



for a greener tomorrow



**MITSUBISHI
ELECTRIC**

Changes for the Better

FACTORY AUTOMATION

HIGH POWER FACTOR CONVERTER FR-HC2

Effective suppression of inverter's power supply harmonics



GLOBAL IMPACT OF MITSUBISHI ELECTRIC



Through Mitsubishi Electric's vision, "Changes for the Better" are possible for a brighter future.

Changes for the Better

We bring together the best minds to create the best technologies. At Mitsubishi Electric, we understand that technology is the driving force of change in our lives. By bringing greater comfort to daily life, maximizing the efficiency of businesses and keeping things running across society, we integrate technology and innovation to bring changes for the better.

Mitsubishi Electric is involved in many areas including the following

Energy and Electric Systems

A wide range of power and electrical products from generators to large-scale displays.

Electronic Devices

A wide portfolio of cutting-edge semiconductor devices for systems and products.

Home Appliance

Dependable consumer products like air conditioners and home entertainment systems.

Information and Communication Systems

Commercial and consumer-centric equipment, products and systems.

Industrial Automation Systems

Maximizing productivity and efficiency with cutting-edge automation technology.

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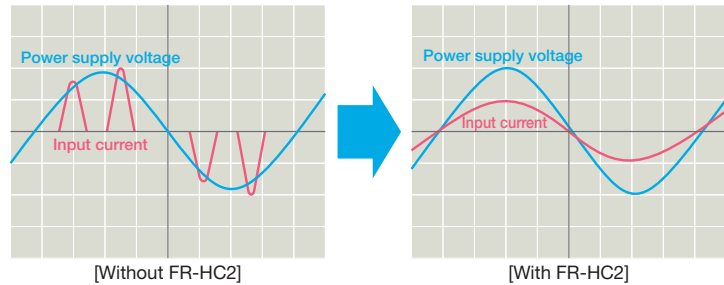
1 Greatly suppressed power supply harmonics

- The HC2 converters, being the self-excitation three-phase bridge circuit under "the Harmonic Suppression Guidelines for Specific Consumers", take the conversion coefficient of the equivalent capacity ($K5 = 0$).

■ Harmonic Conversion Coefficient of the Equivalent Capacity (Excerpt from the Guidelines Appendix)

Classification	Circuit type	Conversion coefficient	Application examples
1	Three-phase bridge	6-pulse converter	Railway substation Electro-chemistry Others
		12-pulse converter	
		24-pulse converter	
3	Three-phase bridge (smoothing capacitor)	Without a reactor	General-purpose inverter
		With a reactor (on AC side)	Lift
		With a reactor (on DC side)	Refrigerator and air conditioner
		With reactors (on AC/DC sides)	Others
4	Single-phase bridge (smoothing capacitor, double voltage rectification)	Without a reactor	General-purpose inverter
		With a reactor (on AC side)	Refrigerator and air conditioner
	Single-phase bridge (smoothing capacitor, full-wave rectification)	Without a reactor	Others
		With a reactor (on AC side)	General-purpose inverter
5	Self-excitation three-phase bridge	$K5 = 0$	PWM converter (high power factor converter)

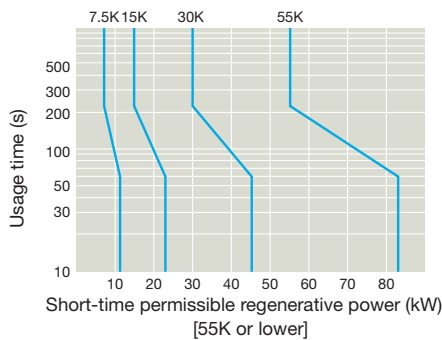
- The waveform with high peaks, which is typical of inverter's input current, is reshaped to be a sine wave with lower input current effective values.
- The lowered effective value enables adoption of smaller power-supply-side devices, such as a power supply transformer, MCCB, and cables. Such smaller equipment saves the cost of equipment.



2 Power regeneration function for energy saving

The power regeneration function, which comes as a standard feature, eliminates the need for brake units. The power regeneration function gives a great breaking capability. (Regeneration is available continuously with 100% torque, and for 60s with the maximum of 150% torque.)

The regenerative power from the motor is returned to the power source, and such a system significantly saves energy.

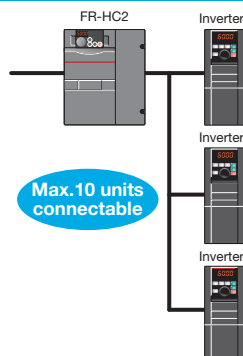


3 Connectable to multiple inverters

The common converter method enables the connection to up to 10 inverters.*1

The power returned during regenerative driving can be supplied to another inverter, saving the overall energy.

*1 : Be sure to use a high power factor converter with the capacity higher than the total capacity of the inverters or the total capacity of the motors. (Refer to page 12.)



4 Compact design for space saving

The high power factor converters (excluding 15K) and input reactors (75K or higher) have become much smaller than their conventional models (FR-HC, MT-HC).

5 Long life parts and life diagnosis function

(1) Longer life parts

- The service life of the cooling fans is now 10 years*1 and that can be even longer with the ON/OFF control of the cooling fan.
- Capacitors with a design life of 10 years*1*2 are adapted. (Using a surrounding air temperature of 105°C for 5000 hours). With these capacitors, the service life of the converter is further extended.

*1 : Surrounding air temperature: Annual average of 40°C (free from corrosive gas, flammable gas, oil mist, dust and dirt).

The design life is a calculated value and is not a guaranteed product life.

*2 : Input current: 80% of the high power factor converter rating

● Estimated service lifespan of the consumable parts

Part name	Estimated lifespan	Reference value by JEMA ^{*3}
Cooling Fan	10 years	2 to 3 years
Main circuit smoothing capacitor	10 years	5 years
Smoothing capacitors on the printed board	10 years	5 years

*3 : Excerpt from "The Periodic Inspection Recommendations on General-purpose Inverters" by the Japan Electrical Manufacturers Association (JEMA).

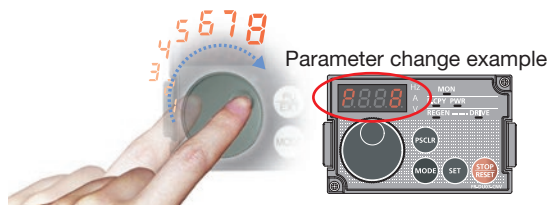
(2) The leading-edge life diagnosis function

- The degree of deterioration of the main circuit capacitor, cooling fan, and inrush current limit circuit can be diagnosed on the monitor.
- Using the self-diagnosis function, the part life warning can be output and the deterioration degree can be monitored. Thus, the self-diagnosis function prevents troubles from occurring.

*4 : A warning is output when any of the control circuit capacitor, inrush current limit circuit, and cooling fan reaches its output level.

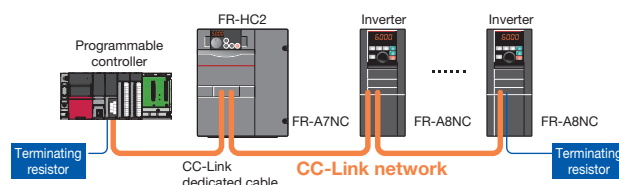
6 Operation panel equipped with the setting dial (FR-DU07-CNV)

- Parameters can be copied using the operation panel (FR-DU07-CNV).
The setting values of the parameters can be stored to the operation panel and the option parameter unit (FR-PU07).
- Items such as input current, input voltage, input power (with the regenerative display), bus voltage, etc. can be monitored.
- Operation can be easily performed with the setting dial.



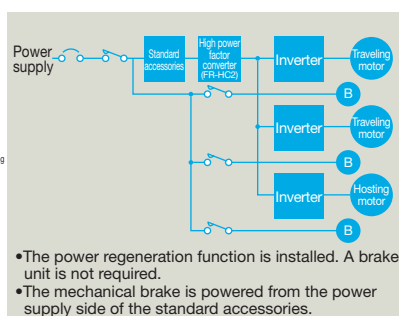
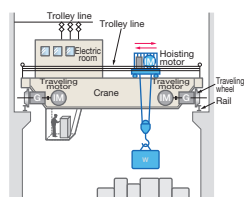
7 Supporting more network protocols

- HC2 supports RS-485 as a standard. With the option FR-A7NC, HC2 also supports CC-Link.
- The power can be monitored during driving/regenerative driving, and this monitoring tells you the energy saving effect.
- Alarm functions and voltage monitors of each phase help you to spot the cause of the alarm.

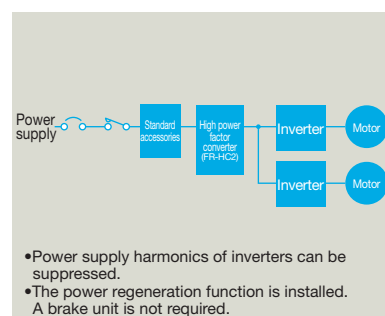
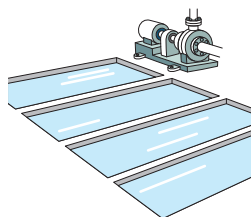


Applications

[Ceiling crane]



[Water treatment plant (pump)]



Extensive lineup

Model

FR-HC2- 7.5K

High power factor converter
basic model name

Symbol	Voltage	Symbol	Applicable capacity
No sign	200V class	7.5K to 560K	Represents the capacity kW.
H	400V class		

Capacity (kW)	7.5	15	30	55	75	110	160	220	280	400	560
Three-phase 200V class	●	●	●	●	●	—	—	—	—	—	—
Three-phase 400V class	●	●	●	●	●	●	●	●	●	●	●

●: Available model —: Not available



Compliant with UL, cUL, EC Directives (CE marking), and Radio Waves Act (South Korea, KC marking). Also, certified as compliant with the Eurasian Conformity (EAC).

The high power factor converters are compliant with the EU RoHS Directive (Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment), friendly to people and to the environment.

To obtain higher environmental resistance, the FR-HC2 has coated printed circuit boards and copper plated conductors. Magnetic contactors also have anti-corrosive coatings on the coated printed circuit board model (FR-HC-□K-60) of the conventional series is replaceable with the standard model of this series.

[Note]

- These coating treatments do not guarantee an operation environment beyond the range indicated in the product specification.
- Coating is applied to the printed circuit board areas excluding its LEDs, connectors, terminal blocks and their peripherals, where coating cannot be applied.
- As for the anti-corrosive treatment of the magnetic contactor, plating is applied to the copper areas where no surface treatment is applied.



High power factor converter^{*1}
(FR-HC2)

Standard accessories

Refer to page 9



Reactor 1
(FR-HCL21)



Reactor 2
(FR-HCL22)



Outside box^{*2}
(FR-HCB2)

^{*1}: Use in combination with standard accessories. Cables for connecting standard accessories are not provided.

^{*2}: Peripheral devices are separately provided for 280K or higher (not provided as the outside box).

Features

Connection example

Standard specifications

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Terminal connection diagram
Terminal specification explanation

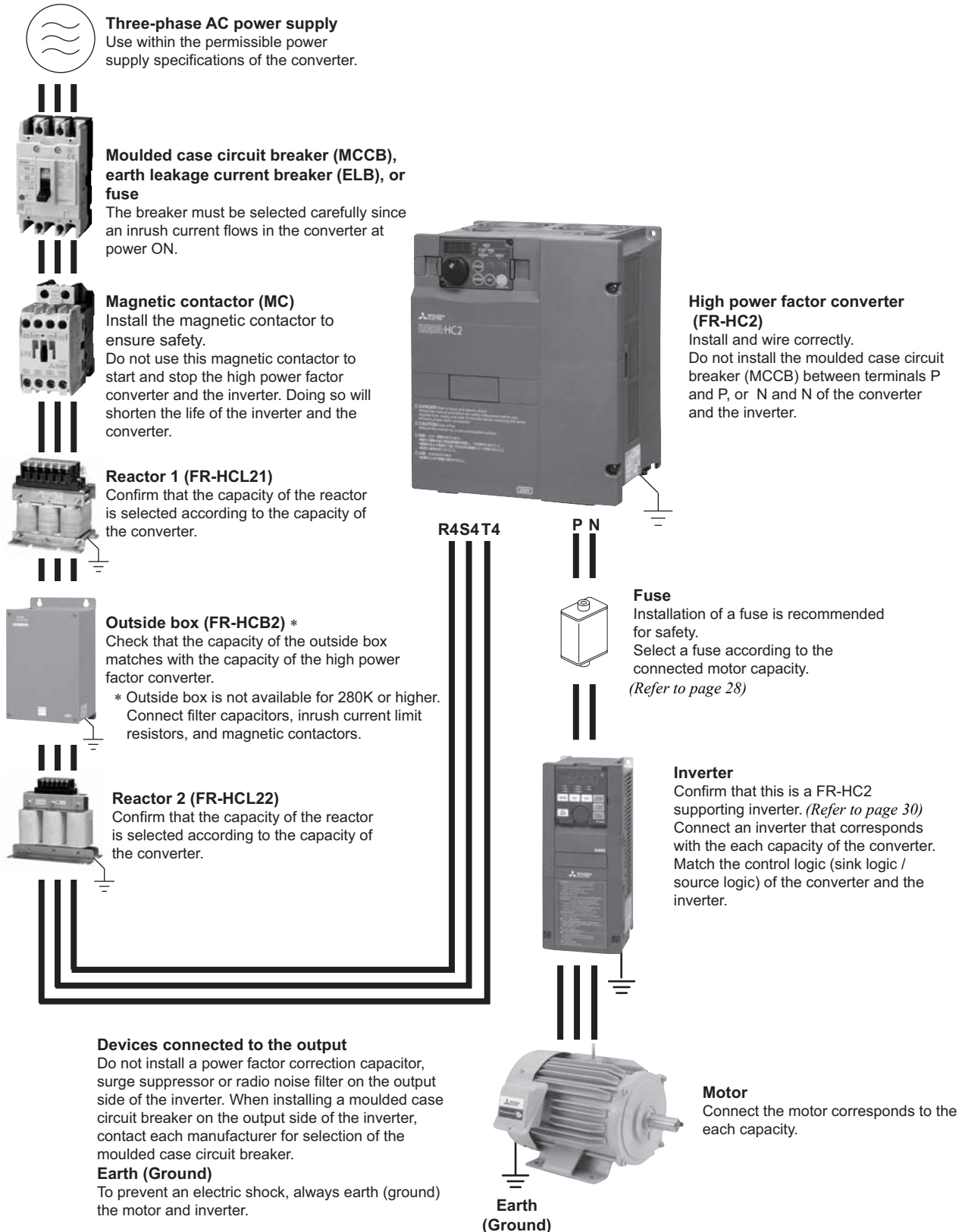
Parameter list

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Option and peripheral devices

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Standard specification rating

●200V

Model name FR-HC2-□K	7.5	15	30	55	75
Applicable inverter capacity (kW)	7.5	15	30	55	75
Rated output capacity (kW) *3	10.7	19.8	38	71	92
Rated input voltage (V)	Three-phase 200V to 220V 50Hz/200V to 230V 60Hz *2				
Rated input current (A)	33	61	115	215	278
Overload current rating *5	150% 60s				
Permissible power supply voltage fluctuation	170V to 242V 50Hz 170V to 253V 60Hz				170V to 230V 50Hz/60Hz
Permissible power supply frequency fluctuation	±5%				
Input power factor	0.99 or more (when load ratio is 100%)				
Power supply capacity (kVA)	14	25	47	88	110
Protective structure of the converter *6	Enclosed type (IP20) *7		Open type (IP00)		
Cooling system	Forced air cooling				
Approximate mass (kg) *8	7	12	24	39	53

●400V

Model name FR-HC2-H□K *1	7.5	15	30	55	75	110	160	220	280	400	560
Applicable inverter capacity (kW)	7.5	15	30	55	75	110	160	220	280	400	560
Rated output capacity (kW) *3	11.0	20.2	37	73	92	135	192	264	336	476	660
Rated input voltage (V) *4	Three-phase 380V to 460V 50Hz/60Hz *2										
Rated input current (A)	17	31	57	110	139	203	290	397	506	716	993
Overload current rating *5	150% 60s										
Permissible power supply voltage fluctuation	323V to 506V 50/60Hz					323V to 460V 50/60Hz					
Permissible power supply frequency fluctuation	±5%										
Input power factor	0.99 or more (when load ratio is 100%)										
Power supply capacity (kVA)	14	26	47	90	113	165	235	322	410	580	804
Protective structure of the converter *6	Enclosed type (IP20)*7		Open type (IP00)								
Cooling system	Forced air cooling										
Approximate mass (kg) *8	9	9	26	43	37	56	120	120	160	250	250

*1 Model name of the 400V class ends with H.

*2 The permissible voltage imbalance ratio is 3% or less. (Imbalance ratio = (highest voltage between lines - average voltage between three lines) / average voltage between three lines × 100).

*3 DC output capacity when the input voltage is 200VAC (400V for the 400V class).

*4 Change the MC power supply stepdown transformer tap according to the input voltage. (Refer to the Instruction Manual)

*5 The % value of the overload current rating indicates the ratio of the overload current to the converter's rated input current. For repeated duty, allow time for the converter and the inverter to return to or below the temperatures under 100% load.

*6 The protective structure is IP40 for FR-DU07-CNV (except the PU connector) and IP00 for the outside box (220K or lower) and the reactor regardless of their capacities.

*7 When the hook of the converter front cover is cut off for installation of the plug-in option, the protective structure changes to the open type (IP00).

*8 Mass of FR-HC2 alone.

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Common specifications

Control specification	Control method		PWM control
	Power supply frequency range		50Hz to 60Hz
	Current limit level		Current limit value selectable (0 to 220% variable)
Operation specification	Input signal (Five terminal)		The following signals can be assigned to <i>Pr. 3 to Pr. 7 (input terminal function selection)</i> : converter stop, monitor switching, converter reset, external thermal relay, and inrush resistance overheat detection.
	Output signal		The following signals can be assigned to <i>Pr. 11 to Pr. 16 (output terminal function selection)</i> : inverter run enable signal, converter reset, converter running, overload alarm, power supply phase detection, output voltage match, instantaneous power failure detection, regenerative drive recognition, electronic thermal relay pre-alarm, fan alarm, heatsink overheat pre-alarm, during retry, input current detection, zero current detection,life alarm, maintenance timer, instantaneous power failure detection hold, alarm, and fault output.
	Open collector output (Five terminals)		
	Relay output (One terminal)		
	Operating status		
	For meter Pulse train output (Max. 2.4kHz: one terminal) Analog output (Max. 10VDC: one terminal)		The following signals can be assigned to <i>Pr. 54 FM terminal function selection (pulse train output)</i> and <i>Pr. 50 AM terminal function selection (analog output)</i> : power supply frequency, input current, input voltage, converter output voltage, electronic thermal relay load factor, input power, reference voltage output.
Indication	Operation panel (FR-DU07-CNV)	Operating status	Power supply frequency, input current, input voltage, fault or alarm indication, converter output voltage, electronic thermal relay load factor, cumulative energization time, cumulative power, input power, input power (with regenerative display), I/O terminal status*1, power/regenerative drive indication, option fitting states *2
		Parameter unit (FR-PU07)	Fault record
			Interactive guidance
Protective/warning function	Protective function		Overcurrent, overvoltage, converter protection thermal, fin overheat, instantaneous power failure, undervoltage, input phase loss, HC2 dedicated board disconnection, input power supply fault, external thermal relay operation *4, parameter error, PU disconnection *4, retry count excess *4, converter CPU fault, operation panel power supply short circuit, 24VDC power output short circuit, input current detection value exceeded *4, inrush current limit circuit fault, internal circuit fault, option fault *5, communication option fault *5.
	Warning functions		Fan alarm, overload signal detection, electronic thermal relay pre-alarm, PU stop, maintenance timer alarm *4, parameter write error, copy operation error, operation panel lock, parameter copy alarm, no-phase detection
Environment	Surrounding air temperature		-10°C to +50°C (non-freezing)
	Ambient humidity		90%RH or less (non-condensing)
	Storage temperature *3		-20°C to +65°C
	Atmosphere		Indoors (without corrosive gas, flammable gas, oil mist, dust and dirt etc.)
	Altitude/ vibration		Maximum 1,000m, 5.9 m/s ² or less *6 at 10 to 55Hz (directions of X, Y, Z axes)

*1 Can be displayed only on the operation panel (FR-DU07-CNV).

*2 Can be displayed only on the option parameter unit (FR-PU07).

*3 Temperature applicable for a short time, e.g. in transit.

*4 This protective function is not available in the initial status.

*5 This protective function is enabled when FR-A7NC is mounted.

*6 2.9m/s² or less for the 160K or higher.

Checking peripheral devices

Peripheral devices

Always install the included peripheral devices. Check the model name of the each peripheral device.
For the 400V class peripheral devices, H is indicated in front of the model name.

FR-HC2-7.5K to 75K, FR-HC2-H7.5K to H220K

Peripheral Device Model Name	Description	Quantity
FR-HC2-(H)□K	High power factor converter	1
FR-HCL21-(H)□K	Filter reactor 1	1
FR-HCL22-(H)□K	Filter reactor 2	1
FR-HCB2-(H)□K	Outside box *	1

* Terminal screws are enclosed for FR-HCB2-7.5K, 15K, FR-HCB2-H7.5K to H30K. (M5 × 6)

FR-HC2-H280K to H560K

Peripheral Device Model Name	Model Name of Consisting Parts	Description	Quantity		
			280K	400K	560K
FR-HC2-H□K	FR-HC2-H□K	High power factor converter	1	1	1
FR-HCL21-H□K	FR-HCL21-H□K	Filter reactor 1	1	1	1
FR-HCL22-H□K	FR-HCL22-H□K	Filter reactor 2	1	1	1
FR-HCC2-H□K	FR-HCC2-H□K	Filter capacitor	1	2	3
	MDA-1	Filter capacitor alarm detector	—	2	3
FR-HCR2-H□K	0.96OHM BKO-CA1996H21	Inrush current limit resistor (without thermostat)	8	15	15
	0.96OHM BKO-CA1996H31	Inrush current limit resistor (with thermostat)	1	3	3
FR-HCM2-H□K	1PH 630VA BKO-CA2001H06	MC power supply stepdown transformer (400V-200V)	1	1	1
	S-N400FXYS AC200V 2A2B	Inrush current limit MC	—	3	3
	S-N600FXYS AC210V 2A2B	Inrush current limit MC	1	—	—
	SR-N4FX AC210V 4A	Buffer relay	1	2	2
	TS-807BXC-5P	Terminal block	6	—	—
	C152C481H21	Terminal block shorting conductor	6	—	—
	C152C423H21	MC shorting conductor	—	6	6
	MYQ4Z AC200/220	Mini relay for filter capacitor alarm detector	—	1	1
	PYF14T	Mini relay terminal block	—	1	1
	PYC-A1	Mini relay clip	—	2	2
	M12×50 ZENNEJI	MC shorting conductor bolt (M12 × 50)	—	24	24
	M12	MC shorting conductor nut (M12)	—	24	24
	MIGAKI 12	MC shorting conductor washer (flat washer)	—	48	48
	BANE 12	MC shorting conductor washer (spring washer)	—	24	24
	SW-PW-P-NA M5 × 12	Inrush current limit resistor screw (M5 × 12)	—	54	54

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Selection of the high power factor converter and the inverter

The required converter capacity differs by the multiple rating selection setting of the inverter.

Refer to the following table for the connectable inverter capacities when connecting one inverter to a high power factor converter. (Other combinations are not applicable.)

○: Compatible

—: The converter can be used as a common converter or a regenerative converter, but its harmonic suppression effect reduces.

×: Not compatible (Not applicable)

● When the inverter capacity and the applicable motor capacity are equal (FR-A800 (ND rating), FR-F800 (LD rating), and 700 series inverters)

Inverter capacity		2.2K or lower	3.7K	5.5K	7.5K	11K	15K	18.5K	22K	30K	37K	45K	55K	75K
200V	FR-HC2-7.5K	—	○	○	○	×	×	×	×	×	×	×	×	×
	FR-HC2-15K	—	—	—	○	○	○	×	×	×	×	×	×	×
	FR-HC2-30K	—	—	—	—	—	○	○	○	○	×	×	×	×
	FR-HC2-55K	—	—	—	—	—	—	—	—	○	○	○	○	×
	FR-HC2-75K	—	—	—	—	—	—	—	—	—	○	○	○	○
400V	FR-HC2-H7.5K	—	○	○	○	×	×	×	×	×	×	×	×	×
	FR-HC2-H15K	—	—	—	○	○	○	×	×	×	×	×	×	×
	FR-HC2-H30K	—	—	—	—	—	○	○	○	○	×	×	×	×
	FR-HC2-H55K	—	—	—	—	—	—	—	—	○	○	○	○	×
	FR-HC2-H75K	—	—	—	—	—	—	—	—	—	○	○	○	○

Inverter capacity		45K or lower	55K	75K	90K	110K	132K	160K	185K	200K	220K	250K
400V	FR-HC2-H110K	—	○	○	○	○	×	×	×	×	×	×
	FR-HC2-H160K	—	—	—	○	○	○	○	×	×	×	×
	FR-HC2-H220K	—	—	—	—	○	○	○	○	○	○	×
	FR-HC2-H280K	—	—	—	—	—	—	○	○	○	○	○
	FR-HC2-H400K	—	—	—	—	—	—	—	—	○	○	○
	FR-HC2-H560K	—	—	—	—	—	—	—	—	—	—	—

Inverter capacity		280K	315K	355K	375K	400K	450K	500K	530K	560K
400V	FR-HC2-H280K	○	×	×	×	×	×	×	×	×
	FR-HC2-H400K	○	○	○	○	○	×	×	×	×
	FR-HC2-H560K	○	○	○	○	○	○	○	○	○

● When the applicable motor capacity is higher than the inverter capacity (FR-A800 (LD rating), FR-A800 (SLD rating), and FR-F800 (SLD rating))

Compare the high power factor converter capacity chosen based on the table above and the applicable motor capacity. Then, choose the high power factor converter according to the capacity whichever is higher.

● When the applicable motor capacity is lower than the inverter capacity (FR-A800 (HD rating)).

Inverter capacity		2.2K or lower	3.7K	5.5K	7.5K	11K	15K	18.5K	22K	30K	37K	45K	55K
200V	FR-HC2-7.5K	—	○	○	×	×	×	×	×	×	×	×	×
	FR-HC2-15K	—	—	—	○	○	×	×	×	×	×	×	×
	FR-HC2-30K	—	—	—	—	—	○	○	○	×	×	×	×
	FR-HC2-55K	—	—	—	—	—	—	—	—	○	○	○	×
	FR-HC2-75K	—	—	—	—	—	—	—	—	—	○	○	○
400V	FR-HC2-H7.5K	—	○	○	×	×	×	×	×	×	×	×	×
	FR-HC2-H15K	—	—	—	○	○	×	×	×	×	×	×	×
	FR-HC2-H30K	—	—	—	—	—	○	○	○	×	×	×	×
	FR-HC2-H55K	—	—	—	—	—	—	—	—	○	○	○	×
	FR-HC2-H75K	—	—	—	—	—	—	—	—	—	○	○	○

Inverter capacity		45K or lower	55K	75K	90K	110K	132K	160K	185K	220K
400V	FR-HC2-H110K	—	○	○	×	×	×	×	×	×
	FR-HC2-H160K	—	—	—	○	○	×	×	×	×
	FR-HC2-H220K	—	—	—	—	○	○	○	×	×
	FR-HC2-H280K	—	—	—	—	—	—	○	○	○
	FR-HC2-H400K	—	—	—	—	—	—	—	—	○
	FR-HC2-H560K	—	—	—	—	—	—	—	—	—

Inverter capacity		250K	280K	315K	355K	400K
400V	FR-HC2-H400K	○	○	○	×	×
	FR-HC2-H560K	—	○	○	○	○

Inverter parameter settings

When using the high power factor converter with the inverter, the following inverter parameters must be set. The parameter setting differ by the inverter series.

For the parameters and the inverters not listed in the table, refer to the Instruction Manual of the inverter.

Inverter series	Pr.30 Regenerative function selection	V/F control	Other than V/F control
		Pr.19 Base frequency voltage	Pr.83 Rated motor voltage
FR-A800, FR-F800	2	Rated motor voltage	
FR-E700, FR-F700PJ, FR-D700	0 (initial value), 2 (automatic restart after instantaneous power failure is enabled)		

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Wiring of several inverters to one converter

Up to ten inverters can be connected to one converter. Be sure to use a high power factor converter with the capacity equal to or higher than the total capacity of inverters/motors. Additionally, the total capacity of the inverters or motors needs to be equal to or higher than half the capacity of the high power factor converter. (High power factor converter capacity $\times 1/2 \leq$ total capacity of connected inverters or motors $\leq$ high power factor converter capacity)

If the total inverter capacity is less than half the capacity of the high power factor converter, the converter can be used as a common converter or a regenerative converter. However, its harmonic suppression effect is reduced.

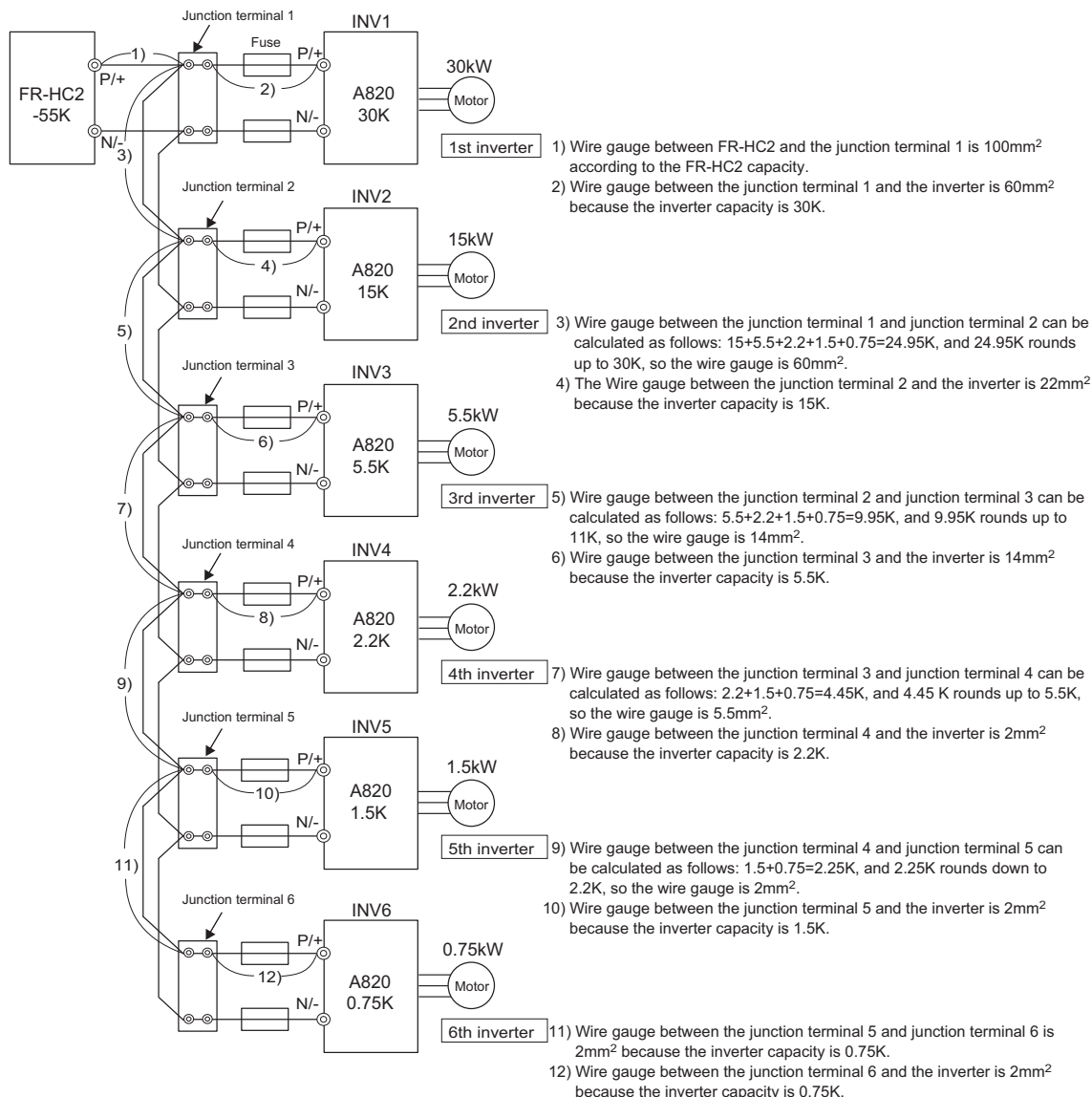
- (1) Junction terminals or cross wiring are used to connect several inverters, so carefully select the wire gauge. Start adding the inverter capacities from the furthest inverter.
- (2) When connecting several inverters, connect starting with the inverter with the highest capacity.
- (3) Installation of a fuse, which corresponds with each motor capacity, is recommended for each inverter when connecting several inverters to one converter. Select a fuse according to the motor capacity.

When using a motor, of which capacity is smaller than the inverter capacity by two ranks or more, select the converter capacity according to the inverter capacity. (Refer to page 28)

- (4) Keep the total wiring length within 50m.

●Main circuit wiring example

The following diagram shows a connection example of the FR-HC2-55K to six inverters: the FR-A820-01540(30K), 00770(15K), 00340(5.5K), 00167(2.2K), 00105(1.5K), and 00070(0.75K) (54.95 kW capacity in total).

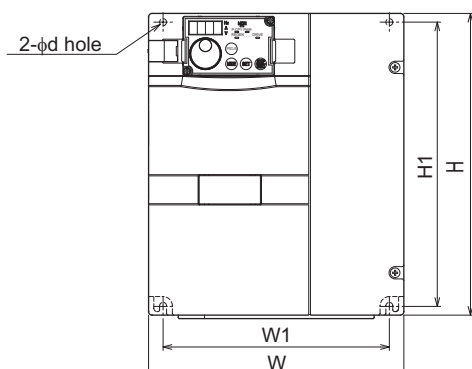


● Converter (FR-HC2)

FR-HC2-75K or lower

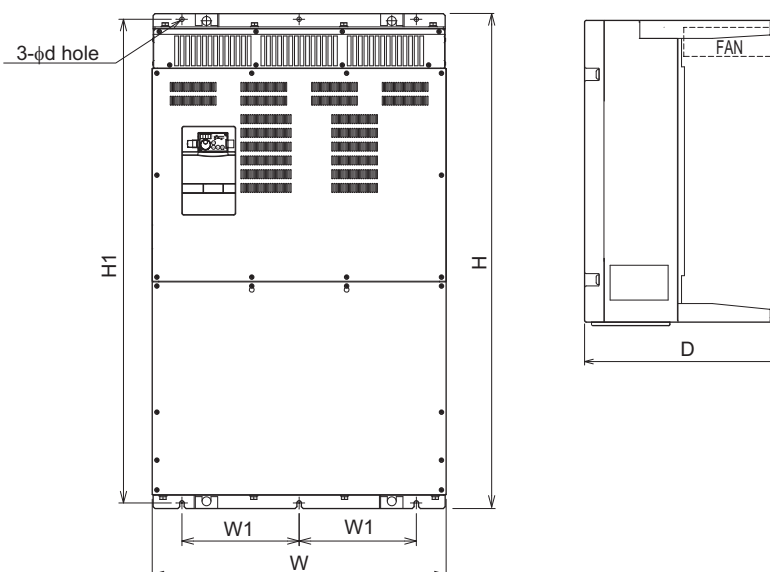
FR-HC2-H110K or lower

(Dimension drawing example: FR-HC2-7.5K)



FR-HC2-H160 to H560K

(Dimension drawing example: FR-HC2-H560K)



200V class

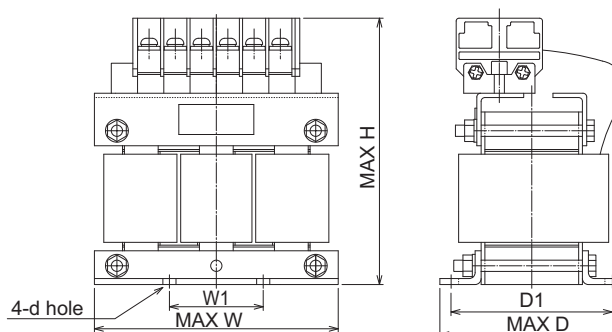
Model	W	W1	H	H1	D	d
FR-HC2-7.5K	220	195	260	245	170	6
FR-HC2-15K	250	230	400	380	190	10
FR-HC2-30K	325	270	550	530	195	10
FR-HC2-55K	370	300	620	595	250	10
FR-HC2-75K	465	400	620	595	300	12

400V class

Model	W	W1	H	H1	D	d
FR-HC2-H7.5K, H15K	220	195	300	285	190	6
FR-HC2-H30K	325	270	550	530	195	10
FR-HC2-H55K	370	300	670	645	250	10
FR-HC2-H75K	325	270	620	595	250	10
FR-HC2-H110K	465	400	620	595	300	12
FR-HC2-H160K, H220K	498	200	1010	985	380	12
FR-HC2-H280K	680	300	1010	984	380	12
FR-HC2-H400K, H560K	790	315	1330	1300	440	12

(Unit: mm)

● Reactor 1 (FR-HCL21) (Dimension drawing example : FR-HCL21-7.5K)



200V class

Model	W*	W1	H	D*	D1	d
FR-HCL21-7.5K	132	50 ±0.5	150	100	86 ⁺⁰ / _{-2.5}	M6
FR-HCL21-15K	162	75 ±0.5	172	126	107 ⁺⁰ / _{-2.5}	M6
FR-HCL21-30K	195	75 ±0.5	210	150	87 ⁺⁰ / _{-2.5}	M6
FR-HCL21-55K	210	75 ±0.5	180	200.5	97 ⁺⁰ / _{-2.5}	M6
FR-HCL21-75K	240	150 ±1	215	215.5	109 ⁺⁰ / _{-2.5}	M8

400V class

Model	W*	W1	H	D*	D1	d
FR-HCL21-H7.5K	132	50 ±0.5	140	105	90 ⁺⁰ / ₋₁	M6
FR-HCL21-H15K	162	75 ±0.5	170	128	105 ⁺⁰ / ₋₁	M6
FR-HCL21-H30K	182	75 ±0.5	195	145.5	90 ⁺⁰ / ₋₁	M6
FR-HCL21-H55K	282.5	255 ±1.5	245	165	112 ±1.5	M6
FR-HCL21-H75K	210	75 ±1	175	210.5	105 ⁺⁰ / _{-2.5}	M6
FR-HCL21-H110K	240	150 ±1	230	220	99 ⁺⁰ / ₋₅	M8
FR-HCL21-H160K	280	150 ±1	295	274.5	150 ⁺⁰ / ₋₅	M8
FR-HCL21-H220K	330	170 ±1	335	289.5	150 ⁺⁰ / ₋₅	M10
FR-HCL21-H280K	330	170 ±1	335	321	203 ⁺⁰ / ₋₅	M10
FR-HCL21-H400K	402	250 ±1	460	550	305 ±10	M10
FR-HCL21-H560K	452	300 ±1	545	645	355 ±10	M12

* The sizes indicated by W and D are not the sizes of the legs.
These indicate the sizes of whole reactors.

(Unit: mm)

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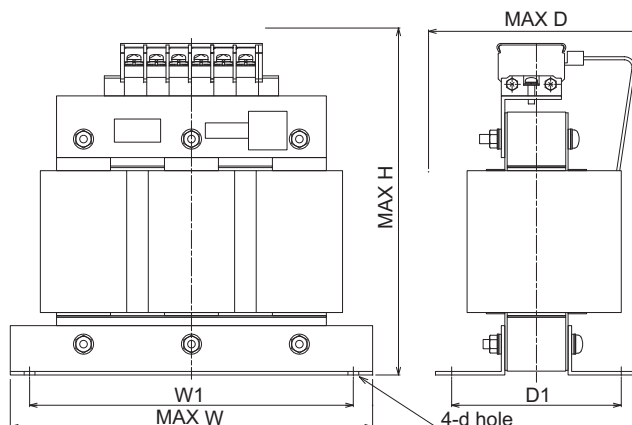
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● Reactor 2 (FR-HCL22) (Dimension drawing example : FR-HCL22-7.5K)



200V class

Model	W*	W1	H	D*	D1	d
FR-HCL22-7.5K	237.5	210 ±1.5	230	140	110 ±1.5	M6
FR-HCL22-15K	257.5	230 ±1.5	260	165	120 ±1.5	M6
FR-HCL22-30K	342.5	310 ±1.5	305	180	130 ±1.5	M8
FR-HCL22-55K	432.5	270 ±1.5	380	280	240 ±1.5	M8
FR-HCL22-75K	474	430 ±2	460	280	128 ±2	M12

400V class

Model	W*	W1	H	D*	D1	d
FR-HCL22-H7.5K	237.5	210 ±1.5	220	140	110 ±1.5	M6
FR-HCL22-H15K	257.5	230 ±1.5	260	165	120 ±1.5	M6
FR-HCL22-H30K	342.5	310 ±1.5	300	180	130 ±1.5	M8
FR-HCL22-H55K	392.5	360 ±1.5	365	200	130 ±1.5	M8
FR-HCL22-H75K	430	265 ±1.5	395	280	200 ±1.5	M10
FR-HCL22-H110K	500	350 ±1.5	440	370	260 ±1.5	M10
FR-HCL22-H160K	560	400 ±1.5	520	430	290 ±1.5	M12
FR-HCL22-H220K	620	400 ±1.5	620	480	320 ±1.5	M12
FR-HCL22-H280K	690	500 ±2	700	560	350 ±2	M12
FR-HCL22-H400K	632	400 ±2	675	705	435 ±10	M12
FR-HCL22-H560K	632	400 ±2	720	745	475 ±10	M12

* The sizes indicated by W and D are not the sizes of the legs.
These indicate the sizes of whole reactors.

(Unit: mm)

● Outside box (FR-HCB2)*

FR-HCB2-55K or lower

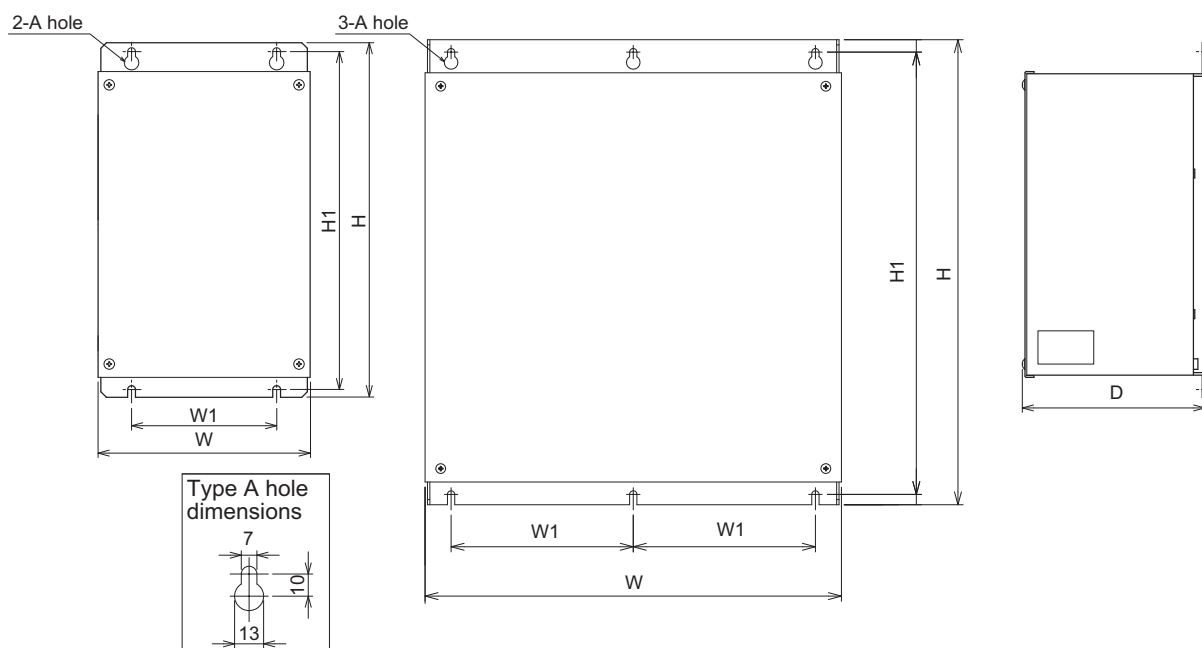
FR-HCB2-H75K or lower

(Dimension drawing example : FR-HCB2-7.5K)

FR-HCB2-75K

FR-HCB2-H110K, H160K, H220K

(Dimension drawing example : FR-HCB2-75K)



200V class

Model	W	W1	H	H1	D
FR-HCB2-7.5K, 15K	190	130	320	305	165
FR-HCB2-30K, 55K	270	200	450	435	203
FR-HCB2-75K	400	175	450	428	250

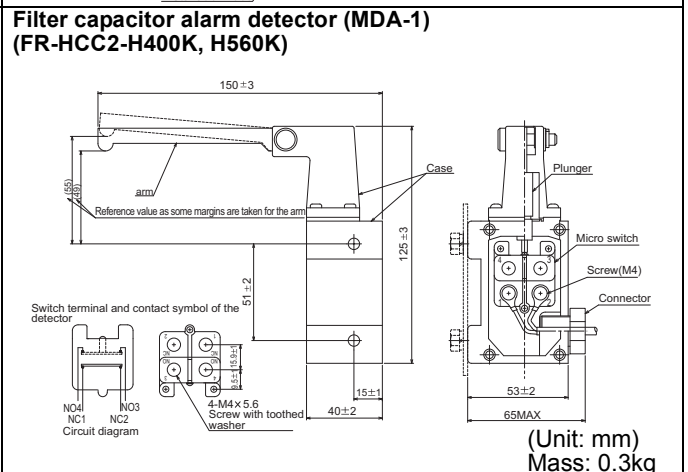
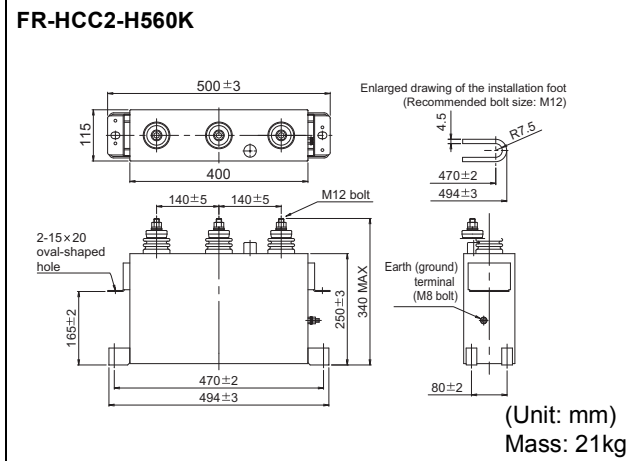
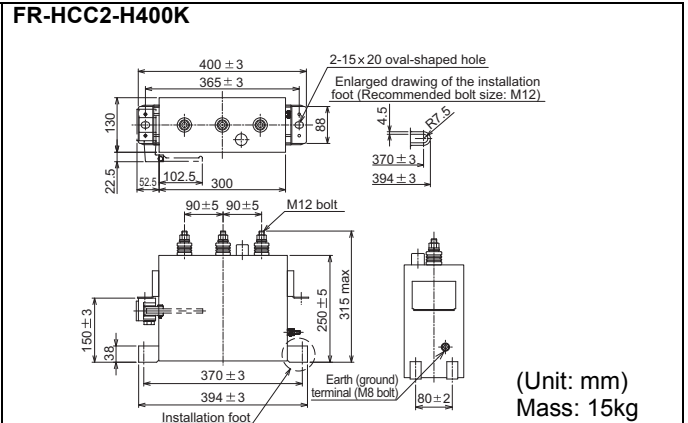
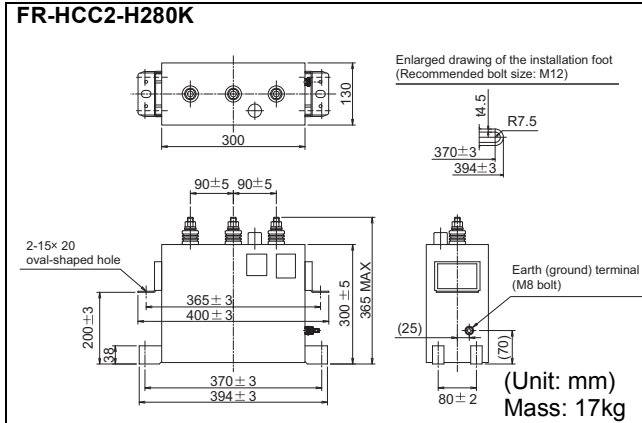
400V class

Model	W	W1	H	H1	D
FR-HCB2-H7.5K to H30K	190	130	320	305	165
FR-HCB2-H55K	270	200	450	435	203
FR-HCB2-H75K	300	250	350	328	250
FR-HCB2-H110K	350	125	450	428	380
FR-HCB2-H160K, H220K	400	175	450	428	440

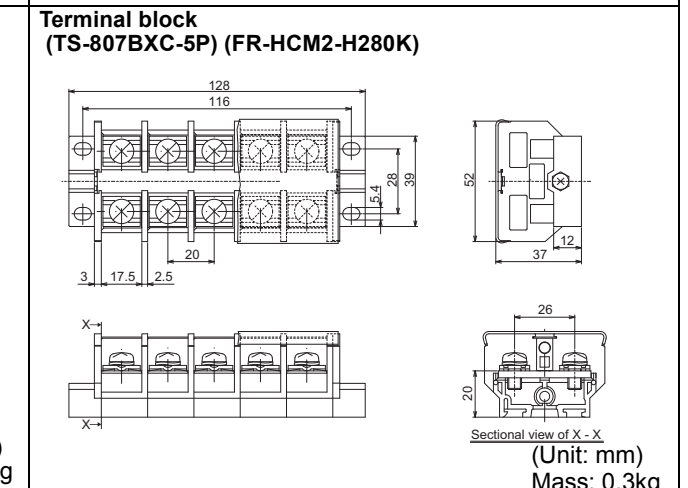
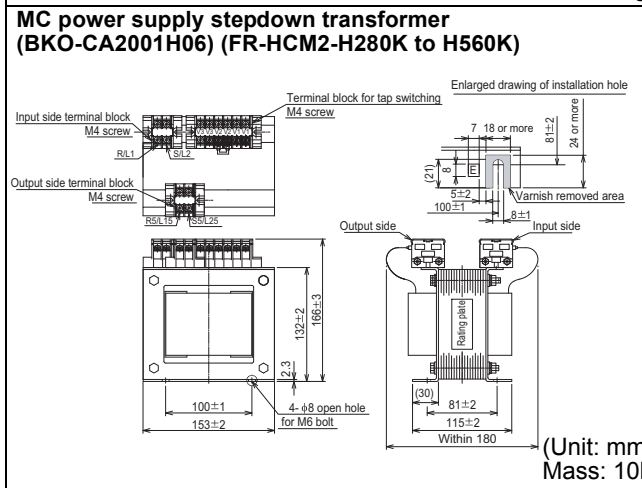
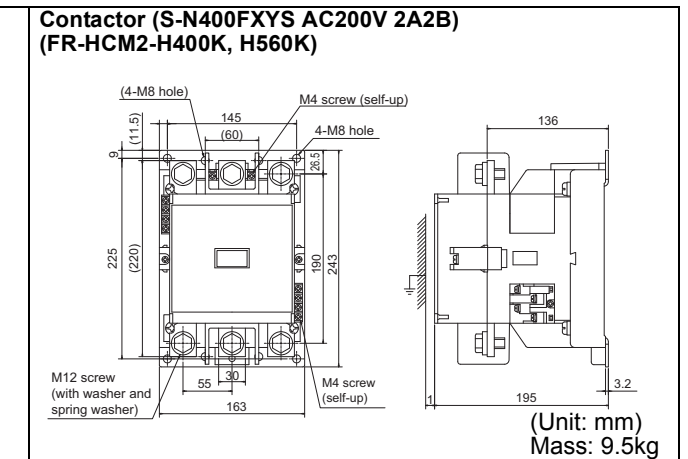
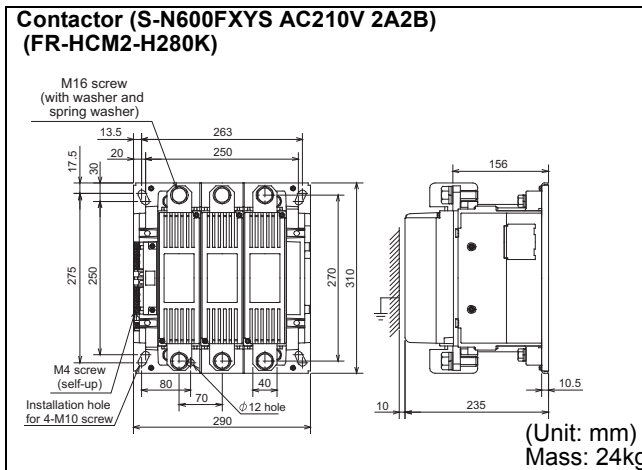
* Peripheral devices are separately provided for the FR-HC2-H280K or higher (not provided as the outside box).

(Unit: mm)

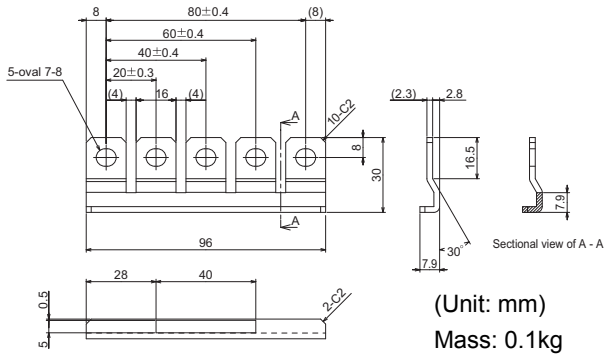
●Filter capacitor (FR-HCC2)



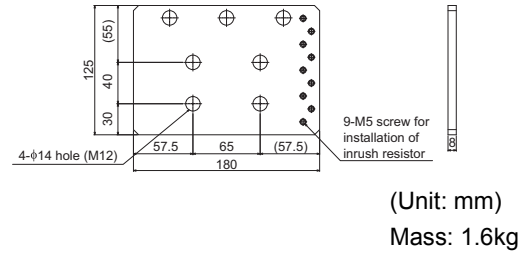
●FR-HCM2



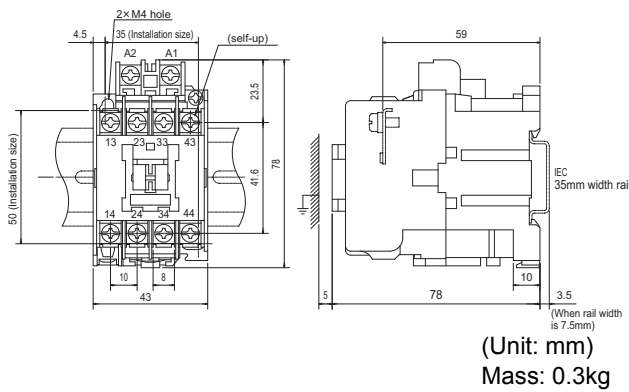
Terminal block shorting conductor (C152C481H21) (FR-HCM2-H280K)



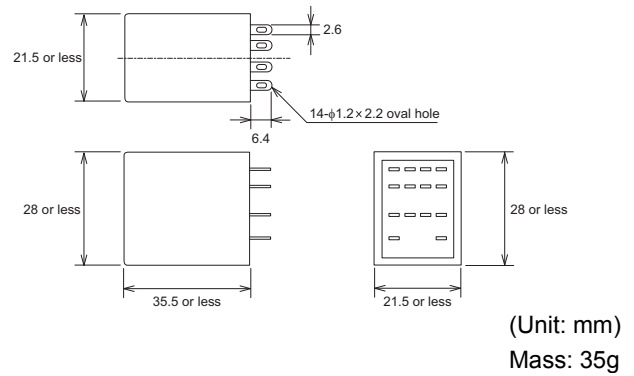
MC shorting conductor (C152C423H21) (FR-HCM2-H400K, H560K)



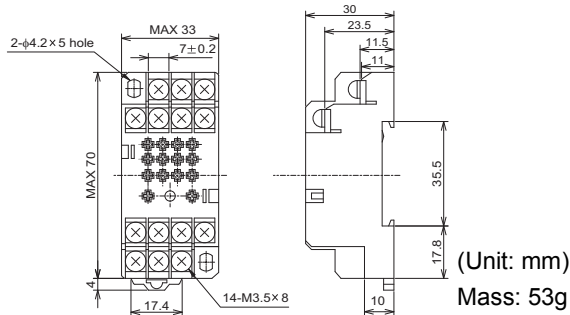
Buffer relay for driving MCs (SR-N4FX AC210V 4A) (FR-HCM2-H280K to H560K)



Mini relay for filter capacitor alarm detector (MYQ4Z AC200/220) (FR-HCM2-H400K, H560K)

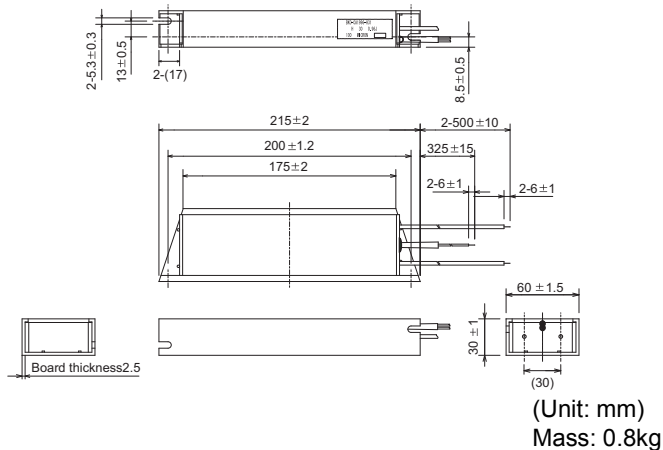


Mini relay terminal block (PYF14T) (FR-HCM2-H400K, H560K)

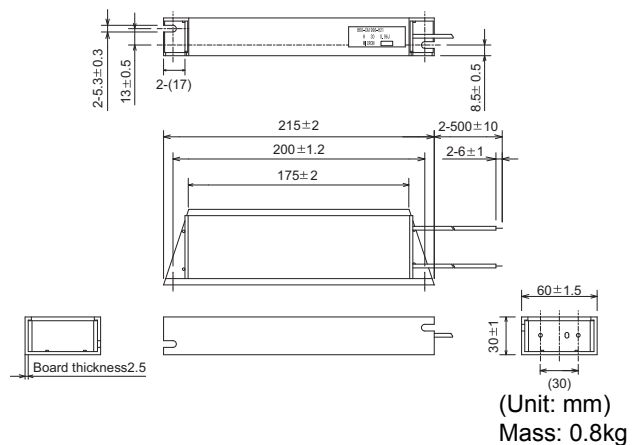


●Inrush current limit resistor (FR-HCR2)

With thermostat (BKO-CA1996H31) (FR-HCR2-H280K to H560K)



Without thermostat (BKO-CA1996H21) (FR-HCR2-H280K to H560K)



Protruding the heatsink

When installing a converter inside an enclosure, the heat generated in the enclosure can be greatly reduced by protruding the heatsink of the converter.

This installation method is recommended when downsizing the enclosure and such.

●When using a heatsink protrusion attachment (FR-A7CN)

For the FR-HC2-7.5K to 75K and FR-HC2-H7.5K to H110K, a heatsink can be protruded outside the enclosure using a heatsink protrusion attachment (FR-A7CN). (For the 160K or higher, the attachment is not necessary when the heatsink is to be protruded.)

Refer to the table below for the applicable heatsink protrusion attachments.

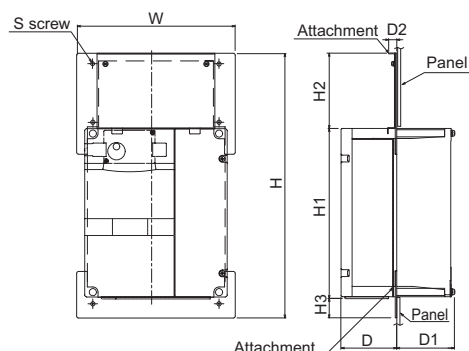
(For the details of FR-A7CN, refer to the Instruction Manual of the option FR-A7CN.)

(1) Heatsink protrusion attachments

Model Name	Applicable converter
FR-A7CN02	FR-HC2-7.5K
FR-A7CN03	FR-HC2-H7.5K, H15K
FR-A7CN04	FR-HC2-15K
FR-A7CN05	FR-HC2-30K FR-HC2-H30K
FR-A7CN09	FR-HC2-75K FR-HC2-H110K

* For a combination other than above, please contact your sales representative.

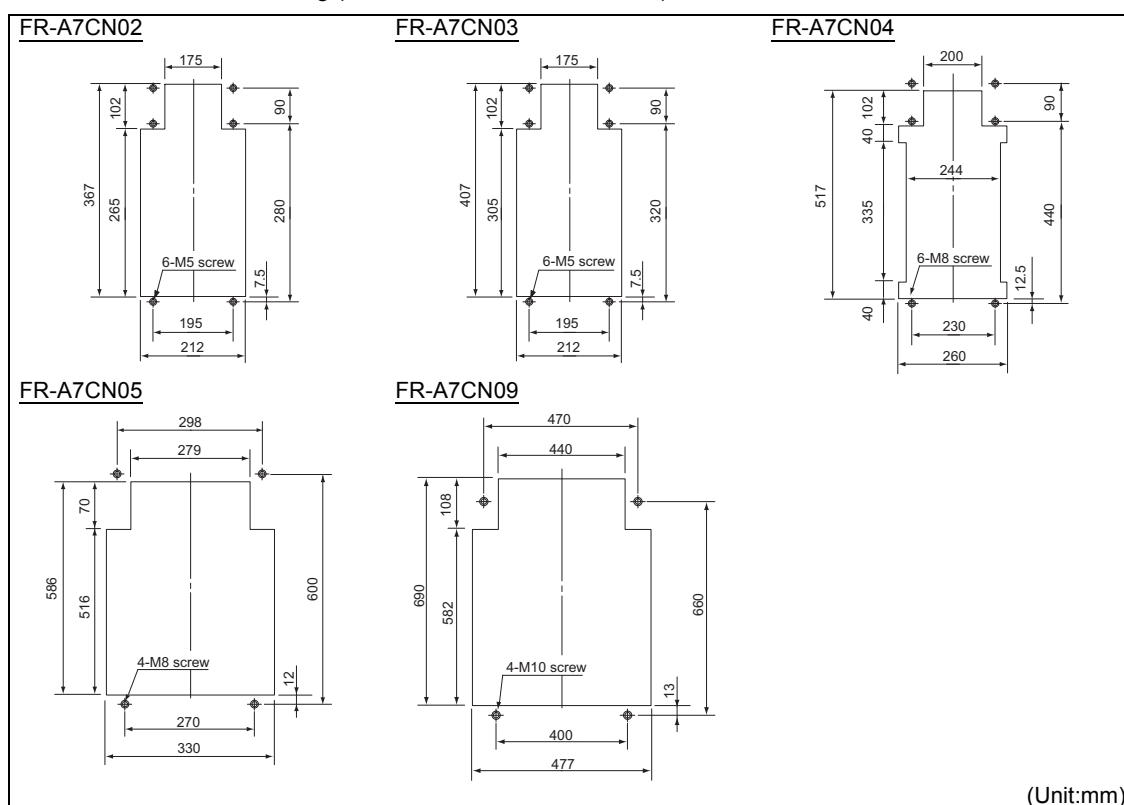
(2) Drawing after attachment installation (when used with the FR-A7CN)



Model	W	H	H1	H2	H3	D	D1	D2	S
FR-A7CN02	245	408.5	260	116.5	32	86	89.4	12.3	M5
FR-A7CN03	245	448.5	300	116.5	32	89	106.4	20	M5
FR-A7CN04	280	554	400	122	32	88.5	110.6	45.3	M8
FR-A7CN05	338	645	480	130	35	123.5	71.5	105	M8
FR-A7CN09	510	725	535	150	40	116.5	183.5	45	M10

(Unit:mm)

(3) Panel cut dimension drawing (when used with the FR-A7CN)

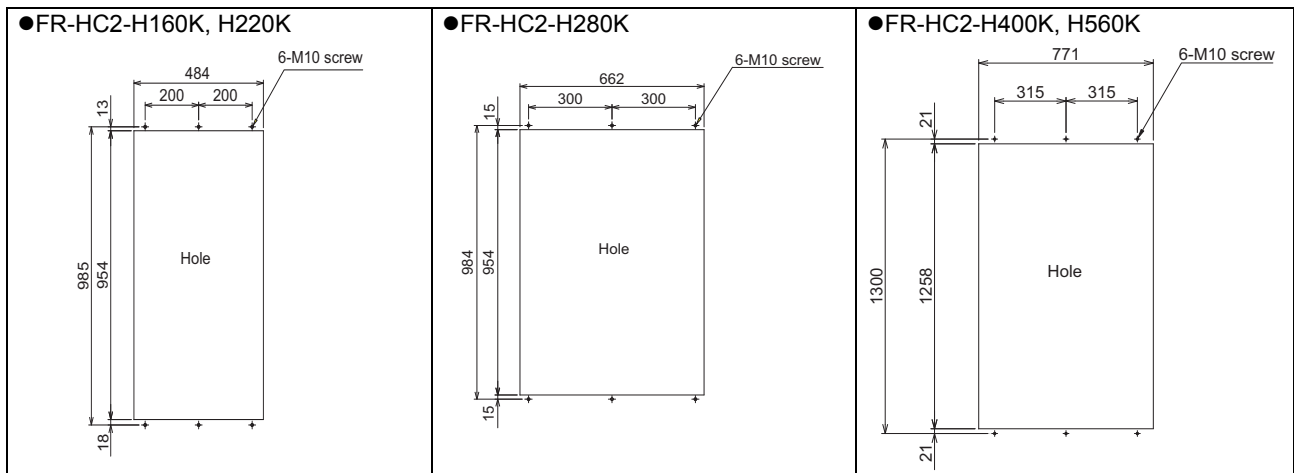


(Unit:mm)

●Heatsink protrusion for 160K or higher

(1) Enclosure cut

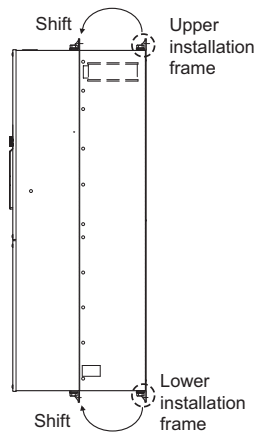
Cut the enclosure according to the capacity of the converter.



(2) Moving and removing the back installation frames

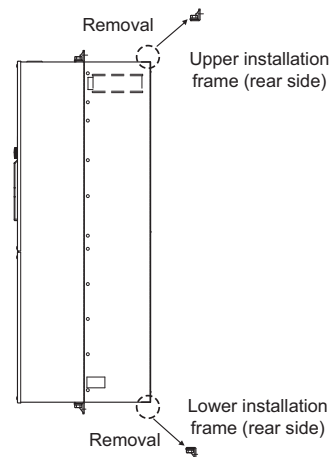
●FR-HC2-H160K to H280K

One installation frame is attached to each of the upper and lower parts of the converter. Change the position of the rear side installation frame on the upper and lower sides of the converter to the front side as shown on the right. When changing the installation frames, make sure that the installation orientation is correct.



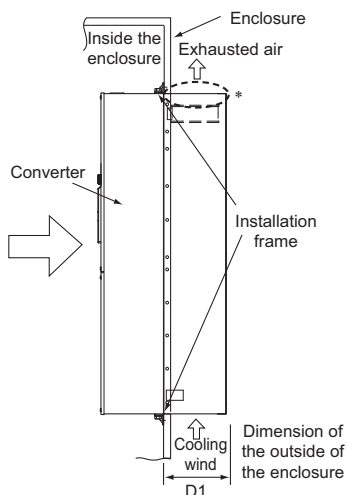
●FR-HC2-H400K, H560K

The converter has installation frames: two on the top and the two on the bottom. As shown on the right, remove the back installation frames on the top and bottom of the converter.

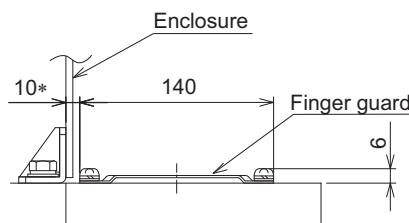


(3) Installing the converter to the enclosure

Protrude the heatsink of the converter from the installation enclosure, and secure the converter using the top and bottom installation frames.



* The enclosure enclosing FR-HC2-H160K and higher has a finger guard on its back. The thickness of the enclosure should be less than 10mm (*), and do not place anything around the finger guard to avoid contact with the finger guard.



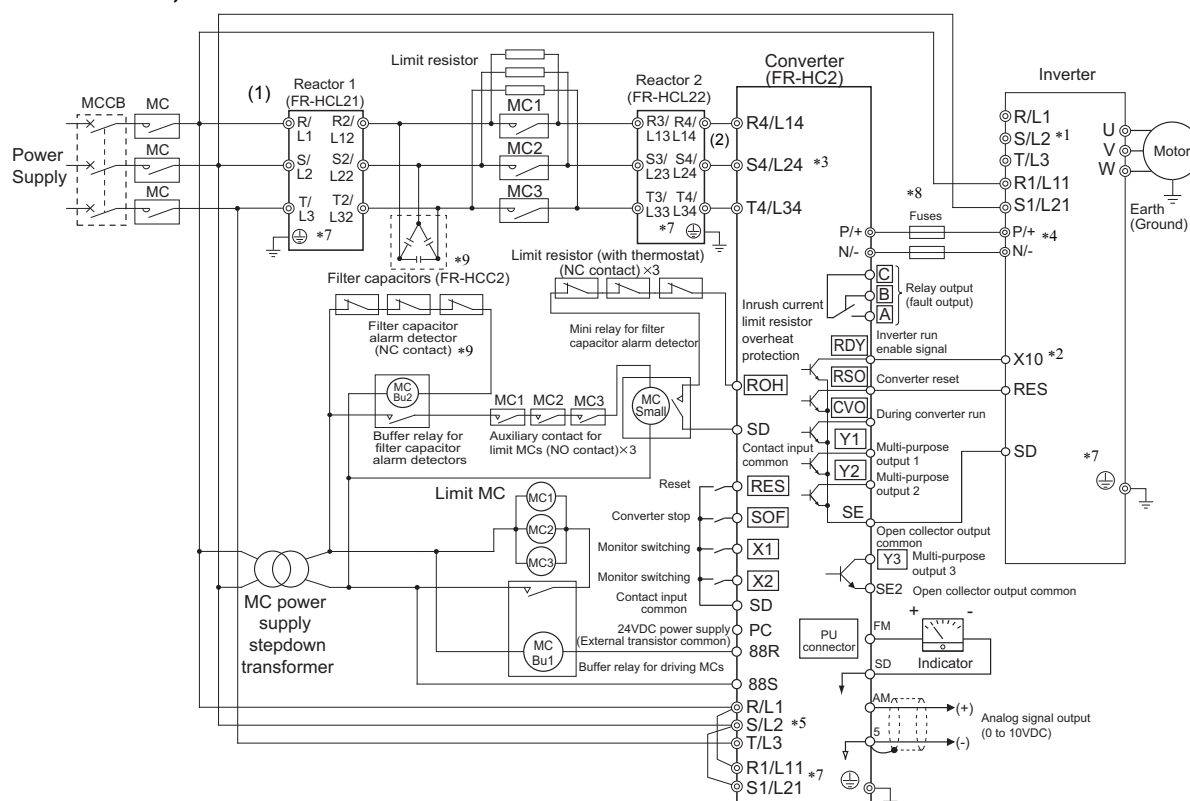
Converter model	D1
FR-HC2-H160K, H220K	185
FR-HC2-H280K to H560K	184



NOTE

- Protruding area contains a cooling fan, so it cannot be used in the environment where water drops, oil mist, dust and other substances exist.
- Foreign substances such as screws and dust must be prevented to enter in the converter or the cooling fan section.

● FR-HC2-H400K, H560K



- *1 Do not connect anything to the inverter power input terminals R/L1, S/L2, and T/L3. Incorrect connection will damage the inverter. Connecting opposite polarity of terminals P and N will damage the converter and the inverter.
- *2 Use input terminal function selection to assign the terminal used for X10 signal. (Refer to the Inverter Instruction Manual.)
- *3 The power phases of the terminals R4/L14, S4/L24, and T4/L34 and the terminals R/L1, S/L2, and T/L3 must be matched.
- *4 Do not insert MCCB between terminals P/+ and N/- (P and P, N and N).
- *5 Always connect the terminal R, S, and T of the converter to the power supply. If the inverter is operated without connecting the terminals to the power supply, the converter will be damaged.
- *6 Do not insert MCCB or MC between (1) (terminal R/L1, S/L2, T/L3 input of the converter) and (2) (terminal R4/L14, S4/L24, T4/L34 input of the converter) of the above diagram. It will not operate properly (except for the inrush current limit MC).
- *7 Securely perform grounding (earthing) by using the grounding (earthing) terminal.
- *8 Installation of a fuse is recommended. (Refer to page 28)
- *9 The number of filter capacitors and filter capacitor alarm detectors differs by the capacity. Connect two sets of filter capacitors and filter capacitor alarm detectors for H400K, and connect three sets for H560K.



NOTE

- When connecting the converter to the inverter, match the control logic (sink logic (initial setting)/source logic). The converter does not operate properly if the control logic is different. (Refer to the Instruction Manual for the switching of the control logic. Refer to the Inverter Instruction Manual for the switching of the control logic of the inverter.)
- Keep the wiring length between terminals as short as possible.
- When sudden large distortion or depression of power supply occurs, reactor may generate abnormal acoustic noise. This acoustic noise is caused by the power supply fault and not by the damage of the converter.
- Do not connect the DC reactor to the inverter when using a high power factor converter.
- When using a sine wave filter with FR-HC2 (75K or higher), select MT-BSL-HC as a reactor for the sine wave filter.

Type	Terminal Symbol	Terminal Name	Description	
Main circuit	R/L1, S/L2, T/L3	Power input	These terminals are used to detect power phase and power voltage, and to input control power. Connect them to the commercial power supply. If the inverter is operated without connecting them to the commercial power supply, the converter will be damaged.	
	R4/L14, S4/L24, T4/L34	Power input	Connect them to the reactor 2. The voltage phases of the terminals R4/L14, S4/L24 and T4/L34 and the terminals R/L1, S/L2 and T/L3 must be matched. If these terminals are not connected correctly, the converter does not operate properly.	
	R1/L11, S1/L21	Power supply for control circuit	These terminals are connected to the phase detection terminals R/L1 and S/L2 in the initial status. To retain the fault display and fault output, remove the jumpers (cables) and apply external power to these terminals.	
	P/+, N/-	Inverter connection	Connect them to the inverter terminals P/+ and N/-.	
		Earth (Ground)	For earthing (grounding) the converter chassis. It must be earthed (grounded).	
Control circuit/input signal	RES	Reset	Used to reset fault output provided when a fault occurs. Turn ON the RES signal for more than 0.1s, then turn it OFF.	
	SOF	Converter stop	Turning ON the SOF signal stops the converter. RDY signal turns OFF, limit MC turns ON	
	ROH	Inrush current limit resistor overheat protection	200V class 7.5K to 75K 400V class 7.5K to 220K	Connect this terminal to terminal ROH1 of the outside box (FR-HCB2). The ROH signal is input to stop the converter operation when the limit resistor may overheat.
			400V class 280K to 560K	An auxiliary contact (NO contact) of a limit resistor MC, a limit resistor (with thermostat) (NC contact), and a filter capacitor alarm detector (NC contact, 400K and 560K) are connected to stop the converter operation when overheating of the limit resistor becomes a concern and when a filter capacitor is faulty.
	X1	Monitor switching	FM and AM output or PU monitor display can be switched by a combination of ON/OFF of X1 signal and X2 signal.	
	X2			
	SD	Contact input common (sink) (initial setting)	Common terminal for contact input terminal (sink logic) and terminal FM.	
		External transistor common (source)	When connecting the transistor output (open collector output), such as a programmable controller in source logic, connect the external power supply common for transistor output to this terminal to prevent a malfunction caused by undesirable currents.	
		24VDC power supply common	Common output terminal for 24VDC 0.1A power supply (terminal PC). Isolated from terminals 5, SE and SE2.	
	PC	External transistor common (sink) (initial setting)	When connecting the transistor output (open collector output), such as a programmable controller in sink logic, connect the external power supply common for transistor output to this terminal to prevent a malfunction caused by undesirable currents.	
		External transistor common (sink) (initial setting)	Common terminal for contact input terminal (source logic)	
		24VDC power supply	Can be used as 24VDC 0.1A power supply.	
Control circuit/output signal	Open collector	RDY	Inverter run enable signal	Permissible load 24VDC (27VDC maximum) 0.1A (A voltage drop is 2.8V maximum when the signal is ON.)
		CVO	During converter run	
		Y1	Multi-purpose output 1	
		Y2	Multi-purpose output 2	
		RSO	Converter reset	
		SE	Open collector output common	
	Pulse	FM	For meter	Permissible load current 2mA At rated input current of the converter: 1440 pulses/s
	Analog	AM	Analog signal output	Output signal 0 to 10VDC Permissible load current 1mA Load impedance 10kΩ
		5	Analog signal output common	—
	Relay	A, B, C	Fault contact	Contact capacity AC230V 0.3A (Power factor=0.4) 30VDC output 0.3A
		88R, 88S	MC connection terminal	Controls the MC for the limit resistor.

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Type	Terminal Symbol	Terminal Name	Description	
Output signals of FR-HC2 dedicated board	Open collector	Y3	Multi-purpose output 3	Output item: Y5 signal (output voltage match) (initial setting) Turns ON when the detected bus voltage equals to the commanded bus voltage.
		SE2	Open collector output common	Common terminal for terminal Y3
Communication	RS-485	—	PU connector	With the PU connector, communication can be made through RS-485. (for connection on a 1:1 basis only) •Conforming standard : EIA-485 (RS-485) •Transmission format : Multidrop •Communication speed : 4800 to 38400bps •Overall length : 500m

**NOTE**

- If the inverter is operated without connecting the terminals R/L1, S/L2, T/L3 of the converter to the power supply, the converter will be damaged.
- indicates that terminal functions can be selected using *Pr. 3 to Pr. 7 (input terminal function selection)* and *Pr. 11 to Pr. 16 (output terminal function selection)*.



REMARKS

⊙ indicates simple mode parameters.

The parameters shaded in allow their settings to be changed during operation even if "1" (write disabled) is set to Pr. 77
Parameter write selection.

Parameter	Name	Range	Increments	Initial value	Customer setting
⊙ 0	Simple mode selection	0, 9999	1	0	
⊙ 1	Maximum power supply frequency	60Hz (Read only)	—	60Hz	
⊙ 2	Minimum power supply frequency	50Hz (Read only)	—	50Hz	
3	ROH terminal function selection	0 to 5, 9999	1	5	
4	SOF terminal function selection		1	0	
5	X1 terminal function selection		1	1	
6	X2 terminal function selection		1	2	
7	RES terminal function selection		1	3	
8	SOF input selection	0, 1, 2	1	0	
9	OH input selection	0, 1	1	0	
10	RDY signal logic selection	0, 100	1	100	
11	RSO terminal function selection	0 to 16, 98, 99, 100 to 116, 198, 199, 9999	1	1	
12	CVO terminal function selection		1	2	
⊙ 13	Y1 terminal function selection		1	3	
⊙ 14	Y2 terminal function selection		1	4	
⊙ 15	Y3 terminal function selection		1	5	
16	ABC terminal function selection		1	99	
⊙ 22	Current limit level	0 to 220%	0.1%	150%	
23	Current limit level (regenerative)	0 to 220%, 9999	0.1%	9999	
24	OL signal output timer	0 to 25s, 9999	0.1s	0s	
25	Input current detection level	0 to 220%	0.1%	150%	
26	Input current detection signal delay time	0 to 10s	0.1s	0s	
27	Input current detection signal retention time	0 to 10s, 9999	0.1s	0.1s	
28	Input current detection operation selection	0, 1	1	0	
29	Zero current detection level	0 to 220%	0.1%	5%	
30	Zero current detection time	0 to 1s	0.01s	0.5s	
31	Life alarm status display	0 to 15 (Read only)	1	0	
32	Inrush current limit circuit life display	0 to 100% (Read only)	1%	100%	
33	Control circuit capacitor life display	0 to 100% (Read only)	1%	100%	
34	Maintenance timer	0 (1 to 9998)	1	0	
35	Maintenance timer alarm output set time	0 to 9998, 9999	1	9999	
36	Cooling fan operation selection	0, 1	1	1	
44	Instantaneous power failure detection signal clear	0, 9999	1	9999	
45	AM output filter	0 to 5s	0.01s	0.01s	
46	Watt-hour meter clear	0, 10, 9999	1	9999	
47	Energization time carrying-over times	Read only	1	0	
48	Cumulative power monitor digit shifted times	0 to 4, 9999	1	9999	
49	Power supply frequency monitoring reference	45Hz to 65Hz	0.01Hz	60Hz	
⊙ 50	AM terminal function selection	1 to 3, 5, 6, 7, 21, 1111 to 4444	1	1234	
⊙ 51	Input power monitoring reference	0 to 100kW/0 to 3600kW *1	0.01kW/ 0.1kW *1	Rated power	
⊙ 52	DU/PU main display data selection	0, 5 to 10, 25, 1111 to 4444	1	1234	
⊙ 53	Input voltage monitoring reference	0 to 500V	0.1V	220V/440V*2	
⊙ 54	FM terminal function selection	1 to 3, 5, 6, 7, 21, 1111 to 4444	1	1234	
⊙ 55	Bus voltage monitoring reference	0 to 1000V	0.1V	340V/680V*2	
⊙ 56	Current monitoring reference	0 to 500A/0 to 3600A *1	0.01A/0.1A *1	Rated current	
⊙ 57	Restart selection	0, 9999	1	9999	

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Parameter	Name	Range	Increments	Initial value	Customer setting
58	Free parameter 1	0 to 9999	1	9999	
59	Free parameter 2	0 to 9999	1	9999	
61	Key lock operation selection	0, 10	1	0	
⊙ 65	Retry selection	0, 1, 2, 3, 4	1	0	
⊙ 67	Number of retries at fault occurrence	0 to 10, 101 to 110	1	0	
⊙ 68	Retry waiting time	0.1 to 360s	0.1s	1s	
⊙ 69	Retry count display erase	0	1	0	
75	Reset selection/disconnected PU detection/ PU stop selection	0 to 3, 14 to 17	1	14	
⊙ 77	Parameter write selection	1, 2	1	2	
80	Voltage control proportional gain	0 to 1000%	1%	100%	
81	Voltage control integral gain	0 to 1000%	1%	100%	
82	Current control proportional gain	0 to 200%	1%	100%	
83	Current control integral gain	0 to 200%	1%	100%	
117	PU communication station number	0 to 31	1	0	
118	PU communication speed	48, 96, 192, 384	1	192	
119	PU communication stop bit length	0, 1, 10, 11	1	1	
120	PU communication parity check	0, 1, 2	1	2	
121	Number of PU communication retries	0 to 10, 9999	1	1	
123	PU communication waiting time setting	0 to 150ms, 9999	1ms	9999	
124	PU communication CR/LF selection	0, 1, 2	1	1	
⊙ 145	PU display language selection	0 to 7	1	0	
168	Parameter for manufacturer setting. Do not set.				
169					
269					
342	Communication EEPROM write selection	0, 1	1	0	
500 *3	Communication error execution waiting time	0 to 999.8s	0.1s	0s	
501 *3	Communication error occurrence count display	0	1	0	
502 *3	Stop mode selection at communication error	0, 3	1	0	
542 *3, *4, *5	Communication station number (CC-Link)	1 to 64	1	1	
543 *3, *4, *5	Baud rate (CC-Link)	0 to 4	1	0	
544 *3, *4	CC-Link extended setting	0, 1, 12	1	0	
C0(900) *6	FM terminal calibration	—	—	—	
C1(901) *6	AM terminal calibration	—	—	—	
989	Parameter copy alarm release	10, 100	1	10/100 *1	
990	PU buzzer control	0, 1	1	1	
991	PU contrast adjustment	0 to 63	1	58	
Pr.CL	Parameter clear	0, 1	1	0	
ALLC	All parameter clear	0, 1	1	0	
Er.CL	Fault history clear	0, 1	1	0	
PCPY	Parameter copy	0, 1, 2, 3	1	0	

*1 Differ according to capacities. (55K or lower/75K or higher)

*2 Differs according to the voltage class. (200V class/400V class)

*3 Parameters which can be set when the plug-in option (FR-A7NC) is mounted.

*4 The setting is reflected after converter reset or at the next power-ON.

*5 "L.ERR" LED on FR-A7NC flickers when a setting is changed. If the converter is reset, the setting is reflected and LED turns off.

*6 The parameter number in parentheses is the one for use with the parameter unit (FR-PU07).

When a fault occurs in the converter, the protective function activates to trip the converter, and the PU display automatically changes to one of the following fault or alarm indications.

Operation Panel Indication			Name
Error message *2	<i>E---</i>	E---	Faults history
	<i>HOLD</i>	HOLD	Operation panel lock
	<i>Er1</i>	Er1	Parameter write error
	<i>rE1~ rE4</i>	rE1 to 4	Copy operation fault
	<i>Err.</i>	Err.	Error
Warning *3	<i>OL</i>	OL	Overload signal detection
	<i>PS</i>	PS	PU stop
	<i>TH</i>	TH	Electronic thermal relay pre-alarm
	<i>MT</i>	MT	Maintenance signal output *7
	<i>CP</i>	CP	Parameter copy
	<i>SL</i>	SL	Power supply not detected
Alarm *4	<i>Fn</i>	FN	Fan fault
Fault *5	<i>E.OC2</i>	E.OC2	Overcurrent trip
	<i>E.OV2</i>	E.OV2	Overvoltage trip
	<i>E.THT</i>	E.THT	Converter overload trip (electronic thermal relay function) *1
	<i>E.FIN</i>	E.FIN	Fin overheat
	<i>E.IPF</i>	E.IPF	Instantaneous power failure
	<i>E.UVT</i>	E.UVT	Undervoltage
	<i>E.ILF</i>	E.ILF	Input phase loss
	<i>E.OHT</i>	E.OHT	External thermal relay operation *6 *7
	<i>E. 2</i>	E. 2	HC2 dedicated board disconnection
	<i>E. 3</i>	E. 3	Option fault
	<i>E.OP3</i>	E.OP3	Communication option fault
	<i>E. PE</i>	E.PE	Parameter storage device fault (control circuit board)
	<i>E.PE2</i>	E.PE2	Parameter storage device fault (main circuit board)
	<i>E.PUE</i>	E.PUE	PU disconnection *7
	<i>E.RET</i>	E.RET	Retry count excess *7
	<i>E. 6 E. 7 E.CPU</i>	E. 6 E. 7 CPU	CPU fault
	<i>E. 8</i>	E. 8	Input power supply fault 1
	<i>E. 9</i>	E. 9	Input power supply fault 2
	<i>E.CTE</i>	E.CTE	Operation panel power supply short circuit, RS-485 terminal power supply short circuit
	<i>E.P24</i>	E.P24	24VDC power output short circuit
	<i>E.CDO</i>	E.CDO	Input current detection value exceeded *7
	<i>E.IOH</i>	E.IOH	Inrush current limit circuit fault
	<i>E. 13</i>	E. 13	Internal circuit fault

*1 Resetting the converter initializes the cumulative value of the internal thermal relay.

*2 The error message shows an operational error. The converter does not trip.

*3 Warnings are messages given before faults occur. The converter does not trip.

*4 Alarms warn the operator of failures with output signals. The converter does not trip.

*5 When faults occur, the protective functions are activated to trip the converter and output the fault signals.

*6 Assign the OH signal to one of Pr.3 to Pr.7 (Input terminal function selection) to enable the external thermal relay operation.

*7 This protective function is not available in the initial status.

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Name			Type	Applications, Specifications, etc.	Applicable converter
Plug-in Type	Communication	CC-Link communication	FR-A7NC	Converter operation, monitoring, and parameter setting can be commanded from a programmable controller.	Shared among all models
Stand-alone shared	Parameter unit (8 languages)		FR-PU07	Interactive parameter unit with LCD display	Shared among all models
	Parameter unit with battery pack		FR-PU07BB	Parameter unit enables parameter setting without supplying power to the converter.	Shared among all models
	Parameter unit connection cable		FR-CB20□	Cable for connection of operation panel or parameter unit □ indicates a cable length. (1m, 3m, 5m)	Shared among all models
	Operation panel connection connector		FR-ADP	Connector to connect the operation panel (FR-DU07-CNV) and connection cable	Shared among all models
	Heatsink protrusion attachment		FR-A7CN 02 to 05, 09	Attachment for protruding the converter heatsink at the back of the enclosure. Refer to <i>page 17</i> for the enclosure cut dimensions.	According to capacities
	Radio noise filter		FR-BIF(H)	For radio noise reduction (connect to the input side)	Shared among all models
	Line noise filter		FR-BSF01/ FR-BLF	For line noise reduction	Shared among all models

Peripheral devices/cable size list

●cable size*1

●200V class

Model	FR-HC2-□		FR-HCB2-□		FR-HCL21-□	FR-HCL22-□
	R4/L14, S4/L24, T4/L34	P/+, N/- *2	R2/L12, S2/L22, T2/L32 R3/L13, S3/L23, T3/L33		R/L1, S/L2, T/L3 R2/L12, S2/L22, T2/L32	R3/L13, S3/L23, T3/L33 R4/L14, S4/L24, T4/L34
7.5K	8	5.5	8		8	8
15K	22	14	22		22	22
30K	60	38	60		60	60
55K	100	100	100		100	100
75K	100	100	100		100	100

●400V class

Model	FR-HC2-□		FR-HCB2/FR-HCC2-□		FR-HCL21-□	FR-HCL22-□
	R4/L14, S4/L24, T4/L34	P/+, N/- *2	R2/L12, S2/L22, T2/L32 R3/L13, S3/L23, T3/L33		R/L1, S/L2, T/L3 R2/L12, S2/L22, T2/L32	R3/L13, S3/L23, T3/L33 R4/L14, S4/L24, T4/L34
H7.5K	3.5	2	3.5		3.5	3.5
H15K	5.5	5.5	5.5		5.5	5.5
H30K	22	14	22		22	22
H55K	60	38	60		60	60
H75K	38	38	38		38	38
H110K	60	60	60		60	60
H160K	100	125	100		100	100
H220K	150	2 × 100	150		150	150
H280K	200	2 × 125	60		200	200
H400K	2 × 200	2 × 200	60		2 × 200	2 × 200
H560K	2 × 250	3 × 250	38		2 × 250	2 × 250

*1 For the 55K or lower, the cable size is that of the cable (HIV cable (600V class 2 vinyl-insulated cable) etc.) with continuous maximum permissible temperature of 75°C. It assumes that the surrounding air temperature is 50°C or less and the wiring distance is 20m or less.

For the 75K or higher, the recommended cable size is that of the cable (LMFC (heat resistant flexible cross-linked polyethylene insulated cable) etc.) with continuous maximum permissible temperature of 90°C. It assumes that the surrounding air temperature is 50°C or less and wiring is performed in an enclosure.

*2 If a cable thinner than the recommended cable size is used, it may not be protected by the DC fuse. (Refer to *page 28* for the fuse selection.)

●Circuit breakers and magnetic contactors

Check the model of the converter and select peripheral devices according to the capacity. Refer to the table below to prepare appropriate peripheral devices.

●200V class

Converter Model	Moulded Case Circuit Breaker (MCCB) *1 or Earth Leakage Circuit Breaker (ELB) *2 (NF, NV type)	Magnetic Contactor (MC) *3
FR-HC2-7.5K	50A	S-T35
FR-HC2-15K	75A	S-T50
FR-HC2-30K	150A	S-T100
FR-HC2-55K	300A	S-N180
FR-HC2-75K	350A	S-N300

●400V class

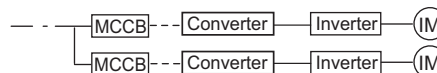
Converter Model	Moulded Case Circuit Breaker (MCCB) *1 or Earth Leakage Circuit Breaker (ELB) *2 (NF, NV type)	Magnetic Contactor (MC) *3
FR-HC2-H7.5K	30A	S-T20
FR-HC2-H15K	50A	S-T25
FR-HC2-H30K	75A	S-T35
FR-HC2-H55K	150A	S-T100
FR-HC2-H75K	175A	S-T100
FR-HC2-H110K	250A	S-N180
FR-HC2-H160K	400A	S-N300
FR-HC2-H220K	500A	S-N400
FR-HC2-H280K	700A	S-N600
FR-HC2-H400K	900A	S-N800
FR-HC2-H560K	1500A	S-N400 (three in parallel)

- *1 •Select an NFB according to the power supply capacity.
•Install one NFB per converter.

- *2 For the use in the United States or Canada, provide the appropriate UL and cUL listed fuse that is suitable for branch circuit protection. (Refer to the Instruction Manual)

- *3 Magnetic contactor is selected based on the AC-1 class. The electrical durability of magnetic contactor is 100,000 times. When the magnetic contactor is used for emergency stop during motor driving, the electrical durability is 25 times.

When using the MC for emergency stop during motor driving or using on the motor side during commercial-power supply operation, select the MC with class AC-3 rated current for the motor rated current.



NOTE

- When the MCCB on the converter input side trips, check for the wiring fault (short circuit), damage to internal parts of the converter, etc. Identify the cause of the trip, then remove the cause and power ON the breaker.
- Configure a system where the magnetic contactor at the converter input side shuts off the power supply at a failure of the converter or the connected inverter. (The converter does not shut off the power supply by itself.) Failure to do so may overheat and burn the resistors in the converter and the connected inverter.

●Fuse

Installation of a fuse is recommended between a high power factor converter and an inverter.

Select a fuse according to the capacity of the connected motor. When using a motor, of which the capacity is smaller than the inverter capacity by two ranks or more, select the fuse with the capacity that is one rank lower than the inverter capacity.

Select a fuse from the table below, and install it to both of the P side and the N side between the high power factor converter and the inverter.

[Fuse selection table]

Motor capacity (kW)	200V class		400V class	
	Fuse rating (A)	Model *1	Fuse rating (A)	Model *1
0.1	5	6.900 CP GR 10.38 0005(FR10GR69V5) *2	—	—
0.2	10	6.900 CP GR 10.38 0010(FR10GR69V10) *2	—	—
0.4	16	6.900 CP GR 10.38 0016(FR10GR69V16) *2	12.5	6.900 CP GR 10.38 0012.5(FR10GR69V12.5) *2
0.75	20	6.900 CP GR 10.38 0020(FR10GR69V20) *2	16	6.900 CP GR 10.38 0016(FR10GR69V16) *2
1.5	25	6.900 CP GR 10.38 0025(FR10GR69V25) *2	16	6.900 CP GR 10.38 0016(FR10GR69V16) *2
2.2	50	6.9 URD 30 TTF 0050	20	6.900 CP GR 10.38 0020(FR10GR69V20) *2
3.7	63	6.9 URD 30 TTF 0063	30	6.900 CP GR 10.38 0030(FR10GR69V30) *2
5.5	100	6.9 URD 30 TTF 0100	50	6.9 URD 30 TTF 0050
7.5	125	6.9 URD 30 TTF 0125	50	6.9 URD 30 TTF 0050
11	160	6.9 URD 30 TTF 0160	80	6.9 URD 30 TTF 0080
15	200	6.9 URD 30 TTF 0200	125	6.9 URD 30 TTF 0125
18.5	250	6.9 URD 30 TTF 0250	125	6.9 URD 30 TTF 0125
22	315	6.9 URD 30 TTF 0315	160	6.9 URD 30 TTF 0160
30	400	6.9 URD 30 TTF 0400	200	6.9 URD 30 TTF 0200
37	500	6.9 URD 30 TTF 0500	250	6.9 URD 30 TTF 0250
45	630	6.9 URD 31 TTF 0630	315	6.9 URD 30 TTF 0315
55	700	6.9 URD 31 TTF 0700	350	6.9 URD 30 TTF 0350
75	800	6.9 URD 31 TTF 0800	450	6.9 URD 30 TTF 0450
90	—	—	500	6.9 URD 30 TTF 0500
110	—	—	550	6.9 URD 31 TTF 0550
132	—	—	630	6.9 URD 31 TTF 0630
160	—	—	800	6.9 URD 31 TTF 0800
185	—	—	900	6.9 URD 32 TTF 0900
220	—	—	1000	6.9 URD 32 TTF 1000 or 6.9 URD 31 TTF 0630 × 2 in parallel *3
250	—	—	1250	6.9 URD 33 TTF 1250 or 6.9 URD 31 TTF 0700 × 2 in parallel *3
280	—	—	1400	6.9 URD 33 TTF 1400 or 6.9 URD 31 TTF 0800 × 2 in parallel *3
315	—	—	1600	6.9 URD 232 TDF 1600 or 6.9 URD 31 TTF 0800 × 2 in parallel *3
355	—	—	1800	6.9 URD 232 TDF 1800 or 6.9 URD 32 TTF 0900 × 2 in parallel *3
400	—	—	1800	6.9 URD 232 TDF 1800 or 6.9 URD 32 TTF 0900 × 2 in parallel *3
450	—	—	2500	6.9 URD 33 TTF 1250 × 2 in parallel *3
500	—	—	2700	6.9 URD 32 TTF 0900 × 3 in parallel *3
560	—	—	2700	6.9 URD 32 TTF 0900 × 3 in parallel *3

*1 Manufacturer: Mersen Japan K.K.

Contact: Sun-Wa Technos Corporation

*2 For fuse holders (2-pole type), use US102 (no blowout indicator) or US102I (with blowout indicator).

*3 When installing several fuses in parallel, leave 12mm or more between the fuses.



NOTE

- Install a fuse across terminal P/+ of the inverter and the converter and across terminal N/- of the inverter and the converter. (Refer to page 12)

[Estimated lifespan of fuse]

Part Name	Estimated lifespan*	Replacement method
Fuse	10 years	Replace with a new one

* Estimated lifespan for when the yearly average surrounding air temperature is 50°C (without corrosive gas, flammable gas, oil mist, dust and dirt etc.)



NOTE

- If the fuse melts down, wiring failure such as a short circuit may be the cause. Identify the problem and fix it before replacing the fuse.

●Recommended noise filter

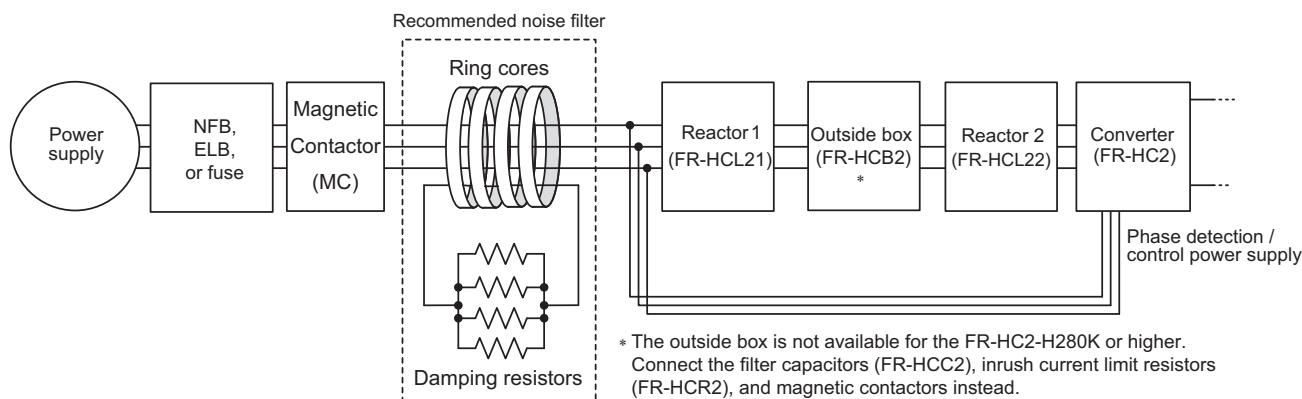
Install this to reduce the electromagnetic noise.

[Connection diagram]

Install the noise filter composed of a common mode chokes (ring cores) and damping resistors on the input side of the high power factor converter.

Use the FINEMET[®] ring cores (manufactured by Hitachi Metals, Ltd.) and the FR-ABR damping resistors (inverter option) to compose the noise filter.

* FINEMET is a registered trademark of Hitachi Metals, Ltd.



[Components]

Item		FR-HC2-□		
		H110K/H160K/H220K	H280K	H400K/H560K
Ring core	Model	FT-3KM F11080GB *1	FT-3KM F140100PB *1	FT-3KM F200160PB *1
	Quantity	4 pcs (penetrated)	4 pcs (penetrated)	4 pcs (penetrated)
Damping resistor	Model	FR-ABR-H22K *2		
	Quantity	4 pcs in parallel (combined resistance: 13 Ω)		
Damping resistor cable	Cable diameter	5.5 mm ² or more (when using HIV cable, etc.) AWG 10 or less (when using THHW cable, etc.) 6 mm ² or more (when using PVC cable, etc.)		
	Cable length	As short as possible within 10 m		

*1 Manufactured by Hitachi Metals, Ltd.

*2 The FR-ABR-H22K consists of two damping resistors. Order two FR-ABR-H22K to have a total of 4 damping resistors.



NOTE

- Observe the instructions given in the Instruction Manual of each component.
- The damping resistor (FR-ABR) requires 5 cm clearance or more around it for directions. Besides, the distance between the damping resistors should be 1 cm or more.
- For the capacities other than the above, installing the recommended noise filter is not required. However, if installing it, use the components for the FR-HC2-H110K.

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SAFETY INSTRUCTIONS

- To use the product safely and correctly, make sure to read the Instruction Manual before using the product.
- This product has not been designed or manufactured for use with any equipment or system operated under life-threatening conditions.
- Please contact our sales office when you are considering using this product in special applications such as passenger mobile, medical, aerospace, nuclear, power or undersea relay equipment or system.
- 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 or other failures are likely to cause a serious accident.
- Do not use this product for a load other than dedicated inverters.

Installation Precautions

Wiring distance

- For the wiring distance between the high power factor converter (FR-HC2) and inverter, refer to the following table.

Across terminals P and P / terminals N and N	50m or shorter
Other control signal lines	30m or shorter

- The total wiring distance between the high power factor converter (FR-HC2) and standard accessories must be 30m or shorter. (For 280K or higher, refer to the Instruction Manual.)

Reactor installation at power supply side

- The terminals R/L1, S/L2, and T/L3 of the high power factor converter are control terminals to detect power phases of the power supply. When wiring, the voltage phases of terminals R4/L14, S4/L24, and T4/L34 and the voltage phases of terminals R/L1, S/L2, and T/L3 must be matched. Failure to connect these terminals correctly will lead to an improper operation of the high power factor converter.
- If the inverter is operated without connecting the terminals R/L1, S/L2, and T/L3 of the high power factor converter to the power supply, the high power factor converter will be damaged.

Operating Precautions

- The Guideline treats the converter as a no-harmonic-emitting device ($K_5 = 0$), but the harmonic component is not completely 0.

Selection Precautions

Connectable inverter

- Connect to the inverter that can accept DC inputs.
- For the MELTRAC, FR-A500L, and FR-F500L series inverters, make sure the connecting inverter is compatible with the high power factor converter. Connection with an incompatible inverter will damage the inverter and the converter.

Sine wave filter selection precautions

- When using a sine wave filter with FR-HC2 (75K or higher), use MT-BSL-HC for the sine wave filter.

Peripheral Device Selection Precautions

Selection and installation of the moulded case circuit breaker

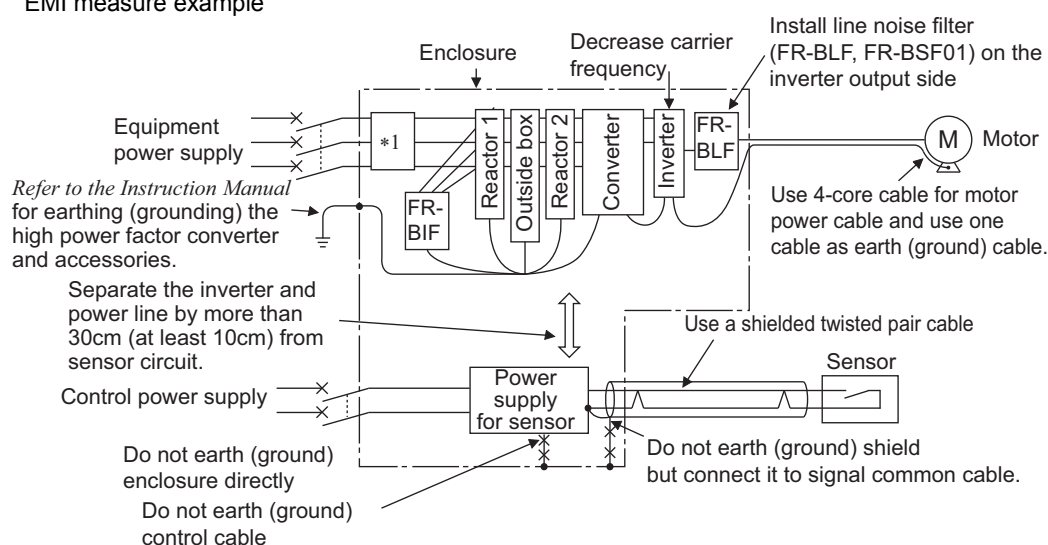
Install a moulded case circuit breaker (MCCB) on the power receiving side to protect the wiring at the converter's input side. For the MCCB selection, refer to *page 27*. (Refer to the materials related to the breaker.) For earth leakage circuit breakers, use the harmonic/surge compatible model provided by Mitsubishi.

Electromagnetic interference

Since the high power factor converter chops input voltage at high carrier frequency, it generates noises. Using the converter with inverters generates more noise than using only inverters. If these noises cause peripheral devices to malfunction, countermeasures should be taken to suppress noises (EMI measures). The EMI measures differ depending on the noise transmission paths.

- The FR-BIF radio noise filter is useful to suppress noises on AM radio broadcasting.
- The FR-BSF01/FR-BLF line noise filters are useful for preventing malfunction of sensors, etc.
- For the noise emitted from power cables, take a distance of 30cm (at least 10cm) from the power cables, and use shielded twisted pair cables for signal cables. Do not earth (ground) the shield. Connect the shield to one common terminal.

EMI measure example



*1 Recommended noise filter (Refer to *page 29*.)

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Protective functions

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Warranty

When using this product, make sure to understand the warranty described below.

1. Warranty period and coverage

We will repair any failure or defect (hereinafter referred to as "failure") in our FA equipment (hereinafter referred to as the "Product") arisen during warranty period at no charge due to causes for which we are responsible through the distributor from which you purchased the Product or our service provider. However, we will charge the actual cost of dispatching our engineer for an on-site repair work on request by customer in Japan or overseas countries. We are not responsible for any on-site readjustment and/or trial run that may be required after a defective unit are repaired or replaced.

[Term]

The term of warranty for Product is twelve months after your purchase or delivery of the Product to a place designated by you or eighteen months from the date of manufacture whichever comes first ("Warranty Period"). Warranty period for repaired Product cannot exceed beyond the original warranty period before any repair work.

[Limitations]

- (1) You are requested to conduct an initial failure diagnosis by yourself, as a general rule. It can also be carried out by us or our service company upon your request and the actual cost will be charged.
However, it will not be charged if we are responsible for the cause of the failure.
- (2) This limited warranty applies only when the condition, method, environment, etc. of use are in compliance with the terms and conditions and instructions that are set forth in the instruction manual and user manual for the Product and the caution label affixed to the Product.
- (3) Even during the term of warranty, the repair cost will be charged on you in the following cases;
 - 1) a failure caused by your improper storing or handling, carelessness or negligence, etc., and a failure caused by your hardware or software problem
 - 2) a failure caused by any alteration, etc. to the Product made on your side without our approval
 - 3) a failure which may be regarded as avoidable, if your equipment in which the Product is incorporated is equipped with a safety device required by applicable laws and has any function or structure considered to be indispensable according to a common sense in the industry
 - 4) a failure which may be regarded as avoidable if consumable parts designated in the instruction manual, etc. are duly maintained and replaced
 - 5) any replacement of consumable parts (condenser, cooling fan, etc.)
 - 6) a failure caused by external factors such as inevitable accidents, including without limitation fire and abnormal fluctuation of voltage, and acts of God, including without limitation earthquake, lightning and natural disasters
 - 7) a failure generated by an unforeseeable cause with a scientific technology that was not available at the time of the shipment of the Product from our company
 - 8) any other failures which we are not responsible for or which you acknowledge we are not responsible for

2. Term of warranty after the stop of production

- (1) We may accept the repair at charge for another seven (7) years after the production of the product is discontinued. The announcement of the stop of production for each model can be seen in our Sales and Service, etc.
- (2) Please note that the Product (including its spare parts) cannot be ordered after its stop of production.

3. Service in overseas

Our regional FA Center in overseas countries will accept the repair work of the Product; however, the terms and conditions of the repair work may differ depending on each FA Center. Please ask your local FA center for details.

4. Exclusion of loss in opportunity and secondary loss from warranty liability

Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation to:

- (1) Damages caused by any cause found not to be the responsibility of Mitsubishi.
- (2) Loss in opportunity, lost profits incurred to the user by Failures of Mitsubishi products.
- (3) Special damages and secondary damages whether foreseeable or not, compensation for accidents, and compensation for damages to products other than Mitsubishi products.
- (4) Replacement by the user, maintenance of on-site equipment, start-up test run and other tasks.

5. Change of Product specifications

Specifications listed in our catalogs, manuals or technical documents may be changed without notice.

6. Application and use of the Product

- (1) For the use of our product, its applications should be those that may not result in a serious damage even if any failure or malfunction occurs in product, and a backup or fail-safe function should operate on an external system to product when any failure or malfunction occurs.
- (2) Our product is designed and manufactured as a general purpose product for use at general industries.
Therefore, applications substantially influential on the public interest for such as atomic power plants and other power plants of electric power companies, and also which require a special quality assurance system, including applications for railway companies and government or public offices are not recommended, and we assume no responsibility for any failure caused by these applications when used.
In addition, applications which may be substantially influential to human lives or properties for such as airlines, medical treatments, railway service, incineration and fuel systems, man-operated material handling equipment, entertainment machines, safety machines, etc. are not recommended, and we assume no responsibility for any failure caused by these applications when used.
We will review the acceptability of the abovementioned applications, if you agree not to require a specific quality for a specific application. Please contact us for consultation.

Features

Connection
example

Standard
specifications

Outline
dimension
drawings

Terminal connection
diagram
Terminal specification
explanation

Parameter
list

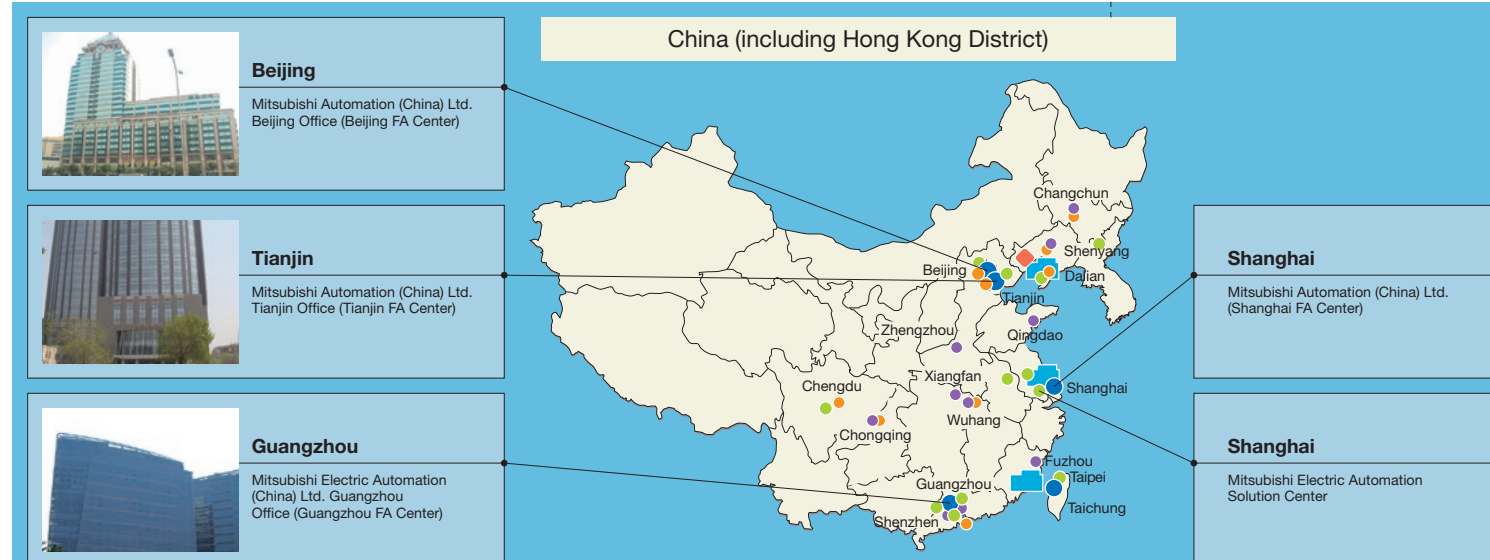
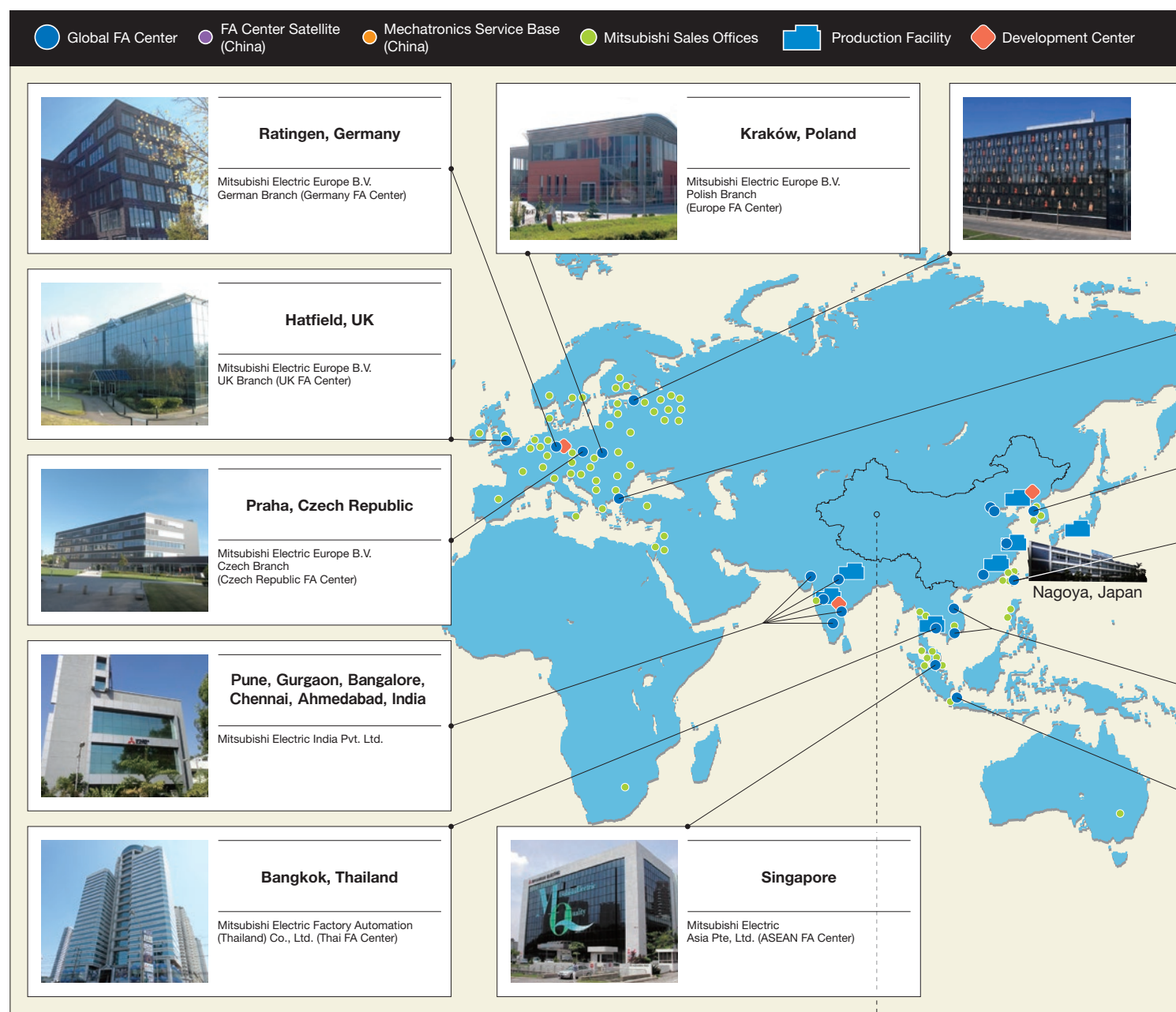
Protective
functions

Options and
peripheral
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Precaution on
selection and
operation

Warranty

Global network for comprehensive support of



customers' manufacturing.



Service bases are established around the world to globally provide the same services as in Japan.

**Overseas bases are opened one after another
to support business expansion of our customers.**

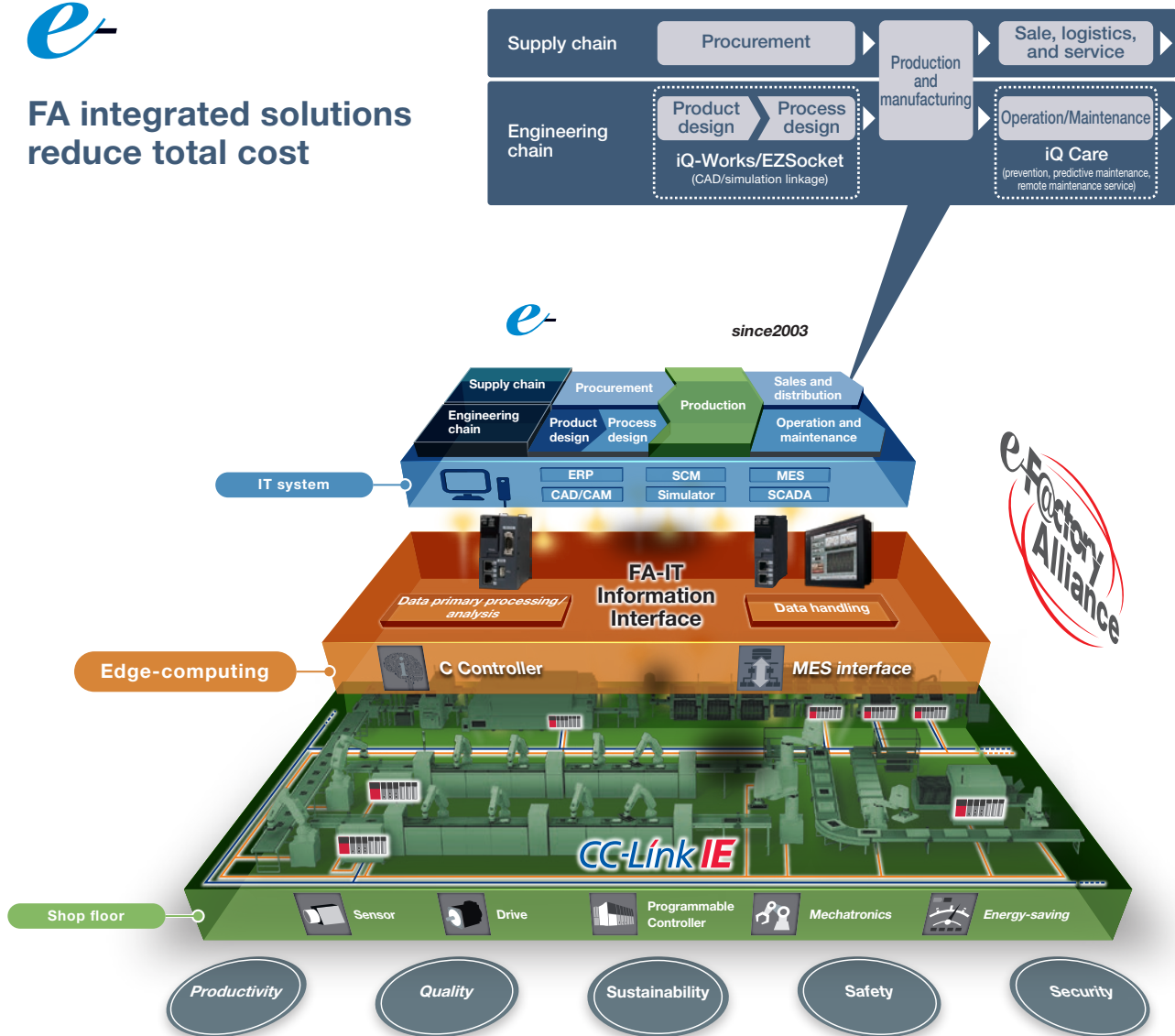
■ Overseas bases As of July 2014 * Some includes distributors				
Area	Our overseas offices	FA Center (Satellite)	Bases providing our products	Countries (Regions)
EMEA	11	6 (2)	146	54
China	13	4 (10)	171	1
Asia	21	13	79	10
America	14	4 (0)	130	16
Others	1	0	3	2
Total	60	27 (12)	529	83

This solution solves customers' issues and concerns by enabling visualization and analysis that lead to improvements and increase availability at production sites.

Utilizing our FA and IT technologies and collaborating with e-F@ctory Alliance partners, we reduce the total cost across the entire supply chain and engineeringchain, and support the improvement initiatives and one-step-ahead manufacturing of our customers.

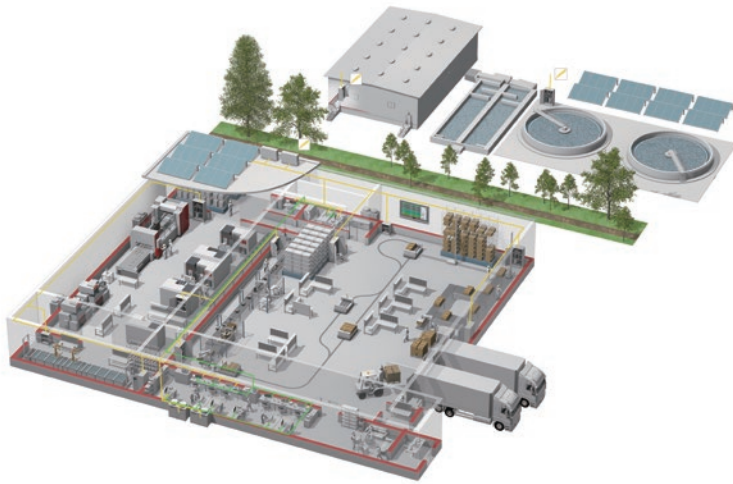


FA integrated solutions reduce total cost



Overall production information is captured in addition to energy information, enabling the realization of efficient production and energy use (energy savings).

YOUR SOLUTION PARTNER



Mitsubishi Electric offers a wide range of automation equipment from PLCs and HMIs to CNC and EDM machines.

A NAME TO TRUST

Since its beginnings in 1870, some 45 companies use the Mitsubishi name, covering a spectrum of finance, commerce and industry.

The Mitsubishi brand name is recognized around the world as a symbol of premium quality.

Mitsubishi Electric Corporation is active in space development, transportation, semi-conductors, energy systems, communications and information processing, audio visual equipment and home electronics, building and energy management and automation systems, and has 237 factories and laboratories worldwide in over 121 countries.

This is why you can rely on Mitsubishi Electric automation solution - because we know first hand about the need for reliable, efficient, easy-to-use automation and control in our own factories.

As one of the world's leading companies with a global turnover of over 4 trillion Yen (over \$40 billion), employing over 100,000 people, Mitsubishi Electric has the resource and the commitment to deliver the ultimate in service and support as well as the best products.



Low voltage: MCCB, MCB, ACB



Medium voltage: VCB, VCC



Power monitoring, energy management



Compact and Modular Controllers



Inverters, Servos and Motors



Visualisation: HMIs



Numerical Control (NC)



Robots: SCARA, Articulated arm



Processing machines: EDM, Lasers, IDS



Transformers, Air conditioning, Photovoltaic systems

* Not all products are available in all countries.

Mitsubishi Electric Corporation Nagoya Works
is a factory certified for ISO 14001
(standards for environmental management
systems).



MITSUBISHI ELECTRIC CORPORATION

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