

## Industrial Inverter

(For 3-phase motors)

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### Instruction Manual

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High-performance inverter

# *TOSVERT VF-AS3*

3-phase 240V class 0.4 to 55kW

3-phase 480V class 0.4 to 280kW

Safety precautions

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**TOSHIBA INDUSTRIAL PRODUCTS AND SYSTEMS CORPORATION**

Notice

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



# I

## Safety precautions

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




### Explanation of markings

Marking	Meaning of marking
 WARNING	Indicates that errors in operation will lead to death or serious injury.
 CAUTION	Indicates that errors in operation will lead to injury <sup>*1</sup> to people or that these errors will cause damage to physical property <sup>*2</sup> .

\*1 Such things as injury, burns or electric 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 an inhibition (Don't do it). Detailed information on the inhibition is described in illustration and text in or near the symbol.
	Indicates a mandatory action that must be followed. Detailed information on the mandatory action is described in illustration and text in or near the symbol.
	Indicates a warning or caution. Detailed information on the warning or caution is described in illustration and text in or near the symbol.

■ **Limits in purpose**




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


 **Safety precautions**


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

■ **Handling**

 **Warning**



 Disassembly inhibited	<ul style="list-style-type: none"> <li>• Never disassemble, modify or repair. This can result in electric shock, fire and other injury. Please call your Toshiba distributor for repairs.</li> </ul>
 Prohibited	<ul style="list-style-type: none"> <li>• Never remove the front cover when the power is on. The unit contains high voltage parts and contact with them will result in electric shock.</li> <li>• Do not stick your fingers into openings such as cable wiring holes and cooling fan covers. The unit contains high voltage parts and contact with them will result in electric shock.</li> <li>• Do not place or insert any kind of object (electrical wire cuttings, rods, wires etc.) inside the inverter. This will cause a short circuit and result in electric shock or fire.</li> <li>• Do not allow water or any other fluids to come in contact with the inverter. This will cause a short circuit and result in electric shock or fire.</li> </ul>
 Mandatory action	<ul style="list-style-type: none"> <li>• Turn the power on only after attaching the front cover. If you turn the power on without attaching the front cover, this will result in electric shock or other injury.</li> <li>• Immediately turn the power off if the inverter begins to emit smoke or an unusual odor, or unusual sounds. Continuous use of the inverter in such a state will cause fire. If the inverter is left to be turned on in that state, it can cause fire. Please call your Toshiba distributor for repairs.</li> <li>• Always turn the power off if the inverter is not used for long time.</li> <li>• The inverter will have failure due to leakage current caused by dust and other material. If the inverter's power is left to be turned on in that state, it can cause fire.</li> </ul>

 **Caution**



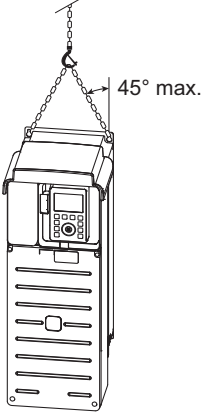
 Contact inhibited	<ul style="list-style-type: none"> <li>Do not touch heat radiating fins or discharge resistors. These devices get high temperature, and you will get burned if you touch them.</li> </ul>
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■ **Transportation & installation**

 **Warning**

 Prohibited	<ul style="list-style-type: none"> <li>Do not install and operate the inverter if it is damaged or any of its components is missing. This will result in electric shock or fire. Please call your Toshiba distributor for repairs.</li> <li>Do not place any inflammable object near the inverter. If flame is emitted due to failure in the inverter, this will lead to fire.</li> <li>Do not install the inverter in any location where the inverter could come into contact with water or other fluids.</li> <li>This will result in electric shock or fire.</li> </ul>
 Mandatory action	<ul style="list-style-type: none"> <li>Operate under the environmental conditions prescribed in the instruction manual. Operations under any other conditions will result in failure.</li> <li>Mount the inverter on a metal plate. The rear panel will get high temperature. Do not mount the inverter on an inflammable object, this will result in fire.</li> <li>Do not operate the inverter with the front cover removed. The unit contains high voltage parts and contact with them will result in electric shock.</li> <li>An emergency stop device must be installed that is configured in accordance with the system specifications. If such an emergency stop device that can activate mechanical brake by shutting off power supply is not installed, operation cannot be stopped immediately by the inverter alone, thus resulting in an accident or injury.</li> <li>All options to be used must be those specified by Toshiba. The use of options other than those specified by Toshiba will result in an accident.</li> <li>In using a power distribution device and options for the inverter, they must be installed in a cabinet. When they are not installed in the cabinet, this will result in electric shock.</li> </ul>




## ⚠ Caution


 Prohibited	<ul style="list-style-type: none"> <li>• For transporting or carrying the inverter, do not hold by the front cover. The cover will come off and the unit will drop, resulting in injury.</li> <li>• Do not install the inverter in any place with large vibration. The unit will fall due to the vibration, resulting in injury.</li> </ul>
 Mandatory action	<ul style="list-style-type: none"> <li>• Carry the inverter by two people or more when the inverter is the model mass 20kg or more (VFAS3-2110P - 2370P, VFAS3-4220PC - 4750PC). If you carry the inverter alone, this will result in injury.</li> <li>• Transport a large-capacity inverter (VFAS3-2450P, 2550P, VFAS3-4900PC - 4280KPC) by a crane. If you transport a heavy load by hand, this will result in injury. Please take the utmost care for the operator's safety, and please handle the inverter carefully in order not to damage the product. For lifting the inverter, hang the inverter with wire ropes via hanging bolts (hanging holes) provided at upper part or lower part of the inverter as shown below.</li> </ul> <div style="text-align: center; margin: 20px 0;">  </div> <ul style="list-style-type: none"> <li>• Please make sure that the inverter is hung by two wire ropes in a balanced manner, and please be careful that the inverter does not receive excessive force during the hanging operation.</li> <li>• Do not carry the inverter with the cover attached, hold nor put the hand in the wiring holes during the transportation. You can have your hands pinched and injured.</li> <li>• Transport the operation panel in accordance with law. Please transport the operation panel by airplane or ship in accordance with law as a lithium battery is used in the operation panel.</li> <li>• Install the inverter at a place which can support the unit's mass. If you install the inverter at a place which does not support the unit's mass, the unit will fall, resulting in injury.</li> <li>• Install the mechanical brake when it is necessary to hold a motor shaft. A brake function of the inverter cannot perform mechanical hold, and it results in injury.</li> <li>• When ambient temperature is above 50°C, use the operation panel by detaching it from the unit. There is a risk that heat can rise up and flame can be emitted in the lithium battery used in the operation panel. When ambient temperature is above 50°C, use the operation panel by detaching the panel from the unit and extending the panel.</li> </ul>



■ Wiring

I

 **Warning**

 <p>Prohibited</p>	<ul style="list-style-type: none"> <li>• Do not connect power supply to the output (motor side) terminals [U/T1], [V/T2] and [W/T3]. Connecting power supply to the output will damage the inverter and result in fire.</li> <li>• Do not insert a braking resistor between DC terminals [PA/+] and [PC/-] or [PO] and [PC/-]. This will result in fire. Please connect the braking resistor in accordance with the instruction manual.</li> <li>• Do not touch wires of equipment (e.g. ELCB) that is connected to the inverter power side at least 15 minutes after turning off the power. If an electric charge remains in a capacitor in the inverter, touching the wires before the indicated time will result in electric shock.</li> <li>• Do not touch output terminals [U/T1], [V/T2] and [W/T3] on the PM motor side while the PM motor is rotating even after turning off the power. While the PM motor is rotating even after the power is turned off, as a high voltage is generated in the output terminals [U/T1], [V/T2] and [W/T3] on the PM motor side, touching the output terminals will result in electric shock. Please perform wiring after verifying that the PM motor is stopped.</li> <li>• When using this 480V class inverter with a power supply system that is grounded in other than the neutral point (e.g. when the power supply has delta connection with single phase grounding), the grounding capacitor should not be grounded (or the capacity of the grounding capacitor should not be increased). Otherwise, it will result in failure or fire.</li> </ul>
 <p>Mandatory action</p>	<ul style="list-style-type: none"> <li>• Electrical construction work must be done by a qualified expert. Erroneous connection of power supply by someone who does not have that expert knowledge will result in fire or electric shock.</li> <li>• Connect output terminals (motor side) correctly. If the phase sequence is incorrect, the motor will operate in reverse and that can result in injury.</li> <li>• Wiring must be done after installation. If you perform wiring prior to installation, this will result in electric shock or other injury. Verify that the power is turned off and the charge lamp is off before starting wiring. If you perform wiring without verification, this will result in electric shock.</li> <li>• Install an earth leakage circuit breaker (ELCB) between the power supply and the inverter (primary side) if protective device against earth leakage is not installed into your system.</li> <li>• Tighten the screws on the terminal block to specified torque. If the screws are not tightened sufficiently to the specified torque, this will result in fire.</li> <li>• Verify that the power supply voltage is within +10% and -15% (<math>\pm 10\%</math> when the load is 100% in continuous operation) of the applied power supply voltage written on the name plate. If you do not use the appropriate power supply voltage, this will result in failure or fire.</li> </ul>
 <p>Be grounded</p>	<ul style="list-style-type: none"> <li>• The grounding wire must be connected securely. If the grounding wire is not securely connected, when the inverter has failure or earth leakage, this will result in electric shock or fire.</li> </ul>



 **Caution**


 <p>Prohibited</p>	<ul style="list-style-type: none"> <li>• Do not attach devices with built-in capacitors (such as noise reduction filters or surge absorbers) to the output terminals (motor side). Heat rises up and this could cause a fire.</li> <li>• Do not switch only one of two grounding capacitor switch screws in the same form. The inverter will have failure due to insufficient switching. Please switch two grounding capacitor switch screws in the same form.</li> <li>• Do not detach the operation panel from the unit when the power is ON. This will result in failure. Please detach the operation panel after turning the power off.</li> <li>• When you connect a USB cable to the operation panel, do not perform the connection while the operation panel is attached to the unit. This will result in failure. Please connect the USB cable to the operation panel after detaching the operation panel from the unit.</li> <li>• Do not connect Ethernet to the RS485 communication connector. Erroneous connection will result in failure.</li> <li>• Do not connect RS485 communication to the Ethernet connector. Erroneous connection will result in failure.</li> </ul>
 <p>Mandatory action</p>	<ul style="list-style-type: none"> <li>• Verify that the power is OFF before detaching the front cover. If you detach the front cover while the power is ON, this will result in electric shock or other injury.</li> <li>• Mount the front cover after wiring. If you turn the power on without attaching the front cover, this will result in electric shock or other injury. Please be careful that if you press too hard the front cover by a screwdriver for attachment, it will damage the inverter unit.</li> <li>• Mount the attached DC reactor (DCL) for VFAS3-4160KPC - 4280KPC. If you do not mount the attached DC reactor (DCL), it will result in failure. Mount the DC reactor (DCL) between [PA/+] and [PO].</li> <li>• Supply AC power supply to cooling fans if you use VFAS3-4160KPC - 4280KPC with DC input. If you do not supply AC power supply, the cooling fans do not operate, and this will result in overheat trip.</li> </ul>





■ Operations

 **Warning**

 Prohibited	<ul style="list-style-type: none"> <li>Do not touch terminals when the inverter's power is on even if the motor is stopped. Touching the terminals while voltage is applied will result in electric shock.</li> <li>Do not touch switches when the hands are wet and do not try to clean the inverter with a damp cloth. This will result in electric shock.</li> <li>Do not touch terminals or motor of the inverter while performing auto tuning. Touching the terminals or motor while voltage is applied to the terminals and motor may result in electric shock, even if the motor is stopped. After setting offline auto-tuning (F400 = "2"), execute the auto tuning at first start of the inverter. The auto tuning takes several seconds and the motor is stopped meanwhile, but voltage is applied to the terminals and motor. The motor may also generate a sound during the auto tuning, but this is not malfunction.</li> </ul>
 Mandatory action	<ul style="list-style-type: none"> <li>Turn the power on only after mounting the front cover. When you use the inverter housed in the cabinet with the front cover removed, always close the cabinet doors first and then turn the power on. If you turn the power on with the front cover or the cabinet doors open, this will result in electric shock.</li> <li>Make sure to set the setup menu correctly. If you set the setup menu incorrectly, this will damage the inverter or cause the inverter to perform unexpected movement.</li> <li>Make sure to set the parameter correctly. If you set the parameter incorrectly, this will damage the inverter or cause the inverter to perform unexpected movement. When you write the parameter in the inverter via a parameter writer or operation panel, please transmit correct data.</li> <li>Make sure that operation instructions are off before resetting the inverter after malfunction. If the inverter is reset while the operation instructions are on, the motor will restart suddenly, resulting in injury.</li> <li>Install circuit protection such as the mechanical brake in the crane. If there is no sufficient circuit protection installed in the crane, insufficient motor torque while auto tuning will cause the machine stalling/falling.</li> </ul>


 **Caution**

 Prohibited	<ul style="list-style-type: none"> <li>Observe all allowable operating ranges of motors and machines in use. Not observing these ranges will result in damage to motors and machines and injury. Please use motors and machines within their respective allowable operating ranges by referring to their respective instruction manuals.</li> <li>Do not set the stall prevention level parameters (F601 and F185) extremely low. If the stall prevention level parameters (F601 and F185) are set at or below the motor no-load current, the stall preventive function will be always enabled and increase the frequency when it judges that regenerative braking is taking place. Do not set the stall prevention level parameters (F601 and F185) at 30% or less under normal use conditions.</li> </ul>
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 <p>Mandatory action</p>	<ul style="list-style-type: none"> <li>• Use the inverter that conforms to specifications of the power supply and the three-phase motor to be operated. If you use the inappropriate inverter, not only will the three-phase motor not rotate correctly, but it will cause serious accidents such as overheating and burning out.</li> <li>• Take countermeasures against leakage current. The leakage current through the stray capacitance of the input/output power wires of inverter and motor can affect peripheral devices. In that case, please take countermeasures such as reducing the carrier frequency or shortening the length of input/output power wires. When the total wire length (total length between an inverter and motors) is more than 100m, if the trip occurs with the motor no-load current, make enough space between phase wires or insert the filter (MSF: motor-end surge voltage suppression filter).</li> </ul>
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■ When operation by communication or extension panel is selected

 **Warning**


 <p>Mandatory action</p>	<ul style="list-style-type: none"> <li>• Set the parameter Communication time-out. If the parameter is not properly set, the inverter cannot be stopped immediately and this will result in injury and accidents.</li> <li>• Install an emergency stop device and an interlock that are configured in accordance with the system specifications. If the inverter cannot be stopped immediately via communication or the extension panel, this will result in injury and accidents.</li> </ul>
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■ When auto-restart after momentary stop function is selected

 **Caution**

 <p>Mandatory action</p>	<ul style="list-style-type: none"> <li>• When the auto-restart after momentary stop function is selected, stand clear of motors and machines at momentary power failure. The motors and machines which have stopped due to momentary power failure will restart suddenly after power is restored, and this will result in injury.</li> <li>• Attach caution labels indicating functions programmed for Auto restart, on inverters, motors and machines. Please prevent accidents with the caution labels.</li> </ul>
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■ When retry function is selected

 **Caution**


 <p>Mandatory action</p>	<ul style="list-style-type: none"> <li>• When the retry function is selected, stand clear of motors and machines at tripping stop. The motors and machines which have stopped due to tripping stop will restart suddenly, and this will result in injury. Take measures for securing safety even if the motor restarts unexpectedly, such as attaching a cover to the motor.</li> <li>• Attach caution labels indicating functions programmed for Retry, on inverters, motors and machines. Please prevent accidents with the caution labels.</li> </ul>
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■ Maintenance and inspection

 **Warning**

 Prohibited	<ul style="list-style-type: none"> <li>Do not replace parts. This will result in electric shock, fire and other injury. Please call your Toshiba distributor for repairs and replacement of expendable parts.</li> </ul>
 Mandatory action	<ul style="list-style-type: none"> <li>Perform daily inspection and periodic inspection on equipment. If the equipment is not inspected and maintained, faults and malfunctions cannot be discovered and that can result in accidents.</li> <li>Before inspection, perform the following steps.                     <ol style="list-style-type: none"> <li>Turn off the power to the inverter.</li> <li>Wait at least 15 minutes and verify that the charge lamp is no longer lit.</li> <li>Use a tester that can measure DC voltages (800 VDC or more), and verify that the voltage to the DC main circuits between [PA/+] and [PC/-] is 45V or less, and verify that the residual voltage of AC main circuits cable is 45V or less.</li> </ol>                     Performing inspection without carrying out these steps can lead to electric shock. When using the PM motor, please verify that the PM motor is stopped. While the PM motor is rotating even after the power is turned off, as a high voltage is generated in the output terminals [U/T1], [V/T2] and [W/T3] on the PM motor side, touching the output terminals will result in electric shock.                 </li> </ul>

■ Disposal


 **Caution**

 Mandatory action	<ul style="list-style-type: none"> <li>If you dispose of the inverter, have it done by a specialist in industry waste disposal*1. If you dispose of the inverter by yourself, this can result in explosion of capacitor or production of noxious gases, resulting in injury.</li> <li>When you dispose of the operation panel, insulate the terminals of the lithium battery by wrapping the terminals with tapes. If the terminals contact with other metal or batteries, this will result in heat rising up, explosion, and fire.</li> </ul>
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\*1 Persons who specialize in the processing of waste and known as "industrial waste product collectors and transporters" or "industrial waste disposal persons". Please observe any applicable law, regulation, rule or ordinance for industrial waste disposal.

■ Sterilization, insect removal processing for wooden packaging material

 **Caution**

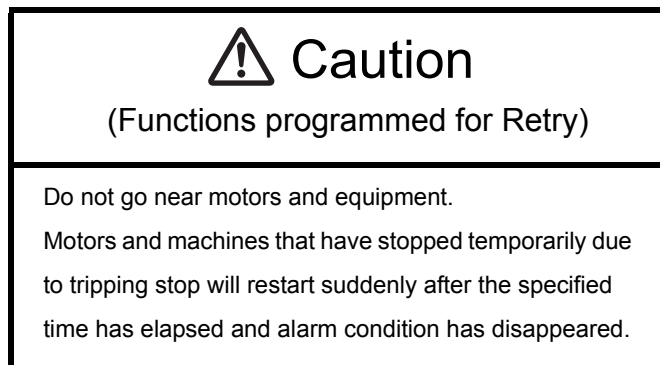
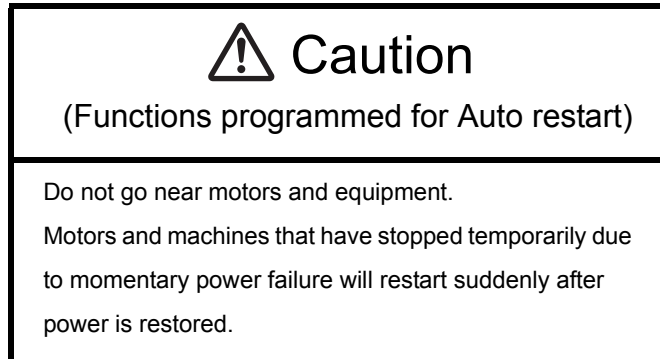
 Mandatory action	<ul style="list-style-type: none"> <li>If wooden packaging materials require sterilization, insect removal processing, make sure to employ methods other than fumigation. The fumigation processing may damage electronic parts by generated gas and steam. Especially halogen disinfectants, such as fluorine, chlorine, bromine and iodine cause corrosion inside the capacitors.</li> </ul>
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■ Attach caution labels

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

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

(Example of caution label)



# II

## Introduction

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Thank you for purchasing Toshiba's industrial inverter.

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

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

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



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15 Warranty.....	15-1
16 Disposal .....	16-1





# 1

## Read first

I

II

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16

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

### 1.1 Check product purchase



#### CAUTION



Mandatory  
action

- Use the inverter that conforms to specifications of the power supply and the three-phase motor to be operated.  
If you use the inappropriate inverter, not only will the three-phase motor not rotate correctly, but it will cause serious accidents such as overheating and burning out.

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

1

Rating label

**VF-AS3**

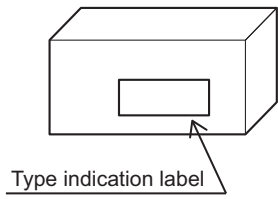
Model name → VFAS3-4280KPC

Rated voltage → 3PH-380/480V  
280kW/400HP (HD) 315kW/500HP (ND)

Applicable motor capacity →

\* Refer to [1. 2] for (HD) and (ND).

Carton box



Danger label

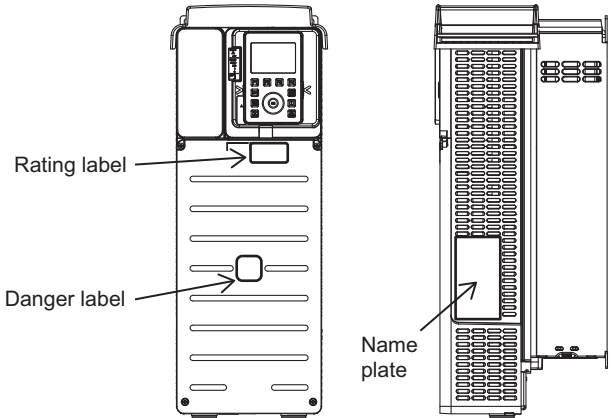
**⚠ DANGER**

**Risk of injury, electric shock or fire.**

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

Data matrix

Inverter main unit



Name plate

Inverter type →

Inverter rated output capacity →

Rated voltage →

Rated input current →

Rated output current →

		INPUT				OUTPUT			
		HD		ND		HD		ND	
		3PH 200/240				3PH 200/240			
U(V)		50 / 60				0.01/500			
kW	F(Hz)	1.7 max		3.0 max		3.3		4.6	
U(V)		3PH 200/240		3PH 230					
F(Hz)		60				0.01/500			
HP	I(A)	1.8 max		2.7 max		FLA 3.2		FLA 4.2	

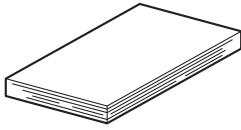
SCCR: For ratings and protection refer to User Manual  
Motor Overload Protection: Class 10

Manufactured in Indonesia from foreign and domestic components.  
Serial No. 9530 19001303 0001

**TOSHIBA INDUSTRIAL PRODUCTS AND SYSTEMS CORPORATION**

TSIJ

Quick start



CD-ROM

Instruction manual is included as electronic data.



DC reactor

Only for frame size A7 and A8.

Danger label kit

Danger labels in 6 languages for sticking .

<p><b>⚠ DANGER</b></p> <p><b>Risque de blessure, d'électrocution ou d'incendie.</b></p> <ul style="list-style-type: none"> <li>• Lire le manuel d'instruction.</li> <li>• Avant d'intervenir dans le variateur couper la puissance et attendre 15 minutes avant d'ouvrir le couvercle.</li> <li>• Assurer un raccordement approprié à la terre.</li> </ul>	<p><b>⚠ GEFAHR</b></p> <p><b>Gefahr von Verletzungen, elektrischem Schlag oder Brand.</b></p> <ul style="list-style-type: none"> <li>• Lesen Sie die Bedienungsanleitung.</li> <li>• Vor öffnen der Abdeckung Gerät vom Netz trennen und 15 Minuten warten.</li> <li>• Sorgen Sie für eine fachgerechte Erdung.</li> </ul>
<p><b>⚠ PERICOLO</b></p> <p><b>Rischio di lesioni, scosse elettriche o incendi.</b></p> <ul style="list-style-type: none"> <li>• Leggere le istruzioni del manuale.</li> <li>• Togliere tensione e attendere 15 minuti prima di aprire il coperchio.</li> <li>• Garantire un adeguato collegamento a terra.</li> </ul>	<p><b>⚠ PELIGRO</b></p> <p><b>Riesgo de daños, descarga eléctrica o fuego.</b></p> <ul style="list-style-type: none"> <li>• Lea el manual de instrucciones.</li> <li>• Antes de retirar la cubierta corte la alimentación y espere 15 minutos.</li> <li>• Asegure una correcta conexión a tierra.</li> </ul>
<p><b>⚠ 危険</b></p> <p><b>有受傷、触电、发生火灾的危险。</b></p> <ul style="list-style-type: none"> <li>• 请仔细阅读使用说明书。</li> <li>• 在运行中或切断电源15分钟之内，请勿揭开盖板。</li> <li>• 务必切实地进行接地。</li> </ul>	<p><b>⚠ 警告</b></p> <p><b>けが、感電、火災のおそれがあります。</b></p> <ul style="list-style-type: none"> <li>• 取扱説明書の注意事項を読むこと。</li> <li>• 通電中及び電源遮断後15分以内は端子台カバーを開けないこと。</li> <li>• 確実に接地を行うこと。</li> </ul>

SF

MNS

BF

RUN

ERR

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

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

Profinet DeviceNet Profibus CANopen



Important

- When you have purchased VFAS3-4160KPC to VFAS3-4280KPC (frame size A7 or A8), the DC reactor is packed together with the unit. Mount the DC reactor to the inverter by referring to [2. 3. 8].

## 1.2 Multi-rating

This inverter has multi-rating.

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

<AUL>="2: ND rating (120%-60s) (0 after execution)"

- Select it to apply equipment with variable torque characteristic.
- Example) Fans, pumps, blowers, etc.

<AUL>="3: HD rating (150%-60s) (0 after execution)"

- Select it to apply equipment with constant torque characteristic.
- Example) Conveyors, load transporting machinery, cranes, mixers, compressors, making machines, machine tools, etc.

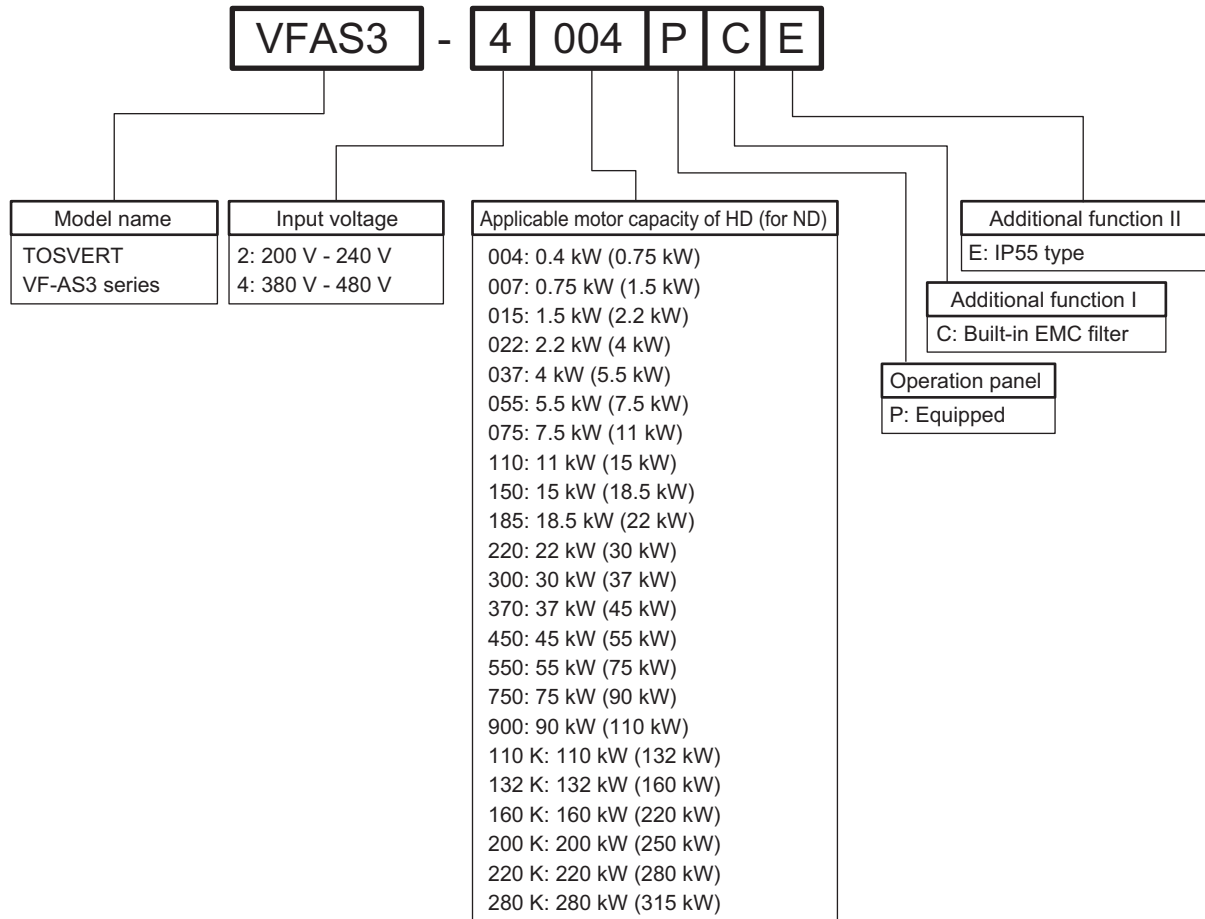
Both of them return to "0" after setting.

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

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

# 1.3 Indication of product type

Explanation of the indication of the inverter type.



**Important**

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

■ **Type and frame size**

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

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

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

**1**



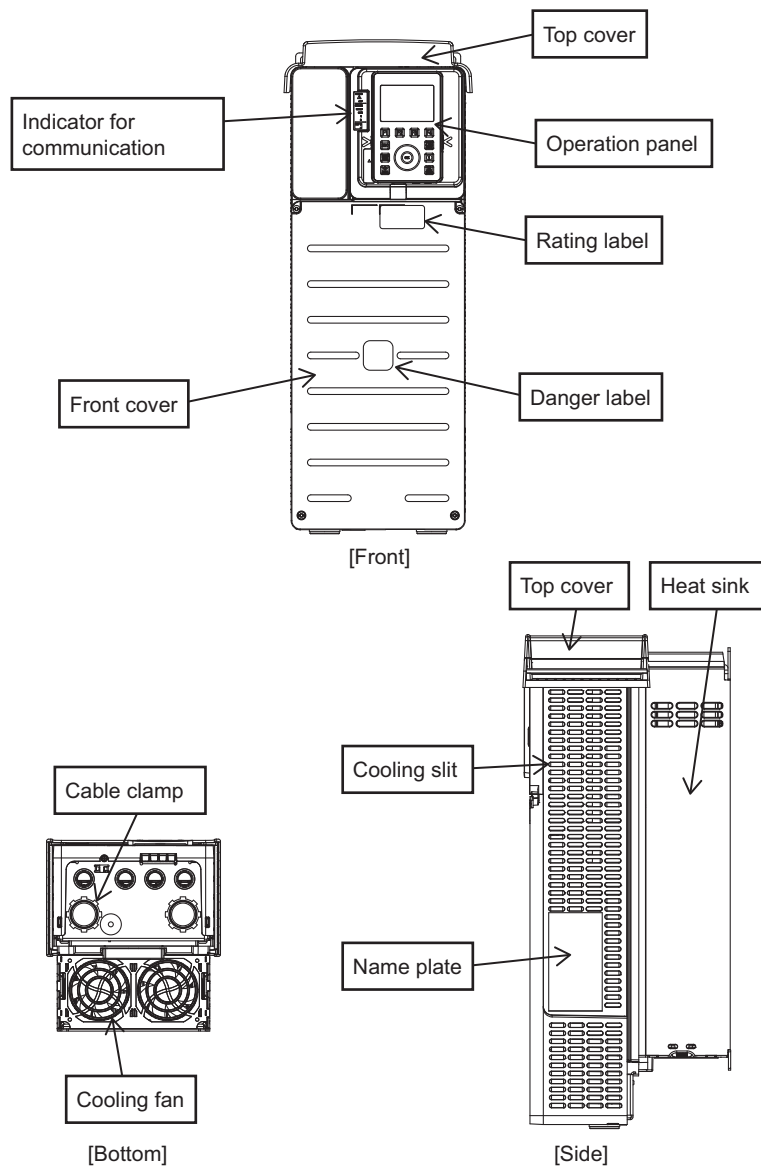
# 1. 4 Structure of equipment

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

## 1. 4. 1 Outside view

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

1



• **Front cover**

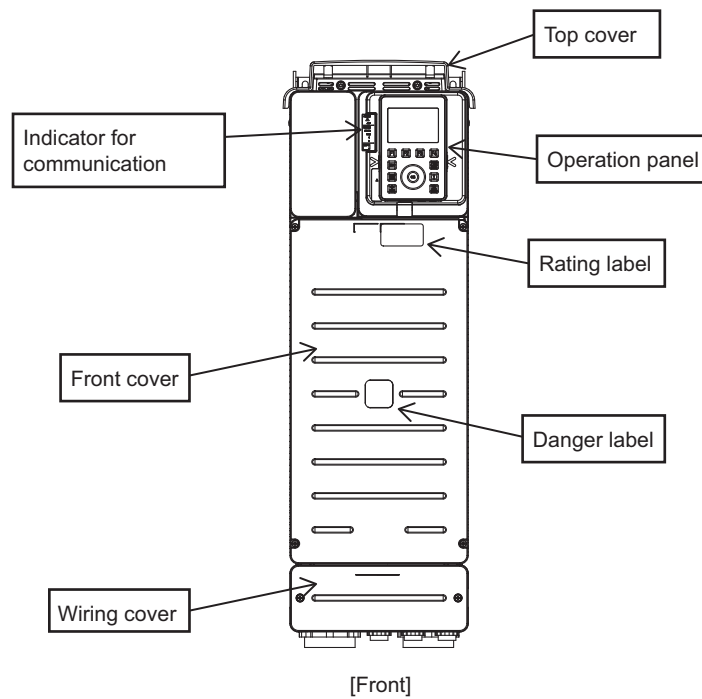
A cover for the terminal blocks (power circuit/control circuit). This cover should be removed for wiring to the power terminal block or the control terminal block, using the connector for communication and the option slot, switching the grounding capacitor, or checking the charge lamp. For how to remove,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

- **Top cover**

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

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

1

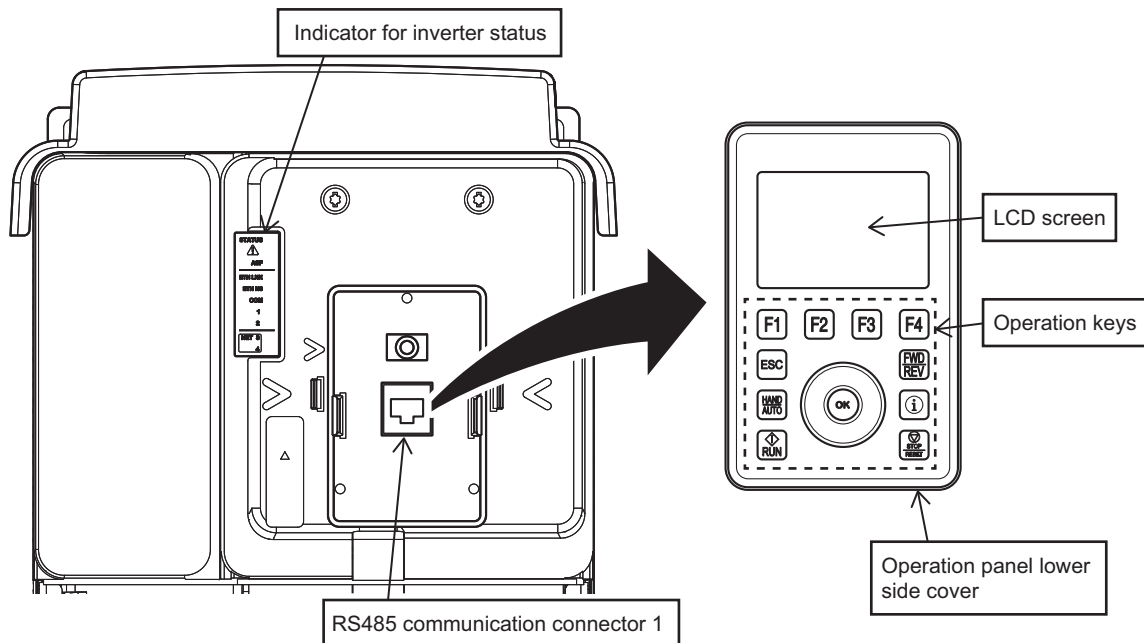


- **Wiring cover**

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

## 1. 4. 2 Operation panel and peripherals

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



### ■ Operation panel

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

It is directly connected to the unit with the operation panel male connector on the back side but can be removed. It can be also used for remote control with Door mounting kit (SBP010Z) and an exclusive cable (optional), see [10. 3. 8] for detail.

#### • LCD screen

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

#### • Operation keys

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

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

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

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

#### • Operation panel lower side cover

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

- **Operation panel female connector**

For handy use, connect the operation panel to this female connector with a cable. To mount the operation panel on the cabinet, use the Door mounting kit SBP010Z (optional).

- **USB-miniB connector**

Used only by manufacturer.

- **Slot for battery**

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

- **RS485 communication connector 1**

Normally, this connector is used for connection of the operation panel.

For remote control, connect the operation panel with an exclusive extension cable (optional).

- **LED indicators**

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

**STATUS (Green LED)**

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

 **(Red LED)**

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

**ASF (Yellow LED)**

- On: STO
- Off: In normal condition

Other seven LEDs indicate the communication status. For details, please see function manual for each communication.

### 1. 4. 3 Terminal blocks

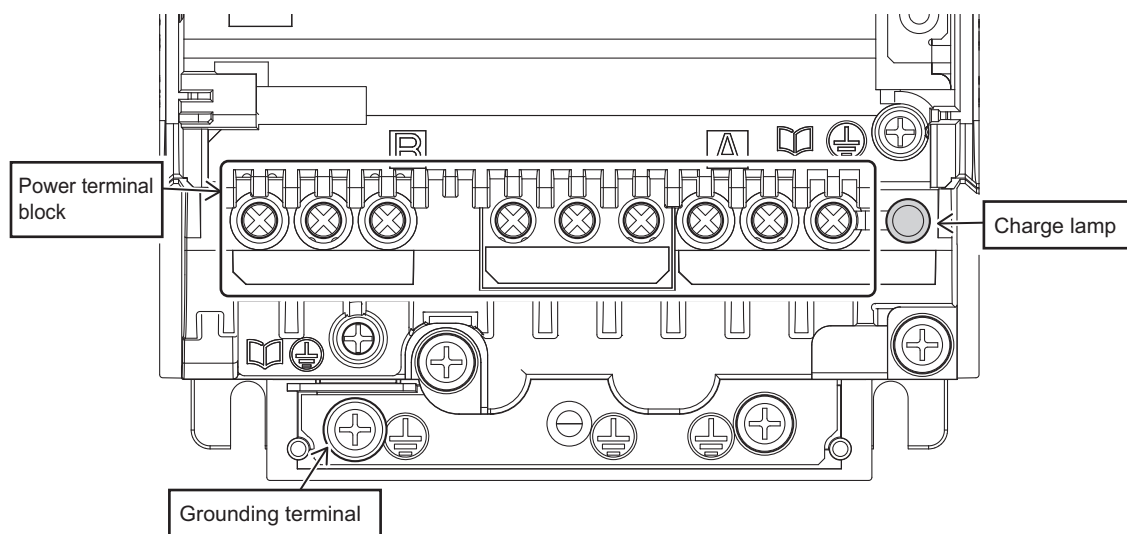
This inverter is equipped with a power terminal block and a control terminal block. To the power terminal block, connect the power supply and the motor. To the control terminal block, connect external control signals.

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

■ **Power terminal block**

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

The following figure shows an example of frame size A1.



• **Power terminal block**

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

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

• **Grounding terminal**

Exclusive terminal to wire a grounding wire.

• **Charge lamp**

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

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

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

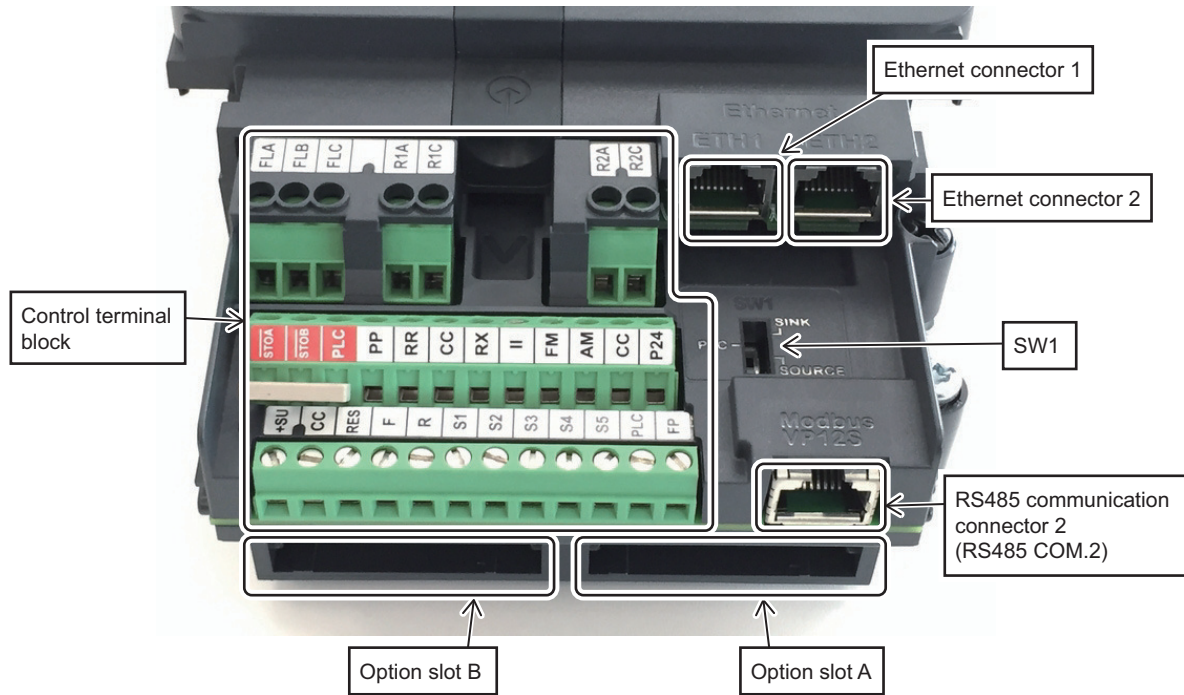
**Memo**

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

■ **Control terminal block**

The control terminal block is common to all the types and is located on the lower side of the operation panel.  
 It connects wiring between the inverter and an external control device.  
 Control terminal block is detachable.

1



• **Control terminal block**

A cage-type terminal block.  
 For details of the terminal types and functions, refer to [2. 3. 5].

• **SW1**

A switch to switch between the sink logic, source logic and external power supply sink logic of the input terminal.  
 The default setting is PLC (external power supply) side. For details, refer to [2. 3. 5].

• **RS485 communication connector 2 (RS485 COM.2)**

An RJ45 connector for RS485 communication.  
 For details, refer to [2. 3. 6].

• **Ethernet connector 1, 2**

Two RJ45 connectors for Ethernet are equipped.  
 For details, refer to [2. 3. 7].

• **Option slot A, B**

Two slots are equipped in the back of the control terminal block.  
 The right one is slot A and the left one is slot B.  
 Furthermore, an option adaptor can be added between the operation panel and the unit.  
 For details, refer to [10. 4. 3].



Important

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

## 1. 4. 4 Features of inverter

This inverter has the following features.

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

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

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

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

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

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

### (4) High environmental friendliness and enhanced environment resistance

- A DC reactor built in as standard suppresses generation of harmonics to comply with IEC61000-3-12.
- An EMC noise filter is built in as standard to comply with C2/C3 (480 V class) of IEC61800-3.
- Comply with the chemicals (3C3)/dust (3S3) standards of IEC60721-3-3. (Frame size A6 or smaller)
- Can be used at an altitude of up to 4800 m. (TN/TT system) (Frame size A6 or smaller)
- A built-in Nema type 1 kit. (Frame size A5 or smaller)
- The inverter is operable at an ambient temperature of -15 to +60°C. ( Frame size A7 and A8:-10 to 60°C)
- The design expectancy life time of the cooling fan, smoothing aluminum electrolytic capacitor for power circuit, and aluminum electrolytic capacitor for control circuit are ten years. (Frame size A6 or smaller)

### (5) High control performance is realized

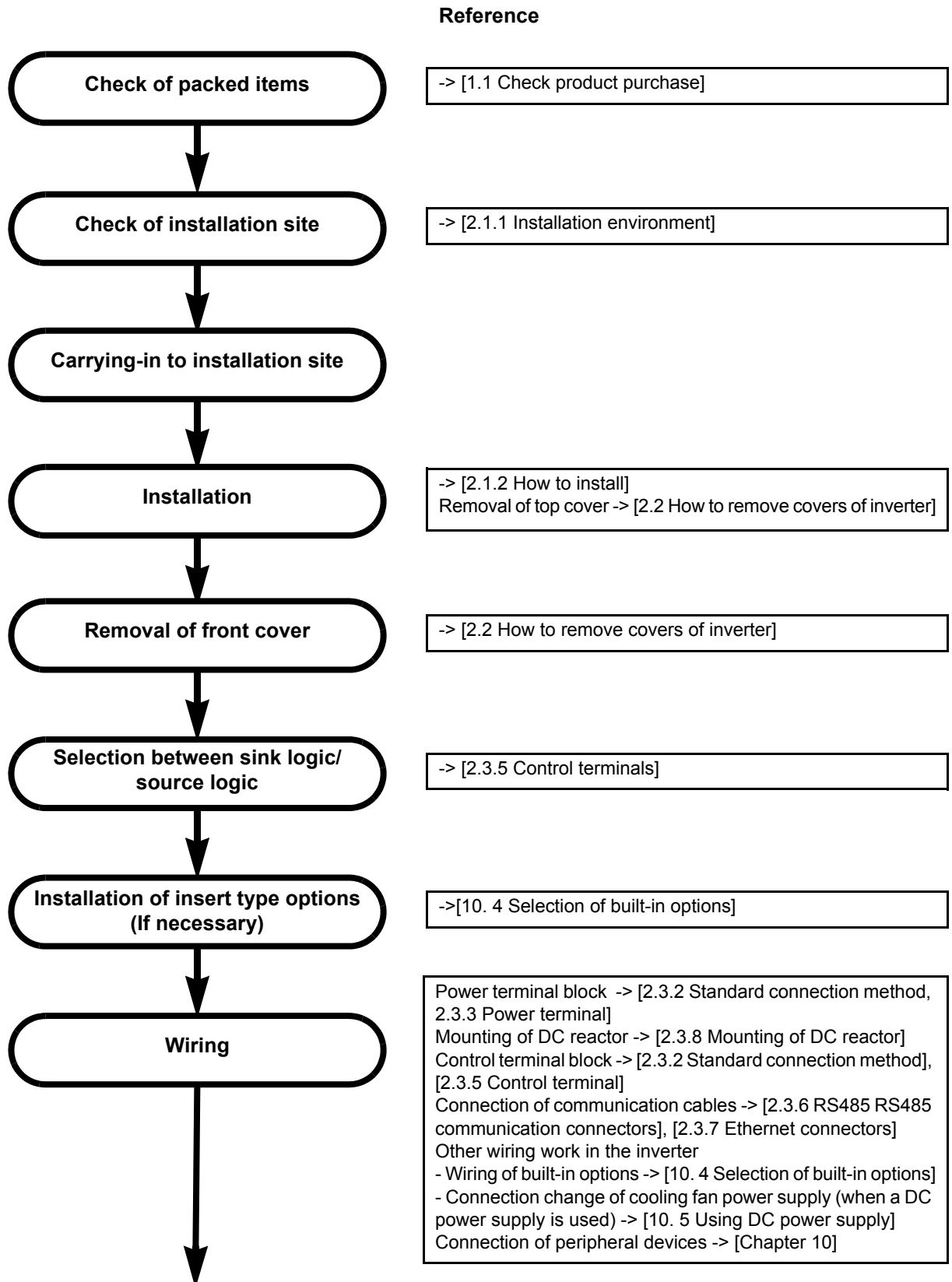
- With its multi-rating, the inverter is usable for a wide range of applications with light load (120% for 1 min) and heavy load (150% for 1 min).
- It is also usable for a PM motor.
- Auto tuning is possible.
- High frequency operation up to 590 Hz is possible.
- High-accuracy motor control is possible.

Note) QR Code is registered trademark of DENSO WAVE INCORPORATED.

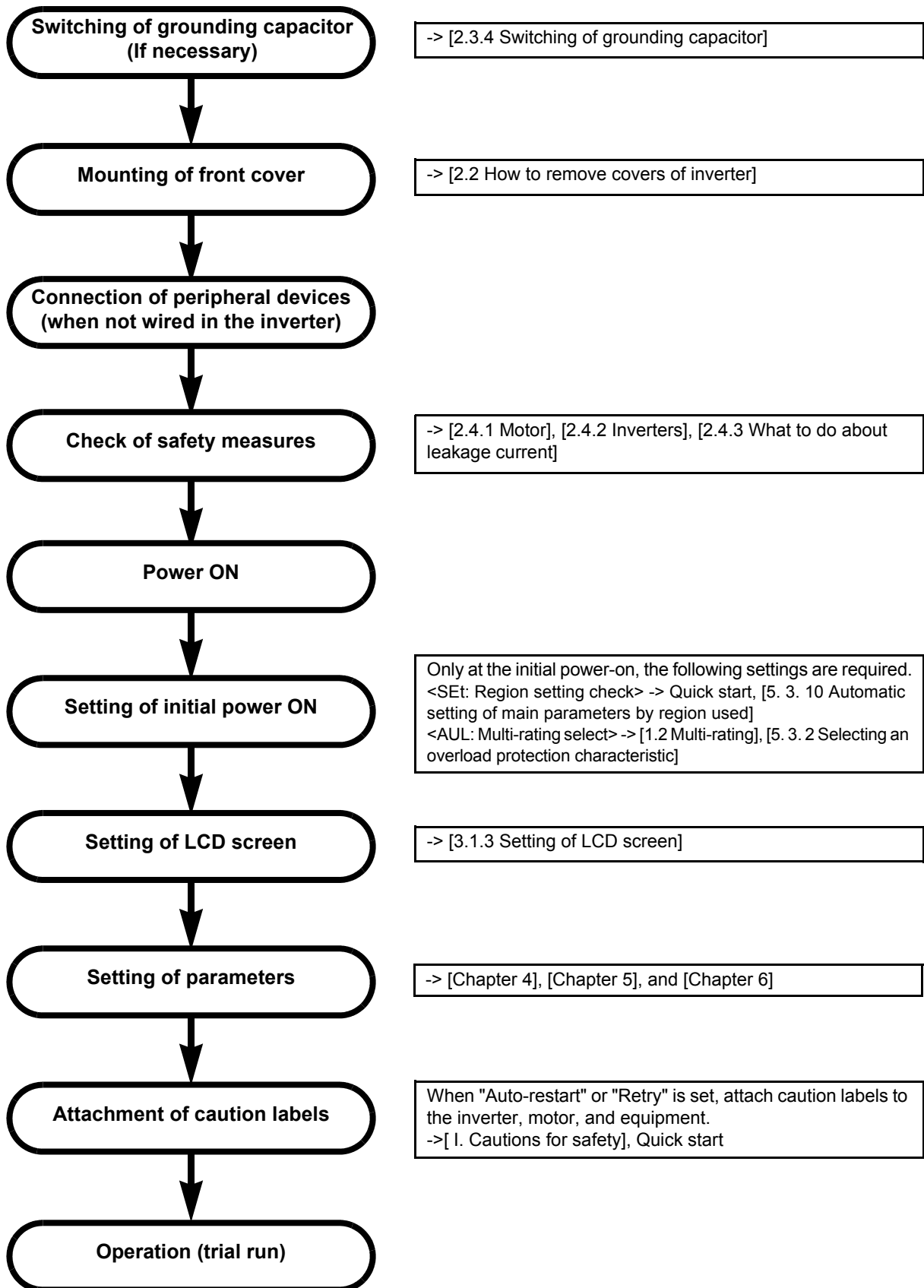
# 1.5 Operation procedure

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

1









# 2

## Installation and wiring



### WARNING



Disassembly prohibited

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



Prohibited

- Do not stick your fingers into openings such as cable wiring holes and cooling fan covers. The unit contains high voltage parts and contact with them will result in electric shock.
- Do not place or insert any kind of object (electrical wire cuttings, rods, wires etc.) inside the inverter.  
This will cause a short circuit and result in electric shock or fire.
- Do not allow water or any other fluids to come in contact with the inverter.  
This will cause a short circuit and result in electric shock or fire.



### CAUTION



Prohibited

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



Mandatory action

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




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

## 2. 1 Installation

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

### 2. 1. 1 Installation environment

2

 <b>WARNING</b>	
 Prohibited	<ul style="list-style-type: none"> <li>Do not place any inflammable object near the inverter. If flame is emitted due to failure in the inverter, this will lead to fire.</li> <li>Do not install the inverter in any location where the inverter could come into contact with water or other fluids. This will result in electric shock or fire.</li> </ul>
 Mandatory action	<ul style="list-style-type: none"> <li>Operate under the environmental conditions prescribed in the instruction manual. Operations under any other conditions will result in failure.</li> </ul>

 <b>CAUTION</b>	
 Prohibited	<ul style="list-style-type: none"> <li>Do not install the inverter in any place with large vibration. The unit will fall due to the vibration, resulting in injury.</li> </ul>

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

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

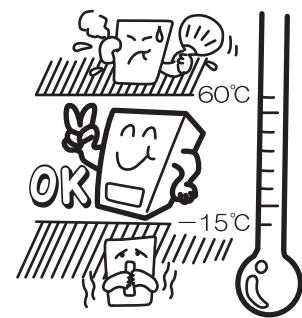


- (2) **Do not install in any location where corrosive gases or grinding fluids are present.**
- (3) **Operate in areas where ambient temperature ranges from -15°C to +60°C.**

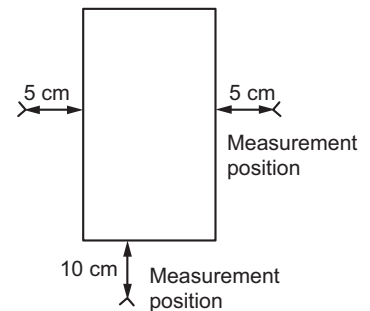
- When using the inverter in locations with temperatures above 50°C, remove the top cover and operation panel of the inverter to use it.

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

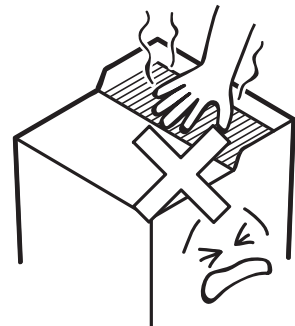
- -10 to 60°C for frame size A7 and A8.
- The inverter is a heat-emitting body. Make sure proper space and ventilation are provided when installing in the cabinet.
- Measure the ambient temperature in the positions shown in the figure on the right.



Position for measuring ambient temperature



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



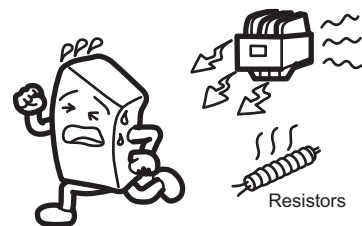
- (5) **Do not install in any location subject to large amounts of vibration.**

- If the inverter is installed in a location that is subject to vibration, anti-vibration measures are required. Please consult with your Toshiba distributor about these measures.



- (6) **If the inverter is installed near any of the equipment listed below, provide measures to insure against errors in operation.**



- Solenoids: Attach a surge suppressor on the coil.
- Brakes: Mount a surge absorber on the coil.
- Magnetic contactors: Mount a surge absorber on the coil.
- Resistors: Place far away from the inverter.





## 2. 1. 2 How to install

2

### WARNING

 Prohibited	<ul style="list-style-type: none"> <li>Do not install and operate the inverter if it is damaged or any of its components is missing. This will result in electric shock or fire. Please call your Toshiba distributor for repairs.</li> </ul>
 Mandatory action	<ul style="list-style-type: none"> <li>Mount the inverter on a metal plate. The rear panel will get high temperature. Do not mount the inverter on an inflammable object, this will result in fire.</li> <li>Do not operate the inverter with the front cover removed. The unit contains high voltage parts and contact with them will result in electric shock.</li> <li>An emergency stop device must be installed that is configured in accordance with the system specifications. If such an emergency stop device that can activate mechanical brake by shutting off power supply is not installed, operation cannot be stopped immediately by the inverter alone, thus resulting in an accident or injury.</li> <li>All options to be used must be those specified by Toshiba. The use of options other than those specified by Toshiba will result in an accident.</li> </ul>

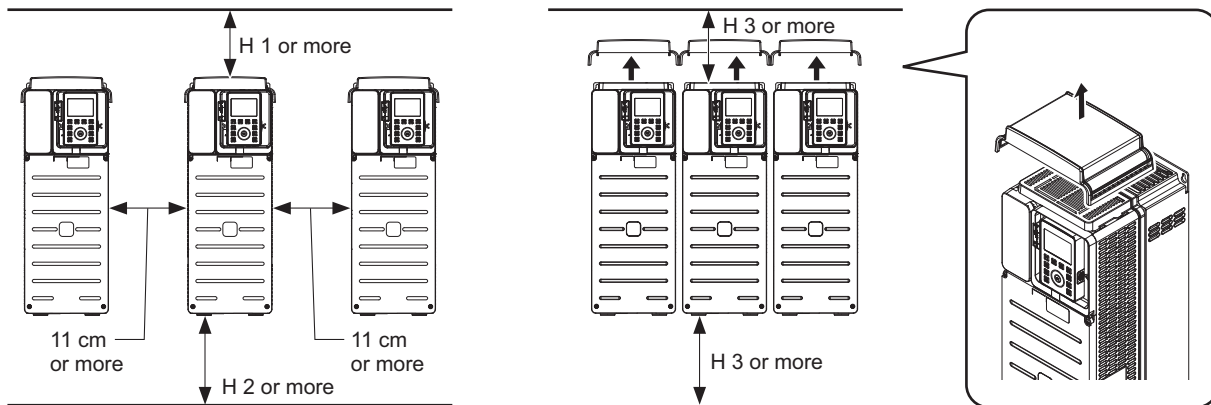
### CAUTION

 Prohibited	<ul style="list-style-type: none"> <li>For transporting or carrying the inverter, do not hold by the front cover. The cover will come off and the unit will drop, resulting in injury.</li> </ul>
 Mandatory action	<ul style="list-style-type: none"> <li>Carry the inverter by two people or more when the inverter is the model mass 20kg or more (VFAS3-2110P - 2370P, VFAS3-4220PC - 4750PC). If you carry the inverter alone, this will result in injury.</li> <li>Install the inverter at a place which can support the unit's mass. If you install the inverter at a place which does not support the unit's mass, the unit will fall, resulting in injury.</li> <li>Install the mechanical brake when it is necessary to hold a motor shaft. A brake function of the inverter cannot perform mechanical hold, and it results in injury.</li> </ul>

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

■ **If multiple inverters are installed**

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



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

**1) Basic installation**

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

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

**2) Side-by-side installation**

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

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



Important

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

**Memo**

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

**■ Current reduction curve**

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

For details, refer to "Instruction manual for load reduction" (E6582116).

**■ Calorific values of inverter and required ventilation**

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



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

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

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

Input voltage Class	Applicable motor capacity (kW)	Inverter type-form	Frame size	Inverter calorific value (W) *1	Inner side calorific value (W) *1	Forced air-cooled Required ventilation amount (m <sup>3</sup> /min)	Sealed cabinet Necessary heat discharge surface quantity (m <sup>2</sup> )	
3-phase 480 V	0.75	VFAS3-	4004PC	A1	56	26	0.32	1.13
	1.5		4007PC		79	28	0.45	1.58
	2.2		4015PC		100	30	0.57	2.00
	4.0		4022PC		140	33	0.79	2.80
	5.5		4037PC		192	37	1.09	3.83
	7.5		4055PC	A2	233	45	1.32	4.66
	11		4075PC		323	53	1.84	6.47
	15		4110PC	A3	455	62	2.58	9.10
	18.5		4150PC		557	70	3.16	11.14
	22		4185PC		603	71	3.42	12.06
	30		4220PC	A4	770	94	4.37	15.40
	37		4300PC		939	107	5.33	18.78
	45		4370PC		1101	123	6.25	22.02
	55		4450PC	A5	1094	132	6.21	21.88
	75		4550PC		1589	175	9.02	31.78
	90		4750PC		1827	199	10.37	36.54
	110		4900PC	A6	2920	309	16.58	58.40
	132		4110KPC		3457	358	19.62	69.13
	160		4132KPC		4013	405	22.78	80.26
	220		4160KPC	A7	5404	452	30.68	108.08
250	4220KPC	A8	6279	606	35.64	125.58		
280	4250KPC		6743	769	38.28	134.86		
315	4280KPC		7749	769	43.99	154.98		

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

■ Panel designing in consideration of effects of noise

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

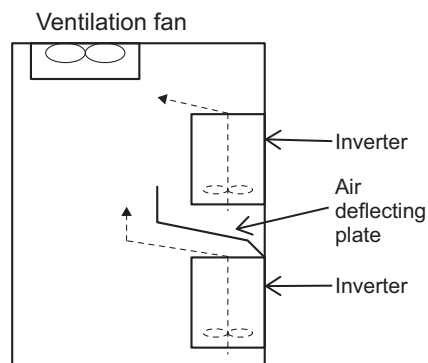
Examples of measures are given below.

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

### ■ When more than one inverter are installed in one cabinet

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

- Ensure a space of at least 20 cm or more on the top and bottom of the inverters.  
(Note: Depending on the inverter type.)
- Install an air deflecting plate so that the heat rising up from the inverter on the bottom does not affect the inverter on the top.
- Inverters may be installed side by side with each other with no space left between them.  
When installing inverters side by side, remove the top cover of the inverter. For how to remove, refer to [2. 2].  
When using the inverter in locations with temperatures above 50°C, use the inverter with the operation panel removed and the output current reduced.



## 2.2 How to remove covers of inverter

### WARNING



Prohibited

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

### CAUTION



Mandatory  
action

- When removing and mounting the front cover, wiring cover or the power terminal block with a screwdriver, be sure not to scratch your hand as these results in injury.
- Turn the power off when removing the front cover and the wiring cover.  
If the power is on, it can result in electric shock or injury.
- Do not press too hard with the screwdriver.  
It can scratch the inverter unit.
- After wiring is complete, be sure to replace the front cover and the wiring cover.  
Otherwise, it can result in electric shock or fire.

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

- **Wiring of the power circuit/control terminal block (refer to [2. 3. 2])**
- **Switching of the control terminal block (refer to [2. 3. 5])**
- **Switching of the grounding capacitor (refer to [2. 3. 4])**
- **Mounting of the DC reactor attached with frame size A7 and A8 (refer to [2. 3. 7])**
- **Mounting of insert type options (refer to [10. 4])**
- **Connection change of the cooling fan power supply when a DC power supply is used (refer to Application manual "DC power supply connect to inverter" (E6582156).**
- **Heat discharge measures in the case of high ambient temperature, side-by-side installation of multiple inverters, etc. (refer to [2. 1. 2])**
- **Removal of installed inverters with frame sizes A1 to A5**

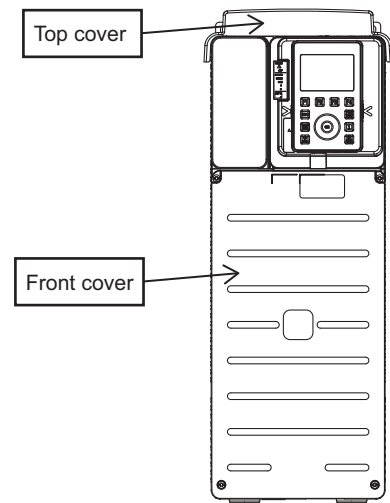
Use the procedure and corresponding figure for each type, shown in following pages, to remove portions such as covers.

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

The parts to be removed are as follows.

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

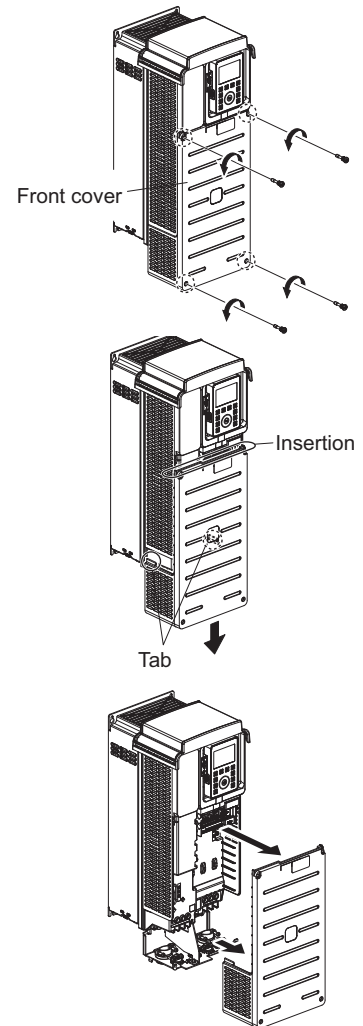
Each cover can be removed separately.



2

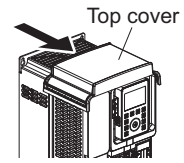
■ Front cover

- 1 Loosen four screws of the front cover.  
 Since the screws are of falling prevention type, they do not come off the front cover even if loosened.
  
- 2 Hold the both side of the front cover and pull it slightly downward.  
 The inserted part of the upper side of the front cover comes off.  
 The tab shown in the figure on the right also come off.
  
- 3 Pull the front cover toward you and remove it from the unit.
  
- 4 Mount the front cover in the reverse procedure.  
 Pay attention to engagement of the tab and insertion of the upper side of the cover.



■ **Top cover**

- 1 Put your fingers in the clearance in the back from the upper side of the top cover, and pull the cover toward you while lifting it upward.  
The tab shown in the figure on the right comes off.



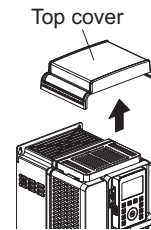
2



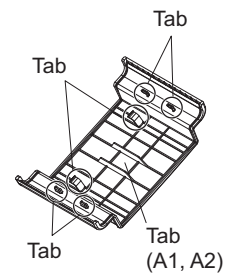
Important

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

- 2 Remove the top cover from the unit.



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

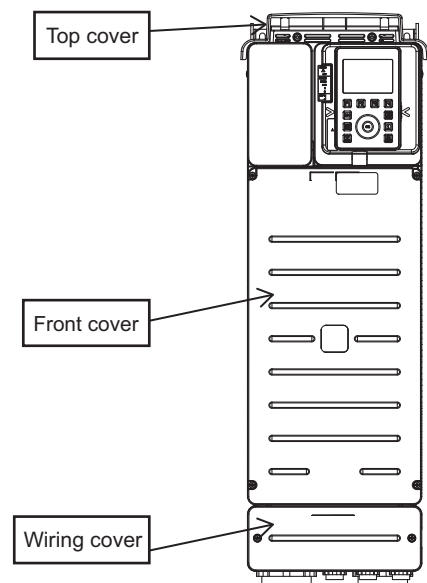


**2. 2. 2 With frame size A4**  
**VFAS3-2110P to 2185P, VFAS3-4220PC to 4370PC**

The parts to be removed are as follows.

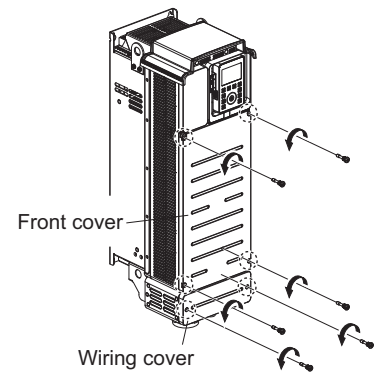
- **Front cover in the middle of the front surface (resin)**
- **Wiring cover on the lower side of the front surface (resin)**
- **Top cover on the top surface (resin)**

Each cover can be removed separately.



## ■ Front cover

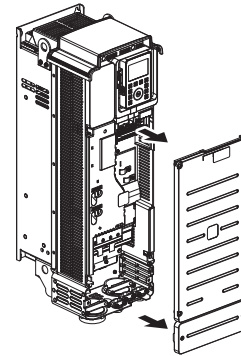
- 1 Loosen four screws of the front cover.  
Since the screws are of falling prevention type, they do not come off the front cover even if loosened.
- 2 Remove the front cover from the unit.  
The upper part of the front cover has no inserted part.
- 3 Mount the front cover in the reverse procedure.



2

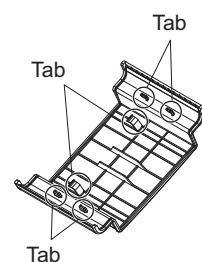
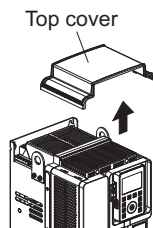
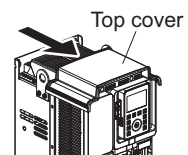
## ■ Wiring cover

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



## ■ Top cover

- 1 Put your fingers in the clearance in the back from the upper side of the top cover, and pull the cover toward you to remove it.  
The tab shown in the figure on the right comes off.



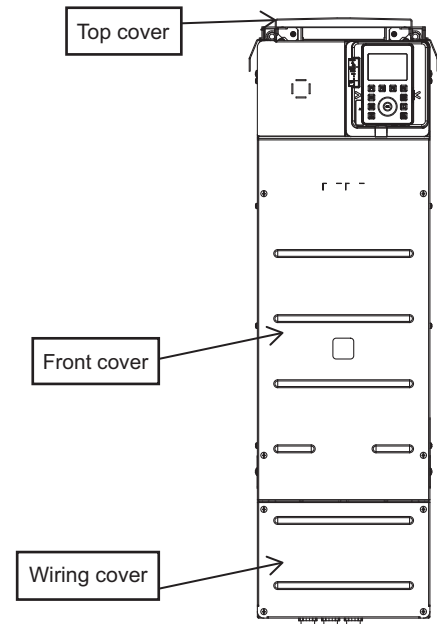
- 2 Mount the top cover in the reverse procedure.

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

The parts to be removed are as follows.

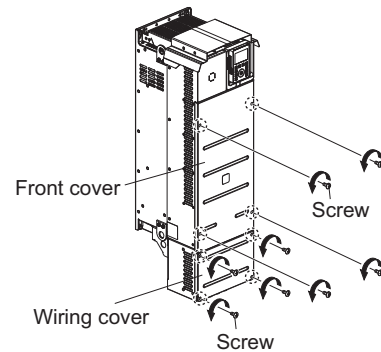
- **Front cover in the middle of the front surface (metal)**
- **Wiring cover on the lower side of the front surface (metal)**
- **Top cover on the top surface (metal)**

Each cover can be removed separately.



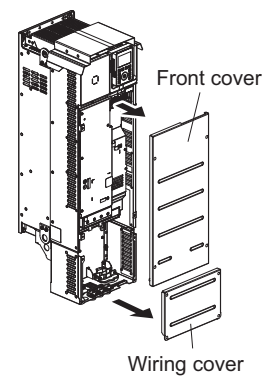
■ **Front cover**

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



■ **Wiring cover**

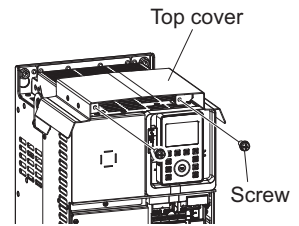
- 1 Remove four screws of the wiring cover.  
Store the removed screws so as not to be lost.
- 2 Remove the wiring cover from the unit.
- 3 Mount the wiring cover in the reverse procedure.



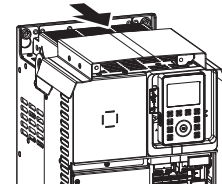


■ **Top cover**

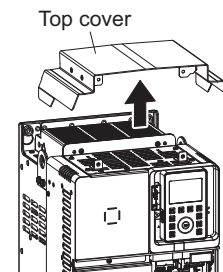
- 1 Remove two screws of the top cover.  
Store the removed screws so as not to be lost.



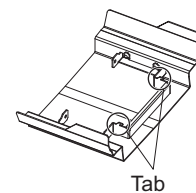
- 2 Pull the top cover slightly toward you.  
The tab shown in the figure on the right comes off.



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



- 4 Mount the top cover in the reverse procedure.

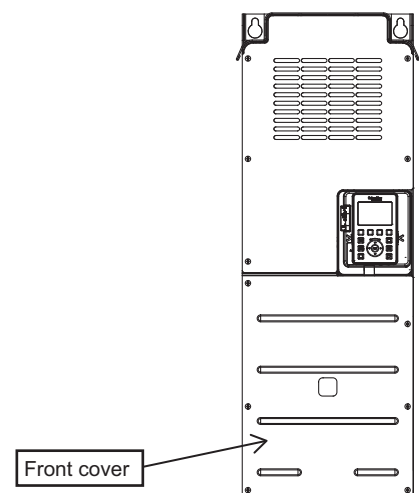


**2. 2. 4 With frame size A6**  
**VFAS3-2450P, 2550P,**  
**VFAS3-4900PC to 4132KPC**

The parts to be removed are as follows.

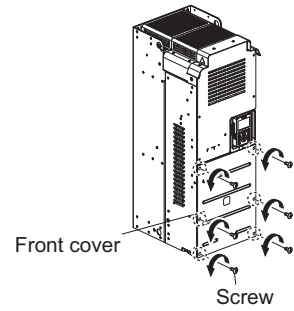
- **Front cover on the lower side of the front surface (metal)**
- **Transparent cover inside the front cover above (transparent resin)**
- **Wiring duct inside the front cover above (black resin)**

The top cover is never removed.

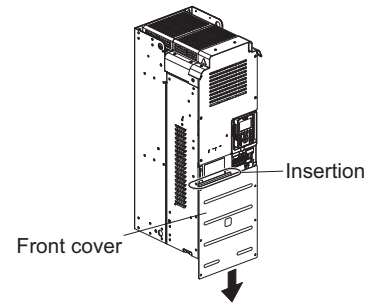


■ **Front cover**

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



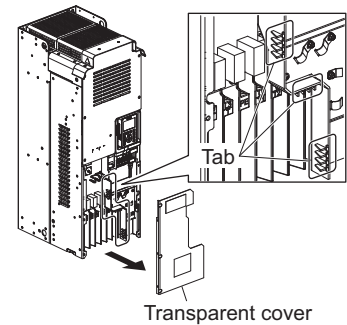
- 2 Lift the bottom end of the front cover, pull the entire cover downward and remove it from the unit.  
Since the upper part of the front cover has an inserted part, the cover cannot be removed just by lifting it.



- 3 Mount the front cover in the reverse procedure.

■ **Transparent cover**

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



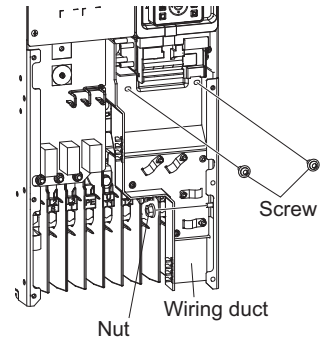
The transparent cover is just to be fitted in. It has no screw.

- 3 Mount the transparent cover in the reverse procedure.

■ **Wiring duct**

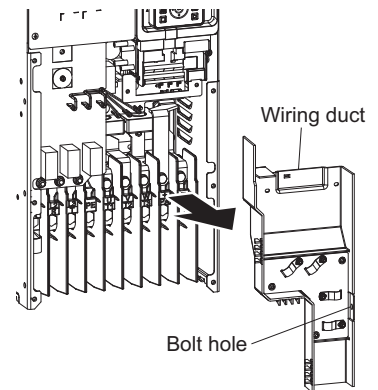
- 1 Remove the front cover and the transparent cover.  
Refer to the procedure above.

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



- Remove one nut.  
Store the removed nut so as not to be lost.

- Lift the left side of the wiring duct first and remove it from the unit.  
Be careful that the bolt from which the nut has been removed does not get caught in the bolt hole.



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

2

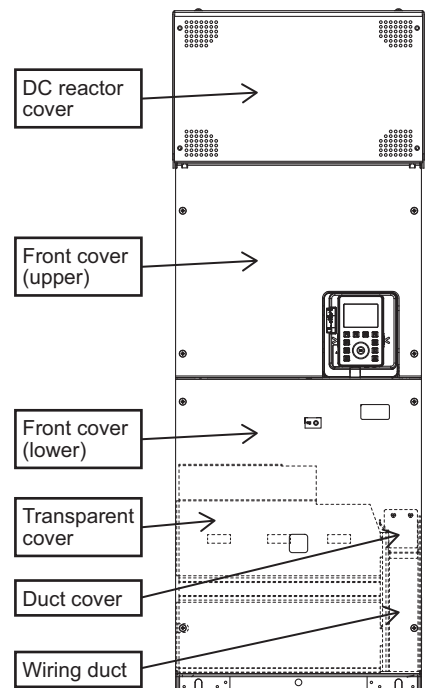
### 2. 2. 5 With frame size A7 and A8 VFAS3-4160KPC, VFAS3-4200KPC to 4280KPC

Here is a case of frame size A7.

Except for its wider unit, frame size A8 has the same enclosure and structure as frame size A7.

The parts to be removed are as follows.

- Front cover (lower) on the lower side of the front surface (metal)
- Transparent cover inside the front cover above (transparent resin)
- Wiring duct inside the front cover above (white resin)
- DC reactor cover on the upper side of the front surface (metal mesh)
- Front cover (upper) in the middle of the front surface (metal)

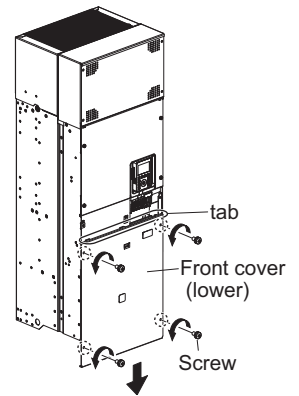


The DC reactor cover can be removed separately from the front cover.

The top cover is never removed.

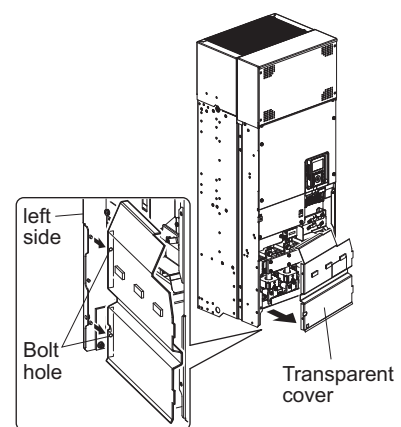
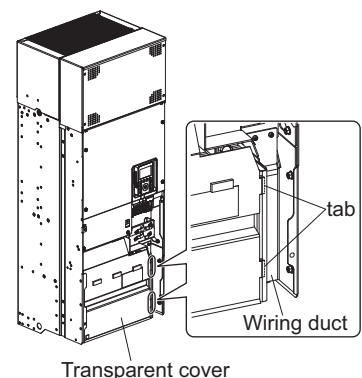
■ **Front cover (lower)**

- 1 Remove four screws of the front cover (lower).  
Store the removed screws so as not to be lost.
  
- 2 Lift the front cover (lower) and remove it from the unit.  
The upper side of the front cover (lower) has three tabs. If you lift them perpendicular to the cover, the cover can be removed without getting caught in the tabs.
  
- 3 Mount the front cover in the reverse procedure.

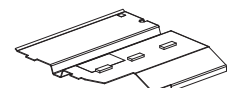


■ **Transparent cover**

- 1 Remove the front cover (lower).  
Refer to the procedure above.
  
- 2 Press and bend the wiring duct lightly by hand and remove two tabs on the right of the transparent cover from the fitting holes of the wiring duct.  
The tabs of the transparent cover are just fitted in.
  
- 3 Lift the right side of the transparent cover first and remove it from the unit.  
The transparent cover is just fitted in and has no screw.  
Be careful that two bolt holes on the left side of the transparent cover do not get caught.

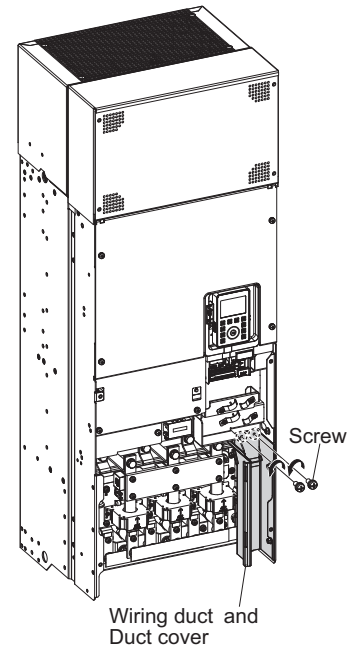


- 4 Mount the transparent cover in the reverse procedure.  
First, adjust the positions of two bolt holes and fit the cover in, then, fit two tabs on the right in the wiring duct.

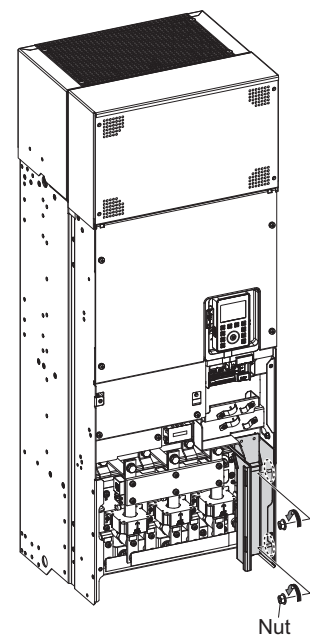


## ■ Wiring duct and Duct cover

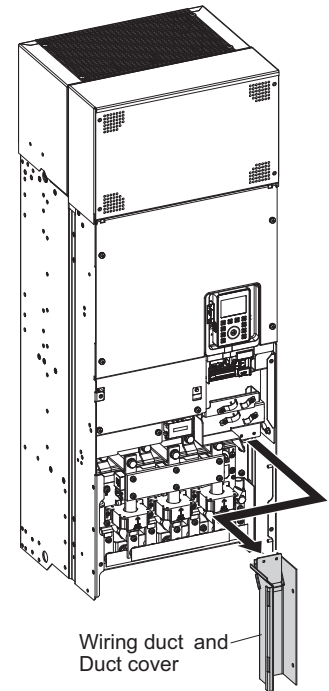
- 1 Remove the front cover (lower) and the transparent cover.  
Refer to the procedure above.
  
- 2 Remove two screws of Duct cover.  
Store Duct cover and screws so as not to be lost.



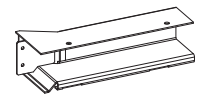
- 3 Remove two nuts of the wiring duct.  
Store the removed nuts so as not to be lost.



- 4 Remove the wiring duct from the unit by pulling it down.

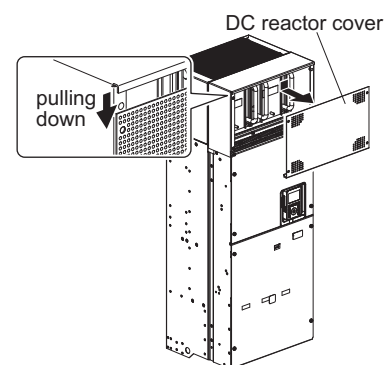
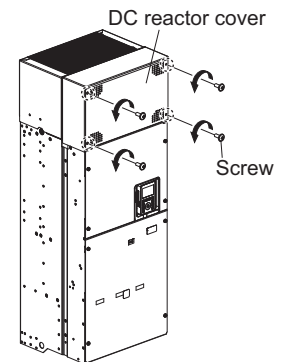


- 5 Mount Wiring duct and Duct cover in the reverse procedure.  
First, insert the upper right part of the wiring duct to the unit. See the figure in step 4.  
Be sure to mount the wiring duct before the transparent cover.



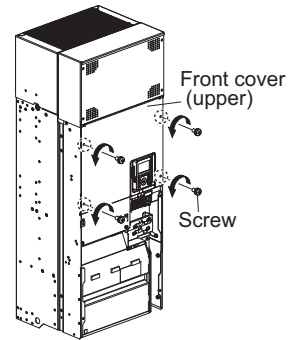
■ DC reactor cover

- 1 Remove four screws of the DC reactor cover.  
Store the removed screws so as not to be lost.
- 2 Lift the lower end of the DC reactor cover slightly and remove it from the unit by pulling down.  
The upper side of the DC reactor cover is to be inserted.
- 3 Mount the DC reactor cover in the reverse procedure.

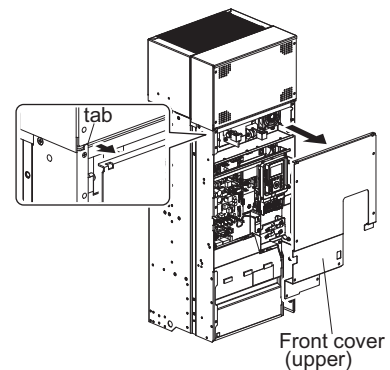


■ **Front cover (upper)**

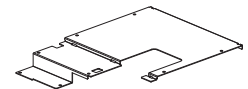
- 1 Remove the front cover (lower) and the DC reactor cover.  
Refer to the procedure above.
- 2 Remove eight screws of the front cover (upper).  
Store the removed screws so as not to be lost.



- 3 Lift the lower end of the front cover (upper) slightly, move the front cover (upper) slightly upward and unfasten two tabs of the unit.  
The upper end of the front cover (upper) is caught in two tabs of the unit.



- 4 Lift the front cover (upper) and remove it from the unit.



- 5 Mount the front cover (upper) in the reverse procedure.  
First, fit the upper end of the front cover (upper) in two tabs of the unit.  
Be sure to mount the front cover (upper) before the front cover (lower) and the DC reactor cover.

**2. 2. 6 Charge lamp**

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

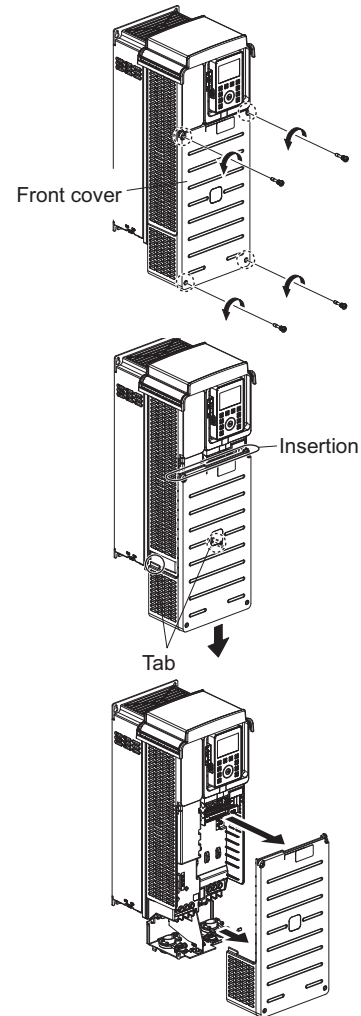
■ **With frame size A1 to A5  
VFAS3-2004P to 2370P, VFAS3-4004PC to 4750PC**

The charge lamp is inside the front cover.

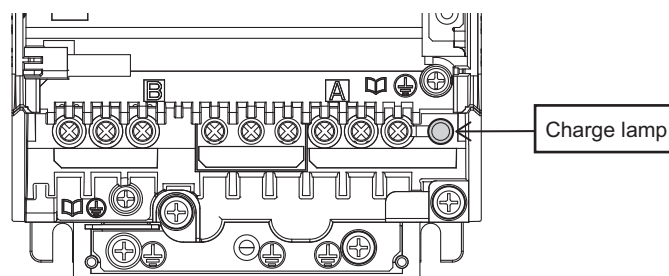
In the case of frame size A1, check the charge lamp in the following procedure. Also for other models, remove the front cover by referring to [2. 2] and check the charge lamp.

## 2

- 1 Loosen four screws of the front cover.  
Since the screws are of falling prevention type, they do not come off the front cover even if loosened.
  
- 2 Hold the both side of the front cover and pull it slightly downward.  
The inserted part of the upper side of the front cover comes off.  
The tab shown in the figure on the right also come off.
  
- 3 Pull the front cover toward you and remove it from the unit.



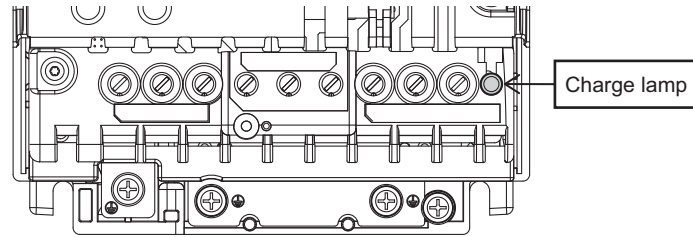
- 4 Check that the charge lamp is on/off.



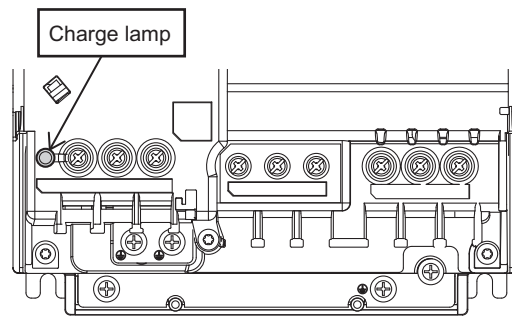
- 5 Mount the front cover in the reverse procedure.  
Pay attention to engagement of the tab and insertion of the upper side of the cover.



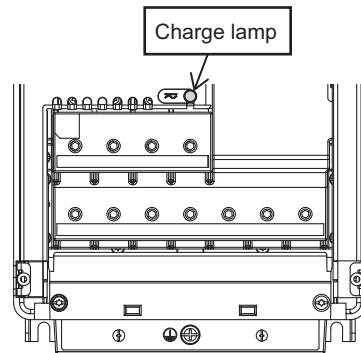
Frame size A2  
VFAS3-2037P, VFAS3-4055PC, 4075PC



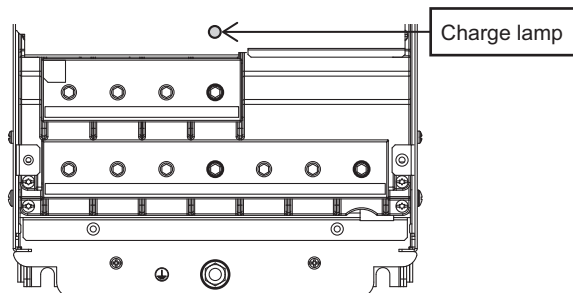
Frame size A3  
VFAS3-2055P, 2075P, VFAS3-4110PC to 4185PC



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



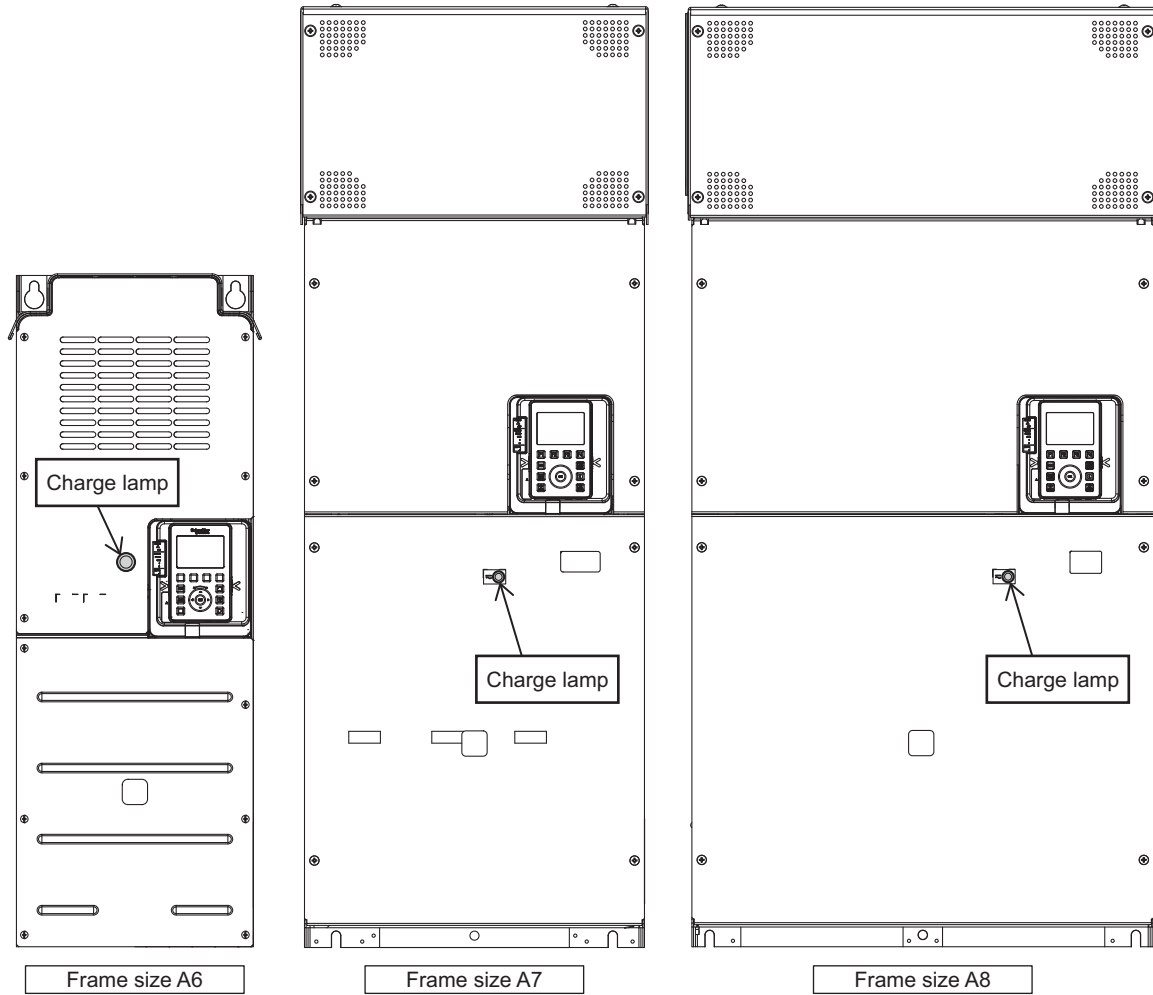
Frame size A5  
VFAS3-2220P to 2370P, VFAS3-4450PC to 4750PC



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




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

2



## 2.3 Wiring

### WARNING



 Disassembly prohibited	<ul style="list-style-type: none"> <li>• Never disassemble, modify or repair. This can result in electric shock, fire and other injury. Please call your Toshiba distributor for repairs.</li> </ul>
 Prohibited	<ul style="list-style-type: none"> <li>• Do not stick your fingers into openings such as cable wiring holes and cooling fan covers. The unit contains high voltage parts and contact with them will result in electric shock.</li> <li>• Do not place or insert any kind of object (electrical wire cuttings, rods, wires etc.) inside the inverter. This will cause a short circuit and result in electric shock or fire.</li> <li>• Do not allow water or any other fluids to come in contact with the inverter. This will cause a short circuit and result in electric shock or fire.</li> </ul>
 Mandatory action	<ul style="list-style-type: none"> <li>• All options to be used must be those specified by Toshiba. The use of options other than those specified by Toshiba will result in an accident.</li> <li>• In using a power distribution device and options for the inverter, they must be installed in a cabinet. When they are not installed in the cabinet, this will result in electric shock.</li> </ul>

2

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

### 2.3.1 Cautions for wiring

#### WARNING

 Prohibited	<ul style="list-style-type: none"> <li>• Never remove the front cover when the power is on. The unit contains high voltage parts and contact with them will result in electric shock.</li> </ul>
 Mandatory action	<ul style="list-style-type: none"> <li>• Mount the front cover after wiring. If you turn the power on without attaching the front cover, this will result in electric shock or other injury.</li> <li>• Electrical construction work must be done by a qualified expert. Erroneous connection of power supply by someone who does not have that expert knowledge will result in fire or electric shock.</li> <li>• Connect output terminals (motor side) correctly. If the phase sequence is incorrect, the motor will operate in reverse and that can result in injury.</li> <li>• Wiring must be done after installation. If you perform wiring prior to installation, this will result in electric shock or other injury.</li> <li>• Verify that the power is turned off and the charge lamp is off before starting wiring. If you perform wiring without verification, this will result in electric shock.</li> <li>• Tighten the screws on the terminal block to specified torque. If the screws are not tightened sufficiently to the specified torque, this will result in fire.</li> <li>• Verify that the power supply voltage is within +10% and -15% (<math>\pm 10\%</math> when the load is 100% in continuous operation) of the applied power supply voltage written on the name plate. If you do not use the appropriate power supply voltage, this will result in failure or fire.</li> </ul>



Be grounded

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

 CAUTION



Prohibited

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



Mandatory action

- Following type of screwdriver should be used;  
 Frame size A1 : PH2 (phillips, bit type2), shaft diameter 5.0mm or less  
 Frame size A2 : PH2 (phillips, bit type2), shaft diameter 5.8mm or less

Pay attention to the following when wiring.

■ **Measures for noise**

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

■ **Control power supply**



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

- To check the cause of the malfunction or trip, set <F602: Trip record retention> to "1: Retain at power off."
- To make the control circuit continuously operate even if the power circuit is shut off due to malfunction or tripping, use an optional control power supply unit and supply power to the control circuit.

■ **Wiring**

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

### 2.3.2 Standard connection method

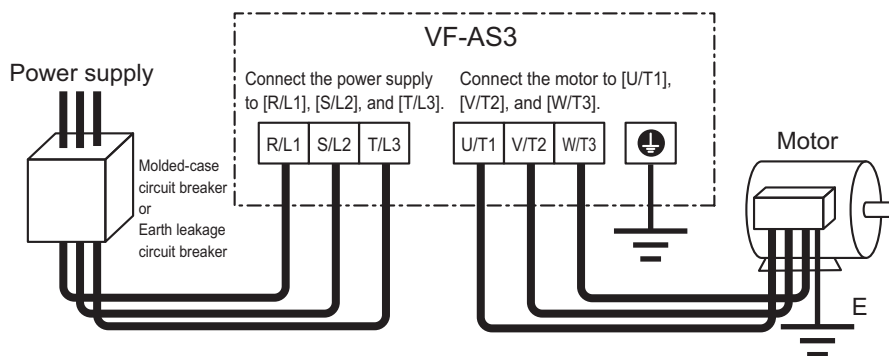
<b>⚠ WARNING</b>	
 Prohibited	<ul style="list-style-type: none"> <li>Do not connect power supply to the output (motor side) terminals [U/T1], [V/T2] and [W/T3]. Connecting power supply to the output will damage the inverter and result in fire.</li> <li>Do not insert a braking resistor between DC terminals [PA/+] and [PC/-] or [PO] and [PC/-]. This will result in fire. Please connect the braking resistor in accordance with the instruction manual.</li> <li>Do not touch wires of equipment (e.g. ELCB) that is connected to the inverter power side at least 15 minutes after turning off the power. If an electric charge remains in a capacitor in the inverter, touching the wires before the indicated time will result in electric shock.</li> </ul>
 Be grounded	<ul style="list-style-type: none"> <li>The grounding wire must be connected securely. If the grounding wire is not securely connected, when the inverter has failure or earth leakage, this will result in electric shock or fire.</li> </ul>

2

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

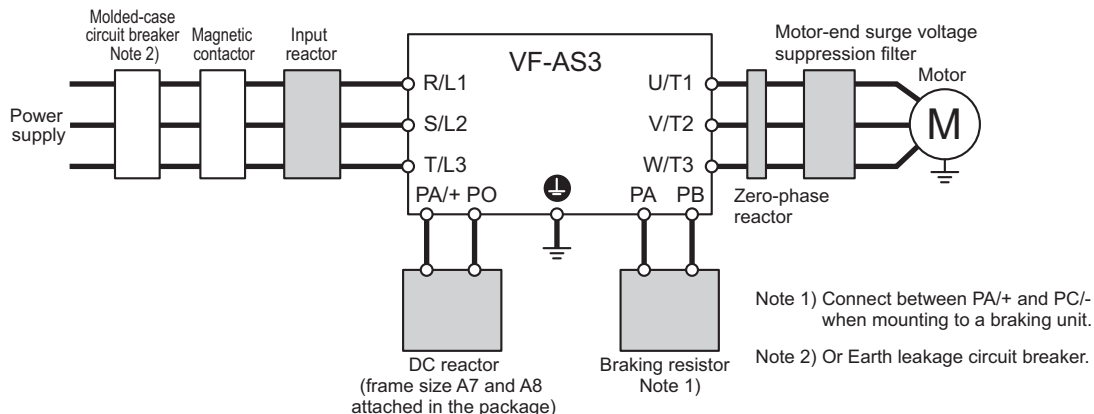
#### ■ Connection to power supply and motor

This diagram shows a standard wiring of the power circuit.  
 Connection to the power supply and motor wiring is common to all the types.



#### ■ Connection to peripheral devices

This diagram shows an example of connection to peripheral devices.



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

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

#### Braking resistor

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

For details, refer to [10. 3. 2].

#### DC input

- To input DC power, connect the inverter between terminals [PA/+] and [PC/-].
- When VFAS3-2110P to VFAS3-2550P or VFAS3-4220PC to VFAS3-4280KPC are used with a DC power supply, a circuit to suppress an inrush current should be required.
- When VFAS3-4160KPC to 4280KPC are used with a DC power supply, three-phase power input for cooling fan driving should be prepared separately.

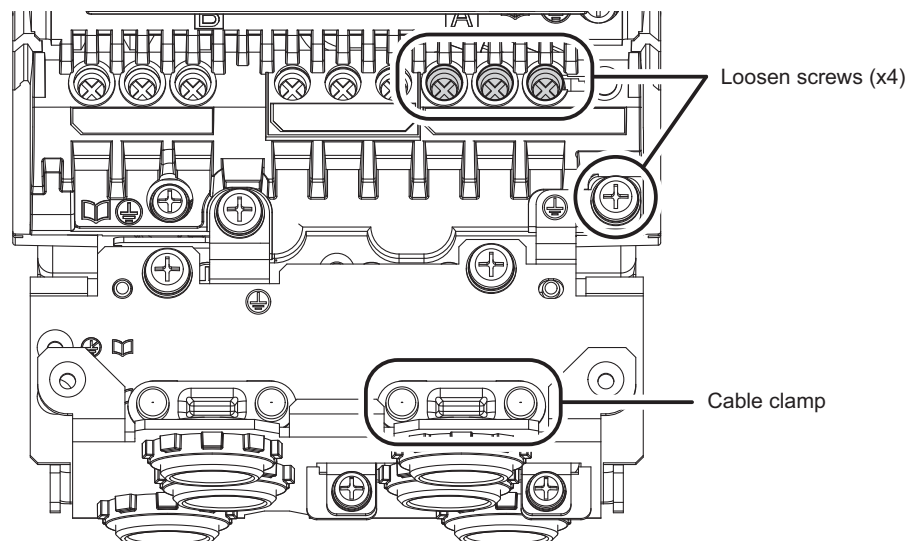
For details, refer to application manual "DC power supply connect to inverter" (E6582156).

### ■ Connection procedure of power circuit wiring

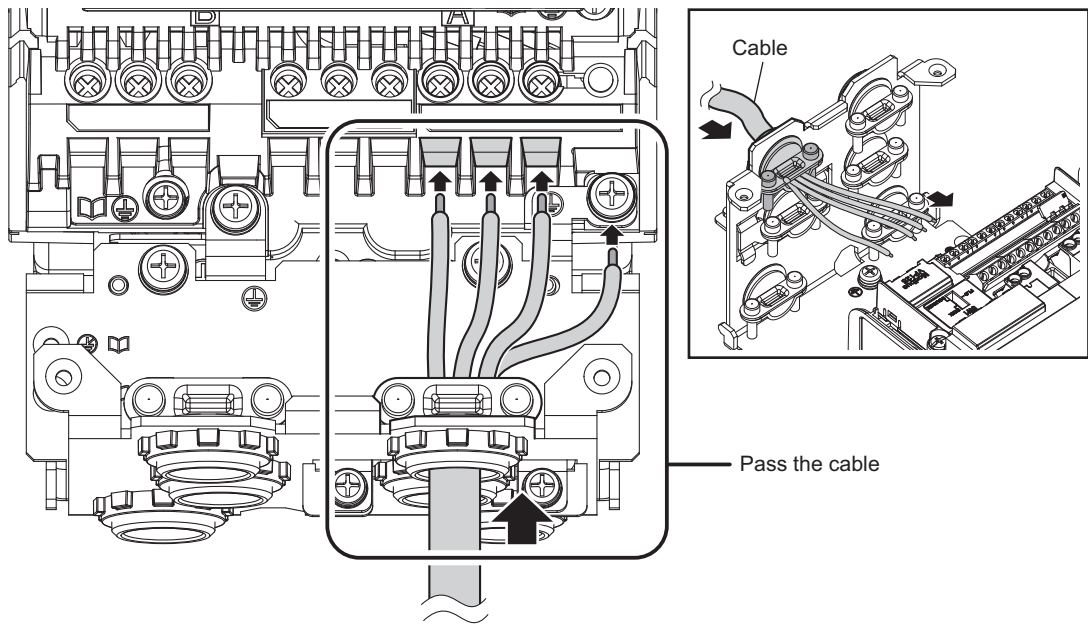
The following is the connection procedure of the power connection, with frame size A1 as an example.

Connect other sizes in the same way.

- 1 Remove the front cover.  
For how to remove, refer to [2. 2. 1].
- 2 Loosen the screws of the grounding terminal for inverter case. Mount the grounding wire to the screws of grounding terminal. Switch the grounding capacitor when needed. For details of how to switch, refer to [2. 3. 4].
- 3 Loosen the screws of the terminals [U/T1], [V/T2], and [W/T3] and a terminal [PE] of the power terminal block.  
The terminal [PE] exists only in frame size A4 to A6.

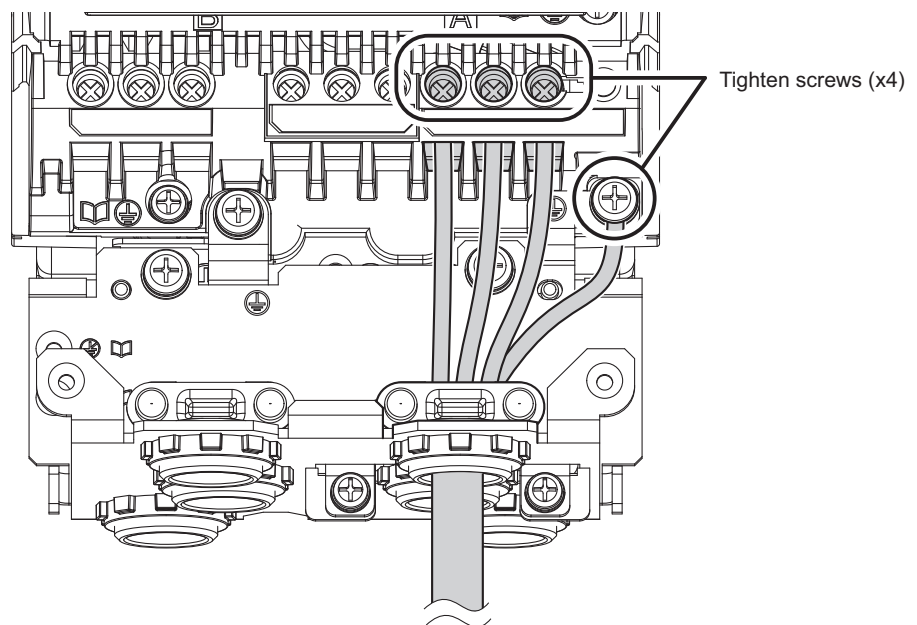


- 4 Pass the motor wiring through the cable clamp.  
The cable clamp exists only in frame size A1 to A5.
- 5 Mount the motor wiring to the screw of each corresponding terminal.  
Mount ferrules with insulation sleeve terminal and crimp-style terminal with insulation sleeve to the end of each wire of the motor in advance. For cautions, refer to "■Wiring" of [2. 3. 1].

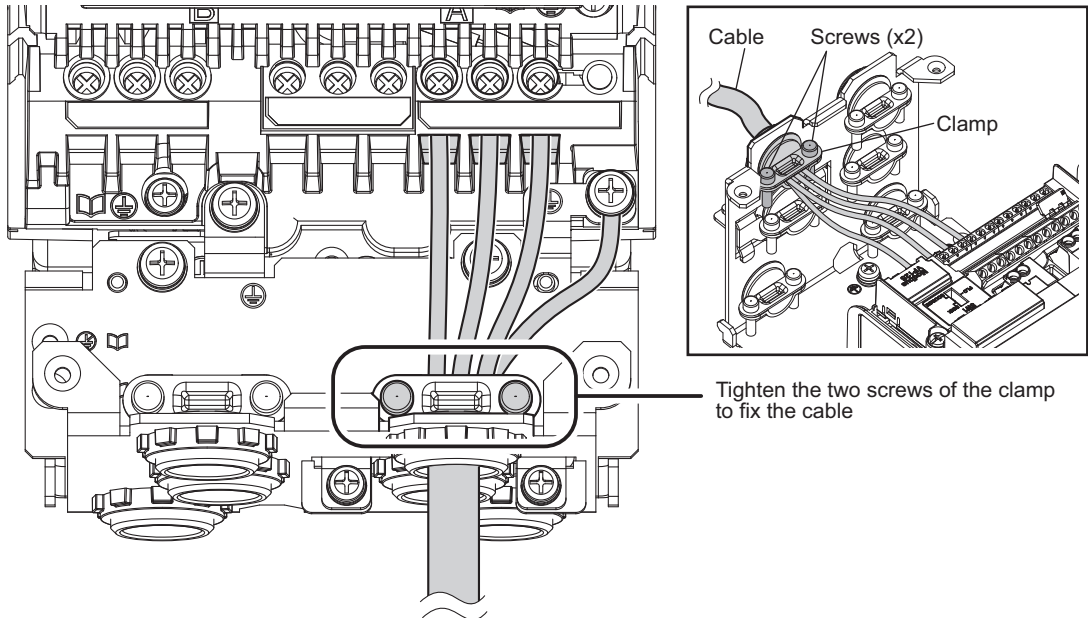


2

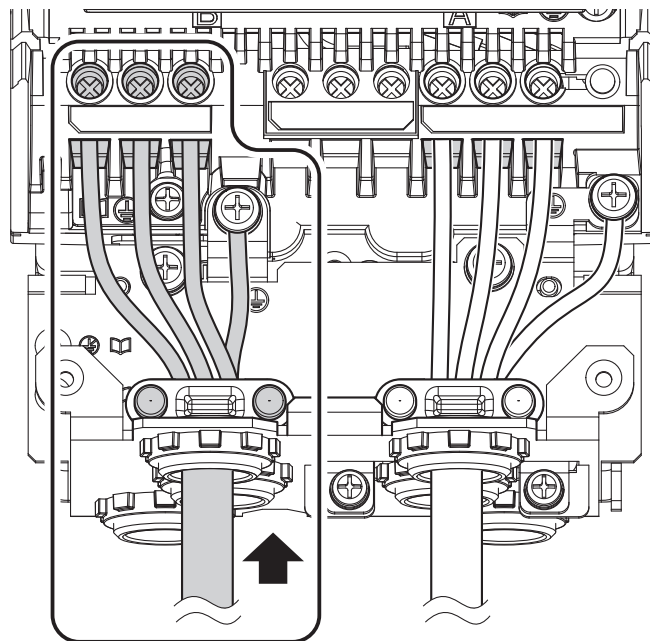
- 6 Tighten the screws of the terminals [U/T1], [V/T2], and [W/T3] and a terminal [PE].  
For the recommended tightening torque, refer to "■Recommended tightening torque of power terminal screws" of [2. 3. 3].



- 7 Tighten two screws of the cable clamp and fix the motor wiring (four wires) with the cable clamp.  
The cable clamp exists only in frame size A1 to A5.



- 8 Similarly, mount the power supply wiring to the terminals [R/L1], [S/L2], and [T/L3] and a terminal [PE] after passing it through other cable clamp.  
For the recommended tightening torque of the screws, refer to "■Recommended tightening torque of power terminal screws" of [2. 3. 3].  
Also fix the power supply wiring with the cable clamp.  
The cable clamp exists only in frame size A1 to A5.



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



**Memo**

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

**■ Connection of control circuit**

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

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

**■ Standard connection diagram**

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



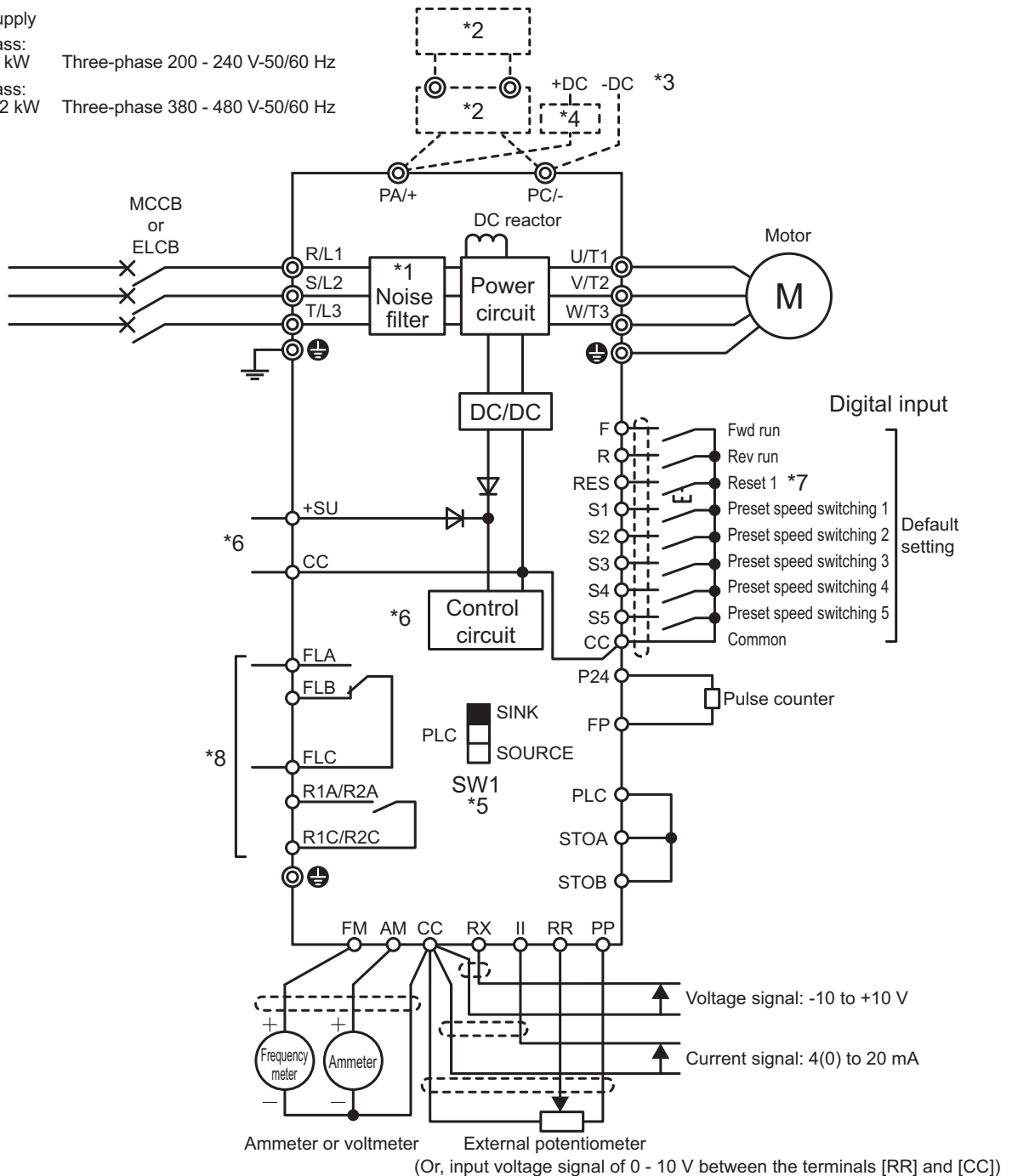
[Standard connection diagram - Sink]

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

Power supply

240 V class:  
45 - 55 kW Three-phase 200 - 240 V-50/60 Hz

480 V class:  
90 - 132 kW Three-phase 380 - 480 V-50/60 Hz



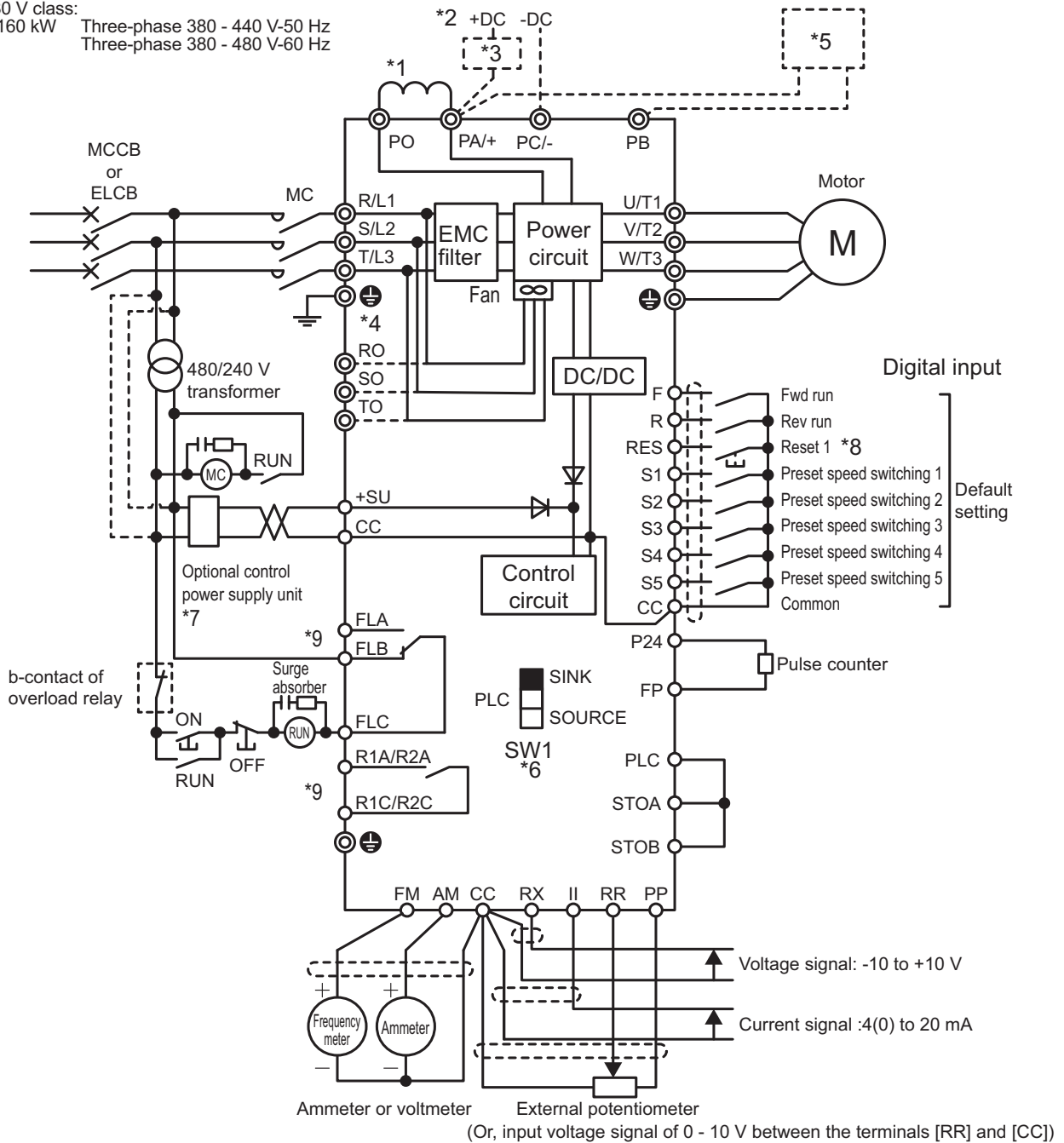
- \*1 EMC filter is built in 480 V class.
- \*2 When a braking resistor (optional) is mounted, a braking unit (optional) is also required.
- \*3 To input DC power, connect the inverter between the terminals [PA/+] and [PC/-].
- \*4 When the inverter is used with a DC power supply, a circuit to suppress an inrush current should be required. For detail, refer to application manual "DC power supply connect to inverter" (E6582156).
- \*5 For the switch function, refer to [2. 3. 5].
- \*6 To supply control power from an external power supply for backing up the control power supplied from the inverter, an optional control power supply unit (CPS002Z) is required. In this case, it is used in conjunction with the inverter internal power supply. Set <F647: Control power option failure detection> to back up the control power supply. For details, refer to [6. 30. 20].
- \*7 The reset signal is activated by ON→OFF trigger input.
- \*8 Connect to power to comply with OVC2 (Over Voltage Category 2). Isolation transformer is necessary when connecting to power supply (OVC3).

[Standard connection diagram - Sink]

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

Power supply

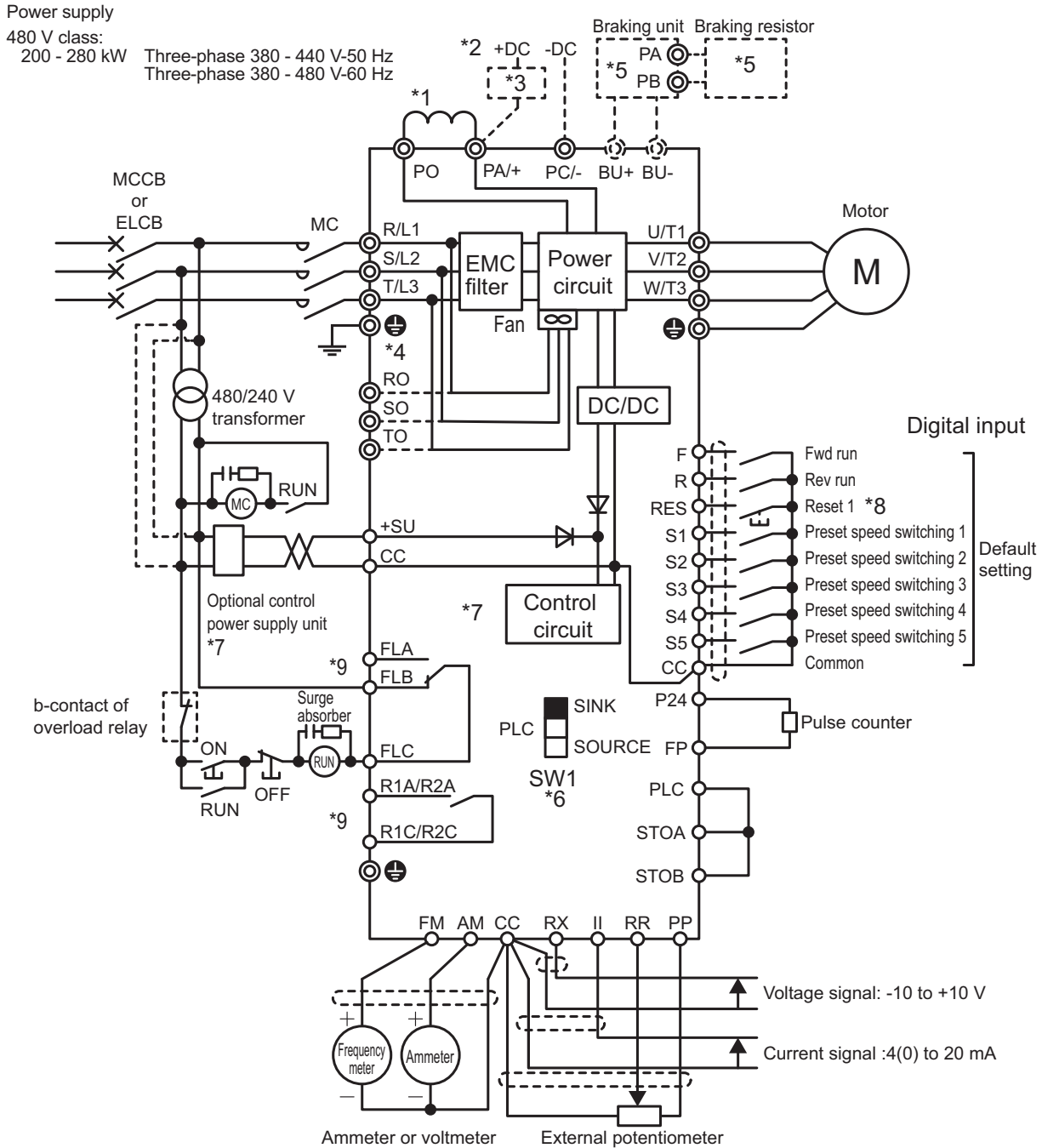
480 V class:  
160 kW Three-phase 380 - 440 V-50 Hz  
Three-phase 380 - 480 V-60 Hz



- \*1 Be sure to mount the DC reactor. A circuit between the terminals [PA/+] and [PO] is not short circuited (at the time of shipping).
- \*2 To input DC power, connect the inverter between the terminals [PA/+] and [PC/-].
- \*3 When the inverter is used with a DC power, a circuit to suppress an inrush current should be required. For detail, refer to application manual "DC power supply connect to inverter" (E6582156).
- \*4 When the inverter is used with a DC power supply, three-phase power input for cooling fan driving is required separately. For details, refer to application manual "DC power supply connect to inverter" (E6582156).
- \*5 External braking resistor (option)
- \*6 For the switch function, refer to [2. 3. 5].
- \*7 To supply control power from an external power supply for backing up the control power supplied from the inverter, an optional control power supply unit (CPS002Z) is required. In this case, it is used in conjunction with the inverter internal power supply. Set <F647: Control power option failure detection> to back up the control power supply. For details, refer to [6. 30. 20].
- \*8 The reset signal is activated by ON→OFF trigger input.
- \*9 Connect to power to comply with OVC2 (Over Voltage Category 2). Isolation transformer is necessary when connecting to power supply (OVC3).

[Standard connection diagram - Sink]

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



- \*1 Be sure to mount the DC reactor. It is not required for DC power input terminal. A circuit between the terminals [PA+] and [PO] is not short circuited (at the time of shipping).
- \*2 To input DC power, connect the inverter between the terminals [PA+] and [PC-]. It is not used in conjunction with the DC reactor option DCL1.
- \*3 When the inverter is used with a DC power supply, a circuit to suppress an inrush current is required. For detail, refer to application manual "DC power supply connect to inverter" (E6582156).
- \*4 When the inverter is used with a DC power supply, three-phase power input for cooling fan driving is required separately. For details, refer to application manual "DC power supply connect to inverter" (E6582156).
- \*5 When a braking resistor (optional) is mounted, a braking unit (optional) is also required.
- \*6 For the switch function, refer to [2. 3. 5].
- \*7 To supply control power from an external power supply for backing up the control power supplied from the inverter, an optional control power supply unit (CPS002Z) is required. In this case, it is used in conjunction with the inverter internal power supply. Set <F647: Control power option failure detection> to back up the control power supply. For details, refer to [6. 30. 20].
- \*8 The reset signal is activated by ON→OFF trigger input.
- \*9 Connect to power to comply with OVC2 (Over Voltage Category 2). Isolation transformer is necessary when connecting to power supply (OVC3).

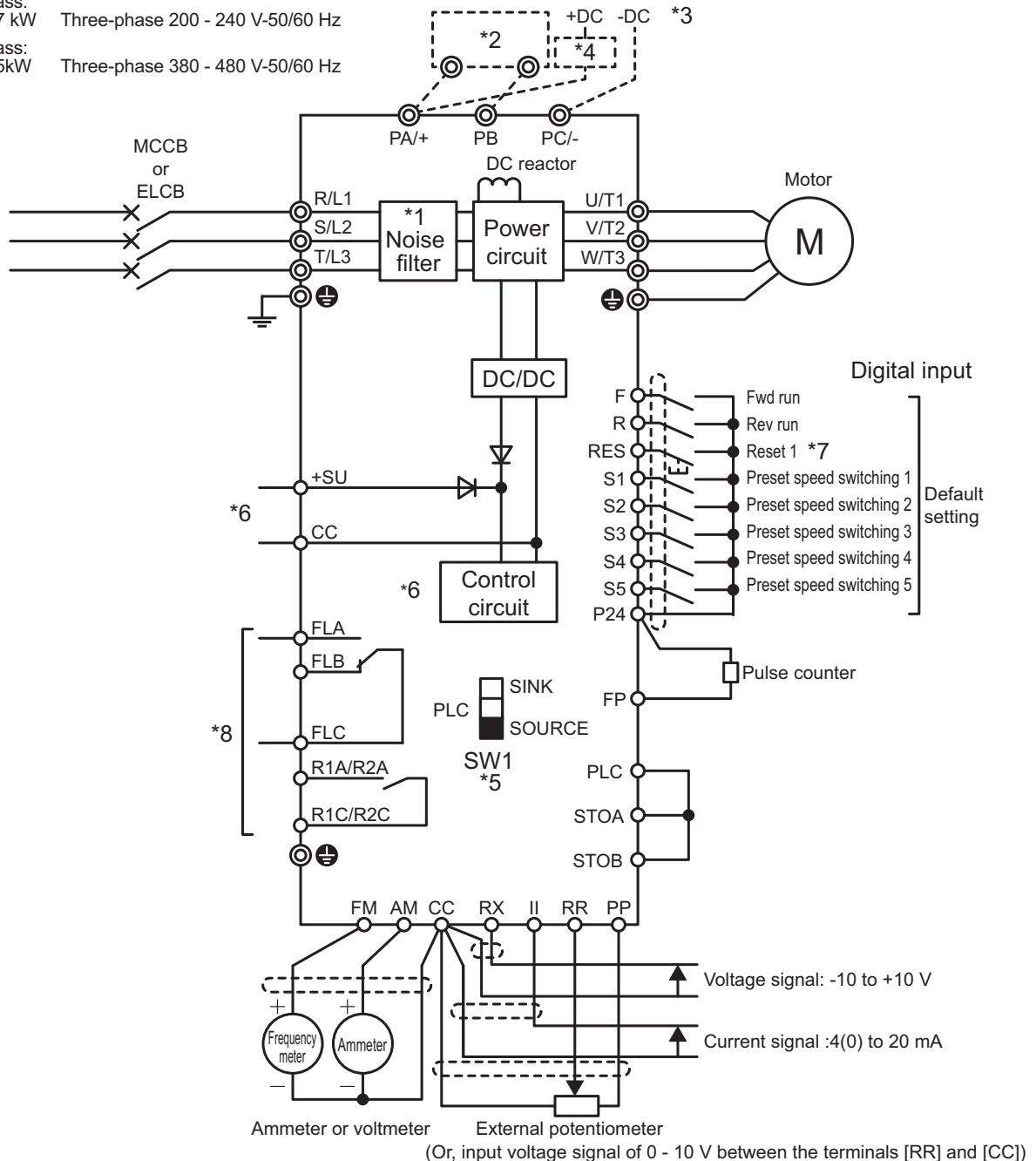
[Standard connection diagram - Source]

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

Power supply

240 V class:  
0.4 - 37 kW Three-phase 200 - 240 V-50/60 Hz

480 V class:  
0.4 - 75kW Three-phase 380 - 480 V-50/60 Hz



- \*1 EMC filter is built in 480 V class.
- \*2 External braking resistor (option).
- \*3 To input DC power, connect the inverter between the terminals [PA/+] and [PC/-].  
When your inverter is VFAS3-2110P to VFAS3-2370P or VFAS3-4220PC to VFAS3-4750PC, a circuit to suppress an inrush current is required. For detail refer to application manual "DC power supply connect to inverter" (E6582156).
- \*5 For the switch function, refer to [2. 3. 5].
- \*6 To supply control power from an external power supply for backing up the control power supplied from the inverter, an optional control power supply unit (CPS002Z) is required. In this case, it is used in conjunction with the inverter internal power supply.  
Set <F647: Control power option failure detection> to back up the control power supply.  
For details, refer to [6. 30. 20].
- \*7 The reset signal is activated by ON→OFF trigger input.
- \*8 Connect to power to comply with OVC2 (Over Voltage Category 2). Isolation transformer is necessary when connecting to power supply (OVC3).

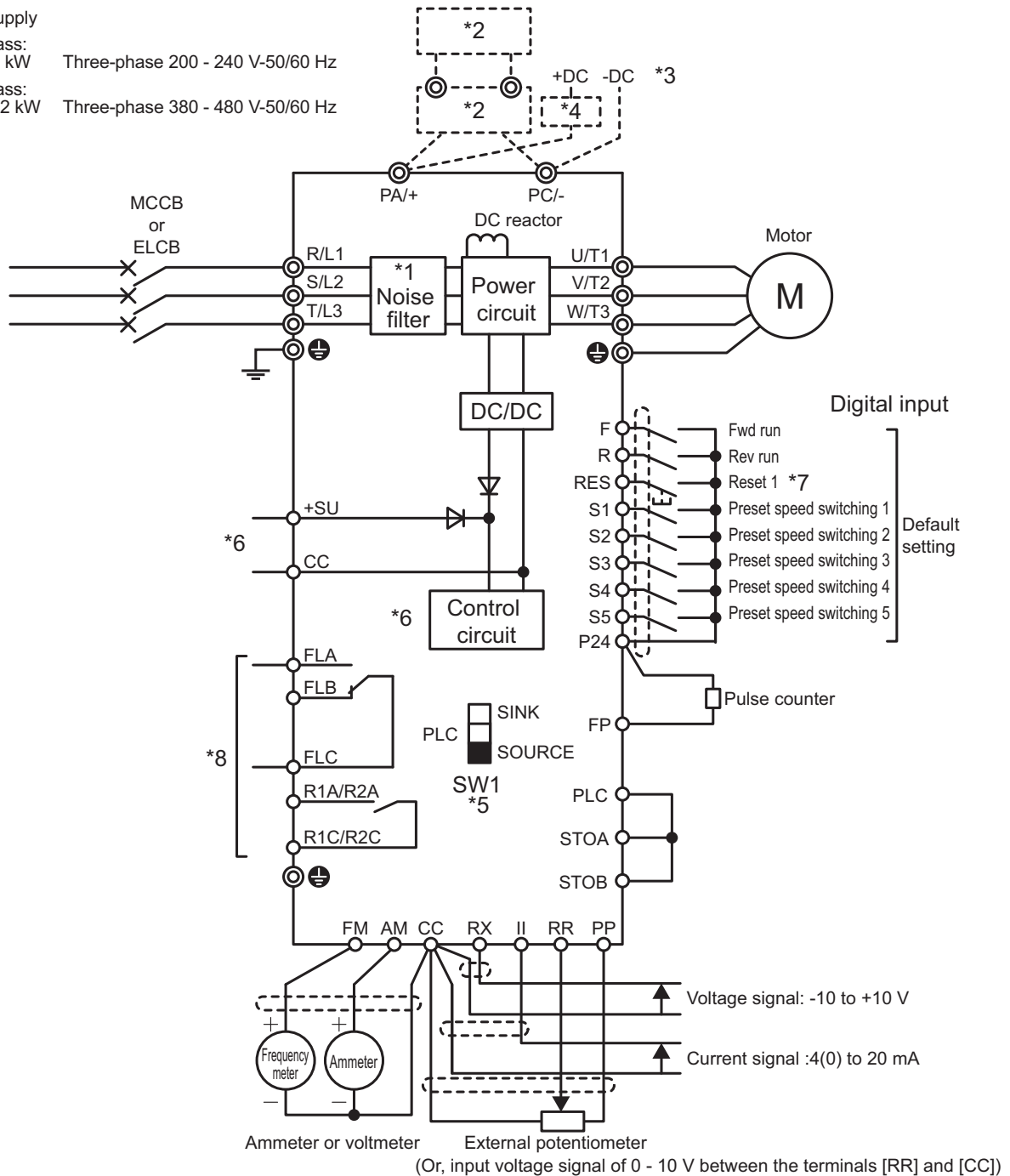
[Standard connection diagram - Source]

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

Power supply

240 V class:  
45 - 55 kW Three-phase 200 - 240 V-50/60 Hz

480 V class:  
90 - 132 kW Three-phase 380 - 480 V-50/60 Hz



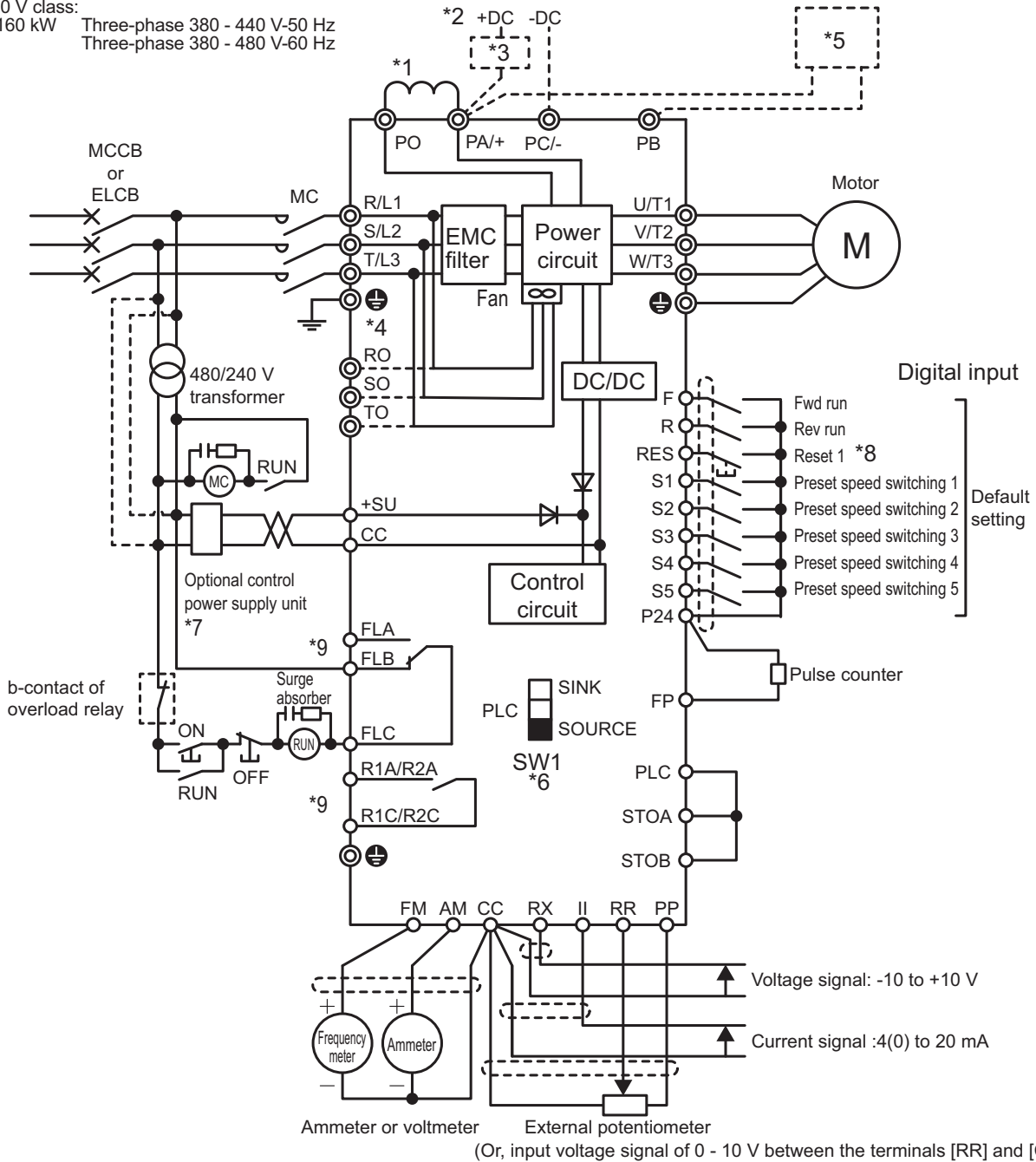
- \*1 EMC filter is built in 480 V class.
- \*2 When a braking resistor (optional) is mounted, a braking unit (optional) is also required.
- \*3 To input DC power, connect the inverter between the terminals [PA/+] and [PC/-].
- \*4 When the inverter is used with a DC power supply, a circuit to suppress an inrush current is required. For detail, refer to application manual "DC power supply connect to inverter" (E6582156).
- \*5 For the switch function, refer to [2. 3. 5].
- \*6 To supply control power from an external power supply for backing up the control power supplied from the inverter, an optional control power supply unit (CPS002Z) is required. In this case, it is used in conjunction with the inverter internal power supply. Set <F647: Control power option failure detection> to back up the control power supply. For details, refer to [6. 30. 20].
- \*7 The reset signal is activated by ON→OFF trigger input.
- \*8 Connect to power to comply with OVC2 (Over Voltage Category 2). Isolation transformer is necessary when connecting to power supply (OVC3).

[Standard connection diagram - Source]

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

Power supply

480 V class:  
 160 kW Three-phase 380 - 440 V-50 Hz  
 Three-phase 380 - 480 V-60 Hz

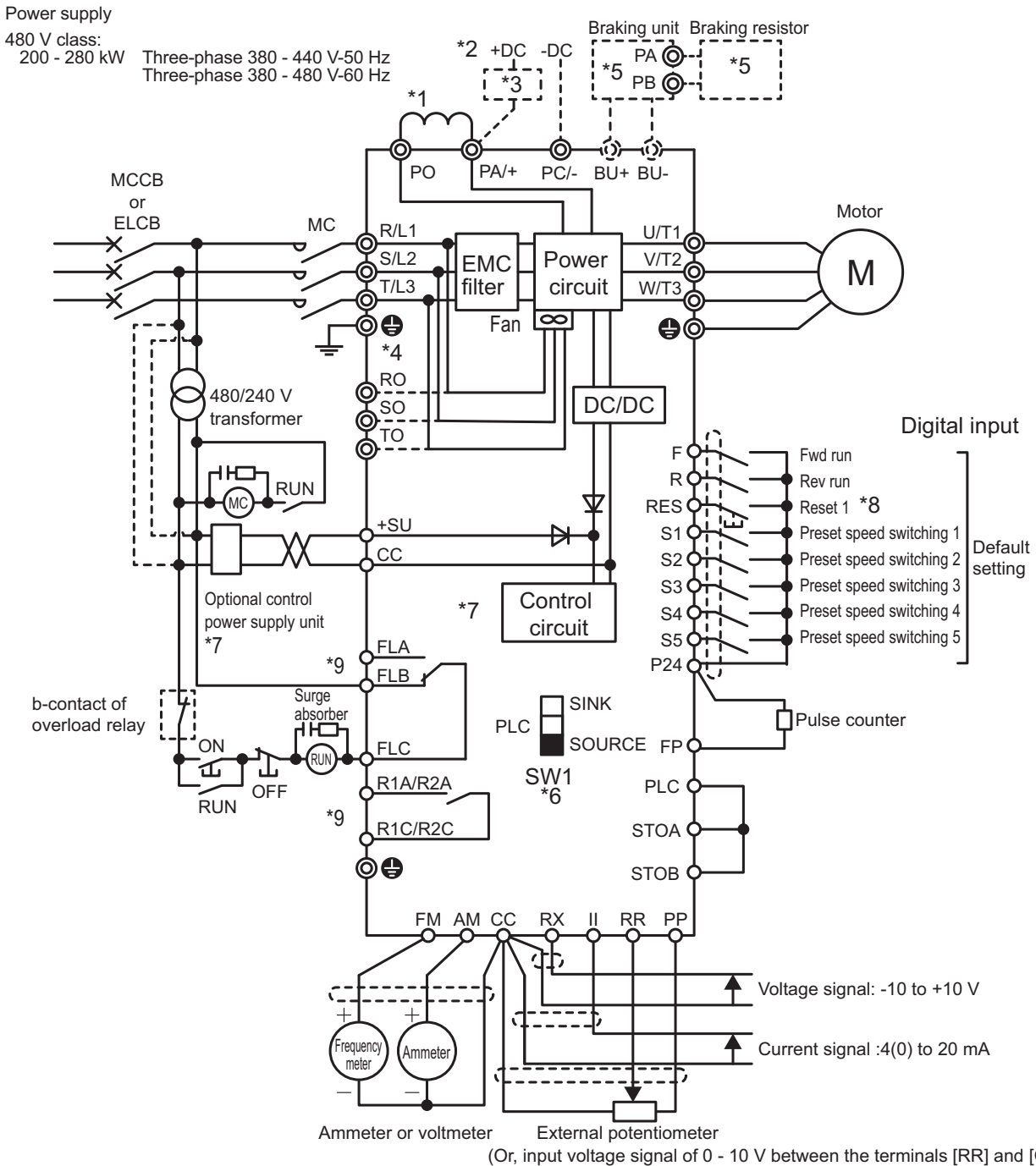


- \*1 Be sure to mount the DC reactor. A circuit between the terminals [PA/+] and [PO] is not short circuited (at the time of shipping).
- \*2 To input DC power, connect the inverter between the terminals [PA/+] and [PC/-].
- \*3 When the inverter is used with a DC power, a circuit to suppress an inrush current should be required. For detail, refer to application manual "DC power supply connect to inverter" (E6582156).
- \*4 When the inverter is used with a DC power supply, three-phase power input for cooling fan driving is required separately. For details, refer to application manual "DC power supply connect to inverter" (E6582156).
- \*5 External braking resistor (option)
- \*6 For the switch function, refer to [2. 3. 5].
- \*7 To supply control power from an external power supply for backing up the control power supplied from the inverter, an optional control power supply unit (CPS002Z) is required. In this case, it is used in conjunction with the inverter internal power supply. Set <F647: Control power option failure detection> to back up the control power supply. For details, refer to [6. 30. 20].
- \*8 The reset signal is activated by ON→OFF trigger input.
- \*9 Connect to power to comply with OVC2 (Over Voltage Category 2). Isolation transformer is necessary when connecting to power supply (OVC3).



[Standard connection diagram - Source]

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




- \*1 Be sure to mount the DC reactor. It is not required for DC power input terminal. A circuit between the terminals [PA/+] and [PO] is not short circuited (at the time of shipping).
- \*2 To input DC power, connect the inverter between the terminals [PA/+] and [PC/-]. It is not used in conjunction with the DC reactor option DCL1.
- \*3 When the inverter is used with a DC power supply, a circuit to suppress an inrush current is required. For detail, refer to application manual "DC power supply connect to inverter" (E6582156).
- \*4 When the inverter is used with a DC power supply, three-phase power input for cooling fan driving is required separately. For details, refer to application manual "DC power supply connect to inverter" (E6582156).
- \*5 If a braking resistor (optional) is mounted, a braking unit (optional) is also required.
- \*6 For the switch function, refer to [2. 3. 5].
- \*7 To supply control power from an external power supply for backing up the control power supplied from the inverter, an optional control power supply unit (CPS002Z) is required. In this case, it is used in conjunction with the inverter internal power supply.
- \*8 The reset signal is activated by ON→OFF trigger input.
- \*9 Connect to power to comply with OVC2 (Over Voltage Category 2). Isolation transformer is necessary when connecting to power supply (OVC3).

### 2. 3. 3 Power terminals

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

■ Functions of power terminals

Terminal symbol	Function	Applicable frame size
	Grounding terminal for inverter case. There are 3 terminals in cooling fin or mounting part of EMC plate.	All frame sizes
[PE]	Grounding terminal.	Frame size A4, A5, and A6
[R/L1] [S/L2] [T/L3]	Connected to an AC power supply. 240 V class: Three-phase 200 - 240 V-50/60 Hz 480 V class: VFAS3-4004PC to 4132KPC : Three-phase 380 - 480 V-50/60 Hz VFAS3-4160KPC to 4280KPC : Three-phase 380 - 440 V- 50 Hz Three-phase 380 - 480 V- 60 Hz	All frame sizes
[U/T1] [V/T2] [W/T3]	Connected to a three-phase motor.	All frame sizes
[PA/+] [PB]	Connected to a braking resistor. Change the parameters <F304: Dynamic braking, OLr trip>, <F308: Braking resistance>, and <F309: Braking resistor capacity> if necessary.	Frame size A1, A2, A3, A4, A5, and A7
[BU/+] [BU/-]	Inside the inverter. Connected to a braking unit (optional). Braking resistor (optional) is connected to a braking unit terminals [PA] and [PB].	Frame size A8
[PA/+] [PC/-]	A DC power can be input. For models of VFAS3-2110P to 2550P and VFAS3-4220PC to 4280KPC, a rush current suppression circuit (optional) is required. Connected to a braking unit (Optional) for frame size A6. Supply AC power supply to cooling fans if you use VFAS3-4160KPC - 4280KPC with DC input.	All frame sizes
[PA/+] [P0]	Be sure to connect the attached DC reactor.	Frame sizes A7 and A8
[R0] [S0] [T0]	Supply AC power supply for cooling fans if you use VFAS3-4160KPC - 4280KPC with DC input.	Frame sizes A7 and A8

**Memo**

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

■ **Recommended tightening torque of power terminal screws**

**Power terminal torque and wire strip length**

Screw size	Frame size	Torque		Strip length (mm)	Cable size
		(N · m)	(lb · in)		
M4	A1	1.3	11.5	10	-
	A2	1.5	13.3	10	-
M5	A3	2.6	23	18	-
M8	A4	5.0	44.3	28	AWG2 or smaller
		10	88.5	28	AWG1 or bigger
M10	A6	27	239	-	-
M12	A5	10	88.5	35	AWG1/0 or smaller
		18	159	35	AWG2/0 or bigger
M12	A7/A8	41	360	-	-
M10	A7	24	212	-	-
M4	A7/A8	1.4	12.4	-	-

2

**Grounding terminal torque**

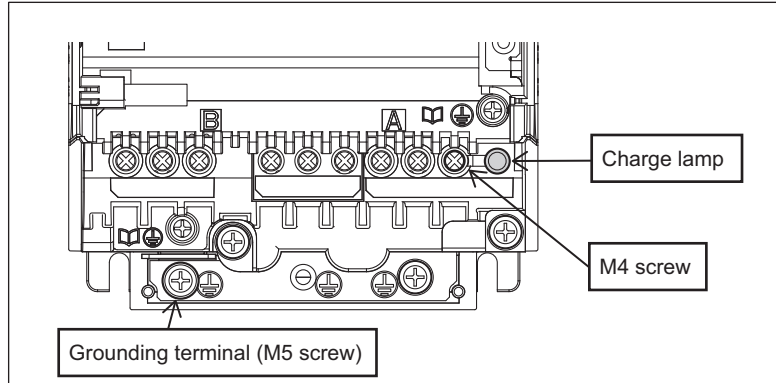
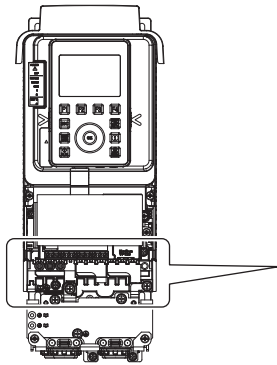
Screw size	Frame size	Torque		Strip length (mm)	Cable size
		(N · m)	(lb · in)		
M5	A1,A2,A3	2.6	23	-	-
M6	A4	4.4	38.9	-	-
M8	A4	5.0	44.3	28	AWG2 or smaller
		10	88.5	28	AWG1 or bigger
M8	A5,A6	11.8	104	-	-
M10	A6	27	239	-	-
M12	A5	10	88.5	35	AWG1/0 or smaller
		18	159	35	AWG2/0 or bigger
M12	A7/A8	41	360	-	-
M10	A7	24	212	-	-

Note) 1(N · m) = 8.850(lb · in)

■ Arrangement of power terminals

1) Frame size A1

VFAS3-2004P to 2022P, VFAS3-4004PC to 4037PC



**⚠ CAUTION**

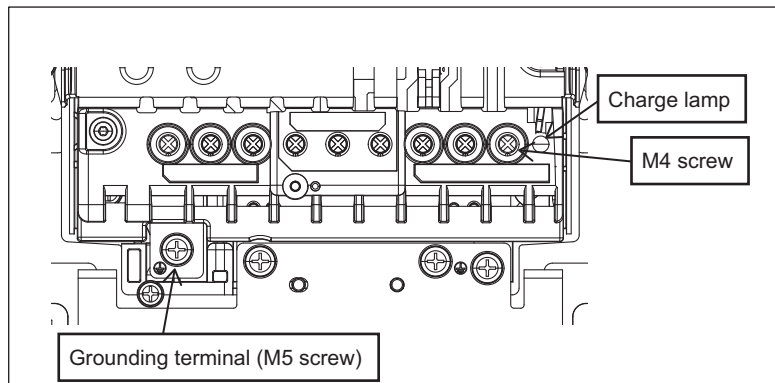
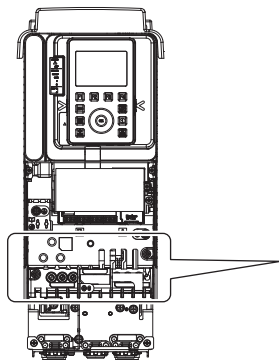


Mandatory action

- Following type of screwdriver should be used for M4 screw; PH2 (phillips, bit type2), shaft diameter 5.0 mm or less.

2) Frame size A2

VFAS3-2037P, VFAS3-4055PC, 4075PC



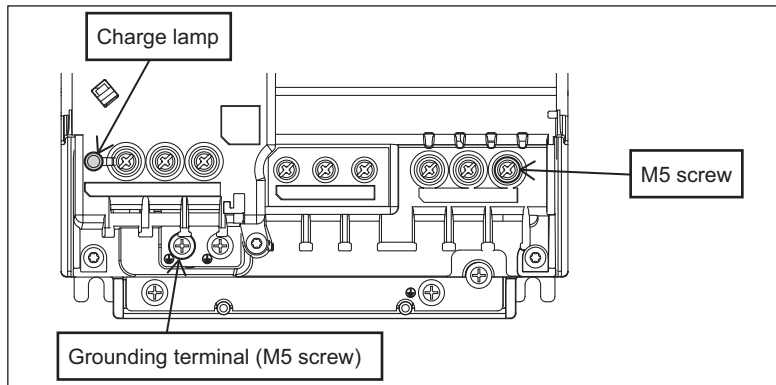
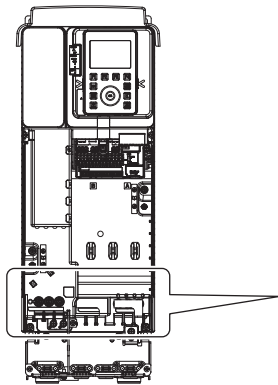
**⚠ CAUTION**



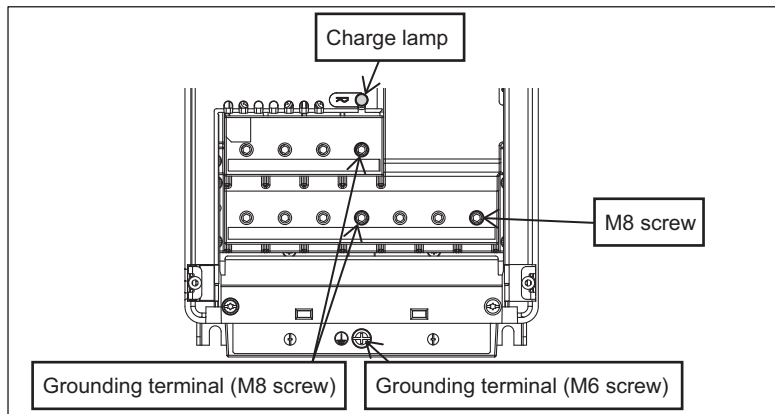
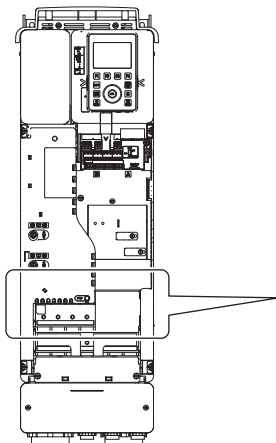
Mandatory action

- Following type of screwdriver should be used for M4 screw; PH2 (phillips, bit type2), shaft diameter 5.8 mm or less

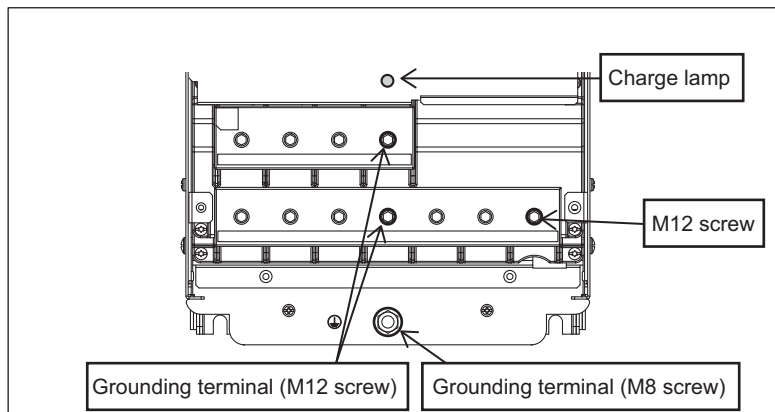
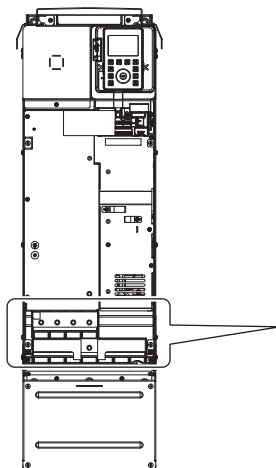
**3) Frame size A3  
VFAS3-2055P, 2075P, VFAS3-4110PC to 4185PC**



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

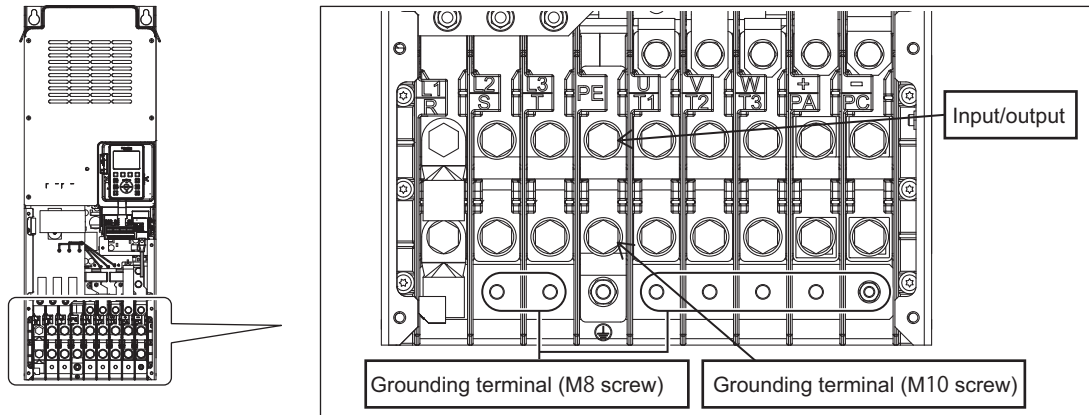


**5) Frame size A5  
VFAS3-2220P to 2370P, VFAS3-4450PC to 4750PC**

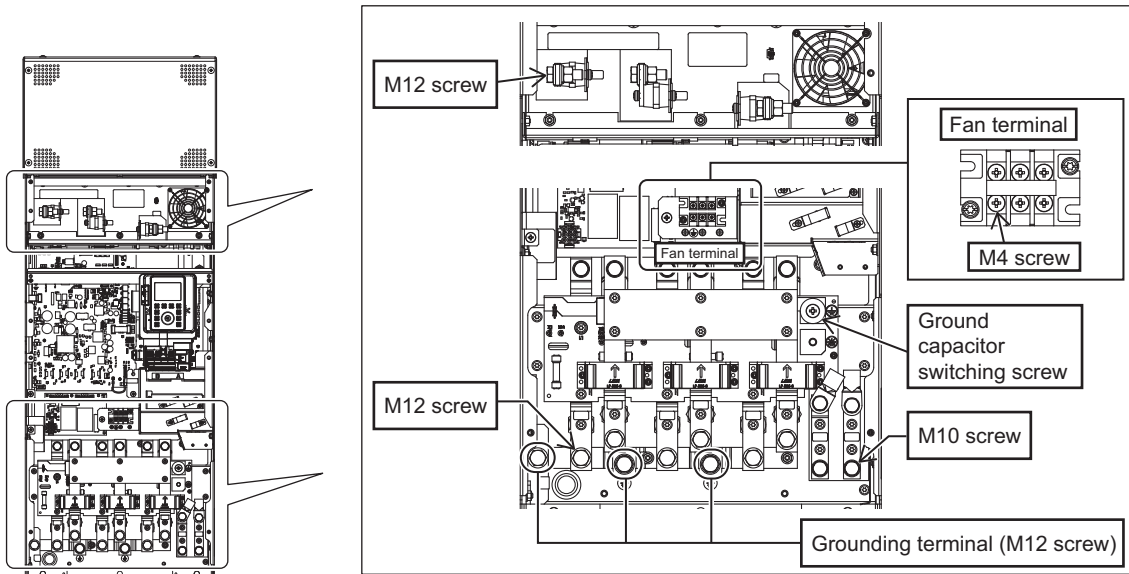


2

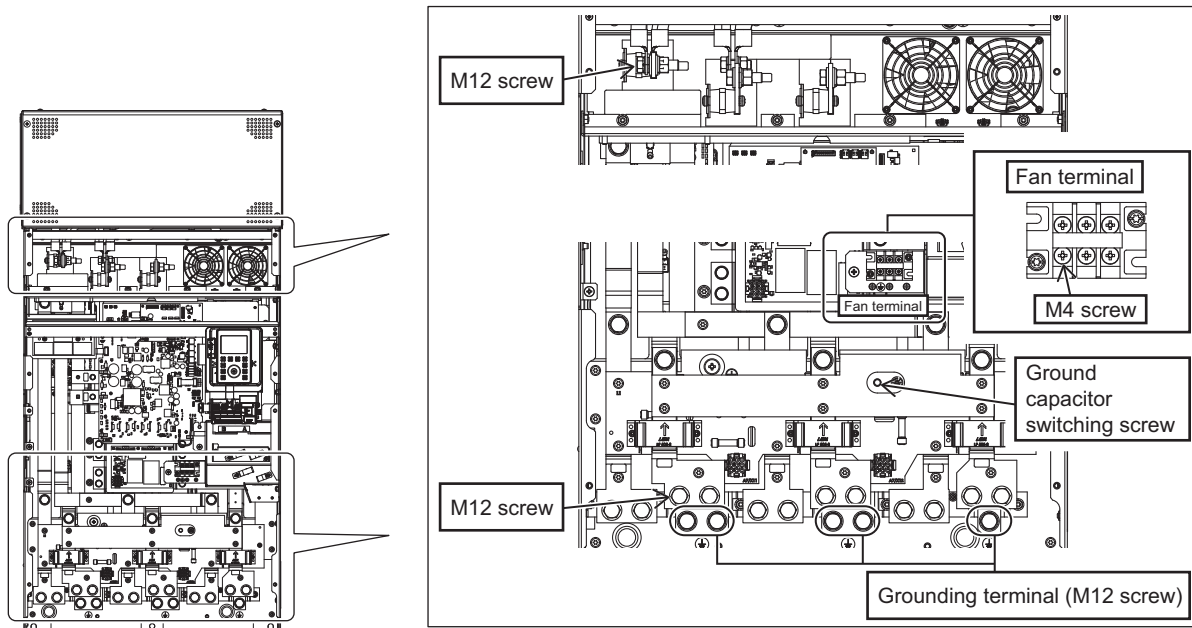
**6) Frame size A6  
VFAS3-2450P, 2550P, VFAS3-4900PC to 4132KPC**



**7) Frame size A7  
VFAS3-4160KPC**



8) Frame size A8  
VFAS3-4200KPC to 4280KPC



2

**2. 3. 4 Switching of grounding capacitor**

**⚠ WARNING**

 Prohibited	<ul style="list-style-type: none"> <li>When using this 480V class inverter with a power supply system that is grounded in other than the neutral point (e.g. when the power supply has delta connection with single phase grounding), the grounding capacitor should not be grounded (or the capacity of the grounding capacitor should not be increased). Otherwise, it will result in failure or fire.</li> </ul>
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This inverter has a built-in noise filter (EMC noise filter for 480V class) and the inverter input power supply is grounded via the capacitor. By switching this grounding capacitor, the leakage current from the inverter can be reduced.

It is switched by changing the position of the exclusive switching screw(s) that varies depending on the type. For some types, the grounding capacitor is completely disconnected (frame size A1 to A5). For others, the capacitor capacity is reduced (frame size A6 to A8).

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

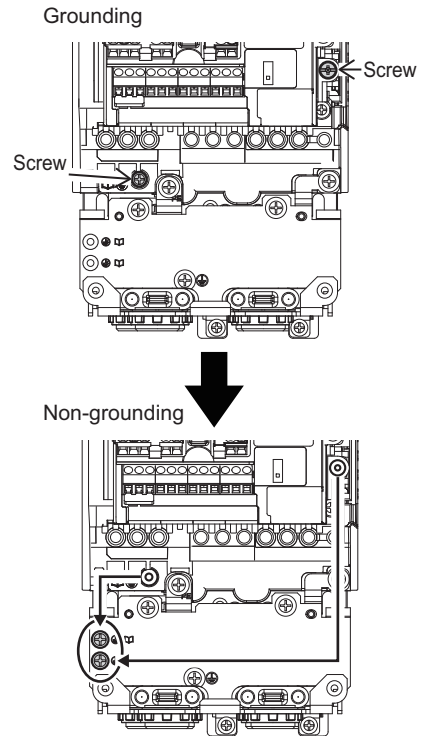
 Important	<ul style="list-style-type: none"> <li>Note that when the grounding capacitor is reduced or not grounded, the inverter unit no longer comply with the EMC directive.</li> <li>Be sure to switch with the power off.</li> <li>For models with two switching screws, be sure to set both screws to the same side.</li> </ul>
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Switch the grounding capacitor in the following procedure given for each type. At the time of shipping, the grounding capacitor is grounded or its capacity is small.

2

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

- 1 Remove the front cover.  
For how to remove, refer to [2. 2. 1].
- 2 Remove two screws for switching of grounding capacitor.  
The grounding capacitor is disconnected.  
Mount the removed screws to the positions shown in the figure on the right and tighten them.
- 3 To recover the shipping state, mount the two screws for switching of grounding capacitor and tighten them.  
The grounding capacitor is connected and grounded.
- 4 After switching, mount the front cover.  
For how to mount, refer to [2. 2. 1].



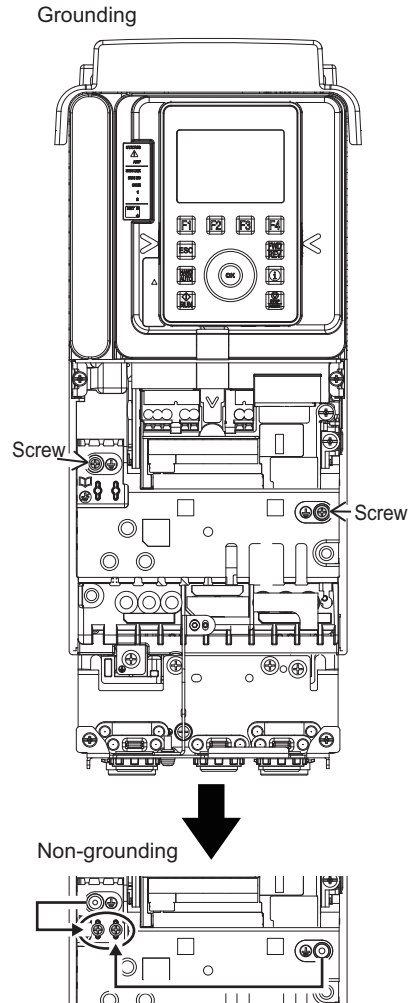
Important

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



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

- 1 Remove the front cover.  
 For how to remove, refer to [2. 2. 1].
- 2 Remove two screws for switching of grounding capacitor.  
 The grounding capacitor is disconnected.  
 Insert the removed screws to the positions shown in the figure on the right.
- 3 To recover the shipping state, mount the two screws for switching of grounding capacitor and tighten them.  
 The grounding capacitor is connected and grounded.
- 4 After switching, mount the front cover.  
 For how to mount, refer to [2. 2. 1].



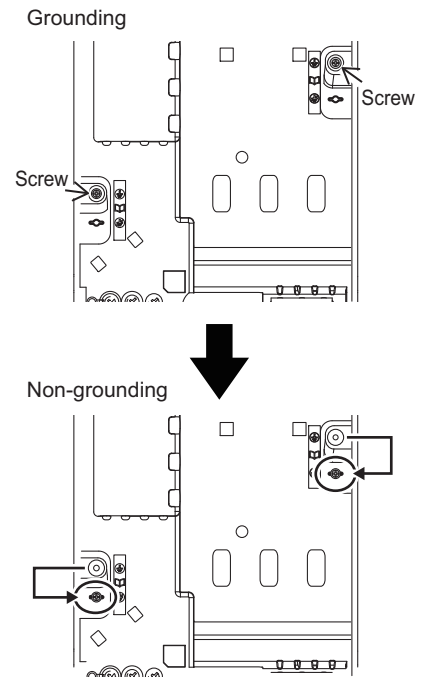
Important

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

2

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

- 1 Remove the front cover.  
For how to remove, refer to [2. 2. 1].
- 2 Remove two screws for switching of grounding capacitor.  
The grounding capacitor is disconnected.  
Insert the removed screws to the positions shown in the figure on the right.
- 3 To recover the shipping state, mount the two screws for switching of grounding capacitor and tighten them.  
The grounding capacitor is connected and grounded.
- 4 After switching, mount the front cover.  
For how to mount, refer to [2. 2. 1].

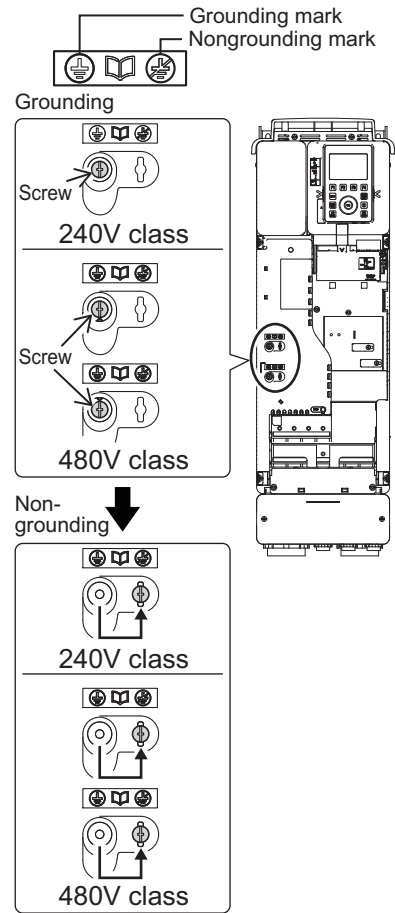


Important

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

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

- 1 Remove the front cover.  
 For how to remove, refer to [2. 2. 2].
  
- 2 Remove the screw(s) for switching of grounding capacitor from the position of the grounding mark and insert it/them into the position of the non-grounding mark.  
 The 240 V class has one screw.  
 The 480 V class has two screws. Remove both of two screws.  
 The grounding capacitor is disconnected.
  
- 3 To recover the shipping state, remove the screw(s) for switching of grounding capacitor and tighten it/them to the screw hole in the position of the grounding mark.  
 The grounding capacitor is connected and grounded.
  
- 4 After switching, mount the front cover.  
 For how to mount, refer to [2. 2. 2].



2

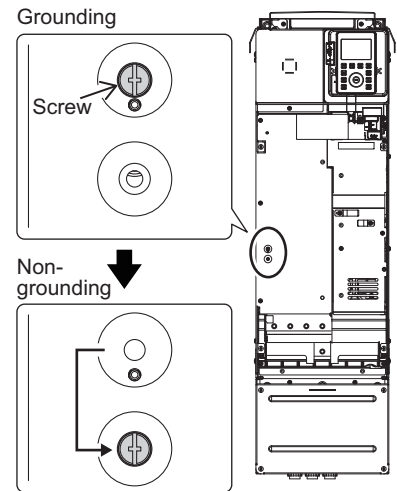


Important

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

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

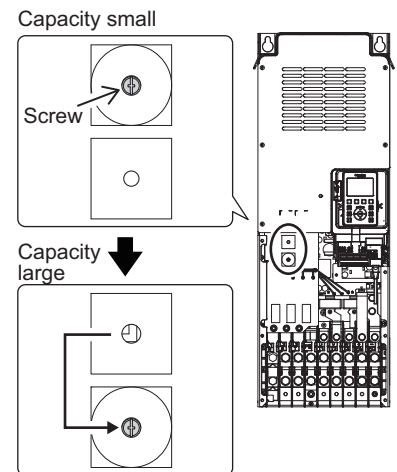
- 1 Remove the front cover.  
 For how to remove, refer to [2. 2. 3].
- 2 Remove the screw for switching of grounding capacitor from the position of the grounding mark and tighten it to the position of the non-grounding mark.  
 The grounding capacitor is disconnected.
- 3 To recover the shipping state, remove the screw(s) for switching of grounding capacitor and tighten it/them to the screw hole in the position of the grounding mark.  
 The grounding capacitor is connected and grounded.
- 4 After switching, mount the front cover.  
 For how to mount, refer to [2. 2. 3].  
 For frame size A6, A7 and A8, grounding capacitor is set to small (non-grounding mark side).  
 To comply with EMC directive, switch the capacitance into large (grounding mark side) according to the procedure below.



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

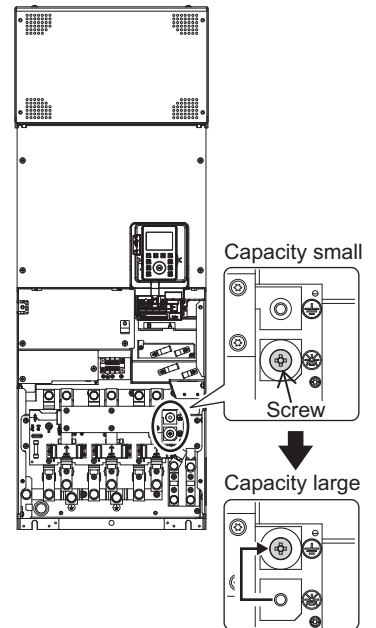
Grounding capacitor is set to small (non-grounding mark side). To comply with EMC directive, switch the capacitance into large (grounding mark side) according to the procedure below.

- 1 Remove the front cover and the transparent cover inside (transparent resin).  
 For how to remove, refer to [2. 2. 4].
- 2 Remove the screw for switching of grounding capacitor from the position of the non-grounding mark and tighten it to the position of the grounding mark.  
 The grounding capacitor's capacity is increased.
- 3 To recover the shipping state, remove the screw(s) for switching of grounding capacitor and tighten it to the screw hole in the position of the non-grounding mark.  
 The grounding capacitor's capacity is recovered.
- 4 After switching, mount the transparent cover and the front cover in this order.  
 For how to mount, refer to [2. 2. 4].



■ With frame size A7  
VFAS3-4160KPC

- 1 Remove the front cover and the transparent cover inside (transparent resin).  
For how to remove, refer to [2. 2. 5].
- 2 Remove the screw for switching of grounding capacitor from the position of the grounding mark and tighten it to the position of the grounding mark.  
The grounding capacitor's capacity is increased.
- 3 To recover the shipping state, remove the screw(s) for switching of grounding capacitor and tighten it/them to the screw hole in the position of the non-grounding mark.  
The grounding capacitor's capacity is reduced.
- 4 After switching, mount the transparent cover and the front cover in this order.  
For how to mount, refer to [2. 2. 5].



**⚠ CAUTION**

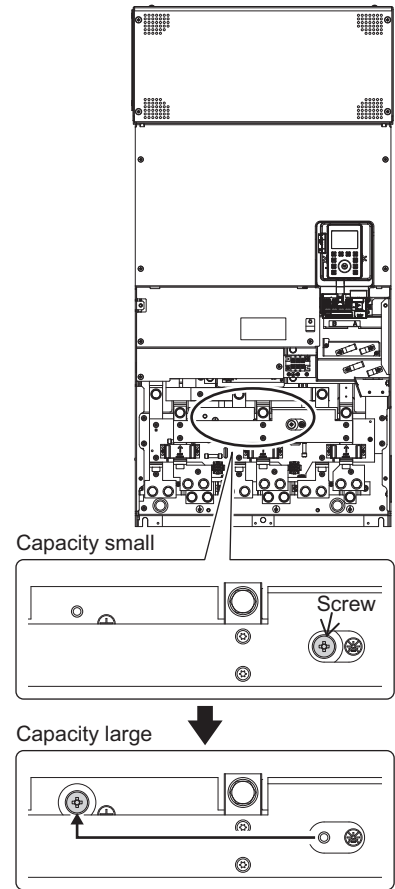


- In case of one phase grounding system (A three-phase supply power is connected in delta), do not change the connection of grounding capacitor before factory setting. If connection changed (this means the capacitance is increased), the capacitor may become damaged.

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.

■ With frame size A8  
VFAS3-4200KPC to 4280KPC

- 1 Remove the front cover and the transparent cover inside (transparent resin).  
For how to remove, refer to [2. 2. 5].
- 2 Remove the screw for switching of grounding capacitor from the position of the grounding mark and tighten it to the position of the grounding mark.  
The grounding capacitor's capacity is increased.
- 3 To recover the shipping state, remove the screw(s) for switching of grounding capacitor and tighten it/them to the screw hole in the position of the non-grounding mark.  
The grounding capacitor's capacity is reduced.
- 4 After switching, mount the transparent cover and the front cover in this order.  
For how to mount, refer to [2. 2. 5].



**⚠ CAUTION**



- 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.

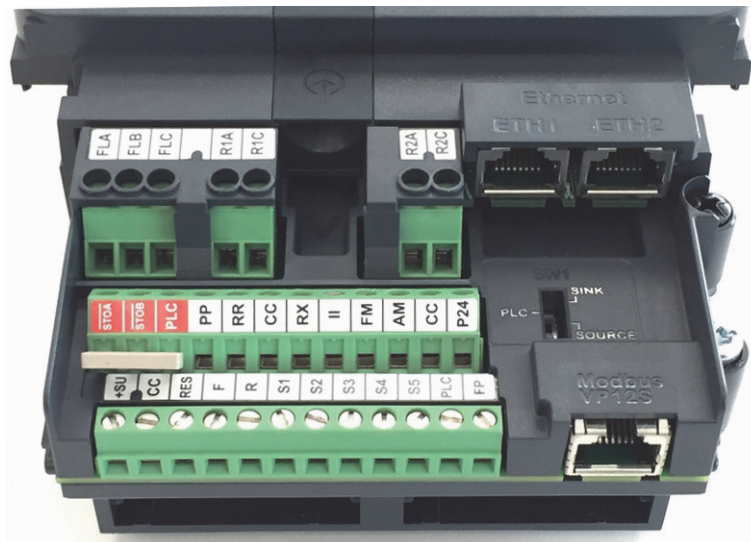
Note) If a neutral grounding system is used, changing the connection of the grounding capacitor as shown in the figure at the top (changing the capacitance from Small to Large) makes the inverter compliant with the EMC directive.

### 2. 3. 5    Control terminals

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

■ **Functions of control terminals**

The control terminal block is common to all the models.



Terminal symbol	Input/output	Function	Electrical specifications	Internal circuit
F	Input	Multifunction programmable digital input. In the default setting, forward run is performed with ON and deceleration stop with OFF.		
R	Input	Multifunction programmable digital input. In the default setting, reverse run is performed with ON and deceleration stop with OFF.	Digital input. • 24 Vdc-5 mA or less	
RES	Input	Multifunction programmable digital input. In the default setting, this inverter protective function is reset by ON→OFF. It has no effect when the inverter is in a normal condition.	Compliant with IEC61131-2 logic type 1 • Sink logic: ON < 10 V, 16 V < OFF • Source logic: OFF < 5 V, 11 V < ON	
S1	Input	Multifunction programmable digital input. In the default setting, preset speed operation is performed with ON	Sink logic and source logic can be switched with the slide switch [SW1]	
S2	Input	Multifunction programmable digital input. In the default setting, preset speed operation is performed with ON		
S3	Input	Multifunction programmable digital input. In the default setting, preset speed operation is performed with ON		
S4	Input	Multifunction programmable digital input. In the default setting, preset speed operation is performed with ON With <F146: Terminal S4 input select>, digital input, pulse train input, and PG input can be switched.	Digital input. • 24 Vdc-5 mA or less	
S5	Input	Multifunction programmable digital input. In the default setting, preset speed operation is performed with ON. With <F147: Terminal S5 input select>, digital input, pulse train input, and PG input can be switched.	Compliant with IEC61131-2 logic type 1 • Sink logic: ON < 10 V, 16 V < OFF • Source logic: OFF < 5 V, 11 V < ON	
			Pulse train input • Up to 30 kpps (duty 50%)	



Terminal symbol	Input/output	Function	Electrical specifications	Internal circuit
CC	Common to input/output	An equipotential terminal of the control circuit. It is allocated in three positions.	-	
PP	Output	Voltage reference output for potentiometer.	10 Vdc (allowable load current: 10 mA)	
FP	Output	Multifunction programmable digital/pulse train output. With <F669: Terminal FP switching>, digital output and pulse train output can be switched.	Digital output • 24 Vdc-50 mA  Pulse train output • Up to 30 kpps (duty 50%)	
RR	Input	Analog input with 0 - 10 Vdc. It can be switched to PTC input, etc. with <F108: Terminal RR input select>.	0 - 10 Vdc (Input impedance: 31.5 kΩ)	
RX	Input	Analog input with -10 to +10 Vdc. With <F107: Terminal RX input voltage select>, it can be switched to 0 - 10 Vdc.	-10 to +10 Vdc (Input impedance: 31.5 kΩ)	
II	Input	Analog current input with 0 - 20 mA. The current can be changed to 4 - 20 mA, etc. with setting of the parameter.	0 - 20 mA (Input impedance: 250 Ω)	

Terminal symbol	Input/output	Function	Electrical specifications	Internal circuit
FM	Output	Multifunction programmable analog output. 0 - 10 Vdc output with default setting. With <F681: Terminal FM switching>, meter option (0 - 1 mA), current (0 - 20 mA) output, and voltage (0 - 10 V) output can be switched.	0 - 10 Vdc (allowable load resistance: 1 kΩ or more) 4 - 20 mAdc (0 - 20 mAdc) (allowable load resistance: 500 Ω or less)	
AM	Output	Multifunction programmable analog output. 0 - 20 mAdc output with default setting. With <F686: Terminal AM switching>, meter option (0 - 1 mA), current (0 - 20 mA) output, and voltage (0 - 10 V) output can be switched.		
PLC	Output	When the slide switch [SW1] is set to the sink side or source side, it can be used as 24 Vdc power output.	24 Vdc-200 mA (200 mA in total with P24) Compliant with IEC61131-2	
	Input	When the slide switch [SW1] is set to the PLC side, it can be used as a common terminal for digital input terminal.	-	
P24	Output	24 Vdc power output.	24 Vdc-200 mA (200 mA in total with PLC) Compliant with IEC61131-2	
+SU	Input	DC power input to operate the control circuit. Connect a control power supply option or 24 Vdc power supply between [+SU] and [CC].	24 Vdc- current 1A or more	
STOA	Input	STO function that complies with the safety standard IEC61800-5-2 (this is different function from programmable digital input). Function is deactivated by shorting the terminals [STOA]-[STOB]-[PLC] with a bridge at factory.	Compliant with IEC61131-2 logic type 1 • Activate < 5 V, 11 V < Deactivate  Refer to Safety Function Manual.	
STOB	Input	When STOA/STOB are OFF during motor is running, motor becomes coast stop. Under this condition, even if STOA/STOB are ON, motor is not running unless run command is once OFF and On again. For details, refer to Safety function manual (E6582067).		

Terminal symbol	Input/output	Function	Electrical specifications	Internal circuit
FLA	Output	Multifunction programmable relay contact output. Operation of the protection function of the inverter is detected in the default setting. The contact across [FLA]-[FLC] is closed and [FLB]-[FLC] is opened during protection function operation.	Maximum contact capacity <ul style="list-style-type: none"> <li>• 250 Vac-2 A (cosφ=1)</li> <li>• 30 Vdc-2 A (at resistive load)</li> <li>• 250 Vac-1 A (cosφ=0.4)</li> <li>• 30 Vdc-1A (L/R=7 ms)</li> </ul>	
FLB				
FLC				
R1A	Output	Multifunction programmable relay contact output. A low-speed signal is output in the default setting.	Minimum contact capacity <ul style="list-style-type: none"> <li>• 24 Vdc-5 mA</li> </ul>	
R1C				
R2A	Output	Multifunction programmable relay contact output. It is not assigned in the default setting. The function can be set with <F134: Terminal R2 function >.	Life <ul style="list-style-type: none"> <li>• 100000 times</li> </ul>	
R2C				

**Important**

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

**Reference**

- To change the function of the terminals [F], [R], [RES], and [S1] - [S5] → Refer to [6. 3. 2]
- To change the function of the terminals [FP], [FL], [R1], and [R2] → Refer to [6. 3. 3]
- To change the function of the terminals [RR] and [RX] → Refer to [6. 2]
- To change the function of the terminals [FM] and [AM] → Refer to [5. 2. 6], [6. 33. 3]

■ Recommended tightening torque of control terminal screws

Control terminal torque and wire strip length

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

**Wire size**

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

■ **Switching of slide switch of control terminal block**

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

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

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



Important

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

■ **Sink logic and source logic**

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

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

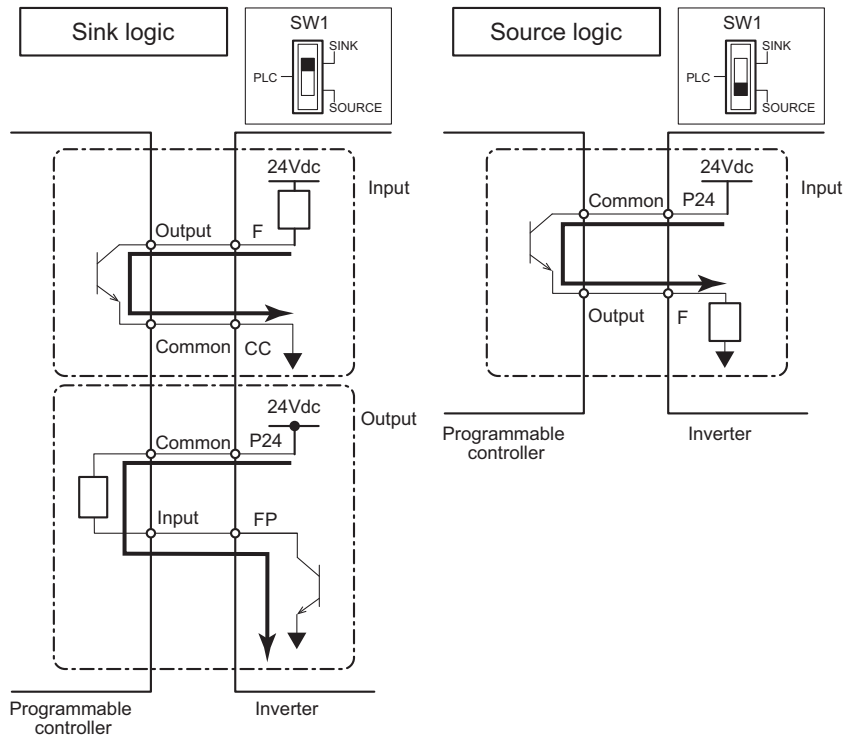
**Memo**

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

1) **When the inverter internal power supply is used**

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

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

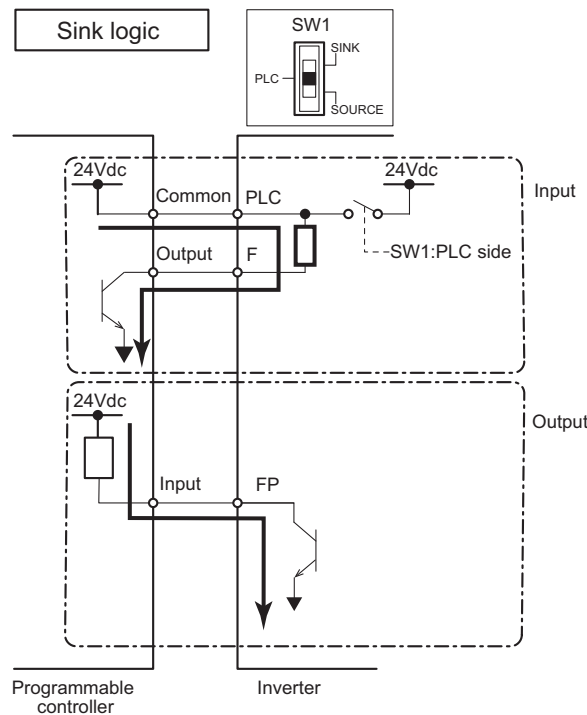


**2) When an external power supply is used**

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

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

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



### **2. 3. 6    RS485 communication connectors**

This inverter is equipped with two RS485 communication ports.

To use RS485, refer to "RS485 Communication Function Instruction Manual" (E6582143).



Important

- Connection of Ethernet to the RS485 communication connectors will result in a failure.

## **2**

### **2. 3. 7    Ethernet connectors**

This inverter is equipped with two Ethernet ports.

To use Ethernet, refer to "Ethernet Function Instruction Manual" (E6582125).




Important

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

### 2. 3. 8 Mounting of DC reactor

## ⚠ Caution

 Mandatory action	<ul style="list-style-type: none"> <li>• Mount the attached DC reactor (DCL) for VFAS3-4160KPC ~ 4280KPC.                      If you do not mount the attached DC reactor (DCL), it will result in malfunction. Mount the DC reactor (DCL) between [PA/+] and [PO].</li> </ul>
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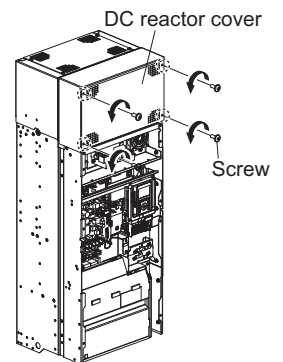
This inverter is equipped with a DC reactor (DCL) as standard, however, for VFAS3-4160KPC to 4280KPC, it is packaged together with the unit.  
 After installing the inverter, mount the DC reactor in the following procedure.

2

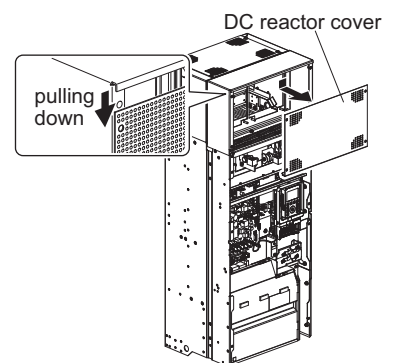
■ **With frame size A7  
 VFAS3-4160KPC**

1 Remove the front cover (upper) of the inverter unit in advance.  
 For how to remove, refer to [2. 2. 5].

2 Remove four screws of the DC reactor cover of the DC reactor.  
 Store the removed screws so as not to be lost.

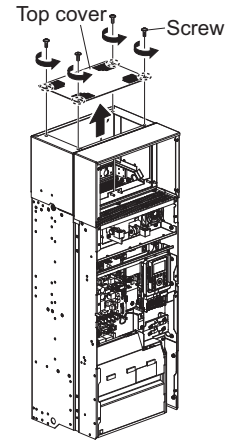


3 Remove the DC reactor cover from the DC reactor by pulling it down.  
 The upper side of the DC reactor cover is to be inserted.



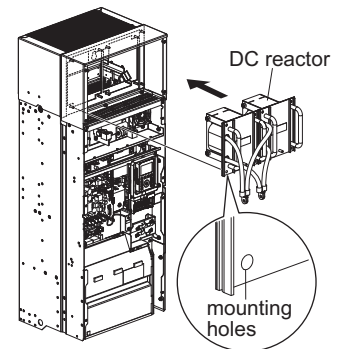
## 2

- Remove four screws of the top cover (mesh) of the DC reactor.  
Store the removed screws so as not to be lost.

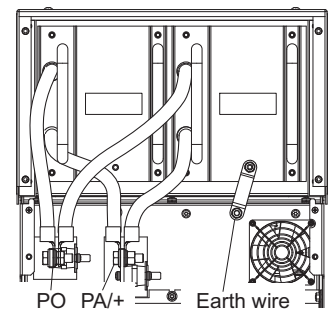


- Remove the top cover (mesh) from the DC reactor.

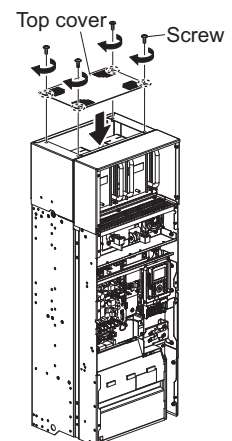
- Check the positions of four mounting holes on the back side of the DC reactor and mount the DC reactor to the panel.



- Wire the DC reactor and the terminals [PA+] and [PO] of the power terminal block.  
Connect two wires (with a crimp-style terminal) from each of two DC reactor units to [PA+] and [PO].  
Connect two flat braided wires for grounding to the grounding terminals respectively.

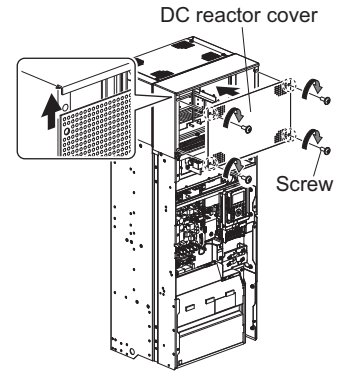


- Mount the top cover (mesh) to the DC reactor and tighten four screws.





- 9 Mount the DC reactor cover to the DC reactor and tighten four screws according to necessity of other work.  
After mounting the DC reactor to the inverter, mount the front cover (upper) before the DC reactor cover.

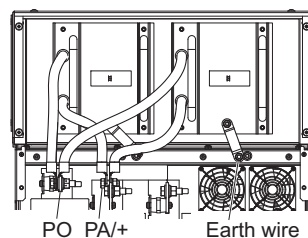


## Memo

- After mounting the DC reactor to the inverter, if the DC reactor cover is mounted and fixed, the front cover (upper) cannot be mounted. Be sure to mount the front cover (upper) before the DC reactor cover.

### ■ With frame size A8 VFAS3-4200KPC to 4280KPC

Except for its wider unit, frame size A8 has the same enclosure and structure as frame size A7. The mounting procedure of the DC reactor is the same as that of frame size A7, however, more wires are connected to the inverter unit. An example of wiring is shown below.



## 2.4 Cautions for application

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

### 2.4.1 Motor

#### CAUTION



Mandatory  
action

- Use the inverter that conforms to specifications of the power supply and the three-phase motor to be operated.  
If you use the inappropriate inverter, not only will the three-phase motor not rotate correctly, but it will cause serious accidents such as overheating and burning out.

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

#### ■ Comparison with commercial power supply operation

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

#### ■ Operation in low-speed range

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

To carry out low-speed operation continuously at the rated torque, use a constant torque motor. In this case, select "constant torque motor" of "4" -"7" in <OLM: Motor overload protection characteristic>. For details, refer to [5. 2. 5].

#### ■ Adjusting motor overload protection level

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

For how to set, refer to [5. 2. 5].

#### ■ High speed operation over 60 Hz

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

#### ■ Lubricating mechanisms

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

■ **Occurrence of instability (abnormal vibrations and overcurrent trips)**

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

- 1) In the following cases, lower the settings of inverter carrier frequency.
  - Combined with a motor that is extremely below applicable motor ratings for the inverter
  - Combined with light load with a load factor of 5% or less
  - Combined with load whose inertial moment is very small
  - Combined with special motors

For details, refer to [6. 14].
  
- 2) In the following case, set the S-pattern acceleration/deceleration function (refer to [6. 27. 1]). When vector control is selected, adjust the load moment of inertia ratio (refer to [6. 23. 1] or switch to V/f constant mode (refer to [5. 3. 4]).
  - Combined with couplings between load devices and motors with high backlash
  
- 3) When vector control is selected, adjust the load moment of inertia ratio (refer to [6. 23. 1] or switch to V/f constant control (refer to [5. 3. 4]) in the following case.
  - Combined with loads that have sharp fluctuations in rotation such as piston movements

■ **Braking motor when turning off power supply**

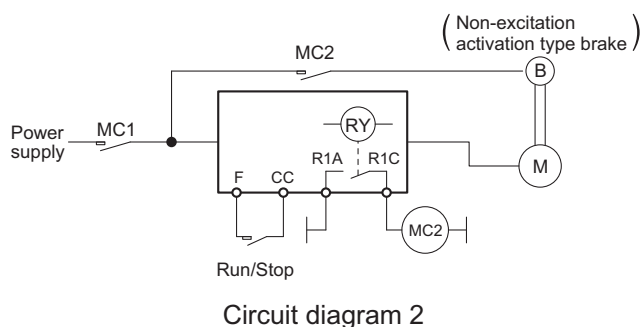
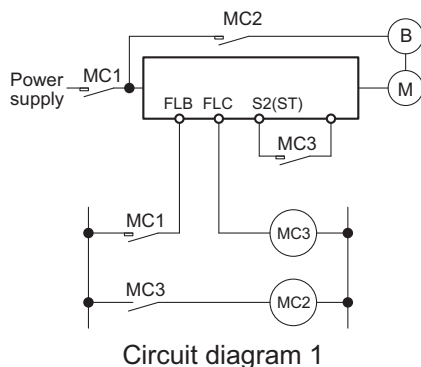
A motor with its power turn off goes into coasting state, and does not stop immediately. To stop the motor quickly as soon as the power is turn off, install an auxiliary brake. There are different kinds of brake devices, both electrical and mechanical. Select the brake that is best for the system.

■ **Load that produces regenerative torque**

When combined with a load that produces regenerative torque, the overvoltage or overcurrent protection function may be activated to trip the inverter. Install a braking resistor to deal with it. For details of the braking resistor, refer to [10. 3. 2].

■ **Motors with brake**

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



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

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

### ■ Measures to protect motors against surge voltages

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

Here are some examples of measures against surge voltages.

- Decrease <F300: Carrier frequency> of the inverter.
- Use a motor with high insulation strength.
- Insert an AC reactor or a motor-end surge voltage suppression filter between the inverter and the motor. Refer to [10. 3. 5].

## 2. 4. 2 Inverters

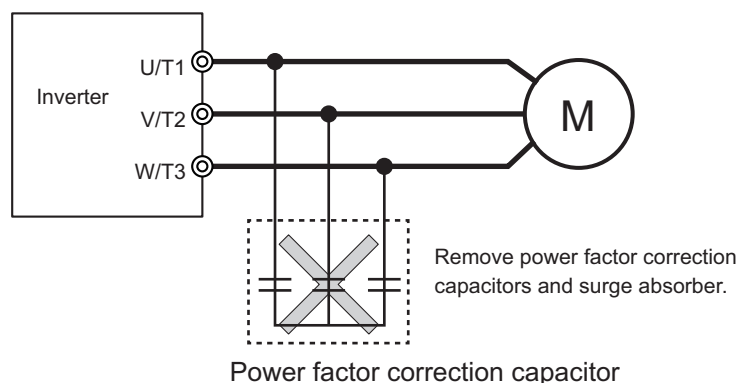
For the inverters to be used, pay attention to the following items.

### ■ Inverter capacity

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

### ■ Power factor correction capacitor

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



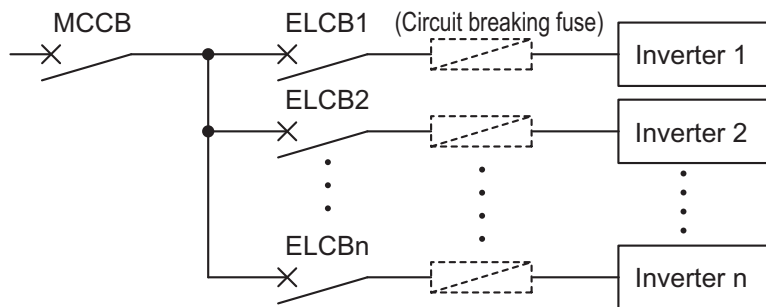
■ **Operating at other than rated voltage**

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.

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

There is no fuse in the inverter's power circuit. Thus, as the diagram below shows, when more than one inverter is used on the same power line, you must select interrupting characteristics so that only ELCB (ELCB1 to ELCBn in the diagram) install in each inverter will trip and the common MCCB (MCCB in the diagram) will not trip when a short occurs in one inverter.

When you cannot select the proper characteristics, install a circuit interrupting fuse on the secondary side of ELCB1 to ELCBn.



Selective circuit breaking of inverters

- \* MCCB : Molded Case Circuit Breaker
- \* ELCB : Earth Leakage Circuit Breaker

■ **If power supply distortion is not negligible**

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

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

■ **Disposal**

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

### 2. 4. 3 What to do about leakage current

## ⚠ CAUTION



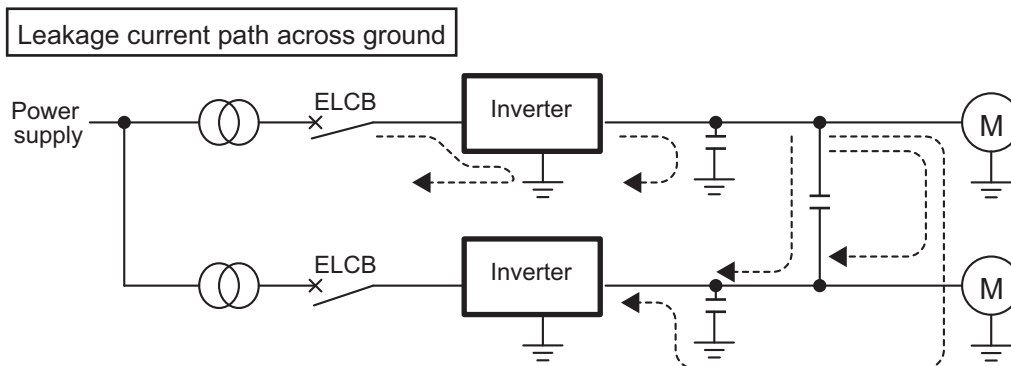
Mandatory action

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

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

#### ■ Influence of leakage current across ground

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



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

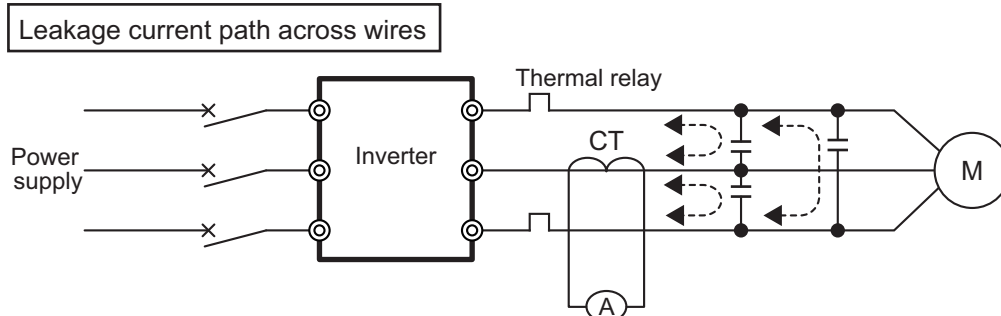
- When there is no radio-noise interference or similar problem, switch the grounding capacitor of the EMC noise filter to "disconnected" (size A1 to A5) or "small capacitance" (size A6 to A8).  
For how to switch the grounding capacitor, refer to [2. 3. 4].
- Decrease <F300: Carrier frequency>.  
When there is no concern against the magnetic noise from the motor, carrier frequency reduction is effective measure. For details, refer to [6. 14].
- Use high frequency remedial products for ELCBs.
- Zero-phase reactor  
It may be effective over the motor cable.

#### Built-in noise filter

The 480 V models of this inverter has a built-in EMC noise filter, so the leakage current value in the delta connection (single-phase grounding) power supply may become greater. For detail, refer to application manual "leakage current" (E6581181).

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

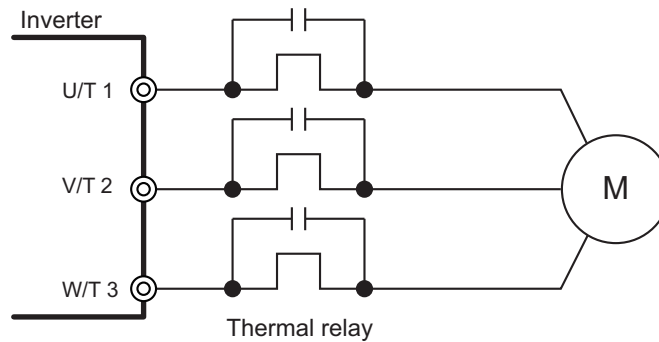
The high frequency component of current leaking into electrostatic capacity between inverter output wires will increase the effective current values and make externally connected thermal relays operate unnecessarily. When the wires are long (50 m or more) or in case of models with motors of low rated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



2

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

- Use the electronic thermal of the inverter.  
The setting of the electronic thermal is done with <tHrA: Motor overload protection current 1>. For details, refer to [5. 2. 5].
- Decrease <F300: Carrier frequency>.  
However, note that the motor magnetic noise is increased.  
For details, refer to [6. 14].
- Install 0.1 to 0.5μF - 1000 V film capacitor to the input/output terminals of each phase in the thermal relay.



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

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

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

- Connect the ammeter to the terminal [FM] and terminal [AM] of the inverter.  
For how to connect the meter and how to set parameters, refer to [5. 3. 6].
- Check the current value with the monitor function.  
For details, refer to [8. 1. 1].
- Set <F300: Carrier frequency> to 5 kHz or less.  
However, this may increase noise on the motor side.  
For details, refer to [6. 14].



# 3 [Basic operation] Operation panel and screen display

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

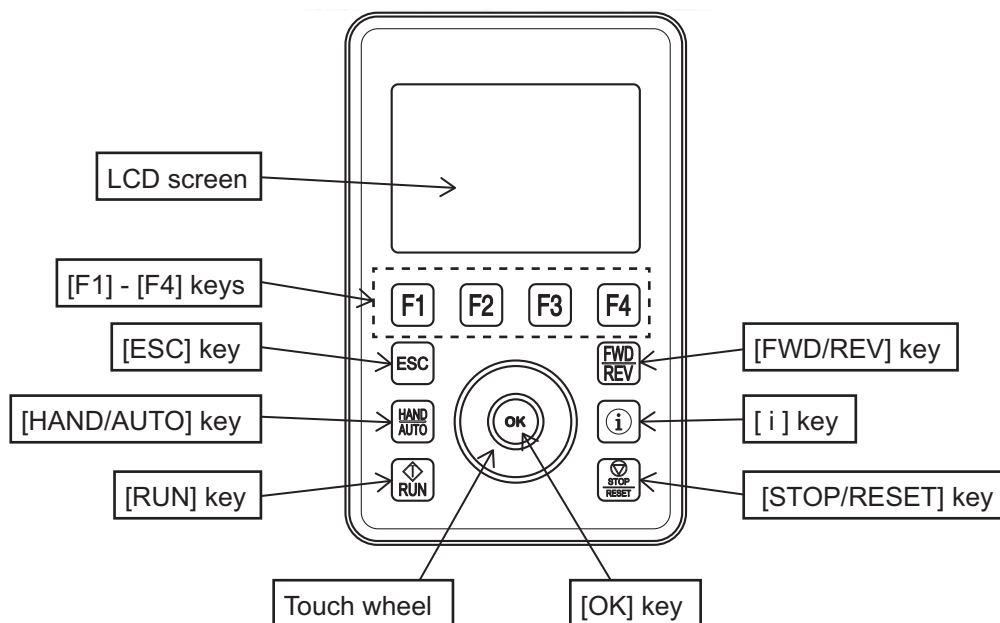
## Memo

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

## 3.1 Basic of operation panel

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

### 3.1.1 LCD screen and operation keys



#### • LCD screen

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

#### • [F1] - [F4] keys

They are keys to execute functions displayed on the screen.

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

- **[ESC] key**

This key switches the display mode.

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

- **[HAND/AUTO] key**

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

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

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

For details, refer to [6. 37].

- **[RUN] key**

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

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

For details, refer to [5. 2. 1].

- **[FWD/REV] key**

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

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

For details, refer to [5. 3. 9].

- **[i] key**

This key displays information.

When "Website (QR code)" is selected, the information is QR code. When "Model information" is selected, model information is displayed.

Necessary information is displayed when a trip occurs.

And you can see QR code for the parameter information when the parameter is selected or edited.

- **Model information**

You can check the following model information.

- Type-Form
- Multi-rating select
- Inverter rated voltage
- Rated output capacity
- Rated output current
- CPU 1 version
- CPU 2 version
- Serial No.
- Region setting

⊗	STOP	0.0Hz	F R
16:32			
Model information			
Type-Form	VFAS3-2037P		
Multi-rating select	HD rating (150%-60s)		
Inverter rated voltage	200V		
Rated output capacity	3.70kW-5.0HP		
Rated output current	18.7A		
Top	Return	Monitor	

■ Website (QR code)

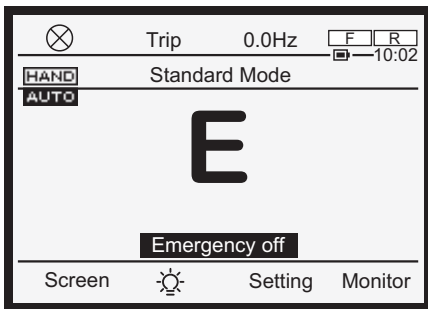
When you press the [i] key, information is displayed.  
 For example, you can access easily from your smartphone to our website by displaying the QR code.



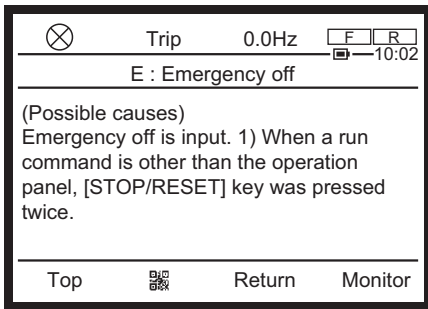
■ Trip information

You can check the trip information of possible causes and remedies. When you press the [F2] key, you can see QR code for troubleshooting.

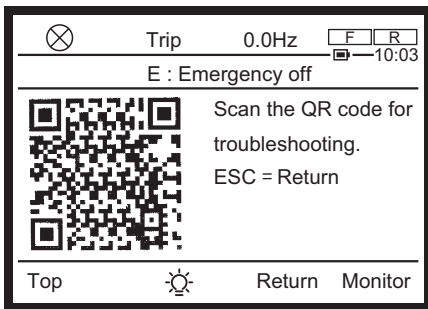
When a trip occurs, the trip title and trip name blink, and the backlight of the LCD screen turns red to inform you of a trip.



↓Press[i] key



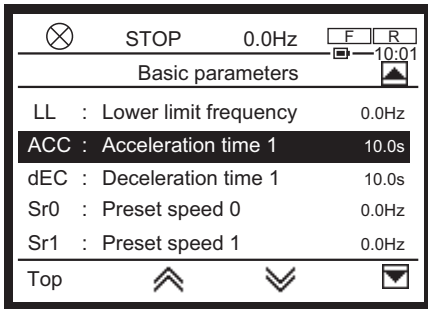
↓Press[F2] key



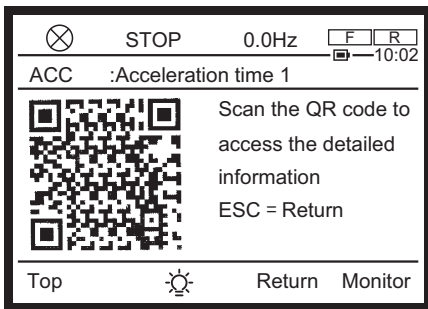
Note) If the camera cannot scan QR code because of the red screen, you can change the backlight color from red to white by pressing the [F2] key.

■ Parameter information

You can see QR code for the parameter when the parameter is selected or edited.



↓Press[i] key



• [STOP/RESET] key

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

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

For details, refer to [5. 2. 1].

Emergency off can be applied to the inverter except when it is operated by the operation panel. When you press this key, **E0FF** blinks. When you press it again, "E" is displayed and the emergency off is applied.

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

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

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

• Touch wheel

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

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

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

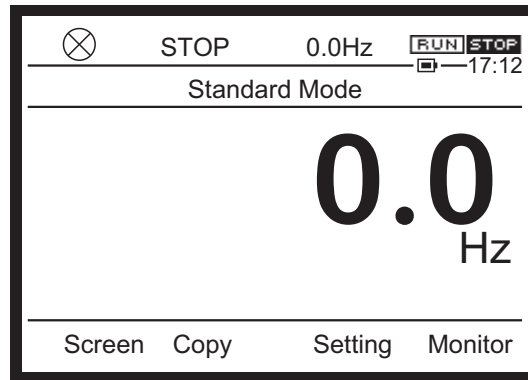
When you lightly touch the top or bottom of the circle, you can move to that direction by one item. For example, if you touch the top of the circle continuously, it works similarly to turning clockwise.

• [OK] key

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

■ [F1] - [F4] keys

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



- Press [F1] key to execute
- Press [F2] key to execute
- Press [F3] key to execute
- Press [F4] key to execute

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

Key	Screen display		Function	Reference
	Displayed position	Display		
[F1]	Left end	Screen	Sets the LCD screen	[3. 1. 3]
		Top	Displays the screen for [Standard mode]	[3. 1. 2]
		A9-- to A8--	Displays parameters of previous hundreds (A900s to A800s)	[4. 2. 1]
		F9-- to F8--	Displays parameters of previous hundreds (F900s to F800s)	[4. 2. 1]
		C9-- to C8--	Displays parameters of previous hundreds (C900s to C800s)	[4. 2. 1]
		X1000	Sets the far left number	[4. 2. 3]
[F2]	Middle left	⊗	Displays details monitor or Same as [OK] key	[3. 1. 4]
		☀	Inverts the backlight color (white or red)	[3. 2. 2]
		Language	Displays the screen for language selection	[3. 1. 3]
		←	Move setting to left	[3. 1. 3] [4. 2. 1]
		⤴	Page up (If there are more than six choices)	-
		Easy	Displays the screen for [Easy mode]	[3. 1. 2]
		Return	Same as [ESC] key (Return to the screen of [Setting mode])	-
		Change	Displays the setting screen of related parameters	[8. 1. 1]
		X100	Sets the number second from the left	[4. 2. 3]
Copy	Copy function	[3. 1. 4]		

Key	Screen display		Function	Reference
	Displayed position	Display		
[F3]	Middle right		Inverts the backlight color (white or red)	[3. 1. 3]
			Move setting to right	[3. 1. 3] [4. 2. 1]
			Page down (If there are more than six choices)	-
		R (Back)	Searches backward	[4. 2. 1]
		Setting	Displays the screen for [Setting mode]	[3. 1. 2]
		Return	Same as [ESC] key (Return to the screen of [Monitor mode])	-
		X10	Sets the number third from the left	[4. 2. 3]
[F4]	Right end	Jog	The inverter performs jog run while the key is pressed	[6. 10]
			Move setting to right	[3. 1. 4]
			Move setting to left	[3. 1. 4]
		Monitor	Displays the screen for [Monitor mode]	[3. 1. 2]
		F2-- to F1--	Displays parameters of next hundreds (F200s to F100s)	[4. 2. 1]
		C1-- to C0--	Displays parameters of next hundreds (C100s to C000s)	[4. 2. 1]
			Displays details monitor	[8. 1. 1]
		F (Next)	Searches forward	[4. 2. 1]
X1	Sets the far right number	[4. 2. 3]		

### 3. 1. 2 Display mode

This inverter has four types of display modes.

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

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

#### (1) [Standard mode]

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

#### (2) [Setting mode]

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

#### (3) [Easy mode]

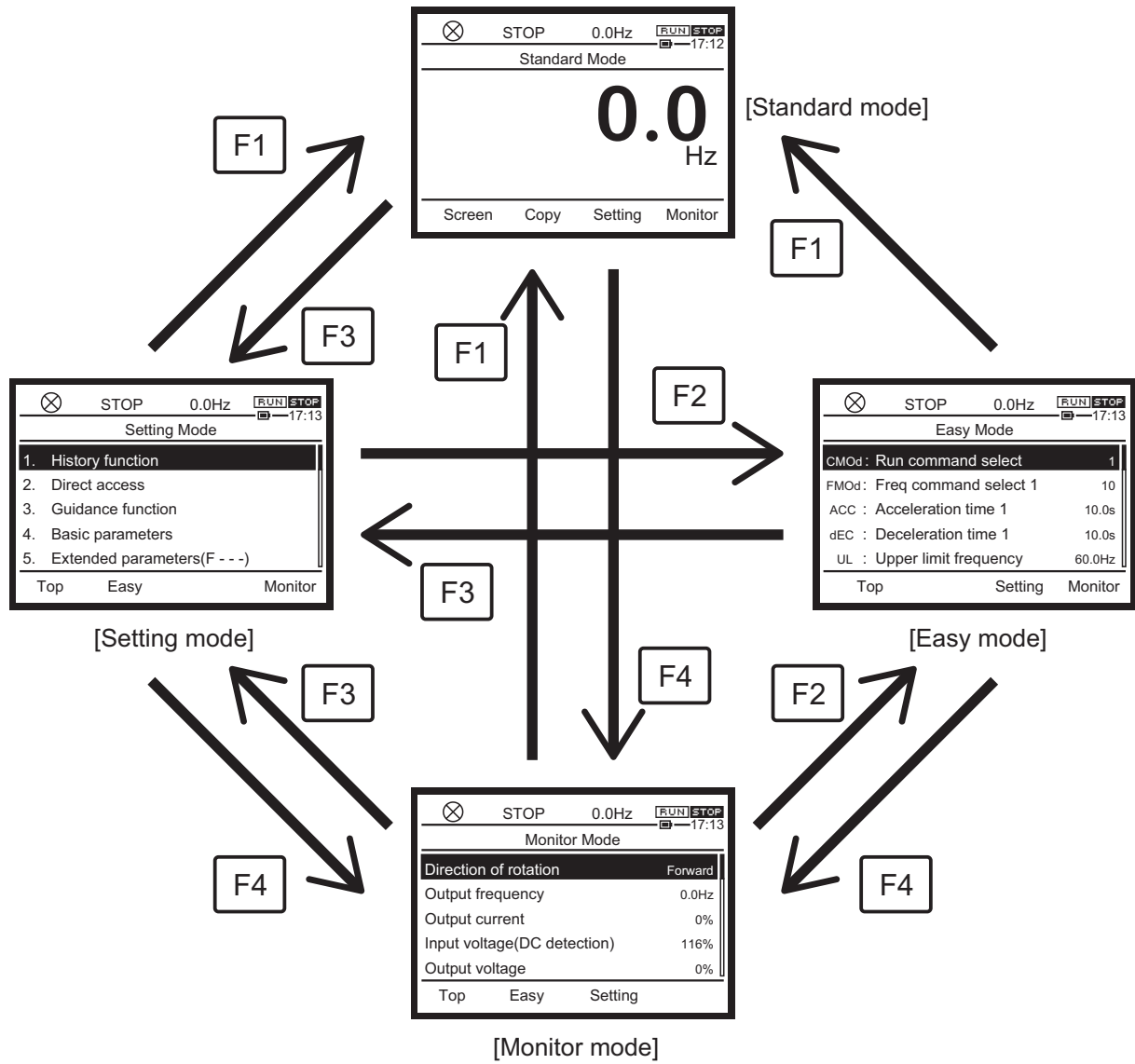
- Parameters are set in this mode.
- In this mode, only the registered parameters are displayed.

(4) [Monitor mode]

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

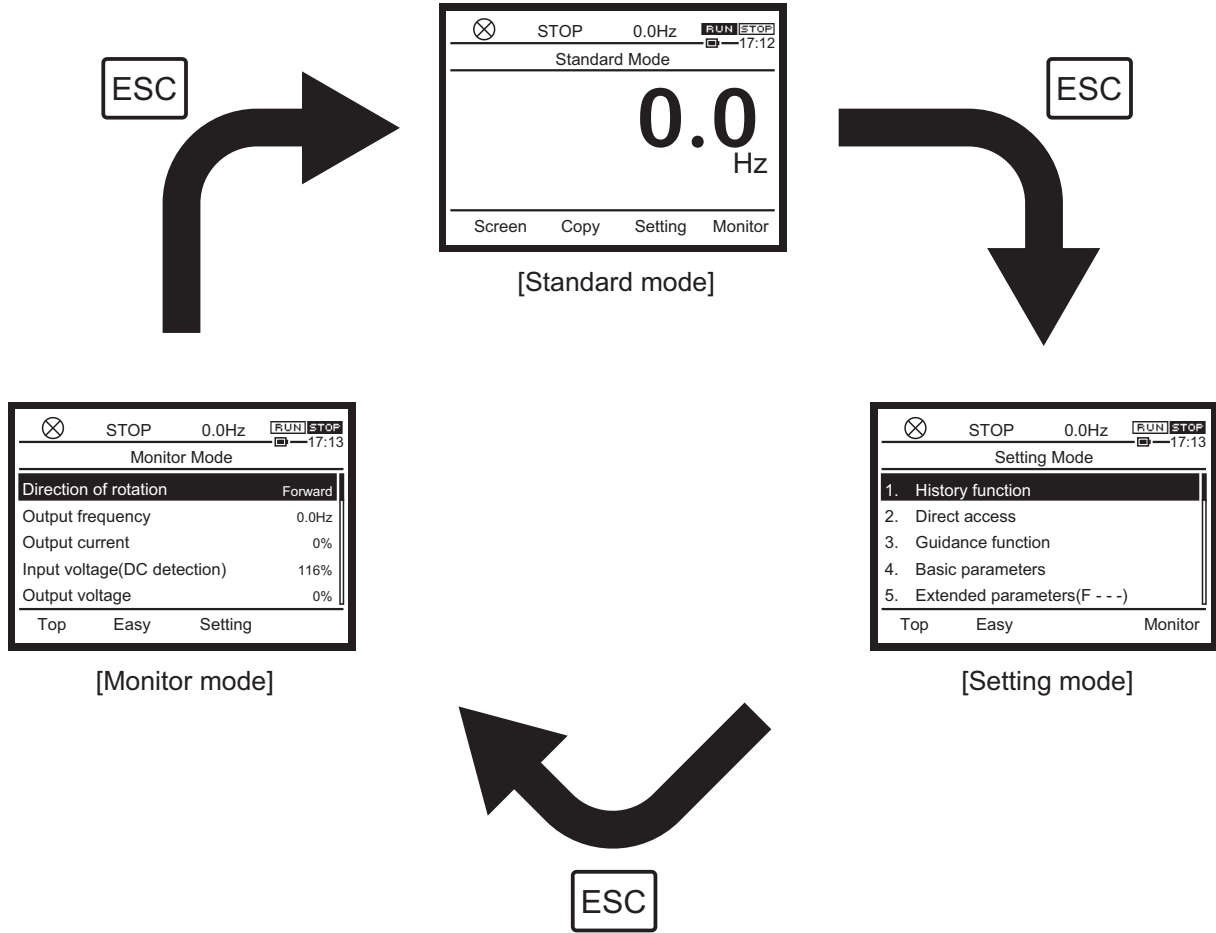
The following are the top screen of each mode and how to switch between them.

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

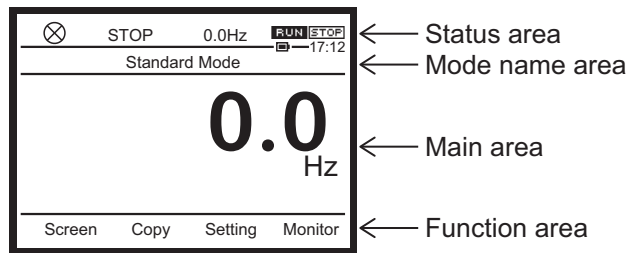


When switching with the [ESC] key

3



■ Screen structure

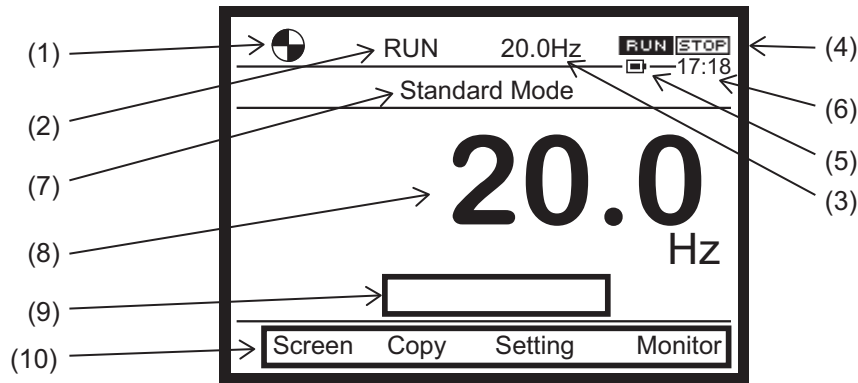




■ Screen display of [Standard mode]

This is the normal display mode of the inverter.

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



(1) The operation status is displayed with the following symbols.

(Rotating): In operation (clockwise for forward run, counterclockwise for reverse run)

: Stop

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

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

"RUN": During run

"STOP": Stopped

"Trip": Trip has occurred

"JOG": In jog run

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

For details, refer to [5. 4. 3].

(4) The run commands are displayed with icons.

Run command from	Icon	Run / Stop
Terminal		Stop
		Fwd Run
		Rev Run
Operation panel, Extension panel		Stop
		Run
Embedded Ethernet		Stop
		Run
RS485 communication (connector 1)		Stop
		Run

Run command from	Icon	Run / Stop
RS485 communication (connector 2)		Stop
		Run
Communication option		Stop
		Run

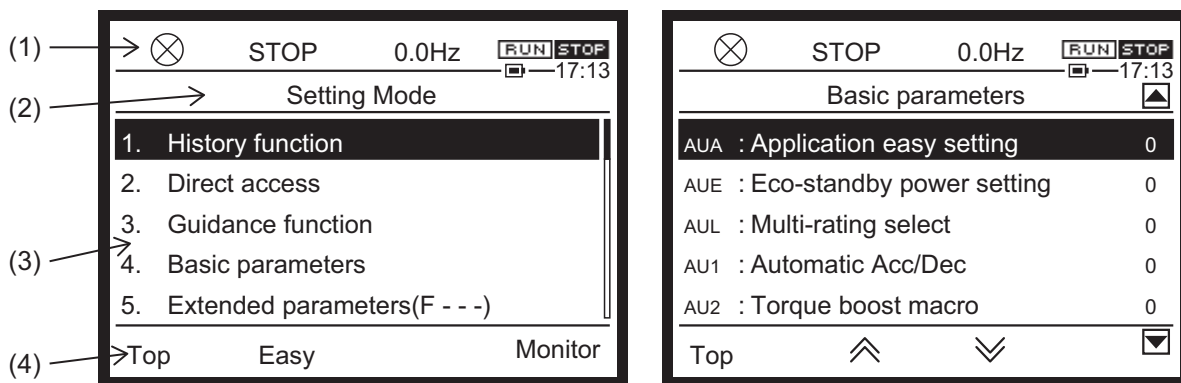
- (5) The remaining capacity of the battery ( yes/ no) is displayed with icons.
- (6) The current time ("hour/minute") is displayed.
- (7) Current display mode  
[Standard mode] is displayed.
- (8) Normally, the output frequency (default setting) is displayed. Set the display contents with <F710: Standard mode display>. For details, refer to [5. 4. 3].  
When an alarm or trip occurs, its contents are displayed.
- (9) When an alarm or trip occurs, the name of the alarm and a message are also displayed here.
- (10) The functions assigned to the [F1] - [F4] keys are displayed.  
For details, refer to [3. 1. 1].

**Memo**

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

■ **Screen display of [Setting mode]**

This is a display mode to set parameters.



Top screen of [Setting mode]

Setting screen of basic parameters

- (1) From the operation status to the current time, this mode has the same display as [Standard mode].
- (2) The current display mode [Setting mode] is displayed.
- (3) The setting items are displayed. One screen can display up to five items.  
Select an item with the touch wheel and press the [OK] key. Then the setting screen is displayed.  
<Setting screen of basic parameter>  
"Left end": Title  
"Middle": Parameter name  
"Right end": Setting value

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

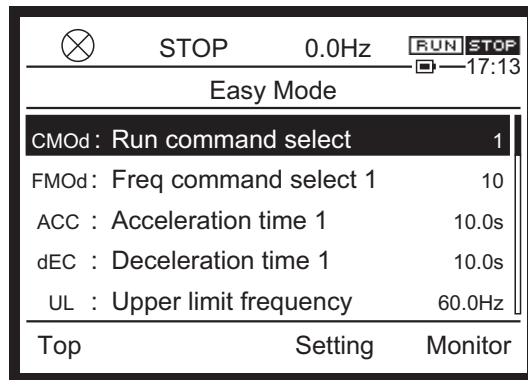
■ **Screen display of [Easy mode]**

This is a display mode to set parameters easily.

It is displayed in the following cases.

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

Only the parameters set in <F751: Easy setting 1> - <F782: Easy setting 32>. For details, refer to [5. 2. 8].

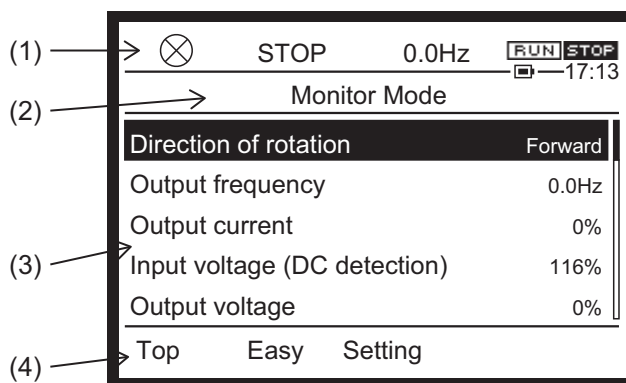


**Memo**


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

■ **Screen display of [Monitor mode]**

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



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


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

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

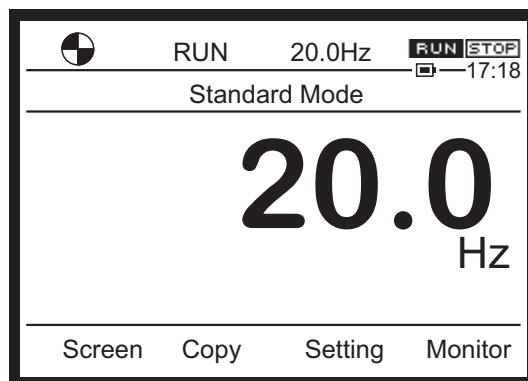
<b>Memo</b>	• For details of [Monitor mode], refer to [Chapter 8].
-------------	--

### 3. 1. 3 Setting of LCD screen

3

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

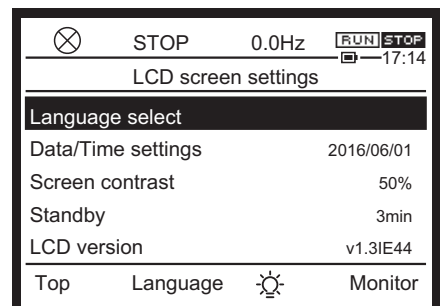
When you press the [F1] key ("Screen") in [Standard mode], the LCD setting screen is displayed. This screen allows various settings of the LCD screen such as selection of display language, setting of current date/time, link to the website, adjustment of contrast, and automatic off time.



■ **LCD screen**

The following five items can be set.

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



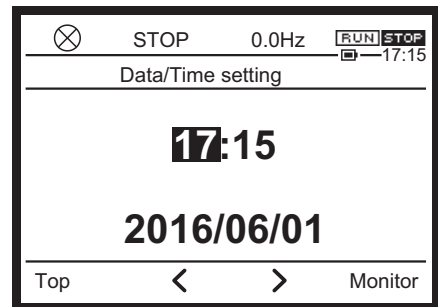
■ **Language selection**

Select a language to be displayed from the list.  
 You can select among English, German, Italian, Spanish, Portuguese, Chinese (simplified). (French and Russian are in preparation.)  
 The default setting is English.  
 A check mark is display to the right end of the selected language.



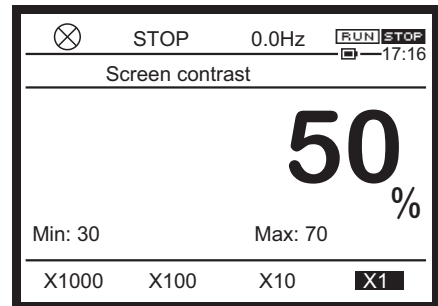
■ **Date/time setting**

Set the date and the time.  
 The time is represented in HH:MM and the date in YYYY/MM/DD.  
 Set the current time.  
 The digits that can be changed are highlighted. Press the [F2] key < or [F3] key > to shift the highlighted digits. Increase or decrease the value and press the [OK] key.



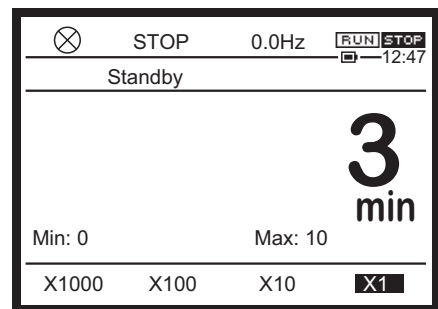
■ **Contrast adjustment**

The contrast can be adjusted in the range of 30 -70%.  
 The default setting is 50%.  
 If you touch the touch wheel, the value in the middle is highlighted. Increase or decrease the value and press the [OK] key.



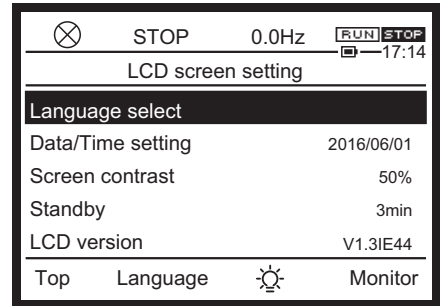
■ **Automatic off time**

The off time of the backlight can be set in the range of 0 min (always on) - 10 min (off after 10 minutes).  
 The default setting is 3 min.  
 If you touch the touch wheel, the value in the middle is highlighted. Increase or decrease the value and press the [OK] key.



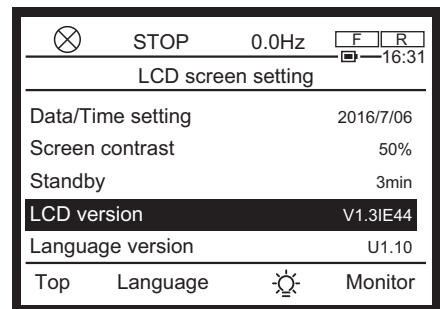
■ **Switching of backlight color**

When you press the [F3] key (☀️ mark), you can change the color of the backlight to white or red. The color is switched every time you press the key.



■ **LCD version and Language version**

You can check the version of the LCD body at the bottom of the screen.



3

**Memo**

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

**3. 1. 4 Copy function**



Mandatory action

- The copy function cannot be used during run. Use this function when the inverter is stopped.
- Never turn off the power of the body or attach/remove the LCD during copying. Otherwise, the memory in the LCD may be damaged, and repair (service call) may be required.

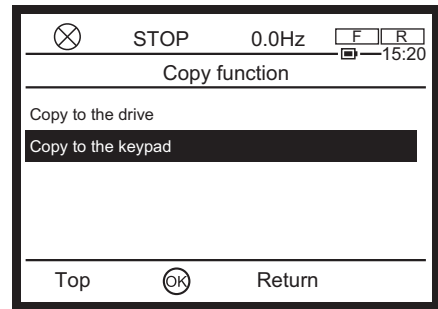
When you press the [F2] key ("Copy") in [Standard mode], the copy function screen is displayed. The copy function allows you to upload/download the parameters of the inverter to/from the file (memory) of the LCD body.

<Limitations>

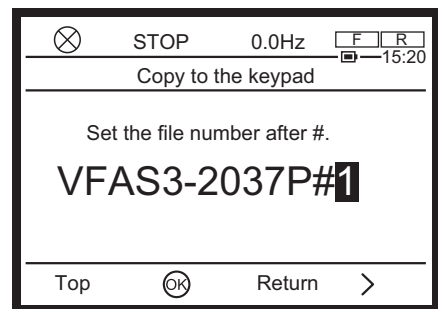
- **Copying cannot be executed between inverters with different capacities.**
- **Re-upload the file if you want to use parameters added with version upgrade.**
- **Up to 16 files can be stored. Since the 17th file cannot be created, overwrite with the same file name.**

**(1) Copying to LCD (uploading)**

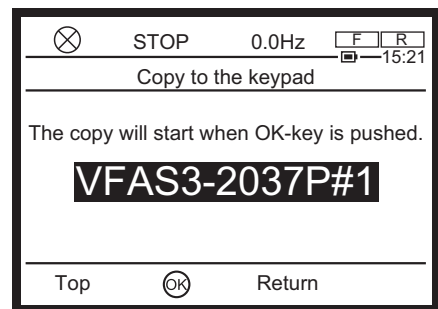
- (1) Select "Copy to the keypad" and press the [OK] or [F2] key.



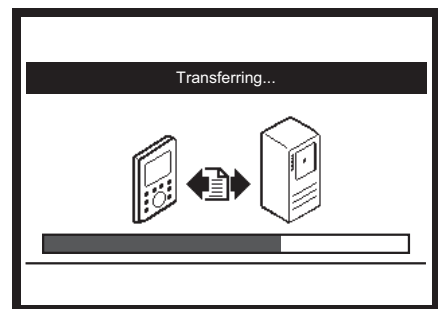
- (2) Set a figure 0 - 99 after the inverter type followed by #, and press the [OK] or [F2] key.



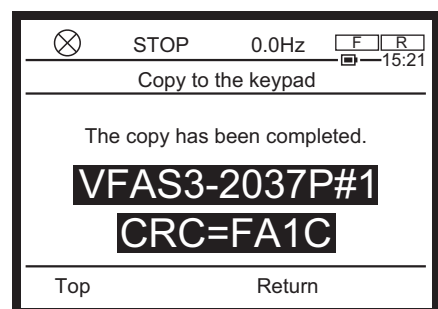
- (3) The highlighted part is the file name. In the following example, "VFAS3-2037P#1" is the file name.



- (4) When you press the [OK] or [F2] key, copying of the parameters of the inverter body to the file (memory) of the LCD body is started.

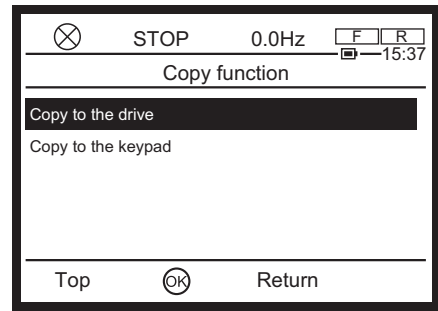


- (5) When the transfer is completed normally, the file name and CRC are displayed.

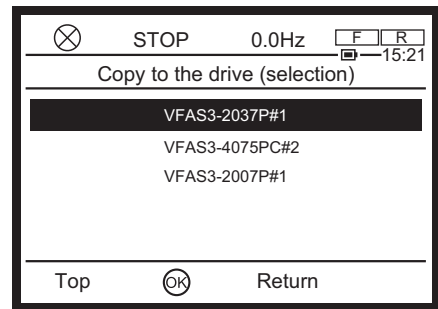


**(2) Copying to inverter (downloading)**

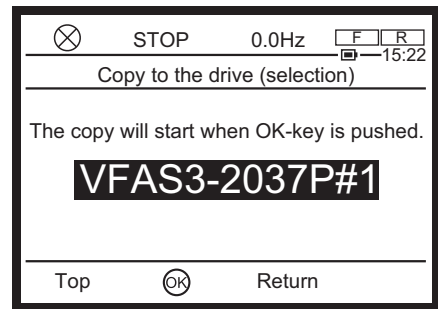
- (1) Select "Copy to the drive", and press the [OK] or [F2] key.



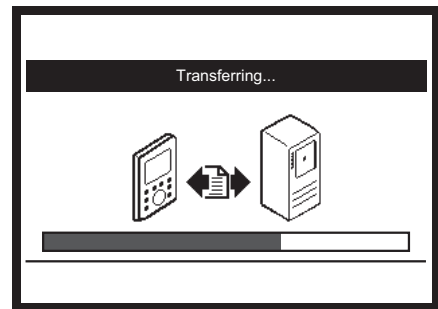
- (2) Select a file to be downloaded to the inverter and press the [OK] or [F2] key.



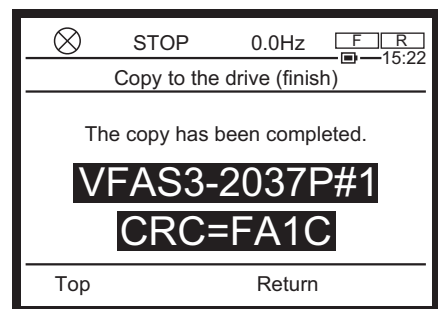
- (3) The selected file is displayed.



- (4) When you press the [OK] or [F2] key, copying from the file (memory) of the LCD body to the parameters of the inverter body is started.



- (5) When the transfer is completed normally, the file name and CRC are displayed.





## 3.2 Normal/emergency screen display



This section explains the screen display of the operation panel.

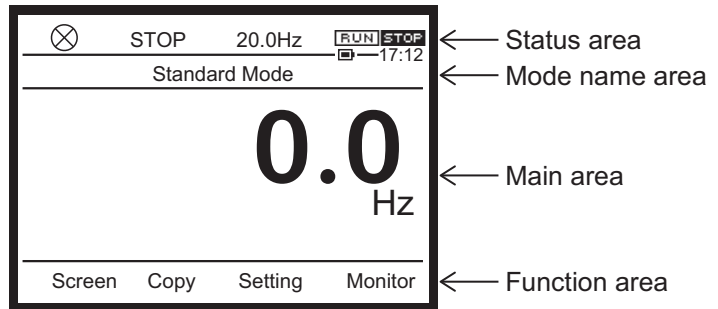
When operation such as parameter setting is not performed, the top screen of [Standard mode] is displayed. During run, output frequency, etc. are displayed, and the status of alarm and trip is displayed when an error occurs.

### 3.2.1 Normal display

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

#### Status area

-  at the left end is stopped
- As status, "STOP" is displayed.
- The frequency command value "20.0 Hz" is displayed (<F723: Status area display of operation panel> = "1: Frequency command value")
- The run command is selected from operation panel, Extension panel (.





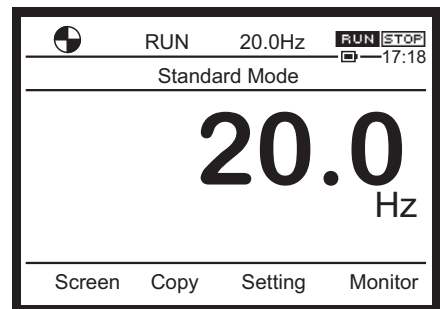
#### Main area

- The output frequency "0.0 Hz" is displayed (<F710: Standard mode display> = "0: Output frequency")

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

#### Status area

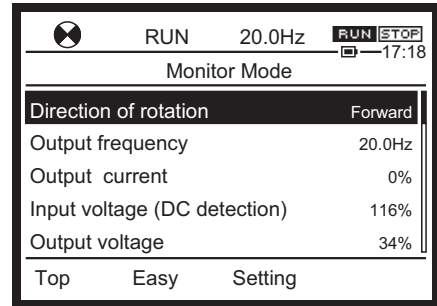
-  at the left end rotates
- As status, "RUN" is displayed
- The frequency command value "20.0 Hz" is displayed (<F723: Status area display of operation panel> = "1: Frequency command value")
- The run command is selected from operation panel, Extension panel (.



#### Main area

- The output frequency "20.0Hz" is displayed (<F710: Standard mode display> = "0: Output frequency")

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



3

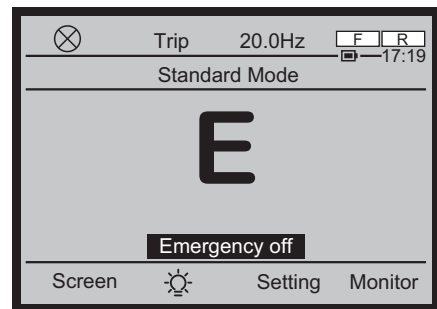
Reference

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

### 3. 2. 2 Display at the time of trip

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

When you press the [i] key, necessary information is displayed. For details, refer to [3. 1. 1].



Memo

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

Reference

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

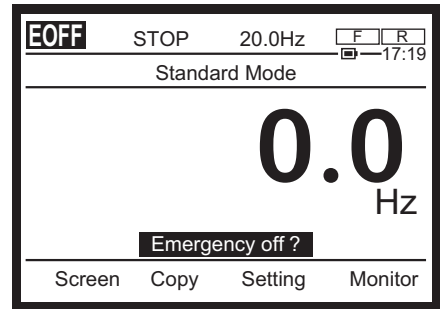
### 3. 2. 3 Emergency off

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

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

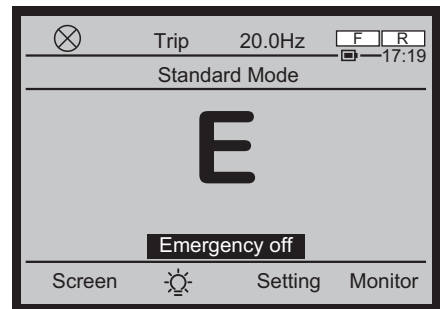
- 1 Press the [STOP/RESET] key.

**E0FF** blinks at the left end of the status area.  
 In [Standard mode], "Emergency off? (STOP) key" is displayed on the lower side in the main areas.  
 In the cases of "Setting mode" and "Monitor mode," just **E0FF** blinks.



- 2 If you press the [STOP/RESET] key again while **E0FF** is blinking, the inverter comes to emergency off.

- The backlight turns red, and "E" blinks.
- "Trip" is displayed in the second position from the left of the status area.
- "Emergency off" is displayed in the main area.



#### Memo

- The blinking **E0FF** returns to the original display status after few seconds if no operation is performed.. The inverter comes to emergency off only if you press the [STOP/RESET] key while **E0FF** is blinking.
- If you want to return only the backlight from red to white, press the [F2] key.

### 3. 2. 4 How to reset trip

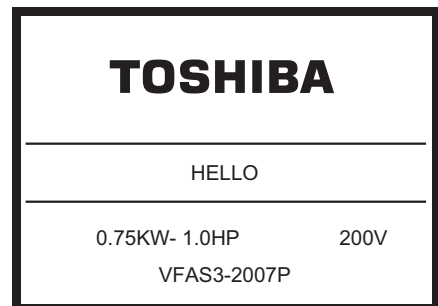
If a trip occurs, you can reset it with panel operation.

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

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



- 2 If you press the [STOP/RESET] key again while "CLr" is blinking, the trip is reset. The display on the screen once disappears, and the screen immediately after power on is displayed. The backlight returns to white.



Important

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

Memo

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

# 4

## [Basic operation] Operation methods of motor

I

II

### WARNING



Prohibited

- Do not touch terminals when the inverter's power is on even if the motor is stopped. Touching the terminals while voltage is applied will result in electric shock.
- Do not touch switches when the hands are wet and do not try to clean the inverter with a damp cloth. This will result in electric shock.
- When the retry function is selected, stand clear of motors and machines at tripping stop. The motors and machines which have stopped due to tripping stop will restart suddenly, and this will result in injury. Take measures for securing safety even if the motor restarts unexpectedly, such as attaching a cover to the motor.
- Do not touch terminals or motor of the inverter while performing auto tuning. Touching the terminals or motor while voltage is applied to the terminals and motor may result in electric shock, even if the motor is stopped. After setting offline auto-tuning (F400 = "2"), execute the auto tuning at first start of the inverter. The auto tuning takes several seconds and the motor is stopped meanwhile, but voltage is applied to the terminals and motor. The motor may also generate a sound during the auto tuning, but this is not malfunction.
- Do not set the stall prevention level parameters (F601 and F185) extremely low. If the stall prevention level parameters (F601 and F185) are set at or below the motor no-load current, the stall preventive function will be always enabled and increase the frequency when it judges that regenerative braking is taking place. Do not set the stall prevention level parameters (F601 and F185) at 30% or less under normal use conditions.



Mandatory action

- Turn the power on only after mounting the front cover. When you use the inverter housed in the cabinet with the front cover removed, always close the cabinet doors first and then turn the power on. If you turn the power on with the front cover or the cabinet doors open, this will result in electric shock.
- Make sure that operation instructions are off before resetting the inverter after malfunction. If the inverter is reset while the operation instructions are on, the motor will restart suddenly, resulting in injury.
- Make sure to set the setup menu correctly. If you set the setup menu incorrectly, this will damage the inverter or cause the inverter to perform unexpected movement.
- Install circuit protection such as the mechanical brake in the crane. If there is no sufficient circuit protection installed in the crane, insufficient motor torque while auto tuning will cause the machine stalling/falling.

### CAUTION



Prohibited

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

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16



Mandatory  
action

- Use the inverter that conforms to specifications of the power supply and the three-phase motor to be operated.  
If you use the inappropriate inverter, not only will the three-phase motor not rotate correctly, but it will cause serious accidents such as overheating and burning out.
- Take countermeasures against leakage current.  
The leakage current through the stray capacitance of the input/output power wires of inverter and motor can affect peripheral devices. In that case, please take countermeasures such as reducing the carrier frequency or shortening the length of input/output power wires. When the total wire length (total length between an inverter and motors) is more than 100m, if the trip occurs with the motor no-load current, make enough space between phase wires or insert the filter (MSF: motor-end surge voltage suppression filter).

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

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

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

4

## 4.1 To run/stop motor

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

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

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

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

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

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

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



Important

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

### ■ Panel run

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

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

**Memo**

- For how to switch other operation method to panel run, refer to [4. 3], [5. 2. 1].

### ■ Terminal run

The motor is operated with an external signal.

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

**Memo**

- For how to switch other operation methods to terminal run, refer to [4. 4], [5. 2. 1].

### ■ Communication run

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

For details, refer to "Communication Function Instruction Manual" (E6582143).

## 4. 2 Basic setting methods of parameters

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

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

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

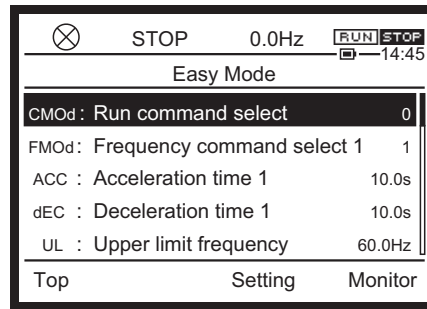
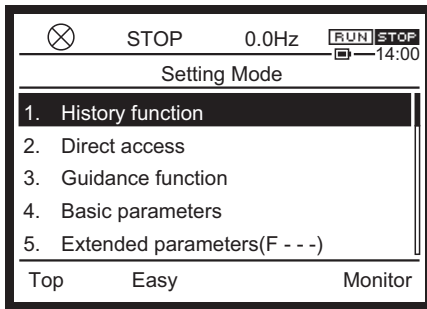
Two parameter setting methods are provided.

#### [Easy mode]

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

#### [Setting mode]

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



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

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

**[Setting mode] -> [Easy mode]**

- Press [F2] key("Easy") at [Setting mode] or [Monitor mode]

**[Easy mode] -> [Setting mode]**

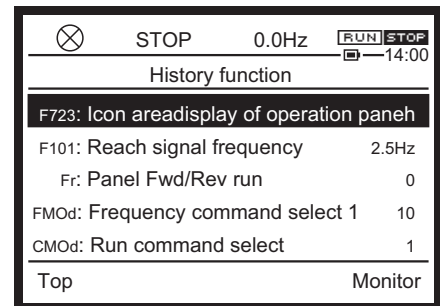
- Press [F3] key("Setting") at [Easy mode], [Standard mode] or [Monitor mode]

■ **[Setting mode]**

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

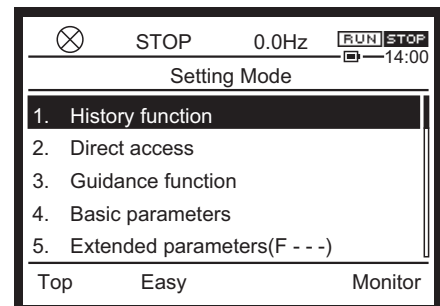
1) **History function <AUH>**

The history of changed parameters is displayed. The latest five parameters whose settings have been changed on the operation panel can be searched automatically. It is a convenient function to immediately change parameters that have been once set or to adjust parameters by changing the setting values little by little. The changed parameters are displayed regardless of the difference from the default setting values.



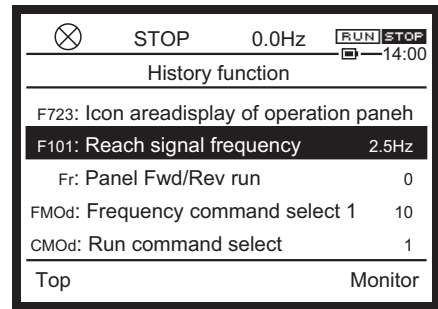
Read the history in the following procedure.

- 1 Select "1. History function" on the [Setting mode] screen and press the [OK] key. The history function screen is displayed. Up to five latest parameters that have been set or changed recently are displayed. For each parameter, the tile, parameter name, and setting value are displayed in one line.

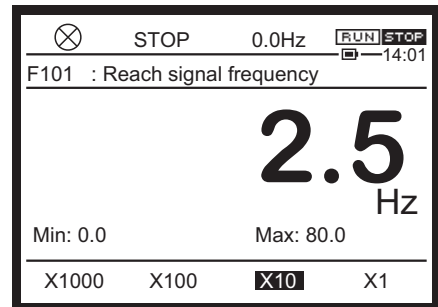




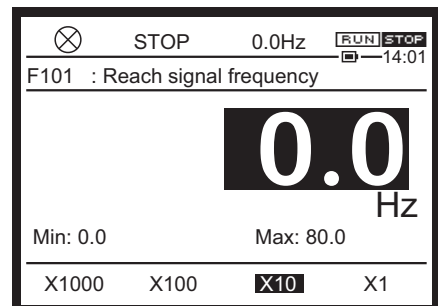
- 2 Select a parameter you want to change and press the [OK] key.  
In the example on the right, <F101: Reach signal specified frequency> is selected.



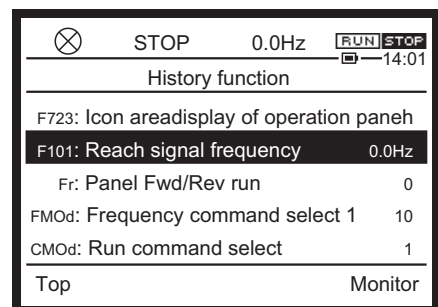
The setting screen of that parameter is opened.



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



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



- 4 Press the [ESC] key.  
The screen returns to the [Setting mode] screen.

Memo

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

4

2) Direct access

A 4-digit communication number is input to specify a parameter, and its setting screen is displayed directly.

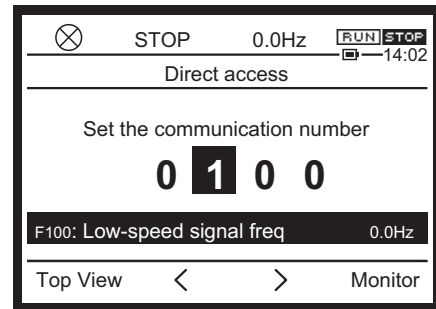
On this setting screen, you can check or change the setting value of the parameter.

When you select "2. Direct access" on the [Setting mode] screen and press the [OK] button, the direct access screen is displayed.

A 4-digit communication number is displayed.

The selected digit is highlighted.

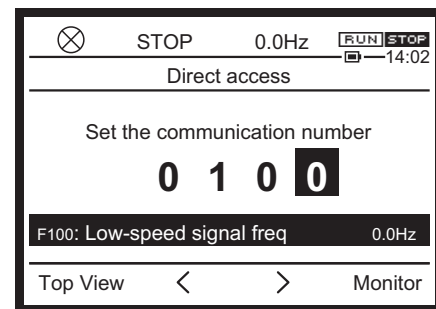
On the lower side of the screen, the title, name, and setting value of the parameter corresponding to the communication number are displayed.



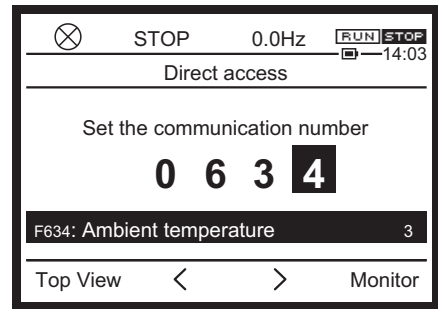
Input the communication number in the following procedure.

1 Set the digit.

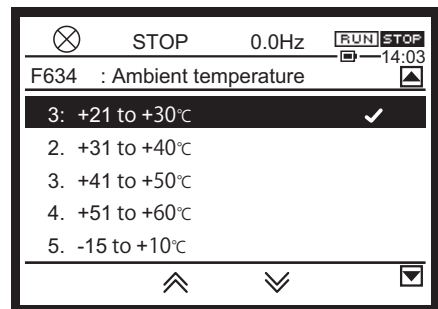
When you press the [F2] key <, the highlighted character is shifted to the left. When you press the [F3] key >, the highlighted character is shifted to the right.



- Set the value with the touch wheel.  
The first, second, and third digits from the right are changed between "0" to "9." The fourth digit from the right is changed among "0", "A", and "C."  
The values are carried or borrowed.  
For example, if the third digit from the right is increased to above "0900," then "A000" is displayed and increased to "A100", "A200" and so on.



- Press the [OK] key.  
The setting screen of the selected parameter is displayed.



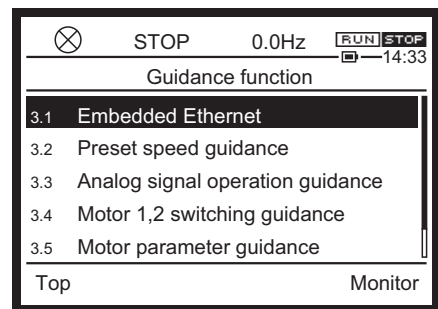
- Press the [ESC] key.  
The screen returns to the direct access screen.

**Memo**

- For the communication number of each parameter, refer to Chapter 11.
- For details of the concrete function and adjustment range of each parameter, refer to Chapters 5 and 6.

**3) Guidance function <AUF>**

Parameters required for a special purpose can be displayed as a group and set collectively.  
You can set necessary parameters easily by setting parameter groups in turn that are automatically formed for special purposes.  
Purpose-specific guidance such as Embedded Ethernet setting, Preset speed operation, Motor 1,2 switching, and Motor parameter is provided.



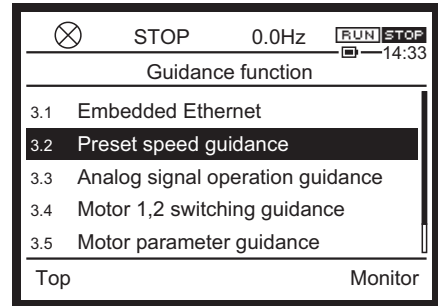
**Parameter setting**

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

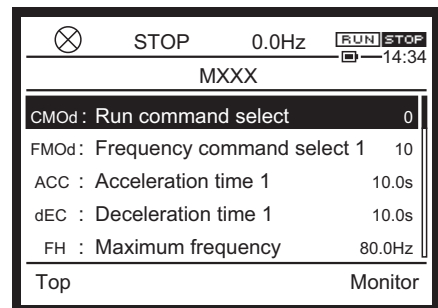
**How to use**

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

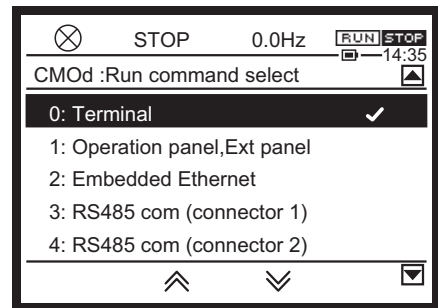
- 1 Select Guidance function "2: Preset speed operation" and press the [OK] key.



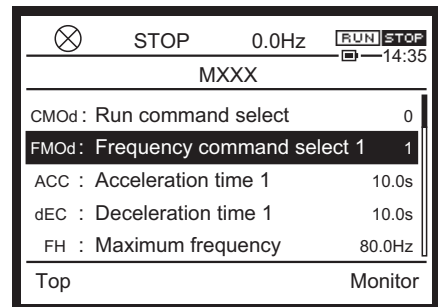
Parameters required for preset speed operation are displayed as a group.



- 2 Press the [OK] key with <CMOD: Run command select> on the top of the preset speed parameter group screen selected. The selection screen of <CMOD> is displayed.



- 3 When you select <CMOD> and press the [OK] key, the screen returns to the preset speed parameter group screen. Select the next parameter <FMod: Frequency command select 1> and press the [OK] key. By setting parameter groups similarly in turn, you can set necessary parameters easily.



**List of parameters changeable by guidance function**

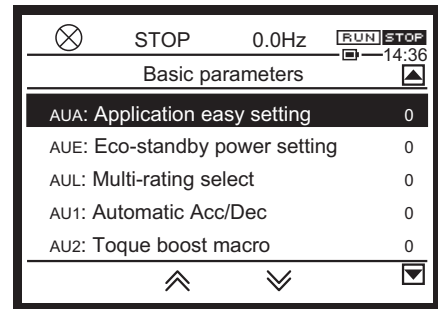
Embedded Ethernet setting	
<AUF>=1	
C081-C096	Device name 1-16
C610	Emb Eth. IP setting mode
C611-C614	Emb Eth. IP address setting value
C615-C618	Emb Eth. Subnet mask setting value
C619-C622	Emb Eth. Default gateway setting value
C629-C632	Emb Eth. IP address monitor
C633-C636	Emb Eth. Subnet mask monitor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

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

**4) Basic parameter**

Basic parameters for inverter operation are displayed.

For details, refer to [5. 3], [5. 4], [11. 2].

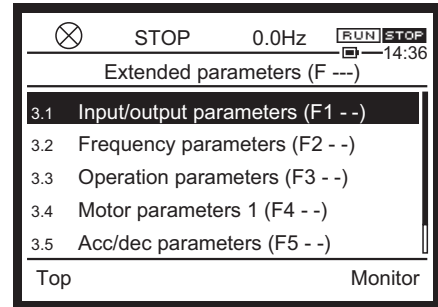


**5) Extended parameter (F---)**

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

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

For details, refer to [5. 4], [Chapter 6], [11. 3].

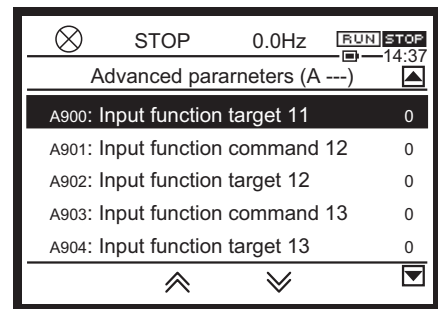


**6) Advanced parameter (A---)**

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

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

For details, refer to [11. 4].

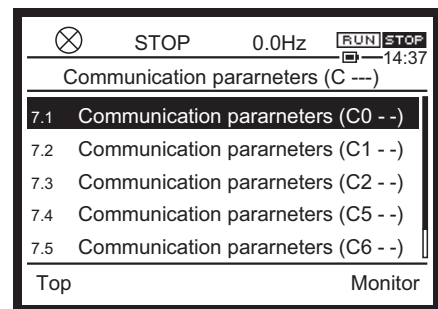


**7) Communication parameter (C---)**

Parameters with communication function are displayed.

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

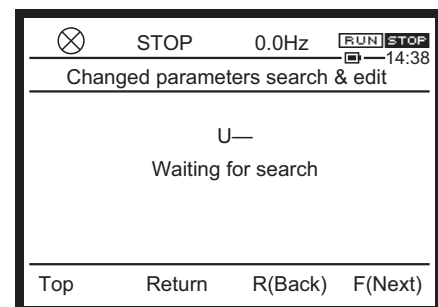
For details, refer to [11. 5].



**8) Changed parameters search & edit <GrU>**

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

The setting values of parameters can be set during search.

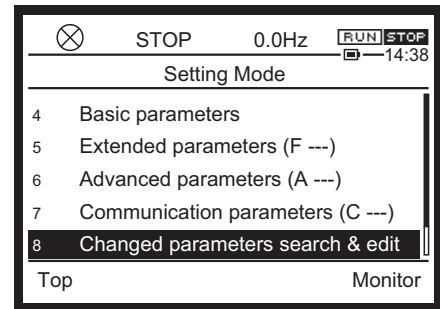


**Memo**

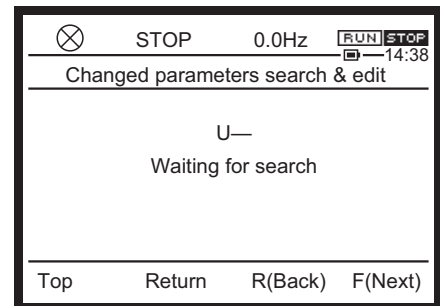
- Since all the parameters are compared with the default setting values, it may take a few seconds until parameters are displayed.
- To cancel parameter search, press the [ESC] key.

Read the changed parameter in the following procedure.

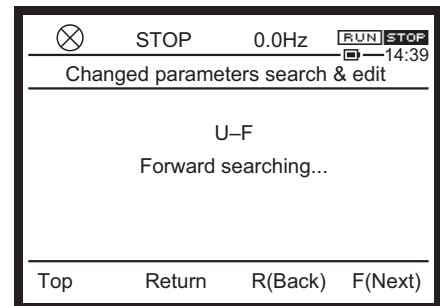
- 1 Select "8. Changed parameters search & edit" on the [Setting mode] screen and press the [OK] key.



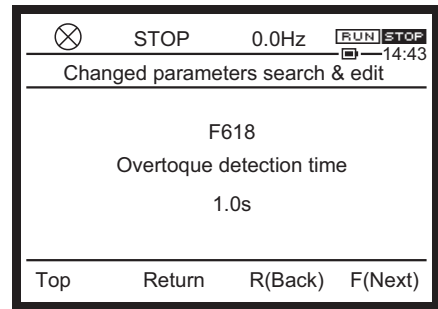
The Changed parameters search & edit screen is displayed.  
 "U-- Waiting for search" is displayed in the main area.



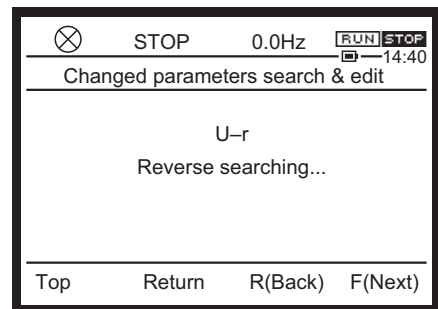
- 2 Press the [F4] key ("F(Next)").  
 During search, "U--F Forward searching..." is displayed.  
 Among the changed parameters, the one with the smallest 4-digit communication number is displayed.  
 The tile, parameter name, and setting value of the parameter are displayed.



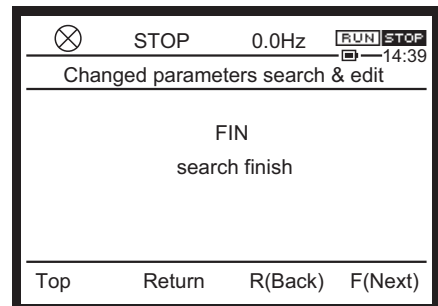
- When you press the [F4] key ("F(Next)") repeatedly, the changed parameters are displayed one by one.



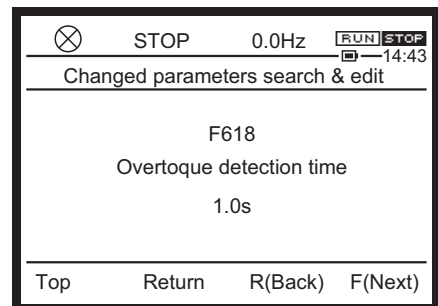
- When you press the [F3] key ("R(Back)"), the changed parameters are displayed one by one from the one with the biggest communication number. During search, "U--r Reverse searching..." is displayed.



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

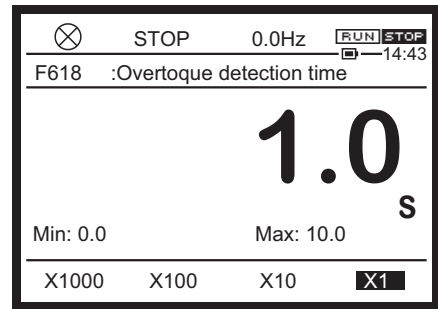


- Press the [OK] key on the screen of the parameter you want to change. In the example on the right, <F618: Overtorque detection time> is selected.

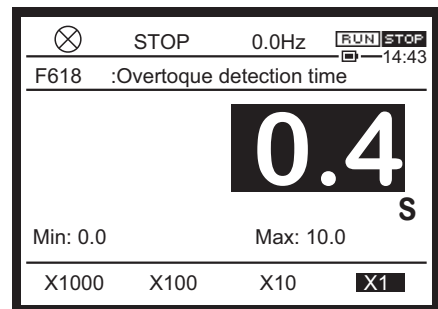




The setting screen of the parameter is opened.

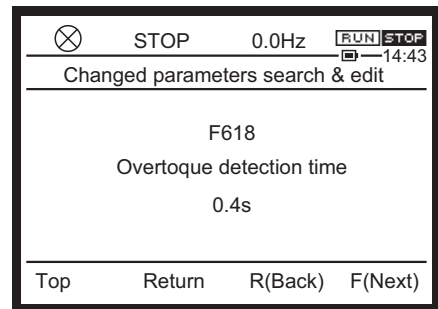


- Change the setting of the selected parameter and press the [OK] key.



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

You can perform forward/reverse search continuously.



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

**Memo**

- Even if the value is changed, when it is reset to the value same as the default setting, it is not displayed in Changed parameters search & edit.
- If "3" is set in <tyP: Default setting>, the parameters are all reset to the default setting. However, the values of some parameters are designed not to return to the default setting, considering maintainability. These parameters are not displayed in Changed parameters search & edit. For details of <tyP: Default setting>, refer to [5. 2. 9].

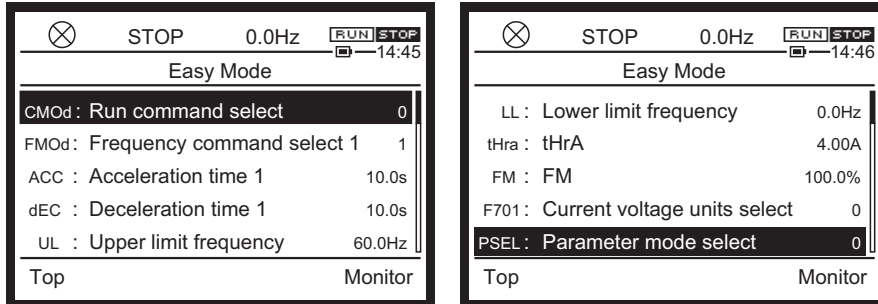


**Important**

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

■ [Easy mode]

In [Easy mode], basic ten (default setting) parameters are displayed.  
Up to 32 parameters can be registered to be displayed.



**<CM0d: Run command select>**

Set inputs (operation panel, terminal, communication) that give a run command to the inverter.  
For details, refer to [5. 2. 1].

**<FM0d: Frequency command select 1>**

Set inputs (operation panel, terminal, communication) that give a frequency command to the inverter.  
For details, refer to [5. 2. 1].

**<ACC: Acceleration time 1>**

Set the time that the output frequency of the inverter takes to reach <FH: Maximum frequency> from 0 Hz.  
For details, refer to [5. 2. 4].

**<dEC: Deceleration time 1>**

Set the time that the output frequency of the inverter takes to decrease to 0 Hz from <FH: Maximum frequency>.  
For details, refer to [5. 2. 4].

**<UL: Upper limit frequency>**

Set the upper limit of the output frequency.  
For details, refer to [5. 2. 3].

**<LL: Lower limit frequency>**

Set the lower limit of the output frequency.  
For details, refer to [5. 2. 3].

**<tHrA: Motor overload protection current 1>**

Set the reference current for protection with electronic thermal.  
For details, refer to [5. 2. 5].

**<FM: Terminal FM adjustment>**

Adjust the scale of the meter connected to the terminal [FM].  
For details, refer to [5. 2. 6].

**<F701: Current, voltage units select>**

Select the unit of current/voltage displayed on the operation panel among % or A (ampere)/V (volt). For details, refer to [5. 2. 7].

**<PSEL: Parameter mode select>**

Select the parameter mode between [Setting mode] and [Easy mode]. For details, refer to [5. 2. 8].

## 4. 2. 2 Basic parameters and extended parameters

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

**Basic parameter**

Basic parameters for inverter operation.

**Extended parameter**

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

**Advanced parameter**

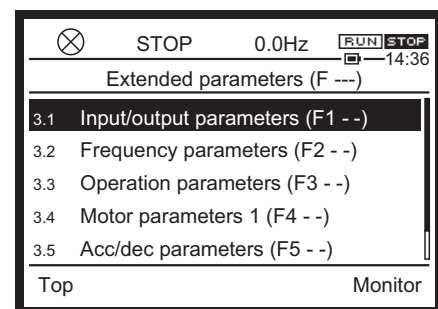
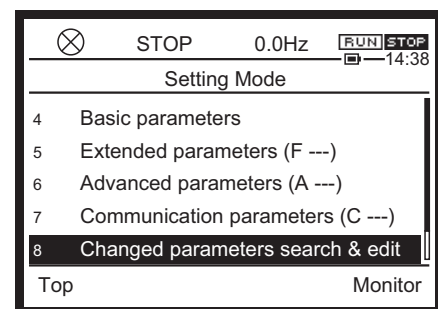
Parameters used for My function, etc. that allows simplified programming. They are represented as "A" and a 3-digit number.

**Communication parameter**

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

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

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



## 4. 2. 3 Basic operation of parameter setting

Set parameters in the following procedure.

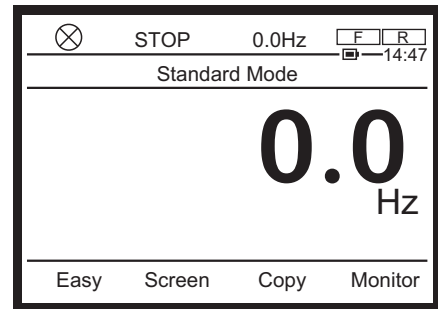
Select an item for some parameters and set a value for others.

■ **Setting of parameter for which an item should be selected**

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

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

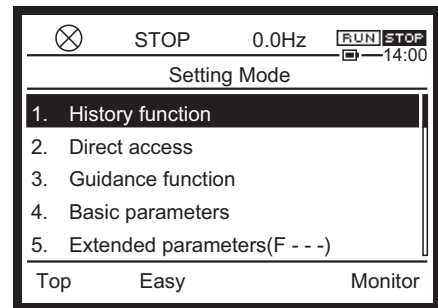
In the example on the right, the operation panel is in [Standard mode], and the output frequency is displayed in the middle of the screen.



- To switch from [Monitor mode], press the [F3] key ("Setting").

- Switch from [Easy mode] to [Standard mode] or [Monitor mode]. For details of switching of display modes, refer to [3. 1. 2].

The [Setting mode] screen is displayed.

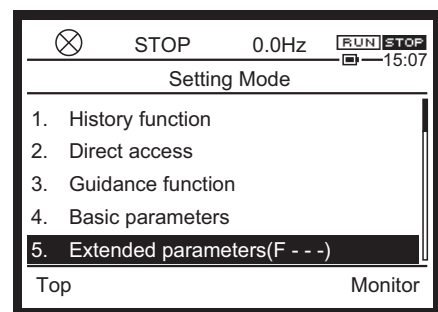


**Memo**

- If [Setting mode] is not displayed on the screen even after the above operation, check the <PSEL: Parameter mode select> setting. When "2: Easy mode only" is set, change the setting. For details, refer to [5. 2. 8].

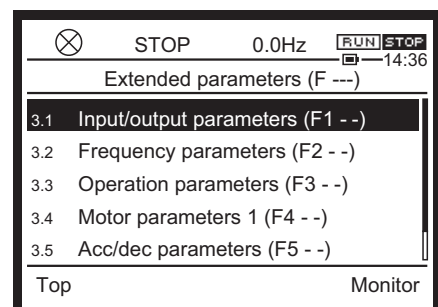
- 2 Select "5. Extended parameter (F---)" with the touch wheel.

The selected item is highlighted.

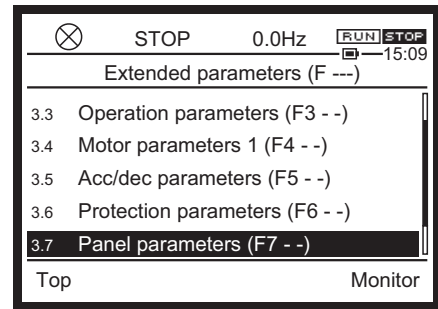


- 3 Press the [OK] key.

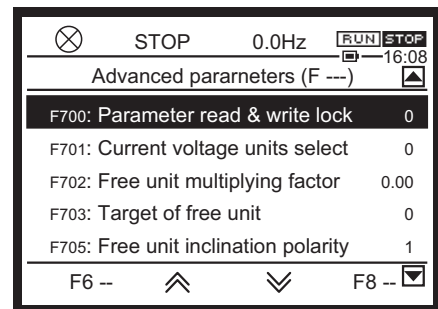
The extended parameter screen is displayed. The screen showing the list of each category with 100 parameters is displayed.



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



- 5 Press the [OK] key. The top screen of the parameters is displayed, starting with <F700: Parameter reading&writing access lockout>.

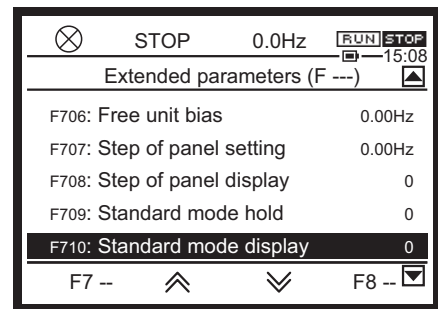


- 6 With the [F3] key  $\nabla$  and the touch wheel, select <F710: Standard mode display>.

The [F3] key  $\nabla$  scrolls down the screen that displays five parameters at a time page by page.

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

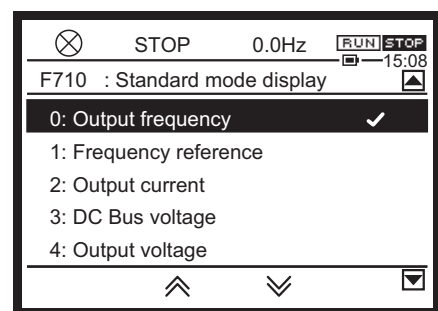
The number displayed at the right end of each item is the current setting value.





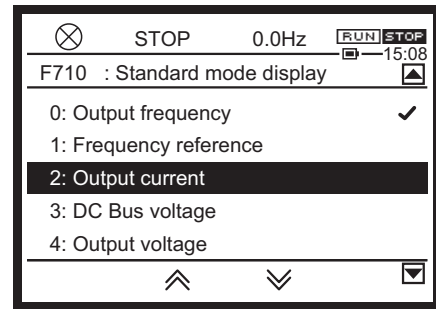
- 7 Press the [OK] key. The setting screen of <F710: Standard mode display> is displayed.

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

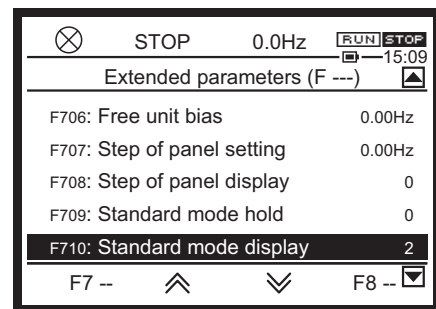
In the example on the right, "0: Output frequency" is the current setting value.



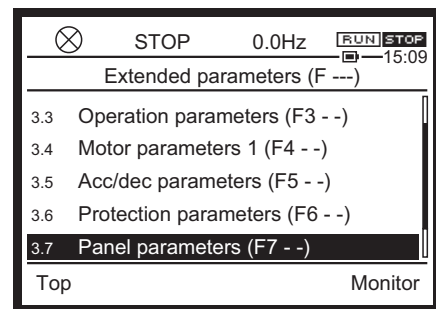
- 8 Select a new setting value.  
 Select it by using the touch wheel, the [F2] key , and the [F3] key .  
 In the example on the right, the setting value is changed to "2: Output current."



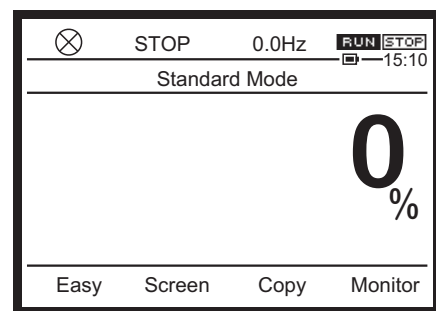
- 9 Press the [OK] key.  
 The setting value is changed. The screen display returns to the previous screen (previous one in the hierarchy), and the screen of the panel parameter is displayed.  
 Check that the number displayed at the right end of the item <F710: Standard mode display> has been changed ("0" -> "2" in the example on the right).



- 10 Press the [ESC] key.  
 The screen display returns to the previous one, and the extended parameter screen is displayed.



- 11 Press the [F1] key ("Standard") and return to [Standard mode].  
 In the example on the right, the display in [Standard mode] has been changed to output current (displayed in %). When you press the [F4] key/[ESC] key, the mode is switched to [Monitor mode].

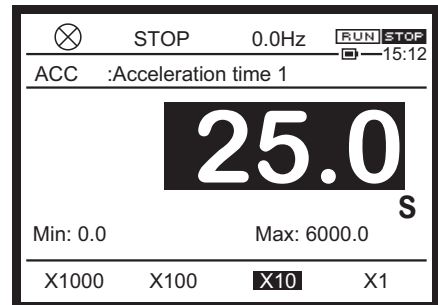


**Memo** • For details of the function and adjustment range of <F710: Standard mode display>, refer to [5. 4. 3].

■ With parameters for which a value should be set

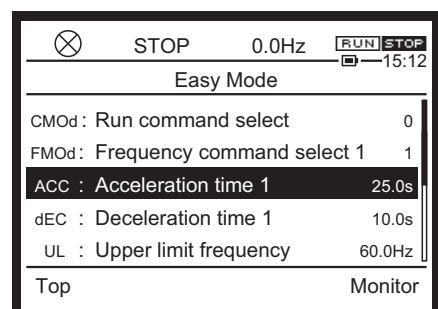
For an example, here is a procedure to set the basic parameter <ACC: Acceleration time 1>. At that time, the current setting value, unit, setting lower limit (Min:), and setting upper limit (Max:) are displayed.

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



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

- 2 Press the [OK] key.  
The setting value is changed, and the screen display returns to the previous one.



<b>Memo</b>	<ul style="list-style-type: none"> <li>• For details of the function and adjustment range of &lt;ACC: Acceleration time 1&gt;, refer to [5. 2. 4].</li> </ul>
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## 4.3 Basic panel run methods

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

### 4.3.1 [Operation example 1] Operating with [RUN] key/ [STOP] key on operation panel

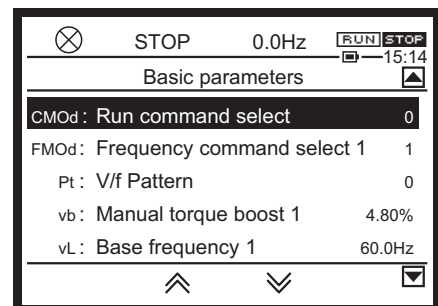
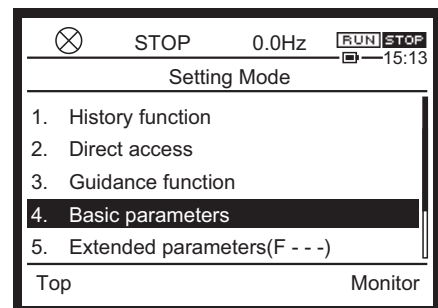
Operate only with the operation panel.

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

Reference

- How to switch the display mode of the operation panel -> Refer to [3. 1. 2]
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details of <CMOd: Run command select>, and <FMOd: Frequency command select 1> -> Refer to [5. 2]

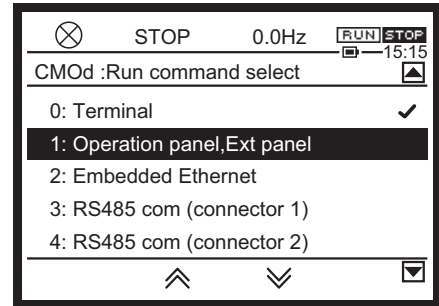
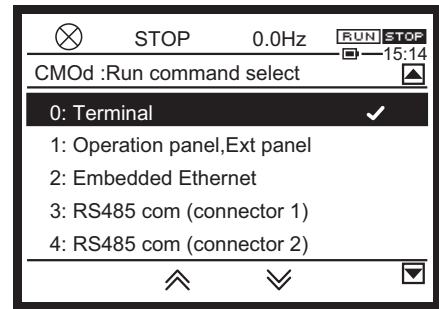
- 1 To set parameters, switch to [Setting mode].  
 Select "4. Basic parameter" and press the [OK] key. The basic parameter screen is displayed.
- 2 Select <CMOd: Run command select> and press the [OK] key.  
 You can also select <CMOd: Run command select> on the [Easy mode] screen.





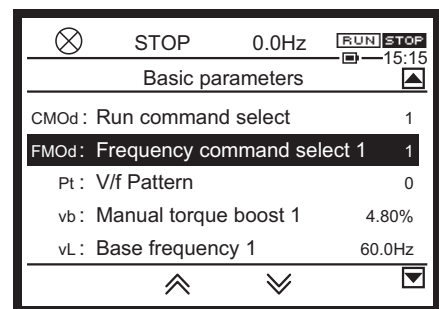
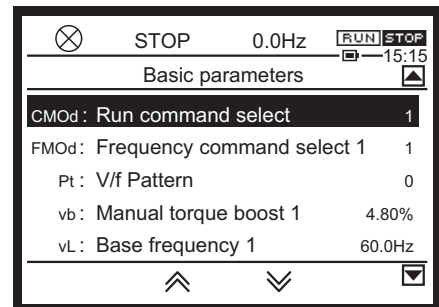
The setting screen is displayed.

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

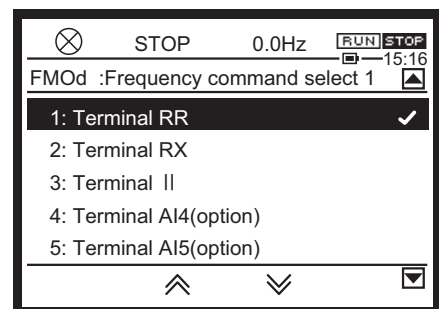


The basic parameter screen is displayed.  
Check that the setting value of <CMOd: Run command select> is "1."

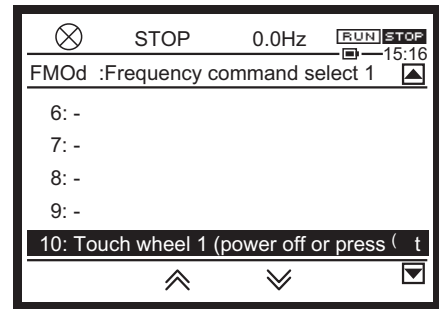
- 4 Select <FMOd: Frequency command select 1> and press the [OK] key.



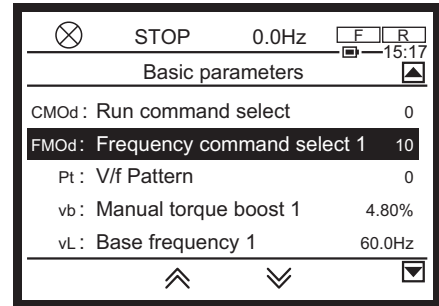
The setting screen is displayed.



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

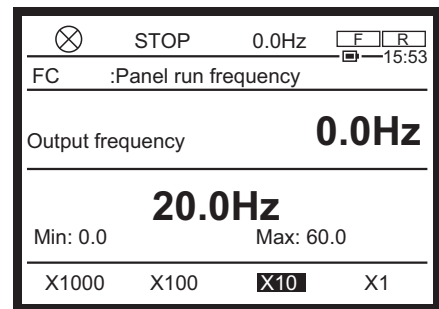


The basic parameter screen is displayed. Check that the setting value of <FMOd: Frequency command select 1> is "10".

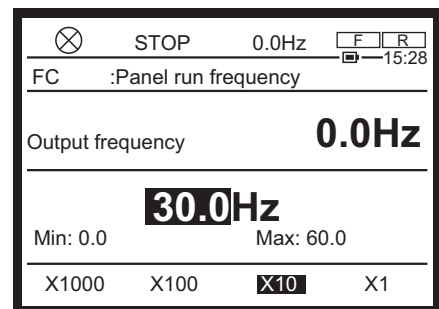


- 6 Press the [ESC] key or [F1] to [F4] keys to switch to the [Standard mode] screen.
- 7 In [Standard mode], press the [OK] key.

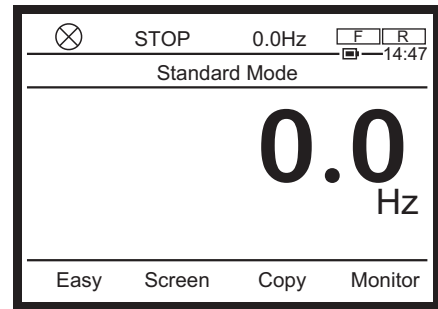
The setting screen of <FC: Panel run frequency> is displayed. If you leave this setting screen as it is, the screen returns to the [Standard mode] screen for a few seconds later.



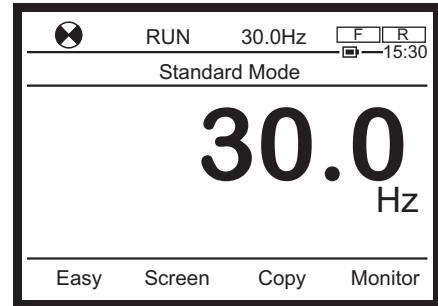
- 8 Change the frequency command value with the touch wheel. When the setting value is changed, the value on the lower side of the screen is highlighted. In the example on the right, it is set to 30.0 Hz. This becomes the frequency command value.



- 9 Press the [OK] key.  
The screen returns to the [Standard mode] screen.





- 10 When you press the [RUN] key, the motor starts running.  
In the main area of the [Standard mode] screen, the output frequency is displayed.  
The motor accelerates according to the setting of <ACC: Acceleration time 1>, and its frequency changes to the frequency command value set with <FC: Panel run frequency> and becomes stable.  
In the example on the right, it is 30.0 Hz.



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

(From the left)

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

**Memo**

- You can change the frequency command value by pressing the [OK] key in [Standard mode] and displaying the setting screen of <FC: Panel run frequency> during run.
- When you change the frequency command value with the touch wheel, the output frequency changes accordingly.

- 11 To stop the motor, press the [STOP] key.  
The motor decelerates according to the setting of <dEC: Deceleration time 1> and stops.

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

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

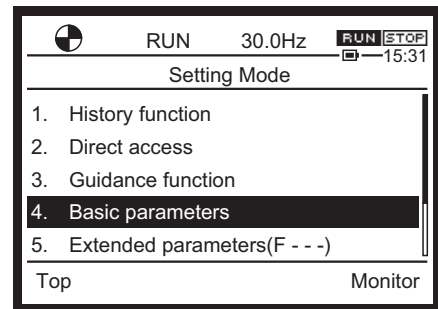
- Make setting so that forward run/reverse run can be input from the operation panel.
- The parameter to be set is <Fr: Panel Fwd/Rev run select>.

Reference

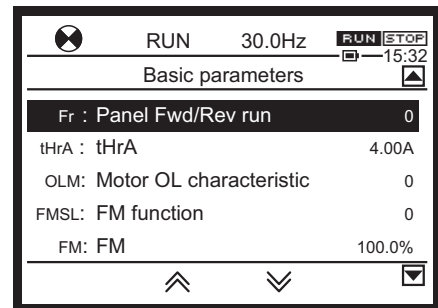
- How to switch the display mode of the operation panel -> Refer to [3. 1. 2]
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details of <Fr: Panel Fwd/Rev run select> -> Refer to [5. 3. 9]

4

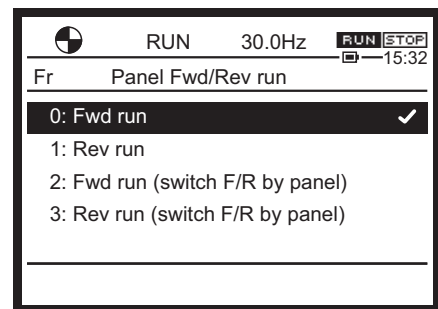
- 1 Operate the motor with the operation panel according to [4. 3. 1].
- 2 Switch to [Setting mode].
- 3 Select "4. Basic parameter" and press the [OK] key.  
The basic parameter screen is displayed.



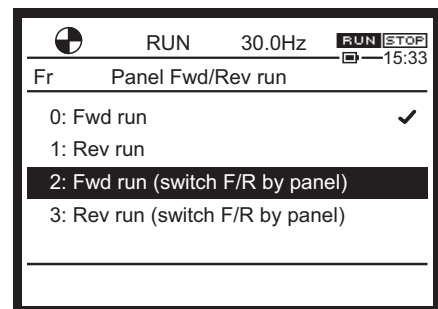
- 4 Select <Fr: Panel Fwd/Rev run select> and press the [OK] key.



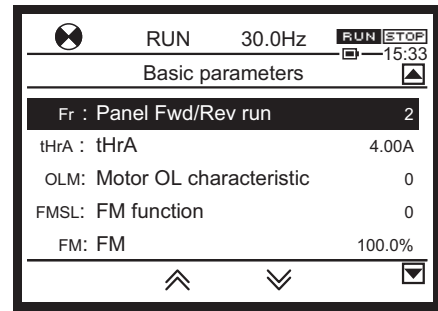
The setting screen is displayed.



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



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



**Memo**

- When you select "1: Rev run" and press the [OK] key, the motor decelerates and starts reverse run. [FWD/REV] key operation is not possible.

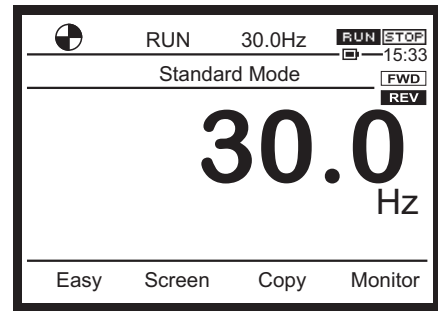
6 Press the [ESC] key or [F1] to [F4] keys to switch to the [Standard mode] screen.

- Icon of direction of rotation

Only when the [FWD]/[REV] key is enabled, is displayed in the mode name area in the upper right of the screen.

When the motor is running forward, is

highlighted. When it is running reversely, is highlighted.



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

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

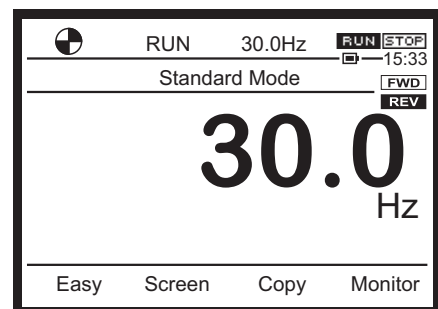
**Memo**

- You can also check the direction of rotation of the motor on the [Monitor mode] screen. For details, refer to [8. 1. 1].

7 When you press the [FWD/REV] key, the direction of rotation of the motor is switched to reverse run. The motor decelerates and shows 0.0 Hz once. Then, it accelerates to the frequency command value set with <FC: Panel run frequency> and becomes stable.

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

- The icon is rotating counterclockwise






- Icon of direction of rotation 

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

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

## 4. 4 Basic terminal run methods

 <b>WARNING</b>	
 Prohibited	<ul style="list-style-type: none"> <li>Do not touch terminals when the inverter's power is on even if the motor is stopped. Touching the terminals while voltage is applied will result in electric shock.</li> <li>Do not touch switches when the hands are wet and do not try to clean the inverter with a damp cloth. This will result in electric shock.</li> </ul>
 Mandatory action	<ul style="list-style-type: none"> <li>Turn the power on only after mounting the front cover. When you use the inverter housed in the cabinet with the front cover removed, always close the cabinet doors first and then turn the power on. If you turn the power on with the front cover or the cabinet doors open, this will result in electric shock.</li> </ul>

This section introduces terminal run methods with basic examples.

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

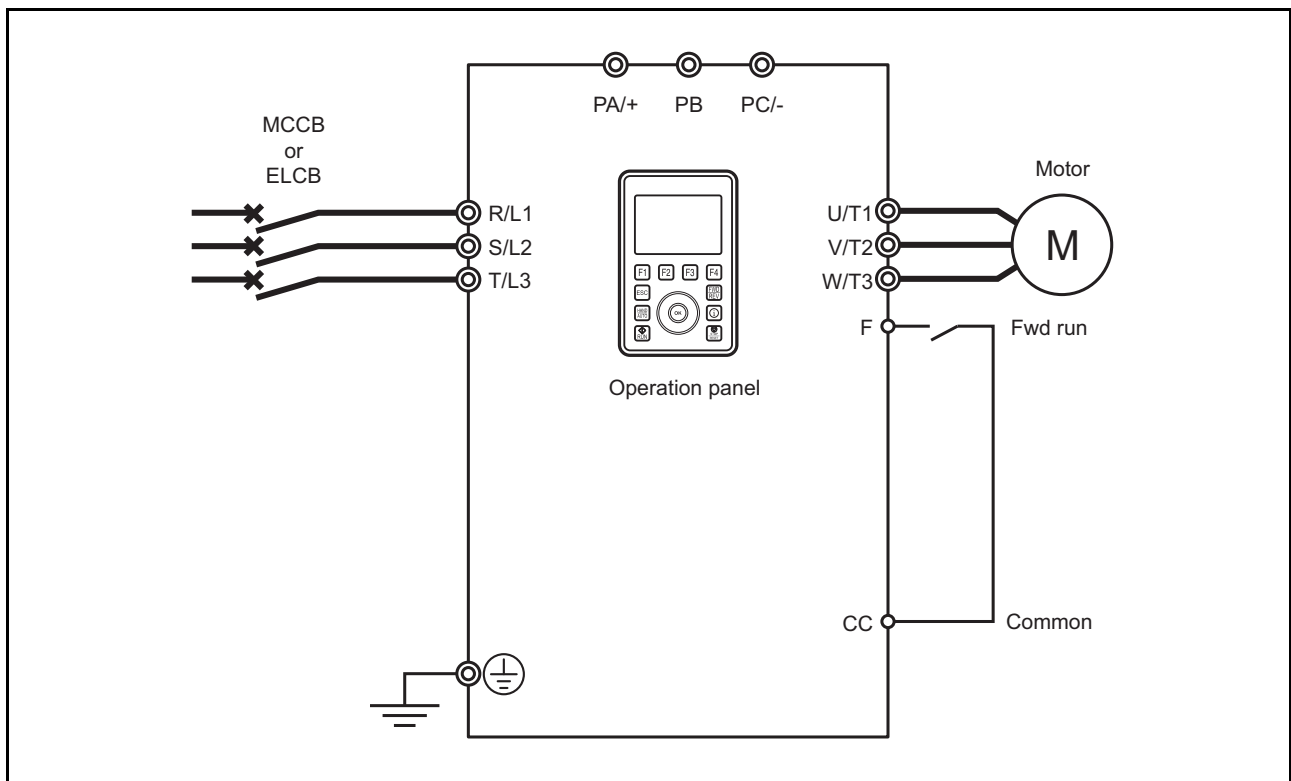
### 4. 4. 1 [Operation example 1] Run/stop with external signal (frequency command with operation panel)

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

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

<b>Reference</b>	<ul style="list-style-type: none"> <li>How to switch the display mode of the operation panel -&gt; Refer to [3. 1. 2]</li> <li>Procedure to change parameter setting -&gt; Refer to [4. 2. 3]</li> <li>Details of &lt;CMOd: Run command select&gt;, and &lt;FMOf: Frequency command select 1&gt; -&gt; Refer to [5. 2. 1]</li> <li>Difference of connection between sink logic and source logic -&gt; Refer to [2. 3. 5]</li> <li>Details of operation by external signals -&gt; Refer to [Chapter 7]</li> </ul>
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4



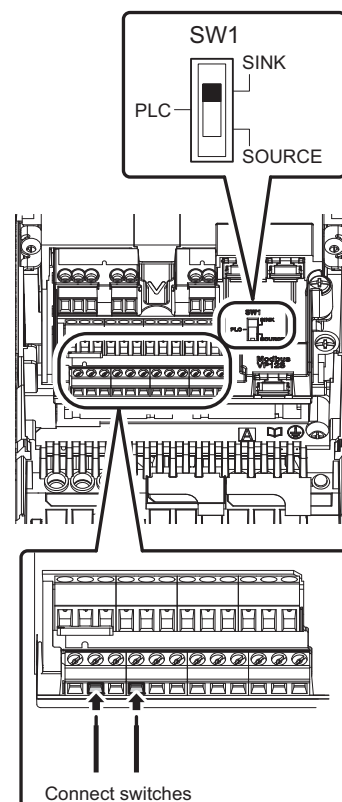
- 1 Turn off the power of the inverter.
- 2 Remove the covers of the control terminal block and parts required for connection. Covers to be removed vary depending on the type of the inverter. For details of how to remove the covers, refer to [2. 2].

- 3 Check that the slide switch [SW1] is on the SINK side.  
If it is set to PLC/SOURCE side, set it to the SINK side.  
For details of the slide switch, refer to [2. 3. 5].

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

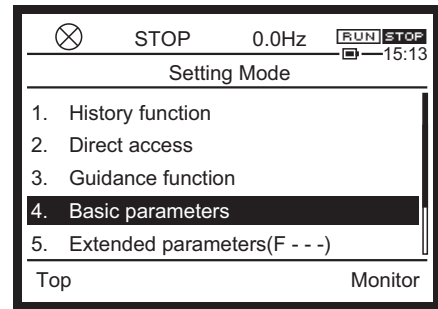
The terminal [F] is used for a forward run command in the default setting.  
For details of positions of the control terminal block and terminals, refer to [2. 3. 5].

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

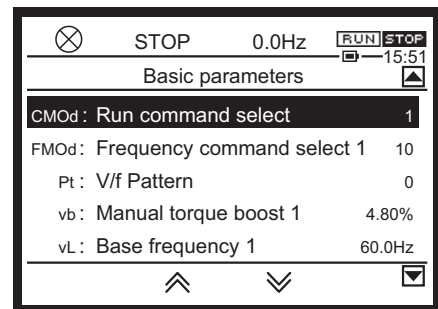




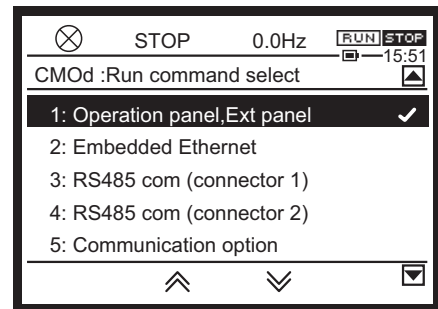
- Switch to [Setting mode].  
Select "4. Basic parameter" and press the [OK] key. The basic parameter screen is displayed.



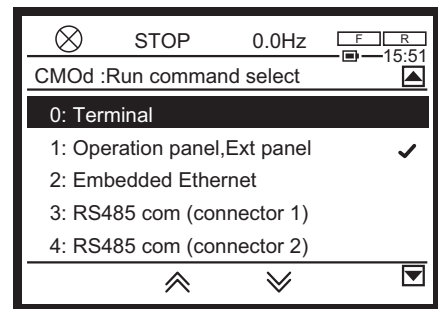
- Select <CMOd: Run command select> and press the [OK] key.  
You can also select <CMOD: Run command select> on the [Easy mode] screen.



The setting screen is displayed.

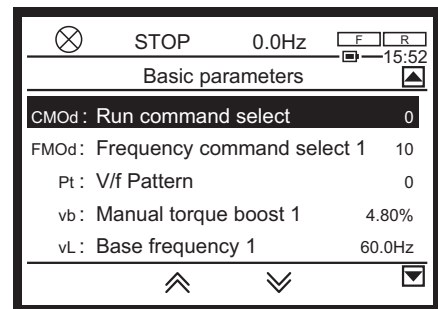


- Select "0: Terminal" and press the [OK] key.

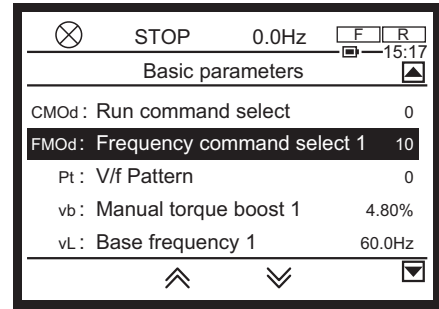


The basic parameter screen is displayed.  
Check that the setting value of <CMOd: Run command select> is "0."

- Select <FMOd: Frequency command select 1> and press the [OK] key.  
The setting screen is displayed.

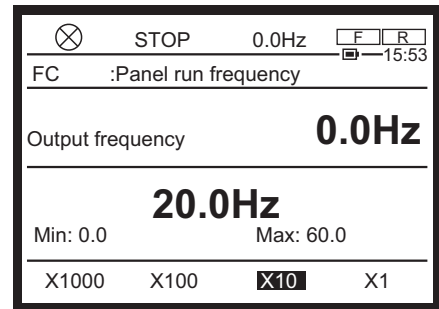


11 Select "10: Touch wheel 1 (power off or press OK to save)" and press the [OK] key.  
The basic parameter screen is displayed.  
Check that the setting value of <FM0d: Frequency command select 1> is "10".

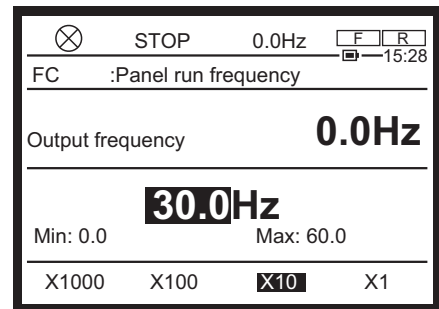


12 Press the [ESC] key or [F1] to [F4] keys to switch to the [Standard mode] screen.

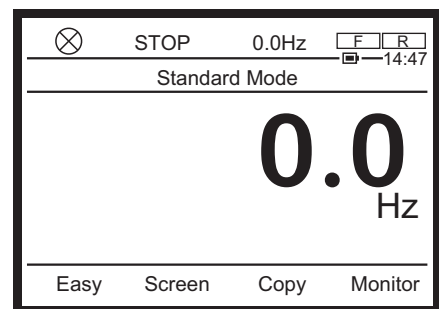
13 In [Standard mode], press the [OK] key.  
The setting screen of <FC: Panel run frequency> is displayed.  
If you leave this setting screen as it is, the screen returns to the [Standard mode] screen for a few seconds later.



14 Change the frequency command value with the touch wheel.  
When the setting value is changed, the value on the lower side of the screen is highlighted.  
In the example on the right, it is set to 30.0 Hz. This becomes the frequency command value.



15 Press the [OK] key.  
The screen returns to the [Standard mode] screen.





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

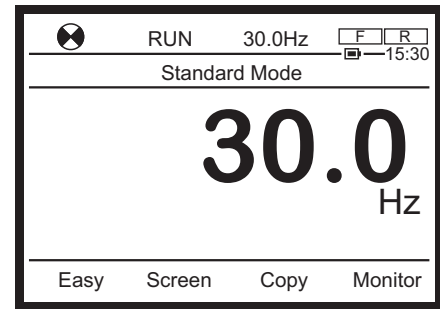
In the main area of the [Standard mode] screen, the output frequency is displayed.

The motor accelerates according to the setting of <ACC: Acceleration time 1>, and its frequency changes to the frequency command value set with <FC: Panel run frequency> and becomes stable.

In the example on the right, it is 30.0 Hz.

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

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



- 17 To stop the motor, turn off the external switch.

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

### Memo

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

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

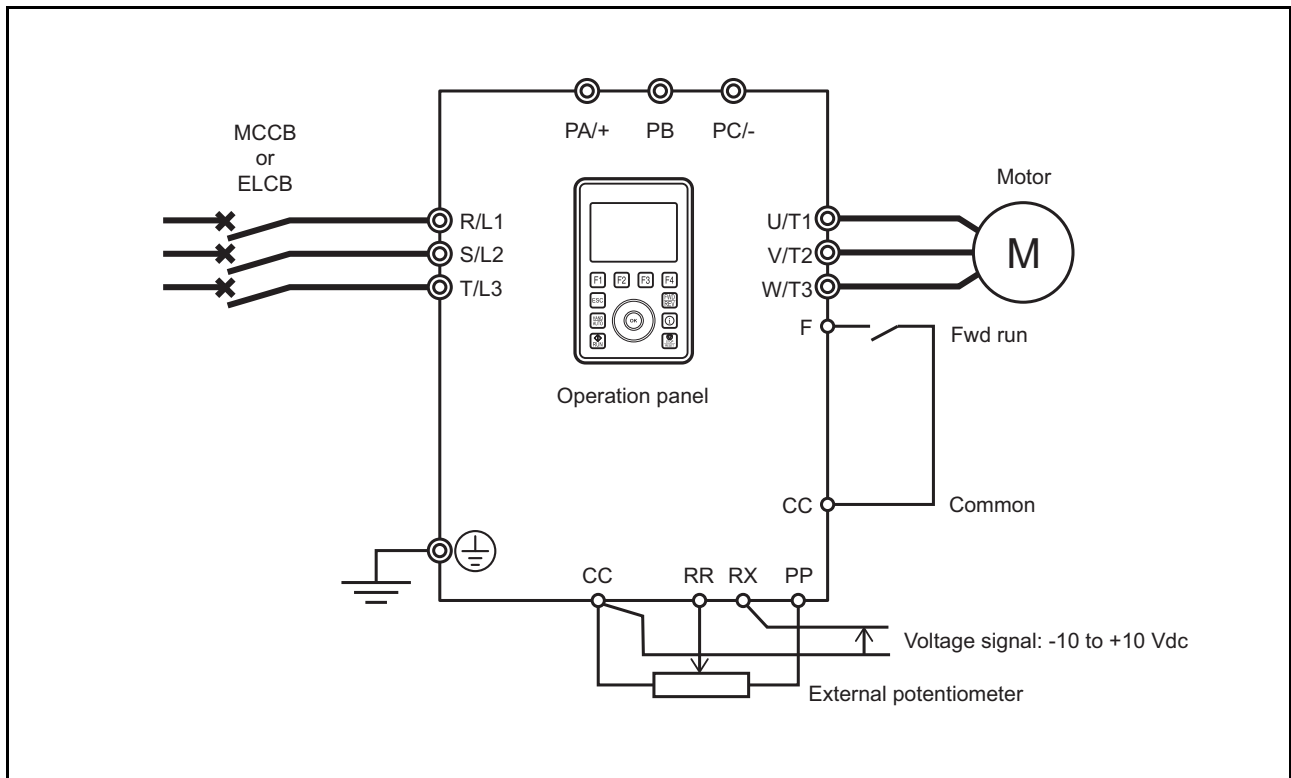
Input both run command and frequency command externally.

Set the frequency command with a potentiometer connected to outside or a voltage/current signal from outside.

- First, check connection from external contacts such as switch/relays to the control terminal.
- Here is a case where run/stop is input with a switch and a frequency command is input with a potentiometer (1 - 10 kΩ, 1/4 W) or voltage (0 - 10 Vdc, -10 to +10 Vdc).
- Next, make setting so that a run command and a frequency command can be input externally (terminal).
- After setting the above, operate the motor by using the external switch/potentiometer or voltage signal.
- The parameters to be set are <CMOD: Run command select> and <FMOD: Frequency command select 1>.
- Control connection is explained in the case of sink logic.

Reference

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



- 1 Turn off the power of the inverter.
- 2 Remove the covers of the control terminal block and parts required for connection. Covers to be removed vary depending on the type of the inverter. For details of how to remove the covers, refer to [2. 2].

- 3 Check that the slide switch [SW1] is on the SINK side.  
If it is set to PLC/SOURCE side, set it to the SINK side.  
For details of the slide switch, refer to [2. 3. 5].

- 4 Check connection of the terminals to be used on the control terminal block.  
For details of positions of the control terminal block and terminals, refer to [2. 3. 5].

**Digital input terminals [F], [CC]**

- Connect the switch and execute forward run of the motor.

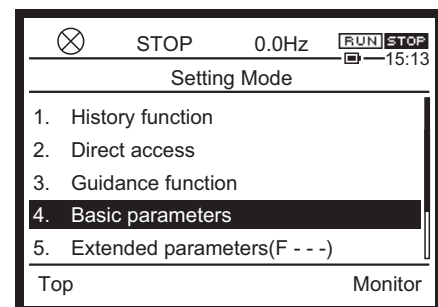
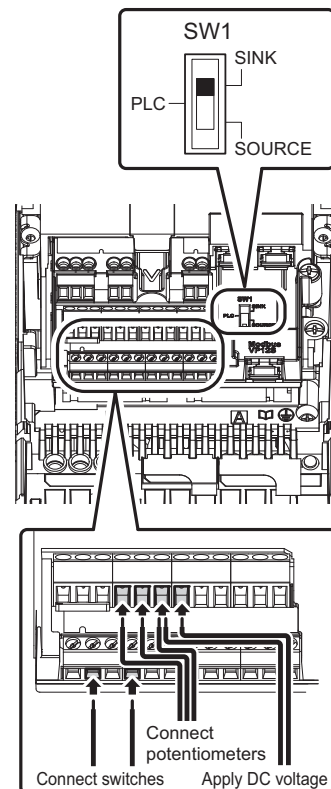
**Potentiometer input terminals [PP], [RR], [CC]**

- Connect both ends of the potentiometer to the terminal [PP] and terminal [CC], and the sliding terminal to the terminal [RR]. Rotate the potentiometer to change the frequency command.
- The terminal [PP] is used for a 10 Vdc power supply for analog input.

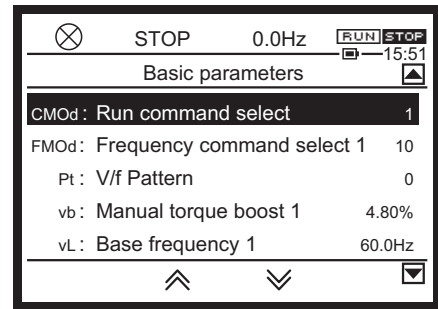
**Analog input terminals [RX], [CC]**

- Input 0 - 10 Vdc or -10 to +10 Vdc as a frequency command signal between the terminal [RX] and terminal [CC].

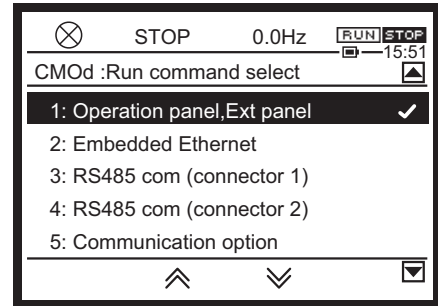
- 5 Mount the covers.  
For how to mount them, refer to [2. 2].
- 6 Turn on the power of the inverter.
- 7 Switch to [Setting mode].  
Select "4. Basic parameter" and press the [OK] key. The basic parameter screen is displayed.



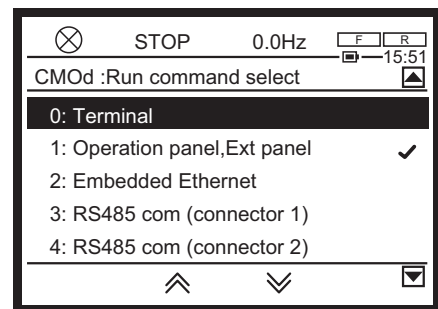
- 8 Select <CMOd: Run command select> and press the [OK] key.  
You can also select <CMOd: Run command select> on the [Easy mode] screen.



The setting screen is displayed.

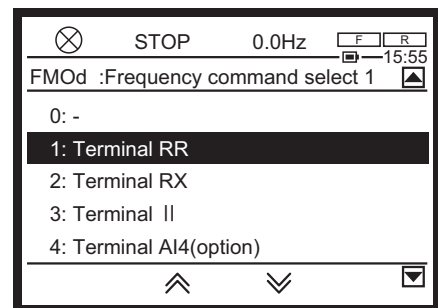


- 9 Select "0: Terminal" and press the [OK] key.  
The basic parameter screen is displayed.  
Check that the setting value of <CMOd: Run command select> is "0."

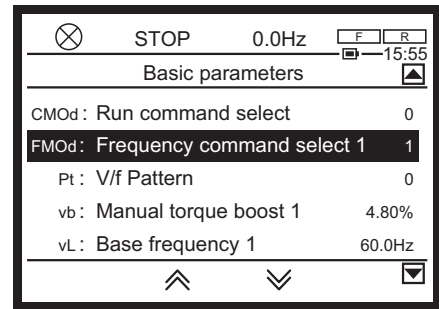


- 10 Select <FMd: Frequency command select 1> and press the [OK] key.  
The setting screen is displayed.

- 11 Select "1: Terminal RR" and press the [OK] key.



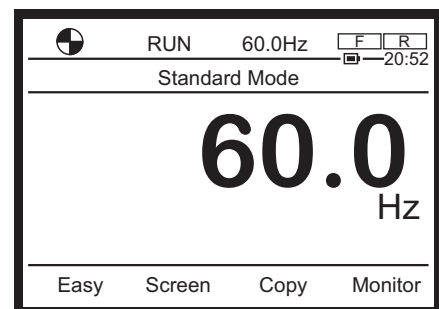
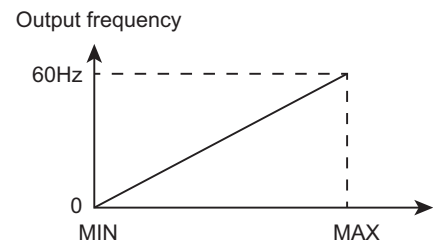
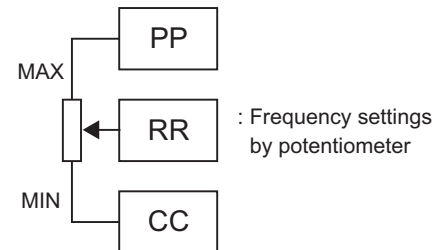
The basic parameter screen is displayed.  
 Check that the setting value of <FM0d: Frequency command select 1> is "1."  
 In this setting, the voltage signal input to the terminal [RR] should be the frequency command.  
 Here, the voltage input to the terminal [RR] is adjusted with the potentiometer.



- 12 Press the [ESC] key or [F1] to [F4] keys to switch to the [Standard mode] screen.  
 In the main area of the [Standard mode] screen, the output frequency (0.0 Hz) is displayed.
- 13 Turn on the external switch.

- 14 When you rotate the potentiometer, the frequency command value increases, and the motor starts running.  
 The following are always displayed in the status area on the upper side of the screen regardless of display mode. (From the left)

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



**Memo**

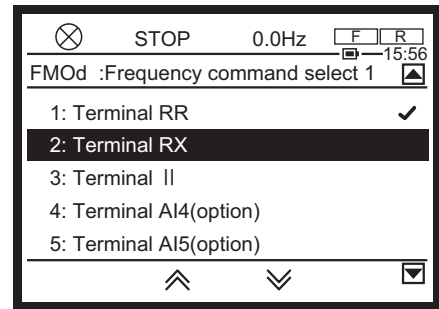
- In some cases, for example, when the potentiometer is set to the maximum/minimum, you can set the two frequency command points. The default setting is 0.0 Hz/60.0 Hz. For details, refer to [7. 3. 2].

- 15 When you turn off the external switch, the motor decelerates and stops.

16 In [Setting mode], change the setting value of <FM0d: Frequency command select 1> to "2: Terminal RX."

In this setting, set the frequency command with the voltage signal (0 - 10 Vdc or -10 to +10 Vdc) connected to the terminal [RX].

Even if the potentiometer is connected to the terminal [RR], a frequency command by the potentiometer is disabled.



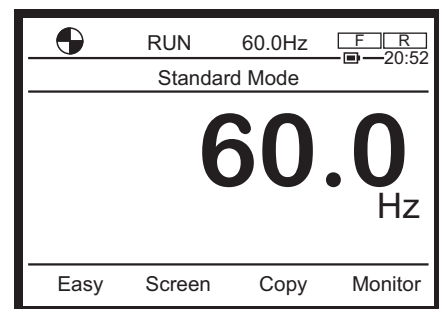
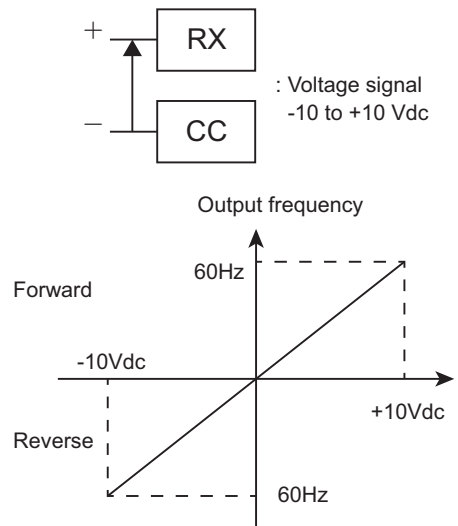
17 In [Standard mode], turn on the external switch.

18 When the voltage signal is increased from 0 V, the frequency command is increased, and the motor starts running.

By inputting a positive/negative voltage signal, forward run/reverse run can be switched.

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

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



Memo

- In some cases, for example, when the voltage is set to the minimum (0 V)/maximum (+10 V), you can set the two frequency command points. The default setting is 0 V: 0.0 Hz, 10 V: 60.0 Hz. For details, refer to [7. 3. 4]. Set the input voltage to the terminal [RX] to "0: 0 - +10 V" or "1: -10 to +10 V" with <F107: Terminal RX input voltage select>.



19 When you turn off the external switch, the motor decelerates and stops.

**Memo**

- You can also change the input specification of the terminal [RR] to PTC input, etc. For details, refer to [6. 2. 3].

### 4. 4. 3 [Operation example 3] Switching run/stop and frequency with external switch

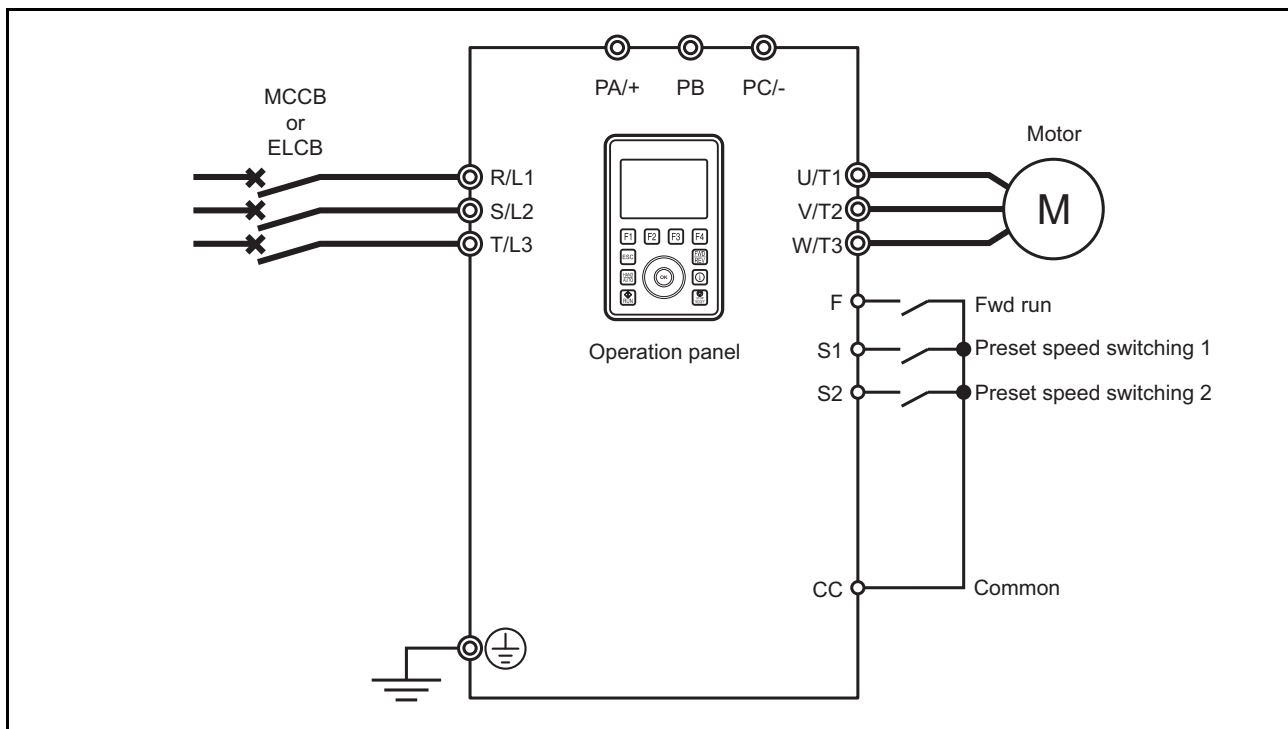
Digital input both a run command and a frequency command externally.

- First, check connection from external contacts such as switch/relays to the control terminal.
- Here is a case where run/stop is input by a switch and a frequency command is operated by 3-speed operation (controlled with two relays).
- Next, make setting so that a run command and a frequency command can be input externally (terminal).
- After setting the above, operate the motor by using the external switch or external signal.
- The parameters to be set are <CMOd: Run command select>, <Sr1: Preset speed 1>, <Sr2: Preset speed 2>, and <Sr3: Preset speed 3>.
- Control connection is explained in the case of sink logic.

4

Reference

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



- 1 Turn off the power of the inverter.
- 2 Remove the covers of the control terminal block and parts required for connection. Covers to be removed vary depending on the type of the inverter. For details of how to remove the covers, refer to [2. 2].

- 3 Check that the slide switch [SW1] is on the SINK side.  
If it is set to PLC/SOURCE side, set it to the SINK side.  
For details of the slide switch, refer to [2. 3. 5].

- 4 Check connection of the terminals to be used on the control terminal block.

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

**Digital input terminals [F], [CC]**

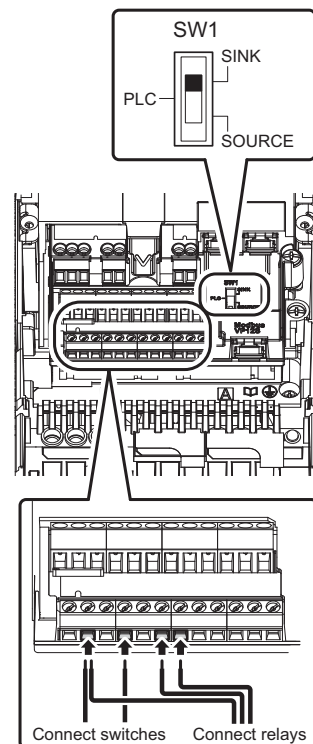
- Connect the switch and execute forward run of the motor.

**Digital input terminals [S1], [CC]**

- Connect relay 1 to perform preset speed operation.

**Digital input terminals [S2], [CC]**

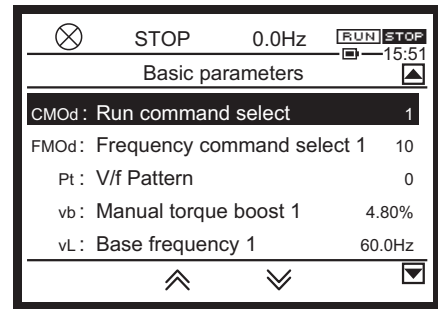
- Connect relay 2 to perform preset speed operation.



<b>Memo</b>	<ul style="list-style-type: none"> <li>• With combination of relay 1 ON, relay 2 ON, and both relay 1 and relay 2 ON, you can set three types of frequency command values.</li> </ul>
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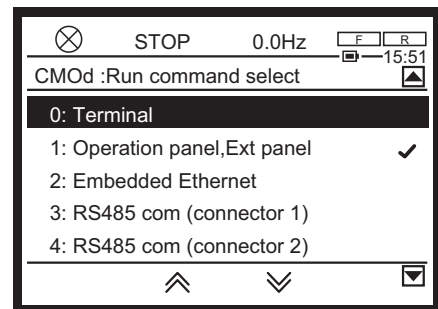
- 5 Mount the covers.  
For how to mount them, refer to [2. 2].
- 6 Turn on the power of the inverter.
- 7 Switch to [Setting mode].
- 8 Select "4. Basic parameter" and press the [OK] key.  
The basic parameter screen is displayed.

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

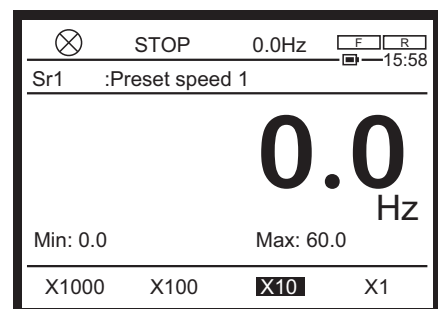


The setting screen is displayed.

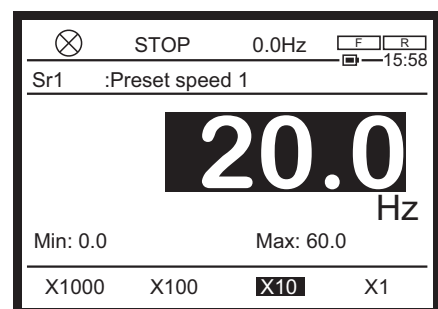
- 10 Select "0: Terminal" and press the [OK] key. The basic parameter screen is displayed. Check that the setting value of <CMOd: Run command select> is "0."



- 11 Select <Sr1: Preset speed 1> and press the [OK] key. The setting screen is displayed. The default setting is 0.0 Hz.

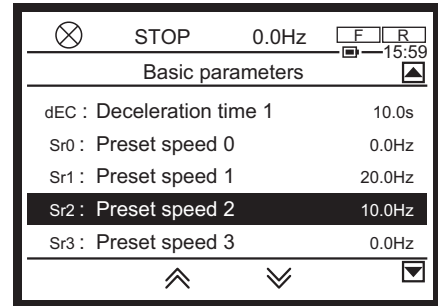


- 12 Change the setting value with the touch wheel. When the setting value is changed, the value on the screen is highlighted. In the example on the right, it is set to 20.0Hz. This is the frequency command value of Preset speed 1.

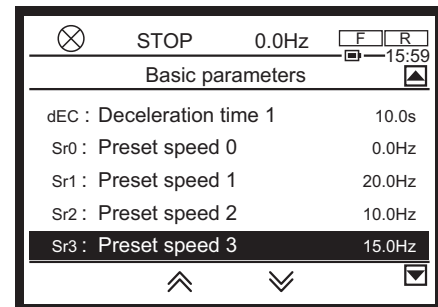


- 13 Press the [OK] key.  
The screen returns to the basic parameter screen.

- 14 Similarly, select <Sr2: Preset speed 2> and <Sr3: Preset speed 3> and change the setting values.



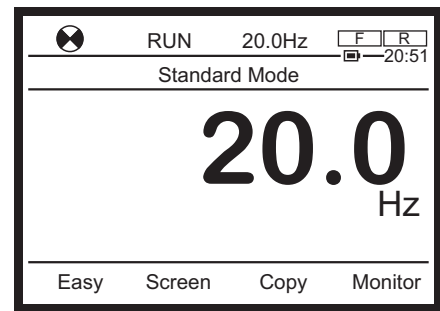
In the example on the right, <Sr2: Preset speed 2> is set to 10.0 Hz and <Sr3: Preset speed 3> to 15.0 Hz.



- 15 Press the [OK] key to return to the basic parameter screen.
- 16 Turn on the external switch.  
Leave the two relays off.
- 17 When you turn on relay 1, the frequency command value of <Sr1> is enabled, and the motor starts running.  
In the main area of the [Standard mode] screen, the output frequency is displayed.

The output frequency changes to the frequency command value set with <Sr1: Preset speed 1> and becomes stable.

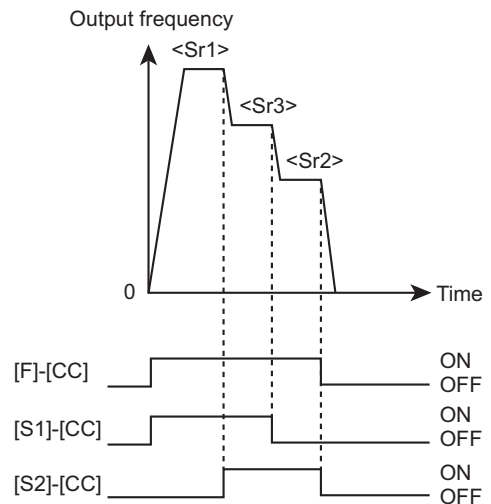
In the example on the right, it is 20.0 Hz.



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

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

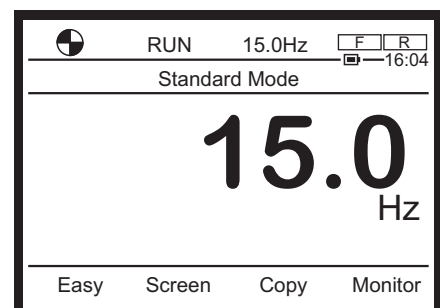
- 18 When you turn on relay 2 with relay 1 on, the frequency command value of <Sr3> is enabled, and the output frequency changes.



The output frequency changes to the frequency command value set with <Sr3: Preset speed 3> and becomes stable.

In the example on the right, it is 15.0 Hz.

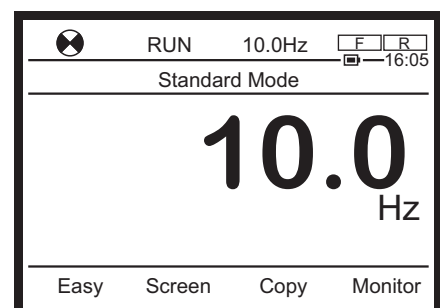
- 19 When you turn off relay 1 with relay 2 on, the frequency command value of <Sr2> is enabled, and the output frequency changes.



The output frequency changes to the frequency command value set with <Sr2: Preset speed 2> and becomes stable.

In the example on the right, it is 10.0 Hz.

- 20 When you turn off the external switch, the motor decelerates and stops.



**Memo**

- For details of preset speed operation, refer to [5. 3. 7].

# 5 [Fundamental operation] How to use parameters

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Frequently set parameters include default 10 parameters in [Easy mode] and basic parameters. This chapter describes these parameters.

## 5.1 Table of parameter access

## 5.2 Settings of main parameters

This section describes how to select run and frequency commands required for operating the motor, how to limit the output frequency, how to set acceleration/deceleration time, how to set the electronic thermal for motor protection, and how to adjust the meter.

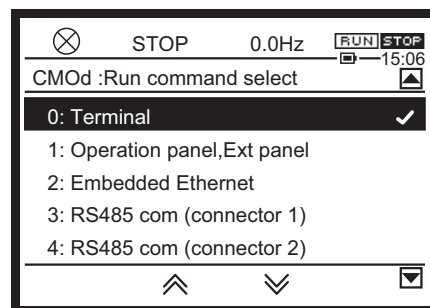
### 5.2.1 Selecting how to input run and frequency commands

#### (1) Selecting how to input run/stop

<CMOd: Run command select>

Basic parameter

Easy mode



#### ■ Function

Select where to input a run command to the inverter.

#### ■ Parameter setting

Title	Parameter name	Adjustment range	Default setting
CMOd	Run command select	0: Terminal 1: Operation panel, Extension panel 2: Embedded Ethernet 3: RS485 communication (connector 1) 4: RS485 communication (connector 2) 5: Communication option	0

## ■ Selecting a setting value

### 0: Terminal

Run/stop the inverter with an external ON/OFF signal.

For how to set terminals and parameters to be used, refer to [4. 4].

For details of operation by external signals, refer to [Chapter 7].

### 1: Operation panel, Extension panel

Press the [RUN], [STOP] key on the operation panel to run/stop the inverter.

You can do it even on the optional extension panel.

For how to set this value, refer to [4. 3].

### 2: Embedded Ethernet

Connect a communication cable to the Ethernet connector 1 or 2, and run/stop the inverter through the Ethernet communication.

For details, refer to "Communication Function Instruction Manual" (E6582125).

### 3: RS485 communication (connector 1)

This has the operation panel mounted when shipped from the factory. Remove the operation panel and connect a communication cable, and you can run/stop the inverter through the RS485 communication.

For details, refer to E6582143.

### 4: RS485 communication (connector 2)

Connect a communication cable to the RS485 communication connector 2 next to the control terminal block. Then, you can run/stop the inverter through the RS485 communication.

For details, refer to [6. 38].

### 5: Communication option

Run/stop the inverter with a communication option command.

For details, refer to Each "Communication function instruction manual."

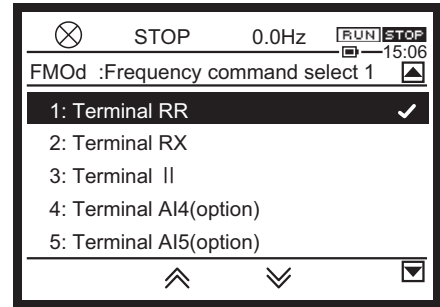
## Memo

- Assign the input terminal function "108: Terminal operation priority" to an unused input terminal. When the input terminal is ON, run command is terminal run. For details, refer to the table of input terminal functions in [7. 2. 1] or [11. 8].
- The priority command from the communication or terminal precedes the command set with <CMOd: Run command select>.



(2) **Selecting how to input a frequency command**

<FM0d: Frequency command select 1>



■ **Function**

Select where to input a frequency command to the inverter.

■ **Parameter setting**

Title	Parameter name	Adjustment range	Default setting
FM0d	Frequency command select 1	0: - 1: Terminal RR 2: Terminal RX 3: Terminal II 4: Terminal AI4 (option) 5: Terminal AI5 (option) 6 - 9: - 10: Touch wheel 1 (power off or press OK to save) 11: Touch wheel 2 (press OK to save) 12: Sr0 13, 14: - 15: Terminal Up/Down frequency 16: Pulse train 17: High resolution pulse train (option) 18, 19: - 20: Embedded Ethernet 21: RS485 communication (connector 1) 22: RS485 communication (connector 2) 23: Communication option	1

■ **Selecting a setting value**

**1: Terminal RR**

Analog signal: Input a frequency command with 0 - 10 Vdc.

For details of the control terminal, refer to [2. 3. 5].

For details of operation by external signals, refer to "Chapter 7".

**2: Terminal RX**

Analog signal: Input a frequency command with -10 to +10Vdc.

For details of the control terminal, refer to [2. 3. 5].

For details of operation by external signals, refer to "Chapter 7".

**3: Terminal II**

Analog signal: Input a frequency command with 4 - 20 mAdc (0 - 20 mAdc).

For details of the control terminal, refer to [2. 3. 5].

For details of operation by external signals, refer to "Chapter 7".

#### **4: Terminal AI4 (option)**

The terminal [AI4] is included in the cassette option. Input a frequency command with an analog signal.

For details of the optional terminal [AI4], refer to [10. 4. 1].

#### **5: Terminal AI5 (option)**

The terminal [AI5] is included in the cassette option. Input a frequency command with an analog signal.

For details of the optional terminal [AI5], refer to [10. 4. 1].

#### **10: Touch wheel 1 (power off or press OK to save)**

Use the touch wheel on the operation panel to input a frequency command.

Even if you turn off the power supply without pressing the [OK] key, a frequency command value will be saved.

On the extension panel, use the up and down arrow keys to input a frequency command.

Even if you turn off the power supply without pressing the [ENT] key, a frequency command value will be saved.

For how to set this value, refer to [4. 3. 1] and [4. 4. 1].

#### **11: Touch wheel 2 (press OK to save)**

Use the touch wheel on the operation panel to input a frequency command.

Press the [OK] key, and a frequency command value will be saved.

On the extension panel, use the up and down arrow keys to input a frequency command.

Press the [ENT] key, a frequency command value will be saved.

For how to set this value, refer to [4. 3. 1] and [4. 4. 1].

#### **12: Sr0**

Set the value of the parameter <Sr0: Preset speed 0> as a setting value of a frequency command.

For details of <Sr0: Preset speed 0>, refer to [5. 3. 7].

#### **15: Terminal Up/Down frequency**

Input a frequency command with an Up/Down command to the input terminal.

For details of how to set parameters and terminals, refer to [6. 6. 5].

#### **16: Pulse train**

Input a frequency command with a pulse train signal (up to 30 kpps) to the terminals [S4] and [S5].

For how to set this value, refer to [6. 6. 4].

#### **17: High resolution pulse train (option)**

Input a frequency command with a high resolution pulse train signal to the input terminal.

For how to set this value, refer to "Digital Encoder Instruction Manual" (E6582148).

#### **20: Embedded Ethernet**

Connect a communication cable to the Ethernet connector 1 or 2, and input a frequency command through the Ethernet communication.

For details, refer to "Ethernet Function Instruction Manual" (E6582125).

**21: RS485 communication (connector 1)**

Remove the operation panel, connect a communication cable, and input a frequency command through the RS485 communication.

For details, refer to [6. 38].

**22: RS485 communication (connector 2)**

Connect a communication cable to the RS485 communication connector 2 next to the control terminal block, and input a frequency command through the RS485 communication.

For details, refer to [6. 38].

**23: Communication option**

Input a frequency command with a communication option command.

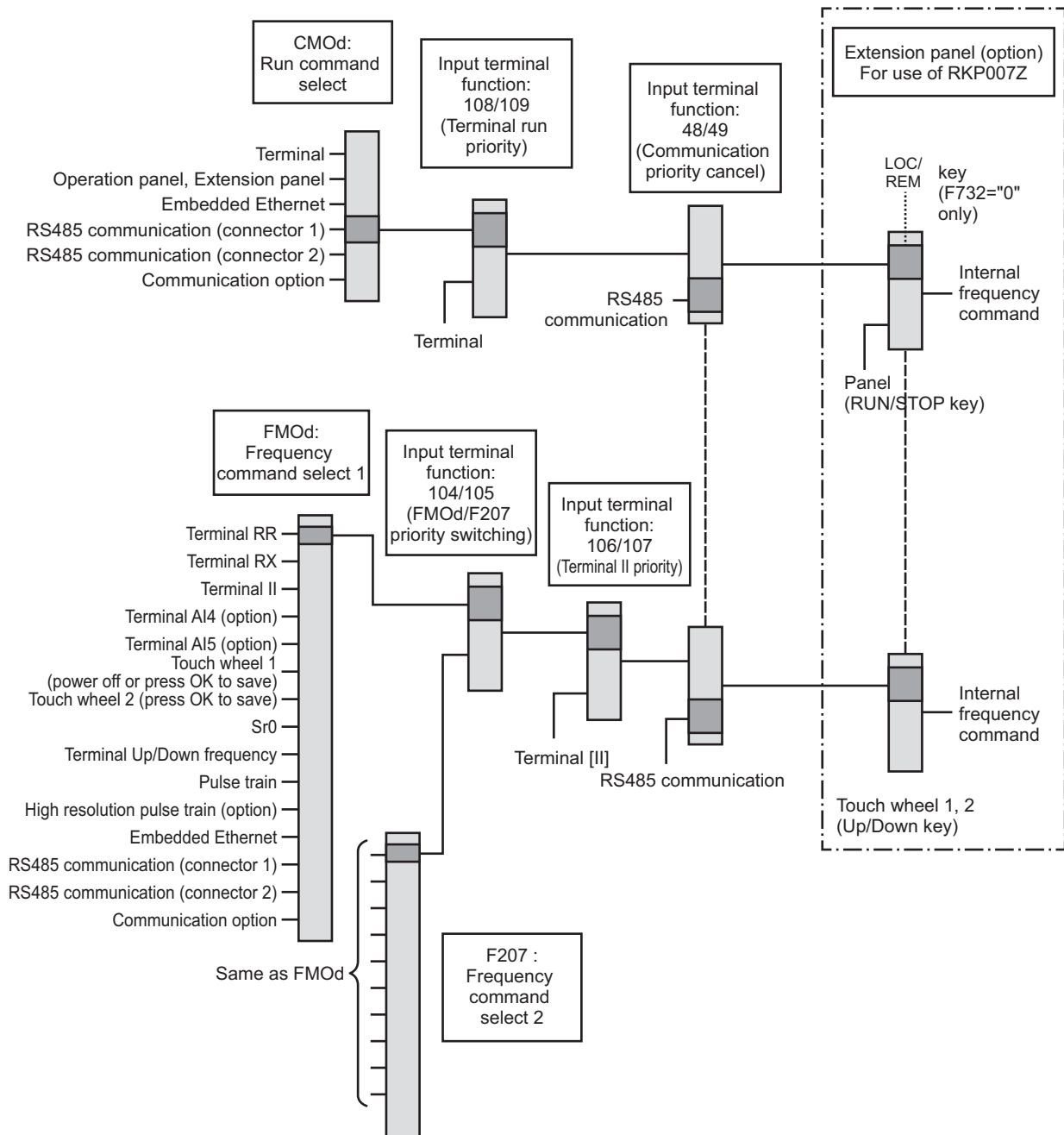
For details, refer to Each "Communication function instruction manual."

**Memo**

- The following functions set for the input terminal are always enabled regardless of the settings of <CMOd: Run command select> and <FMOd: Frequency command select 1>.
  - Reset (enabled at trip only)
  - Standby
  - External thermal trip
  - Coast stop command
- Set <CMOd: Run command select> and <FMOd: Frequency command select 1> after stopping the inverter.  
You cannot set them during run.  
However, when <F736: CMOd/FMOd change lockout during run> is set to "0: Unlocked", you can change them during run. For details, refer to [6. 34. 1].
- The priority command from the communication or terminal precedes the setting of <FMOd: Frequency command selection 1>.
- <F207: Frequency command select 2> is provided.  
Use <FMOd: Frequency command select 1> in the default setting. However, you can switch between two frequency command selections. For details, refer to [5. 4. 1].

(3) Example of switching run and frequency commands

The figure below shows an example of switching run and frequency commands.

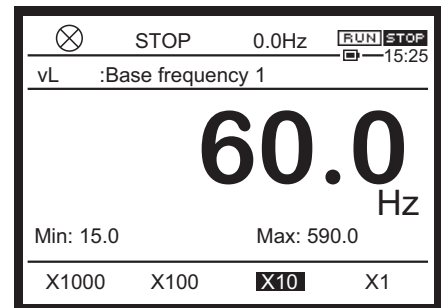


5

## 5. 2. 2 Setting rated frequency and rated voltage of motor

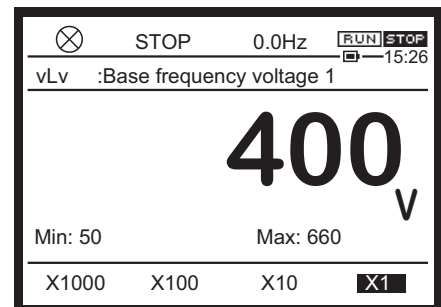
<vL: Base frequency 1>

Basic parameter



<vLv: Base frequency voltage 1>

Basic parameter



5

### ■ Function

These parameters are used to set the rated frequency and rated voltage of the motor according to machinery. They are important parameters to decide the control range of the inverter.

### ■ Parameter setting

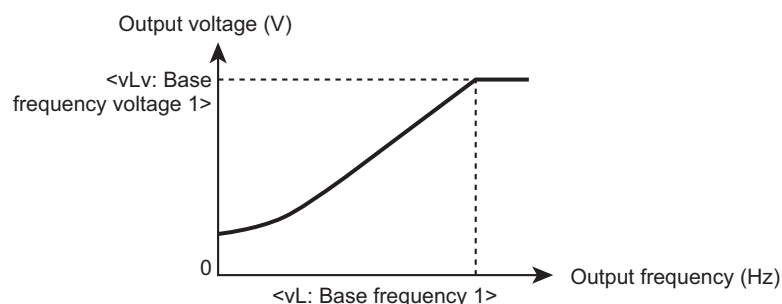
Title	Parameter name	Adjustment range	Unit	Default setting
vL	Base frequency 1	15.0 - 590.0	Hz	50.0/60.0 *1
vLv	Base frequency voltage 1	240V class: 50-330 480V class: 50-660	V	*1

\*1 Depending on the setup menu. Refer to [5. 3. 10].  
The value of <vL> should be equal or smaller than that of <FH>.

### ■ Reference of setting

Set the rated frequency (50 Hz, 60 Hz, etc.) and rated voltage (200 V, 220 V, etc.) of the motor according to the specifications of machinery.

The inverter is controlled based on the rating of the motor specified with these parameters.



**Memo**

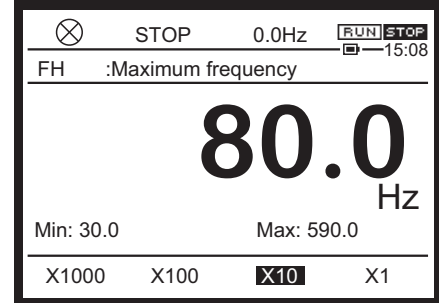
- You can set four types of motor rating. For details including <F170: Base frequency 2>, refer to [6. 4].

### 5. 2. 3 Setting the output frequency limit

#### (1) **Setting the maximum frequency of the inverter**

<FH: Maximum frequency>

Basic parameter



#### ■ **Function**

Set the maximum value of the frequency output from the inverter.  
This frequency is also the criteria of acceleration and deceleration time.

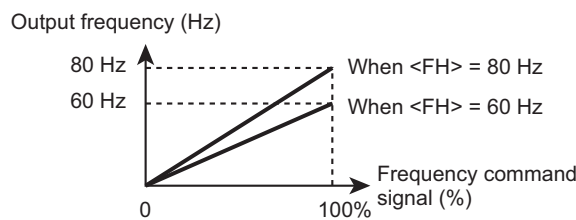
#### ■ **Parameter setting**

Title	Parameter name	Adjustment range	Unit	Default setting
FH	Maximum frequency	30.0 - 590.0	Hz	80.0 *1

\*1 Depending on the setup menu. Refer to [5. 3. 10].  
The value of <FH> should be equal or greater than that of <VL>.

#### ■ **Guideline for the setting**

Set the maximum frequency suited for the rating of the motor and load.



#### Memo

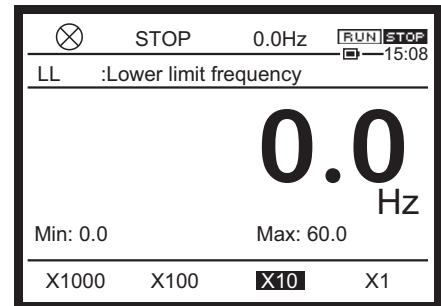
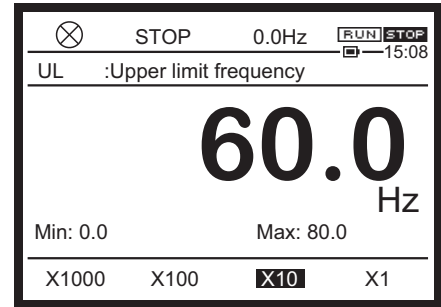
- Set <FH: Maximum frequency> after stopping the inverter. You cannot set it during run.
- When increasing the value of <FH: Maximum frequency>, you should also set the corresponding value of <UL: Upper limit frequency> as required. --> Refer to the following "Setting the upper and lower limits of the output frequency".

(2) **Setting the upper and lower limits of the output frequency**

<UL: Upper limit frequency>



<LL: Lower limit frequency>



5

■ **Function**

Set the upper limit frequency to decide the upper limit of the output frequency and the lower limit frequency to decide the lower limit.

■ **Parameter setting**

Title	Parameter name	Adjustment range	Unit	Default setting
UL	Upper limit frequency	0.0 - FH	Hz	50.0/60.0 *1
LL	Lower limit frequency	0.0 - UL	Hz	0.0

\*1 Depending on the setup menu. Refer to [5. 3. 10].

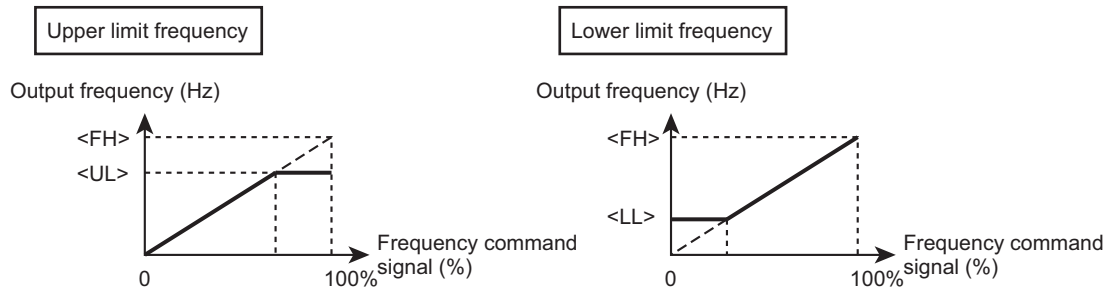
■ **Guideline for the setting**

Set <UL: Upper limit frequency> to a value which is ten times or less the values of <vL: Base frequency 1>.

If the output frequency is exceeding to 10 times of <vL>, the "A-05" alarm will appear, and the value of the output frequency will be limited to a value which is 10 times the value of <vL: Base frequency 1>.

The same holds for Base frequency 2 - 4. (Refer to [6. 4].)





**Memo**

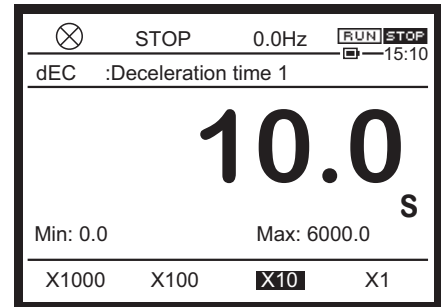
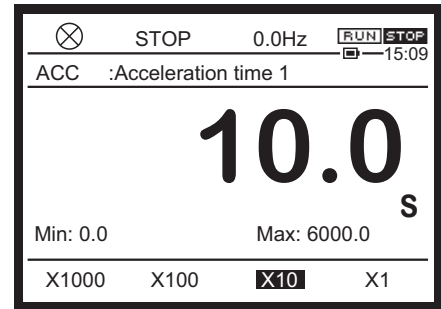
- Frequencies under the setting value of <F240: Start frequency> are not output. --> Refer to [6. 7. 1].
- During operation of the stall prevention, the inverter may run at the frequency exceeding the value of <UL: Upper limit frequency> or the frequency under the value of <LL: Lower limit frequency>.

## 5. 2. 4 Setting acceleration/deceleration time

### <ACC: Acceleration time 1>



### <dEC: Deceleration time 1>



5

### ■ Function

Set a time for acceleration and deceleration.

In <ACC: Acceleration time 1>, set a time before the output frequency of the inverter reaches the value of <FH: Maximum frequency> from 0.0 Hz.

In <dEC: Deceleration time 1>, set a time before the output frequency of the inverter decreases to 0.0 Hz from the value of <FH: Maximum frequency>.

Unit for a setting time is selected with <F519: Unit of Acc/Dec time>.

### ■ Parameter setting

Title	Parameter name	Adjustment range	Unit	Default setting
ACC	Acceleration time 1	0.0 - 6000 (600.0)	s	*1
dEC	Deceleration time 1	0.0 - 6000 (600.0)	s	*1

\*1 The default is 10.0/30.0/60.0 (s) depending on the capacity. Refer to [11. 6].

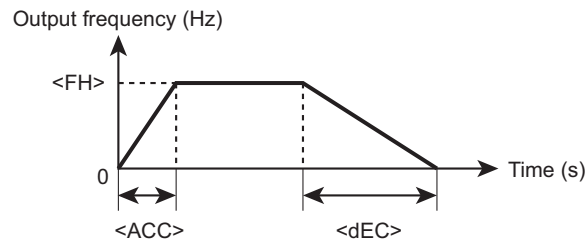
Title	Parameter name	Adjustment range	Default setting
F519	Unit of Acc/Dec time	0: - 1: 0.01s unit (0 after execution) 2: 0.1s unit (0 after execution)	0

### ■ Guideline for the setting

The criteria of acceleration time and deceleration time is the value of <FH: Maximum frequency>. Note that it is not the value of <UL: Upper limit frequency>.

You can use <F519: Unit of Acc/Dec time> to switch the unit of setting time between 0.1s and 0.01s.

With acceleration/deceleration time set to 0.0 second, the unit of 0.05 second is used internally for <F519> is "2: 0.1s unit" (default setting), and the unit of 0.01 second for <F519> is "1: 0.01s unit".



### Memo

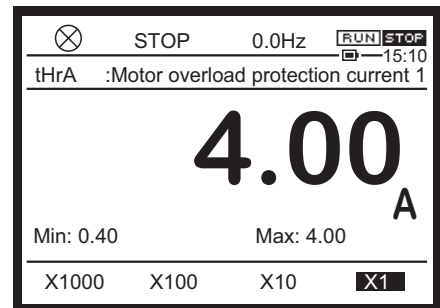
- When you set a time shorter than the optimum acceleration/deceleration time determined by the load condition, the stall prevention action may cause the acceleration/deceleration time to be longer than the setting value.
- If you set a further shorter acceleration/deceleration time, the inverter may stop due to an overcurrent trip or overvoltage trip for protection. For details, refer to "Chapter 13".
- The stop methods of the motor are the deceleration stop by <dEC: Deceleration time 1> or the coast stop. For details, refer to [6. 3. 1].
- You can set four types of options for each acceleration and deceleration time. For Acceleration time 2 through 4 and Deceleration time 2 through 4, refer to [6. 27. 2].

## 5. 2. 5 Protecting the motor from overload

<tHrA: Motor overload protection current 1>

Basic parameter

Easy mode



### ■ Function

Set a protection characteristic of the electronic thermal suited for the rating and characteristic of the motor. The electronic thermal operates based on the set current value, and any trip occurs. This will protect the motor.

### ■ Parameter setting

Title	Parameter name	Adjustment range	Unit	Default setting
tHrA	Motor overload protection current 1	Depending on capacity *1	A *1	*1

\*1 The range, unit, and default setting are depending on the capacity. Refer to [11. 6].

### ■ Reference of setting

Set <tHrA> suited for the motor rated current. Set necessary parameters for the used motor or operation.

### ■ Selecting a motor type and protective function: <OLM: Motor overload protection characteristic>, <F606: Motor overload reduction frequency threshold>

Select a motor type and whether the motor overload trip "OL2" and overload stall are enabled or disabled.

The inverter overload trip "OL1" is always detected to protect the inverter.

Title	Parameter name	Adjustment range	Unit	Default setting
OLM	Motor overload protection characteristic	0: Standard motor, OL2, No stall 1: Standard motor, OL2, Stall 2: Standard motor, No OL2 trip, No stall 3: Standard motor, No OL2 trip, Stall 4: Constant torque motor, OL2, No stall 5: Constant torque motor, OL2, Stall 6: Constant torque motor, No OL2 trip, No stall 7: Constant torque motor, No OL2 trip, Stall		0
F606	Motor overload reduction frequency threshold	0.0 - 60.0	Hz	6.0

Memo

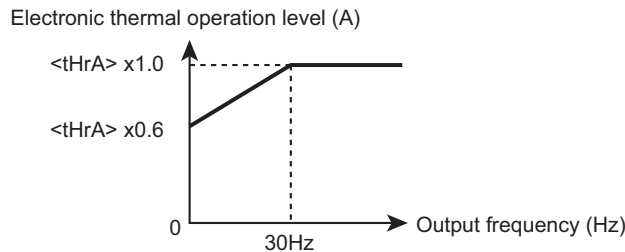
**What is overload stall?**

- The overload stall function can apply to variable torque characteristic load where a lower frequency reduces load current, such as a fan, pump, and blower. When the inverter detects overload, this function automatically lowers the output frequency before the motor overload trip "OL2" occurs. This function enables you to run the inverter at the frequency where load current balances. As a result, the inverter can continue to run without trip.
- Do not apply the overload stall function to constant torque characteristic load (load with constant load current regardless of the frequency, for example, in a conveyor).

**1) When the general purpose motor is used**

When the motor runs at low speed (low frequency), its cooling effect will degrade. To prevent overheat of the motor caused by this problem, the inverter starts to detect overload earlier than usual when using the general purpose motor.

**<OLM: Motor overload protection characteristic> = "0" to "3"**



The reduction start frequency of the electronic thermal is fixed to 30 Hz.

**2) When the constant-torque motor is used**

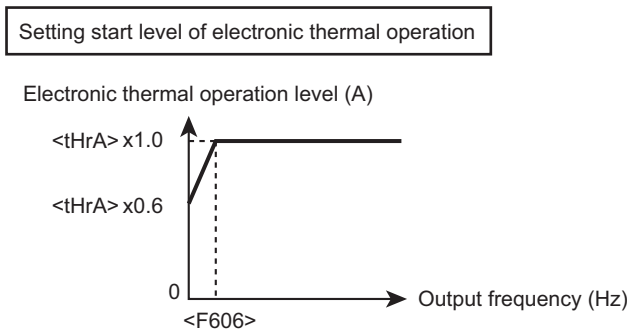
The constant-torque motor can run at constant torque at lower speed (lower frequency) compared to the general purpose motor. However, an extremely low speed will cause the cooling effect of the motor to decrease.

Set the value of <F606: Motor overload reduction frequency threshold> suited for the motor characteristic.

**<OLM: Motor overload protection characteristic> = "4" to "7"**

**Setting of <F606: Motor overload reduction frequency threshold>**

We recommend the estimation of across 6 Hz (default setting) (refer to the following figure).



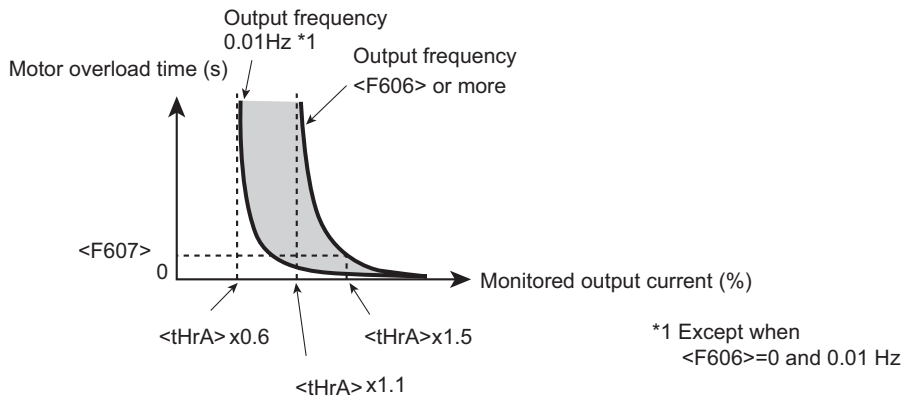
■ **Setting a time before the trip of the electronic thermal occurs: <F607: Motor overload time>**

Setting a time before the trip of the electronic thermal occurs: <F607: Motor overload time>  
 Set a time before the overload trip "OL2" occurs at the motor overload of 150%.

Title	Parameter name	Adjustment range	Unit	Default setting
F607	Motor overload time	10 - 2400	s	300

Monitored output current (%)		Motor overload time (s) (Outline data)			
tHrA=100	tHrA=50	F607=600 is set		F607=300 is set	
		F606 or more	0.01 Hz	F606 or more	0.01 Hz
68	34	-	7200	-	3600
70	35	-	3600	-	1800
80	40	-	1000	-	500
90	45	-	600	-	300
100	50	-	420	-	210
112	56	12000	310	6000	155
120	60	2400	270	1200	135
130	65	1200	230	600	115
140	70	800	190	400	95
150	75	600	170	300	85
200	100	270	110	135	55

Motor overload protection characteristics



■ **Selecting how to detect inverter overload: <F631: Inverter overload detection>**

This function enables to automatically increase the continuous output current and the inverter overload capacity when the ambient temperature is low.

Title	Parameter name	Adjustment range	Default setting
F631	Inverter overload detection	HD 0: 150%-60s 1: Temperature estimation ND 0: 120%-60s 1: Temperature estimation	10

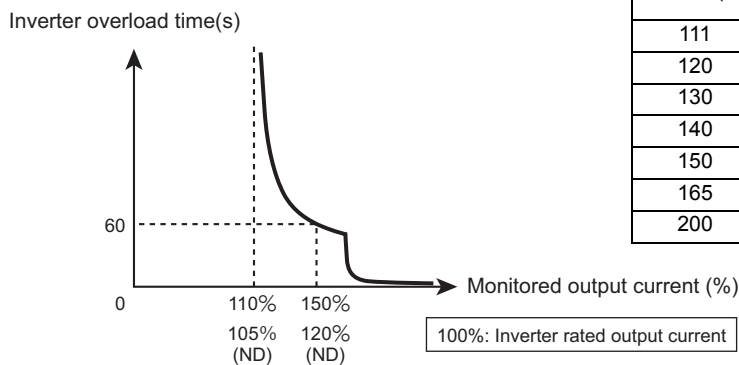
Set <F631: Inverter overload detection> to "1: Temperature estimation".

- If the inverter overload trip "OL1" occurs, you can clear it by decreasing the value of <F601: Stall prevention level 1> or setting <ACC: Acceleration time 1> or <dEC: Deceleration time 1> to a longer value.
- To protect the inverter unit, you cannot turn off inverter overload detection.

**0: 150%-60s (HD rating) or 0: 120%-60s (ND rating)**

The inverter is protected with the uniform overload curve of 150%-60s (120%-60s for ND rating), regardless of temperature.

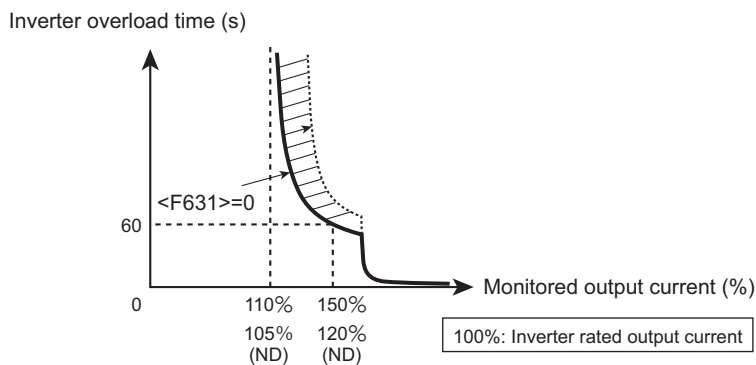
Inverter overload protection characteristics



**1: Temperature estimation**

Estimate inverter internal temperature rise and automatically adjust overload protection characteristics (the diagonally shaded area in the following figure).

Inverter overload protection characteristics



- When the output frequency is 0.1 Hz or less, or when the output current is 150% or more, the overload trip "OL1" or overcurrent trips "OC1 through OC3" may occur in shorter time to protect the inverter.

- The overload detection level depends on the output frequency or carrier frequency.

■ **Saving an overload integral value at power off : <F632: Electronic thermal memory target>**

Set a target to reset the integral value of overload at power off. It applies to both the motor electronic thermal and overload detection for inverter protection.

Title	Parameter name	Adjustment range	Default setting
F632	Electronic thermal memory target	0: No.1 to 4 motor, memory disabled 1: No.1 to 4 motor, memory enabled 2: No.1 motor, memory disabled 3: No.1 motor, memory enabled	0

**0: No.1 to 4 motor, memory disabled**

**2: No.1 motor, memory disabled**

Reset the integral value. "0" applies to No.1 to 4 motors and "2" to the No.1 motor only.

**1: No.1 to 4 motor, memory enabled**

**3: No.1 motor, memory enabled**

For memory enabled, the overload integral values of the motor and inverter are saved at power off. When power supply is ON again, the calculation process is resumed from the state when it is powered off.

However, with the RTC enabled (with operation panel), the subtraction process is performed according to virtual cooling curves, regardless of the setting.

■ **Overload pre-alarm output**

When the motor overload level reaches the setting value (%) of <F657: Overload alarm level> for the overload trip "OL2" integral value, "L" appears. Also, an overload pre-alarm signal can be output from the output terminal. For details, refer to [7. 2. 2].

Title	Parameter name	Adjustment range	Unit	Default setting
F657	Overload alarm level	10 - 100	%	50

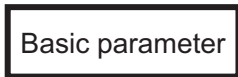


## 5. 2. 6 Adjusting the meter connected to the inverter

### <FM: Terminal FM adjustment>

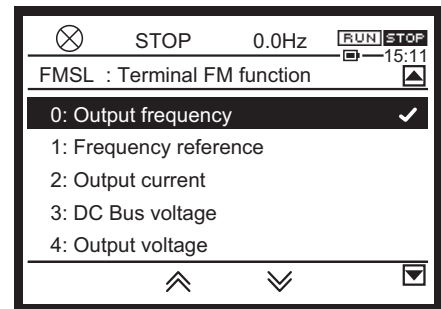
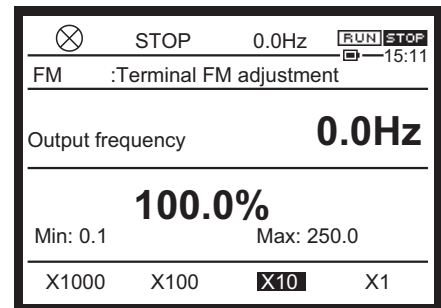


### <FMSL: Terminal FM function>



### <F671: Terminal AM adjustment>

### <F670: Terminal AM function>



#### ■ Function

To indicate the output frequency and output current of the inverter in the meter, connect the meter to the terminal [FM] or [AM].

After connecting them, you should adjust the scale of the meter.

#### ■ Parameter setting

Title	Parameter name	Adjustment range	Unit	Default setting
FM	Terminal FM adjustment	0.1 - 250.0	%	100.0
F671	Terminal AM adjustment	0.1 - 250.0	%	100.0

Select the content to be indicated in the meter by <FMSL: Terminal FM function> and <F670: Terminal AM function>.

Title	Parameter name	Adjustment range	Default setting
FMSL	Terminal FM function	0: Output frequency 1: Frequency command value 2: Output current 3: Input voltage (DC detection) 4: Output voltage 5: Stator frequency 6: Speed feedback frequency (real time) 7: Speed feedback frequency (1-second filter) 8: Torque 9: Torque command	0

Title	Parameter name	Adjustment range	Default setting
		10: Output frequency during run. Frequency command value during stop. 11: Torque current 12: Exciting current 13: PID feedback value 14: Motor overload factor (OL2 data) 15: Inverter overload factor (OL1 data) 16: Braking resistor overload factor (OLr data) 17: Braking resistor load factor (%ED) 18: Input power 19: Output power 20: Input cumulative power 21: Output cumulative power 22: Fixed output 1 23: Fixed output 2 24: Terminal RR input value 25: Terminal RX input value 26: Terminal II input value 27: Motor speed command 28: Terminal FM output value 29: Terminal AM output value 30: - 31: Communication data output 32 - 33: - 34: Motor load factor 35: Inverter load factor 36 - 40: - 41: Terminal FP pulse train output value 42: - 43: - 44: Terminal AI4 input value 45: Terminal AI5 input value 46 - 49: My function monitor output 1 - 4 50 - 61: - 62: PID result frequency 63: PID set value 64: Light-load high-speed switching load torque 65: Light-load high-speed torque during constant speed run 66 - 70: - 71: Motor speed (estimated value) 72 - 75: - 76: Terminal S4/S5 pulse train input value 77 - 78: - 79: Dancer control PID result frequency 80 - 119: - 120: Internal temperature 1 121 - 123: - 124: Power circuit board temperature 125 - 129: -	

Title	Parameter name	Adjustment range	Default setting
		130: External PID3 set value 131: External PID3 feedback value 132: External PID3 result value 133: External PID4 set value 134: External PID4 feedback value 135: External PID4 result value 136 - 149: - 150: Signed output frequency 151: Signed frequency command value 152: Signed stator frequency 153: Signed speed feedback frequency (real time) 154: Signed speed feedback frequency (1-second filter) 155: Signed torque 156: Signed torque command 157: - 158: Signed torque current 159: Signed PID feedback value 160: Signed terminal RX input value 161: Signed terminal AI4 input value 162: Signed terminal AI5 input value	
F670	Terminal AM function	Same as <FMSL>	2

■ **How to adjust the scale of the meter with the inverter run**

As an example, this section describes how to adjust the scale of the frequency meter connected to the terminal [FM].

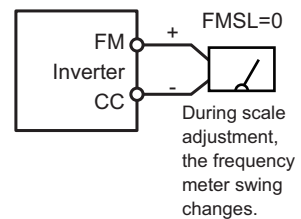
Use the adjustment screw of the meter to set a zero point in advance.

This method can apply to the meter connected to the terminal [AM] as well.

- 1 Connect the frequency meter as shown in the figure below.

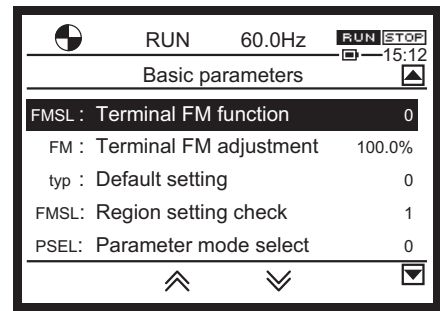
For how to connect it to the control terminal block, refer to [2. 3. 5] and [4. 4].

Instruction of output frequency



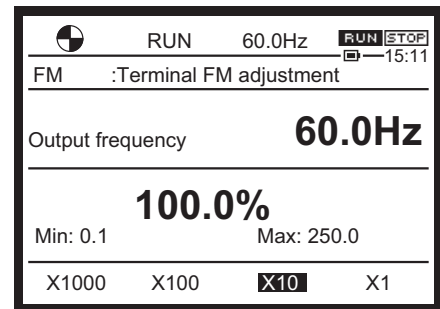
- In the basic parameters of [Setting mode], set <FMSL: Terminal FM function> to "0: Output frequency".

The default setting of <FMSL> is "0".



- In the basic parameters of [Setting mode], select <FM: Terminal FM adjustment> and press the [OK] key.

The output frequency of the inverter is displayed in the upper part of the screen, and the output level (%) of the terminal [FM] in the lower part.



- Turning the touch wheel will change the indication of the meter and the output level (%) of the terminal [FM] in the lower field of the screen. Adjust the scale so that the indication of the meter matches the output frequency.



- Press the [OK] key to complete the adjustment of the meter.

■ **How to adjust the scale of the meter with the inverter stopped**

You can adjust the scale of the meter even at the inverter stop state.

When <FMSL: Terminal FM adjustment> and <F670: Terminal AM adjustment> are set "22", signal value is fixed at the following values.

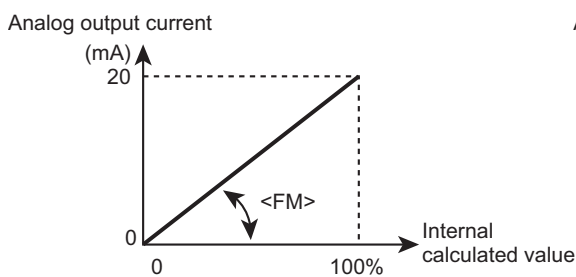
<FMSL>/<F670>

- 0, 1, 5, 6, 7, 10, 13, 62, 63, 79, 130, 131, 132, 133, 134, 135, 150, 151, 152, 153, 154, 159 : Maximum frequency (FH)
- 2, 11, 12, 108 : 200% of rated current
- 3, 4 : 150% of rated voltage
- 8, 9, 64, 65, 155, 156 : 250% of rated torque
- 14,15,16 : Maximum value of OL factor (100%)
- 34 : Maximum value of OL2 factor (600%)
- 35 : Maximum value of OL1 factor (250%)
- 17 : %ED value of braking resistor

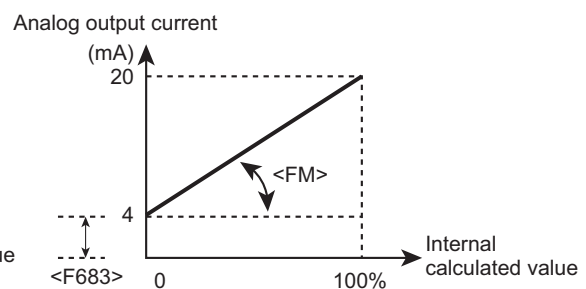
- 18, 19 : 200% of rated power
- 20, 21 : 1000 x F749
- 24, 25, 26, 28, 29, 31, 41, 44, 45, 74, 75, 76, 160, 161, 162 : Maximum value
- 27, 71 : FH x 60/F856
- 46, 47 : 65535
- 48, 49 : 32767
- 120, 124 : 200°C

When <FMSL: Terminal FM adjustment> and <F670: Terminal AM adjustment> are set "23", signal value is fixed at half of the above values.

■ For 4 - 20 mA output



This is when <F682: Terminal FM inclination polarity> is "1: Positive inclination (upward slope)" and <F683: Terminal FM bias> is "0". When <F682> is set to "0: Negative inclination (downward slope)", the inclination becomes negative.



This is when <F682> is "1" and <F683: Terminal FM bias> is "20". 20% value (4mA) of the full scale output current (20 mA in this case) will be the output current at internal calculated value of 0%.

Adjust the values of <F682: Terminal FM inclination polarity> and <F683: Terminal FM bias> for 4 - 20 mA output.

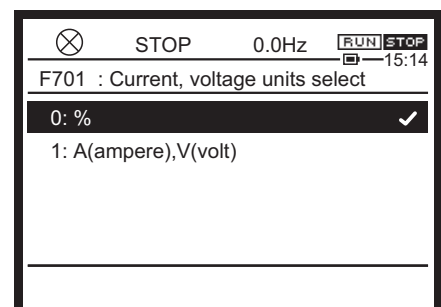
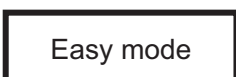
For details, refer to [6. 33. 3].

Memo

- The maximum resolution is 1/1024 for both the terminals [FM] and [AM].
- To use the terminals [FM] and [AM] for current output, set external load resistance to 600Ω or less.
- To use the terminals [FM] and [AM] for voltage output, set external load resistance to 1kΩ or more.

5. 2. 7 Selecting the display units for current and voltage

<F701: Current, voltage units select>



## ■ Function

Select the display units of parameters and monitors represented in current and voltage.

## ■ Parameter setting

Title	Parameter name	Adjustment range	Default setting
F701	Current, voltage units select	0: % 1: A (ampere), V (volt)	0

## ■ Applicable parameters and monitors

The following list shows parameters and monitors whose display units can be changed with <F701: Current, voltage units select>.

### Displayed in A (amperes)

- Parameter
  - <F251: DC braking current>
  - <F601: Stall prevention level 1>, <F185: Stall prevention level 2>
  - <F326: Brake release undercurrent threshold>
  - <F611: Undercurrent detection level>
- Monitor
  - Output current
  - Torque current
  - Exciting current

### Displayed in V (volts)

- Parameter
  - <F191: V/f 5-point VF1 voltage>
  - <F193: V/f 5-point VF2 voltage>
  - <F195: V/f 5-point VF3 voltage>
  - <F197: V/f 5-point VF4 voltage>
  - <F199: V/f 5-point VF5 voltage>
- Monitor
  - Input voltage
  - Output voltage

<vLv: Base frequency voltage 1>, <F171: Base frequency voltage 2>, <F175: Base frequency voltage 3>, and <F179: Base frequency voltage 4> are always displayed in V (volts). You cannot change it.

## ■ Selecting a setting value

### 0: %

Current and voltage are displayed in percent.

For current (A), 100% means the rated current of the inverter.


For voltage (V), 100% with 200 V for 240 V class and 400 V for 480 V class.


### 1: A (ampere), V (volt)

Current is displayed in A (amperes) and voltage in V (volts).

■ **Setting example**

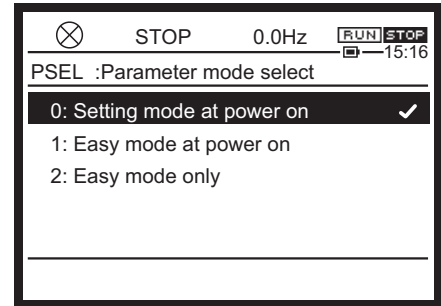
While a model with a rated current of ●● A is used at the rated load (100% load), the monitor mode is displayed as follows:

 RUN 60.0Hz <span style="float:right">RUN STOP</span> 15:15	
Monitor Mode	
Direction of rotation	Forward
Output current	0%
DC bus voltage	119%
Output voltage	0%
Torque	0%
Top Easy Setting	

 RUN 60.0Hz <span style="float:right">RUN STOP</span> 15:15	
Monitor Mode	
Direction of rotation	Forward
Output current	0.0A
DC bus voltage	476V
Output voltage	0V
Torque	0%
Top Easy Setting	

## 5. 2. 8 Selecting the parameter mode between [Setting mode] and [Easy mode]

<PSEL: Parameter mode select>



### ■ Function

Select the display mode of parameter settings between [Setting mode] and [Easy mode].  
 You can select a mode at power on and use the operation key to switch it or see only [Easy mode].  
 How to read parameters depends on a mode.

#### [Easy mode]

- Register frequently set parameters as [Easy mode] parameters in advance. Only the registered parameters (up to 32) appear.
- Ten parameters are selected in the default setting. You can change them as required.

#### [Setting mode]

- You can read all parameters in the standard [Setting mode].

### ■ Parameter setting

Title	Parameter name	Adjustment range	Default setting
PSEL	Parameter mode select	0: Setting mode at power on 1: Easy mode at power on 2: Easy mode only	0

### ■ Selecting a setting value

#### 0: Setting mode at power on

The parameter mode is set to [Setting mode] at power on.  
 You can use the operation key to switch between [Setting mode] and [Easy mode].

- Operation panel: [ESC] key or [F1] key  
 For details, refer to [3. 1. 2].
- Extension panel: [EASY] key (if any)

#### 1: Easy mode at power on

The parameter mode is set to [Easy mode] at power on.  
 You can use the operation key to switch between [Setting mode] and [Easy mode].

- Operation panel: [ESC] key or [F1] key  
 For details, refer to [3. 1. 2].
- Extension panel: [EASY] key (if any)

#### 2: Easy mode only

The parameter mode is always [Easy mode].  
 You cannot see the [Setting mode] screen.

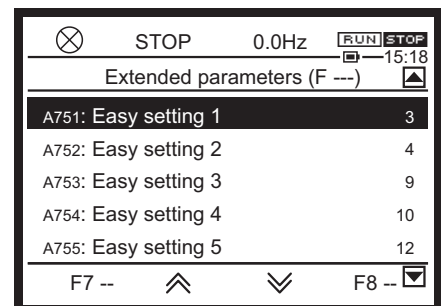


■ **Setting parameters in [Easy mode]**

Up to 32 parameters are displayed in [Easy mode]. Set among <F751: Easy setting 1> through <F782: Easy setting 32>.

Title	Parameter name	Adjustment range	Default setting
F751	Easy setting 1	0 - 2999	3<CMOd>
F752	Easy setting 2	0 - 2999	4<FMd>
F753	Easy setting 3	0 - 2999	9<ACC>
F754	Easy setting 4	0 - 2999	10<dEC>
F755	Easy setting 5	0 - 2999	12<UL>
F756	Easy setting 6	0 - 2999	13<LL>
F757	Easy setting 7	0 - 2999	31<tHrA>
F758	Easy setting 8	0 - 2999	6<FM>
F759 - F780	Easy setting 9 through Easy setting 30	0 - 2999	999 (No function)
F781	Easy setting 31	0 - 2999	701<F701>
F782	Easy setting 32	0 - 2999	50<PSEL>

In [Easy mode], only parameters registered with <F751: Easy setting 1> through <F782: Easy setting 32> appear in the order of registration.

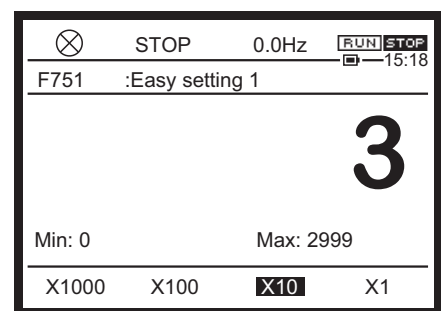


Set communication numbers of registered parameters for <F751: Easy setting 1> through <F782: Easy setting 32>.

For communication numbers, refer to [11. 2] - [11. 5]. Set the parameter address you want to display to F751-F782.

For example,

- in case the parameter F123 is set to F751, set 123 to F751.
- in case the parameter A456 is set to F752, set 1456 to F752.
- in case the parameter C789 is set to F753, set 2789 to F753.

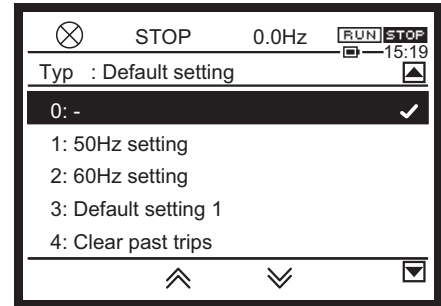


<b>Memo</b>	<ul style="list-style-type: none"> <li>• When no parameter should be registered, set &lt;F751: Easy setting 1&gt; through &lt;F782: Easy setting 32&gt; to "999".</li> </ul>
-------------	--

## 5. 2. 9 Returning parameters to their default settings Clearing each history

<tyP: Default setting>

Basic parameter



### ■ Function

You can return parameters to their default settings at a time, clear run times, and store/rewrite parameters specified by users.

### ■ Parameter setting

Title	Parameter name	Adjustment range	Default setting
tyP	Default setting	0: - 1: 50Hz setting 2: 60Hz setting 3: Default setting 1 4: Clear past trips 5: Clear cumulative run time 6: Initialize typeform 7: Store user settings 8: Rewrite user settings 9: Clear cumulative fan run time 10, 11: - 12: Clear number of starting 13: Default setting 2 (complete initialization) 14: Clear number of external equipment starting 15: Clear cumulative overcurrent time	0

Note) The setting value becomes 0 after execution, but a check mark is added to the previous setting value.

■ **Selecting a setting value**

**1: 50Hz setting**

The following parameters are set for the base frequency 50 Hz.

Setting values of other parameters are not changed.

When you select a parameter and press the [OK] key, nothing appears momentarily, the same content displayed at power on appears, and the mode enters [Standard mode].

<FH: Maximum frequency>	50Hz
<UL: Upper limit frequency>	*1 % display
<vL: Base frequency 1>	
<F170: Base frequency 2>	
<F174: Base frequency 3>	
<F178: Base frequency 4>	
<F204: RR point 2 frequency>	
<F213: RX point 2 frequency>	
<F219: II point 2 frequency>	
<F225: AI4 point 2 frequency>	
<F231: AI5 point 2 frequency>	
<F237: S4/S5 Pulse train input point 2 frequency>	
<F330: Light-load high-speed automatic operation frequency>	
<F355: Commercial power switching>	
<F364: PID1 deviation upper-limit>	
<F365: PID1 deviation lower-limit>	
<F367: PID1 set value upper-limit>	
<F370: PID1 output upper-limit>	
<F426: Fwd speed limit level>	
<F428: Rev speed limit level>	
<F814: Communication point 2 frequency>	
<A220: Pump increase detection frequency>	
<A229: Pump decrease switching frequency>	
<A230: PID start frequency at pump decrease switching>	
<A316: PID2 deviation upper-limit>	
<A317: PID2 deviation lower-limit>	
<A319: PID2 set value upper-limit>	
<A322: PID2 output upper-limit>	
<A538: PTI position frequency UL>	
<F417: Motor rated speed>	1400 - 1480min <sup>-1</sup> (Depending on capacity)

## 2: 60Hz setting

The following parameters are set for the base frequency 60Hz.

Setting values of other parameters are not changed.

When you select a parameter and press the [OK] key, nothing appears momentarily, the same content displayed at power on appears, and the mode enters [Standard mode].

<FH: Maximum frequency>	60Hz
<UL: Upper limit frequency>	*1 % display
<vL: Base frequency 1>	
<F170: Base frequency 2>	
<F174: Base frequency 3>	
<F178: Base frequency 4>	
<F204: RR point 2 frequency>	
<F213: RX point 2 frequency>	
<F219: II point 2 frequency>	
<F225: AI4 point 2 frequency>	
<F231: AI5 point 2 frequency>	
<F237: S4/S5 Pulse train input point 2 frequency>	
<F330: Light-load high-speed automatic operation frequency>	
<F355: Commercial power switching>	
<F364: PID1 deviation upper-limit>	
<F365: PID1 deviation lower-limit>	
<F367: PID1 set value upper-limit>	
<F370: PID1 output upper-limit>	
<F426: Fwd speed limit level>	
<F428: Rev speed limit level>	
<F814: Communication point 2 frequency>	
<A220: Pump increase detection frequency>	
<A229: Pump decrease switching frequency>	
<A230: PID start frequency at pump decrease switching>	
<A316: PID2 deviation upper-limit>	
<A317: PID2 deviation lower-limit>	
<A319: PID2 set value upper-limit>	
<A322: PID2 output upper-limit>	
<A538: PTI position frequency UL>	
<F417: Motor rated speed>	1680 - 1775min <sup>-1</sup> (Depending on capacity)

### 3: Default setting 1

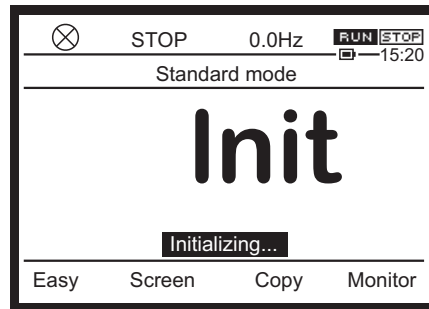
Return parameters except for some ones to their default settings.

When you select the setting and press the [OK] key, "Init" blinks in the main area and "Initializing" appears under it for a while.

They disappear momentarily, the same content displayed at power on appears, and the mode enters [Standard mode].

The history of past trip data is cleared.

To initialize all parameters, set <tyP: Default setting> to "13".



## Memo

- The values of the following parameters are designed not to return to their default settings, considering maintainability.  
Also, these parameters do not appear in the <Changed parameters search & edit> even if they are set to values different from default settings.
- <FMSL: Terminal FM function>
- <FM: Terminal FM adjustment>
- <SEt: Region setting check>
- <F107: Terminal RX input voltage select>
- <F108: Terminal RR input select>
- <F148: Terminal AI4 input select>
- <F149: Terminal AI5 input select>
- <F379: PG option voltage>
- <F470: RR input bias>
- <F471: RR input gain>
- <F472: RX input bias>
- <F473: RX input gain>
- to
- <F479: AI5 input gain>
- <F669: Terminal FP switching>
- <F670: Terminal AM function>
- <F671: Terminal AM adjustment>
- <F681: Terminal FM switching>
- <F682: Terminal FM inclination polarity>
- <F683: Terminal FM bias>
- <F685: Terminal FM upper-limit level>
- <F686: Terminal AM switching>
- <F687: Terminal AM inclination polarity>
- <F688: Terminal AM bias>
- <F690: Terminal AM upper-limit level>
- <F750: EASY key function>
- <F790: Panel display at power on>
- <F791: 1st and 2nd characters of F790> - <F798: 15th and 16th characters of F790>
- <F809: Operation panel connection priority>
- <F880: Free memorandum>
- <A005 - A008: >
- <C081 - C096: >

**4: Clear past trips**

Initialize (clear) the history information of eight past trips.

No parameter is changed.

When you select the setting and press the [OK] key, nothing appears momentarily, the same content displayed at power on appears, and the mode enters [Standard mode].

**5: Clear cumulative run time**

Clear cumulative run time to 0.

When you select the setting and press the [OK] key, nothing appears momentarily, the same content displayed at power on appears, and the mode enters [Standard mode].

**6: Initialize typeform**

Clear a trip if the type error "EtyP" occurs.

However, if it occurs, contact your Toshiba distributor.

When you select the setting and press the [OK] key, nothing appears momentarily, the same content displayed at power on appears, and the mode enters [Standard mode].

### 7: Store user settings

Store the setting values of all current parameters.

### 8: Rewrite user settings

Rewrite the setting values of the parameters stored in "7: Store user settings" to the inverter.

You can use parameter initial settings specific for users with "7: Store user settings" and "8: Rewrite user settings."

### 9: Clear cumulative fan run time

Clear cumulative fan run time to 0.

Set it, for example, when you have replaced the cooling fan.

When you select the setting and press the [OK] key, nothing appears momentarily, the same content displayed at power on appears, and the mode enters [Standard mode].

### 12: Clear number of starting

Clear the values on the monitor to 0 for the number of starting, the number of forward starting, and the number of reverse starting.

When you select the setting and press the [OK] key, nothing appears momentarily, the same content displayed at power on appears, and the mode enters [Standard mode].

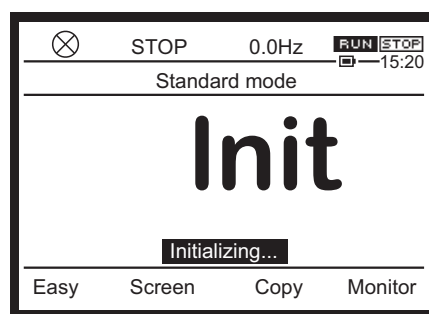
### 13: Default setting 2 (complete initialization)

Return all parameters to their default settings at a time.

When you select the setting and press the [OK] key, "Init" blinks in the main area and "Initializing" appears under it for a while.

They disappear momentarily, the same content displayed at power on appears, and the mode enters [Standard mode].

All parameters are returned to their default settings, and the history data of past trips is also cleared.



#### Memo

- Set <tyP: Default setting> after stopping the inverter. You cannot set it during run.

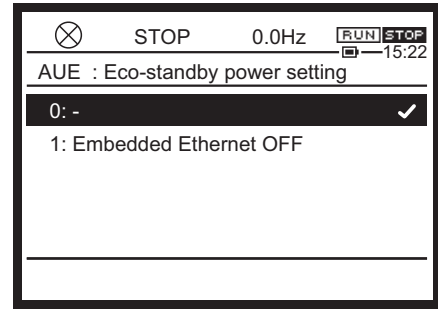
## 5.3 Setting other basic parameters

This section describes basic parameters not included in [5.2].  
Set any parameter in the [Setting mode].

### 5.3.1 Setting energy savings

<AUE: Eco-standby power setting>

Basic parameter



5

■ **Function**

Turn off the unused function to reduce standby electricity.

■ **Parameter setting**

Title	Parameter name	Adjustment range	Default setting
AUE	Eco-standby power setting	0: - 1: Embedded Ethernet OFF	0

Note) The setting value becomes 0 after execution, but a check mark is added to the previous setting value.

■ **Selecting a setting value**

**1: Embedded Ethernet OFF**

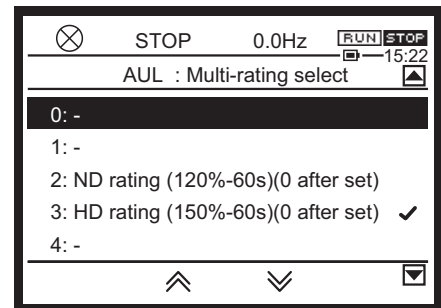
Standby electricity can be reduced when you do not use the embedded Ethernet.



### 5. 3. 2 Selecting an overload protection characteristic

<AUL: Multi-rating select>

Basic parameter



■ **Function**

Select an inverter overload protection characteristic suited for the torque characteristic of the machine.

■ **Parameter setting**

Title	Parameter name	Adjustment range	Default setting
AUL	Multi-rating select	0,1: - 2: ND rating (120%-60s) (0 after execution) 3: HD rating (150%-60s) (0 after execution) 4 - 8: -	3

Note) The setting value becomes 0 after execution, but a check mark is added to the previous setting value.

■ **Selecting a setting value**

**2: ND rating (120%-60s) (0 after execution)**

Select this value when applying the machine with variable torque characteristic.

Example) Fan, pump, blower, etc.

**3: HD rating (150%-60s) (0 after execution)**

Select this value when applying the machine with constant torque characteristics.

Example) Conveyor, load transporting machinery, crane, concrete mixer, compressor, making machine, machine tool, etc.

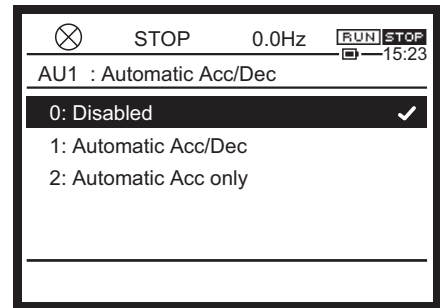
**Memo**

- The default setting of some parameters are different between HD rating and ND rating. Refer to [11. 6].

### 5. 3. 3 Acceleration/deceleration time adjustment automatically according to load

<AU1: Automatic Acc/Dec>

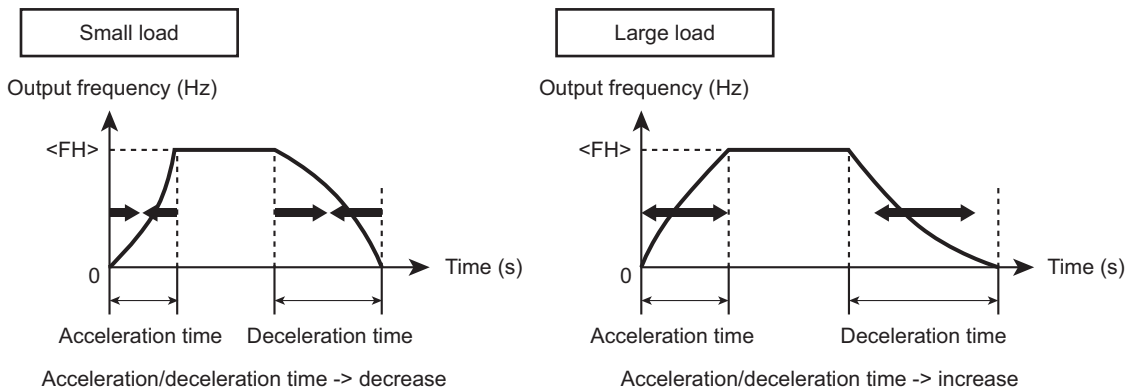
Basic parameter



■ Function

This is a parameter that automatically adjusts the acceleration/deceleration time according to the load condition to prevent an overcurrent trip during acceleration/deceleration.

5



■ Parameter setting

Title	Parameter name	Adjustment range	Default setting
AU1	Automatic Acc/Dec	0: Disabled 1: Automatic Acc/Dec 2: Automatic Acc only	1

■ Selecting a setting value

1: Automatic Acc/Dec

The acceleration/deceleration time is adjusted automatically in the range in which the output current does not exceed the rated current of the inverter. The adjustment range is 1/8 to 8 times as long as the time set with <ACC: Acceleration time 1> and <dEC: Deceleration time 1>. If you set suitable values for the average load with <ACC: Acceleration 1> and <dEC: Deceleration 1> in advance, it will be easy to deal with load fluctuation.

2: Automatic Acc only

Only the acceleration time is adjusted automatically. The speed is decelerated according to the setting of <dEC: Deceleration time 1>.



## Important

- Use this parameter with the motor connected.
- When the inverter is used with a load that fluctuates considerably, it may fail to adjust the acceleration or deceleration time in time, and therefore may be tripped.
- When using the optional braking resistor or braking unit, do not set <AU1: Automatic Acc/Dec> to "1". Otherwise, braking resistor overload may occur during deceleration.

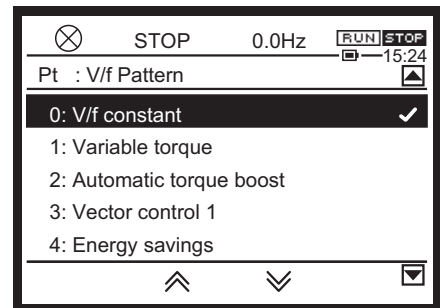
## Memo

- When the acceleration/deceleration time is automatically set, the acceleration/deceleration time is always changed according to the load. For machinery that requires constant acceleration/deceleration time, accelerate or decelerate with the setting time of <ACC: Acceleration time 1> and <dEC: Deceleration time 1> instead of using this function. For details, refer to [5. 2. 4].

### 5. 3. 4 Selecting motor control method

<Pt: V/f Pattern>

Basic parameter



■ **Function**

This is a parameter to select the motor control method according to the characteristics and application of the machinery.

**Memo**

- With <AU2: Torque boost macro>, you can set <Pt> of this parameter to "2: Automatic torque boost", "3: Vector control 1", and "4: Energy savings" and <F400: Offline auto-tuning > to "2" simultaneously.

■ **Parameter setting**

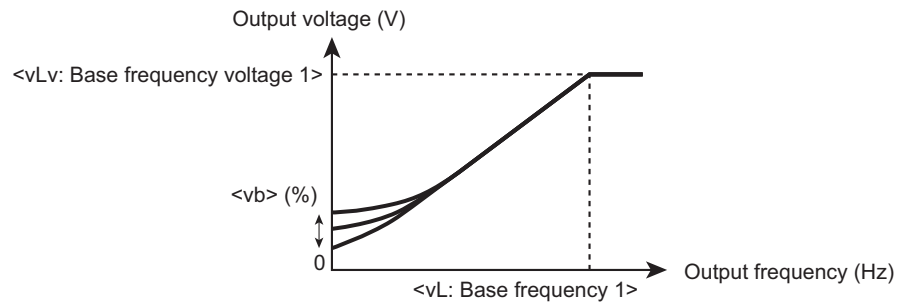
Title	Parameter name	Adjustment range	Default setting
Pt	V/f Pattern	0: V/f constant 1: Variable torque 2: Automatic torque boost 3: Vector control 1 4: Energy savings 5: Dynamic energy savings (for fan and pump) 6: PM motor control 7: V/f 5-point setting 8: - 9: Vector control 2 (speed / torque) 10: PG feedback control 11: PG feedback vector control (speed / torque) 12: -	0

■ **Selecting a setting value**

**0: V/f constant**

This is a typical control method of an inverter, and the inverter is controlled so that the ratio of the output frequency (f) and the output voltage (V) becomes almost constant.

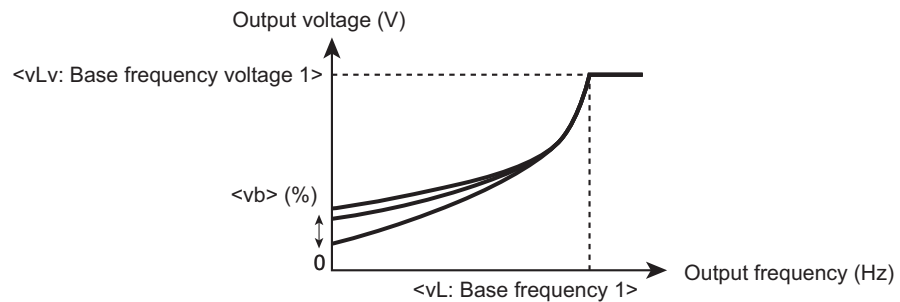
It is applied to loads with equipment like conveyors that requires the same torque at low speeds as at rated speeds.



To increase the torque at low speeds, increase the setting value of <vb: Manual torque boost 1>. For details, refer to [5. 3. 6].

**1: Variable torque**

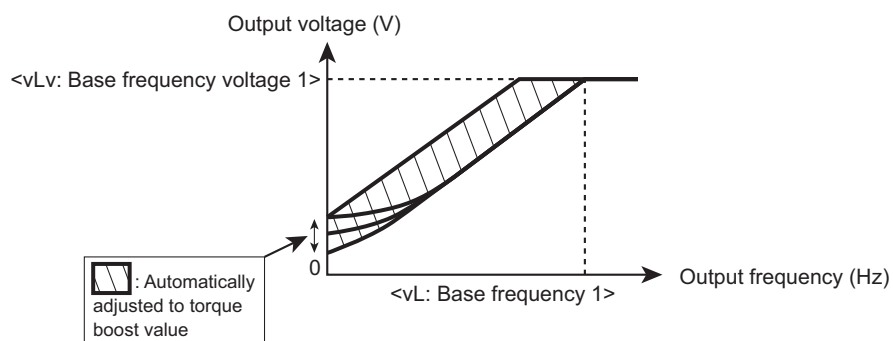
This is applied to loads such as fans, pumps and blowers in which the torque is proportional to the square of load motor speed.



**2: Automatic torque boost**

The load current in the speed range from startup to base frequency is detected and the output voltage (torque boost) from the inverter is automatically adjusted. This gives steady torque for stable operation.

It is applied to loads that require torque.



Operation may become unstable depending on loads. In this case, set <Pt> = "0: V/f constant" and increase the value of <vb: Manual torque boost 1>.

**Setting of motor parameters**

When <Pt> is "2", setting of motor parameters is required.

When the motor you are using is a 4P Toshiba premium efficiency motor which has the same capacity as the inverter, there is basically no need to set the parameters.

First, look at the motor name plate and set the following parameters.

- <vL: Base frequency 1> (Rated frequency)
- <vLv: Base frequency voltage 1> (Rated voltage)
- <F405: Motor rated capacity>
- <F415: Motor rated current>
- <F417: Motor rated speed>

Next, perform auto-tuning. Two parameter setting methods are provided.

### 1) Setting with <AU2: Torque boost macro>

Set <AU2: Torque boost macro> to "1". Set <Pt> to "2: Automatic torque boost" and <F400: Offline auto-tuning> to "2" simultaneously.

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

### 2) Setting with <F400: Offline auto-tuning>

Set <F400: Offline auto-tuning> to "5".

For details, refer to [6. 23. 1].

\* If an auto-tuning error occurs, set motor parameters individually by referring to [6. 23. 1]

"■Setting method 4: Manually setting motor parameter".

## 3: Vector control 1

High-torque and high-precision stable operation is realized in the speed range from startup to base frequency.

It is applied to load transporting machinery and elevators that require high torque and machine tools that require high precision.

- High starting torque can be obtained.
- It is effective when smooth stable operation from a low speed is required.
- The change of motor speed caused by load fluctuation is suppressed to realize high-precision operation.

When <Pt> is "3", setting of motor parameters is required.

When the motor you are using is a 4P Toshiba premium efficiency motor which has the same capacity as the inverter, there is basically no need to set the parameters.

In other cases, look at the motor name plate and set the following parameters.

- <vL: Base frequency 1> (Rated frequency)
- <vLv: Base frequency voltage 1> (Rated voltage)
- <F405: Motor rated capacity>
- <F415: Motor rated current>
- <F417: Motor rated speed>

Three parameter setting methods are provided.

### 1) Setting with <AU2: Torque boost macro>

Set <AU2: Torque boost macro> to "2". Set <Pt> to "3: Vector control 1" and <F400: Offline auto-tuning> to "2" simultaneously.

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

### 2) Setting with <F400: Offline auto-tuning>

Set <F400: Offline auto-tuning> to "5".

For details, refer to [6. 23. 1].

\* If an auto-tuning error occurs, set motor parameters individually by referring to [6. 23. 1] "■Setting method 4: Manually setting motor parameter".

### 3) Manual setting

Set each motor constant.

For details, refer to [6. 23. 1].

## 4: Energy savings

Energy can be saved in all speed ranges by detecting load current and flowing the optimum current that fits the load.

When <Pt> is "4", setting of motor parameters is required.

When the motor you are using is a 4P Toshiba premium efficiency motor which has the same capacity as the inverter, there is basically no need to set the parameters.

In other cases, look at the motor name plate and set the following parameters.

- <vL: Base frequency 1> (Rated frequency)
- <vLv: Base frequency voltage 1> (Rated voltage)
- <F405: Motor rated capacity>
- <F415: Motor rated current>
- <F417: Motor rated speed>

Three parameter setting methods are provided.

### 1) Setting with <AU2: Torque boost macro>

Set <AU2: Torque boost macro> to "3". Set <Pt> to "4: Energy savings" and <F400: Offline auto-tuning> to "2" simultaneously.

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

### 2) Setting with <F400: Offline auto-tuning>

Set <F400: Offline auto-tuning> to "5".

For details, refer to [6. 23. 1].

\* If an auto-tuning error occurs, set motor parameters individually by referring to [6. 23. 1] "■Setting method 4: Manually setting motor parameter".

### 3) Manual setting

Set each motor constant.

For details, refer to [6. 23. 1].

## 5: Dynamic energy savings (for fan and pump)

Energy can be saved in all speed ranges by detecting load current and flowing the optimum current that fits the load. Even in a low-speed range with especially decreased efficiency, more substantial energy savings than those provided when <Pt> is "4: Energy savings" can be achieved by controlling to maximize the efficiency.

The inverter cannot respond to rapid load fluctuations, so this setting should be used only for loads, such as fans and pumps that have less load fluctuations.

When <Pt> is "5", setting of motor parameters is required.

When the motor you are using is a 4P Toshiba premium efficiency motor which has the same capacity as the inverter, there is basically no need to set the parameters.

In other cases, look at the motor name plate and set the following parameters.

- <vL: Base frequency 1> (Rated frequency)
- <vLv: Base frequency voltage 1> (Rated voltage)

- <F405: Motor rated capacity>
- <F415: Motor rated current>
- <F417: Motor rated speed>

Two parameter setting methods are provided.

**1) Setting with <F400: Offline auto-tuning>**

Set <F400: Offline auto-tuning> to "5".

For details, refer to [6. 23. 1].

\* If an auto-tuning error occurs, set motor parameters individually by referring to [6. 23. 1] "■Setting method 4: Manually setting motor parameter".

**2) Manual setting**

Set each motor constant.

For details, refer to [6. 23. 1].

**6: PM motor control**

Permanent magnet motors (PM motors) that are highly efficient can be operated in sensor-less operation.

Setting of parameters for PM motor is required. For details, refer to [6. 23. 2].

**7: V/f 5-point setting**

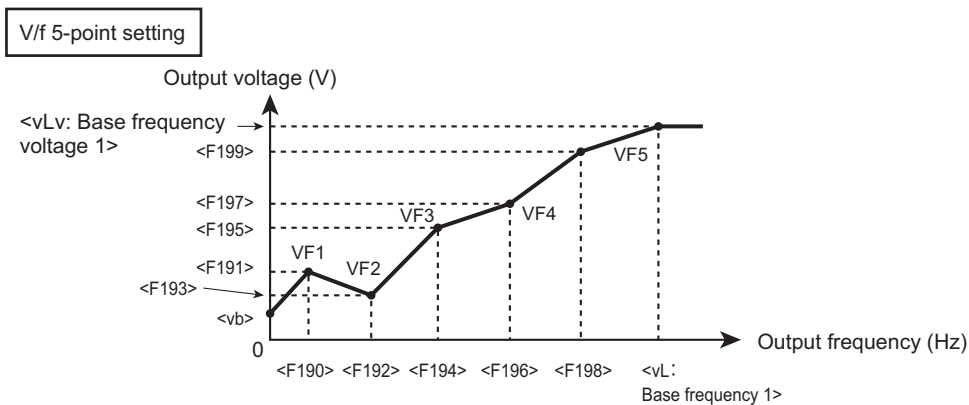
V/f control characteristics can be created according to machinery. Set frequency and voltage in five points and run the inverter with V/f control characteristics derived by connecting these points.

Set five points from VF1 to VF5 with the following parameters <F190> to <F199>.

Title	Parameter name	Adjustment range	Unit	Default setting
F190	V/f 5-point VF1 frequency	0.0 - FH	Hz	0.0
F191	V/f 5-point VF1 voltage	0.0 - 125.0	% *1	0.0
F192	V/f 5-point VF2 frequency	0.0 - FH	Hz	0.0
F193	V/f 5-point VF2 voltage	0.0 - 125.0	% *1	0.0
F194	V/f 5-point VF3 frequency	0.0 - FH	Hz	0.0
F195	V/f 5-point VF3 voltage	0.0 - 125.0	% *1	0.0
F196	V/f 5-point VF4 frequency	0.0 - FH	Hz	0.0
F197	V/f 5-point VF4 voltage	0.0 - 125.0	% *1	0.0
F198	V/f 5-point VF5 frequency	0.0 - FH	Hz	0.0
F199	V/f 5-point VF5 voltage	0.0 - 125.0	% *1	0.0

\*1 100% with 200 V for 240 V class and 400 V for 480 V class.





Important

- Set <vb: Manual torque boost 1> to approximately 0 to 3% of the base frequency voltage. If the setting value is too large, it may impair the linearity between points.
- If the inclination of the set V/f is above 8.25%/Hz, Points setting alarm 2 "A-02" occurs. When "A-02" alarm occurs, internal V/f is limited to 8.25%/Hz.

**9: Vector control 2 (speed / torque)**

It is applied to torque control.

Vector control realize high-torque and high-precision stable operation in the speed range from startup to base frequency.

It is applied to load transporting machinery and elevators that require high torque and machine tools that require high precision.

- High starting torque can be obtained.
- It is effective when smooth stable operation from a low speed is required.
- The change of motor speed caused by load fluctuation is suppressed to realize high-precision operation.

When <Pt> is "9", setting of motor parameters is required.

When the motor you are using is a 4P Toshiba premium efficiency motor which has the same capacity as the inverter, there is basically no need to set the parameters.

In other cases, look at the motor name plate and set the following parameters.

- <vL: Base frequency 1> (Rated frequency)
- <vLv: Base frequency voltage 1> (Rated voltage)
- <F405: Motor rated capacity>
- <F415: Motor rated current>
- <F417: Motor rated speed>

Two parameter setting methods are provided.

**1) Setting with <F400: Offline auto-tuning>**

Set <F400: Offline auto-tuning> to "5".

For details, refer to [6. 23. 1].

\* If an auto-tuning error occurs, set motor parameters individually by referring to [6. 23. 1] "■Setting method 4: Manually setting motor parameter".

**2) Manual setting**

Set each motor constant.

For details, refer to [6. 23. 1].

**10: PG feedback control**

Vector control is performed by using speed feedback signals from the motor.

Attach the PG feedback option to the inverter. Use a motor with speed sensor (encoder) and connect signals from the encoder to the PG feedback option.

In the following cases, use <Pt> = "11: PG feedback vector control (speed / torque)"

- To perform torque control
- To perform speed control that requires high precision
- When low-speed operation (with motor slip frequency or less) of regeneration is required

When <Pt> is "10", setting of motor parameters is required.

Look at the motor name plate and set the following parameters first.

- <vL: Base frequency 1> (Rated frequency)
- <vLv: Base frequency voltage 1> (Rated voltage)
- <F405: Motor rated capacity>
- <F415: Motor rated current>
- <F417: Motor rated speed>

Two parameter setting methods are provided.

**1) Automatic setting with auto-tuning**

Set <F400: Offline auto-tuning> to "5".

For details, refer to [6. 23. 1].

**2) Manual setting**

Set each motor constant.

For details, refer to "Digital Encoder Instruction Manual" (E6582148).

**11: PG feedback vector control (speed / torque)**

Vector control is performed by using feedback signals from the motor. It is applied to high-precision speed control and torque control.

Attach the PG feedback option to the inverter. Use a motor with speed sensor (encoder) and connect signals from the encoder to the PG feedback option.

Torque control is performed based on the torque command, so the motor speed depends on the relationship between the load torque and the motor generated torque.

When <Pt> is "11", setting of motor parameters is required.

Look at the motor name plate and set the following parameters first.

- <vL: Base frequency 1> (Rated frequency)
- <vLv: Base frequency voltage 1> (Rated voltage)
- <F405: Motor rated capacity>
- <F415: Motor rated current>
- <F417: Motor rated speed>

Two parameter setting methods are provided.

**1) Automatic setting with auto-tuning**

Set <F400: Offline auto-tuning> to "5".

For details, refer to [6. 23. 1].

**2) Manual setting**

Set each motor constant.

For details, refer to "Digital Encoder Instruction Manual" (E6582148).

### ■ Cautions for automatic torque boost and vector control

- Look at the motor name plate and be sure to set the following parameters.
  - <vL: Base frequency 1> (Rated frequency)
  - <vLv: Base frequency voltage 1> (Rated voltage)
  - <F405: Motor rated capacity>
  - <F415: Motor rated current>
  - <F417: Motor rated speed>
- The vector control exerts its characteristics effectively within the speed range of <vL: Base frequency 1>. The same characteristics will not be obtained in speed ranges over the base frequency.
- When using vector control, set <vL: Base frequency 1> in the range of 40 to 120 Hz.
- Use a three-phase motor with a capacity that is the same as the inverter's rated capacity or one rank below. The minimum applicable motor capacity is 0.1 kW.
- Use a motor that has 2 to 16 P.
- Operate one motor in combination with one inverter. Vector control cannot be used when one inverter is operated with more than one motor. When using a combination of several motors, set <Pt> to "0: V/f constant".
- The maximum length of wires between the inverter and motor is 30 m. If the wires are longer than 30 m, be sure to perform offline auto-tuning with the wires connected. However, the effects of voltage drop due to resistance of wiring cause motor-generated torque in the vicinity of base frequency to be somewhat lower.
- When a reactor or motor-end surge voltage suppression filter is connected between the inverter and a motor, the motor's generated torque may fall. Performing offline auto-tuning may also cause a trip "Etn1". When a trip has occurred, connect the inverter and the motor directly to perform offline auto-tuning, or set motor parameters by referring to the test record of the motor.
- Attach the speed sensor used for PG feedback control directly to the motor. If it is attached via a gear, etc., rigidity is not ensured, causing hunting of the motor or a trip of the inverter.
- If the motor is not connected or a motor with extremely small capacity is connected for operation for the purpose of operation check of the inverter, etc., set <Pt> to "0: V/f constant" temporarily. If it is set to Automatic torque boost, Vector control, PM control, PG feedback control, or PG feedback vector control, normal operation may not be possible.

#### Memo

- <Pt: V/f Pattern> is valid only with No.1 motor.
- If it is switched to No.2 to 4 motor, V/f constant control is applied regardless of the setting of <Pt>.

### ■ Cautions for PM motor control

- If the motor is not connected or a motor with extremely small capacity is connected for operation for the purpose of operation check of the inverter, etc., set <Pt> to "0: V/f constant" temporarily. If it is set to PM motor control, normal operation may not be possible.

### ■ Cautions for motor control

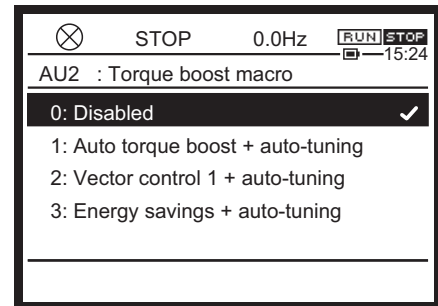
- Set the upper limit for frequency command to a value which is three or four times the value of <vL>.
- The value of run frequency is limited to a value which is ten times or less the values of <vL>, and the alarm "A-05" will appear when it is exceeded.

- If the inclination of the set V/f is over 8.25%/Hz, the alarm "A-02" will appear. When "A-02" alarm occurs, internal V/f is limited to 8.25%/Hz.

### 5. 3. 5 Setting parameters for torque boost and energy saving easily

<AU2: Torque boost macro>

Basic parameter



■ **Function**

This parameter is used to set V/f Pattern of the inverter and offline auto-tuning of motor parameters simultaneously for machinery that requires torque boost and energy saving.

■ **Parameter setting**

Title	Parameter name	Adjustment range	Default setting
AU2	Torque boost macro	0: Disabled 1: Automatic torque boost + offline auto-tuning 2: Vector control 1 + offline auto-tuning 3: Energy savings + offline auto-tuning	0



Important

- Before setting <AU2: Torque boost macro>, look at the motor name plate and be sure to set the following parameters.
    - <vL: Base frequency 1> (Rated frequency)
    - <vLv: Base frequency voltage 1> (Rated voltage)
    - <F405: Motor rated capacity>
    - <F415: Motor rated current>
    - <F417: Motor rated speed>
- Set other motor parameters as necessary.

■ **Selection of setting value**

**1: Automatic torque boost + offline auto-tuning**

This is applied to loads that require torque.

The load current in the speed range from startup to base frequency is detected and the output voltage (torque boost) from the inverter is automatically adjusted. This gives steady torque for stable operation.

- When <AU2: Torque boost macro> is set to "1", <Pt: V/f Pattern> is set to "2" automatically.
- The same characteristics can be obtained by setting <Pt> to "2: Automatic torque boost" and <F400: Offline auto-tuning> to "2: Auto-tuning at run command (0 after execution)". For details, refer to [6. 23. 1].

**2: Vector control 1 + offline auto-tuning**

This is applied to load transporting machinery and elevators that require high torque and machine tools that require high precision.

High-torque and high-precision stable operation is realized in the speed range from startup to base frequency.

- When <AU2: Torque boost macro> is set to "2", <Pt: V/f Pattern> is set to "3" automatically.
- The same characteristics can be obtained by setting <Pt> to "3: Vector control 1" and <F400: Offline auto-tuning> to "2: Auto-tuning at run command (0 after execution)". For details, refer to [6. 23. 1].

**3: Energy savings + offline auto-tuning**

This is applied to machinery such as fans and pumps that requires energy saving.

Energy can be saved in all speed ranges by detecting load current and flowing the optimum current that fits the load.

- When <AU2: Torque boost macro> is set to "3", <Pt: V/f Pattern> is set to "4" automatically.
- The same characteristics can be obtained by setting <Pt> to "4: Energy savings" and <F400: Offline auto-tuning> to "2: Auto-tuning at run command (0 after execution)". For details, refer to [6. 23. 1].

■ **If vector control cannot be set**

First read the precautions about vector control in [5. 3. 4].

If the desired torque cannot be obtained, refer to [6. 23], [6. 25].

If auto-tuning error "Etn1" appears, refer to [6. 23. 1], [6. 23. 2].

■ **Parameters set simultaneously with <AU2: Torque boost macro>**

<AU2: Torque boost macro> is a parameter to set <Pt: V/f Pattern> and <F400: Offline auto-tuning> simultaneously.

Therefore, if <AU2> is changed, the following relevant parameters are changed automatically.

<AU2>		Automatically set parameters			
		<Pt>		<F400>	
0	0 is displayed after resetting it	-	Check the setting value of <Pt>.	-	-
1	Automatic torque boost + offline auto-tuning	2	Automatic torque boost	2	Execute (0 after execution)
2	Vector control + offline auto-tuning	3	Vector control 1	2	Execute (0 after execution)
3	Energy savings + offline auto-tuning	4	Energy savings	2	Execute (0 after execution)

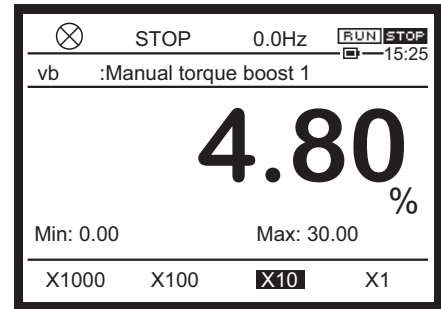
**Memo**

- For details of offline auto-tuning, refer to [6. 23. 1].

### 5. 3. 6 Increasing starting torque

<vb: Manual torque boost 1>

Basic parameter



■ **Function**

The starting torque is increased by increasing the setting value when starting torque is required. It is valid when the setting value of <Pt: V/f Pattern> is "0: V/f constant", "1: Variable torque", or "7: V/f 5-point setting".

■ **Parameter setting**

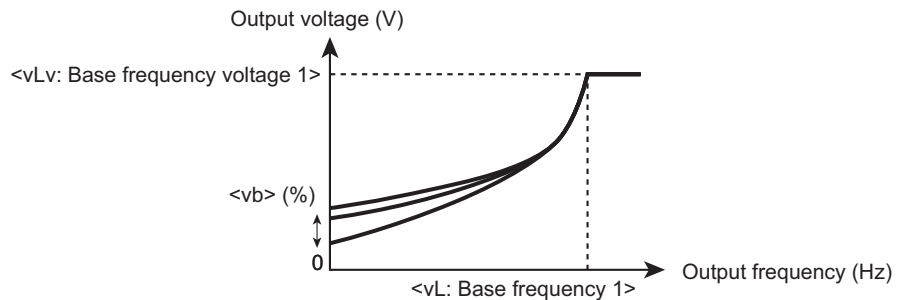
Title	Parameter name	Adjustment range	Unit	Default setting
vb	Manual torque boost 1	0.00 - 30.00	%	*1

\*1 Depending on the capacity. Refer to [11. 6].

■ **Reference of setting**

100% is based on 200V, or 400V.

Set the value within +2% of the default setting, generally.



Important

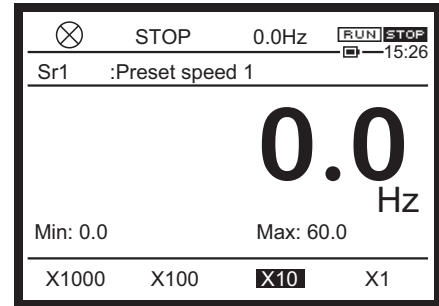
- The optimum value is programmed for each inverter capacity by default setting. When a value larger than the reference value is set, an overcurrent trip may occur at startup.
- Repeated operation with excessive torque boost may cause failure of IGBT in the power circuit. When larger starting torque is required, consider using vector control. For details, refer to [5. 3. 4].

### 5. 3. 7 Operating by switching frequency command with external logic signal

<Sr0: Preset speed 0> to <Sr7: Preset speed 7>

Basic parameter

<F287: Preset speed 8> to <F294: Preset speed 15>  
 <F964: Preset speed 16> to <F979: Preset speed 31>



■ **Function**

The frequency commands are switched with external logic signals. For example, high speed and low speed are switched with 1-speed and 2-speed. Up to 31-speed can be set.

They can be used as interruption frequency commands because they have priority over other frequency commands.

■ **Parameter setting**

Title	Parameter name	Adjustment range	Unit	Default setting
Sr0	Preset speed 0	LL - UL	Hz	0.0
Sr1 to Sr7	Preset speed 1 - 7	LL - UL	Hz	0.0
F287 to F294	Preset speed 8 - 15	LL - UL	Hz	0.0
F964 to F979	Preset speed 16 - 31	LL - UL	Hz	0.0



Important

- They are valid in the case of run/stop with terminals. Set <CMOd: Run command select> to "0". For details, refer to [5. 2. 1].
- Preset speed 16 to 31 are set only by terminal input. They cannot be set via communication.
- Preset speed 16 to 31 do not support preset speed with the functions. If these functions are required, select preset speed 1 to 15.

■ **Reference of setting**

Set the frequency to be used for preset speed 1 to 31 with <Sr1: Preset speed 1> to <F979: Preset speed 31>.

When the preset speed command (external logic signal) is off, the frequency command set with <FMOd: Frequency command select 1> is valid. When <FMOd: Frequency command select 1> is "12: Sr0", the setting value of <Sr0: Preset speed 0> becomes the frequency command.

**Memo**

- The preset speed command is always given priority when other frequency commands are input at the same time.



■ Setting example of preset speed frequency

Here is a case of sink logic (when the slide switch [SW1] is set to SINK).

	Terminal	Preset speed operation														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	[S1]	✓	-	✓	-	✓	-	✓	-	✓	-	✓	-	✓	-	✓
	[S2]	-	✓	✓	-	-	✓	✓	-	-	✓	✓	-	-	✓	✓
	[S3]	-	-	-	✓	✓	✓	✓	-	-	-	-	✓	✓	✓	✓
	[S4]	-	-	-	-	-	-	-	✓	✓	✓	✓	✓	✓	✓	✓
[S5]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

	Terminal	Preset speed operation															
		16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
	[S1]	-	✓	-	✓	-	✓	-	✓	-	✓	-	✓	-	✓	-	✓
	[S2]	-	-	✓	✓	-	-	✓	✓	-	-	✓	✓	-	-	✓	✓
	[S3]	-	-	-	-	✓	✓	✓	✓	-	-	-	-	✓	✓	✓	✓
	[S4]	-	-	-	-	-	-	-	-	✓	✓	✓	✓	✓	✓	✓	✓
[S5]	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	

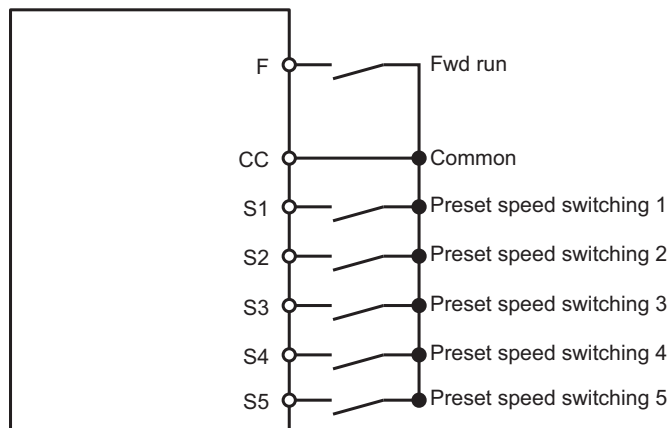
✓: ON, - : OFF (When it is all OFF, then frequency command other than Preset speed operation is enabled.)

Set the input terminal functions as follows.

- <F114: Terminal S1 function 1> = "10: Preset speed switching 1"
- <F115: Terminal S2 function> = "12: Preset speed switching 2"
- <F116: Terminal S3 function> = "14: Preset speed switching 3"
- <F117: Terminal S4 function> = "16: Preset speed switching 4"
- <F118: Terminal S5 function> = "118: Preset speed switching 5"

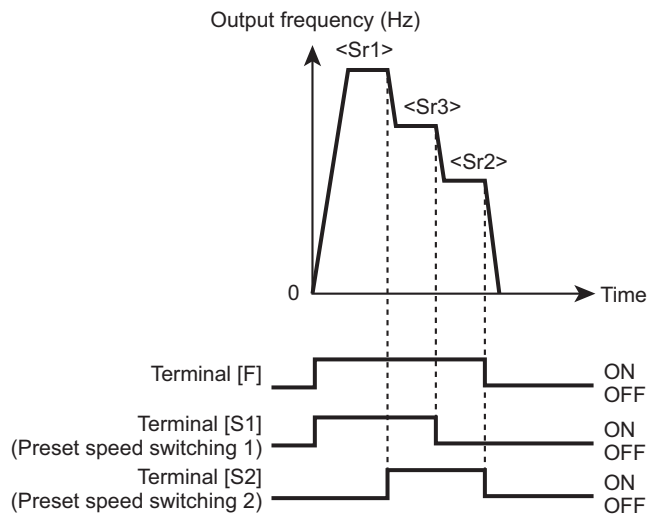
Connect them as shown in the digram below.

In case of sink logic



The following is an operation example of preset speed 1 - 3.

In this case, set <Sr1: Preset speed 1> to <Sr3: Preset speed 3>.



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■ **When changing frequency command during run**

The frequency command can be changed during run with preset speed command.

Set <F724: Frequency setting target by touch wheel> to "1: FC + Preset speed". When you operate the touch wheel during run with preset speed command, the frequency command can be changed.

When you press the [OK] key, the setting value of the preset speed frequency can be changed.

Title	Parameter name	Adjustment range	Default setting
F724	Frequency setting target by touch wheel	0: Panel run frequency command (FC) 1: FC + Preset speed	0

0: Panel run frequency command (FC)

Sets the frequency command from the operation panel.

1: FC + Preset speed

Sets the frequency command from the operation panel during run with the preset speed command.

**Memo**

- While the frequency command is being adjusted, the frequency for running is switched if other preset speed command is input. However, the screen display and the adjustment target of the touch wheel are not switched. When you press the [OK] key, the display is switched to the current frequency for running.

■ **Setting of operation function**

For preset speed frequency commands of 1-speed to 15-speed, functions such as direction of rotation, acceleration/deceleration time, V/f control, and torque limit can be set.

After setting <F560: Preset speed operation style> to "1: With function", set functions with <F561 Preset speed 1> to <F576: Preset speed 15>.

Title	Parameter name	Adjustment range	Default setting
F560	Preset speed operation style	0: Frequency only 1: With function	0

**0: Frequency only**

Only the frequency command is valid.

**1: With function**

For each preset speed commands of 1-speed to 15-speed, direction of rotation, acceleration/ deceleration time, V/f control, and torque limit can be set.

In this case, the direction of rotation of the motor is as set with <F561: Operation function (1-speed)> to <F576: Operation function (0-speed)>, not as the input of terminal [F] or terminal [R].

Title	Parameter name	Adjustment range	Default setting
F561 - F575	Operation function (1-speed) to Operation function (15-speed)	0: Fwd run +1: Rev run +2: Acc/Dec switching signal 1 +4: Acc/Dec switching signal 2 +8: V/f switching signal 1 +16: V/f switching signal 2 +32: Torque limit switching signal 1 +64: Torque limit switching signal 2	0
F576	Operation function (0-speed)		

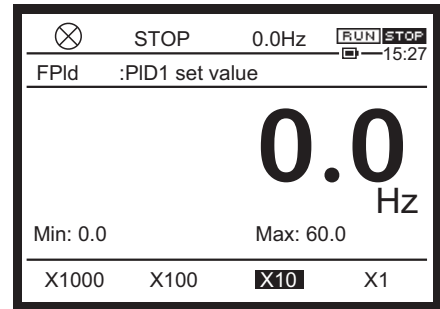
Add the values of the functions to be used for setting. For example, when using the functions of Rev run (+1) and Acc/Dec switching signal 1 (+2), set "3" (+1+2=+3).

Do not set +8, or +16 to F576.

### 5. 3. 8 Setting PID control

<FPId: PID1 set value>

Basic parameter



■ **Function**

This parameter is applied to process control including keeping airflow, pressure, and the amount of flow constant.

The set value and the feedback signal (4 - 20 mA, 0 - 10 V) from the detector are compared, and the frequency is changed toward the set value.

■ **Parameter setting**

Title	Parameter name	Adjustment range	Unit	Default setting
FPId	PID1 set value	F368 to F367	Hz	0.0

■ **Reference of setting**

1) **Selecting set value and feedback input**

Set the set value of PID control with <F389: PID1 set value select> and the feedback input value with <F360: PID1 feedback input select>.

- For <F389>, do not set the signal used for <F360>.
- When the feedback value and the set value match, the signal can be output. Assign function "144: PID 1, 2 frequency command agreement" to the output terminals.

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Title	Parameter name	Adjustment range	Default setting
F389	PID1 set value select	0: selected by FMOd/F207 1: Terminal RR 2: Terminal RX 3: Terminal II 4: Terminal AI4 (option) 5: Terminal AI5 (option) 6 - 11: - 12: FPId 13, 14: - 15: Terminal Up/Down frequency 16: Pulse train 17: High resolution pulse train (option) 18, 19: - 20: Embedded Ethernet 21: RS485 communication (connector 1) 22: RS485 communication (connector 2) 23: Communication option	0
F360	PID1 feedback input select	0: - 1: Terminal RR 2: Terminal RX 3: Terminal II 4: Terminal AI4 (option) 5: Terminal AI5 (option) 6 - 16: - 17: High resolution pulse train (option)	0

**2) Setting contents of PID control**

Set <F359: PID control 1> to "1: Process PID control".

Title	Parameter name	Adjustment range	Unit	Default setting
F359	PID control 1	0: Disabled 1: Process PID control 2: Speed PID control 3: Easy positioning P control 4: Dancer control 5 - 10: - 11: Minus Process PID control 12: Minus Speed PID control 13: Minus Easy positioning P control 14: Minus Dancer control		0
F367	PID1 set value upper-limit	0.0 - FH	Hz	50.0/60.0
F368	PID1 set value lower-limit	0.0 - F367	Hz	0.0

Set <ACC: Acceleration time 1> and <dEC: Deceleration time 1> to the time that is suitable for the system. Refer to [5. 2. 4].

To limit the setting values, set the following parameters.

- To limit the set value: <F367: PID1 set value upper-limit>, <F368: PID1 set value lower-limit >
- To limit the output frequency: <UL: Upper limit frequency>, <LL: Lower limit frequency> (Refer to [5. 2. 3].)

**Memo**

- PID control can be temporarily turned off with an external signal. Assign "36: PID control OFF" to an input terminal.
- PID control should be OFF when very low speed drive is needed.
- If speed PID is selected, motor is possibly rotating forward and reverse. If you don't want to rotate reverse, set <F311: Reverse inhibited> or select process PID (<F359>=1, or 11).

**3) Adjusting PID control gain level**

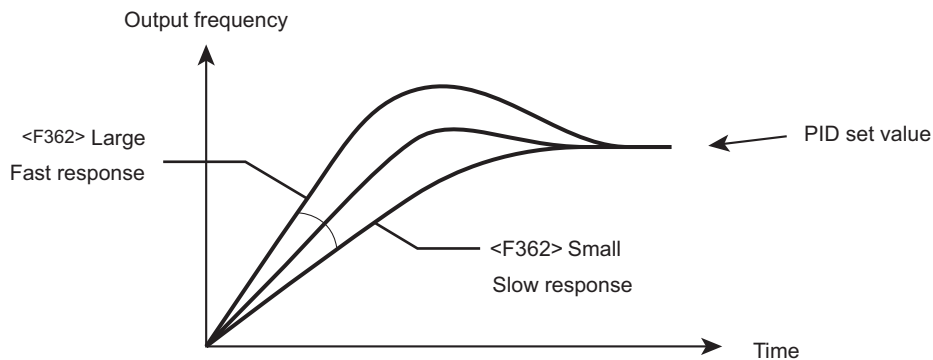
Adjust the PID control gain level according to the set values, the feedback signals, and the object to be controlled.

Title	Parameter name	Adjustment range	Unit	Default setting
F362	PID1 proportional gain	0.01 - 100.0	-	0.30
F363	PID1 integral gain	0.01 - 100.0	s <sup>-1</sup>	0.20
F366	PID1 differential gain	0.00 - 2.55	s	0.00

**<F362: PID1 proportional gain>**

This parameter adjusts the proportional gain level of PID control. A correction value proportional to the particular deviation (the difference between the set value and the feedback value) is obtained by multiplying this deviation by the parameter setting.

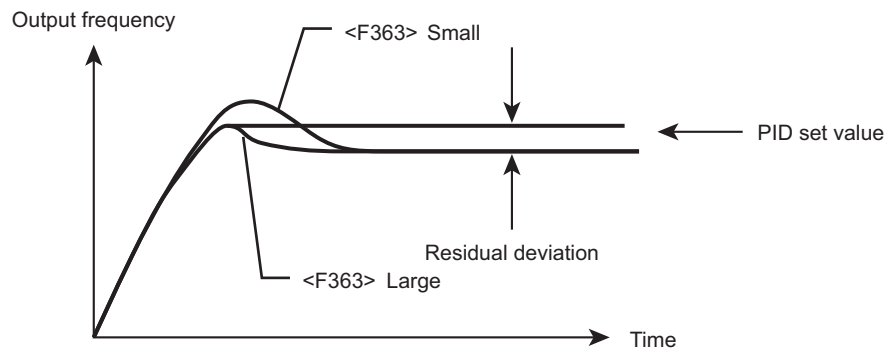
A larger P-gain adjustment value gives faster response. Too large an adjustment value, however, results in an unstable event such as hunting.



**<F363: PID1 integral gain>**

This parameter adjusts the integral gain level of PID control. Any remaining deviations (residual deviation offset) during proportional action are cleared to zero.

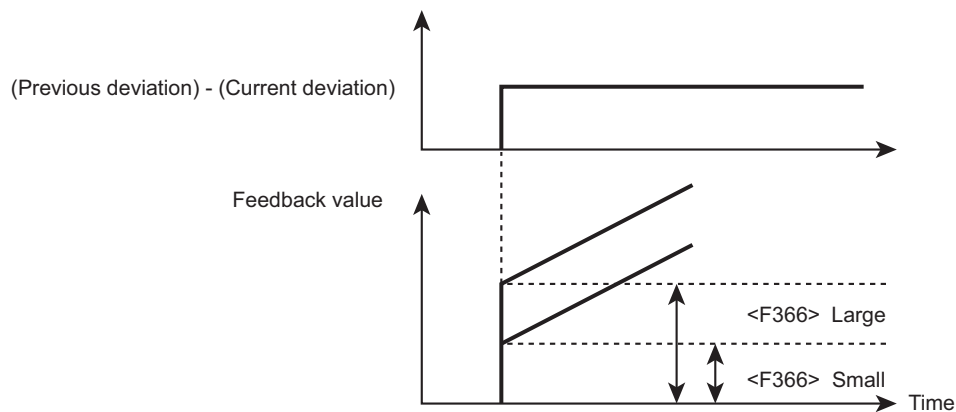
A larger I-gain adjustment value reduces residual deviations. Too large an adjustment value, however, results in an unstable event such as hunting.



The integral/derivative amount of PID control can be reset with an external signal. Assign function number "52: PID differential/integral reset" to an input terminal.

**<F366: PID1 differential gain>**

This parameter adjusts the differential gain level of PID control. This gain increases the speed of response to a rapid change in deviation (difference between the set value and the feedback value). Note that setting the gain beyond necessity may cause fluctuations in output frequency, and thus operation to become unstable.

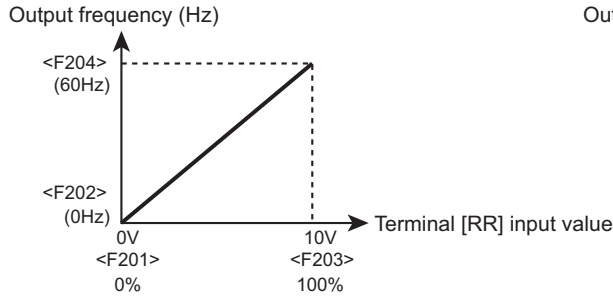


The integral/derivative amount of PID control can be reset with an external signal. Assign "52: PID differential/integral reset" to an input terminal.

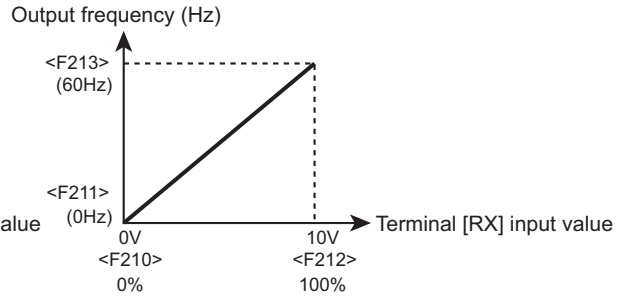
**4) Adjusting feedback input**

Make adjustment by converting input level of the feedback value into frequency. Refer to [6. 6. 2].

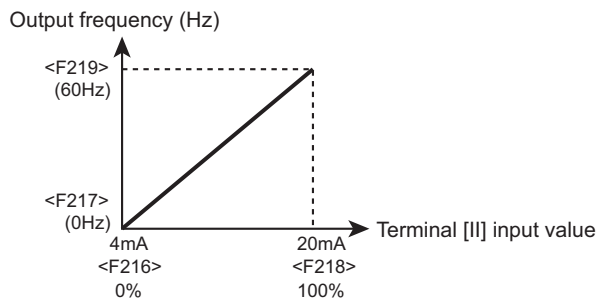
Example of 0 - 10 Vdc voltage input setting



Example of -10 - +10 Vdc voltage input setting



Example of 4 - 20 mAdc current input setting



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### 5) Setting the time elapsed before PID control starts

Waiting time until starting PID control system can be set to avoid PID control until the control system becomes stable at power on.

The inverter ignores feedback input signals and runs at the frequency determined by the frequency command value for the period of time set with <F369: PID1 start wait time>, and enters PID control after the elapsed time.

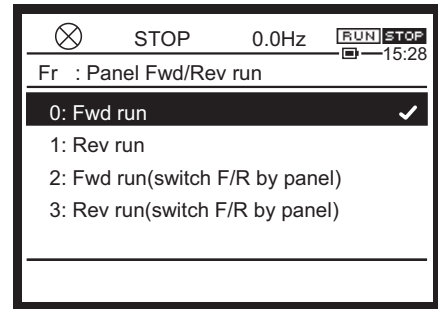
Title	Parameter name	Adjustment range	Unit	Default setting
F369	PID control start wait time	0 - 2400	s	0



### 5. 3. 9 Switching direction of rotation during panel run

<Fr: Panel Fwd/Rev run select>

Basic parameter



■ **Function**

This parameter is used to select the direction of rotation of the motor during panel run. The direction of rotation can be changed during run by using the [FWD/REV] key on the operation panel.

■ **Parameter setting**

Title	Parameter name	Adjustment range	Default setting
Fr	Panel Fwd/Rev run select	0: Fwd run 1: Rev run 2: Fwd run (switchable F/R by panel) 3: Rev run (switchable F/R by panel)	0

■ **Selecting a setting value**

**0: Fwd run**

When you press the [RUN] key on the operation panel, the motor runs forward. Forward run/reverse run cannot be switched.

**1: Rev run**

When you press the [RUN] key on the operation panel, the motor runs reversely. Forward run/reverse run cannot be switched.

**2: Fwd run (switchable F/R by panel)**



When you press the [RUN] key on the operation panel, the motor runs forward. When you press the [FWD/REV] key during forward run, the motor starts running reversely. When you press the [FWD/REV] key again, the motor starts running forward. The command given before "MOFF" display is remained at the power off.

**3: Rev run (switchable F/R by panel)**



When you press the [RUN] key on the operation panel, the motor runs reversely. When you press the [FWD/REV] key during reverse run, the motor starts running forward. When you press the [FWD/REV] key again, the motor starts running reversely. The command given before "MOFF" display is remained at the power off.

■ **Direction of rotation of motor**

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

-  /  display of the rotation direction icon.
- Direction of rotation of the rotating icon
- "Forward"/"Reverse" display of the direction of rotation in [Monitor mode].

When the [FWD]/[REV] key is valid,   is displayed at the upper right of the LCD screen.

When the motor is running forward,  is highlighted. When it is running reversely,  is highlighted.

## Memo

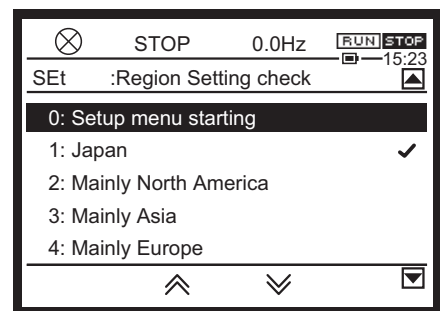
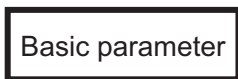
- This function is valid when the motor is run/stopped from the operation panel or extension panel (<CMOd: Run command select> = "1").
- In the case of terminal run, setting with <Fr: Panel Fwd/Rev run select> is invalid.  
Switch forward/reverse run with the terminal [F] and the terminal [R].  
Terminal [F]: Fwd run  
Terminal [R]: Rev run  
For details of terminal run, refer to "Chapter 7".

### 5. 3. 10 Automatic setting of main parameters by region used



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

<SEt: Region setting check>



■ **Function**

When you select a region using in the setup menu at initial Power on, parameters such as the base frequency of the motor is set automatically according to the selected region. You can check the region that has been set or reset it by starting the setup menu.

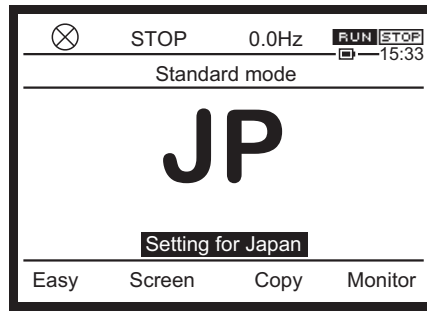
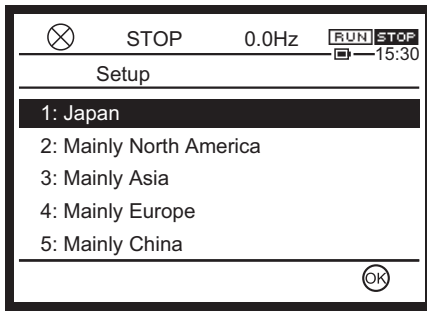
■ **Parameter setting**

Title	Parameter name	Adjustment range	Default setting
SEt	Region setting check	0: Setup menu starting 1: Japan (read only) 2: Mainly North America (read only) 3: Mainly Asia (read only) 4: Mainly Europe (read only) 5: Mainly China (read only)	0

■ **Selecting a setting value**

**0: Setup menu starting**

The setup menu to select the region where the inverter is used is started. When you select the region, parameters such as the base frequency and the base frequency voltage of the motor that are described on the separate table are automatically set.



Important

- While the setup menu is started, you cannot return to the previous step even if you press the [ESC] key.
- Note that all parameters return to status of default setting and the trip history data is cleared.

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- 1: Japan (read only)
- 2: Mainly North America (read only)
- 3: Mainly Asia (read only)
- 4: Mainly Europe (read only)
- 5: Mainly China (read only)

All of 1 to 5 are display to check the setting. Even if you select any of them and press the [OK] key, new setting cannot be made.

There is a mark at the right end of the region selected in the setup menu.

■ Parameters set with setup menu

Parameter title	Function	Mainly North America	Mainly Asia	Mainly Europe	China	Japan
FH	Maximum frequency (Hz)	80.0	80.0	80.0	50.0	80.0
F307	Supply voltage compensation	2	2	2	2	3
F319	Regenerative over-flux upper limit (%)	120	120	120	140	140
F417	Motor rated speed (min <sup>-1</sup> )	*1	*1	*1	*1	*1
vLv, F171, F175, F179	Base frequency Voltage (V)	230	230	230	200	200
		460	400	400	380	400
vL, UL, F170, F174, F178, F204, F213, F219, F225, F231, F237, F330, F335, F364, F367, F370, F426, F428, F814, A316, A319, A322, A346, A349, A352, A376, A379, A382	Frequency (Hz)	60.0	50.0	50.0	50.0	60.0

Parameter title	Function	Mainly North America	Mainly Asia	Mainly Europe	China	Japan
F606, F643	Frequency (max of set value) (Hz)	60.0	50.0	50.0	50.0	60.0
F405	Motor rated Capacity (kW)	3.7	4.0	4.0	4.0	3.7
		0.4	0.4	0.4	0.4	0.37
F704	Reference Website	0	1	1	1	1

\*1 Depending on the region and the capacity. Refer to [11. 6].

## Memo

- The setting values of the parameters set with the setup menu can be changed as in the case of other parameters.

## 5. 4 Setting of extended parameters that are especially important

This section explains the parameters that are especially important among the extended parameters. For other extended parameters not introduced here, refer to "Chapter 6".

### 5. 4. 1 Switching two frequency commands

<FMOD: Frequency command select 1>

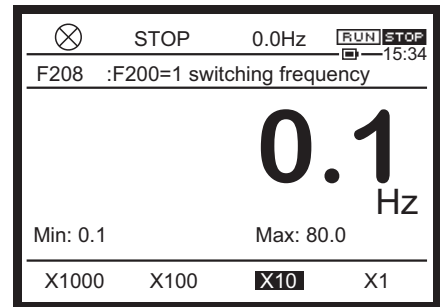
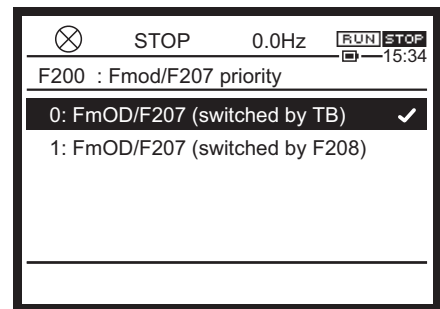
Basic parameter

Easy mode

<F207: Frequency command select 2>

<F200: Frequency command priority select>

<F208: Frequency command switching frequency>



#### ■ Function

Two frequency commands, for example manual setting with external potentiometer and automatic setting with 4 - 20 mA signals, can be switched.

Switch two frequency commands set with <FMOD: Frequency command select 1> and <F207: Frequency command select 2> with input terminal signals or switching frequency set with <F200: Frequency command priority select>.

■ Parameter setting

Title	Parameter name	Adjustment range	Default setting
FMOd	Frequency command select 1	0: - 1: Terminal RR 2: Terminal RX	1
F207	Frequency command select 2	3: Terminal II 4: Terminal AI4 (option) 5: Terminal AI5 (option) 6 - 9: - 10: Touch wheel 1 (power off or press OK to save) 11: Touch wheel 2 (press OK to save) 12: Sr0 13, 14: - 15: Terminal Up/Down frequency 16: Pulse train 17: High resolution pulse train (option) 18, 19: - 20: Embedded Ethernet 21: RS485 communication (connector 1) 22: RS485 communication (connector 2) 23: Communication option	3

Title	Parameter name	Adjustment range	Default setting
F200	Frequency command priority select	0: FMOd/F207 (switched by TB) 1: FMOd/F207 (switched by <F208>)	0

Title	Parameter name	Adjustment range	Unit	Default setting
F208	Frequency command switching frequency	0.1 - FH	Hz	0.1

■ Setting of two frequency commands

Set with <FMOd: Frequency command select 1> and <F207: Frequency command select 2>. The adjustment range is the same.

Refer to "■ Selection of setting value" of <FMOd: Frequency command select 1> in [5. 2. 1].

■ Setting of <F200: Frequency command priority select>

**0: FMOd/F207 (switched by TB)**

The frequency commands set with <FMOd: Frequency command select 1> and <F207: Frequency command select 2> are switched with input terminal signals.

Setting of the function number of the input terminal is required.

**1: FMOd/F207 (switched by <F208>)**

The frequency commands set with <FMOd: Frequency command select 1> and <F207: Frequency command select 2> are switched with frequency.

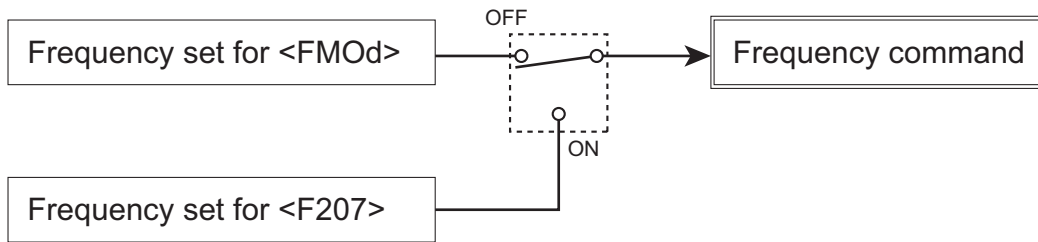
Set the switching frequency with <F208: Frequency command switching frequency>.

■ **Switching with input terminal <F200> = "0"**

Set <F200: Frequency command priority select> to "0".

Assign "104: FMOd/F207 priority switching" to an unused input terminal. For details, refer to [7. 2. 1].

- When the input terminal is OFF, run the motor with the frequency command set with <FMOd: Frequency command select 1>.
- When the input terminal is ON, run the motor with the frequency command set with <F207: Frequency command select 2>.

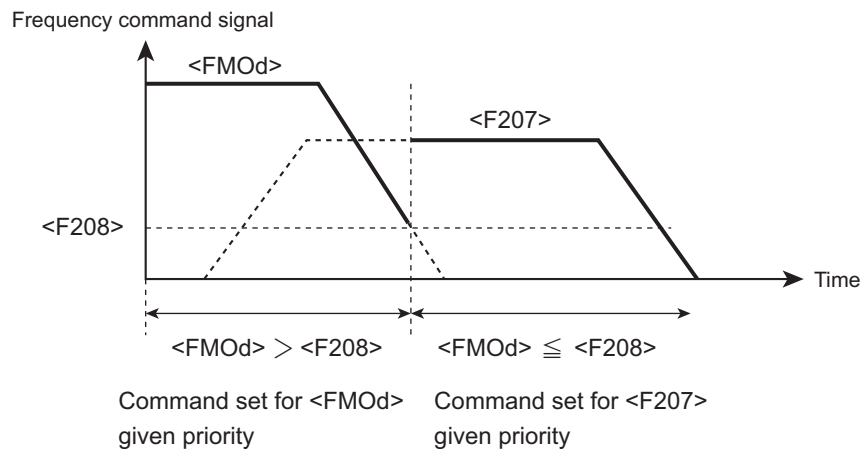


5

■ **Automatic switching with switching frequency <F200> = "1"**


Set <F200: Frequency command priority select> to "1" and set the frequency with <F208: Frequency command switching frequency>.


- If the frequency command set with <FMOd: Frequency command select 1> is larger than the value set with <F208>, the value set with <FMOd> becomes the frequency command.
- If the frequency command set with <FMOd> is larger than the value set with <F208>, the value set with <F207: Frequency command value 2> becomes the frequency command.





## 5. 4. 2 Restarting smoothly after momentary power failure

 **CAUTION**

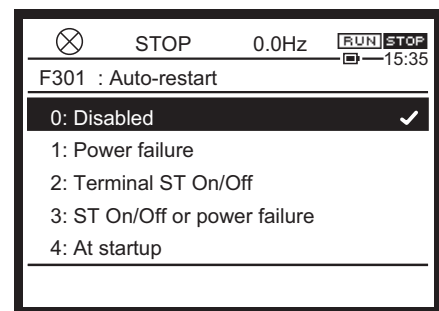


Mandatory action

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

Please prevent accidents with the caution labels.

### <F301: Auto-restart>



#### ■ Function

The motor that is coasting due to momentary power failure is accelerated immediately after the power is restored (auto-restart function).

In addition, this parameter detects the motor speed and direction of rotation of the motor during coasting at the time of startup, and allows switching from commercial power operation to inverter operation without stopping the motor(motor speed search function).

#### ■ Parameter setting

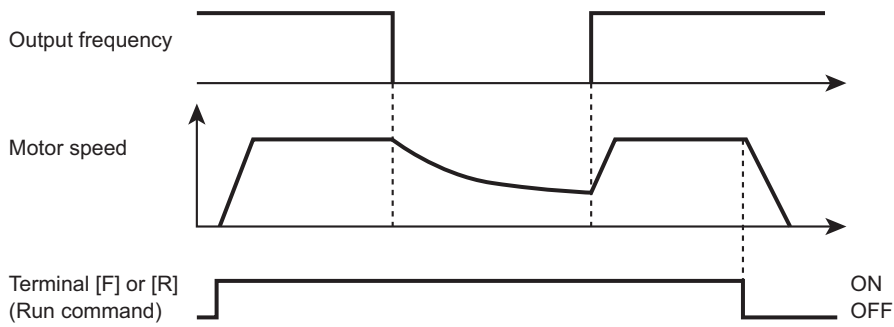
Title	Parameter name	Adjustment range	Default setting
F301	Auto-restart	0: Disabled 1: Power failure 2: Terminal ST On/Off 3: Terminal ST On/Off or power failure 4: At startup	0

#### ■ Selecting a setting value

##### 1: Power failure

The motor that is coasting due to momentary power failure is accelerated immediately after the power is restored.

It is operated after power is restored after power circuit undervoltage is detected. Turn on the run command.



**2: Terminal ST On/Off**

The motor speed and direction of rotation of the coasting motor are detected to start it smoothly (motor speed search function).

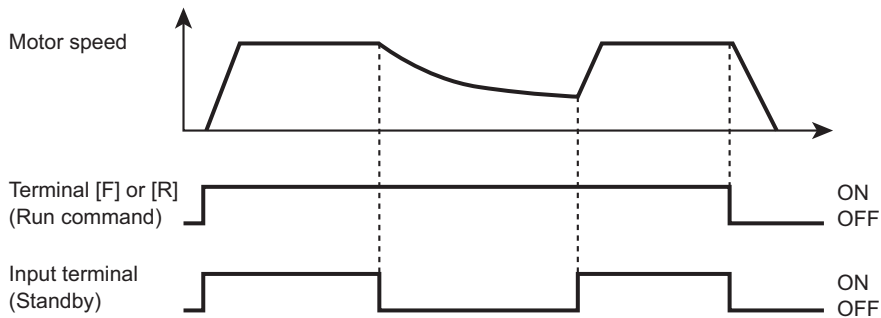
The input terminal to which "ST: Standby" is assigned is turned off. It is operated when the input terminal is turned on again. Turn on the run command.

Since "ST: Standby" is always ON in default setting, make setting as follows.

- Set <F110: Always active function 1> to "0: No function" (Refer to [6. 3. 1])
- Assign "6: ST: Standby" to an unused input terminal

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For assignment of a function to an input terminal, refer to [7. 2. 1].



**3: Terminal ST On/Off or power failure**

It is operated both in "1" and "2"

**4: At startup**

A motor speed search is executed each time at startup.

When the motor is rotated by the external factor before running by the inverter, it can be started without trip.



## Important

- At restart, it takes about 1 second for the inverter to check the motor speed. For this reason, the startup takes more time than usual.
- Use this function when operating a system with one motor connected to one inverter. This function may not operate properly in a system configuration when multiple motors are connected to one inverter.
- When using this parameter, do not set <F605: Output phase loss detection> to "1", "2", or "4". For details, refer to [6. 30. 5].
- Do not apply it for cranes.  
The load may be lowered during waiting time from input of the run command to startup. To apply the inverter to cranes, therefore, set <F301: Auto-restart> to "0: Disabled". Do not use the retry function, either.
- This function is always enabled at torque control. (independent to <F301> setting)

## Memo

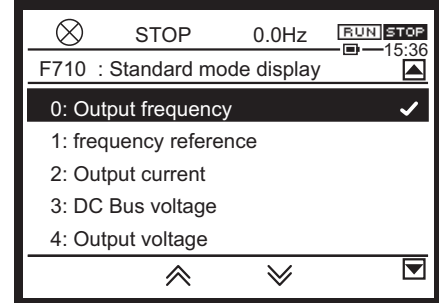
- When the motor is restarted from retry, this function is operated regardless of the setting of this parameter.
- It is not malfunction that abnormal noise might be heard from the motor during the motor speed search at the auto-restart.

### 5. 4. 3 Customizing display

(1) **Selecting contents displayed in [Standard mode]**

<F710: Standard mode display>

<F720: Standard mode display of extension panel>



■ **Function**

The display contents in [Standard mode] can be changed. Different contents can be displayed on the operation panel of the inverter unit and the extension panel (optional).

Select the display contents in [Standard mode] when the power is turned on. In the default setting, the output frequency is displayed.

■ **Parameter setting**

Title	Parameter name	Adjustment range	Default setting
F710	Standard mode display	0 - 162*1	0
F720	Standard mode display of extension panel	0 - 162*1	0

\*1 For details, refer to the table at the end of this subsection.

■ **Reference of setting**

With <F710: Standard mode display>, set the contents to be displayed in [Standard mode] on the operation panel when the power is turned on. Set the extension panel with <F720: Standard mode display of extension panel>.

In either case, "0: Output frequency" in the default setting.

**Memo**

- Different contents can be displayed on the operation panel of the inverter unit and the extension panel (optional).

■ **Setting list of <F710: Standard mode display> and <F720: Standard mode display of extension panel>**

Setting value	Function name	Display unit	Setting value	Function name	Display unit
0	Output frequency	0.1 Hz	71	Motor speed (estimated value)	1
1	Frequency command value	0.1 Hz	72	Communication option Receiving counter	1
2	Output current	1%/<F701> setting	73	Communication option Abnormal counter	1
3	Input voltage (DC detection)	1%/<F701> setting	76	Terminal S4/S5 pulse train input value	0.10%
4	Output voltage	1%/<F701> setting	77	My function COUNT1	1
5	Stator frequency	0.1 Hz	78	My function COUNT2	1
6	Speed feedback frequency (real time)	0.1 Hz	79	Dancer control PID result frequency	0.1 Hz
7	Speed feedback frequency (1-second filter)	0.1 Hz	80	Embedded Ethernet Transmission counter	1
8	Torque	1%	81	Embedded Ethernet Receiving counter	1
9	Torque command	1%	82	Embedded Ethernet Abnormal counter	1
10	Output frequency during run. Frequency command value during stop.	Hz/free unit	83	Connected option number	1
11	Torque current	1%	84	My function COUNT3	1
12	Exciting current	1%	85	My function COUNT4	1
13	PID feedback value	0.1 Hz	86	My function COUNT5	1
14	Motor overload factor (OL2 data)	1%	90	Cumulative power ON time	100 hours
15	Inverter overload factor (OL1 data)	1%	91	Cumulative cooling fan run time	100 hours
16	Braking resistor overload factor (OLr data)	1%	92	Cumulative run time	100 hours
17	Braking resistor load factor (%ED)	1%	93	Cumulative overcurrent time	100 hours
18	Input power	0.1 kW	95	Pump 0 run time	100 hours
19	Output power	0.1 kW	96	Pump 1 run time	100 hours
20	Input cumulative power	<F749> setting	97	Pump 2 run time	100 hours
21	Output cumulative power	<F749> setting	98	Pump 3 run time	100 hours

Setting value	Function name	Display unit	Setting value	Function name	Display unit
22	-	-	99	Pump 4 run time	100 hours
23	-	-	100	Number of starting	10000 times
24	Terminal RR input value	1%	101	Number of Fwd starting	10000 times
25	Terminal RX input value	1%	102	Number of Rev starting	10000 times
26	Terminal II input value	1%	103	External equipment counter	Time
27	Motor speed command	-	105	Pump 5 run time	100 hours
28	Terminal FM output value	1	106	Pump 6 run time	100 hours
29	Terminal AM output value	1	107	Pump 7 run time	100 hours
30	-	-	108	Pump 8 run time	100 hours
31	Communication data output	*1	109	Pump 9 run time	100 hours
32	Slot A option CPU version	-	110	Number of trip	Time
33	Slot B option CPU version	-	111	Number of serious failure trip	1
34	Motor load factor	%	112	Number of slight failure trip	1
35	Inverter load factor	%	113	Number of specified trip 1	1
36	Inverter rated current	A	114	Number of specified trip 2	1
37	Inverter rated current (with carrier frequency correction )	A	115	Number of specified trip 3	1
38	Actual carrier frequency	kHz	120	Internal temperature 1	°C
39	Slot C option CPU version	-	124	Power circuit board temperature	°C
40	Embedded Ethernet CPU version	-	130	External PID3 set value	0.1 Hz
41	Terminal FP pulse train output value	pps	131	External PID3 feedback value	0.1 Hz
43	Terminal FM/AM gain setting value	-	132	External PID3 result value	0.1 Hz
44	Terminal AI4 input value	1%	133	External PID4 set value	0.1 Hz
45	Terminal AI5 input value	1%	134	External PID4 feedback value	0.1 Hz
46	My function monitor output 1	-	135	External PID4 result value	0.1 Hz
47	My function monitor output 2	-	150	Signed output frequency	0.1 Hz
48	My function monitor output 3	-	151	Signed frequency command value	0.1 Hz
49	My function monitor output 4	-	152	Signed stator frequency	0.1 Hz
62	PID result frequency	0.1 Hz	153	Signed speed feedback frequency (real time)	0.1 Hz

Setting value	Function name	Display unit	Setting value	Function name	Display unit
63	PID set value	0.1 Hz	154	Signed speed feedback frequency (1-second filter)	0.1Hz
64	Light-load high-speed switching load torque	1%	155	Signed torque	1%
65	Light-load high-speed torque during constant speed run	1%	156	Signed torque command	1%
66	Pattern operation group number	0.1	158	Signed torque current	1%
67	Pattern operation remaining cycle number	1	159	Signed PID feedback value	0.1 Hz
68	Pattern operation preset speed number	1	160	Signed terminal RX input value	1%
69	Pattern operation remaining time	0.1	161	Signed terminal AI4 input value	1%
70	Inverter rated voltage	1	162	Signed terminal AI5 input value	1%

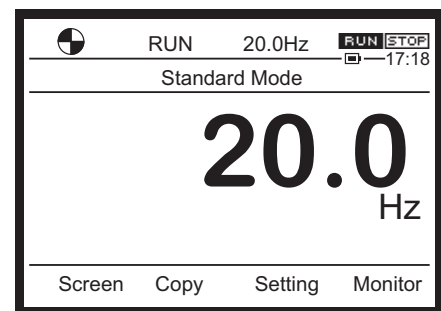
\*1 For details, refer to "RS485 Communication Function Instruction Manual" (E6582143).

**(2) Selecting contents displayed in the status area**

<F723: Status area display of operation panel>

■ **Function**

Sets the content displayed third from the left end of the status area. Default setting displays the frequency command value.



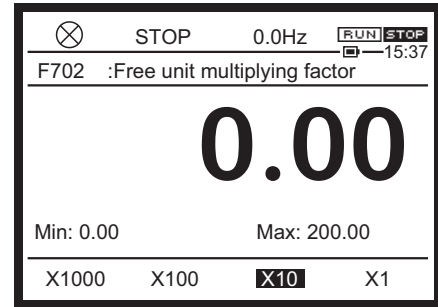
■ **Parameter setting**

Title	Parameter name	Adjustment range	Default setting
F723	Status area display of operation panel	0 - 162*1	1

\*1 For details, refer to the table at the end of the previous subsection (1).

(3) **Displaying frequency by converting to other unit**

- <F702: Free unit multiplication factor>
- <F703: Target of free unit>
- <F705: Free unit inclination polarity>
- <F706: Free unit bias>



■ **Function**

The monitor display and the frequency display of parameters can be converted into the motor speed or load speed.

The unit of the set value or that of feedback can be changed at PID control for easy setting.

■ **Parameter setting**

Title	Parameter name	Adjustment range	Unit	Default setting
F702	Free unit multiplication factor	0.00: Disabled 0.01 - 200.0	times	0.00
F703	Target of free unit	0: All frequencies 1: PID frequencies	-	0
F705	Free unit inclination polarity	0: Negative inclination (downward slope) 1: Positive inclination (upward slope)	-	1
F706	Free unit bias	0.00 - FH	Hz	0.00

■ **Reference of setting**

The value obtained by multiplying the displayed frequency by the setting value of <F702: Free unit multiplication factor> is displayed.

"Value displayed" = "Monitor-displayed" or "parameter-set frequency" x <F702>

■ **Parameters converted with <702: Free unit multiplication factor>**

**When <F703: Target of free unit> is "0"**

It applies to all the frequency.

- Frequency monitor display: Frequency command value, Output frequency, PID feedback value, Stator frequency, During stop: Frequency command value (During run: Output frequency)
- Frequency-related parameters: <FC>, <FH>, <UL>, <LL>, <FPId>, <Sr0> - <Sr7>, <F100>, <F101>, <F102>, <F190>, <F192>, <F194>, <F196>, <F198>, <F202>, <F204>, <F208>, <F211>, <F213>, <F217>, <F219>, <F223>, <F225>, <F229>, <F231>, <F235>, <F237>, <F240>, <F241>, <F242>, <F243>, <F244>, <F250>, <F260>, <F265>, <F267>, <F268>, <F270> - <F275>, <F287> - <F294>, <F321>, <F322>, <F330>, <F331>, <F346>, <F350>, <F352>, <F355>, <F364>, <F365>, <F367>, <F368>, <F370>, <F371>, <F374>, <F383>, <F391> - <F393>, <F426>, <F428>, <F431>, <F432>, <F466>, <F505>, <F513>, <F517>, <F606>, <F623>, <F624>, <F643>, <F649>, <F812>, <F814>, <F964> - <F979>



<A220>, <A222>, <A226>, <A227>, <A229>, <A230>, <A316>, <A317>, <A319>, <A320>, <A322>, <A323>, <A326>, <A327>, <A923> - <A927>  
<C154>, <C155>, <C697>

**When <F703: Target of free unit> is "1"**

It applies only to the PID control-related frequency.

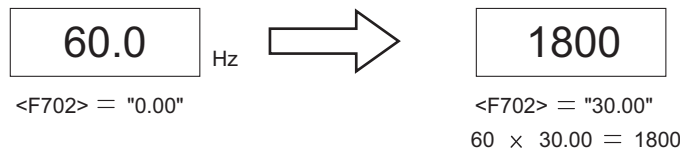
- PID control-related parameters: <FPId>, <F364>, <F365>, <F367>, <F368>, <F374>, <A316>, <A317>, <A319>, <A320>, <A326>, <A327>

<b>Memo</b>	<ul style="list-style-type: none"> <li>• Base frequency is always Hz. &lt;vL: Base frequency 1&gt;, &lt;F170: Base frequency 2&gt;, &lt;F174: Base frequency 3&gt;, &lt;F178: Base frequency 4&gt;</li> </ul>
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■ **Setting example of <F702: Free unit multiplicaton factor>**

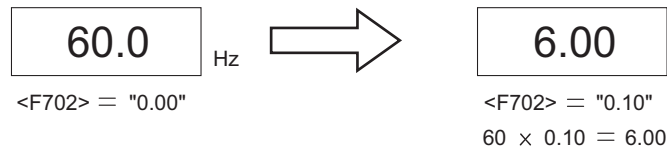
1) **Motor speed display**

When output frequency 60 Hz is displayed as 1800min<sup>-1</sup> at the time of 4-pole motor operation



2) **Load speed display**

When output frequency 60 Hz is displayed as conveyor speed of 6m/min



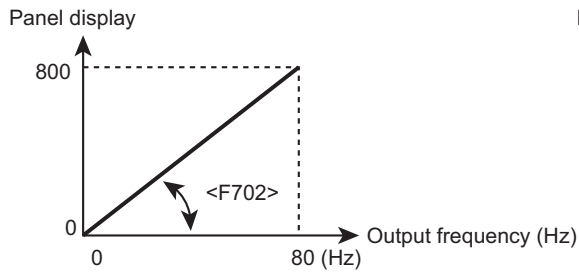
■ **Setting of <F705: Free unit inclination polarity> and <F706: Free unit bias>**

The inclination of the free unit can be changed, and the bias can be set.

The following are examples of setting and screen display (when <F702> = "10.0", <FH> = "80.0").

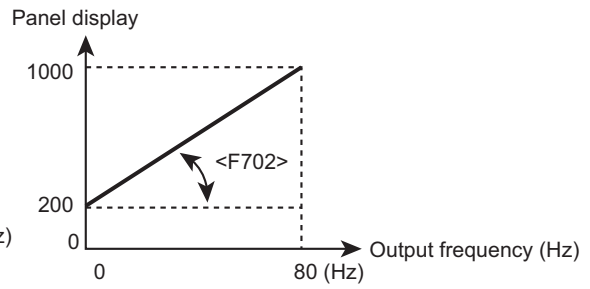
Positive inclination

<F705>="1", <F706>="0.00"



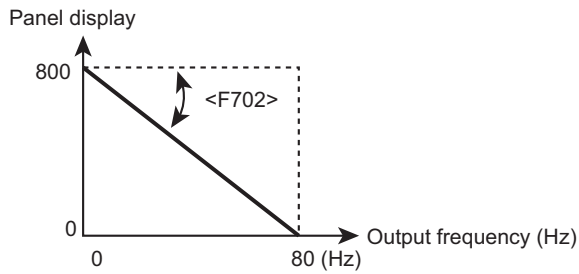
Positive inclination with bias

<F705>="1", <F706>="20.00"



Negative inclination

<F705>="0", <F706>="80.00"



5



Important

- This parameter is a function to display the output frequency of the inverter multiplied by the factor. It does not display the actual motor speed or line speed precisely.