needs to be replaced if it makes a noise or vibrates abnormally.
Remove the portion $A$ and then portion $B$ in the following figure to remove the cooling fan.

2) Smoothing capacitor

The smoothing aluminum electrolytic capacitor in the main circuit DC section degrades in performance because of ripple currents, etc. The smoothing aluminum electrolytic capacitor in the main circuit DC section degrades in performance because of ripple currents, etc. It becomes necessary to replace the capacitor after it is used for about 5 years under normal conditions (average ambient temperature: $40^{\circ} \mathrm{C}$, load factor: not more than $80 \%$, operation time: 12 hours per day). For the inverter that applicable motor output is $15 \mathrm{~kW}(200 \mathrm{~V})-18.5 \mathrm{~kW}(400 \mathrm{~V})$ or less, replace the capacitor together with the printed circuit board.
<Criteria for appearance check>

- Absence of liquid leak
- Safety valve in the depressed position
- Measurement of electrostatic capacitance and insulation resistance

Note: When it becomes necessary to replace expendable parts, contact your supplier. For safety's sake, never replace any part on your own.

By checking the cumulative operating time and the part replacement alarm information, you can get a rough idea of when each part should be replaced. For the replacement of parts, contact the service network or your supplier. (Operation hours can be known by alarm output, if it is set. For more details, refer to Section 6.33.12.)

## - Standard replacement cycles of principal parts

The table below provides a listing of the replacement cycles of parts when used under normal conditions (average ambient temperature: $40^{\circ} \mathrm{C}$, load factor: not more than $80 \%$, operation time: 12 hours per day). The replacement cycle of each part does not mean its service life but the number of years over which its failure rate does not increase significantly.

| Part name |  | Standard replacement cycle | Replacement mode and others |
| :--- | :--- | :---: | :--- |
| Cooling fan | $(200 \mathrm{~V} / 55 \mathrm{~kW}$ models and <br> $400 \mathrm{~V} / 90 \mathrm{~kW}$ models or smaller) | 5 years | Replacement with a new one |
|  | $(200 \mathrm{~V} / 75 \mathrm{~kW}$ models and <br> $400 \mathrm{~V} / 110 \mathrm{~kW}$ models or larger) | 5 years (Inside air cooling fan) | Replacement with a new one <br> Smoothing capacitor 0 years (Outside air cooling fan) |

Note: The life of a part greatly varies depending on the environment of use. Do not install in any location where there are large amounts of dust, metallic fragments and oil mist.

### 14.3 Making a call for servicing

For the Toshiba service network, refer to the back cover of this instruction manual. If defective conditions are encountered, please contact the Toshiba service section in charge via your Toshiba dealer.
When making a call for servicing, please inform us of the contents of the rating label on the right panel of the inverter, the presence or absence of optional devices, etc., in addition to the details of the failure.

### 14.4 Keeping the inverter in storage

Take the following precautions when keeping the inverter in storage temporarily or for a long period of time.

1. Store the inverter in a well-ventilated place away from heat, damp, dust and metal powder.
(storage temperature:- $25 \sim+70^{\circ} \mathrm{C}$ )
2. If no power is supplied to the inverter for a long time, the performance of its large-capacity electrolytic capacitor declines.
When leaving the inverter unused for a long time, supply it with electricity once every two years, for 5 hours or more each, to recover the performance of the large-capacity electrolytic capacitor. And also check the function of the inverter. It is advisable not to supply the commercial power directly to the inverter but to gradually increase the power supply voltage with a transformer, etc.

## 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 water or wind, 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.

## 16. Disposal of the inverter

|  | - For safety's sake, do not dispose of the disused inverter yourself but ask an industrial waste <br> disposal agent (*). <br> If the collection, transport and disposal of industrial waste is done by someone who is not <br> licensed for that job, it is a punishable violation of the law. (Laws in regard to cleaning and <br> processing of waste materials) <br> (*) Persons who specialize in the processing of waste and known as "industrial waste product <br> collectors and transporters" or "industrial waste disposal persons." |
| :--- | :--- |

When disposing a used inverter, pay heed to the following points.

Blasting during incineration : There is a danger that electrolytic condensers used in the inverter may burst if it is burnt in an incinerator, because electrolyte inside the condenser expands with heat. Be careful of blasting of electrolytic condensers.

Plastics : Plastics used as covers of the inverter and so on generate poisonous gas when the inverter burnt. When burning the inverter, be careful of such poisonous gas.

Disposing manner : Be sure to dispose the inverter properly as an industrial waste.

TOSHIBA INTERNATIONAL CORPORATION
13131 West Little York RD., Houston,
TX 77041, U.S.A
TEL: +1-713-466-0277
FAX: +1-713-896-5226
TOSHIBA ASIA PACIFIC PTE., LTD
152 Beach Rd., \#16-00 Gateway East,
Singapore 189721
TEL: +65-6297-0900
FAX: +65-6297-5510

## TOSHIBA CHINA CO., LTD

23rd Floor, HSBC Tower, 101 Yin Cheng East Road, Pudong New Area, Shangha 200120, The People's Republic of China TEL: +86-(0)21-6841-5666 FAX: +86-(0)21-6841-1161

TOSHIBA INTERNATIONAL CORPORATION PTY., LTD 2 Morton Street Parramatta, NSW2150, Australia TEL: +61-(0)2-9768-6600 FAX: +61-(0)2-9890-7542

## TOSHIBA INFORMATION, INDUSTRIAL AND POWER

 SYSTEMS TAIWAN CORP.6F, No66, Sec 1 Shin Sheng N.RD, Taipei, Taiwan TEL: +886-(0)2-2581-3639 FAX: +886-(0)2-2581-3631


- For further information, please contact your nearest Toshiba Liaison Representative or International Operations - Producer Goods. - The data given in this manual are subject to change without notice.

2008-12


[^0]:    VFAS1-2055PL
    VFAS1-4055PL, 4075PL

[^1]:    *1:Be sure to short across NO-CC

[^2]:    Note: Parameter displays on the right always return to $\bar{\Omega}$ after resetting. The previous setting is displayed on the

[^3]:    * There are two types of function: the function that conforms to commands selected by $\left[\pi \Omega \mathrm{g}^{\prime}\right.$, and the function that conforms only to commands from the terminal board.
    $\Rightarrow$ Refer to the table of input terminal function selection in Section 7.2.
    * When priority is given to commands from a linked computer or terminal board, they have priority over the setting of [ngo.

[^4]:    * To increase the torque further, increase the setting value of the manual torque boost parameter $u$ b.
    $\Rightarrow$ For more details, refer to Section 5.7.

[^5]:    ＊The d $5 P \|$ converts the following parameter settings：
    －A display Current monitor display
    Setting of electronic thermal protection level $1 / 2 / 3 / 4$ டH，Fi73，Fi77，Figi，F5；i F540
    DC braking current Fこら；
    Stall prevention level F50i
    － V display Voltage monitor display
    V／f 5－point setting Fi91，F193，F195，F197，F199

[^6]:    It is recommendable to use an ammeter with a current rating 1.5 or more times as high as the output current rating of the inverter.

[^7]:    *1: Note: If power is interrupted during deceleration stop, power

[^8]:    Note:To put out signals to OUT2, select the parameter $F i \Xi i$.

[^9]:    Note: Refer to Section 5. 8 цL (Base frequency 1) for $F i 70, F i 74$ and $F i g$,
    Section 5. 8 ぃ
    Section 5.7 ぃ (Manual torque boost) for $F i \bar{Z}, F i 75$ and $F i 8 G$,
     respectively.

[^10]:    - Function

    These parameters are used to specify whether to send a switching signal to an external sequencer (such as an MC ) in the event that the inverter trips. The use of an input signal makes it possible to switch between inverter operation and commercial power operation without stopping the motor.
    $\Rightarrow$ For details, see Instruction Manual (E6581364) specified in Section $\mathbf{6} . \mathbf{4 2}$.
    [Parameter setting]

[^11]:    *1: Inverter with a model number ending with $-W N, H N: 50.0-W P: 50.0$

[^12]:    * When using a long cable (guide: 30m or over), be sure to make auto-tuning 1 ( $F 400=$ こ $)$.

[^13]:    P Precautions on auto－tuning 1
    （1）The inverter is tuned automatically（auto－tuning $1 F 4 \Omega \Omega=\Omega$ ）when the inverter is started for the first time after setup．During auto－tuning 1，which takes about 3 minutes from several seconds，the motor is energized，although it is standing still．Noise may be produced by the motor during auto－tuning 1 ， which，however，does not indicate that something is wrong with the inverter or the motor．
    （2）Conduct auto－tuning $1(F 400=$ こ $)$ ）only after the motor has been connected and operation completely stopped． If auto－tuning is conducted immediately after operation stops，the presence of a residual voltage may result in abnormal tuning．
    （3）Usually，auto－tuning terminates into 3 minutes from several seconds as each model．If an error occurs， however，the inverter trips（display $E \Sigma \Omega$ ）and no motor constant is set．For these motors，perform manual tuning using（2）described below．
    （4）It may not be possible to tune automatically special motors such as high－speed motor or high－slip motor．For these motors，perform manual tuning using（2）described below．
    （5）Provide cranes and hoists with sufficient circuit protection such as mechanical braking．Without sufficient circuit protection，the result of insufficient motor torque during tuning could create the risk of the machine stalling／failing．
    （6）If auto－tuning is impossible or an auto－tuning error $\left(E \varepsilon_{\Omega}\right)$ is displayed，perform manual tuning with（2） described below．
    PPrecautions on vector control $\Rightarrow$ Refer to Section 5．6，9）．

[^14]:    Output frequency $=$ Reference frequency $\times\{1+$ Override $(F 729$ setting value [\%]/100\}

[^15]:    1 -Function
    Output signals from FM/AM terminals are analog voltage signals. Their standard setting range is from 0 to 10 Vdc .
    The output current from terminal FM can be changed to 0 to 20 mAdc (or 4 to 20 mAdc ) by changing the settings of terminal SW2 and a parameter.

[^16]:    （Continued overleaf）

[^17]:    （Continued overleaf）

[^18]:    42. 
    43. 6.42
    6.42 $\star$ 2: $\Rightarrow$ For details, refer to Instruction Manual (E6581341) specified in Section 6.42
[^19]:    1: Default values vary depending on the capacity. $\Rightarrow$ See the table of K-46
    *2: Changing the parameter $\leftarrow 4 \circ$ enables to set to 0.01 sec. (adjustment range: $0.01 \sim 600.0$ sec.).

[^20]:    Tis paramustment range a fundamental para

[^21]:    *2: Default values vary depending on the capacity. $\Rightarrow$ See the table of K-46

[^22]:    | $\star 1: \Rightarrow$ For details, refer to Instruction Manual (E6581315) specified in Section 6.42. | 2: Effective when a command value is sent by communication. |
    | :--- | :--- |
    | $\star 3: \Rightarrow$ This function is for Modbus plus communication option (planning). |  |

[^23]:    *1: $\Rightarrow$ For details, refer to Instruction Manual (E6581335) specified in Section 6.42

[^24]:    *1: $\Rightarrow$ For details, refer to Instruction Manual (E6581337) specified in Section 6.42

[^25]:     $\Rightarrow$ For details, refer to Section 5.16; [Terminal FM-related parameters]. $\Rightarrow$ For monitor indications, refer to Section 8.3; [Set up values of monitor indication parameters].

[^26]:    （Continued overleaf）

