Thank you for choosing this Mitsubishi Electric S-PM geared motor drive unit. This Instruction Manual (Basic) provides handling information and precautions for use of the equipment. Please forward this Instruction Manual (Basic) to the end user.

Contents

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To obtain the Instruction Manual (Applied)

Contact where you purchased the drive unit, your Mitsubishi Electric sales representative, or the nearest Mitsubishi Electric FA Center for the following manual:

- Instruction Manual (Applied) [IB(NA)-0600478ENG]

This manual is required if you are going to utilize functions and performance.

The PDF version of this manual is also available for download at "Mitsubishi Electric FA site", the Mitsubishi Electric FA network service on the world wide web (URL: www.MitsubishiElectric.co.jp/fa).
This Instruction Manual (Basic) provides handling information and precautions for use of the equipment. Please forward this Instruction Manual (Basic) to the end user.

### Electric Shock Prevention

**WARNING** Incorrect handling may cause hazardous conditions, resulting in death or severe injury.

- Do not touch the printed circuit board or handle the cables.
- Do not change the cooling fan while power is ON. It is dangerous to change the cooling fan while power is ON.
- Do not subject the cables to scratches, excessive stress, heavy loads or pinching. Otherwise you may get an electric shock.
- Do not change the cooling fan while power is ON. It is dangerous to change the cooling fan while power is ON.
- Do not touch the printed circuit board or handle the cables with wet hands. Otherwise you may get an electric shock.
- When measuring the main circuit capacitor capacity, the DC voltage is applied to the motor for 1s at powering OFF. Never touch the motor terminal, etc. right after powering OFF. To confirm that, LED indication of the operation panel must be checked. (It must be OFF.)
- Do not connect a resistor directly to the DC terminals P+/N+ and N/-.
- Be sure to perform daily and periodic inspections as specified in the Instruction Manual. Otherwise burst, damage, etc. may occur.
- While power is ON or for some time after power-OFF, do not touch the drive unit since the drive unit will be extremely hot. Doing so can cause burns.

**CAUTION** Incorrect handling may cause hazardous conditions, resulting in death or severe injury.

- The voltage applied to each terminal must be the ones specified in the Instruction Manual. Otherwise burst, damage, etc. may occur.
- The cables must be connected to the correct terminals. Otherwise burst, damage, etc. may occur.
- Polarity must be correct. Otherwise burst, damage, etc. may occur.
- While power is ON or for some time after power-OFF, do not touch the drive unit since the drive unit will be extremely hot. Doing so can cause burns.

---

2. Fire Prevention

**WARNING** Incorrect handling may cause hazardous conditions, resulting in death or severe injury.

- Before wiring or inspection, power must be switched OFF. To confirm that, LED indication of the operation panel must be checked. (It must be OFF.)
- Do not connect a resistor directly to the DC terminals P+/N+ and N/-. Doing so could cause a fire.
- Be sure to perform daily and periodic inspections as specified in the Instruction Manual. If a product is used without any inspection, a burst, breakage, or a fire may occur.

**CAUTION** Incorrect handling may cause hazardous conditions, resulting in death or severe injury.

- The drive unit must be installed on a nonflammable wall without holes (so that nobody touches the drive unit heatsink on the rear side, etc.). Mounting it to or near flammable material can cause a fire.
- If the drive unit has become faulty, the drive unit power must be switched OFF. A continuous flow of large current could cause a fire.
- When using a brake resistor, a sequence that will turn OFF power when a fault signal is output must be configured. Otherwise the brake resistor may overheat due to damage of the brake transistor and possibly cause a fire.
- Do not connect a resistor directly to the DC terminals P+/N+ and N/-. Doing so could cause a fire.
- Be sure to perform daily and periodic inspections as specified in the Instruction Manual. If a product is used without any inspection, a burst, breakage, or a fire may occur.

3. Injury Prevention

**WARNING** Incorrect handling may cause hazardous conditions, resulting in death or severe injury.

- While the drive unit power is ON, do not remove the front cover or the wiring cover. Do not run the drive unit with the front cover or the wiring cover removed. Otherwise you may access the exposed high voltage terminals or the charging part of the circuitry and get an electric shock.
- Even if power is OFF, do not remove the front cover except for wiring or periodic inspection. You may accidentally touch the charged drive unit circuits and get an electric shock.
- Before wiring or inspection, power must be switched OFF. To confirm that, LED indication of the operation panel must be checked. (It must be OFF.) Any person who is involved in wiring or inspection shall wait for at least 10 minutes after the power supply has been switched OFF and check that there are no residual voltage using a tester or the like. The capacitor is charged with high voltage for some time after power OFF, and it is dangerous.
- This drive unit must be earthed (grounded). Earthing (grounding) must conform to the requirements of national and local safety regulations and electrical code (IEC section 250, IEC 61140 class 1 and other applicable standards). A neutral-point earthed (grounded) power supply for 400V class drive unit in compliance with EN standard must be used.
- Any person who is involved in wiring or inspection of this equipment shall be fully competent to do the work.
- The drive unit must be installed before wiring. Otherwise you may get an electric shock or be injured.
- Setting dial and key operations must be performed with dry hands to prevent an electric shock. Otherwise you may get an electric shock.
- Do not subject the cables to scratches, excessive stress, heavy loads or pinching. Otherwise you may get an electric shock.
- Do not change the cooling fan while power is ON. It is dangerous to change the cooling fan while power is ON.
- Do not touch the printed circuit board or handle the cables with wet hands. Otherwise you may get an electric shock.
- When measuring the main circuit capacitor capacity, the DC voltage is applied to the motor for 1s at powering OFF. Never touch the motor terminal, etc. right after powering OFF to prevent an electric shock.
- A PM motor is a synchronous motor with embedded magnets. High-voltage is generated at motor terminals while the motor is running even after the drive unit power is turned OFF. Before wiring or inspection, the motor must be confirmed to be stopped. For applications where the motor is driven by the load, the low-voltage manual contactor, which is installed at the drive unit’s output side, must be opened before wiring or inspection. Otherwise you may get an electric shock.
4. Additional Instructions

Also the following points must be noted to prevent an accidental failure, injury, electric shock, etc.

(1) Transportation and Mounting

- **CAUTION**
  - The product must be transported in correct method that corresponds to the weight. Failure to do so may lead to injuries.
  - Do not stack the boxes containing drive units higher than the number recommended.
  - The product must be installed to the position where withstands the weight of the product according to the information in the Instruction Manual.
  - Do not install or operate the drive unit if it is damaged or has parts missing.
  - When carrying the drive unit, do not hold it by the front cover or setting dial; it may fall off or fail.
  - Do not stand or rest heavy objects on the product.
  - The drive unit mounting orientation must be correct.
  - Foreign conductive objects must be prevented from entering the drive unit. That includes screws and metal fragments or other flammable substance such as oil.
  - As the drive unit is a precision instrument, do not drop or subject it to impact.
  - The drive unit must be used under the following environment: Otherwise the drive unit may be damaged.

<table>
<thead>
<tr>
<th>Environment</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surrounding air temperature</td>
<td>-10°C to +50°C (non-freezing)</td>
</tr>
<tr>
<td>Ambient humidity</td>
<td>95%RH or less (non-condensing)</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>20°C to +45°C</td>
</tr>
<tr>
<td>Atmosphere</td>
<td>Mist free (free from corrosive gas, flammable gas, oil mist, dust and dirt)</td>
</tr>
<tr>
<td>Altitude/ inclination</td>
<td>Maximum 1000 m.</td>
</tr>
</tbody>
</table>

- Temperature applicable for a short time, e.g. in transit.
- If halogen-based materials (fluorine, chlorine, bromine, iodine, etc.) infiltrate into a Mitsubishi Electric product, the product will be damaged. Halogen-based materials are often included in fumigant, which is used to sterilize or disinfect wooden packages. When packaging, prevent residual fumigant coming from being infiltrated into Mitsubishi Electric products, or use an alternative sterilization or disinfection method (heat disinfection, etc.) for packaging. Sterilization of disinfection of wooden package should also be performed before packaging the product.

(2) Wiring

- **CAUTION**
  - Do not install a power factor correction capacitor or surge suppressor/capacitor type filter on the drive unit output side. These devices on the drive unit output side may be overheated or burn out.
  - The connection orientation of the output cables U, V, W to the motor affects the rotation direction of the motor.
  - PM motor terminals (U, V, W) hold high-voltage while the PM motor is running even after the power is turned OFF. Before wiring, the PM motor must be confirmed to be stopped. Otherwise you may get an electric shock.
  - Never connect a PM motor to the commercial power supply. Applying the commercial power supply to input terminals (U, V, W) of a PM motor will burn the PM motor. The PM motor must be connected with the output terminals (U, V, W) of the drive unit.
  - If halogen-based materials (fluorine, chlorine, bromine, iodine, etc.) infiltrate into a Mitsubishi Electric product, the product will be damaged. Halogen-based materials are often included in fumigant, which is used to sterilize or disinfect wooden packages. When packaging, prevent residual fumigant coming from being infiltrated into Mitsubishi Electric products, or use an alternative sterilization or disinfection method (heat disinfection, etc.) for packaging. Sterilization of disinfection of wooden package should also be performed before packaging the product.

(3) Trial run

- **CAUTION**
  - Before starting operation, each parameter must be confirmed and adjusted. A failure to do so may cause some machines to make unexpected motions.

(4) Usage

- **CAUTION**
  - A PM motor and the drive unit must be used in the specified capacity combination.
  - Do not use multiple PM motors with one drive unit.
  - Any person must stay away from the equipment when the retry function is set as it will restart suddenly after trip.
  - Since pressing the STOP/RESET key may not stop output depending on the function setting status, separate circuit and switch that make an emergency stop (power OFF, mechanical brake operation for emergency stop, etc.) must be provided.
  - OFF status of the start signal must be confirmed before resetting the drive unit fault. Resetting drive unit alarm with the start signal ON restarts the motor suddenly.
  - Do not use a PM motor in an application where a motor is driven by its load and runs at a speed higher than the maximum motor speed.
  - According to the motor to be connected, perform PM parameter initialization. Incorrect initial setting of parameters may damage the motor.
  - The parameters for motor operation are initially set for an S-PM geared motor.
  - When other PM motors are used, set parameters according to the motor.
  - Do not use the drive unit for a load other than the PM motor.
  - Connection of any other electrical equipment to the drive unit output may damage the equipment.
  - Do not modify the equipment.
  - Do not perform parts removal which is not instructed in this manual. Doing so may lead to fault or damage of the product.

- **CAUTION**
  - The electronic thermal relay function does not guarantee protection of the motor from overheating. It is recommended to install an external thermal for overheat protection.
  - Do not use magnetic contactor on the drive unit input for frequent starting/stopping of the drive unit. Otherwise, the life of the drive unit decreases.
  - The effect of electromagnetic interference must be reduced by using an EMC filter or by other means. Otherwise nearby electronic equipment may be affected.
  - Appropriate measures must be taken to suppress harmonics. Otherwise power supply harmonics from the drive unit may heatdamage the power factor correction capacitor and generator.
  - When parameter clear or parameter clear is performed, the required parameters must be set again before starting operations because all parameters return to the initial value.
  - The drive unit can be easily set for high-speed operation. Before changing its setting, the performances of the motor and machine must be fully examined.
  - Stop status cannot be hold by the drive unit's brake function. In addition to the drive unit's brake function, a holding device must be installed to ensure safety.
  - Before running a drive unit which had been stored for a long period, inspection and test operation must be performed.
  - Static electricity in your body must be discharged before you touch the product. Otherwise the product may be damaged.
  - In the system with a PM motor, the drive unit power must be turned ON before closing the contacts of the controller at the output side.
  - If you are installing the drive unit to drive a three-phase device while you are contracted for lighting and power service, consult your electric power supplier.
(5) Emergency stop

**CAUTION**

- A safety backup such as an emergency brake must be provided for devices or equipment in a system to prevent hazardous conditions in case of failure of the drive unit or an external device controlling the drive unit.
- When the breaker on the drive unit input side trips, the wiring must be checked for fault (short circuit), and internal parts of the drive unit for a damage, etc. The cause of the trip must be identified and removed before turning ON the power of the breaker.
- When any protective function is activated, appropriate corrective action must be taken, and the drive unit must be reset before resuming operation.

(6) Maintenance, inspection and parts replacement

**CAUTION**

- Do not carry out a megger (insulation resistance) test on the control circuit of the drive unit. It will cause a failure.

(7) Disposal

**CAUTION**

- The drive unit must be treated as industrial waste.

General instruction

Many of the diagrams and drawings in this Instruction Manual (Basic) show the drive unit without a cover or partially open for explanation. Never operate the drive unit in this manner. The cover must be always reinstalled and the instruction in this Instruction Manual (Basic) must be followed when operating the drive unit.

For more details on a PM motor, refer to the Instruction Manual of the PM motor.

---

Abbreviation

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PU</td>
<td>Operation panel and parameter unit (FR-PU07)</td>
</tr>
<tr>
<td>Drive unit</td>
<td>The FR-D700-G series drive unit for Mitsubishi Electric S-PM geared motor</td>
</tr>
<tr>
<td>FR-D700-G</td>
<td>The FR-D700-G series drive unit for Mitsubishi Electric S-PM geared motor</td>
</tr>
<tr>
<td>Pr</td>
<td>Parameter number (Number assigned to function)</td>
</tr>
<tr>
<td>PU operation</td>
<td>Operation using the PU (operation panel/FR-PU07)</td>
</tr>
<tr>
<td>External operation</td>
<td>Operation using the control circuit signals</td>
</tr>
<tr>
<td>Combined operation</td>
<td>Operation using both the PU (operation panel/FR-PU07) and External operation</td>
</tr>
<tr>
<td>PM motor</td>
<td>Permanent magnet motor: an IPM motor, an SPM motor, or the Mitsubishi Electric GV series S-PM geared motor</td>
</tr>
</tbody>
</table>

Trademark

- Company and product names herein are the trademarks and registered trademarks of their respective owners.

Mark

- REMARKS: Additional helpful contents and relations with other functions are stated.
- NOTE: Contents requiring caution or cases when set functions are not activated are stated.
- POINT: Useful contents and points are stated.

Notes on descriptions in this Instruction Manual

- Connection diagrams in this Instruction Manual appear with the control logic of the input terminals as sink logic, unless otherwise specified. (For the control logic, refer to page 1.)
- Refer to the Instruction Manual (Applied) for further information on the following points.
  - Removal and reinstallation of the cover
  - Connection of stand-alone option unit
  - EMC and leakage currents
  - Detailed explanation on parameters
  - Troubleshooting
  - Check first when you have a trouble
  - Inspection items (life diagnosis, cooling fan replacement)
  - Measurement of main circuit voltages, currents and powers

Harmonic suppression guideline (when drive units are used in Japan)

All models of drive units used by specific consumers are covered by "The Harmonic Suppression Guideline for Consumers Who Receive High Voltage or Special High Voltage". (For further details, refer to Chapter 3 of the Instruction Manual (Applied).)
1 OUTLINE

1.1 Product checking and parts identification

Unpack the drive unit and check the capacity plate on the front cover and the rating plate on the drive unit side face to ensure that the product agrees with your order and the drive unit is intact.

Drive unit model

```
FR - D720 - 1.5 K - G
```

- **Symbol**
  - Voltage class
    - D720: Three-phase 200V class
    - D740: Three-phase 400V class

- **Capacity plate**
  - Drive unit model: FR-D720-1.5K-G
  - Serial number: XXXXXXX

- **Rating plate**
  - Drive unit model
  - Input rating
  - Output rating
  - Serial number
  - Country of origin

- **Cooling fan**
  - The cooling fan is removable.

- **Operation panel**
  - (Refer to page 2.)

- **Voltage/current input switch**
  - (Refer to page 9.)

- **PU connector**
  - (Refer to page 9.)

- **Cooling fan**
  - The cooling fan is removable.

- **Accessory**
  - Fan cover fixing screws (M3 × 35mm): D720-0.2K to 0.75K-G, D740-0.4K-G, 0.75K-G
  - D720-1.5K to 3.7K-G: 1

These screws are necessary for compliance with the EU Directive. (Refer to page 46.)

REMARKS

- For how to find the SERIAL number, refer to page 50.
- Caution stickers are enclosed with this instruction manual. These caution stickers include stickers that are used for the automatic restart after instantaneous power failure function, which are not required for FR-D700-G.
1.2 Operation panel

1.2.1 Names and functions of the operation panel

The operation panel cannot be removed from the drive unit.

### Component Diagram

- **(a) Unit indicator**
  - **Hz**: Lit to indicate frequency. (Blinks when the set frequency monitor is displayed.)
  - **A**: Lit to indicate current.
  - (Both “Hz” and “A” are lit to indicate a value other than frequency or current.)

- **(b) Monitor (4-digit LED)**
  - Shows the speed, parameter number, etc.
  - (To monitor the output power, the set speed and other items, set Pr. 52.)

- **(c) Setting dial**
  - The dial of the Mitsubishi Electric drive unit. The setting dial is used to change the speed and parameter settings.
  - Press to display the following:
    - The control method (PM motor control) during the monitor mode is displayed.
    - The set speed is displayed by pressing the setting dial for 1 second or longer when the drive unit is in the PU operation mode or External/PU combined operation mode (Pr. 79 = “3”).
    - Present set value is displayed during calibration
    - Displays the order in the fault history mode

- **(d) Start command**
  - Select the rotation direction in Pr. 40.

- **(e) MODE key**
  - Used to switch among different setting modes.
  - Pressing simultaneously changes the operation mode.
  - Holding this key for 2 seconds locks the operation. The key lock is invalid when Pr. 161 = “0” (initial setting). Refer to the Instruction Manual (Applied).

- **(f) SET key**
  - Used to enter a setting.
  - If pressed during the operation, monitored item changes as the following:

- **(g) Operation status indicator**
  - Lit or blinks during drive unit operation.
  - **Lit**: When the forward rotation operation is being performed.
  - Slow blinking (1.4s cycle): When the reverse rotation operation is being performed.
  - Fast blinking (0.2s cycle): When the MRS signal is being input.

- **(h) Parameter setting mode indicator**
  - Lit to indicate the parameter setting mode.

- **(i) Monitor indicator**
  - Lit to indicate the monitor mode.

- **(j) Operation mode indicator**
  - **PU**: Lit to indicate the PU operation mode.
  - **EXT**: Lit to indicate the External operation mode (EXT is lit at power-ON in the initial setting.)
  - **NET**: Lit to indicate the Network operation mode.
  - PU and EXT Lit to indicate EXT/PU combined operation mode 1 and 2
  - All of these indicators are OFF when the command source is not at the operation panel.

- **(k) STOP/RESET key**
  - Used to stop operation commands.
  - Used to reset a fault when the protective function (fault) is activated.

- **(l) PU/EXT key**
  - Used to switch between the PU and External operation modes.
  - To use the External operation mode (operation using a separately connected speed setting potentiometer and start signal), press this key to light up the EXT indicator.
  - (Press simultaneously (0.5s), or change the Pr. 79 setting to change to the combined operation mode. Refer to the Instruction Manual (Applied).)
  - PU: PU operation mode
  - EXT: External operation mode
  - Used to cancel the PU stop also.
## Operation panel

### 1.2.2 Basic operation (factory setting)

#### Operation mode switchover

At powering ON (External operation mode)

- **At powering ON**
- **PU Jog operation mode**

#### Mode/speed setting

- **PU operation mode** (Rotation speed monitor)
- **Parameter setting mode**
  - **PU Jog operation mode**
  - **Output current monitor**
  - **Output voltage monitor**

#### Parameter setting

- **Parameter setting mode** (Refer to page 4)
  - **Display the present setting**
  - **Parameter write is completed!!**
  - **Parameter and setting value appear alternately.**

#### Fault history

- **Fault history**
  - **Initial value change list**
  - **PM parameter initialization**
  - **Automatic parameter setting**

---

**Operation for displaying fault history** (Refer to Chapter 4 of the Instruction manual (Applied).)

The past eight faults can be displayed.

- (The latest fault is ended by "\."
- While a fault is displayed:
  - The display shifts as follows by pressing \( \text{SET} \): Rotation speed at the fault → Output current → Output voltage → Energization time.
  - (After Energization time, it goes back to a fault display)

- Pressing the setting dial shows the fault history number.
1.2.3 Changing the parameter setting value

Changing example: Change the Pr. 1 Maximum setting.

**Operation**

1. **Screen at power-ON**
   - The monitor display appears.

2. **Changing the operation mode**
   - Press \( \text{PU} \) to choose the PU operation mode. [PU] indicator is lit.

3. **Parameter setting mode**
   - Press \( \text{Pr} \) to choose the parameter setting mode.

4. **Selecting the parameter number**
   - Turn \( \text{Pr} \) until \( \text{Pr. 1} \) appears.

5. **Reading the set value**
   - Press \( \text{Pr} \) to read the present set value.
   - \( 3000 \text{ rpm} \) (initial value) appears.

6. **Changing the setting value**
   - Turn \( \text{Pr} \) to change the set value to \( 1800 \text{ rpm} \).

7. **Setting the parameter**
   - Press \( \text{Pr} \) to set.
   - The parameter number and the setting value are displayed alternately.

**Remarks**

- Set "1" in Pr. CL Parameter clear, ALLC all parameter clear to initialize all parameters. (Parameters are not cleared when "1" is set in Pr. 77 Parameter write selection.) Refer to the extended parameter list of the Instruction Manual (Applied) for parameters cleared with this operation.

1.2.4 Parameter clear/all parameter clear

**Point**

- Refer to the extended parameter list of the Instruction Manual (Applied) for parameters cleared with this operation.

**Operation**

1. **Screen at power-ON**
   - The monitor display appears.

2. **Changing the operation mode**
   - Press \( \text{PU} \) to choose the PU operation mode. [PU] indicator is lit.

3. **Parameter setting mode**
   - Press \( \text{Pr} \) to choose the parameter setting mode.

4. **Selecting Parameter Clear (All Parameter Clear)**
   - Turn \( \text{Pr} \) until \( \text{Pr. CL} \) (ALLC) appears.

5. **Selecting the setting value**
   - Press \( \text{Pr} \) to read the present set value.
   - \( 0 \) (initial value) appears.
   - Turn \( \text{Pr} \) to change it to the set value "1".

6. **Executing Parameter Clear**
   - Press \( \text{Pr} \) to set.
   - "1" and Pr. CL (ALLC) indications are displayed alternately.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Clear is not executed.</td>
</tr>
<tr>
<td>1</td>
<td>Sets parameters back to the initial values. (Parameter clear sets back all parameters except calibration parameters and terminal function selection parameters to the initial values.) Refer to the extended parameter list of the Instruction Manual (Applied) for availability of parameter clear and all parameter clear.</td>
</tr>
</tbody>
</table>
2 INSTALLATION AND WIRING

AC power supply
Use within the permissible power supply specifications of the drive unit. To ensure safety, use a molded case circuit breaker or earth leakage circuit breaker (ELB), fuse. The breaker must be selected carefully since an inrush current flows in the drive unit at power on. (Refer to page 6.)

Magnetic contactor (MC)
Install the magnetic contactor to ensure safety. Do not use this magnetic contactor to start and stop the drive unit. Doing so will cause the drive unit life to be shortened. (Refer to page 6.)

Reactor (FR-HAL, FR-HEL option)
Reactors (option) must be used when power harmonics measures are taken, the power factor is to be improved or the drive unit is installed near a large power supply system (500kVA or more). The drive unit may be damaged if you do not use reactors. Select the reactor according to the model. Remove the jumpers across terminals P/+ and P1 to connect the DC reactor.

Noise filter (ferrite core) (FR-BSF01, FR-BLF)
Install a noise filter (ferrite core) to reduce the electromagnetic noise generated from the drive unit. Effective in the range from about 1MHz to 10MHz. A wire should be wound four turns or more.

Filterpack (FR-BFP2), which contains DC reactor and noise filter in one package, is also available.

Motor Earth
Drive unit
(R-FR-D700-G)

RS-232C - RS-485 converter is required when connecting to PC with RS-232C interface. (Refer to page 41.)

Contactor Example: No-fuse switch (DSN type)
Install a contactor in an application where the PM motor is driven by the load even at power-OFF of the drive unit. Do not open or close the contactor while the drive unit is running (outputting).

Brake resistor (FR-ABR, MRS type, MYS type)
Braking capability can be improved. (0.4K or higher)

Brake unit (FR-BU2)
Reduces the radio noise.

Resistor unit (FR-BR)
Discharging resistor (GZG, GRZG)

RS-485(RS-232C) Converter

Devices connected to the output
Do not install a power factor correction capacitor, surge suppressor or noise filter (capacitor) on the output side of the drive unit. When installing a molded case circuit breaker on the output side of the drive unit, contact each manufacturer for selection of the molded case circuit breaker.

Earth (Ground)
To prevent an electric shock, always earth (ground) the motor and drive unit. For reduction of induction noise from the power line of the drive unit, it is recommended to use the earth (ground) cable by returning it to the earth (ground) terminal of the drive unit.

: Install this as required.
2.1 Peripheral devices

Check the drive unit model of the drive unit you purchased. Appropriate peripheral devices must be selected according to the capacity. Refer to the following list and prepare appropriate peripheral devices.

(1) S-PM geared motor

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Applicable Drive Unit Model</th>
<th>Motor Output (kW)</th>
<th>Molded Case Circuit Breaker (MCCB) or Earth Leakage Circuit Breaker (ELB)</th>
<th>Input Side Magnetic Contactor*3</th>
<th>Reactor</th>
</tr>
</thead>
<tbody>
<tr>
<td>200V</td>
<td>FR-D720-0.2K-G</td>
<td>0.1</td>
<td>5A S-T10 S-T10</td>
<td>Without With With With</td>
<td>FR-HAL</td>
</tr>
<tr>
<td></td>
<td>FR-D720-0.4K-G</td>
<td>0.2</td>
<td>5A S-T10 S-T10</td>
<td>Without With With With</td>
<td>FR-HAL</td>
</tr>
<tr>
<td></td>
<td>FR-D720-0.75K-G</td>
<td>0.4</td>
<td>10A S-T10 S-T10</td>
<td>Without With With With</td>
<td>FR-HAL</td>
</tr>
<tr>
<td></td>
<td>FR-D720-1.5K-G</td>
<td>0.75</td>
<td>15A S-T10 S-T10</td>
<td>Without With With With</td>
<td>FR-HAL</td>
</tr>
<tr>
<td></td>
<td>FR-D720-2.2K-G</td>
<td>1.5</td>
<td>20A S-T10 S-T10</td>
<td>Without With With With</td>
<td>FR-HAL</td>
</tr>
<tr>
<td></td>
<td>FR-D720-3.7K-G</td>
<td>2.2</td>
<td>30A S-T10 S-T10</td>
<td>Without With With With</td>
<td>FR-HAL</td>
</tr>
<tr>
<td>400V</td>
<td>FR-D740-0.4K-G</td>
<td>0.2</td>
<td>5A S-T10 S-T10</td>
<td>Without With With With</td>
<td>FR-HAL</td>
</tr>
<tr>
<td></td>
<td>FR-D740-0.75K-G</td>
<td>0.4</td>
<td>10A S-T10 S-T10</td>
<td>Without With With With</td>
<td>FR-HAL</td>
</tr>
<tr>
<td></td>
<td>FR-D740-1.5K-G</td>
<td>0.75</td>
<td>15A S-T10 S-T10</td>
<td>Without With With With</td>
<td>FR-HAL</td>
</tr>
<tr>
<td></td>
<td>FR-D740-2.2K-G</td>
<td>1.5</td>
<td>20A S-T10 S-T10</td>
<td>Without With With With</td>
<td>FR-HAL</td>
</tr>
<tr>
<td></td>
<td>FR-D740-3.7K-G</td>
<td>2.2</td>
<td>30A S-T10 S-T10</td>
<td>Without With With With</td>
<td>FR-HAL</td>
</tr>
</tbody>
</table>

*1 Select an MCCB according to the power supply capacity. 
*2 For the use in the United States or Canada, refer to page 9, and select an appropriate fuse or molded case circuit breaker (MCCB).
*3 Magnetic contactor is selected based on the AC-1 class. The electrical durability of magnetic contactor is 500,000 times. When the magnetic contactor is used for emergency stop during motor driving, the electrical durability is 25 times.
*4 If using an MC for emergency stop during motor driving, select an MC regarding the drive unit input side current as JEM1038-AC-3 class rated current.

NOTE
- The life of the drive unit is influenced by surrounding air temperature. Pay attention to the surrounding air temperature. This must be noted especially when the drive unit is installed in an enclosure. (Refer to Chapter 1 of the Instruction Manual (Applied).)
- Wrong wiring might lead to damage of the drive unit. The control signal lines must be kept fully away from the main circuit to protect them from noise. (Refer to page 9.)
- Do not install a power factor correction capacitor, surge suppressor or noise filter (capacitor) on the drive unit output side. This will cause the drive unit to trip or the capacitor and surge suppressor to be damaged. If any of the above devices are connected, immediately remove them.
- Electromagnetic wave interference
  The input/output (main circuit) of the drive unit includes high frequency components, which may interfere with the communication devices (such as AM radios) used near the drive unit. In this case, install the FR-BIF optional noise filter (capacitor) for use in the input side only or FR-BSP01 or FR-BLF noise filter (ferrite core) to minimize interference. (Refer to Chapter 3 of the Instruction Manual (Applied).)
- Refer to the Instruction Manual of each option and peripheral devices for details of peripheral devices.
- A PM motor cannot be driven by the commercial power supply.
- A PM motor is a magnet motor. High-voltage is generated at motor terminals while the motor is running even after the drive unit power is turned OFF. Before closing the contactor on the output side, make sure that the drive unit power is ON and the motor is stopped.

Voltage

Applicable Drive Unit Model

Motor Output (kW)

Molded Case Circuit Breaker (MCCB) or Earth Leakage Circuit Breaker (ELB)

Input Side Magnetic Contactor*3

Reactor

Power factor improving (AC or DC) reactor connection

Power factor improving (AC or DC) reactor connection

FR-HAL

FR-HEL
### Peripheral devices

#### (2) Other PM motor (IPM or SPM)

- **Select an MCCB according to the power supply capacity.**
- **Install one MCCB per drive unit.**
- **For the use in the United States or Canada, refer to page 49, and select an appropriate fuse or molded case circuit breaker (MCCB).**
- **Magnetic contactor is selected based on the AC-1 class. The electrical durability of magnetic contactor is 500,000 times. When the magnetic contactor is used for emergency stop during motor driving, the electrical durability is 25 times.**
- **If using an MC for emergency stop during motor driving, select an MC regarding the drive unit input side current as JEM1038-AC-3 class rated current.**
- **The power factor may be slightly lower.**

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Applicable Drive Unit Model</th>
<th>Motor Output (kW)</th>
<th>Molded Case Circuit Breaker (MCCB)&lt;sup&gt;1&lt;/sup&gt; or Earth Leakage Circuit Breaker (ELB)&lt;sup&gt;2&lt;/sup&gt; (NF or NV type)</th>
<th>Input Side Magnetic Contactor&lt;sup&gt;3&lt;/sup&gt;</th>
<th>Reactor</th>
</tr>
</thead>
<tbody>
<tr>
<td>200V class</td>
<td>FR-D720-0.2K-G</td>
<td>0.2</td>
<td>5A</td>
<td>5A</td>
<td>S-T10</td>
</tr>
<tr>
<td></td>
<td>FR-D720-0.4K-G</td>
<td>0.4</td>
<td>5A</td>
<td>5A</td>
<td>S-T10</td>
</tr>
<tr>
<td></td>
<td>FR-D720-0.75K-G</td>
<td>0.75</td>
<td>10A</td>
<td>5A</td>
<td>S-T10</td>
</tr>
<tr>
<td></td>
<td>FR-D720-1.5K-G</td>
<td>1.5</td>
<td>15A</td>
<td>10A</td>
<td>S-T10</td>
</tr>
<tr>
<td></td>
<td>FR-D720-2.2K-G</td>
<td>2.2</td>
<td>20A</td>
<td>15A</td>
<td>S-T10</td>
</tr>
<tr>
<td></td>
<td>FR-D720-3.7K-G</td>
<td>3.7</td>
<td>30A</td>
<td>30A</td>
<td>S-T21</td>
</tr>
<tr>
<td>400V class</td>
<td>FR-D740-0.4K-G</td>
<td>0.4</td>
<td>5A</td>
<td>5A</td>
<td>S-T10</td>
</tr>
<tr>
<td></td>
<td>FR-D740-0.75K-G</td>
<td>0.75</td>
<td>5A</td>
<td>5A</td>
<td>S-T10</td>
</tr>
<tr>
<td></td>
<td>FR-D740-1.5K-G</td>
<td>1.5</td>
<td>10A</td>
<td>10A</td>
<td>S-T10</td>
</tr>
<tr>
<td></td>
<td>FR-D740-2.2K-G</td>
<td>2.2</td>
<td>15A</td>
<td>10A</td>
<td>S-T10</td>
</tr>
<tr>
<td></td>
<td>FR-D740-3.7K-G</td>
<td>3.7</td>
<td>20A</td>
<td>15A</td>
<td>S-T10</td>
</tr>
</tbody>
</table>

---

**NOTE**

- Select a MCCB and a magnetic contactor according to the drive unit model, and cable and reactor according to the motor output.
- When the breaker on the drive unit input side trips, check for the wiring fault (short circuit), damage to internal parts of the drive unit, etc. Identify the cause of the trip, then remove the cause and power ON the breaker.

---

<sup>1</sup> Select an MCCB according to the power supply capacity.
<sup>2</sup> Install one MCCB per drive unit.
<sup>3</sup> Magnetic contactor is selected based on the AC-1 class. The electrical durability of magnetic contactor is 500,000 times. When the magnetic contactor is used for emergency stop during motor driving, the electrical durability is 25 times.
<sup>4</sup> If using an MC for emergency stop during motor driving, select an MC regarding the drive unit input side current as JEM1038-AC-3 class rated current.
<sup>5</sup> The power factor may be slightly lower.
2.2 Installation of the drive units and precautions

(1) Installation of the drive unit
Enclosure surface mounting
Remove the front cover and wiring cover to mount the drive unit to the surface. (Remove the covers in the directions of the arrows.)

- FR-D720-0.2K to 0.75K-G
- FR-D720-1.5K to 3.7K-G
- FR-D740-0.4K to 3.7K-G

![Diagram showing installation](image)

**NOTE**
- When encasing multiple drive units, install them in parallel as a cooling measure.
- Install the drive unit vertically.
- For heat dissipation and maintenance, allow minimum clearance shown in the figures below from the drive unit to the other devices and to the inner surface of the enclosure.

```
Measurement position

-10°C to +50°C (non-freezing)

* When using the drive units at the surrounding air temperature of 40°C or less, the drive units can be installed without any clearance between them (0cm clearance).
```

![Clearance measurement](image)

(2) Environment
Before installation, check that the environment meets the specifications on page 42.

**Note**
- Install the drive unit on a strong surface securely and vertically with bolts.
- Leave enough clearances and take cooling measures.
- Avoid places where the drive unit is subjected to direct sunlight, high temperature and high humidity.
- Install the drive unit on a nonflammable wall surface.
- When designing or building an enclosure for the drive unit, carefully consider influencing factors such as heat generation of the contained devices and the operating environment.
2.3 Wiring

2.3.1 Terminal connection diagram

**NOTE**
- To prevent a malfunction caused by noise, separate the signal cables more than 10cm from the power cables. Also separate the main circuit wire of the input side and the output side.
- After wiring, wire offcuts must not be left in the drive unit. Wire offcuts can cause an alarm, failure or malfunction. Always keep the drive unit clean. When drilling mounting holes in an enclosure etc., take caution not to allow chips and other foreign matter to enter the drive unit.
### 2.3.2 Terminal specifications

<table>
<thead>
<tr>
<th>Type</th>
<th>Terminal Symbol</th>
<th>Terminal Name</th>
<th>Terminal Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main circuit terminal</td>
<td>R/L1, S/L2, T/L3</td>
<td>AC power input</td>
<td>Connect to the commercial power supply. Do not connect anything to these terminals when using the high power factor converter (FR-HC2) or power regeneration common converter (FR-CV).</td>
</tr>
<tr>
<td></td>
<td>U, V, W</td>
<td>Drive unit output</td>
<td>Connect a PM motor.</td>
</tr>
<tr>
<td></td>
<td>P+ , PR</td>
<td>Brake resistor connection</td>
<td>Connect a brake resistor (FR-ABR, MRS type, MYS type) across terminals P+ and PR. (The brake resistor can not be connected to the 0.2K.)</td>
</tr>
<tr>
<td></td>
<td>P+, P-</td>
<td>Brake unit connection</td>
<td>Connect the brake unit (FR-BU2) power regeneration common converter (FR-CV) or high power factor converter (FR-HC2).</td>
</tr>
<tr>
<td></td>
<td>Earth (Ground)</td>
<td>For earthing (grounding) the drive unit chassis. Must be earthed (grounded).</td>
<td></td>
</tr>
<tr>
<td>Multi-circuit terminal</td>
<td>STF</td>
<td>Forward rotation start</td>
<td>Turn ON the STF signal to start forward rotation and turn it OFF to stop. When the STF and STR signals are turned ON simultaneously, the stop command is given.</td>
</tr>
<tr>
<td></td>
<td>STR</td>
<td>Reverse rotation start</td>
<td>Turn ON the STR signal to start reverse rotation and turn it OFF to stop.</td>
</tr>
<tr>
<td></td>
<td>RH, RM, RL</td>
<td>Multi-speed selection</td>
<td>Multi-speed can be selected according to the combination of RH, RM and RL signals.</td>
</tr>
<tr>
<td>Contact input</td>
<td>SD</td>
<td>Contact input common (sink) (initial setting)</td>
<td>Common terminal for contact input terminal (sink logic) and terminal FM.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>External transistor common (source)</td>
<td>Connect this terminal to the power supply common terminal of a transistor output (open collector output) device, such as a programmable controller, in the source logic to avoid malfunction by undesirable current.</td>
</tr>
<tr>
<td></td>
<td>PC</td>
<td>24VDC power supply common</td>
<td>Connect this terminal to the power supply common terminal of a transistor output (open collector output) device, such as a programmable controller, in the sink logic to avoid malfunction by undesirable current.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Contact input common (source)</td>
<td>Connect this terminal to the power supply common terminal of a transistor output (open collector output) device, such as a programmable controller, in the sink logic to avoid malfunction by undesirable current.</td>
</tr>
<tr>
<td>Contact output</td>
<td>10</td>
<td>Speed setting power supply</td>
<td>Used as power supply when connecting potentiometer for speed setting (speed setting) from outside of the drive unit.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>Speed setting (voltage)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>Speed setting (current)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>Speed setting common</td>
</tr>
<tr>
<td>Speed setting</td>
<td></td>
<td></td>
<td>24VDC permissible load current 10mA.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Input resistance 10kΩ ±1kΩ</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Permissible maximum voltage 20VDC</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Current input: Input resistance 24kΩ ±5Ω Maximum permissible current 30mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Voltage input: Input resistance 10kΩ ±1kΩ Permissible maximum voltage 20VDC</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Input voltage: 24VDC ±2% (or 0 to 5V, 0 to 10V)</td>
</tr>
<tr>
<td>Control output</td>
<td>A, B, C</td>
<td>Relay output (fault output)</td>
<td>Changeover contact output indicates that the drive unit’s protective function has activated and the output stopped. Fault discontinuity across B-C (continuity across A-C). Normal: continuity across B-C (discontinuity across A-C)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RUN</td>
<td>Drive unit running</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SE</td>
<td>Open collector output common</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FM</td>
<td>For meter</td>
</tr>
</tbody>
</table>

**R/L1, S/L2, T/L3**
- Symbol: AC power input
- Terminal Name: Connect to the commercial power supply.
- Terminal Specification: Do not connect anything to these terminals when using the high power factor converter (FR-HC2) or power regeneration common converter (FR-CV).

**U, V, W**
- Symbol: Drive unit output
- Terminal Name: Connect a PM motor.

**P+ , PR**
- Symbol: Brake resistor connection
- Terminal Name: Connect a brake resistor (FR-ABR, MRS type, MYS type) across terminals P+ and PR.
- Terminal Specification: The brake resistor can not be connected to the 0.2K.

**P+, P-**
- Symbol: Brake unit connection
- Terminal Name: Connect the brake unit (FR-BU2) power regeneration common converter (FR-CV) or high power factor converter (FR-HC2).

**Earth (Ground)**
- Terminal Name: For earthing (grounding) the drive unit chassis.
- Terminal Specification: Must be earthed (grounded).

**STF**
- Symbol: Forward rotation start
- Terminal Name: Turn ON the STF signal to start forward rotation and turn it OFF to stop.
- Terminal Specification: When the STF and STR signals are turned ON simultaneously, the stop command is given.

**STR**
- Symbol: Reverse rotation start
- Terminal Name: Turn ON the STR signal to start reverse rotation and turn it OFF to stop.

**RH, RM, RL**
- Symbol: Multi-speed selection
- Terminal Name: Multi-speed can be selected according to the combination of RH, RM and RL signals.

**SD**
- Symbol: Contact input common (sink) (initial setting)
- Terminal Name: Common terminal for contact input terminal (sink logic) and terminal FM.

**External transistor common (source)**
- Terminal Name: Connect this terminal to the power supply common terminal of a transistor output (open collector output) device, such as a programmable controller, in the source logic to avoid malfunction by undesirable current.

**PC**
- Symbol: 24VDC power supply common
- Terminal Name: Common terminal for contact input terminal (source logic).

**External transistor common (sink) (initial setting)**
- Terminal Name: Connect this terminal to the power supply common terminal of a transistor output (open collector output) device, such as a programmable controller, in the sink logic to avoid malfunction by undesirable current.

**Contact input common (source)**
- Terminal Name: Common terminal for contact input terminal (source logic).

**24VDC power supply**
- Terminal Name: Can be used as 24VDC 0.1A power supply.

**10**
- Symbol: Speed setting power supply
- Terminal Name: Used as power supply when connecting potentiometer for speed setting (speed setting) from outside of the drive unit.

**2**
- Symbol: Speed setting (voltage)
- Terminal Name: Inputting 0 to 5VDC (or 0 to 10V) provides the maximum rotation speed at 5V (10V) and makes input and output proportional. Use Pr. 71 to switch between input 0 to 5VDC (initial setting) and 0 to 10VDC.

**4**
- Symbol: Speed setting (current)
- Terminal Name: Inputting 4 to 20mADC (or 0 to 5V, 0 to 10V) provides the maximum rotation speed at 20mA and makes input and output proportional. This input signal is valid only when the AU signal is ON (terminal 2 input is invalid). To use terminal 4 (initial setting is current input), set “4” in any of Pr. 178 to Pr.182 (input terminal function selection) to assign the function, and turn ON AU signal. Use Pr. 267 to switch among input 4 to 20mA (initial setting), 0 to 5VDC and 0 to 10VDC. Set the voltage/current input switch in the “V” position to select voltage input (0 to 5V/0 to 10V).

**5**
- Symbol: Speed setting common
- Terminal Name: Used as 24VDC 0.1A power supply.

**Speed setting**
- Terminal Name: 24VDC permissible load current 10mA.
- Terminal Specification: Input resistance 10kΩ ±1kΩ
- Terminal Specification: Permissible maximum voltage 20VDC
- Terminal Specification: Current input: Input resistance 24kΩ ±5Ω Maximum permissible current 30mA
- Terminal Specification: Voltage input: Input resistance 10kΩ ±1kΩ Permissible maximum voltage 20VDC
- Terminal Specification: Input voltage: 24VDC ±2% (or 0 to 5V, 0 to 10V)

**Relay output (fault output)**
- Terminal Name: Changeover contact output indicates that the drive unit’s protective function has activated and the output stopped.

**Drive unit running**
- Terminal Name: Switched Low when the drive unit rotation speed is equal to or higher than the 1r/min. Switched High during stop or DC injection brake operation. (Low is when the open collector output transistor is ON (conducts) high is when the transistor is OFF (does not conduct).)
- Terminal Specification: Permissible load 24VDC (maximum 27VDC) 0.1A (a voltage drop is 3-4V maximum when the signal is ON)

**Open collector output common**
- Terminal Name: Common terminal of terminal RUN.

**For meter**
- Terminal Name: Used to output a selected monitored item (such as Rotation speed) among several monitored items. (Not output during drive unit reset.)
- Terminal Specification: The output signal is proportional to the magnitude of the corresponding monitored item.
- Terminal Specification: Permissible load current 1mA 1440 pulses/s at 3000rpm
With the PU connector, communication can be established through RS-485:

- Conforming standard: EIA-485 (RS-485)
- Transmission format: Multidrop link
- Communication speed: 4800 to 38400bps
- Overall length: 500m

**NOTE**

- To change the input specification for terminal 4, set Pr. 267 and the voltage/current input switch correctly, then input the analog signal relevant to the setting. Applying a voltage with voltage/current input switch in "I" position (current input is selected) or a current with switch in "V" position (voltage input is selected) could cause component damage to the drive unit or analog circuit of output devices.
- Connecting the power supply to the drive unit output terminals (U, V, W) will damage the drive unit. Do not perform such wiring.
- Indicates that terminal functions can be selected using Pr. 178 to Pr. 182, Pr. 192, Pr. 197 (I/O terminal function selection).
- The terminal names and functions shown here are the initial settings.
- The terminals S1, S2, SC, and SO are for manufacturer setting. Do not connect anything to these. Doing so may cause a drive unit failure. Do not remove the shortening wires across the terminals S1 and SC and the terminals S2 and SC. Removing either of these shortening wires disables the drive unit operation.

### Wiring

<table>
<thead>
<tr>
<th>Type</th>
<th>Terminal Symbol</th>
<th>Terminal Name</th>
<th>Terminal Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication</td>
<td>—</td>
<td>PU connector</td>
<td>With the PU connector, communication can be established through RS-485.</td>
</tr>
</tbody>
</table>

### Type of Terminal

- **Pr. 267:** Set the input specification for terminal 4.
- **Pr. 178 to Pr. 182, Pr. 192, Pr. 197:** Select terminal functions using these parameters.
- **Pr. 178 to Pr. 182:** Select input/output functions for terminals S1 and SC.
- **Pr. 192:** Select input/output functions for terminals S2 and SC.
- **Pr. 197:** Select input/output functions for terminal SO.

### Terminal Names

- **S1, S2, SC, SO:** Manufacturer setting terminals. Do not connect anything to these terminals.

### Overall Length

- Overall length: 500m
### 2.3.3 Terminal arrangement of the main circuit terminal, power supply and the motor wiring

#### Three-phase 200V/400V class

<table>
<thead>
<tr>
<th>Applicable Drive unit Model</th>
<th>Terminal Screw Size mm</th>
<th>Tightening Torque N·m</th>
<th>Crimping Terminal</th>
<th>HIV Cables, etc. (mm²) AWG</th>
<th>PVC Cables, etc. (mm²)</th>
<th>Earthing cable (grounding)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FR-D720-0.2K to 0.75K-G</td>
<td>M3.5</td>
<td>1.2</td>
<td>R/L1 S/L2 T/L3 U, V, W 2.3-3.5 2.3-3.5</td>
<td>2 2 14 14 14 14 2.5 2.5</td>
<td>2.5 2.5</td>
<td></td>
</tr>
<tr>
<td>FR-D720-1.5K-G to 3.7K-G</td>
<td>M4</td>
<td>1.5</td>
<td>R/L1 S/L2 T/L3 U, V, W 2.4</td>
<td>2 2 14 14 2.5 2.5</td>
<td>2.5</td>
<td></td>
</tr>
</tbody>
</table>

#### Three-phase 400V class (when input power supply is 440V)

<table>
<thead>
<tr>
<th>Applicable Drive unit Model</th>
<th>Terminal Screw Size mm</th>
<th>Tightening Torque N·m</th>
<th>Crimping Terminal</th>
<th>HIV Cables, etc. (mm²) AWG</th>
<th>PVC Cables, etc. (mm²)</th>
<th>Earthing cable (grounding)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FR-D740-0.4K to 3.7K-G</td>
<td>M4</td>
<td>1.5</td>
<td>R/L1 S/L2 T/L3 U, V, W 2.4</td>
<td>2 2 14 14 2.5 2.5</td>
<td>2.5</td>
<td></td>
</tr>
</tbody>
</table>

- **NOTE**
  - Tighten the terminal screw to the specified torque. A screw that has been tightened too loosely can cause a short circuit or malfunction. A screw that has been tightened too tightly can cause a short circuit or malfunction due to the unit breakage.
  - Use crimping terminals with insulation sleeve to wire the power supply and motor.

#### Wiring

1. The cable size is that of the cable (HIV cable class 2 vinyl-insulated cable) etc. with continuous maximum permissible temperature of 75°C. Assumes that the surrounding air temperature is 50°C or less and the wiring distance is 20m or less.
2. The recommended cable size is of the cable (THHW cable) with continuous maximum permissible temperature of 75°C. Assumes that the surrounding air temperature is 40°C or less and the wiring distance is 20m or less.
3. The recommended cable size is that of the cable (PVC cable) with continuous maximum permissible temperature of 70°C. Assumes that the surrounding air temperature is 40°C or less and the wiring distance is 20m or less.

Make sure the power cables are connected to the R/L1, S/L2, T/L3. (Phase need not be matched.) Never connect the power cable to the U, V, W of the drive unit. Doing so will damage the drive unit.

Connect the motor to U, V, W. Turning ON the forward rotation switch (signal) at this time rotates the motor counterclockwise when viewed from the load shaft.

The following table indicates a selection example for the wiring length of 20m.

The line voltage drop can be calculated by the following formula:

\[ \text{Line voltage drop (V)} = \frac{0.05 \times \text{wire resistance (mΩ/m)} \times \text{wiring distance (m)} \times \text{current (A)}}{1000} \]

Use a larger diameter cable when the wiring distance is long or when it is desired to decrease the voltage drop (torque reduction) in the low speed range.
2.3.4 Wiring of control circuit

(1) Control circuit terminal layout

Recommend wire size:
0.3mm² to 0.75mm²

NOTE
• Do not remove the shortening wires across the terminals S1 and SC and the terminals S2 and SC. Removing either of these shortening wires disables the drive unit operation.

(2) Wiring method

Use crimp terminals and stripped wire for the control circuit wiring. For single wire, the stripped wire can be used without crimp terminal.
Connect the end of wires (crimp terminal or stranded wire) to the terminal block.

1) Strip the signal wires as shown below. If too much of the wire is stripped, a short circuit may occur with neighboring wires. If not enough of the wire is stripped, wires may become loose and fall out. Twist the stripped end of wires to prevent them from fraying. Do not solder it.

2) Crimp the terminals on the wire. Insert wires to the crimp terminal, and check that the wires come out for about 0 to 0.5 mm from a sleeve.
Check the condition of the crimp terminals after crimping. Do not use the crimp terminals of which the crimping is inappropriate, or the face is damaged.
Crimp terminals commercially available (as of January 2017. The product may be changed without notice.)

- Phoenix Contact Co., Ltd.

<table>
<thead>
<tr>
<th>Wire Gauge (mm²)</th>
<th>With Insulation Sleeve</th>
<th>Ferrule Part No.</th>
<th>Without Insulation Sleeve</th>
<th>For UL Wire</th>
<th>Crimping Tool Model No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>CRIMPFOX 6</td>
</tr>
<tr>
<td>0.5</td>
<td>A1 0.34-10TQ</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.75</td>
<td>A1 0.75-10WH</td>
<td>A0.75-10</td>
<td>A0.75-10WH-GB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>A1 1.5-10RD</td>
<td>A1-10</td>
<td>A1 1.5-10RD/1000GB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.25, 1.5</td>
<td>A1 1.5-10BK</td>
<td>A1.5-10</td>
<td>A1 1.5-10BK/1000GB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.75 (for two wires)</td>
<td>A1-TWIN 2 x 0.75-10GY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- NICHIFU Co., Ltd.

<table>
<thead>
<tr>
<th>Wire Gauge (mm²)</th>
<th>Blade Terminal Part No.</th>
<th>Insulation Cap Part No.</th>
<th>Crimping Tool Model No.</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0.3 to 0.75</td>
<td>BT 0.75-11</td>
<td>VC 0.75</td>
<td>NH 69</td>
<td>2</td>
</tr>
</tbody>
</table>

3) Insert the wire into the terminal block.

When using single wire or stranded wire without crimp terminal, push an open/close button all the way down with a flathead screwdriver, and insert the wire.

**NOTE**
- When using stranded wire without a blade terminal, twist enough to avoid short circuit with neighboring terminals or wires.
- Place the flathead screwdriver vertical to the open/close button. In case the blade tip slips, it may cause damage to drive unit or injury.

**Wire removal**
Pull the wire with pushing the open/close button all the way down firmly with a flathead screwdriver.

**NOTE**
- Pulling out the terminal block forcefully without pushing the open/close button all the way down may damage the terminal block.
- Use a small flathead screwdriver (Tip thickness: 0.4mm/ tip width: 2.5mm).
- If a flathead screwdriver with a narrow tip is used, terminal block may be damaged.

Products available on the market: (as of February 2016)

<table>
<thead>
<tr>
<th>Product</th>
<th>Type</th>
<th>Maker</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flathead screwdriver</td>
<td>SZF 0-0.4 x 2.5</td>
<td>Phoenix Contact Co., Ltd.</td>
</tr>
</tbody>
</table>

- A ferrule terminal with an insulation sleeve compatible with MTW wire which has a thick wire insulation
- Applicable for terminal A, B, and C.

- Applicable for blade terminals A, B, and C.
Wiring

(3) Control circuit common terminals (SD, 5, SE)

- Terminals SD, SE and 5 are common terminals for I/O signals. (All common terminals are isolated from each other.) Do not earth them. Avoid connecting the terminals SD and 5 and the terminals SE and 5.
- Terminal SD is a common terminal for the input terminals (STF, STR, RH, RM, RL) and pulse train output terminal (FM). The open collector circuit is isolated from the internal control circuit by photocoupler.
- Terminal 5 is a common terminal for the speed setting signals (terminals 2 or 4). It should be protected from external noise using a shielded or twisted cable.
- Terminal SE is a common terminal for the open collector output terminal (RUN). The contact input circuit is isolated from the internal control circuit by photocoupler.

(4) Wiring instructions

- It is recommended to use the cables of 0.3mm² to 0.75mm² gauge for connection to the control circuit terminals.
- The maximum wiring length should be 30m (200m for terminal FM).
- Do not short across terminals PC and SD. Drive unit may be damaged.
- Use two or more parallel micro-signal contacts or twin contacts to prevent contact faults when using contact inputs since the control circuit input signals are micro-currents.
- To suppress EMI, use shielded or twisted cables for the control circuit terminals and run them away from the main and power circuits (including the 200V relay sequence circuit). For the cables connected to the control circuit terminals, connect their shields to the common terminal of the connected control circuit terminal. When connecting an external power supply to the terminal PC, however, connect the shield of the power supply cable to the negative side of the external power supply. Do not directly earth (ground) the shield to the enclosure, etc.
- Always apply a voltage to the fault output terminals (A, B, C) via a relay coil, lamp, etc.
- When using an external power supply for transistor output, note the following points to prevent a malfunction caused by undesirable current.
  - Do not connect any terminal SD on the drive unit or the 0V terminal of the external power supply (when the sink logic is selected).
  - Do not connect the terminal PC on the drive unit and the +24V terminal of the external power supply (when the source logic is selected).
- Do not install an external power source in parallel with the internal 24VDC power source (connected to terminals PC and SD) to use them together.

Refer to Chapter 2 of the Instruction Manual (Applied) for the detail.

2.3.5 Assigning signals (output stop signal (MRS), reset signal (RES), etc.) to contact input terminals

POINT

- Use parameters (Pr.178 to Pr.182 input terminal function selection) to select and change the functions assigned to input terminals.
- To assign the output stop signal (MRS) to the terminal RH, for example, assign “24” to Pr.182 RH terminal function selection. Refer to page 4 to change the parameter setting.
- Set Pr.160 Extended function display selection = “0” (extended parameters enabled).
## Parameter List

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Name</th>
<th>Unit</th>
<th>Initial value</th>
<th>Range</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>178</td>
<td>STF terminal function selection</td>
<td>1</td>
<td>0</td>
<td>0-23</td>
<td>-</td>
</tr>
<tr>
<td>179</td>
<td>STR terminal function selection</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>180</td>
<td>RL terminal function selection</td>
<td>1</td>
<td>0</td>
<td>0-10</td>
<td>-</td>
</tr>
<tr>
<td>181</td>
<td>RM terminal function selection</td>
<td>1</td>
<td>1</td>
<td>0-14</td>
<td>-</td>
</tr>
<tr>
<td>182</td>
<td>RH terminal function selection</td>
<td>1</td>
<td>2</td>
<td>0-16</td>
<td>-</td>
</tr>
</tbody>
</table>

### Notes:
- **Changing the terminal assignment using Pr.178 to Pr.182 (input terminal function selection)** may affect other functions. Set parameters after confirming the function of each terminal.
2.4 Connection of a dedicated external brake resistor (MRS type, MYS type, FR-ABR) (0.4K or higher)

Install a dedicated brake resistor (MRS type, MYS type, FR-ABR) outside when the motor driven by the drive unit is made to run by the load, quick deceleration is required, etc. Connect a dedicated brake resistor (MRS type, MYS type, FR-ABR) to terminal P/+ and PR. (For the locations of terminal P/+ and PR, refer to the terminal block layout (page 12).)

Set parameters below. (Refer to the Instruction Manual (Applied) for the parameter details.)

<table>
<thead>
<tr>
<th>Connected Brake Resistor</th>
<th>Pr. 38 Regenerative function selection Setting</th>
<th>Pr. 70 Special regenerative brake duty Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRS type, MYS type</td>
<td>0 (initial value)</td>
<td>0%</td>
</tr>
<tr>
<td>MRS type, MYS type (used at 100% torque/6%ED)</td>
<td>1</td>
<td>6%</td>
</tr>
<tr>
<td>FR-ABR</td>
<td>1</td>
<td>15%</td>
</tr>
</tbody>
</table>

- It is recommended to configure a sequence, which shuts off power in the input side of the drive unit by the external thermal relay as shown below, to prevent overload and burnout of the brake resistor (MRS type, MYS type) and high duty brake resistor (FR-ABR) in case the regenerative brake transistor is damaged. (The brake resistor cannot be connected to the 0.2K.)

<table>
<thead>
<tr>
<th>Power Supply Voltage</th>
<th>Brake Resistor</th>
<th>Thermal Relay Type (Mitsubishi Electric Product)</th>
<th>Rated Operating Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>200V</td>
<td>MRS120W200</td>
<td>TH-T25-0.7A</td>
<td>120VAC: 2A (NO contact) / 3A (NC contact), 240VAC: 1A (NO contact) / 2A (NC contact) (AC15 class)</td>
</tr>
<tr>
<td></td>
<td>MRS120W100</td>
<td>TH-T25-1.3A</td>
<td>110VDC: 0.2A, 220VDC: 0.1A (DC13 class)</td>
</tr>
<tr>
<td></td>
<td>MRS120W60</td>
<td>TH-T25-2.1A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MRS120W40</td>
<td>TH-T25-3.6A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MYS220W90</td>
<td>TH-T25-5A</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Power Supply Voltage</th>
<th>Brake Resistor</th>
<th>Thermal Relay Type (Mitsubishi Electric Product)</th>
<th>Rated Operating Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>200V</td>
<td>FR-ABR-0.4K</td>
<td>TH-T25-0.7A</td>
<td>120VAC: 2A (NO contact) / 3A (NC contact), 240VAC: 1A (NO contact) / 2A (NC contact) (AC15 class)</td>
</tr>
<tr>
<td></td>
<td>FR-ABR-0.75K</td>
<td>TH-T25-1.3A</td>
<td>110VDC: 0.2A, 220VDC: 0.1A (DC13 class)</td>
</tr>
<tr>
<td></td>
<td>FR-ABR-2.0K</td>
<td>TH-T25-2.1A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FR-ABR-3.7K</td>
<td>TH-T25-3.6A</td>
<td></td>
</tr>
<tr>
<td>400V</td>
<td>FR-ABR-H0.4K</td>
<td>TH-T25-0.24A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FR-ABR-H0.75K</td>
<td>TH-T25-0.35A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FR-ABR-H1.5K</td>
<td>TH-T25-0.9A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FR-ABR-H2.0K</td>
<td>TH-T25-1.3A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FR-ABR-H3.7K</td>
<td>TH-T25-2.1A</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE**

- The brake resistor connected should only be the dedicated brake resistor.
- Perform wiring and operation according to the Instruction Manual of each option unit.
- Brake resistor cannot be used with the brake unit, high power factor converter, power supply regeneration converter, etc.
- Do not use the brake resistor (MRS type, MYS type) with a lead wire extended.
- Do not connect a resistor directly to terminals P/+ and N-. This could cause a fire.

---

Connection of a dedicated external brake resistor (MRS type, MYS type, FR-ABR) (0.4K or higher)
3  PRECAUTIONS FOR USE OF THE DRIVE UNIT

This product is a highly reliable product, but incorrect peripheral circuit making or operation/handling method may shorten the product life or damage the product.

Before starting operation, always recheck the following items.

(1) Use crimp terminals with insulation sleeve to wire the power supply and motor.

(2) Application of power to the output terminals (U, V, W) of the drive unit will damage the drive unit. Never perform such wiring.

(3) After wiring, wire offcuts must not be left in the drive unit.
   Wire offcuts can cause an alarm, failure or malfunction. Always keep the drive unit clean.
   When drilling mounting holes in an enclosure etc., take care not to allow chips and other foreign matter to enter the drive unit.

(4) Use cables of the size to make a voltage drop 2% or less.
   If the wiring distance is long between the drive unit and motor, a main circuit cable voltage drop will cause the motor torque to decrease especially at the output of a low speed. Refer to page 14 for the recommended wire sizes.

(5) Keep the total wiring length within the specified length.
   Especially for long distance wiring, the equipment connected to the output side may malfunction or become faulty under the influence of a charging current due to the stray capacity of the wiring. Therefore, note the overall wiring length. (Refer to page 15.)

(6) Electromagnetic wave interference
   The input/output (main circuit) of the drive unit includes high frequency components, which may interfere with the communication devices (such as AM radios) used near the drive unit. In this case, install the FR-BIF optional capacitor type filter (for use in the input side only) or FR-BSF01 or FR-BLF line noise filter to minimize interference.

(7) Electrical corrosion of the bearing
   When a motor is driven by the drive unit, axial voltage is generated on the motor shaft, which may cause electrical corrosion of the bearing in rare cases depending on: the wiring, load, operating conditions of the motor, or the use of the capacitive filter+1.
   The following shows examples of countermeasures for the drive unit.
   • Remove the capacitive filter.
   • Provide a common mode choke+2 on the output side of the drive unit. (This is effective regardless of the use of the capacitive filter.)
   +1 Mitsubishi Electric capacitive filter: FR-BIF, SF[ ], FR-ENSF[ ], FR-ENP2[ ]
   +2 Recommended common mode choke: FT-300 F series FINEMET® common mode choke cores manufactured by Hitachi Metals, Ltd.
   FINEMET is a registered trademark of Hitachi Metals, Ltd.

(8) Do not install a power factor correction capacitor, surge suppressor or capacitor type filter on the drive unit output side.
   This will cause the drive unit to trip or the capacitor and surge suppressor to be damaged. If any of the above devices are connected, immediately remove them.

(9) For some short time after the power is switched OFF, a high voltage remains in the smoothing capacitor.
   When accessing the drive unit for inspection, wait for at least 10 minutes after the power supply has been switched OFF, and then make sure that the voltage across the main circuit terminals P/+ and N/- of the drive unit is not more than 30VDC using a tester, etc.

(10) A short circuit or earth (ground) fault on the drive unit output side may damage the drive unit module.
   • Fully check the to-earth (ground) insulation and phase to phase insulation of the drive unit output side before power-On. Especially for an old motor or use in hostile atmosphere, securely check the motor insulation resistance etc.
PRECAUTIONS FOR USE OF THE DRIVE UNIT

(11) Do not use the drive unit input side magnetic contactor to start/stop the drive unit.
Since repeated inrush currents at power ON will shorten the life of the converter circuit (switching life is about 1,000,000
times.), frequent starts and stops of the MC must be avoided. Turn ON/OFF the drive unit start controlling terminals (STF,
STR) to run/stop the drive unit. (Refer to the Instruction Manual (Applied).)

(12) Across terminals P/+ and PR, connect only an external brake resistor.
  - Do not connect a mechanical brake.
  - The brake resistor cannot be connected to the 0.2K. Do not connect anything to terminals P/+ and PR.
  Also, never short between these terminals.

(13) Do not apply a voltage higher than the permissible voltage to the drive unit I/O signal circuits.
Application of a voltage higher than the permissible voltage to the drive unit I/O signal circuits or opposite polarity may
damage the I/O devices. Especially check the wiring to prevent the speed setting potentiometer from being connected
incorrectly to short terminals 10 and 5.

(14) If the machine must not be restarted when power is restored after a power failure, provide a magnetic contactor
in the drive unit's input side and also make up a sequence which will not switch ON the start signal.
If the start signal (start switch) remains ON after a power failure, the drive unit will automatically restart as soon as the
power is restored.

(15) Drive unit input side magnetic contactor (MC)
On the drive unit input side, connect a MC for the following purposes. (Refer to page 6 for selection.)
1) To release the drive unit from the power supply when a fault occurs or when the drive is not functioning (e.g.
emergency stop operation). For example, MC avoids overheat or burnout of the brake resistor when heat capacity of
the resistor is insufficient or brake regenerative transistor is damaged with short while connecting an optional brake
resistor.
2) To prevent any accident due to an automatic restart at restoration of power after a drive unit stop made by a power
failure
3) To separate the drive unit from the power supply to ensure safe maintenance and inspection work.
If using an MC for emergency stop during operation, select an MC regarding the drive unit input side current as
JEM1038-AC-3 class rated current.

(16) Handling of drive unit output side magnetic contactor
Switch the magnetic contactor between the drive unit and motor only when both the drive unit and motor are at a stop.
When the magnetic contactor is turned ON while the drive unit is operating, overcurrent protection of the drive unit and
such will activate.

(17) Countermeasures against drive unit-generated EMI
If electromagnetic noise generated from the drive unit causes speed setting signal to fluctuate and motor rotation speed
to be unstable when changing motor speed with analog signal, the following countermeasures are effective.
  - Do not run the signal cables and power cables (drive unit I/O cables) in parallel with each other and do not bundle
them.
  - Run signal cables as far away as possible from power cables (drive unit I/O cables).
  - Use shield cables as signal cables.
  - Install a ferrite core on the signal cable (Example: ZCAT3035-1330 TDK).

(18) Instructions for overload operation
When performing operation of frequent start/stop of the drive unit, rise/fall in the temperature of the transistor element of
the drive unit will repeat due to a repeated flow of large current, shortening the life from thermal fatigue. Since thermal
fatigue is related to the amount of current, the life can be increased by reducing current at locked condition, starting
current, etc. Decreasing current may increase the life. However, decreasing current will result in insufficient torque and
the drive unit may not start. Reducing the current may extend the service life but may also cause torque shortage, which
leads to a start failure. An effective measure is to use a drive unit and motor with higher capacities. Doing so will provide
a margin to the load.

(19) Make sure that the specifications and rating match the system requirements.
4 FAILSAFE OF THE SYSTEM WHICH USES THE DRIVE UNIT

When a fault occurs, the drive unit trips to output a fault signal. However, a fault output signal may not be output at a drive unit fault occurrence when the detection circuit or output circuit fails, etc. Although Mitsubishi Electric assures best quality products, provide an interlock which uses drive unit status output signals to prevent accidents such as damage to machine when the drive unit fails for some reason and at the same time consider the system configuration where failsafe from outside the drive unit, without using the drive unit, is enabled even if the drive unit fails.

(1) Interlock method which uses the drive unit status output signals

By combining the drive unit status output signals to provide an interlock as shown below, a drive unit failure can be detected.

<table>
<thead>
<tr>
<th>No.</th>
<th>Interlock Method</th>
<th>Check Method</th>
<th>Used Signals</th>
<th>Refer to</th>
</tr>
</thead>
<tbody>
<tr>
<td>1)</td>
<td>Drive unit protective function operation</td>
<td>Operation check of an alarm contact</td>
<td>Fault (ALM) signal</td>
<td>Chapter 4 of the Instruction Manual (Applied).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Circuit error detection by negative logic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2)</td>
<td>Drive unit operating status</td>
<td>Operation ready signal check</td>
<td>Operation ready (RY) signal</td>
<td>Chapter 4 of the Instruction Manual (Applied).</td>
</tr>
<tr>
<td>3)</td>
<td>Drive unit running status</td>
<td>Logic check of the start signal and running signal</td>
<td>Start signal (STF signal, STR signal) Drive unit running (RUN) signal</td>
<td>Chapter 4 of the Instruction Manual (Applied).</td>
</tr>
<tr>
<td>4)</td>
<td>Drive unit running status</td>
<td>Logic check of the start signal and output current</td>
<td>Start signal (STF signal, STR signal) Output current detection (Y12) signal</td>
<td>Chapter 4 of the Instruction Manual (Applied).</td>
</tr>
</tbody>
</table>

(2) Backup method outside the drive unit

Even if the interlock is provided by the drive unit status signal, enough failsafe is not ensured depending on the failure status of the drive unit itself. For example, when the drive unit CPU fails, even if the interlock is provided using the drive unit fault signal, start signal and RUN signal, there is a case where a fault signal is not output and RUN signal is kept output even if a drive unit fault occurs.

Provide a speed detector to detect the motor speed and current detector to detect the motor current and consider the backup system such as checking up as below according to the level of importance of the system.

1) Start signal and actual operation check

Check the motor running and motor current while the start signal is input to the drive unit by comparing the start signal to the drive unit and detected speed of the speed detector or detected current of the current detector. Note that the motor current runs as the motor is running for the period until the motor stops since the drive unit starts decelerating even if the start signal turns OFF. For the logic check, configure a sequence considering the drive unit deceleration time. In addition, it is recommended to check the three-phase current when using the current detector.

2) Command speed and actual operation check

Check if there is no gap between the actual speed and commanded speed by comparing the drive unit speed command and detected speed of the speed detector.
5  DRIVE THE MOTOR

The drive unit needs a speed command and a start command. Speed command (set speed) determines the rotation speed of the motor. Turning ON the start command starts the motor to rotate.

REMARKS
- Set the required parameters according to the load and operating conditions. (Refer to page 29)

5.1  Start/stop from the operation panel (PU operation)

POINT
From where is the speed command given?
- Operation at the speed set in the speed setting mode of the operation panel. (Refer to 5.1.1 refer to page 21).
- Operation using the setting dial as the potentiometer. (Refer to 5.1.2 refer to page 22).
- Change of speed with ON/OFF switches connected to terminals. (Refer to 5.1.3 refer to page 23).
- Perform speed setting using voltage input signal. (Refer to 5.1.4 refer to page 24).
- Perform speed setting using current input signal. (Refer to 5.1.4 refer to page 24).

5.1.1  Setting the speed by the operation panel

Operation example
Operate at 900r/min.

Operation

1. Screen at power-ON
   The monitor display appears.

2. Operation mode change
   Press [PU] to choose the PU operation mode. [PU] indicator is lit.

3. Speed setting
   Turn [ ] to show the speed "900" (900r/min) you want to set. The indication blinks for about 5s. While the value is flashing, press [ ] to set the speed. "F" and "900" are displayed alternately. After about 3s of alternate display, the indication of the value goes back to "0" (monitor display). (If [ ] is not pressed, the indication of the value goes back to "0" after about 5s of flashing. In that case, turn [ ] again, and set the speed.)

4. Start → acceleration → constant speed
   Press [ ] to start operation.
   The speed value on the indication increases in Pr. 7 Acceleration time, and "900" (900r/min) appears.
   (To change the set speed, perform the operation in above step 3. Starting from the previously set speed.)

5. Deceleration → stop
   Press [ ] to stop. The speed value on the display decreases in Pr. 8 Deceleration time, and the motor stops rotating with "0" (0r/min) displayed.

REMARKS
- Can also be used like a potentiometer to perform operation. (Refer to Chapter 4 of the Instruction Manual (Applied).)
- When you always operate in the PU operation mode at power-ON, set Pr.79 Operation mode selection = "1" to choose the PU operation mode always.
Start/stop from the operation panel (PU operation)

5.1.2 Using the setting dial like a potentiometer to perform operation

POINT

- Set "0" (extended parameter valid) in Pr. 160 Extended function display selection.
- Set "1" (setting dial potentiometer mode) in Pr. 161 Speed setting/key lock operation selection.

Operation example: Change the speed from 0r/min to 1800r/min during operation

<table>
<thead>
<tr>
<th>Operation</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Screen at power-ON</td>
<td>The monitor display appears.</td>
</tr>
<tr>
<td>2. Operation mode change</td>
<td>Press ( \uparrow ) to choose the PU operation mode. PU indicator is lit.</td>
</tr>
<tr>
<td>3. Selecting the setting dial mode</td>
<td>Change the Pr. 160 setting to &quot;0&quot; and the Pr. 161 setting to &quot;1&quot;.</td>
</tr>
<tr>
<td></td>
<td>(Refer to page 4 for change of the setting.)</td>
</tr>
<tr>
<td>4. Start</td>
<td>Press ( \Delta ) to start the speed.</td>
</tr>
<tr>
<td>5. Speed setting</td>
<td>Turn ( \Delta ) until <em>&quot;1800&quot; (1800/min)</em> appears. The value in the flashing indication is set as the value of the set speed. You need not press ( \Delta ).</td>
</tr>
</tbody>
</table>

REMARKS

- If the indication changes from the blink of "1800" to the display of "0", the Pr. 161 Speed setting/key lock operation selection setting may not be "1."
- Independently of whether the drive unit is running or at a stop, the speed can be set by merely turning the \( \Delta \).

NOTE

- When setting speed by turning setting dial, the speed goes up to the set value of Pr. 1 Maximum setting (Initial value: 3000r/min). Adjust Pr. 1 Maximum setting setting according to the application.
Start/stop from the operation panel (PU operation)

5.1.3 Setting the speed by switches (three-speed setting) (Pr. 4 to Pr. 6)

**POINT**

- Use operation panel ( ) to give a start command.
- Switch ON the RH, RM, or RL signal to give a speed command.
- Set "4" (External/PU combined operation mode 2) in Pr. 79 Operation mode selection.

**Operation example**

Operation at low speed (300r/min)

1. **Screen at power-ON**
   - The monitor display appears.
2. **Easy operation mode setting**
   - Press  and  for 0.5s. " " appears, and the [PRM] indicator blinks.
3. **Operation mode selection**
   - Turn  until " " appears. [PU] and [PRM] indicators blink.
4. **Operation mode setting**
   - Press  to enter the setting. (Set "4" in Pr. 79.)
   - " " and " " are displayed alternately. [PU] and [EXT] indicators are lit.
5. **Speed setting**
   - Turn ON the low-speed switch (RL).
6. **Start → acceleration → constant speed**
   - Press  to start running.
   - The speed value on the indication increases in Pr. 7 Acceleration time, and " " (300r/min) appears.
   - [RUN] indicator is lit during forward rotation operation and blinks slowly during reverse rotation operation.
7. **Deceleration → stop**
   - Press  to stop.
   - The speed value on the indication decreases in Pr. 8 Deceleration time, and the motor stops rotating with " " (0r/min) displayed.
8. **Speed setting (OFF)**
   - Turn OFF the low-speed switch (RL).

**REMARKS**

- The initial values of the terminals RH, RM, RL are 3000r/min, 1500r/min, and 300r/min. (Use Pr. 4, Pr. 5 and Pr. 6 to change.)
- In the initial setting, when two or three of multi-speed settings are simultaneously selected, priority is given to the set speed of the lower signal.
- For example, when the RH and RM signals turn ON, the RM signal (Pr. 5) has a higher priority.
- Maximum of 15-speed operation can be performed. ( Refer to Chapter 4 of the Instruction Manual (Applied).)
### Start/stop from the operation panel (PU operation)

#### 5.1.4 Setting the speed by analog input (voltage input/current input)

**POINT**
- Use the operation panel (PU) to give a start command.
- Use the (speed setting) potentiometer (voltage input) or 4-to-20mA input (current input) to give a speed command.
- Set "4" (External/PU combined operation mode 2) in Pr. 79 Operation mode selection.

**Connection example for voltage input**
(The drive unit supplies 5V power to the speed setting potentiometer. (terminal 10))

**Connection example for current input**
Assign the AU signal in one of Pr. 178 to Pr. 182.

**Operation example**
Operate at 3000r/min.

**Operation**

1. **Screen at power-ON**
   - The monitor display appears.

2. **Assignment of the AU signal (current input)**
   - Set Pr. 160 to "0" to activate extended parameters.
   - To assign the AU signal, set "4" in one of Pr. 178 to Pr. 182. (Refer to page 4 to change the setting.)
   - Turn ON the AU signal.

3. **Easy operation mode setting**
   - Press and for 0.5s. "- - -" appears, and the [PRM] indicator blinks.

4. **Operation mode selection**
   - Press until "- - -" appears. [PU] and [PRM] indicators blink.
   - Press (PU) to enter the setting. (Set "4" in Pr.79.)

5. **Operation mode setting**
   - "- - -" and "- - -" are displayed alternately. [PU] and [EXT] indicators are lit.

6. **Start**
   - Press (RUN) indicator turns OFF.

7. **Acceleration**
   - For voltage input, turn the potentiometer (speed setting potentiometer) clockwise slowly to full.
   - For current input, input 20mA.
   - The speed value on the display increases in Pr. 7 Acceleration time, and "3000" (3000r/min) appears.
   - [RUN] indicator is lit during forward rotation operation and blinks slowly during reverse rotation operation.

8. **Deceleration**
   - For voltage input, turn the potentiometer (speed setting potentiometer) counterclockwise slowly to full.
   - For current input, input 4mA.
   - The speed value on the display decreases in Pr. 8 Deceleration time, and the motor stops rotating with "0" (0r/min) displayed.
   - [RUN] blinks fast.

9. **Stop**
   - Press (RUN) indicator turns OFF.

**REMARKS**
- The speed at the full clockwise turn of the potentiometer (speed setting potentiometer) (maximum potentiometer setting) is 3000r/min in the initial setting. (To change the setting, use Pr. 125.) (Refer to page 28.)
- For current input, the speed at 20mA input is 3000r/min in the initial setting. (To change the setting, use Pr. 126.) (Refer to Chapter 4 of the Instruction Manual (Applied).)
- To input 10VDC to the terminal 1, set Pr. 73 Analog input selection = "0". The initial value is "1 (0 to 5V input)." (Refer to Chapter 4 of the Instruction Manual (Applied).)
Start and stop using terminals (External operation)

5.2 Start and stop using terminals (External operation)

POINT
From where is the speed command given?
- Operation at the speed set in the speed setting mode of the operation panel "Pr. 79 = 3"
- Give a speed command by switch (multi-speed setting) "Pr. 79 = 5"
- Perform speed setting by a voltage input signal "Pr. 79 = 5"
- Perform speed setting by a current input signal "Pr. 79 = 5"

5.2.1 Setting the speed by the operation panel (Pr. 79 = 3)

POINT
- Switch ON the STF(STR) signal to give a start command.
- Use the operation panel ( ) to give a speed command.
- Set "3" (External/PU combined operation mode 1) in Pr. 79.

Operation example Operate at 900r/min.

1. Screen at power-ON
   The monitor display appears.

2. Easy operation mode setting
   Press ( ) and ( ) for 0.5s. " " appears, and the [PRM] indicator blinks.

3. Operation mode selection
   Turn ( ) until " " appears. [EXT] and [PRM] indicators blink.

4. Operation mode setting
   Press ( ) to enter the setting. (Set "3" in Pr. 79.)
   * " " and " " are displayed alternately. [PU] and [EXT] indicators are lit.

5. Speed setting
   Turn ( ) to show the speed " " you want to set. The indication blinks for about 5s. While the indication is flashing,
   press ( ) to set the speed. " " and " " are displayed alternately. After about 3s of alternate display, the monitor
   display goes back to " " (monitor display). (If ( ) is not pressed, the monitor display goes back to " " (0r/min) after about
   5s of flashing. In that case, turn ( ) again, and set the speed.)

6. Start acceleration constant speed
   Turn the start switch (STF or STR) ON.
   The speed value on the display increases in Pr. 7 Acceleration time, and " " (900r/min) appears.
   [RUN] indicator is lit during forward rotation operation and blinks during reverse rotation operation.
   (To change the set speed, perform the operation in above step 5. Starting from the previously set speed.)

7. Deceleration stop
   Turn OFF the start switch (STF or STR). The speed value on the indication decreases in Pr. 8 Deceleration time, and the motor
   stops rotating with " " (0r/min) displayed. [RUN] turns OFF.
5.2.2 Setting the speed by switches (three-speed setting) (Pr. 4 to Pr. 6)

**POINT**
- Switch ON the STF (STR) signal to give a start command.
- Switch ON the RH, RM, or RL signal to give a speed command.

**Operation example**

**Operation at high speed (3000r/min)**

1. Screen at power-ON
   - The monitor display appears.
2. Speed setting
   - Turn ON the high-speed switch (RH).
3. Start → Acceleration → constant speed
   - Turn ON the start switch (STF or STR). The speed value on the indication increases in Pr. 7 Acceleration time, and “**3000**” appears. [RUN] indicator is lit during forward rotation operation and blinks during reverse rotation operation.
   - When RL is turned ON, 1500r/min is displayed. When RL is turned ON, 300r/min is displayed.
4. Deceleration → Stop
   - Turn OFF the start switch (STF or STR). The speed value on the indication decreases in Pr. 8 Deceleration time, and the motor stops rotating with “**0**” (0r/min) displayed. [RUN] turns OFF.
5. Speed setting (OFF)
   - Turn OFF the high-speed switch (RH).

**REMARKS**
- Initial values of terminals RH, RM, RL are 3000r/min, 1500r/min, and 300r/min. (To change, set Pr. 4, Pr. 5, and Pr. 6.)
- In the initial setting, when two or three of multi-speed settings are simultaneously selected, priority is given to the set speed of the lower signal.
  - For example, when the RH and RM signals turn ON, the RM signal (Pr. 5) has a higher priority.
- Maximum of 15-speed operation can be performed. Refer to Chapter 4 of the Instruction Manual (Applied).
Start and stop using terminals (External operation)

5.2.3 Setting the speed by analog input (voltage input/current input)

POINT

- Turn ON the STF(STR) signal to give a start command.
- Use the potentiometer (speed setting potentiometer) (voltage input) or 4-to-20mA input (current input) to give a speed command.

[Connection example for voltage input]
(The drive unit supplies 5V power to the speed setting potentiometer (terminal 10))

[Connection example for current input]
Assign the AU signal in one of Pr. 178 to Pr. 182.

Operation example
Operate at 3000r/min.

Operation

1. Screen at power-ON
   The monitor display appears.

2. Assignment of the AU signal (current input) (Refer to the step 3 for voltage input.)
   Set Pr. 160 to "0" to activate extended parameters.
   To assign the AU signal, set "4" in one of Pr. 178 to Pr. 182. (Refer to page 4 to change the setting.)
   Turn ON the AU signal.

3. Start
   Turn the start switch (STF or STR) ON.
   [RUN] blinks fast because the speed command is not given.

4. Acceleration → constant speed
   For voltage input, turn the potentiometer (speed setting potentiometer) clockwise slowly to full.
   For current input, input 20mA.
   The speed value on the display increases in Pr. 7 Acceleration time, and "3000" (3000r/min) appears.
   [RUN] indicator is lit during forward rotation operation and blinks slowly during reverse rotation operation.

5. Deceleration
   For voltage input, turn the potentiometer (speed setting potentiometer) counterclockwise slowly to full.
   For current input, input 4mA.
   The speed value on the display decreases in Pr. 8 Deceleration time, and the motor stops rotating with "0" (0r/min) displayed.
   [RUN] blinks fast.

6. Stop
   Turn the start switch (STF or STR) OFF.
   [RUN] turns OFF.

REMARKS

- For voltage input, the speed (maximum potentiometer setting) at the full right turn of the (speed setting) potentiometer is 3000/min in the initial setting. (To change the setting, use Pr. 125.) (Refer to page 28.)
- For current input, the speed at 20mA input is 3000/min in the initial setting. (To change the setting, use Pr. 126.) (Refer to Chapter 4 of the Instruction Manual (Applied).)
- To input 10VDC to the terminal 2, set Pr. 73 Analog input selection = "0". The initial value is "1 (0 to 5V input)".
- To always select the External operation mode, set Pr. 79 Operation mode selection = "2 (External operation mode)".

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5.2.4 Setting the speed at the maximum potentiometer indication

< How to change the maximum speed>

When you want to use 0 to 5VDC input speed setting potentiometer to change the speed at 5V from 3000r/min (initial value) to 2100r/min, make adjustment to output "2100r/min" at 5V voltage input. Set "2100r/min" in Pr.125.

Parameter selection

1. Turn \( P_{125} \) until " \( P_{125} \) " (Pr. 125) appears. Press \( \text{SET} \) to show the present set value "3000" (3000r/min).

Changing the maximum speed

2. Turn \( \text{SET} \) to change the set value to "2100" (2100r/min). Press \( \text{SET} \) to enter "2100" and " \( P_{125} \) " are displayed alternately.

Mode/monitor check

3. Press \( \text{SET} \) twice to choose the monitor/speed monitor.

Start

4. Turn the start switch (STF or STR) ON. [RUN] blinks fast because the speed command is not given.

Acceleration \( \rightarrow \) constant speed

5. Turn the potentiometer (speed setting potentiometer) clockwise slowly to full. The speed value on the display increases in Pr. 7 Acceleration time, and "2100" (2100r/min) appears. [RUN] indicator is lit during forward rotation operation and blinks slowly during reverse rotation operation.

Deceleration

6. Turn the potentiometer (speed setting potentiometer) counterclockwise slowly to full. The speed value on the display decreases in Pr. 8 Deceleration time, and the motor stops rotating with "0" (0r/min) displayed. [RUN] blinks fast.

Stop

7. Turn the start switch (STF or STR) OFF. [RUN] turns OFF.

REMARKS

- Use calibration parameter \( C_2 \) to set speed at 0V and calibration parameter \( C_0 \) to adjust the meter. (Refer to Chapter 4 of the Instruction Manual (Applied).)
- To input 10VDC to the terminal 2, set Pr.73 Analog input selection = "0". The initial value is "1 (0 to 5V input)". (Refer to Chapter 4 of the Instruction Manual (Applied).)
- As other adjustment methods of speed setting voltage gain, there are methods to adjust with a voltage applied to across terminals 2 and 5 and a method to adjust at any point without a voltage applied. (Refer to Chapter 4 of the Instruction Manual (Applied) for the setting method of calibration parameter \( C_4 \).)
- Change the speed (3000r/min) at the maximum current input (20mA in the initial setting)
  - [\( \text{SET} \)] Adjust with Pr.126 Terminal 4 speed setting gain speed. (Refer to Chapter 4 of the Instruction Manual (Applied).)
- Change the speed (0r/min) at the minimum current input (4mA in the initial setting)
  - [\( \text{SET} \)] Adjust with the calibration parameter \( C_5 \) Terminal 4 speed setting bias speed. (Refer to Chapter 4 of the Instruction Manual (Applied).)
6 PARAMETERS

Simple variable-speed operation can be performed with the drive unit in the initial settings. Set the required parameters according to the load and operating conditions. Use the operation panel to set or change a parameter. (Refer to Chapter 4 of the Instruction Manual (Applied) for the detailed description of parameters.)

6.1 Simple mode parameters

POINT
In the initial setting, only the simple mode parameters are displayed by the Pr.160 Extended function display selection setting. Change the Pr.160 Extended function display selection setting as required. (Refer to page 4 to change the parameter.)

<table>
<thead>
<tr>
<th>Parameter Number</th>
<th>Name</th>
<th>Increments</th>
<th>Initial Value</th>
<th>Range</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Maximum setting</td>
<td>1/1000r/min</td>
<td>3000r/min</td>
<td>1 to 12000r/min / 0 to 8000r/min</td>
<td>Use this parameter to set the upper limit for the rotation speed.</td>
</tr>
<tr>
<td>2</td>
<td>Minimum setting</td>
<td>1/1000r/min</td>
<td>0r/min</td>
<td>1 to 3600r/min / 0 to 2400r/min</td>
<td>Use this parameter to set the lower limit for the rotation speed.</td>
</tr>
<tr>
<td>4</td>
<td>Multi-speed setting (high speed)</td>
<td>1/1000r/min</td>
<td>3000r/min</td>
<td>1 to 10000r/min / 0 to 8000r/min</td>
<td>Use these parameters to change among pre-set operation speeds with the terminals. The speeds are pre-set with parameters.</td>
</tr>
<tr>
<td>5</td>
<td>Multi-speed setting (middle speed)</td>
<td>1/1000r/min</td>
<td>1500r/min</td>
<td>1 to 10000r/min / 0 to 8000r/min</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Multi-speed setting (low speed)</td>
<td>1/1000r/min</td>
<td>3000r/min</td>
<td>1 to 10000r/min / 0 to 8000r/min</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Acceleration time</td>
<td>0.1s</td>
<td>5s</td>
<td>0 to 3000s</td>
<td>Use these parameters to set the acceleration/deceleration time.</td>
</tr>
<tr>
<td>8</td>
<td>Deceleration time</td>
<td>0.1s</td>
<td>5s</td>
<td>0 to 3000s</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Electronic thermal OIL relay</td>
<td>0.01A</td>
<td>Rated motor current</td>
<td>0 to 500A</td>
<td>With this parameter, the drive unit protects the motor from heat. Set the rated motor current.</td>
</tr>
<tr>
<td>79</td>
<td>Operation mode selection</td>
<td>1</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>125</td>
<td>Terminal 2 speed setting gain speed</td>
<td>1/1000r/min</td>
<td>3000r/min</td>
<td>1 to 10000r/min / 0 to 8000r/min</td>
<td>Use this parameter to change the speed at the maximum potentiometer setting (5V in the initial setting)</td>
</tr>
<tr>
<td>126</td>
<td>Terminal 4 speed setting gain speed</td>
<td>1/1000r/min</td>
<td>3000r/min</td>
<td>1 to 10000r/min / 0 to 8000r/min</td>
<td>Use this parameter to change the speed at the maximum current input (20mA in the initial setting)</td>
</tr>
<tr>
<td>160</td>
<td>Extended function display selection</td>
<td>1</td>
<td>9999</td>
<td></td>
<td></td>
</tr>
<tr>
<td>999</td>
<td>Automatic parameter setting</td>
<td>1</td>
<td>9999</td>
<td>10, 9999</td>
<td>Communication parameter settings for Mitsubishi Electric’s human machine interface (GOT) connection are changed as a batch.</td>
</tr>
<tr>
<td>Pr.CL</td>
<td>Parameter clear</td>
<td>1</td>
<td>0</td>
<td>0, 1</td>
<td>Setting &quot;1&quot; returns all parameters except calibration parameters to the initial values.</td>
</tr>
<tr>
<td>ALLC</td>
<td>All parameter clear</td>
<td>1</td>
<td>0</td>
<td>0, 1</td>
<td>Setting &quot;1&quot; returns all parameters to the initial values.</td>
</tr>
<tr>
<td>Et.CL</td>
<td>Fault history clear</td>
<td>1</td>
<td>0</td>
<td>0, 1</td>
<td>Setting &quot;1&quot; clears eight past faults.</td>
</tr>
<tr>
<td>Pr.CH</td>
<td>Initial value change list</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>Displays and sets the parameters changed from the initial value.</td>
</tr>
<tr>
<td>PM</td>
<td>PM parameter initialization</td>
<td>1</td>
<td>8004, 8006, 9009</td>
<td>9009, 9009, 9009, 9009, 2</td>
<td>The setting of the motor parameters can be changed to the initial setting required to control a PM motor.</td>
</tr>
<tr>
<td>AUTO</td>
<td>Automatic parameter setting</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>The setting of the communication parameters can be changed to the initial setting required for connection of the Mitsubishi Electric’s human machine interface (GOT).</td>
</tr>
</tbody>
</table>

1. The value left of the slash is for the 2.2K drive unit or lower. The one right of the slash is for the 3.7K drive unit.
2. Settings "8006" and "9009" can be displayed after offline auto tuning is performed.
### 6.2 Parameter list

**REMARKS**
- ● Indicates simple mode parameters.
- The parameters surrounded by a black border in the table allow its setting to be changed during operation even if "0" (initial value) is set in Pr. 77 Parameter write selection.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Name</th>
<th>Setting Range</th>
<th>Initial Value</th>
<th>Parameter</th>
<th>Name</th>
<th>Setting Range</th>
<th>Initial Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Maximum setting</td>
<td>0 to 12000/min</td>
<td>3000/min</td>
<td>36</td>
<td>Speed jump 3B</td>
<td>0 to 100%/min</td>
<td>9999</td>
</tr>
<tr>
<td>2</td>
<td>Minimum setting</td>
<td>0 to 8000/min</td>
<td>0/min</td>
<td>37</td>
<td>Speed display</td>
<td>0, 0.01 to 9999</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>Multi-speed setting (high speed)</td>
<td>0 to 12000/min</td>
<td>3000/min</td>
<td>40</td>
<td>RUN key rotation direction selection</td>
<td>0, 1</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>Multi-speed setting (middle speed)</td>
<td>0 to 8000/min</td>
<td>0/min</td>
<td>41</td>
<td>Up-to-speed sensitivity</td>
<td>0 to 100%</td>
<td>10%</td>
</tr>
<tr>
<td>6</td>
<td>Multi-speed setting (low speed)</td>
<td>0 to 8000/min</td>
<td>0/min</td>
<td>42</td>
<td>Speed detection</td>
<td>0 to 12000/min</td>
<td>180/min</td>
</tr>
<tr>
<td>7</td>
<td>Acceleration time</td>
<td>0 to 3600s</td>
<td>5s</td>
<td>43</td>
<td>Speed detection for reverse rotation</td>
<td>0 to 12000/min</td>
<td>9999</td>
</tr>
<tr>
<td>8</td>
<td>Deceleration time</td>
<td>0 to 3600s</td>
<td>5s</td>
<td>44</td>
<td>Second acceleration/ deceleration time</td>
<td>0 to 3600s</td>
<td>5s</td>
</tr>
<tr>
<td>9</td>
<td>Electronic thermal OIL relay</td>
<td>0 to 50A</td>
<td>Rated motor current</td>
<td>45</td>
<td>Second deceleration time</td>
<td>0 to 3600s</td>
<td>9999</td>
</tr>
<tr>
<td>10</td>
<td>Coasting speed</td>
<td>0 to 3600/min</td>
<td>90/min</td>
<td>46</td>
<td>Second stall prevention operation current</td>
<td>0 to 200%</td>
<td>9999</td>
</tr>
<tr>
<td>11</td>
<td>DC injection brake operation time</td>
<td>0 to 10s</td>
<td>0.5s</td>
<td>52</td>
<td>DU/PU main display data selection</td>
<td>0, 8 to 12, 14, 20, 23 to 25, 52 to 55, 61, 62, 64, 100</td>
<td>0</td>
</tr>
<tr>
<td>13</td>
<td>Starting speed</td>
<td>0 to 1500/min</td>
<td>15/min</td>
<td>54</td>
<td>FM terminal function selection</td>
<td>1 to 3, 5, 7 to 12, 14, 21, 24, 25, 52, 53, 61, 62</td>
<td>1</td>
</tr>
<tr>
<td>15</td>
<td>Jog speed setting</td>
<td>0 to 12000/min</td>
<td>15/min</td>
<td>55</td>
<td>Speed monitoring reference</td>
<td>0 to 12000/min</td>
<td>9999</td>
</tr>
<tr>
<td>16</td>
<td>Jog acceleration/deceleration time</td>
<td>0 to 3600s</td>
<td>0.5s</td>
<td>56</td>
<td>Speed monitoring reference</td>
<td>0 to 12000/min</td>
<td>5000/min</td>
</tr>
<tr>
<td>17</td>
<td>MRS input selection</td>
<td>0, 2, 4</td>
<td>0</td>
<td>59</td>
<td>Remote function selection</td>
<td>0 to 3</td>
<td>0</td>
</tr>
<tr>
<td>20</td>
<td>Acceleration/deceleration reference speed</td>
<td>0 to 12000/min / 20 to 8000/min</td>
<td>3000/min</td>
<td>65</td>
<td>Retry selection</td>
<td>0 to 5</td>
<td>0</td>
</tr>
<tr>
<td>22</td>
<td>Stall prevention operation level</td>
<td>0 to 200%</td>
<td>150%</td>
<td>66</td>
<td>Number of retries at fault occurrence</td>
<td>0 to 10, 101 to 110</td>
<td>0</td>
</tr>
<tr>
<td>24</td>
<td>Multi-speed setting (speed 4)</td>
<td>0 to 12000/min / 0 to 8000/min</td>
<td>9999</td>
<td>68</td>
<td>Retry waiting time</td>
<td>0.1 to 800s</td>
<td>1s</td>
</tr>
<tr>
<td>25</td>
<td>Multi-speed setting (speed 5)</td>
<td>0 to 12000/min</td>
<td>9999</td>
<td>69</td>
<td>Retry count display erase</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>26</td>
<td>Multi-speed setting (speed 6)</td>
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### Parameter List

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<td>990</td>
<td>PU buzzer control</td>
<td>0, 1</td>
<td>1</td>
</tr>
<tr>
<td>991</td>
<td>PU contrast adjustment</td>
<td>0 to 83</td>
<td>58</td>
</tr>
<tr>
<td>997</td>
<td>Fault initialization</td>
<td>18 to 18, 32 to 34, 48, 49, 64, 62, 96, 97, 112, 128, 129, 144, 145, 176 to 178, 192, 190, 197, 199, 201, 208, 230, 245, 9999</td>
<td>9999</td>
</tr>
<tr>
<td>998</td>
<td>PM parameter initialization</td>
<td>6004, 8104, 8009, 9109, 9109, 9109</td>
<td>6004</td>
</tr>
<tr>
<td>999</td>
<td>Automatic parameter setting</td>
<td>16, 9999</td>
<td>9999</td>
</tr>
<tr>
<td>Pr.CL</td>
<td>Parameter clear</td>
<td>0, 1</td>
<td>0</td>
</tr>
<tr>
<td>ALLC</td>
<td>All parameter clear</td>
<td>0, 1</td>
<td>0</td>
</tr>
<tr>
<td>Er.CL</td>
<td>Fault history clear</td>
<td>0, 1</td>
<td>0</td>
</tr>
<tr>
<td>Pr.CH</td>
<td>Initial value change list</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>PM</td>
<td>PM parameter initialization</td>
<td>6004, 8005, 9009</td>
<td>6004</td>
</tr>
<tr>
<td>AUTO</td>
<td>Automatic parameter setting</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

### REMARKS

- The unit for parameter setting and its setting range can be changed from "r/min" to "Hz". Use Pr.144 to change the setting.
- With parameter unit (FR-PU07), up to the highest value in the setting range can be set.
- Settings "1000" and "9999" can be displayed after offline auto tuning is performed.
- While the parameter settings copied to the latest version drive unit (manufactured in April 2018 or later) are verified against the parameter settings copied to the parameter unit (FR-PU07) from the older version drive unit (manufactured in March 2018 or earlier) after the parameter settings are copied, a verification error about parameters marked with *5 will be displayed. However, these errors are not faults. Press "0" on the parameter unit to proceed the verification. (For information about Parameter copy and Parameter verification, refer to the Instruction Manual of the parameter unit.)
- Copying the parameter settings from the latest version drive unit to the older version drive unit is prohibited. If doing so, reset the copied parameter settings by performing Parameter clear or All parameter clear.
- Settings "1000" and "9999" can be displayed after offline auto tuning is performed.


7 TROUBLESHOOTING

When a fault occurs in the drive unit, the drive unit trips and the PU display automatically changes to one of the following fault or alarm indications.

If the fault does not correspond to any of the following faults or if you have any other problem, please contact your sales representative.

- Retention of fault output signal... When the magnetic contactor (MC) provided on the input side of the drive unit is opened at a fault occurrence, the drive unit's control power will be lost and the fault output will not be held.
- Fault or alarm indication...........When a fault or alarm occurs, the operation panel display automatically switches to the fault or alarm indication.
- Resetting method.................When a fault occurs, the drive unit output is kept stopped. Unless reset, therefore, the drive unit cannot restart. (Refer to page 34.)
- When any fault occurs, take the appropriate corrective action, then reset the drive unit, and resume operation.
  Not doing so may lead to the drive unit fault and damage.

The drive unit fault or alarm indications are roughly categorized as below.

1. Error message
   A message regarding operational fault and setting fault by the operation panel and parameter unit (FR-PU07) is displayed. The drive unit does not trip.

2. Warning
   The drive unit does not trip even when a warning is displayed. However, failure to take appropriate measures will lead to a fault.

3. Alarm
   The drive unit does not trip. You can also output an alarm signal by making parameter setting.

4. Fault
   When a fault occurs, the drive unit trips and a fault signal is output.

REMARKS

- For the details of fault displays and other malfunctions, also refer to the Instruction Manual (Applied).
- Past eight faults can be displayed using the setting dial. (Refer to page 3 for the operation.)

7.1 Reset method of protective function

(1) Resetting the drive unit
The drive unit can be reset by performing any of the following operations. Note that the internal thermal integrated value of the electronic thermal relay function and the number of retries are cleared (erased) by resetting the drive unit.

Drive unit recovers about 1s after the reset is released.

Operation 1: ...... Using the operation panel, press to reset the drive unit.
   (This may only be performed when a fault occurs (refer to page 35 for fault).)

Operation 2: ...... Switch power OFF once. After the indicator of the operation panel turns OFF, switch it ON again.

Operation 3: ...... Turn ON the reset signal (RES) for more than 0.1s. (If the RES signal is kept ON, "Err." appears (blinks) to indicate that the drive unit is in a reset status.)

NOTE

- OFF status of the start signal must be confirmed before resetting the drive unit fault. Resetting drive unit fault with the start signal ON restarts the motor suddenly.
When a fault occurs, the drive unit trips and the PU display automatically changes to one of the following fault or alarm indications.

### 7.2 List of fault displays

<table>
<thead>
<tr>
<th>Function Name</th>
<th>Description</th>
<th>Countermeasure</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation panel lock</td>
<td>Operation has been attempted during the operation panel lock.</td>
<td>Press [ ] for 2s to release lock.</td>
<td>OL, FL</td>
</tr>
<tr>
<td>Password locked</td>
<td>Parameter setting has been attempted although parameter setting is set to be disabled.</td>
<td>Enter the password in Pr. 77 Parameter lock/unlock to unlock the password function before operating.</td>
<td>LDC d</td>
</tr>
<tr>
<td>Write disable error</td>
<td>Parameter setting has been attempted while a value other than &quot;2&quot; is set in Pr. 77 Parameter write selection.</td>
<td>+ Check the setting of Pr. 77 Parameter write selection.</td>
<td>E 1</td>
</tr>
<tr>
<td>Write error during operation</td>
<td>Parameter setting has been attempted when the command source is not at the operation panel.</td>
<td>After setting the operation mode to the &quot;PU operation mode,&quot; set the parameters.</td>
<td>E 0</td>
</tr>
<tr>
<td>Calibration error</td>
<td>Analog input bias and gain calibration values have been set too close.</td>
<td>Check the settings of calibration parameters C1, C2, C3 and C7 (calibration functions).</td>
<td>E 3</td>
</tr>
<tr>
<td>Mode designation error</td>
<td>Parameter setting has been attempted in the External or NET operation when Pr. 77 Parameter write selection is not &quot;2.&quot;</td>
<td>After setting the operation mode to the &quot;PU operation mode,&quot; set the parameters.</td>
<td>E 4</td>
</tr>
<tr>
<td>Drive unit reset</td>
<td>The reset signal (RES signal) is ON. drive unit output is shut off.</td>
<td>+ Turn OFF the reset command.</td>
<td>E r</td>
</tr>
<tr>
<td>Stall prevention (overcurrent)</td>
<td>The overcurrent stall prevention has been activated.</td>
<td>+ Set Pr.7 Acceleration time and Pr.8 Deceleration time longer.</td>
<td>OL</td>
</tr>
<tr>
<td>Stall prevention (overvoltage)</td>
<td>The overvoltage stall prevention function or the regeneration avoidance function has been activated. (This warning is also output during the regeneration avoidance operation.)</td>
<td>Set the deceleration time longer.</td>
<td>OL</td>
</tr>
<tr>
<td>Regenerative brake pre-alarm 1</td>
<td>The regenerative brake duty has reached 85% of the Pr. 79 special regenerative brake duty settings or higher.</td>
<td>Set the deceleration time longer.</td>
<td>r b</td>
</tr>
<tr>
<td>Electronic thermal relay function pre-alarm</td>
<td>The cumulative value of the electronic thermal O/L relay has reached 85% of the Pr. 9 Electronic thermal O/L relay settings or higher.</td>
<td>Reduce the load and frequency of operation, Set an appropriate value in Pr. 9 Electronic thermal O/L relay.</td>
<td>rH</td>
</tr>
<tr>
<td>PU stop</td>
<td>The cumulative energization time has exceeded the maintenance output timer set value.</td>
<td>Turn the start signal OFF and release with .</td>
<td>PS</td>
</tr>
<tr>
<td>Maintenance signal output 2</td>
<td>The voltage at the main circuit power has been lowered.</td>
<td>Investigate the devices on the power supply side such as the power supply itself.</td>
<td>lP</td>
</tr>
<tr>
<td>Undervoltage</td>
<td>The shorting wire across the terminals S1 and SC or the terminals S2 and SC is disconnected.</td>
<td>Short across the terminals S1 and SC and the terminals S2 and SC with shortening wires.</td>
<td>lU</td>
</tr>
<tr>
<td>SA</td>
<td>The cooling fan is at a standstill although it is required to be operated.</td>
<td>Check for fan failure. Please contact your sales representative.</td>
<td>Fl</td>
</tr>
</tbody>
</table>
### List of fault displays

<table>
<thead>
<tr>
<th>Function Name</th>
<th>Description</th>
<th>Countermeasure</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Overcurrent trip during acceleration</strong></td>
<td>Overcurrent has occurred during acceleration.</td>
<td>• Set the acceleration time longer. (Shorten the downward acceleration time in vertical lift application.)</td>
<td>EDC 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• If “E.OC1” always appears at start, disconnect the motor once and restart the drive unit. If “E.OC1” still appears, the drive unit may be faulty. Contact your sales representative.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Check the wiring for output short circuit and ground fault.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Change the setting to enable the stall prevention operation (Pr.156).</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Lower the stall prevention operation level.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Choose drive and motor capacities that match.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• If the motor is coasting, stop the motor, then input a start command.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Set the acceleration time longer. (Shorten the downward acceleration time in vertical lift application.)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• If “E.OC1” always appears at start, disconnect the motor once and restart the drive unit. If “E.OC1” still appears, the drive unit may be faulty. Contact your sales representative.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Check the wiring for output short circuit and ground fault.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Change the setting to enable the stall prevention operation (Pr.156).</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Lower the stall prevention operation level.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Choose drive and motor capacities that match.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• If the motor is coasting, stop the motor, then input a start command.</td>
<td></td>
</tr>
<tr>
<td><strong>Overcurrent trip during constant speed</strong></td>
<td>Overcurrent has occurred during constant speed operation.</td>
<td>• Keep the load stable.</td>
<td>EDC 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Check the wiring to avoid output short circuit or ground fault.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Change the setting to enable the stall prevention operation (Pr.156).</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Lower the stall prevention operation level.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Choose drive and motor capacities that match.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• If the motor is coasting, stop the motor, then input a start command.</td>
<td></td>
</tr>
<tr>
<td><strong>Overcurrent trip during deceleration or stop</strong></td>
<td>Overcurrent has occurred during deceleration or at a stop.</td>
<td>• Set the deceleration time longer.</td>
<td>EDC 3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Check the wiring to avoid output short circuit or ground fault.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Change the setting to enable the stall prevention operation (Pr.156).</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Lower the stall prevention operation level.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Choose drive and motor capacities that match.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• If the motor is coasting, stop the motor, then input a start command.</td>
<td></td>
</tr>
<tr>
<td><strong>Regenerative overvoltage trip during acceleration</strong></td>
<td>Overvoltage has occurred during acceleration.</td>
<td>• Set the acceleration time shorter.</td>
<td>EDv 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Use the regeneration avoidance function (Pr. 882, Pr. 883, Pr. 885, Pr. 886).</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Set the Pr. 22 Stall prevention operation level correctly.</td>
<td></td>
</tr>
<tr>
<td><strong>Regenerative overvoltage trip during constant speed</strong></td>
<td>Overvoltage has occurred during constant speed operation.</td>
<td>• Keep the load stable.</td>
<td>EDv 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Use the regeneration avoidance function (Pr. 882, Pr. 883, Pr. 885, Pr. 886).</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Use the brake resistor, brake unit or power regeneration common converter (FR-CV) as required.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Set the Pr. 22 Stall prevention operation level correctly.</td>
<td></td>
</tr>
<tr>
<td><strong>Regenerative overvoltage trip during deceleration or stop</strong></td>
<td>Overvoltage has occurred during deceleration or at a stop.</td>
<td>• Set the deceleration time longer. (Set the deceleration time which matches the moment of inertia of the load.)</td>
<td>EDv 3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Make the brake cycle longer.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Use the regeneration avoidance function (Pr. 882, Pr. 883, Pr. 885, Pr. 886).</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Use the brake resistor, brake unit or power regeneration common converter (FR-CV) as required.</td>
<td></td>
</tr>
<tr>
<td>Function Name</td>
<td>Description</td>
<td>Countermeasure</td>
<td>Display</td>
</tr>
<tr>
<td>---------------</td>
<td>-------------</td>
<td>----------------</td>
<td>---------</td>
</tr>
</tbody>
</table>
| Drive unit overload trip (electronic thermal O/L relay function) *1 | The electronic thermal relay function for drive unit element protection has been activated. | * Set the acceleration time longer.  
* Adjust the Pr.757 PM control torque boost and Pr.795 DC brake torque boost settings.  
* Reduce the load.  
* Set the surrounding air temperature to within the specifications. | EFGH |
| Motor overload trip (electronic thermal O/L relay function) *1 | The electronic thermal relay function for motor protection has been activated. | * Reduce the load.  
* Adjust the Pr.757 PM control torque boost and Pr.795 DC brake torque boost settings.  
* Set the stall prevention operation level accordingly. | EFMN |
| Heatsink overheat | The heatsink has overheated. | * Set the surrounding air temperature to within the specifications.  
* Clean the heatsink.  
* Replace the cooling fan. | EFI ☐ |
| Input phase loss *2 | One of the three phases on the drive unit input side has been lost. It may also appear if phase-to-phase voltage of the three-phase power input has become largely unbalanced. | * Wire the cables properly.  
* Repair a break portion in the cable.  
* Check the Pr.872 Input phase loss protection selection setting.  
* Set Pr.872 Input phase loss protection selection = "0" (without input phase loss protection) when three-phase input voltage is largely unbalanced. | EILF |
| Stall prevention stop | The rotation speed has dropped to 15r/min as a result of deceleration due to the excess motor load. | Reduce the load. (Check the Pr.22 Stall prevention operation level setting.) | EDL1 |
| Loss of synchronism detection | Operation has gone out of synchronism.  
Operation was performed without connecting a motor. | * Set the acceleration time longer.  
* If the motor is coasting, stop the motor, then input a start command. Alternatively, use the automatic restart after instantaneous power failure/flying start function.  
* According to the motor to be used, perform PM parameter initialization.  
* When driving a motor other than the S-PM geared motor, perform offline auto tuning.  
* Check the connection of the PM motor, or set the PM motor test operation. | E50R |
| Brake transistor alarm detection | A fault has occurred in the brake circuit, such as a brake transistor breakage. (In this case, the drive unit must be powered off immediately.) | Replace the drive unit. | EBEB |
| Output side earth (ground) fault overcurrent at start *2 | An earth (ground) fault has occurred on the drive unit's output side. | Remedy the ground fault portion. | ECN ☐ |
| Output phase loss | One of the three phases (U, V, W) on the drive unit's output side (load side) has been lost during drive unit operation. | * Wire the cables properly.  
* If the motor is coasting, stop the motor, then input a start command. | EILF |
| External thermal relay operation *2 | The external thermal relay connected to the OH signal has been activated. | * Reduce the load and operate less frequently.  
* Even if the relay contacts are reset automatically, the drive unit will not reset unless it is reset. | EBM ☐ |
| PTC thermistor operation *2 | Resistance of the PTC thermistor connected between the terminal 2 and terminal 10 has reached the Pr.541 PTC thermistor protection level setting or higher. | Reduce the load. | EPFC |
| Parameter storage device fault | Operation of the component where parameters are stored (control circuit board) has become abnormal. | Please contact your sales representative.  
When performing parameter setting frequently for communication purposes, set "1" in Pr.342 Communication EEPROM write selection to enable RAM write. Note that powering OFF returns the drive unit to the status before RAM write. | EPE |

*1 When Pr.755 PM control torque boost 1 is set to "0", the Pr.757 PM control torque boost setting will be set to "0" and the function cannot be used.

*2 **Parameter storage device fault** cannot occur when the PM parameter test operation is set to "0".
### 7.3 Check first when you have a trouble

<table>
<thead>
<tr>
<th>Description</th>
<th>Countermeasure</th>
</tr>
</thead>
</table>
| Motor does not start | Check and speed command sources and enter a start command (STF, etc.) and a speed command.
| Motor or machine is making abnormal acoustic noise | Clean the motor fan. Improve the environment. If the situation does not improve after taking the above measure, please contact your sales representative.
| Drive unit generates abnormal noise | Install the fan cover correctly.
| Motor generates heat abnormally | Check the rotation direction specification of the motor's output shaft. Alternatively, the connection of the start signal (STF, forward rotation, STR, reverse rotation)
| Motor rotates in the opposite direction | Check the settings of Pr.1 Maximum setting, Pr.2 Minimum setting, and calibration parameters C1 to C7. Short across the terminals S1 and SC and the terminals S2 and SC with shortening wires.
| Speed greatly differs from the setting | Check the settings of Pr.1 Maximum setting, Pr.2 Minimum setting, and calibration parameters C1 to C7. Short across the terminals S1 and SC and the terminals S2 and SC with shortening wires.
| Acceleration/deceleration is not smooth | Reduce the load. Alternatively, increase the acceleration/deceleration time. Make adjustments to situate the machine equipment in a more stable place. Eliminate the load fluctuation. Use Pr.15 Ultra low vibration operation selection to disable stall prevention operation.
| Speed varies during operation | Check the speed setting signals. Operation mode is not changed properly Turn OFF the start signal (STF) or STR. Check if Pr.75 Operation mode selection is set appropriately.
| Operation panel display is not operating | Check the wiring and the installation.
| Speed does not accelerate | Check the settings of Pr.1 Maximum setting, Pr.2 Minimum setting, and calibration parameters C1 to C7.
| Unable to write parameter setting | Check Pr.7 Parameter optimisation selection.

* For further information on troubleshooting, refer to the Instruction Manual (Applied).
Inspection items

For some short time after the power is switched OFF, a high voltage remains in the smoothing capacitor. When accessing the drive unit for inspection, wait for at least 10 minutes after the power supply has been switched OFF, and then make sure that the voltage across the main circuit terminals P/+ and N/- of the drive unit is not more than 30VDC using a tester, etc.

8.1 Inspection items

<table>
<thead>
<tr>
<th>Area of Inspection</th>
<th>Inspection Item</th>
<th>Description</th>
<th>Interval</th>
<th>Corrective Action at Alarm Occurrence</th>
<th>Customer's Check</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>Power supply voltage</td>
<td>Check that main circuit voltages are normal</td>
<td>Periodic ¤</td>
<td>Contact the manufacturer</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Contact the manufacturer</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Clean</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Inspect the power supply</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>General</td>
<td>Check with megger (across main circuit terminals and earth (ground) terminal)</td>
<td>Daily</td>
<td>Contact the manufacturer</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Retighten</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Contact the manufacturer</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Clean</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Conductor, cable</td>
<td>Check for stain</td>
<td>Daily</td>
<td>Contact the manufacturer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Terminal block</td>
<td>Check for damage</td>
<td>Daily</td>
<td>Contact the manufacturer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Smoothing aluminum electrolytic capacitor</td>
<td>Check for stain</td>
<td>Daily</td>
<td>Contact the manufacturer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Relay</td>
<td>Check that the operation is normal and no chatter is heard</td>
<td>Daily</td>
<td>Contact the manufacturer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Operation check</td>
<td>(1) Check that the output voltages across phases with the drive unit operated alone is balanced</td>
<td>Periodic ©</td>
<td>Contact the manufacturer</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2) Check that no fault is found in protective and display circuits in a sequence protective operation test</td>
<td></td>
<td>Contact the manufacturer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Overall</td>
<td>Check for unusual odor and discoloration</td>
<td>Periodic ©</td>
<td>Stop the device and contact the manufacturer</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Check for serious rust development</td>
<td>Periodic ©</td>
<td>Contact the manufacturer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Aluminum electrolytic capacitor</td>
<td>Check for liquid leakage at a capacitor or deformation trace</td>
<td>Periodic ©</td>
<td>Contact the manufacturer</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Visual check and judge by the life check of the main circuit capacitor (Refer to Chapter 4 of the Instruction Manual (Applied))</td>
<td></td>
<td>Contact the manufacturer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cooling fan</td>
<td>Check for stain</td>
<td>Daily</td>
<td>Replace the fan</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fix with the fan cover fixing screws</td>
<td></td>
<td>With the fan cover fixing screws</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clean</td>
<td></td>
<td>Clean</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Display</td>
<td>Check that display is normal</td>
<td>Daily</td>
<td>Contact the manufacturer</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clean</td>
<td></td>
<td>Clean</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Meter</td>
<td>Check that reading is normal</td>
<td>Daily</td>
<td>Stop the device and contact the manufacturer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Load motor</td>
<td>Check for vibration and abnormal increase in operation noise</td>
<td>Daily</td>
<td>Stop the device and contact the manufacturer</td>
<td></td>
</tr>
</tbody>
</table>
8.2 Replacement of parts

The drive unit consists of many electronic parts such as semiconductor devices. The following parts may deteriorate with age because of their structures or physical characteristics, leading to reduced performance or fault of the drive unit. For preventive maintenance, the parts must be replaced periodically.

Use the life check function as a guidance of parts replacement.

<table>
<thead>
<tr>
<th>Part Name</th>
<th>Estimated Lifespan</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooling fan</td>
<td>10 years</td>
<td>Replace (as required)</td>
</tr>
<tr>
<td>Main circuit smoothing capacitor</td>
<td>10 years &lt;2</td>
<td>Replace (as required)</td>
</tr>
<tr>
<td>On-board smoothing capacitor</td>
<td>10 years &lt;2</td>
<td>Replace the board (as required)</td>
</tr>
<tr>
<td>Relays</td>
<td>—</td>
<td>as required</td>
</tr>
</tbody>
</table>

*1 Estimated Lifespan for when the yearly average surrounding air temperature is 40°C (without corrosive gas, flammable gas, oil mist, dust and dirt etc.)

*2 Output current: 80% of the drive unit rated current

NOTE

Continuous use of a leaked, deformed, or degraded smoothing aluminum electrolytic capacitor (refer to page 19) may lead to a burst, breakage or fire. Replace such a capacitor without delay.

For parts replacement, contact the nearest Mitsubishi Electric FA Center.
9 SPECIFICATIONS

9.1 Rating

● Three-phase 200V power supply

<table>
<thead>
<tr>
<th>Model FR-D720-□/K-G</th>
<th>0.2</th>
<th>0.4</th>
<th>0.75</th>
<th>1.5</th>
<th>2.2</th>
<th>3.7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated capacity (kVA)</td>
<td>0.3</td>
<td>0.6</td>
<td>1.0</td>
<td>1.7</td>
<td>2.8</td>
<td>4.0</td>
</tr>
<tr>
<td>Rated current (A)</td>
<td>1.4</td>
<td>2.5</td>
<td>4.2</td>
<td>7.0</td>
<td>10.0</td>
<td>16.5</td>
</tr>
<tr>
<td>Overload current rating</td>
<td>150% 60s, 200% 0.5s (Rated motor current, inverse-time characteristics)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated input AC voltage/frequency</td>
<td>Three-phase 200 to 240V 50Hz/60Hz</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Permissible AC voltage fluctuation</td>
<td>±5%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Permissible frequency fluctuation</td>
<td>170 to 264V 50Hz/60Hz</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power supply capacity (kVA)</td>
<td>0.4</td>
<td>0.7</td>
<td>1.2</td>
<td>2.1</td>
<td>4.0</td>
<td>5.5</td>
</tr>
<tr>
<td>Protective structure (JEM1030)</td>
<td>Enclosed type (IP20)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooling system</td>
<td>Self-cooling</td>
<td>Forced air cooling</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approximate mass (kg)</td>
<td>0.5</td>
<td>0.8</td>
<td>1.0</td>
<td>1.4</td>
<td>1.4</td>
<td>1.8</td>
</tr>
</tbody>
</table>

● Three-phase 400V power supply

<table>
<thead>
<tr>
<th>Model FR-D740-□/K-G</th>
<th>0.4</th>
<th>0.75</th>
<th>1.5</th>
<th>2.2</th>
<th>3.7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated capacity (kVA)</td>
<td>0.4</td>
<td>0.9</td>
<td>1.7</td>
<td>2.7</td>
<td>3.8</td>
</tr>
<tr>
<td>Rated current (A)</td>
<td>1.2</td>
<td>2.2</td>
<td>3.8</td>
<td>5.0</td>
<td>8.0</td>
</tr>
<tr>
<td>Overload current rating</td>
<td>150% 60s, 200% 0.5s (Rated motor current, inverse-time characteristics)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated input AC voltage/frequency</td>
<td>Three-phase 380 to 480V 50Hz/60Hz</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Permissible AC voltage fluctuation</td>
<td>±5%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Permissible frequency fluctuation</td>
<td>325 to 528V 50Hz/60Hz</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power supply capacity (kVA)</td>
<td>0.9</td>
<td>1.5</td>
<td>2.5</td>
<td>5.5</td>
<td>9.6</td>
</tr>
<tr>
<td>Protective structure (JEM1030)</td>
<td>Enclosed type (IP20)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooling system</td>
<td>Self-cooling</td>
<td>Forced air cooling</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approximate mass (kg)</td>
<td>1.3</td>
<td>1.3</td>
<td>1.4</td>
<td>1.5</td>
<td>1.5</td>
</tr>
</tbody>
</table>

1 The rated output capacity assumes the following output voltages: 230V for three-phase 200V, and 440V for three-phase 400V.

2 The power supply capacity varies with the value of the power supply side drive unit impedance (including those of the input reactor and cables).
### 9.2 Common specifications

<table>
<thead>
<tr>
<th>Control method</th>
<th>PM sensorless vector control (low-speed range: current synchronization operation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carrier frequencies</td>
<td>97Hz</td>
</tr>
<tr>
<td>Maximum speed</td>
<td>2000/min (at 100Hz for 1.5kW S-PM geared motor or lower, or 150Hz for 2.2kW S-PM geared motor) +1</td>
</tr>
<tr>
<td>Speed setting resolution</td>
<td>One thousandth (1/1000) of the speed setting gain speed (terminals 2 and 4: 10 bits, 0 to 10V) One five-hundredth (1/500) of the speed setting gain speed (terminals 2 and 4: 9 bits, 0 to 5V) One thousandth (1/1000) of the speed setting gain speed (terminal 4: 10 bits, 0 to 20mA)</td>
</tr>
<tr>
<td>Carrier frequencies</td>
<td>5kHz</td>
</tr>
<tr>
<td>Maximum speed</td>
<td>3000r/min (at 100Hz for 1.5kW S-PM geared motor or lower, or 150Hz for 2.2kW S-PM geared motor) +1</td>
</tr>
<tr>
<td>Frequency accuracy</td>
<td>Digital input: Within 0.01% of the set output frequency</td>
</tr>
<tr>
<td>Analog input: Within ±1% of the maximum output frequency (25°C ±10°C)</td>
<td></td>
</tr>
<tr>
<td>Speed setting resolution</td>
<td>Analog input: One thousandth (1/1000) of the speed setting gain speed (terminals 2 and 4: 10 bits, 0 to 10V) One five-hundredth (1/500) of the speed setting gain speed (terminals 2 and 4: 9 bits, 0 to 5V) One thousandth (1/1000) of the speed setting gain speed (terminal 4: 10 bits, 0 to 20mA)</td>
</tr>
<tr>
<td>Digital input: Mean</td>
<td></td>
</tr>
<tr>
<td>PM sensorless vector control range</td>
<td>1:10 (300r/min to 3000r/min) +1</td>
</tr>
<tr>
<td>Starting torque</td>
<td>PM control torque boost, DC injection brake torque boost</td>
</tr>
<tr>
<td>Torque boost</td>
<td>100% (initial value)</td>
</tr>
<tr>
<td>Acceleration/deceleration time setting</td>
<td>1 to 3600s (acceleration and deceleration can be set individually) Linear and S-pattern acceleration/deceleration modes are available.</td>
</tr>
<tr>
<td>Initial magnetic pole detection time</td>
<td>Approx. 0.1s (performed at start, at LX signal ON.)</td>
</tr>
<tr>
<td>Stall prevention operation level</td>
<td>Operation current level (0 to 200%), and whether to use the function or not can be selected</td>
</tr>
<tr>
<td>Surrounding air temperature</td>
<td>0°C to 40°C maximum (non-freezing) +1</td>
</tr>
<tr>
<td>Ambient humidity</td>
<td>90%RH or less (non-condensing)</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-20°C to 65°C</td>
</tr>
<tr>
<td>Atmosphere</td>
<td>Indoor (without corrosive gas, flammable gas, oil mist, dust and dirt etc.)</td>
</tr>
<tr>
<td>Altitude/vibration</td>
<td>Maximum 1000m, 5.9m/s² or less at 10 to 55Hz (directions of X, Y, Z axes)</td>
</tr>
</tbody>
</table>

*1 When using the drive units at the surrounding air temperature of 40°C or less, the drive units can be installed closely attached (0cm clearance).

*2 Temperatures applicable for a short time, e.g. in transit.

*3 The maximum speed varies by motor type (rating).
Specifications of S-PM geared motors

9.3 Specifications of S-PM geared motors

9.3.1 Motor specifications

- Model names of S-PM geared motors

<table>
<thead>
<tr>
<th>Series</th>
<th>Output Voltage</th>
<th>Speed (3000/min / nominal reduction ratio)</th>
<th>Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>GV-S (parallel shaft, fixed load)</td>
<td>0.1 to 2.2kW 200V class</td>
<td>0.2 to 2.2kW 400V class</td>
<td>200V class</td>
</tr>
<tr>
<td>GV-SSY (right-angled shaft, fixed load)</td>
<td>0.2 to 2.2kW 400V class</td>
<td>0.2 to 2.2kW 400V class</td>
<td>400V class</td>
</tr>
</tbody>
</table>

- 200V class

<table>
<thead>
<tr>
<th>Motor model</th>
<th>Compatible drive unit</th>
<th>Rated output (kW)</th>
<th>Continuous characteristic</th>
<th>Rated torque (Nm)</th>
<th>Rated speed (r/min)</th>
<th>Maximum speed (r/min)</th>
<th>Number of poles</th>
<th>Maximum torque</th>
<th>Rated current (A)</th>
<th>Structure</th>
<th>Protective structure</th>
<th>Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>GV-CK-KW</td>
<td>FR-D750-CXG-G</td>
<td>0.1</td>
<td>0.2</td>
<td>0.32</td>
<td>3000</td>
<td>3000</td>
<td>4</td>
<td>2.2</td>
<td>0.55</td>
<td>Totally enclosed self-cooling</td>
<td>IP44 (indoors), IP44 (outdoors) for semi-standard models</td>
<td>Surrounding air temperature and humidity 0°C to +40°C (non-freezing), 90RH or less (non-condensing)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.2</td>
<td>0.4</td>
<td>1.27</td>
<td>2.39</td>
<td>4.78</td>
<td>0.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Vibration 4.9ms⁻² (0.5G) for continuous operation, 9.8ms⁻² (1G) for instantaneous operation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.4</td>
<td>0.75</td>
<td>2.39</td>
<td>4.78</td>
<td>7.00</td>
<td>1.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>9.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- 400V class

<table>
<thead>
<tr>
<th>Motor model</th>
<th>Compatible drive unit</th>
<th>Rated output (kW)</th>
<th>Continuous characteristic</th>
<th>Rated torque (Nm)</th>
<th>Rated speed (r/min)</th>
<th>Maximum speed (r/min)</th>
<th>Number of poles</th>
<th>Maximum torque</th>
<th>Rated current (A)</th>
<th>Structure</th>
<th>Protective structure</th>
<th>Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>GV-CK-KW</td>
<td>FR-D740-CXG-G</td>
<td>0.2</td>
<td>0.4</td>
<td>0.64</td>
<td>3000</td>
<td>3000</td>
<td>4</td>
<td>2.2</td>
<td>0.55</td>
<td>Totally enclosed self-cooling</td>
<td>IP44 (indoors), IP44 (outdoors) for semi-standard models</td>
<td>Surrounding air temperature and humidity 0°C to +40°C (non-freezing), 90RH or less (non-condensing)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.4</td>
<td>0.75</td>
<td>1.27</td>
<td>2.39</td>
<td>4.78</td>
<td>0.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Vibration 4.9ms⁻² (0.5G) for continuous operation, 9.8ms⁻² (1G) for instantaneous operation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>9.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- The above characteristics apply when the rated AC voltage is input from the drive unit (refer to page 42). Output and rated motor speed are not guaranteed when the power supply voltage drops.
- The value at the motor shaft. The torque at the output shaft changes according to the reduction ratio and the reduction gear efficiency.
- The 0.75kW motor with a brake has the totally enclosed fan-cooled type structure.
9.3.2 Motor torque characteristic

- In the low-speed range (less than 300r/min), the torque output can be increased up to 100% of the setting, but continuous operation is not possible.
- When the input voltage is low, the torque may be reduced.
- The operable speed range at constant torque is 300r/min to 3000r/min. Continuous operation cannot be performed in 300r/min or less.

- Setting Pr.785 PM control torque boost to 50% or less enables continuous operation at the speed less than 300r/min. However, the keep the short-time torque to Pr.785 setting or lower.
  - 80% for the FR-D720-1.5K-G or lower and the FR-D740-1.5K-G or lower
  - When the input voltage is low, the torque may be reduced.
- The operable speed range at constant torque is 300r/min to 3000r/min.
9.4 Outline dimension drawings

### Three-phase 200V class

<table>
<thead>
<tr>
<th>Drive unit Model</th>
<th>W</th>
<th>W1</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>FR-D720-0.2K-G</td>
<td>68</td>
<td>56</td>
<td>80.5</td>
</tr>
<tr>
<td>FR-D720-0.3K-G</td>
<td>108</td>
<td>96</td>
<td>135.5</td>
</tr>
<tr>
<td>FR-D720-0.75K-G</td>
<td>170</td>
<td>158</td>
<td>142.5</td>
</tr>
<tr>
<td>FR-D720-1.5K-G</td>
<td>108</td>
<td>96</td>
<td>135.5</td>
</tr>
<tr>
<td>FR-D720-2.2K-G</td>
<td>170</td>
<td>158</td>
<td>142.5</td>
</tr>
<tr>
<td>FR-D720-3.7K-G</td>
<td>170</td>
<td>158</td>
<td>142.5</td>
</tr>
</tbody>
</table>

### Three-phase 400V class

<table>
<thead>
<tr>
<th>Drive unit Model</th>
<th>W</th>
<th>W1</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>FR-D740-0.4K-G</td>
<td>108</td>
<td>96</td>
<td>135.5</td>
</tr>
<tr>
<td>FR-D740-0.75K-G</td>
<td>170</td>
<td>158</td>
<td>142.5</td>
</tr>
<tr>
<td>FR-D740-1.5K-G</td>
<td>170</td>
<td>158</td>
<td>142.5</td>
</tr>
<tr>
<td>FR-D740-2.2K-G</td>
<td>170</td>
<td>158</td>
<td>142.5</td>
</tr>
<tr>
<td>FR-D740-3.7K-G</td>
<td>170</td>
<td>158</td>
<td>142.5</td>
</tr>
</tbody>
</table>

(Unit:mm)
The EU Directives are issued to standardize different national regulations of the EU Member States and to facilitate free movement of the equipment, whose safety is ensured, in the EU territory. Since 1996, compliance with the EMC Directive that is one of the EU Directives has been legally required. Since 1997, compliance with the Low Voltage Directive, another EU Directive, has been also legally required. When a manufacturer confirms its equipment to be compliant with the EMC Directive and the Low Voltage Directive, the manufacturer must declare the conformity and affix the CE marking.

The authorized representative in the EU

The authorized representative in the EU is shown below.
Name: Mitsubishi Electric Europe B.V.
Address: Mitsubishi-Electric-Platz 1, 40882 Ratingen, Germany

Note
We declare that this drive unit, when equipped with the dedicated EMC filter, conforms with the EMC Directive in industrial environments and affix the CE marking on the drive unit. When using the drive unit in a residential area, take appropriate measures and ensure the conformity of the drive unit used in the residential area.

(1) EMC Directive

We declare that this drive unit, when equipped with the EMC Directive compliant EMC filter, conforms with the EMC Directive and affix the CE marking on the drive unit (except the single-phase 100V power supply model).

- EMC Directive: 2014/30/EU

Note: First environment
Environment including buildings/facilities which are directly connected to a low voltage main supply which also supplies residential buildings.
Directly connected means that there is no intermediate transformer between these buildings.
Second environment
Environment including all buildings/facilities which are not directly connected to a low voltage main supply which also supplies residential buildings.

Note
- Set the EMC Directive compliant EMC filter to the drive unit. Insert line noise filters and ferrite cores to the power and control cables as required.
- Connect the drive unit to an earthed power supply.
- Install a motor, the EMC Directive compliant EMC filter, and a control cable according to the instructions written in the EMC Installation Guidelines (BCN-A21041-204). (Please contact your sales representative for the EMC Installation Guidelines.)
- The cable length to the motor should be within 20m so that the EMC Directive compliant noise filter functions sufficiently.
- Confirm that the final integrated system with the drive unit conforms with the EMC Directive.
(2) Low Voltage Directive

We have self-confirmed our drive units as products compliant to the Low Voltage Directive (Conforming standard EN 61800-5-1) and affix the CE marking on the drive units.

Outline of instructions

- Do not use an earth leakage circuit breaker as an electric shock protector without connecting the equipment to the earth. Connect the equipment to the earth securely.
- Wire the earth (ground) terminal independently. (Do not connect two or more cables to one terminal.)
- Use the cable sizes on page 14 under the following conditions.
  - Surrounding air temperature: 40°C maximum
  - If conditions are different from above, select appropriate wire according to EN60204.
- Use a tinned (plating should not include zinc) crimping terminal to connect the earth cable. When tightening the screw, be careful not to damage the threads.
- Use a moulded case circuit breaker and magnetic contactor which conform to the EN or IEC Standard.
- When using an earth leakage circuit breaker, use a residual current operated protective device (RCD) of type B (breaker which can detect both AC and DC). If not, provide double or reinforced insulation between the drive unit and other equipment, or put a transformer between the main power supply and drive unit.
- Use the drive unit under the conditions of overvoltage category II ( usable regardless of the earth (ground) condition of the power supply), overvoltage category III (usable with the earthed-neutral system power supply, 400V class only) specified in IEC60664.
- To use the drive unit under the conditions of pollution degree 3, install it in the enclosure of IP54 or higher.
- To use the drive unit outside of an enclosure in the environment of pollution degree 2, fix the fan cover with fan cover fixing screws enclosed.

Note, the protection structure of the Drive unit units is considered to be an IP00.

- On the input and output of the drive unit, use cables of the type and size set forth in EN60204.
- The operating capacity of the relay outputs (terminal symbols A, B, C) should be 30VDC, 0.3A. (Relay output has basic isolation from the drive unit internal circuit.)
- Control circuit terminals on page 9 are safely isolated from the main circuit.
- Environment

<table>
<thead>
<tr>
<th></th>
<th>Running</th>
<th>In Storage</th>
<th>During Transportation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surrounding air temperature</td>
<td>-10°C to +50°C</td>
<td>-20°C to +65°C</td>
<td>-20°C to +65°C</td>
</tr>
<tr>
<td>Humidity</td>
<td>95% RH or less</td>
<td>90% RH or less</td>
<td>90% RH or less</td>
</tr>
<tr>
<td>Maximum Altitude</td>
<td>1000m</td>
<td>1000m</td>
<td>10000m</td>
</tr>
</tbody>
</table>
For branch circuit protection, select an appropriate UL and cUL listed fuse with a cut-off speed of Class T, Class J, Class CC, or faster, or a UL 489 molded case circuit breaker (MCCB) in accordance with the following table.

Maximum allowable rating by US National Electrical Code. Exact size must be chosen for each installation.

When using the electronic thermal relay function as motor overload protection, set the rated motor current in Pr. 9 Electronic thermal O/L relay.

Electronic thermal relay function operation characteristic

Short circuit current ratings
- 200V class
  Suitable For Use In A Circuit Capable of Delivering Not More Than 5kA rms Symmetrical Amperes, 264V Maximum.
- 400V class
  Suitable For Use In A Circuit Capable of Delivering Not More Than 5kA rms Symmetrical Amperes, 528V Maximum.
Appendix 2  Instructions for UL and cUL

(Standard to comply with: UL 508C, CSA C22.2 No. 214-13)

1. General precaution

CAUTION - Risk of Electric Shock -
The bus capacitor discharge time is 10 minutes. Before starting wiring or inspection, switch power off, wait for more than 10 minutes, and check for residual voltage between terminal P/+ and N/- with a meter etc., to avoid a hazard of electrical shock.

ATTENTION - Risque de choc électrique -
La durée de décharge du condensateur de bus est de 10 minutes. Avant de commencer le câblage ou l’inspection, mettez l’appareil hors tension et attendez plus de 10 minutes.

2. Installation

The below types of drive unit have been approved as products for use in enclosure and approval tests were conducted under the following conditions. Design the enclosure so that the surrounding air temperature, humidity and ambience of the drive unit will satisfy the specifications. (Refer to page 42.)

Branch Circuit Protection

Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electrical Code for the U.S. or the Canadian Electrical Code for Canada and any additional codes. As specified, UL Class T, Class J, Class CC fuses or any faster acting fuse with the appropriate rating or Listed UL 489 Molded Case Circuit Breaker (MCCB), or Type E combination motor controller must be employed.

3. Short circuit ratings

• 200V class
  Suitable for use in a circuit capable of delivering not more than 100 kA rms symmetrical amperes, 264 V maximum.

• 400V class
  Suitable for use in a circuit capable of delivering not more than 25 kA rms symmetrical amperes, 480Y/277 volts maximum when protected by the Type E combination motor controllers indicated in the above table.

4. Wiring

Refer to the National Electrical Code (Article 310) regarding the allowable current of the cable. Select the cable size for 125% of the rated current according to the National Electrical Code (Article 430). For wiring the input (R/L1, S/L2, T/L3) and output (U, V, W) terminals of the drive unit, use the UL Listed copper, stranded wires (rated at 75°C) and round crimping terminals. Crimp the crimping terminals with the crimping tool recommended by the terminal maker.

5. Motor overload protection

When using the electronic thermal relay function as motor overload protection, set the rated motor current to Pr. 9 Electronic thermal O/L relay (refer to page 48).

NOTE

Motor over temperature sensing is not provided by the drive.
Check the SERIAL number indicated on the drive unit rating plate or package. (Refer to page 1.)

The product certified in compliance with the Eurasian Conformity has the EAC marking.

Note: EAC marking
In 2010, three countries (Russia, Belarus, and Kazakhstan) established a Customs Union for the purposes of revitalizing the economy by forming a large economic bloc by abolishing or reducing tariffs and unifying regulatory procedures for the handling of articles.

Products to be distributed over these three countries of the Customs Union must comply with the Customs Union Technical Regulations (CU-TR), and the EAC marking must be affixed to the products.

For information on the country of origin, manufacture year and month, and authorized sales representative (importer) in the CU area of this product, refer to the following:

- Country of origin indication
  Check the rating plate of the product. (Refer to page 1.)
  Example: MADE IN JAPAN

- Manufactured year and month
  Check the SERIAL number (refer to Appendix 4) indicated on the rating plate (refer to page 1) of the product.

- Authorized sales representative (importer) in the CU area
  The authorized sales representative (importer) in the CU area is shown below.
  Name: Mitsubishi Electric (Russia) LLC
  Address: 52, bld 1 Kosmodamianskaya Nab 115054, Moscow, Russia
  Phone: +7 (495) 721-2070
  Fax: +7 (495) 721-2071

Appendix 3 SERIAL number check

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Year</th>
<th>Month</th>
<th>Control number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>SERIAL (Serial No.)</td>
</tr>
</tbody>
</table>

The SERIAL consists of one symbol, two characters indicating the production year and month, and six characters indicating the control number.

Last digit of the production year is indicated as the Year, and the Month is indicated by 1 to 9, X (October), Y (November), and Z (December).

Appendix 4 Instructions for EAC

The product certified in compliance with the Eurasian Conformity has the EAC marking.

Note: EAC marking
In 2010, three countries (Russia, Belarus, and Kazakhstan) established a Customs Union for the purposes of revitalizing the economy by forming a large economic bloc by abolishing or reducing tariffs and unifying regulatory procedures for the handling of articles.

Products to be distributed over these three countries of the Customs Union must comply with the Customs Union Technical Regulations (CU-TR), and the EAC marking must be affixed to the products.

For information on the country of origin, manufacture year and month, and authorized sales representative (importer) in the CU area of this product, refer to the following:

- Country of origin indication
  Check the rating plate of the product. (Refer to page 1.)
  Example: MADE IN JAPAN

- Manufactured year and month
  Check the SERIAL number (refer to Appendix 4) indicated on the rating plate (refer to page 1) of the product.

- Authorized sales representative (importer) in the CU area
  The authorized sales representative (importer) in the CU area is shown below.
  Name: Mitsubishi Electric (Russia) LLC
  Address: 52, bld 1 Kosmodamianskaya Nab 115054, Moscow, Russia
  Phone: +7 (495) 721-2070
  Fax: +7 (495) 721-2071
Appendix 5 Restricted Use of Hazardous Substances in Electronic and Electrical Products

The mark of restricted use of hazardous substances in electronic and electrical products is applied to the product as follows based on the “Management Methods for the Restriction of the Use of Hazardous Substances in Electrical and Electronic Products” of the People’s Republic of China.

电器电子产品有害物质限制使用标识要求

本产品中所含有的有害物质的名称、含量、含有部件如下表所示。

* 产品中所含有害物质的名称及含量

<table>
<thead>
<tr>
<th>部件名称</th>
<th>有害物质</th>
<th>铅 (Pb)</th>
<th>汞 (Hg)</th>
<th>镉 (Cd)</th>
<th>六价铬 (Cr(VI))</th>
<th>多溴联苯 (PBB)</th>
<th>多溴二苯醚 (PBDE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>电路板组件 (包括印刷电路板及其构成的零部件, 如电阻、电容、集成电路、连接器等)、电子部件</td>
<td>×○×○○○</td>
<td>×○×○○○</td>
<td>×○×○○○</td>
<td>×○×○○○</td>
<td>×○×○○○</td>
<td>×○×○○○</td>
<td>×○×○○○</td>
</tr>
<tr>
<td>金属壳体、金属部件</td>
<td>×○×○○○</td>
<td>×○×○○○</td>
<td>×○×○○○</td>
<td>×○×○○○</td>
<td>×○×○○○</td>
<td>×○×○○○</td>
<td>×○×○○○</td>
</tr>
<tr>
<td>橡胶、电线</td>
<td>×○×○○○</td>
<td>×○×○○○</td>
<td>×○×○○○</td>
<td>×○×○○○</td>
<td>×○×○○○</td>
<td>×○×○○○</td>
<td>×○×○○○</td>
</tr>
</tbody>
</table>

上表依据 SJ/T11364 规定编制。
×：表示该有害物质在该部件至少一种均质材料中的含量超出 GB/T26572 规定的限量要求。
○：表示该有害物质在该部件所有均质材料中的含量均在 GB/T26572 规定的限量要求以下。

根据产品型号，一部分部件可能不包含在产品中。

Appendix 6 Referenced Standard (Requirement of Chinese standardized law)

This Product is designed and manufactured accordance with following Chinese standards.

Electrical safety: GB12668.501
EMC: GB12668.3
**For Maximum Safety**

- Mitsubishi Electric drive units are not designed or manufactured to be used in equipment or systems in situations that can affect or endanger human life.
- When considering this product for operation in special applications such as machinery or systems used in passenger transportation, medical, aerospace, atomic power, electric power, or submarine repeating applications, please contact your nearest Mitsubishi Electric sales representative.
- Although this product was manufactured under conditions of strict quality control, you are strongly advised to install safety devices to prevent serious accidents when it is used in facilities where breakdowns of the product are likely to cause a serious accident.
- Please do not use this product for loads other than the PM motor.

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### REVISIONS

*The manual number is given on the bottom left of the back cover.*

<table>
<thead>
<tr>
<th>Revision Date</th>
<th>Manual Number</th>
<th>Revision</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 2012</td>
<td>IB(NA)-0600477ENG-B</td>
<td>Modification Change in the India FA Center address</td>
</tr>
<tr>
<td>Apr. 2016</td>
<td>IB(NA)-0600477ENG-C</td>
<td>Addition • FR-1K760.0.4K to 3.7K-G • Pr.281 Brake operation time at start • Pr.283 Brake operation time at stop • Pr.643 Voltage compensation amount setting • Pr.658 Wiring resistance • Setting values &quot;10, 11&quot; of Pr.167 Output current detection operation selection • Setting values &quot;20, 37, 120, 137&quot; of Pr.190 and Pr.192</td>
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<tr>
<td>May 2018</td>
<td>IB(NA)-0600477ENG-D</td>
<td>Addition • Pr.71, Pr.80, Pr.81, Pr.83, Pr.84, Pr.90, Pr.92, Pr.93, Pr.96, Pr.600 to Pr.604, Pr.672, Pr.702, Pr.706, Pr.707, Pr.711, Pr.712, Pr.717, Pr.721, Pr.724 to Pr.726, Pr.824, Pr.825, Pr.859, Pr.908 • AppendixD Referenced Standard (Requirement of Chinese standardized law) • Appendix2 Instructions for UL and cUL</td>
</tr>
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