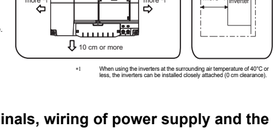
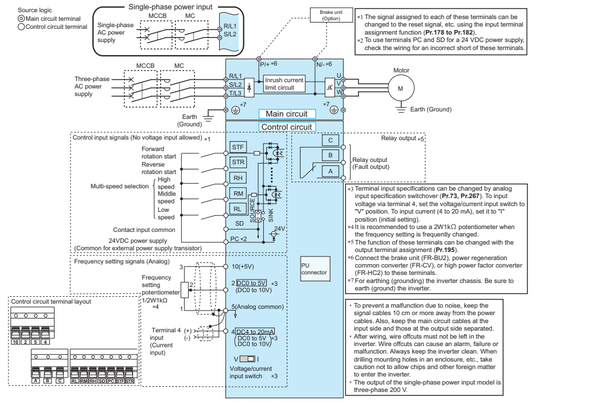
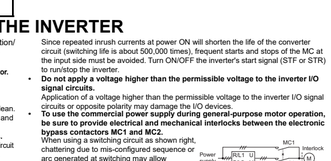






MITSUBISHI ELECTRIC

INVERTER

FREQROL-CS80

Instructions and Cautions for Use of Inverters

FR-CS84-012 to 295-60

FR-CS82S-025 to 100-60

Please forward this document to the end user.
For details, refer to the Instruction Manual (Detailed) of the inverter.

Contact information

The document is available for download on the following web page:
http://app.mitsubishielectric.com/app/fa/download/search.do?mode=manual

Find the contact information on the following web page:
http://www.mitsubishielectric.com/company/about/locations/index.html

IB-0600720-C(2110)

This document provides handling information and precautions for use of this product.
Please forward this document to the end user.

Safety instructions

Do not attempt to install, operate, maintain or inspect the product until you have read through this document (Instructions and Cautions for Use of Inverters) and appended documents carefully and can use the equipment correctly.
Do not use this product until you have a full knowledge of the equipment, safety information and instructions.

- **Installation, operation, maintenance, and inspection must be performed by qualified personnel. Here, qualified personnel means a person who meets all the following conditions.**
- **A person who possesses a certification in regard with electric appliance handling, or person took a proper engineering training. Such training may be available at your local Mitsubishi Electric office. Contact your local sales office for schedules and locations.**

In this document (Instructions and Cautions for Use of Inverters), the safety instruction levels are classified into "WARNING" and "CAUTION".

⚠WARNING	**Incorrect handling may cause hazardous conditions, resulting in death or severe injury.**
⚠CAUTION	**Incorrect handling may cause hazardous conditions, resulting in medium or slight injury, or may cause only material damage.**

Note that even the ⚠CAUTION level may lead to a serious consequence depending on conditions. Be sure to follow the instructions of both levels as they are critical to personnel safety.

◆ **Fire Prevention**

⚠CAUTION

- The inverter must be installed on a nonflammable wall without any through holes so that nobody touches the heatsink, etc. on the rear side of the inverter. Installing it on or near flammable material may cause a fire.
- If the inverter has become faulty, the inverter power must be switched OFF. A continuous flow of large current may cause a fire.
- Do not connect a resistor directly to the DC terminals P/+ and N/-. Doing so could cause a fire.
- Be sure to perform daily and periodic inspections as specified in the Instruction Manual. If this product is used without any inspection, a burst, breakage, or a fire may occur.

◆ **Injury Prevention**

⚠CAUTION

- The voltage applied to each terminal must be as specified in this document. Otherwise a burst, damage, etc. may occur.
- The cables must be connected to the correct terminals. Otherwise a burst, damage, etc. may occur.
- The polarity (+ and -) must be correct. Otherwise a burst, damage, etc. may occur.
- While power is ON or for some time after power OFF, do not touch the inverter as it will be extremely hot. Touching these devices may cause a burn.

◆ **Additional Instructions**
The following instructions must be also followed. If the product is handled incorrectly, it may cause an unexpected fault, injury, or electric shock

⚠CAUTION

Transportation and installing

- Any person who is opening a package using a sharp object, such as a knife or cutter, must wear gloves to prevent injuries caused by the edge of the sharp object.
- The product must be transported in correct method that corresponds to the weight. Failure to do so may lead to injuries.
- Do not stand or place any heavy object on the product.
- Do not stack the boxes containing products higher than the number recommended.
- When carrying the product, do not hold it by the front cover. Doing so may cause a fall or failure of the product.
- During installation, caution must be taken not to drop the inverter as doing so may cause injuries.
- The product must be installed on the surface that withstands the weight of the product.
- Do not install the product on a hot surface.
- The installing orientation of the inverter must be correct.
  The inverter must be installed securely with screws so that it does not drop.
- Do not install or operate the inverter if it is damaged or has parts missing.
- Prevent conductive items such as screws and metal fragments, or flammable substances such as oil from entering the inverter.
- As the inverter is a precision instrument, do not drop or subject it to impact.
- The surrounding air temperature must be -10 to +40°C*1(non-freezing). Otherwise the inverter may be damaged.
- The ambient humidity must be 95% RH or less (non-condensing). Otherwise the inverter may be damaged. (Refer to page 6 for details.)
- The temporary storage temperature (applicable to a short limited time such as a transportation time) must be between -20 and +65°C. Otherwise the inverter may be damaged.
- Any person must stay away from the motor or machinery when the retry function or the automatic restart after instantaneous power failure function is set in the inverter as the motor or the machine will restart suddenly at occurrence of a fault or instantaneous power failure.
- The inverter must be used indoors (without corrosive gas, flammable gas, oil mist, dust and dirt). Otherwise the inverter may be damaged.

*1 40 to 50°C (non-freezing) at the rated current reduced by 15%.

⚠CAUTION

Transportation and installing

- The inverter must be used at an altitude of 2500 m or less, with 5.9 m/s2 or less vibration at 10 to 55 Hz (directions of X, Y, Z axes). Otherwise the inverter may be damaged.
- If halogen-based materials (fluorine, chlorine, bromine, iodine, etc.), included in fumigants to sterilize or disinfect wooden packages, infiltrate into the product, the product may be damaged. Prevent residual fumigant components from being infiltrated into the product when packaging, or use an alternative sterilization or disinfection method (heat disinfection, etc.). Note that sterilization of disinfection of wooden package should be performed before packing the product.

Wiring

- Do not install a power factor correction capacitor, surge absorber, or radio noise filter on the inverter's output side. These devices may be overheated or burn out.
- The output of the inverter (output terminals U, V, and W) must be correctly connected to a motor. Otherwise the motor rotates inversely.

Test operation

- Before starting the test operation, confirm or adjust the parameter settings. A failure to do so may cause some machines to make unexpected motions.

⚠WARNING

Usage

- Access to the motor is allowed only after it is fully confirmed that the motor does not start running.
- Depending on the product's function settings, the product does not stop its output even when the STOP/RESET key on the operation panel is pressed. To prepare for it, provide a separate circuit and switch (to turn the product power OFF, or apply a mechanical brake, etc.) for an emergency stop.
- Be sure to turn OFF the start (STF/STR) signal before clearing the fault as the product will restart the motor suddenly after a fault clear.
- Use only a three-phase induction motor as a load on this product. Connection of any other electrical equipment to the inverter output may damage the equipment.
- Do not modify the product.
- Do not remove any part which is not instructed to be removed in the Instruction Manuals. Doing so may lead to a failure or damage.

⚠CAUTION

Usage

- The electronic thermal O/L relay function may not be enough for protection of a motor from overheating. It is recommended to install an external thermal relay for overheat protection.
- Do not use a magnetic contactor on the inverter input side for frequent starting/stopping of the inverter. Otherwise the life of the inverter decreases.
- Use a noise filter or other means to minimize the electromagnetic interference with other electronic equipment used nearby the inverter.
- Appropriate measures must be taken to suppress harmonics. Otherwise power harmonics generated from the inverter may heat/damage a power factor correction capacitor or a generator.
- To drive a 400 V class motor by the inverter, use an insulation-enhanced motor, or take measures to suppress surge voltage. Otherwise surge voltage attributable to the line constants may occur at the motor terminals, deteriorating the insulation of the motor.
- As all parameters return to their initial values after the Parameter clear or All parameter clear is performed, the parameters must be set again as required before the operation is started.
- The inverter can be easily set for high-speed operation. Therefore, consider all things related to the operation such as the performance of a motor and equipment in a system before the setting change.
- Before running an inverter which have been stored and not been operated for a long period, perform an inspection and a test operation.
- If no indication appears on the operation panel after a quick power reset, it may be caused by activation of the internal protection circuit. In such a case, turn OFF the power supply on the input side once and wait several minutes. Note that a quick power reset may shorten the life of this product.
- To avoid damage due to static electricity, static electricity in your body must be discharged before you touch the product.
- To maintain the security (confidentiality, integrity, and availability) of the inverter and the system against unauthorized access, DoS*2 attacks, computer viruses, and other cyberattacks from external devices via network, take appropriate measures such as firewalls, virtual private networks (VPNs), and antivirus solutions. We shall have no responsibility or liability for any problems involving inverter trouble and system trouble by DoS attacks, unauthorized access, computer viruses, and other cyberattacks.

Emergency stop

- 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 the inverter failure.
- If the breaker installed on the inverter input side is tripped, check for the wiring fault (such as short circuit) and damage to internal parts of the inverter, etc. Identify and remove the cause of the trip before resetting the tripped breaker and applying the power to the inverter again.
- When any protective function is activated, take an appropriate corrective action before resetting the inverter to resume the operation.
- Maintenance, inspection and parts replacement
- Do not carry out a megger (insulation resistance) test on the control circuit of the inverter. Doing so will cause a failure.

Disposal

- The product must be treated as industrial waste.

*2 DoS: A denial-of-service (DoS) attack disrupts services by overloading systems or exploiting vulnerabilities, resulting in a denial-of-service (DoS) state.

General instruction

- For clarity purpose, illustrations in this document may be drawn with covers or safety guards removed. Ensure all covers and safety guards are properly installed in place prior to starting operation.

1 REMOVAL AND REINSTALLATION OF WIRING COVER

1.1 Removal of the wiring cover

Loosen the mounting screws of the wiring cover to pull out and remove the cover easily. To remove or reinstall the wiring cover of the FR-CS84-012 to 080 or the FR-CS82S, open the front cover.

1.2 Inverter installation

◆ **Inverter placement**
For the FR-CS84-036 to 080 and the FR-CS82S-070 and 100, remove the wiring cover before installing the inverter.

- Install the inverter on a strong surface securely with screws.
- Leave enough clearances and take cooling measures.
- Avoid places where the inverter is subjected to direct sunlight, high temperature and high humidity.
- Install the inverter on a nonflammable wall surface.
- When encasing multiple inverters in an enclosure, install them in parallel as a cooling measure.
- For heat dissipation and maintenance, keep clearance between the inverter and the other devices or enclosure surface. The clearance below the inverter is required as a wiring space, and the clearance above the inverter is required as a heat dissipation space.
- Install the inverter on the wall with no holes to prevent the cooling air from escaping.

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

2 WIRING

2.1 Terminal layout of the main circuit terminals, wiring of power supply and the motor

- Make sure the power cables are connected to terminals R/L1, S/L2, and T/L3. However, the FR-CS82S is not equipped with terminal T/L3. (the phases need not be matched). Never connect the power cable to terminals U, V, and W of the inverter. Doing so will damage the inverter.
- Connect the motor to terminals U, V, and W. The motor rotates counterclockwise when viewed from the motor load side when the forward rotation switch (signal) turns ON.

2.2 Terminal connection diagram

*1 The signal assigned to each of these terminals can be changed to the reset signal, etc. using the input terminal assignment function (**Pr.178 to Pr.182**).
*2 To use terminals PC and SD for a 24 VDC power supply, check the wiring for an incorrect short of these terminals.
*3 Terminal input specifications can be changed by analog input specification switchover (**Pr.73, Pr.267**). To input voltage via terminal 4, set the voltage/current input switch to "V" position. To input current (4 to 20 mA), set it to "I" position (initial setting).
*4 It is recommended to use a 2W1kΩ potentiometer when the frequency setting is frequently changed.
*5 The function of these terminals can be changed with the output terminal assignment (**Pr.195**).
*6 Connect the brake unit (FR-BU2), power regeneration common converter (FR-CV), or high power factor converter (FR-HC2) to these terminals.
*7 For earthing (grounding) the inverter chassis. Be sure to earth (ground) the inverter.

- To prevent a malfunction due to noise, keep the signal cables 10 cm or more away from the power cables. Also, keep the main circuit cables at the input side and those at the output side separated.
- After wiring, wire offcuts must not be left in the inverter. Wire offcuts can cause an alarm, failure or malfunction. Always keep the inverter clean. When drilling mounting holes in an enclosure, etc., take caution not to allow chips and other foreign matter to enter the inverter.
- The output of the single-phase power input model is three-phase 200 V.

2.3 Applicable cables and wiring length

Select a recommended cable size to ensure that the voltage drop will be 2% or less.
If the wiring distance is long between the inverter and motor, the voltage drop in the main circuit will cause the motor torque to decrease especially at a low speed.
The following table indicates a selection example for the wiring length of 20 m.

Applicable inverter model		Terminal screw size*4	Tightening torque (N·m)	Crimp terminal		Cable gauge							
						HIV cables, etc. (mm2)*1			AWG/MCM*2		PVC cables, etc. (mm2)*3		
				R/L1, S/L2, T/L3	U, V, W	R/L1, S/L2, T/L3	U, V, W	Earthing (grounding)	R/L1, S/L2, T/L3	U, V, W	R/L1, S/L2, T/L3	U, V, W	Earthing (grounding)
Three-phase 400 V class	FR-CS84-012, 022	M3.5	1.2	2-3.5	2-3.5	2	2	2	14	14	2.5	2.5	2.5
	FR-CS84-036 to 080	M4	1.5	2-4	2-4	2	2	2	14	14	2.5	2.5	2.5
	FR-CS84-120	M4	1.5	5.5-4	2-4	3.5	2	3.5	12	14	4	2.5	4
	FR-CS84-160	M4	1.5	5.5-4	5.5-4	3.5	3.5	3.5	12	12	4	4	4
	FR-CS84-230	M5	2.5	8-5	8-5	8	8	5.5	8	8	10	10	10
	FR-CS84-295	M5	2.5	8-5	8-5	8	8	5.5	8	8	10	10	10
Single-phase 200V class	FR-CS82S-025 to 042	M3.5	1.2	2-3.5	2-3.5	2	2	2	14	14	2.5	2.5	2.5
	FR-CS82S-070	M4	1.5	2-4	2-4	2	2	2	14	14	2.5	2.5	2.5
	FR-CS82S-100	M4	1.5	5.5-4	2-4	3.5	2	3.5	12	14	4	2.5	4

*1 It is the gauge of a cable with the continuous maximum permissible temperature of 75°C (HIV cable (600 V grade heat-resistant PVC insulated wire), etc.). It assumes a surrounding air temperature of 50°C or lower and the wiring distance of 20 m or shorter.
*2 It is the gauge of the cable with continuous maximum permissible temperature of 75°C (THHW cable). It assumes a surrounding air temperature of 40°C or lower and the wiring distance of 20 m or shorter (selection example mainly for use in the United States).
*3 It is the gauge of a cable with the continuous maximum permissible temperature of 70°C (PVC cable). It assumes a surrounding air temperature of 40°C or lower and the wiring distance of 20 m or shorter (selection example mainly for use in Europe).
*4 It indicates the size of screw for terminals R/L1, S/L2, T/L3, U, V, W, P/+, and N/- and a terminal for earthing (grounding).

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

$$\text{Line voltage drop [V]} = \sqrt{3} \times \text{wire resistance [m}\Omega\text{/m]} \times \text{wiring distance [m]} \times \text{current [A]} / 1000$$

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.

◆ **Total wiring length**
Connect one or more motors within the total wiring length (sum of the wiring lengths of the motor and the inverter) shown in the following table.

Cable type	Model FR-CS84-[]									Model FR-CS82S-[]			
	012	022	036	050	080	120	160	230	295	025	042	070	100
Unshielded	50 m	50 m	50 m	50 m	50 m	100 m	100 m	100 m	100 m	50 m	50 m	50 m	50 m
Shielded	25 m	25 m	50 m	50 m	50 m	100 m	100 m	100 m	100 m	25 m	25 m	50 m	50 m

When driving a 400 V class motor by the inverter, surge voltages attributable to the wiring constants may occur at the motor terminals, deteriorating the insulation of the motor. In this case, use a 400 V class inverter-driven insulation-enhanced motor.
When the wiring length is 50 m or more, set "8" (8 kHz) or less in **Pr.72 PWM frequency selection**.

2.4 Control circuit specification

Type	Terminal symbol	Terminal name	Terminal function description		Rated specification
Contact input	STF	Forward rotation start	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.	Input resistance: 4.7 kΩ Voltage when contacts are open: 21 to 26 VDC Current when contacts are short-circuited: 4 to 6 mADC
	STR	Reverse rotation start	Turn ON the STR signal to start reverse rotation and turn it OFF to stop.		
	RH, RM, RL	Multi-speed selection	Multi-speed can be selected according to the combination of RH, RM and RL signals. When a multi-speed setting signal is ON, the signal takes precedence over the terminal 2 analog input.		
	SD	Contact input common (sink)	Common terminal for the contact input terminal (sink logic).		―――
		External transistor common (source) (initial setting)	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.		
		24 VDC power supply common	Common output terminal for 24 VDC 30 mA power supply (terminal PC). Isolated from terminal 5.		
	PC	External transistor common (sink)	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.		Power supply voltage range: 22 to 26.5 VDC Permissible load current: 30 mA
		Contact input common (source) (initial setting)	Common terminal for the contact input terminal (source logic).		
		24 VDC power supply	Can be used as a 24 VDC 30 mA power supply.		
Frequency setting	10	Frequency setting power supply	Used as the power supply for an external frequency setting (speed setting) potentiometer.		5.0 ± 0.2 VDC Permissible load current: 10 mA
	2	Frequency setting (voltage)	Inputting 0 to 5 VDC (or 0 to 10 VDC) provides the maximum output frequency at 5 V (or 10 V) and makes input and output proportional. Use **Pr.73** to switch between input 0 to 5 VDC (initial setting) and 0 to 10 VDC.*1		Input resistance: 10 kΩ ± 1 kΩ Permissible maximum voltage: 20 VDC
	4	Frequency setting (current)	Inputting 4 to 20 mADC (or 0 to 5 V, 0 to 10 V) provides the maximum output frequency at 20 mA 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 the terminal 4 (current input at initial setting), assign "4 " to any of **Pr.178** to **Pr.182** (Input terminal function selection) before turning ON the AU signal. Use **Pr.267** to switch among input 4 to 20 mA (initial setting), 0 to 5 VDC, and 0 to 10 VDC. Set the voltage/current input switch in the "V" position to select voltage input (0 to 5 V or 0 to 10 V).*1		For current input Input resistance: 249 ± 5 Ω Permissible maximum current: 30 mA For voltage input Input resistance: 10 ±1 kΩ Permissible maximum voltage: 20 VDC Current input (initial status) Voltage input V I V I
	5	Frequency setting common	Common terminal for the frequency setting signal (terminal 2 or 4). Do not earth (ground).		―――
Relay	A, B, C	Relay output (fault output)	1 changeover contact output that indicates that an inverter's protective function has been activated and the outputs are stopped. Fault: discontinuity across B and C (continuity across A and C), Normal: continuity across B and C (discontinuity across A and C)		Contact capacity:230 VAC 0.3 A (power factor =0.4) 30 VDC 0.3 A
RS-485	――	PU connector	With the PU connector, communication can be made through RS-485. ・Conforming standard: EIA-485 (RS-485) ・Transmission format: Multidrop link ・Communication speed: 4800 to 115200 bps ・Wiring length: 500 m		

*1 Set **Pr.73, Pr.267**, and the voltage/current input switch correctly, then input an analog signal in accordance with the setting.
Applying a voltage with the voltage/current input switch in the "I" position (current input is selected) or applying a current with the switch in the "V" position (voltage input is selected) could cause component damage of the inverter or analog circuits of output devices.

3 Basic operation

4 SPECIFICATIONS

4.1 Rating

Model		012	022	036	050	080	120	160	230	295	-	-	-	-
	FR-CS84-[]-60	012	022	036	050	080	120	160	230	295	-	-	-	-
	FR-CS82S-[]-60	-	-	-	-	-	-	-	-	-	025	042	070	100
Applicable motor capacity (kW)*1		0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	15	0.4	0.75	1.5	2.2
Output	Rated capacity (kVA)*2	0.9	1.7	2.7	3.8	6.1	9.1	12.2	17.5	22.5	1.0	1.7	2.8	4.0
	Rated current (A)*4	1.2 (1.0)	2.2 (1.9)	3.6 (3.1)	5.0 (4.3)	8.0 (6.8)	12.0 (10.2)	16.0 (13.6)	23.0 (19.6)	29.5 (25.1)	2.5 (2.1)	4.2 (3.6)	7.0 (6.0)	10.0 (8.5)
	Overload current rating *3	150% 60 s, 200% 0.5 s (inverse-time characteristics)												
	Rated voltage *5	Three-phase 380 to 480 V									Three-phase 200 to 240 V			
Power supply	Rated input AC voltage and frequency	Three-phase 380 to 480 V, 50/60 Hz									Single-phase 200 to 240 V, 50/60 Hz			
	Permissible AC voltage fluctuation	325 to 528 V, 50/60 Hz									170 to 264 V, 50/60 Hz			
	Permissible frequency fluctuation	±5%									±5%			
	Power supply capacity (kVA)*6	1.5	2.5	4.5	5.5	9.5	12.0	17.0	20.0	28.0	1.5	2.3	4.0	5.2
Protective structure (IEC 60529)		Open type (IP20)												
Cooling system		Natural					Forced air				Natural			Forced air
Approx. mass (kg)		0.6	0.6	0.9	0.9	1.4	1.9	1.9	3.5	3.5	0.6	0.6	1.4	1.4

*1 The applicable motor capacity is the maximum allowable capacity of the motor with respect to a Mitsubishi Electric 4-pole standard motor.
*2 The rated output capacity indicated assumes that the output voltage is 230 V for single-phase 200 V class and 440 V for three-phase 400 V class.
*3 The percentage of the overload current rating is the ratio of the overload current to the inverter's rated output current. For repeated duty, allow time for the inverter and motor to return to or below the temperatures under 100% load. For single-phase 200 V model, the bus voltage decreases to power failure detection level and the load of 100% or higher may not be available if the automatic restart after instantaneous power failure function (**Pr.57**) or the power failure stop function (**Pr.261**) is set and power supply voltage is low while the load increases.
*4 When operating the inverter with surrounding air temperature of 50°C, the rated output current is shown in parentheses.
*5 The maximum output voltage does not exceed the power supply voltage. The maximum output voltage can be changed within the setting range. However, the maximum point of the voltage waveform at the inverter output side is the power supply voltage multiplied by about $\sqrt{2}$.
*6 The power supply capacity is the value at the rated output current. The input power impedances (including those of the input reactor and cables) affect the value.

4.2 Common specifications

Control	Control method		Soft-PWM control, high carrier frequency PWM control (selectable among V/F control, General-purpose magnetic flux vector control, Optimum excitation control)
	Output frequency range		0.2 to 400 Hz
	Frequency setting and resolution	Analog input	0.06/60 Hz at 0 to 10 V / 10 bits (terminals 2 and 4). 0.12/60 Hz at 0 to 5 V / 9 bits (terminals 2 and 4). 0.06/60 Hz at 0 to 20 mA / 10 bits (terminal 4).
		Digital input	0.01 Hz
	Frequency accuracy	Analog input	Within ±1% of the maximum output frequency at 25°C (±10°C).
		Digital input	0.01% or less of the set output frequency
	Voltage/frequency characteristics		Selectable base frequency of 0 to 400 Hz, with selectable modes between Constant-torque and Adjustable 3 points V/F
	Starting torque		150% or more at 1 Hz ,with slip compensation function enabled under General-purpose magnetic flux vector control
	Torque boost		Manual torque boost
	Acceleration/deceleration time setting		0.1 to 3600 s, with individually acceleration and deceleration settings, selectable modes between Linear and S-pattern acceleration/deceleration
	DC injection brake		Operation frequency: 0 to 120 Hz, operation time: 0 to 10 s, operation voltage: 0 to 30% variable
	Stall prevention operation level		Operation current: 0 to 200% variable, with selectable availability of the function
Operation	Frequency setting signal	Analog input (2)	Terminal 2: Selectable from 0 to 10 V / 0 to 5 V Terminal 4: Selectable from 0 to 10 V / 0 to 5 V / 4 to 20 mA
		Digital input	Input from the operation panel or parameter unit, with selectable frequency setting increments
	Start signal		Separate forward/reverse signal, with selectable start self-holding input (3-wire input)
	Input signal (5)		Using **Pr.178 to Pr.182 (Input terminal function selection)**, the signal can be selected from the following: Multi-speed selection, Remote setting, Second acceleration/deceleration function selection, Terminal 4 input selection, JOG operation selection, PID control valid terminal, External thermal relay input, Output stop, Start self-holding selection, Forward rotation command, Reverse rotation command, Inverter reset, Traverse function selection.
	Operational function		Maximum frequency, minimum frequency, frequency jump operation, external thermal relay input selection, automatic restart after instantaneous power failure operation, forward/reverse rotation prevention, remote setting, second acceleration/deceleration function, multi-speed operation, regeneration avoidance, slip compensation, operation mode selection, offline auto tuning, PID control, computer link operation (RS-485 communication), Optimum excitation control, power failure stop, MODBUS RTU, Input monitoring, emergency drive, increased magnetic excitation deceleration.
	Output signal relay output (1)		Using **Pr.195 output terminal function selection**, the signal can be selected from the following: Inverter running, Up to frequency, Overload warning, Output frequency detection, Electronic thermal O/L relay pre-alarm, Inverter operation ready, Output current detection, PID lower limit, PID upper limit, PID forward/reverse rotation output, Heatsink overheat pre-alarm, During deceleration at occurrence of power failure, During PID control activated, PID output interruption, During retry, Alarm output, Fault output, Fault output 3.
Indication	Operation panel Parameter unit (FR-PU07)	Operating status monitoring	Selectable from the following: output frequency, output current(steady state), output voltage, frequency setting, cumulative energization time, actual operation time, converter output voltage, electronic thermal relay function load factor, motor load factor, PID set point, PID measured value, PID deviation, inverter I/O terminal monitor, output power, cumulative power, motor thermal load factor, inverter thermal load factor.
		Fault monitoring	Fault record is displayed when a protective function is activated. Past 8 fault records are stored. (output voltage, output current, frequency, and cumulative energization time right before the protective function is activated.)
		Interactive guidance	Help function for operation guide*1
Protective function		Fault	Overcurrent during acceleration, Overcurrent during constant speed, Overcurrent during deceleration, Overvoltage during acceleration, Overvoltage during constant speed, Overvoltage during deceleration, Inverter overload trip (electronic thermal relay function), Motor overload trip (electronic thermal relay function), Heatsink overheat, Input phase loss*3, Output side earth (ground) fault overcurrent as start, Output short circuit, Output phase loss, External thermal relay operation*2, Internal storage device fault, Parameter error, PU disconnection*2, Retry count excess*2, CPU fault, Inrush current limit circuit fault, 4 mA input fault*2, Stall prevention stop, Output current detection value exceeded*2, Inverter output fault*5, Undervoltage.
		Warning	Overcurrent stall prevention, Overvoltage stall prevention, PU stop, Parameter write error, Electronic thermal O/L relay pre-alarm, Undervoltage, Inrush current limit resistor heating, Operation panel lock, Password locked, Inverter reset, emergency drive in operation*2
Environment	Surrounding air temperature		-10 to +40°C (non-freezing)*4, or 40 to 50°C (non-freezing) at the rated current reduced by 15%
	Surrounding air humidity		95% RH or less (non-condensing)for models with circuit board coating (conforming to IEC 60721-3-3:1994 3C2/3S2)
	Storage temperature*6		-20 to +65°C
	Ambience		Indoors (free from corrosive gas, flammable gas, oil mist, dust or dirt)
	Altitude/vibration		2500 m or less (For the installation at an altitude above 1000 m, consider a 3% reduction in the rated current per 500 m increase in altitude.)/ 5.9 m/s^2 or less at 10 to 55 Hz (directions of X, Y, Z axes)

*1 Available for the option parameter unit (FR-PU07) only.
*2 Not available in the initial status.
*3 Available for the three-phase power input models.
*4 When using the inverters at the surrounding air temperature of 40°C or less, the inverters can be installed closely attached (0 cm clearance).
*5 Available for the FR-CS84-160 or lower or the FR-CS82S.
*6 Applicable to conditions for a short time, for example, in transit.

4.3 Outline dimension drawings

Inverter model	W	W1	H	H1	D	C
FR-CS84-012-60	68	56	128	118	118	5
FR-CS84-022-60						
FR-CS84-036-60	108	96	128	118	130	
FR-CS84-050-60						
FR-CS84-080-60					160	
FR-CS84-120-60	197.5	185.5	150	138	134	
FR-CS84-160-60						
FR-CS84-230-60	180	164	260	244	165	6
FR-CS84-295-60						
FR-CS82S-025-60	68	56	128	118	118	5
FR-CS82S-042-60						
FR-CS82S-070-60	108	96	128	118	160	
FR-CS82S-100-60						

5 PRECAUTIONS FOR USE OF THE INVERTER

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

- **Use crimp terminals with insulation sleeves to wire the power supply and the motor.**
- **Application of power to the output terminals (U, V, W) of the inverter will damage the inverter. Never perform such wiring.**
- **After wiring, wire offcuts must not be left in the inverter.**
  Wire offcuts can cause a fault, failure, or malfunction. Always keep the inverter clean. When drilling mounting holes in an enclosure etc., take caution not to allow chips and other foreign matter to enter the inverter.
- **Use an appropriate cable gauge to suppress the voltage drop to 2% or less.**
  If the wiring distance is long between the inverter and motor, a voltage drop in the main circuit will cause the motor torque to decrease especially during the output of a low frequency.
- **Keep the total wiring length within the specified length.**
  In long distance wiring, charging currents due to stray capacitance in the wiring may degrade the fast-response current limit operation or cause the equipment on the inverter's output side to malfunction. Pay attention to the total wiring length.
- **Electromagnetic wave interference:**
  The input/output (main circuit) of the inverter includes high frequency components, which may interfere with the communication devices (such as AM radios) used near the inverter. In such a case, install the optional radio noise filter FR-BIF (for use in the input side only) or FR-BSF01 or FR-BLF EMC filter (ferrite core) to minimize interference.
- **Electrical corrosion of the bearing:**
  When a motor is driven by the inverter, 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 specific inverter settings (high carrier frequency, use of a capacitive filter*1).
  The following shows examples of countermeasures for the inverter.
  - Decrease the carrier frequency.
  - Remove the capacitive filter.
  - Provide a common mode choke*2 on the output side of the inverter. (This is effective regardless of the use of the capacitive filter.)

  *1 Mitsubishi Electric capacitive filter: FR-BIF, SF[], FR-E5NF-[], FR-S5NFSA[]
  *2 Recommended common mode choke: FT-3KM F series FINEMET® common mode choke cores manufactured by Hitachi Metals, Ltd. FINEMET is a registered trademark of Hitachi Metals, Ltd.
- **Do not install a power factor correction capacitor, surge suppressor, or radio noise filter on the inverter's output side.**
  Doing so will shut off the inverter output or damage the capacitor or surge suppressor. If any of the above devices is connected, immediately remove it.
- **For a some time after the power-OFF, a high voltage remains in the smoothing capacitor, and it is dangerous.**
  A smoothing capacitor holds high voltage some time after the inverter power supply turns OFF. Before performing an inspection inside the inverter, wait 10 minutes or longer after power-OFF, then confirm that the voltage across the main circuit terminals P/+ and N/- on the inverter is low enough using a tester, etc.
- **A short circuit or earth (ground) fault on the inverter's output side may damage the inverter module.**
  - Fully check the insulation resistance of the circuit prior to inverter operation since repeated short circuits caused by peripheral circuit inadequacy or an earth (ground) fault caused by wiring inadequacy or reduced motor insulation resistance may damage the inverter module.
  - Fully check the phase-to-earth (ground) insulation and phase-to-phase insulation of the inverter's output side before power-ON.
    Especially for an old motor or use in hostile atmosphere, securely check the motor insulation resistance, etc.
- **Do not use the magnetic contactor (MC) on the inverter's input side to start/stop the inverter.**
  Since repeated inrush currents at power ON will shorten the life of the converter circuit (switching life is about 500,000 times), frequent starts and stops of the MC at the input side must be avoided. Turn ON/OFF the inverter's start signal (STF or STR) to run/stop the inverter.
- **Do not apply a voltage higher than the permissible voltage to the inverter I/O signal circuits.**
  Application of a voltage higher than the permissible voltage to the inverter I/O signal circuits or opposite polarity may damage the I/O devices.
- **To use the commercial power supply during general-purpose motor operation, be sure to provide electrical and mechanical interlocks between the electronic bypass contactors MC1 and MC2.**
  When using a switching circuit as shown right, chattering due to mis-configured sequence or arc generated at switching may allow undesirable current to flow in and damage the inverter.

- **If the machine must not be restarted when power is restored after a power failure, provide an MC in the inverter'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 inverter will automatically restart as soon as the power is restored.
- **MC on the inverter's input side**
  On the inverter's input side, connect the MC for the following purposes:
  - To disconnect the inverter from the power supply at activation of a protective function or at malfunctioning of the driving system (emergency stop, etc.).
  - To prevent any accident due to an automatic restart at power restoration after an inverter stop made by a power failure.
  - To separate the inverter from the power supply to ensure safe maintenance and inspection work.

  To use the MC installed on the inverter's input side for emergency stop during normal operation, select the MC conforming to JEM 1038-AC-3 rated current for the inverter rated input current.
- **Handling of the MC on the inverter's output side:**
  Turning ON/OFF the MC installed between the inverter and the motor must be done while both the inverter and the motor are at a stop. If the MC is turned ON while the inverter is operating, overcurrent protection of the inverter and such will be activated. To switch to commercial power supply with the MC during general-purpose motor operation, stop both the inverter and the motor before the switching.
- **Countermeasures against inverter-generated EMI:**
  If electromagnetic noise generated from the inverter causes the frequency setting signal to fluctuate and the motor rotation speed to be unstable when changing the motor speed with analog signals, the following countermeasures are effective:
  - Do not run the signal cables and power cables (inverter I/O cables) in parallel with each other and do not bundle them.
  - Run signal cables as far away as possible from power cables (inverter I/O cables).
  - Use shielded cables.
  - Install a ferrite core on the signal cable (example: ZCAT3035-1330 manufactured by TDK).
- **Instructions for overload operation:**
  When performing frequent starts/stops by the inverter, rise/fall in the temperature of the transistor element of the inverter 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. Reducing current may extend the service life but may also cause torque shortage, which leads to a start failure. Adding a margin to the current can eliminate such a condition. For a general-purpose motor, use an inverter of a higher capacity (up to two ranks).
- **Make sure that the specifications and rating match the system requirements.**

6 Appendix

6.1 Instructions for compliance with the EU Directives

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 inverter, when equipped with the dedicated EMC filter, conforms with the EMC Directive in industrial environments and affix the CE marking on the inverter. When using the inverter in a residential area, take appropriate measures and ensure the conformity of the inverter used in the residential area.

◆ **EMC Directive**
We declare that this inverter, when equipped with the EMC Directive compliant EMC filter, conforms with the EMC Directive and affix the CE marking on the inverter.

- EMC Directive: 2014/30/EU
- Standard(s): EN 61800-3:2004 (Second environment / PDS Category "C3")
- This inverter is not intended to be used on a low-voltage public network which supplies domestic premises.
- Radio frequency interference is expected if used on such a network.
- The installer shall provide a guide for installation and use, including recommended mitigation devices.

Note:
Firstenvironment
Environment including residential buildings. Includes building directly connected without a transformer to the low voltage power supply network which supplies power to residential buildings.
Secondenvironment
Environment including all buildings except buildings directly connected without a transformer to the lower voltage power supply network which supplies power to residential buildings.

- **Note**
  - Set the EMC Directive compliant EMC filter to the inverter. Insert line noise filters and ferrite cores to the power and control cables as required.
  - Connect the inverter to an earthed power supply.
  - Install a motor and a control cable written in the Technical News (MF-S-139) according to the instruction.
  - Confirm that the final integrated system with the inverter conforms with the EMC Directive.

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

- **Outline of instructions**
  - Do not use an earth leakage current breaker as an electric shock protector without connecting the equipment to the earth. Connect the equipment to the earth securely.
  - Wire the earth terminal independently. (Do not connect two or more cables to one terminal.)
  - Use the cable sizes on page 8 under the following conditions.
    - Surrounding air temperature: 40°C maximum
  - If conditions are different from above, select appropriate wire according to EN 60204 Appendix C TABLE 5.
  - Use a tinned (plating should not include zinc) crimping terminal to connect the earth (ground) cable. When tightening the screw, be careful not to damage the threads.
  - For use as a product compliant with the Low Voltage Directive, use PVC cable whose size is indicated on page 8.
  - Use the molded case circuit breaker and magnetic contactor which conform to the EN or IEC Standard.
  - This product can cause a d.c. current in the protective earthing conductor. Where a residual current-operated protective (RCD) or monitoring (RCM) device is used for protection in case of direct or indirect contact, only an RCD or RCM of Type B is allowed on the supply side of this product.
  - Use the inverter 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, 400 V class only) and pollution degree 2 or lower specified in IEC 60664. An insulating transformer needs to be installed in the input side of the inverters.
    •To use the inverter under the conditions of pollution degree 2, install it in the enclosure ofIP2X or higher.
    •To use the inverter under the conditions of pollution degree 3, install it in the enclosure of IP54 or higher.
  - On the input and output of the inverter, use cables of the type and size set forth in EN 60204 Appendix C.
  - The operating capacity of the relay outputs (terminal symbols A, B, and C) should be 30 VDC, 0.3 A. (Relay output has basic isolation from the inverter internal circuit.)
  - Control circuit terminals on page 7 are safely isolated from the main circuit.
  - Environment

	During operation	In storage	During transportation
Surrounding air temperature	-10 to +40°C	-20 to +65°C	-20 to +65°C
Ambient humidity	95% RH or lower	95% RH or lower	95% RH or lower
Maximum altitude	2500 m*1	2500 m	10000 m

*1 For the installation at an altitude above 1000 m, consider a 3% reduction in the rated current per 500 m increase in altitude.

◆ **Fuse selection**

- To select fuses for branch circuit protection, refer to ◆ Wiring protection in 6.2 Instructions for UL and cUL.

◆ **Short circuit ratings**
200 V Class : Suitable for use in a circuit capable of delivering not more than 100 kA rms symmetrical amperes, 240 V maximum.
400 V Class : Suitable for use in a circuit capable of delivering not more than 100 kA rms symmetrical amperes, 480 V maximum.

6.2 Instructions for UL and cUL

(Standard to comply with: UL 61800-5-1, CSA C22.2 No.274-13)

◆ **Installation**
The below types of inverter 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 inverter will satisfy the specifications.

- **Wiring 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.
  Select an UL/cUL fuse in accordance with the table below.

Inverter model	Fuse model	Manufacturer	Rating
FR-CS84-012	170M1408	Bussmann	700V 10A
FR-CS84-022 to 036	170M1409	Bussmann	700V 16A
FR-CS84-050	170M1410	Bussmann	700V 20A
FR-CS84-080	170M1412	Bussmann	700V 32A
FR-CS84-120	A070URD30TTI050	Mersen	700V 50A
FR-CS84-160	A070URD30TTI080	Mersen	700V 80A

Inverter model	Fuse model	Manufacturer	Rating
FR-CS84-230	A070URD30TTI080	Mersen	700V 80A
FR-CS84-295	A070URD30TTI125	Mersen	700V 125A
FR-CS82S-025	170M1410	Bussmann	700V 20A
FR-CS82S-042	170M1411	Bussmann	700V 25A
FR-CS82S-070	A070URD30TTI050	Mersen	700V 50A
FR-CS82S-100	A070URD30TTI080	Mersen	700V 80A

◆ **Wiring to the power supply and the motor**
For wiring the input (R/L1, S/L2, T/L3) and output (U, V, W) terminals of the inverter, use the UL listed copper, stranded wires (rated at 75°C) and round crimp terminals. Crimp the terminals with the crimping tool recommended by the terminal manufacturer.

◆ **Short circuit ratings**
200 V Class : Suitable for use in a circuit capable of delivering not more than 100 kA rms symmetrical amperes, 240 V maximum.
400 V Class : Suitable for use in a circuit capable of delivering not more than 100 kA rms symmetrical amperes, 480 V maximum.

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

Operational characteristic of the electronic thermal relay function

This function detects the overload (overheat) of the motor, stops the operation of the inverter's output transistor, and stops the output. (The operation characteristic is shown on the left.)

- When using a constant-torque motor

(1) Set "1" in **Pr.71**. (This provides a 100% continuous torque characteristic in the low-speed range.)
(2) Set the rated motor current in **Pr.9**.

*1 When a value 50% of the inverter rated output current (current value) is set in **Pr.9**
*2 The % value denotes the percentage to the inverter rated current. It is not the percentage to the rated motor current.
*3 When you set the electronic thermal relay function dedicated to the Mitsubishi Electric constant-torque motor, this characteristic curve applies to operation at 6 Hz or higher.
*4 Transistor protection is activated depending on the temperature of the heatsink. The protection may be activated even with less than 150% depending on the operating conditions.

- The internal accumulated heat value of the electronic thermal relay function is reset by inverter power reset and reset signal input Avoid unnecessary reset and power-OFF.
- When multiple motors are driven with a single inverter or when a multi-pole motor or a special motor is driven, install an external thermal relay (OCR) between the inverter and motors. Note that the current indicated on the motor rating plate is affected by the line-to-line leakage current when selecting the setting for an external thermal relay.
- The cooling effect of the motor drops during low-speed operation. Use a thermal protector or a motor with built-in thermistor.
- When the difference between the inverter and motor capacities is large and the setting is small, the protective characteristics of the electronic thermal relay function will be deteriorated. In this case, use an external thermal relay.
- A special motor cannot be protected by the electronic thermal relay function. Use an external thermal relay.

6.3 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.
  Example: MADE IN CHINA
- Manufactured year and month
  Check the SERIAL number indicated on the rating plate of the product.

Rating plate example

□	○	○	○○○○○○
Symbol	Year	Month	Control number

SERIAL

The SERIAL consists of one symbol, two characters indicating the production year and month, and six characters indicating the control number.
The last digit of the production year is indicated as the Year, and the Month is indicated by 1 to 9, X (October), Y (November), or Z (December).

- 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

6.4 EU ErP Directive (Ecodesign Directive)

The following table shows the power loss data according to Ecodesign Directive.The regulation covers 3-phase variable speed drives from 0.12 kW ≤ Pn ≤ 1000 kW.

Model name	Rated Apparent power (kVA)	Stand by loss (W)	load point 1 (90;100) (%)	load point 2 (50;100) (%)	load point 3 (0;100) (%)	load point 4 (90;50) (%)	load point 5 (50;50) (%)	load point 6 (0;50) (%)	load point 7 (50;25) (%)	load point 8 (0;25) (%)	IE class
FR-CS84-012(0.4K)-60	0.9	5.1	1.8	1.8	1.8	1.6	1.6	1.6	1.6	1.6	IE2
FR-CS84-022(0.75K)-60	1.7	5.1	1.6	1.6	1.6	1.2	1.2	1.2	1.0	1.0	IE2
FR-CS84-036(1.5K)-60	2.7	5.1	1.7	1.6	1.6	1.1	1.1	1.1	1.0	0.9	IE2
FR-CS84-050(2.2K)-60	3.8	5.1	1.8	1.8	1.8	1.3	1.3	1.3	1.0	1.0	IE2
FR-CS84-080(3.7K)-60	6.1	9.2	1.8	1.8	1.8	1.3	1.3	1.3	1.1	1.1	IE2
FR-CS84-120(5.5K)-60	9.1	9.2	1.5	1.5	1.5	0.8	0.8	0.8	0.6	0.6	IE2
FR-CS84-160(7.5K)-60	12.2	10.2	1.5	1.5	1.5	0.8	0.8	0.8	0.6	0.6	IE2
FR-CS84-230(11K)-60	17.5	16.9	2.3	2.2	2.3	1.3	1.3	1.3	0.9	1.0	IE2
FR-CS84-295(15K)-60	22.5	16.9	2.0	2.0	2.0	1.1	1.1	1.1	0.8	0.8	IE2

三菱电机通用变频器

FREQROL-CS80

变频器的使用简介和注意事项

FR-CS84-012 ～ 295-60
FR-CS82S-025 ～ 100-60

请将本资料送到操作人员手上。
关于详细内容，请参照变频器本体的使用手册 （详细篇）。
可以从下述网页下载使用手册。
http://cn.mitsubishielectric.com/fa/zh/download/dwn_idx_manual.asp

如有疑问请向下列机构垂询
三菱电机自动化(中国)有限公司
MITSUBISHI ELECTRIC AUTOMATION (CHINA) LTD.
电话：021-23223030
http://cn.mitsubishielectric.com/fa/zh/

三菱电机自动化(中国)有限公司 首页

IB-0600720-C(2110)

本资料对使用时的操作、注意事项进行说明。
另外，请将本入门指南送到操作人员手上。

安全注意事项

应在仔细阅读本使用说明 （变频器的使用简介和注意事项）及其附带资料的基础上，正确地进行安装、运行、维护、检查。在熟悉机器的知识、安全信息以及全部有关注意事项以后再使用。
必须由专业技术人员进行安装、操作、维护检查。专业技术人员指满足以下所有条件的人员。
・接受过适当的技术训练人员或持有可以从事电气设备资格的人员。请注意是否可以在所在地区的三菱电机接受适当的技术训练。关于日期、举办场所，请联系营业所。
・可以得到连接在安全控制系统的保护装置 （例：光幕）操作手册的人员。或者，熟读、熟知这些手册的人员。

在本使用说明 （变频器的使用简介和注意事项）中，将安全注意事项等级分为 “ 警告 ” 和 “ 注意 ”。

⚠警告　**错误操作可能造成危险后果，导致死亡或重伤事故。**

⚠注意　**错误操作可能造成危险后果，导致中度伤害、轻伤及设备损失。**

此外，⚠注意 中记载的事项，根据情况的不同， 也可能造成严重后果。两者所记均为重要内容，请务必遵守。

◆ 防止火灾

⚠注意
- 应将变频器安装在无孔的不易燃的壁面上 （避免从背后触及变频器散热片）。直接安装在易燃物上或靠近易燃物品，会导致火灾。
- 变频器发生故障时，应切断变频器的电源。若持续地流过大电流，会导致火灾。
- 请勿在直流端子 P/+、N/- 上直接连接电阻。否则会引起火灾。
- 务必实施使用手册中记载的日常检查及定期检查。若不注意检查而持续使用，将导致破裂、损坏及火灾的发生。

◆ 防止损伤

⚠注意
- 仅可对各个端子施加使用说明中所规定的电压。否则会造成故障或损坏。
- 请勿错误地连接端子。否则会造成故障或损坏。
- 请勿弄错极性 （+ -）。否则会导致故障、损坏等。
- 通电时或电源断开后的一段时间内，变频器温度仍较高，因此请勿触摸。否则会导致烫伤。

◆ 其它注意事项
请充分注意以下注意事项。误操作会导致意外事故、受伤、触电等。

⚠注意

搬运和安装
- 使用刀具开封时，为了防止因刀尖而受伤，请佩戴防护手套。
- 应根据产品的重量用正确的方法搬运。否则会导致受伤。
- 请勿攀爬变频器、或在变频器上装载重物。
- 请勿进行超过限制的多层装载。
- 请勿在搬运时抓握前盖板。否则会导致脱落、故障。
- 安装时应注意防止变频器脱落以免受伤。
- 应安装在能够充分承受变频器重量的壁面上。
- 请勿安装在高温壁面上。
- 务必遵守变频器的安装方向。
- 为了不让变频器脱落，应用螺丝牢固地固定。
- 请勿安装和运行有损伤、少部件的变频器。
- 请勿让螺丝、金属片等导电性异物及油等可燃异物进入变频器。
- 变频器是精密机器，应避免将变频器掉落、或使其受到强烈冲击。
- 请在环境温度为 -10 ℃～ +40 ℃ *1（无结冻）的条件下使用。否则将导致变频器故障。
- 请在环境湿度为 95%RH 以下（无凝露）的条件下使用。否则将导致变频器故障。
- 请在储存温度（运输时等短时间内适用的温度）为 -20 ℃～ +65 ℃的条件下使用。否则将导致变频器故障。
- 请在室内 （无腐蚀性气体、可燃性气体、油雾和尘埃）使用。否则将导致变频器故障。
- 请在海拔为 2500m 及以下、振动为 $5.9m/s^2$ 以下、10 ～ 55Hz（X、Y、Z 各方向）的条件下使用。否则将导致变频器故障。
- 用于木制包装材料的消毒、杀虫的熏蒸剂中所含有的卤系物质 （氟、氯、溴、碘等）一旦渗入本产品，将会导致故障。包装时，应采取相应措施防止残留的熏蒸剂渗入到本公司的产品中、或采取熏蒸剂以外的方法 （热处理等）进行处理。此外，请在木材用于包装前实施消毒、杀虫措施。

*1　额定电流减小 15% 时，为 +40 ℃～ +50 ℃ （无结冻）。

⚠注意

接线
- 请勿在变频器的输出侧安装进相电容器或浪涌抑制器、无线电噪声滤波器。否则会导致变频器过热、烧毁。
- 应正确连接输出侧的 （U、V、W 端）电缆。否则电机将反转。

试运行调整
- 请在运行前进行各参数的确认、调整。否则可能会因机械设备的原因导致变频器出现预料之外的动作。

⚠警告

使用方法
- 选择了再试功能或瞬间停电再启动功能的情况下，发生报警时或瞬间停电时会突然重启，因此请务必远离电机与设备。
- 应务必确认电机确实未启动后再接近电机。
- 即使按下操作面板的 STOP/RESET 键，根据功能的设定状态，有时输出也不会停止，因此请另外准备紧急停止回路 （电源切断及紧急停止用的机械制动动作等）和急停开关。
- 请在进行报警复位前确认运行信号已断开，否则变频器会突然重启。
- 请勿用于三相感应电机以外的负载。在变频器的输出侧连接其他电气设备时，可能会导致设备损坏。
- 请勿对设备进行改造。
- 请勿拆卸使用说明中未记载的部件。否则会导致故障或损坏。

⚠注意

使用方法
- 电子过热保护不能完全确保对电机的过热保护。建议同时设置外部热敏继电器进行过热保护。
- 请勿频繁使用电磁接触器启停变频器。否则会导致变频器使用寿命缩短。
- 应使用噪声滤波器等以减少电磁干扰的影响。否则可能会影响变频器附近使用的电子设备。
- 应采取相应的措施抑制谐波。否则变频器产生的电源谐波可能会导致进相电容器和发电机过热及损坏。
- 变频器驱动 400V 系列电机时，必须使用绝缘强化的电机、或实施抑制浪涌电压的对策。电机端子上因接线常数而产生的浪涌电压会导致电机的绝缘恶化。
- 进行了参数清除或全部清除后，务必在运行前再次设定必要参数。各参数将恢复至初始值。
- 变频器可以容易地进行高速运行的设定，所以应充分确认电机和机械的性能后再进行设定更改。
- 长期保管后的变频器，使用前务必对其进行检查和试运行。
- 在短时间内重新接通电源时，如果操作面板无显示，则可能是内部保护电路已起动。此时，应先将输入侧的电源设为 OFF 之后再等待数分钟。另外，短时间内重新接通电源将导致变频器寿命下降。
- 为了防止静电导致损坏，应在接触本产品前去掉身体的静电。
- 为了防止经由网络的外部设备的非法访问、DoS*1 攻击、计算机病毒以及其他的网络攻击，以保障变频器及系统的安全 （可用性、完整性、机密性）时，应设置防火墙及 VPN、对计算机安装杀毒软件等采取相应的对策。对于因 DoS 攻击、非法访问、计算机病毒以及其他的网络攻击导致的变频器及系统故障方面的各种问题，本公司概不负责。

异常时的处理
- 为防止机械和设备在变频器发生故障时处于危险状态，应设置紧急制动等安全备用装置。
- 变频器输入侧的断路器跳闸，可能是因为接线异常 （短路等）或变频器内部部件的破损。应查明断路器跳闸的原因并排除故障后，再次连接断路器。
- 保护功能动作时，应处理导致其动作的原因后再复位变频器，然后开始运转。

维护、检查和部件更换
- 请勿用兆欧表 （绝缘电阻）测试变频器的控制回路。否则会导致故障。

报废后的处理
- 请作为工业废物处理。

*2　DoS：通过耗费目标电脑的资源或使其变得脆弱，来使其无法提供正常服务以及为该种状态

一般注意事项
- 为了对细节部位进行说明，本使用说明中的部分图解表示的是已拆下盖板、安全用断路器状态下的变频器，在运行变频器时应务必按规定将盖板、断路器恢复原状，并按使用说明的规定进行操作。

1　接线盖板的拆卸与安装

1.1　接线盖板的拆卸

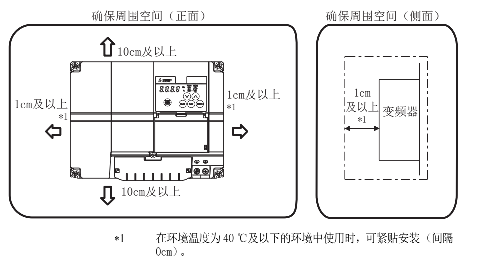
通过拧松安装螺丝并向面前拉开，可以轻松地拆卸接线盖板。请对准导槽安装至本体。FR-CS84-012 ～ 080、FR-CS82S 时，需要打开前盖板。

1.2　变频器的安装

◆ 变频器的设置

在对 FR-CS84-036 ～ 080、FR-CS82S-070、FR-CS82S-100 变频器进行安装之前，应先拆下接线盖板后拧紧螺丝。

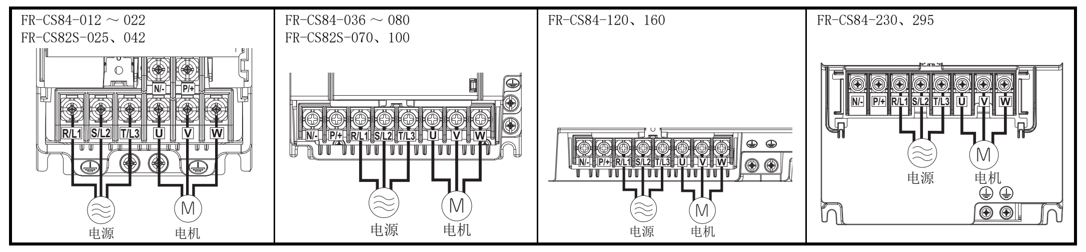
- 应使用螺丝将变频器牢固地垂直安装在坚实的表面上。
- 应确保有足够的空间并采取冷却措施。
- 应避免将变频器安装于阳光直射、高温、潮湿的环境中。
- 应将变频器安装在不易燃的壁面上。
- 在控制柜中安装多台变频器时，应并排安装并采取冷却措施。
  为了便于其散热及对其进行维护，变频器应与其他设备及控制柜的壁面保持一定距离。变频器下方需留有接线空间，变频器上方需留出散热空间。
- 为了防止冷却风从背后的孔洞流失，请确保变频器安装的墙面平整无孔。



*1　在环境温度为 40 ℃及以下的环境中使用时，可紧贴安装（间隔 0cm）。

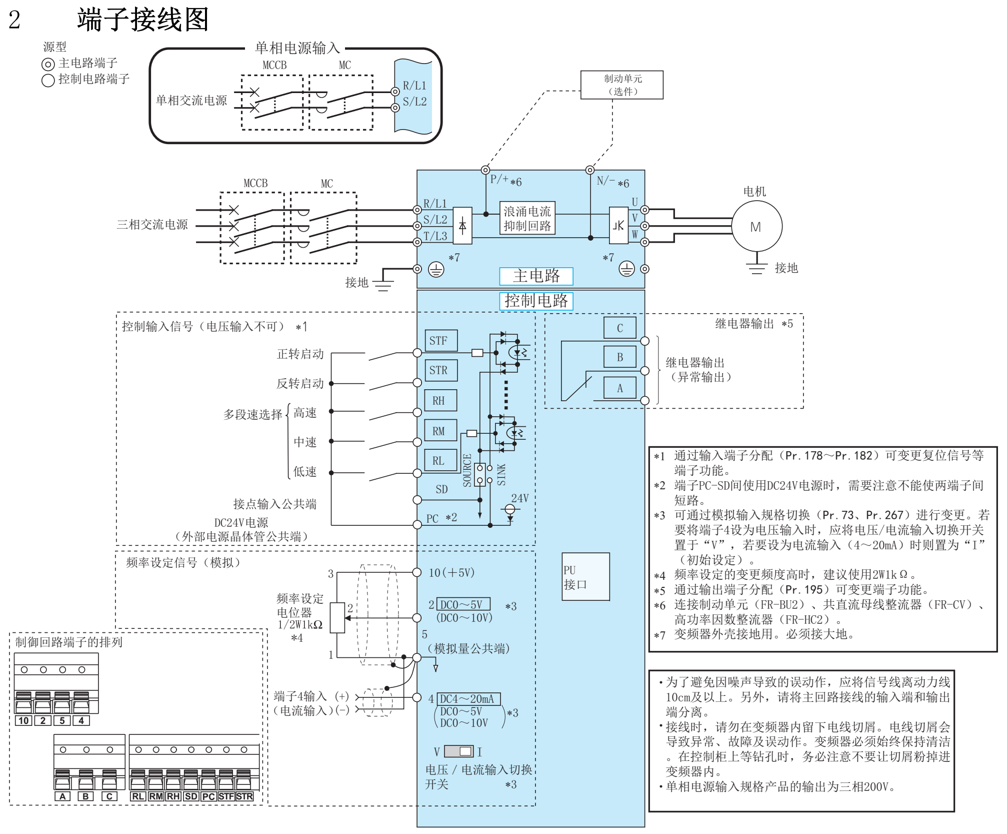
2　接线

2.1　主回路端子的端子排列与电源、电机的接线



- 电源线必须连接至 R/L1、S/L2、T/L3。FR-CS82S 时，不使用 T/L3。（没有必要考虑相序。）绝对不能连接至 U、V、W，否则变频器会损坏。
- 电机连接至 U、V、W。此时，接通正转开关 （信号）后，从负载轴看到的电机实际旋转方向为逆时针方向。

2.2　端子接线图



*1 通过输入端子分配（Pr. 178～Pr. 182）可变更复位信号等端子功能。
*2 端子PC-SD间使用DC24V电源时，需要注意不能使两端子间短路。
*3 可通过模拟输入规格切换（Pr. 73、Pr. 267）进行变更。若要将端子4设为电压输入时，应将电压/电流输入切换开关置于“V”，若要设为电流输入（4～20mA）时则置为“I”（初始设定）。
*4 频率设定的变更频度高时，建议使用2W1kΩ。
*5 通过输出端子分配（Pr. 195）可变更端子功能。
*6 连接制动单元（FR-BU2）、共直流母线整流器（FR-CV）、高功率因数整流器（FR-HC2）。
*7 变频器外壳接地用。必须接大地。

- 为了避免因噪声导致的误动作，应将信号线离动力线10cm及以上。另外，请将主回路接线的输入端和输出端分离。
- 接线时，请勿在变频器内留下电线切屑。电线切屑会导致异常、故障及误动作。变频器必须始终保持清洁。在控制柜上等钻孔时，务必注意不要让切屑粉掉进变频器内。
- 单相电源输入规格产品的输出为三相200V。

2.3　适用电线与接线长度

为使电压下降在 2% 以内，请选定适当型号的电线。
变频器和电机间的接线距离较长时，特别是在低速的情况下，会由于主回路电缆的电压下降而导致电机的转矩下降。
接线长为 20m 的选定示例详见下表。

适用变频器型号		端子螺丝尺寸 *4	拧紧力矩 N•m	压接端子 R/L1、S/L2、T/L3	压接端子 U、V、W	HIV 电线等 (mm2) *1 R/L1、S/L2、T/L3	HIV U、V、W	HIV 接地线	AWG/MCM *2 R/L1、S/L2、T/L3	AWG/MCM U、V、W	PVC 电线等 (mm2) *3 R/L1、S/L2、T/L3	PVC U、V、W	PVC 接地线
三相 400V 等级	FR-CS84-012, 022	M3.5	1.2	2-3.5	2-3.5	2	2	2	14	14	2.5	2.5	2.5
	FR-CS84-036 ～ 080	M4	1.5	2-4	2-4	2	2	2	14	14	2.5	2.5	2.5
	FR-CS84-120	M4	1.5	5.5-4	2-4	3.5	2	3.5	12	14	4	2.5	4
	FR-CS84-160	M4	1.5	5.5-4	5.5-4	3.5	3.5	3.5	12	12	4	4	4
	FR-CS84-230	M5	2.5	8-5	8-5	8	8	5.5	8	8	10	10	10
	FR-CS84-295	M5	2.5	8-5	8-5	8	8	5.5	8	8	10	10	10
单相 200V 等级	FR-CS82S-025、042	M3.5	1.2	2-3.5	2-3.5	2	2	2	14	14	2.5	2.5	2.5
	FR-CS82S-070	M4	1.5	2-4	2-4	2	2	2	14	14	2.5	2.5	2.5
	FR-CS82S-100	M4	1.5	5.5-4	2-4	3.5	2	3.5	12	14	4	2.5	4

*1　连续工作时的最高允许温度为 75 ℃的电线 （600V 系列 二乙烯基绝缘电线）尺寸。假设环境温度为 50 ℃及以下、且接线距离为 20m 及以下。
*2　连续工作时的最高允许温度为 75 ℃的电线 （THHW 电线）尺寸。假设环境温度为 40 ℃及以下、且接线距离为 20m 及以下。（主要是在美国使用时的选定示例。）
*3　连续工作时的最高允许温度为 70 ℃的电线 （PVC 电线）尺寸。假设环境温度为 40 ℃及以下、且接线距离为 20m 及以下。（主要是在欧洲使用时的选定示例。）
*4　端子螺丝尺寸表示 R/L1、S/L2、T/L3、U、V、W、P/+、N/- 接地用螺丝的尺寸。

线间电压降低值可以按以下公式算出。

线间电压降低值 [V] $=\sqrt{3}\times$ 电线电阻 [mΩ/m] × 接线距离 [m] × 电流 [A]/1000

接线距离较长或想减少低速端的电压降 （转矩降低）时请使用粗电线。

◆ 接线总长度

连接 1 台或多台电机时，其连接线路总长度 （电机与变频器的接线长度的和）应低于下表内的值。

接线种类	型号 FR-CS84-[] 012	022	036	050	080	120	160	230	295	型号 FR-CS82S-[] 025	042	070	100
无屏蔽层	50m	50m	50m	50m	50m	100m	100m	100m	100m	50m	50m	50m	50m
有屏蔽层	25m	25m	50m	50m	50m	100m	100m	100m	100m	25m	25m	50m	50m

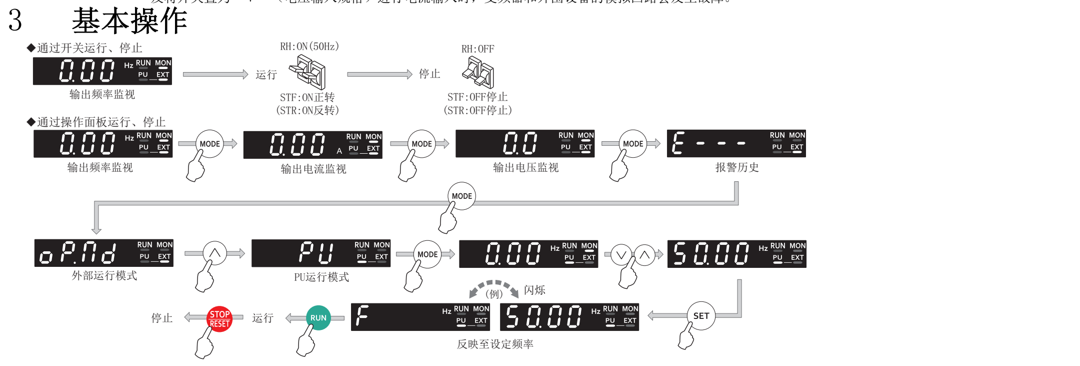
变频器驱动 400V 等级的电机时，电机端子上因接线常数而产生的浪涌电压会导致电机的绝缘恶化。此时，使用 “400V 等级变频器驱动用绝缘强化电机 ” 且接线长度为 50m 以上时有条件限制。应将 **Pr. 72 PWM 频率选择**设定为 8 （8kHz）以下。

2.4　控制回路

种类	端子记号	端子名称	端子功能说明		额定规格
接点输入	STF	正转启动	STF 信号 ON 时为正转、OFF 时为停止指令。	STF、STR 信号同时 ON 时为停止指令	输入电阻 4.7kΩ 开路时电压 DC21 ～ 26V 短路时 DC4 ～ 6mA
	STR	反转启动	STR 信号 ON 时为反转、OFF 时为停止指令。		
	RH, RM, RL	多段速度选择	用 RH、RM 和 RL 信号的组合可以选择多段速度。多段速信号为 ON 时，优先于模拟输入端子 （端子 2）。		
	SD	接点输入公共端 （漏型）	接点输入端子 （漏型逻辑）的公共端子。		—
		外部晶体管公共端（源型）（初始设定）	源型逻辑的情况下连接了可编程控制器等的晶体管输出 （集电极开路输出）时，将晶体管输出用的外部电源公共端连接到该端子上，可防止寄生电流导致的误动作。		
		DC24V 电源公共端	DC24V 30mA 电源 （端子 PC）的公共端输出端子。端子 5 为绝缘状态。		
	PC	外部晶体管公共端 （漏型）	漏型逻辑的情况下连接了可编程控制器等的晶体管输出 （集电极开路输出）时，将晶体管输出用的外部电源公共端连接到该端子上，可防止寄生电流导致的误动作。		电源电压范围 DC22 ～ 26.5V 允许负载电流 30mA
		接点输入公共端 （源型）（初始设定）	接点输入端子 （源型逻辑）的公共端子。		
		DC24V 电源	可以作为 DC24V、30mA 的电源使用。		
频率设定	10	频率设定用电源	使用频率设定 （速度设定）用电位器作为外部连接时的电源。		DC5.0V ± 0.2V 允许负载电流 10mA
	2	频率设定 （电压）	输入 DC0 ～ 5V （或 0 ～ 10V）时，最大输出频率为 5V （10V），输入输出成正比。通过 Pr. 73 进行 DC0 ～ 5V （初始设定）和 DC0 ～ 10V 的输入切换。*1		输入电阻 10kΩ ± 1kΩ 最大允许电压 DC20V
	4	频率设定 （电流）	输入 DC4 ～ 20mA （或 0 ～ 5V、0 ～ 10V）时，最大输出频率为 20mA，输入频率与输出成正比。只有 AU 信号置为 ON 时端子 4 的输入信号才会有效 （端子 2 的输入将无效）。使用端子 4 （初始设定：电流输入）时，应将 Pr. 178 ～ Pr. 182 （输入端子功能选择） 的其中任意一个设定为 “4” 并分配功能，然后将 AU 信号设为 ON。通过 Pr. 267 进行 4 ～ 20mA （初始设定）和 DC0 ～ 5V、DC0 ～ 10V 的输入切换。要设为电压输入 （0 ～ 5V/0 ～ 10V）时，应将电压 / 电流输入切换开关置为 “V”。*1		输入电流时：输入电阻 249Ω ± 5Ω 最大允许电流 30mA 输入电压时：输入电阻 10kΩ ± 1kΩ 最大允许电压 DC20V 电流输入（初始状态） 电压输入
	5	频率设定公共端	频率设定信号 （端子 2 或 4）的公共端子。请勿接大地。		———
继电器	A, B, C	继电器输出 （异常输出）	指示变频器因保护功能动作而停止输出的 1c 接点输出。异常时：B-C 间不导通 （A-C 间导通），正常时：B-C 间导通 （A-C 间不导通）		接点容量 AC230V 0.3A （功率因数= 0.4） DC30V 0.3A
RS-485	——	PU 接口	可以通过 PU 接口进行 RS-485 通迅。对应规格：EIA-485(RS-485) 通讯方式：多点链接方式 通讯速率：4800 ～ 115200bps 最长距离：500m		

*1　请正确设定 Pr. 73、Pr. 267 和电压 / 电流输入切换开关后，输入符合设定的模拟信号。将电压 / 电流输入切换开关置为 “I” （电流输入规格）进行电压输入时，及将开关置为 “V” （电压输入规格）进行电流输入时，变频器和外围设备的模拟回路会发生故障。

3　基本操作



4　规　格

4.1　额定

型号	FR-CS84-[]-60	012	022	036	050	080	120	160	230	295	-	-	-	-
	FR-CS82S-[]-60	-	-	-	-	-	-	-	-	-	025	042	070	100
适用电机容量 （kW）*1		0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	15	0.4	0.75	1.5	2.2
输出	额定容量 （kVA）*2	0.9	1.7	2.7	3.8	6.1	9.1	12.2	17.5	22.5	1.0	1.7	2.8	4.0
	额定电流 （A）*4	1.2 (1.0)	2.2 (1.9)	3.6 (3.1)	5.0 (4.3)	8.0 (6.8)	12.0 (10.2)	16.0 (13.6)	23.0 (19.6)	29.5 (25.1)	2.5 (2.1)	4.2 (3.6)	7.0 (6.0)	10.0 (8.5)
	过负载电流额定 *3	150% 60s、200% 0.5s （反时限特性）												
	额定电压 *5	三相 380 ～ 480V									三相 200 ～ 240V			
电源	额定输入交流电压・频率	三相 380 ～ 480V 50Hz/60Hz									单相 200 ～ 240V 50Hz/60Hz			
	交流电压允许波动范围	325 ～ 528V 50Hz/60Hz									170 ～ 264V 50Hz/60Hz			
	频率允许波动范围	±5%									±5%			
	电源设备容量 （kVA）*6	1.5	2.5	4.5	5.5	9.5	12.0	17.0	20.0	28.0	1.5	2.3	4.0	5.2
保护结构 （IEC 60529）		开放式 （IP20）												
冷却方式		自冷					强制风冷				自冷			强制风冷
大约质量 （kg）		0.6	0.6	0.9	0.9	1.4	1.9	1.9	3.5	3.5	0.6	0.6	1.4	1.4

*1　适用电机容量是使用三菱电机的 4 极标准电机时的最大适用容量。
*2　输出电压为单相 200V 等级的额定输出容量为 230V，输出电压为三相 400V 等级的额定输出容量为 440V。
*3　过负载电流额定的 % 值表示与变频器的额定输出电流之比的比率值。反复使用时，必须等待变频器和电机降到 100% 负载时的温度以下。仅在单相 200V 时，设定了瞬时停电再启动 （Pr. 57）或停电停止 （Pr. 261）后，电源电压的减小会导致负载变大，从而可能会出现母线电压减小到停电检测水平、负载无法达到 100% 以上。
*4　环境温度为 50 ℃的条件下使用时，额定电流减小为 （）中的值。
*5　最大输出电压不能大于电源电压。在设定范围内可以变更最大输出电压。但是变频器输出侧电压的峰值为电源电压的 $\sqrt{2}$ 倍左右。
*6　电源容量是额定输出电流时的值。随电源侧电抗 （包括输入电抗器和电线）的值而变。

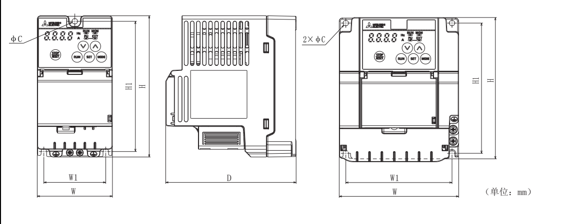
4.2　通用规格

控制特性	控制方式		Soft-PWM 控制 / 高载波频率 PWM 控制 （可选择 V/F 控制、通用磁通矢量控制、最佳励磁控制）
	输出频率范围		0.2 ～ 400Hz
	频率设定分辨率	模拟输入	0.06Hz/60Hz （端子 2、4：0 ～ 10V/10bit） 0.12Hz/60Hz （端子 2、4：0 ～ 5V/9bit） 0.06Hz/60Hz （端子 4：0 ～ 20mA/10bit）
		数字输入	0.01Hz
	频率精度	模拟输入	最大输出频率 ±1% 以内 （25 ℃ ±10 ℃）
		数字输入	设定输出频率的 0.01% 以内
	电压 / 频率特性		可在 0 ～ 400Hz 之间任意设定基准频率，可以选择恒转矩、V/F3 点可调整
	启动转矩		150% 以上 （1Hz 时）・・・ 设定为通过通用磁通矢量控制进行转差补偿时
	转矩提升		手动转矩提升
	加 / 减速时间设定		可选择 0.1 ～ 3600s （可分别设定加减速时间）、直线或 S 形加减速模式
	直流制动		动作频率 （0 ～ 120Hz）、动作时间 （0 ～ 10s）、动作电压 （0 ～ 30%）可变
	失速防止动作水平		可以设定动作电流水平 （0 ～ 200% 间可变），可以选择有或无
运行特性	频率设定信号	模拟输入	2 点 端子 2：可选择 0 ～ 10V、0 ～ 5V 端子 4：可选择 0 ～ 10V、0 ～ 5V、4 ～ 20mA
		数字输入	可选择通过操作面板、参数单元进行输入，可选择频率设定单位
	启动信号		可选择正反转分别控制、启动信号自动保持输入 （3 线输入）
	输入信号 （5 点）		多段速度选择、遥控设定、第 2 加减速功能选择、端子 4 输入选择、JOG 运行选择、PID 控制有效端子、外部过热保护输入、输出停止、启动自动保持选择、正转指令、反转指令、变频器复位、三角波功能选择、变频器运行许可信号，以上这些信号可通过 Pr. 178 ～ Pr. 182 （输入端子功能选择）进行任意选择
	运行功能		上下限频率设定、频率跳变运行、外部过热保护输入选择、瞬间停止再启动运行、防止正反转、遥控设定、第 2 加减速功能、多段速度运行、再生回避、转差补偿、运行模式选择、离线自动调谐功能、PID 控制、计算机链接运行 （RS-485）、最佳励磁控制、停电停止、MODBUS RTU、强励磁减速、输入监视功能、紧急驱动
	输出信号 继电器输出 （1 点）	运行状态	变频器运行中、频率到达、过载报警、输出频率检测、电子过热保护预报警、变频器运行准备完成、输出电流检测、PID 下限极限、PID 上限极限、PID 正转反转输出、FIN 过热保护预警、停电减速中、PID 控制动作中、PID 输出中断中、再试中、轻故障输出、异常输出、异常输出 3，以上这些输出可通过 Pr. 195 （输出端子功能选择）进行任意选择
显示	操作面板 参数单元 (FR-PU07)	运行状态	可以选择输出频率、输出电流 （稳定）、输出电压、频率设定值、累计通电时间、实际运行时间、整流器输出电压、电子过热保护负载率、电机负载率、PID 目标值、PID 测定值、PID 偏差、变频器输入输出端子监视、输出电量、累计电量、电机热保护负载率、变频器热保护负载率
		异常内容	保护功能启动时显示异常内容、存储 8 次异常内容 （保护功能启动前的输出电压、电流、频率、累计通电时间）
		互动指导	帮助功能的操作向导 *1
保护 / 报警功能		保护功能	加速中过电流、恒速中过电流、减速中过电流、加速中过电压、恒速中过电压、减速中过电压、变频器过热保护启动、电机过热保护启动、散热片过热、输入缺相 *3、启动时输出侧接地过电流、输出短路、输出缺相、外部过热保护启动 *2、内部电路异常、参数错误、发生 PU 脱离 *2、再试次数溢出 *2、CPU 异常、浪涌电流抑制回路异常、4mA 输入丧失异常 *2、因失速防止而停止、输出电流检测值溢出 *2、变频器输出异常 *5、欠电压错误
		报警功能	过电流失速防止、过电压失速防止、PU 停止、参数写入错误、电子过热保护预报警、欠电压、浪涌电流抑制警告温度升高、操作面板锁定、密码设定中、变频器复位中、紧急驱动执行中 *2
环境	环境温度		-10 ℃～ +40 ℃ （无结冻） *4、 +40 ℃～ +50 ℃ （无结冻）（额定电流减小 15% 时）
	环境湿度		95%RH 以下 （无凝露）有基板涂层 （符合 IEC60721-3-3:1994 3C2/3S2）
	储存温度 *4		-20 ℃～ +65 ℃
	周围环境		室内 （无腐蚀性气体、可燃性气体、油雾和尘埃等）
	海拔高度・振动		2500m 以下 （在超过标高 1000m 的位置安装时，每升高 500m，额定电流需要降低 3%。），$5.9m/s^2$ 以下，10 ～ 55Hz （X、Y、Z 各方向）

*1　仅选件的参数单元 （FR-PU07）可以显示。
*2　初始状态下，该保护功能无效。
*3　该保护功能仅对三相电源输入规格品有效。
*4　在环境温度为 40 ℃及以下的环境中使用时，可紧贴安装 （间隔 0cm）。
*5　仅 FR-CS84-160 及以下、FR-CS82S 有效。
*6　在运输时等短时间内可以适用的温度。

4.3　外形尺寸图

变频器型号	W	W1	H	H1	D	C
FR-CS84-012-60	68	56	128	118	118	5
FR-CS84-022-60						
FR-CS84-036-60	108	96	128	118	130	
FR-CS84-050-60						
FR-CS84-080-60					160	
FR-CS84-120-60	197.5	185.5	150	138	134	
FR-CS84-160-60						
FR-CS84-230-60	180	164	260	244	165	6
FR-CS84-295-60						
FR-CS82S-025-60	68	56	128	118	118	5
FR-CS82S-042-60						
FR-CS82S-070-60	108	96	128	118	160	
FR-CS82S-100-60						

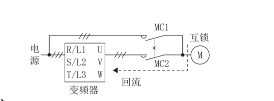


5　变频器使用注意事项

本产品虽然具有高可靠性，但外围电路的构成方式和运行、操作方法等的影响可能会导致产品的寿命缩短或损坏。请务必再次确认以下注意事项后再进行使用。

- **电源及电机接线的压接端子，推荐使用带绝缘套管的端子。**
- **电源接到变频器输出端子 （U、V、W）上将损坏变频器。请绝对避免此种接线。**
- **接线时，请勿在变频器内留下电线切屑。**
  电线切屑会导致异常、故障及误动作。变频器必须始终保持清洁。
  在控制柜上等钻孔时，务必注意不要让切屑粉掉进变频器内。
- **为使线路电压下降在 2% 以内，应使用适当尺寸的电线接线。**
  变频器和电机间的接线距离较长时，特别是在低频率输出的情况下，会由于主回路电缆的电压下降而导致电机的转矩下降。
- **使用的总接线长度应控制在规定长度以内。**
  特别是进行长距离接线时，受到因接线的寄生电容而产生的充电电流的影响，会出现高响应电流限制功能下降、连接在变频器输出侧的设备发生误动作等不良现象，所以请注意总接线长度。
- **关于电磁波干扰**
  变频器输入 / 输出 （主电路）包含有谐波成分，可能干扰变频器附近的通讯设备 （如 AM 收音机）。这种情况下安装无线电噪音滤波器 FR-BIF （输入侧专用）、线噪音滤波器 FR-BSF01、FR-BLF 等选件，可以将干扰降低。
- **关于轴承电腐蚀**
  用变频器驱动电机时，原理上在电机轴部会产生轴电压，根据接线方法、负载、运行状态、变频器设定状态 （存在高载波频率、容量性滤波器 *1），有时会发生轴承电腐蚀现象。
  以下是变频器侧的对策示例。
  - 降低载波频率
  - 取下容量性滤波器
  - 在变频器输出侧追加共模滤波器 *2 （与有无容量性滤波器无关，均有效）

  *1　本公司容量性滤波器：FR-BIF、SF □、FR-E5NF- □、FR-S5NFSA □
  *2　推荐的共模滤波器：FINEMET® 共模扼流圈用铁芯 FT-3KM F 系列 （日立金属株式会社制造）“FINEMET” 是日立金属株式会社的注册商标。
- **请勿在变频器的输出侧安装进相用电容器或浪涌抑制器、无线电噪声滤波器。**
  否则会导致变频器故障或电容、浪涌抑制器损坏。如已安装上述设备，应立即拆除。
- **切断电源后的一段时间内电容器仍为高压充电状态，非常危险。**
  进行变频器内部的检查时，即使断开电源后，在短暂时间内平滑电容器中也仍为高电压状态，应在经过 10 分钟后用万用表等确认变频器主回路端子 P/+ 和 N/- 间的电压已充分下降以下后再进行操作。
- **变频器输出侧的短路或接地会引起变频器模块的损坏。**
  - 外围回路不正常引起的反复短路，或接线不良、电机的绝缘电阻低下引起的接地会导致变频器模块损坏，所以运行变频器前应充分确认回路的绝缘电阻。
  - 请在接通电源之前充分确认变频器输出侧的对地绝缘、相间绝缘。
    特别在使用旧电机或周围环境较差的情况下，请确实确认电机的绝缘电阻等。
- **请勿通过变频器输入侧的电磁接触器启停变频器。**
  频繁的通过输入侧电磁接触器进行开关操作时，接通电源时反复出现的浪涌电流会导致浪涌电流抑制回路部的寿命缩短，因此应避免上述操作。请务必使用启动信号 （STF、STR 信号的 ON、OFF）进行变频器的启动与停止。
- **请勿对变频器输入输出信号回路施加超过允许值的电压。**
  对变频器的输入输出信号回路施加超过允许值的电压、弄错极性，则有可能损坏输入输出信号用元件。
- **使用通用电机的情况下进行工频切换运行时，应对工频切换用 MC1 和 MC2 切实地设置电气与机械式互锁。**
  除错误接线外，如右图所示的工频切换回路上进行切换时所发生的电弧、或顺控失误而造成开关连打等现象会引起电源回流而损坏变频器。



- **停电后电力恢复时，如需防止设备重新启动，则应在变频器的输入侧安装电磁接触器的同时加以启动信号不为 ON 的顺控。**
  如果启动信号 （启动开关）保持为 ON，则变频器将在电力恢复后自动重新启动。
- **变频器输入侧电磁接触器 （MC）的设置目的**
  在下列情况下，建议在变频器输入侧设置 MC。
  - 变频器保护功能动作或驱动装置异常时 （紧急停止操作等）需要把变频器与电源断开时。
  - 防止变频器因掉电停止后再复电时的自行启动而引发事故。
  - 为确保保养、点检工作的安全，需要把变频器与电源断开时。

  变频器输入侧的 MC 被用于以上所示目的的情况下，在一般运行中使用紧急停止时，电机的额定电流请根据 JEM1038-AC-3 级额定使用电流进行选定。
- **变频器输出侧电磁接触器的使用**
  请在变频器和电机都停止后再切换变频器和电机之间的电磁接触器。变频器运行中从 OFF 切换到 ON 时，变频器的过电流保护等将启动。使用通用电机的情况下，为了切换至工频电源等而设置 MC 时，应在变频器和电机停止以后再切换 MC。
- **关于变频器产生的噪声对策**
  通过模拟信号改变电机转速时，为了防止变频器产生的噪声导致频率设定信号发生变动以及电机转速不稳定等，请采取下列对策。
  - 避免将信号线和动力线 （变频器输入输出线）平行接线和成束接线。
  - 信号线尽量远离动力线 （变频器输入输出线）。
  - 信号线使用屏蔽线。
  - 信号线上设置铁氧体磁心 （例：ZCAT3035-1330 TDK 制）。
- **关于过载运行的注意事项**
  变频器高频度地反复进行运行 / 停止时，会有大量的电流反复通过，变频器的晶体管元件的温度会因此反复上升 / 下降，从而会出现热疲劳而导致其使用寿命缩短。因热疲劳受电流的大小影响，因此通过限制电流或降低启动电流等可以延长其使用寿命。虽然降低电流可以延长寿命，但如果电流本身降低则会引起转矩不足、无法启动等。因此，使用通用电机时，可以采取增大变频器容量 （增大 2 个档次）以增加电流容量的措施。
- **请充分确认规格和额定是否满足机械、系统的要求。**

6　附　　录

6.1　对于欧洲指令的注意事项

欧州指令是以统一欧盟各成员国的限制规定，促进安全性有保证的产品在欧盟内部的顺畅流通为目的而发行的指令。
1996 年，对欧州指令之一的 EMC 指令的符合证明被赋予了法律义务。此外，自 1997 年起，对欧州指令之一的低电压指令的符合也被赋予了法律义务。符合 EMC 指令以及低电压指令的制造商所认可的产品必须由制造商自己宣布符合，并标注 “CE 标识 ”。

- 欧盟圈内销售负责人
  以下为欧盟圈内销售负责人。
  公司名称：Mitsubishi Electric Europe B.V.
  地址：Mitsubishi-Electric-Platz 1, 40882 Ratingen, Germany
- 注意事项
  本变频器通过装备专用的噪声滤波器可以在工业环境中使用，符合 EMC 指令，并标有 “CE 标志 ”。若要在居住环境中使用，则需要用户实施相应措施以确保适合当下居住环境。

◆ 关于 EMC 指令

本变频器在装备了应对 EMC 指令的噪声滤波器后，符合 EMC 指令，并标有 “CE 标志 ”。
- EMC 指令：2014/30/EU
- 标准规格：EN61800-3:2004 (Second environment / PDS Category “C3”)
- 本变频器未设想用于为民用供电的低压公用配电系统。
- 用于低压公用配电系统时，会发生无限频率干扰。
- 安装者应推荐可减小无限频率干扰的装置等、提供安装及使用的指导。

注：
Firstenvironment
包含民用住宅的环境。包含不通过变压器而直接连接到向民用住宅供电的低压供电网的建筑物在内的环境。
Secondenvironment
包含除不通过变压器而直接连接到向民用住宅供电的低压供电网的建筑物以外的所有建筑物在内的环境。

◆ 注意事项
- 请为变频器配置对应 EMC 指令的噪声滤波器。应根据需要为动力电缆和控制电缆插入数据线噪声滤波器或铁氧体磁芯。
- 请将变频器连接到有接地的电源。
- 请根据指示安装技术快报 （MF-S-139）中记载的电机和控制电缆。
- 应确认接入变频器的最终系统符合 EMC 指令。

◆ 关于低电压指令

本变频器对低电压指令 （标准规格 EN61800-5-1）声明适用，本变频器上粘贴有 CE 标识。

◆ 注意事项
- 请勿在设备未接地的情况下仅使用漏电断路器作为触电保护。应确保设备接地。
- 接地端子应单独接线 （请勿在一个端子上连接两条或更多的电线）。
- 请在以下条件下选择接地电线和电线尺寸。
  ・环境温度：最高 40 ℃
  条件不同时，应使用 EN60204 附录 C 的表 5 中规定的电线。
- 接地线的连接应使用附带镀锡 （不含锌的电镀）的压接端子。用螺丝紧固时，请注意不要破坏螺纹牙。
- 作为符合低电压指令的产品使用时，应使用 PVC 电线实施接地。
- 请使用符合 EN 或 IEC 规格的无熔丝断路器、电磁接触器。
- 由于可能会从本产品向保护接地导体流入直流电流，因此使用残留电流保护设备 （RCD）或残留电流监视 （RCM）时，应将 B 型的 RCD 或 RCM 连接到产品的电源侧。
- 变频器应在 IEC60664 中规定的过电压等级Ⅱ（无论怎样的电源接地条件下都可使用），过电压等级Ⅲ（仅中性点接地的电源可以使用仅限 400V 等级），污染度 2 以下的条件下使用。使用本变频器时，应在输入侧连接绝缘变压器。
  ・在污染度 2 的环境中使用时，应将变频器安装在 IP2X 以上的控制柜中。
  ・在污染度 3 的环境中使用时，应将变频器安装在 IP54 以上的控制柜中。
- 变频器的输入输出接线，应使用 EN60204 附录 C 中规定的线型和线种。
- 继电器输出 （端子记号 A、B、C）的使用容量为 DC30V、0.3A。（此继电器输出与变频器内部回路绝缘。）
- 所示的控制回路端子相对于主回路端子已进行了安全绝缘。
- 环境

	运行中	储　存	运输时
环境温度	-10 ～ +40 ℃	-20 ～ +65 ℃	-20 ～ +65 ℃
湿度	95%RH 以下	95%RH 以下	95%RH 以下
海拔	2500m *1	2500m	10000m

*1　在超过标高 1000m 的位置安装时，每升高 500m，额定电流需要降低 3%。

◆ 关于熔丝选定
关于分支电路保护的熔丝选定，请参照第 6.2 UL、cUL 的注意事项◆熔丝选定。

◆ 短路额定
200V 等级： 此变频器适合在可以提供 100kA rms 以下的正弦波电流、最大 240V 电压的电源上使用。
400V 等级： 此变频器适合在可以提供 100kA rms 以下的正弦波电流、最大 480V 电压的电源上使用。

6.2　关于 UL、cUL 的注意事项

（对应规格 UL 61800-5-1, CSA C22.2 No.274-13）

◆ 安装
已经取得电气柜用产品的认证。
电气柜的设计应满足变频器的环境温度、湿度、周围环境的规格要求。

◆ 关于接线保护
在美国国内设置时，请按照 National Electrical Code 及当地的规格要求使用。
在加拿大设置时，请按照 Canadian Electrical Code 及当地的规格要求使用。

请根据下表使用 UL、cUL 认可熔丝。

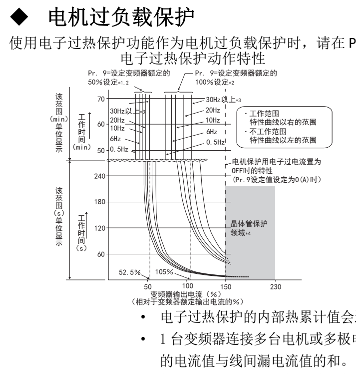
变频器型号	熔丝型号	制造厂商	额定
FR-CS84-012	170M1408	Bussmann	700V 10A
FR-CS84-022 ～ 036	170M1409	Bussmann	700V 16A
FR-CS84-050	170M1410	Bussmann	700V 20A
FR-CS84-080	170M1412	Bussmann	700V 32A
FR-CS84-120	A070URD30TTI050	Mersen	700V 50A
FR-CS84-160	A070URD30TTI080	Mersen	700V 80A
FR-CS84-230	A070URD30TTI080	Mersen	700V 80A
FR-CS84-295	A070URD30TTI125	Mersen	700V 125A
FR-CS82S-025	170M1410	Bussmann	700V 20A
FR-CS82S-042	170M1411	Bussmann	700V 25A
FR-CS82S-070	A070URD30TTI050	Mersen	700V 50A
FR-CS82S-100	A070URD30TTI080	Mersen	700V 80A

◆ 电源、电机的接线
对变频器的输入 （R/L1、S/L2、T/L3）、输出 （U、V、W）端子接线时，请使用 UL 认证的铜绞线 （额定 75 ℃）、圆形压接端子。请使用端子厂商推荐的压接工具对压接端子进行压接。

◆ 短路额定
200V 等级： 此变频器适合在可以提供 100kA rms 以下的正弦波电流、最大 240V 电压的电源上使用。
400V 等级： 此变频器适合在可以提供 100kA rms 以下的正弦波电流、最大 480V 电压的电源上使用。

◆ 电机过负载保护
使用电子过热保护功能作为电机过负载保护时，请在 Pr. 9 电子过热保护中设定电机额定电流。

电子过热保护动作特性



检测电机的过负载 （过热），中止变频器输出晶体管的动作并停止输出。（动作特性如左图所示）
- 使用恒转矩电机时
  (1)　请设定 Pr. 71 = “1”。（低速区域时呈 100% 连续转矩特性）
  (2)　在 Pr. 9 中设定电机的额定电流。

*1　在 Pr. 9 中设定了变频器额定输出电流的 50% 的值 （电流值）时
*2　% 值表示相对于变频器额定输出电流的 %。不是对应于电机额定电流的 %。
*3　设定了三菱电机恒转矩电机专用的电子过热保护时，在 6Hz 以上的运行中将以该特性曲线运行。
*4　晶体管保护动作随冷却散热片的温度而动作。根据运行状况，可能会在未达到 150% 时动作。

- 电子过热保护的内部热累计值会通过变频器电源复位以及输入复位信号复位为初始值。应避免不必要的复位及电源切断。
- 1 台变频器连接多台电机或多极电机、特殊电机进行运行时，请在变频器和电机间设置外部热敏继电器 (OCR)。外部热敏继电器的设定值为电机额定铭牌的电流值与线间漏电流值的和。
- 低速运行时，由于电机的冷却能力下降，请使用有内置过热保护器或热敏电阻的电机。
- 当变频器和电机容量相差过大和设定值过小时，电子过热保护的保护特性将恶化。在此情况下，请使用外部热敏继电器。
- 特殊电机不能用电子过热保护。请使用外部热敏继电器。
- 电子过热保护的过热检测并非直接测定电机温度。

6.3　关于电器电子产品有害物质限制使用 Restricted Use of Hazardous Substances in Electronic and Electrical Products

根据中华人民共和国的《电器电子产品有害物质限制使用管理办法》，对适用于产品的 “ 电器电子产品有害物质限制使用标识 ” 的内容记载如下。
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。
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.

- 产品中所含有害物质的名称及含量

部件名称 *2	有害物质 *1 铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
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	×	○	×	○	○	○
金属壳体、金属部件	×	○	○	○	○	○
树脂壳体、树脂部件	○	○	○	○	○	○
螺丝、电线	○	○	○	○	○	○

电器电子产品有害物质限制使用标识要求 （环境保护使用期限标识）

上表依据SJ/T11364的规定编制。
○：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。
×：表示该有害物质在该部件的至少一种均质材料中的含量超出GB/T26572规定的限量要求。
*1　即使表中记载为 ×，根据产品型号，也可能会有有害物质的含量为限制值以下的情况。
*2　根据产品型号，一部分部件可能不包含在产品中。