

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.

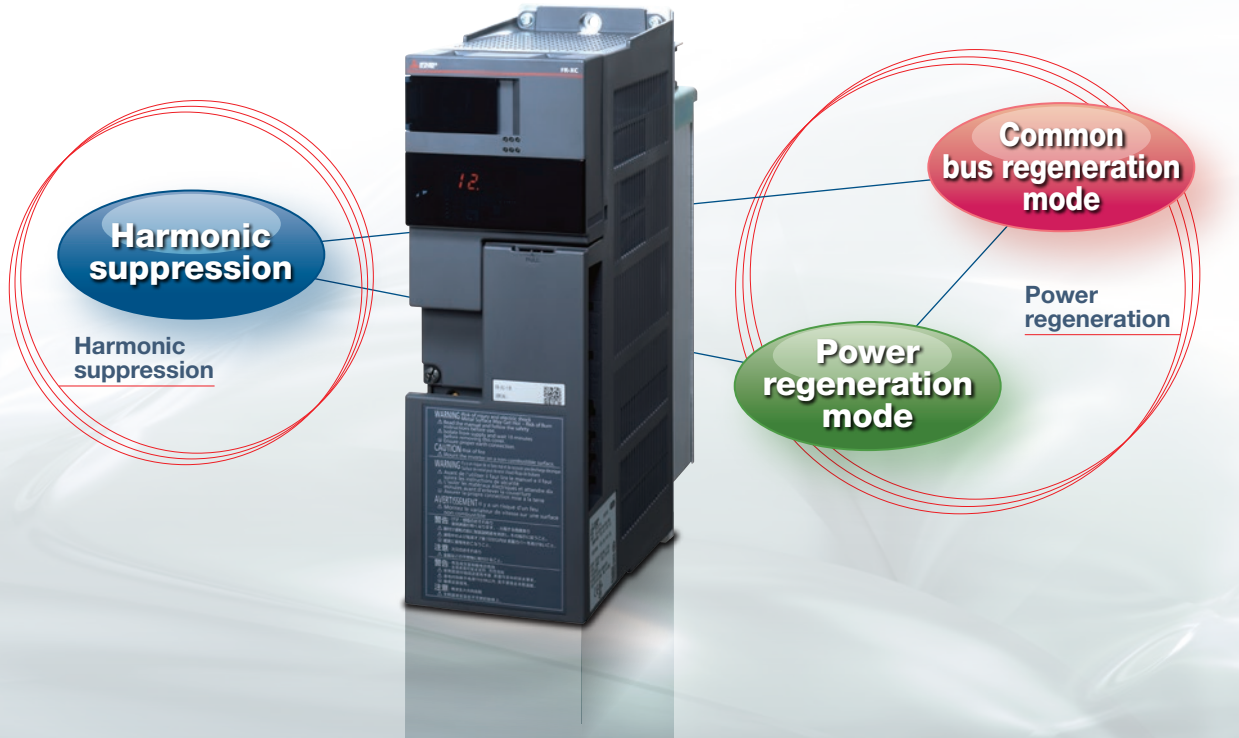
Industrial Automation Systems

Maximizing productivity and efficiency with cutting-edge automation technology.

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Single Solution for Both Harmonic Suppression and Power Regeneration

Choose the suitable function for your needs by using the FR-XC converter with the FR-XCB or FR-XCL reactor.



	Harmonic suppression	Common bus regeneration mode	Power regeneration mode
Energy saving by power regeneration	★★★★	★★★★	★★★★
Power supply harmonic current suppression	★★★★	—	—
Reduction in the power supply capacity or the facility size by power factor improvement	★★★★	—	—
Use as a common converter	★★★★	★★★★	—
Initial cost reduction	★	★★	★★★★
Less wiring work	★★★★	★★★★	★★★★
Smaller enclosure size	★★	★★★★	★★★★

★★★★: Highly effective ★★★: Moderately effective ★: Slightly effective —: N/A

Compact design offering solution to harmonic problems

Harmonic suppression

Harmonic suppression (K5 = 0) achieved
Power supply capacity reduced by power factor improvement

FR-XC + FR-XCB



Power regeneration contributing to energy saving

Common bus regeneration mode

Total cost reduction by connecting up to 10 inverters
Harmonic suppression function available

FR-XC + FR-XCL

FR-XC + FR-XCB

Power regeneration mode

Space saving achievable depending on the regenerative power

FR-XC + FR-XCL



Compact design offering solution to harmonic problems

The FR-XC-15K or lower does not have the harmonic suppression function.

Harmonic suppression

FR-XC + FR-XCB

Harmonic suppression (K5 = 0) achieved

- The FR-XC series converter in use with the dedicated box-type reactor FR-XCB is classified as the self-excitation three-phase bridge circuit under the "Harmonic Suppression Guidelines for Specific Consumers" and achieves K5 = 0 (conversion factor for equivalent capacity). (It is assumed that the converter generates no harmonics.)

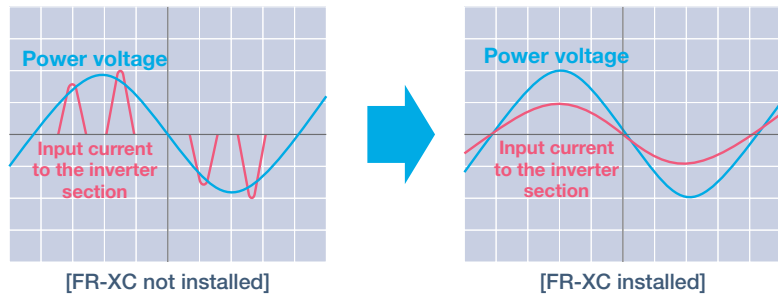
Harmonic Conversion Coefficient of the Equivalent Capacity (Excerpt from the Guidelines Appendix)

Classification	Circuit type	Conversion coefficient	Application examples
1	Three-phase bridge	6-pulse converter	K11 = 1
		12-pulse converter	K12 = 0.5
		24-pulse converter	K13 = 0.25
3	Three-phase bridge (smoothing capacitor)	Without a reactor	K31 = 3.4
		With a reactor (on AC side)	K32 = 1.8
		With a reactor (on DC side)	K33 = 1.8
		With reactors (on AC/DC sides)	K34 = 1.4
4	Single-phase bridge (smoothing capacitor, double voltage rectification)	Without a reactor	K41 = 2.3
		With a reactor (on AC side)	K42 = 0.35
	Single-phase bridge (smoothing capacitor, full-wave rectification)	Without a reactor	K43 = 2.9
		With a reactor (on AC side)	K44 = 1.3
5	Self-excitation three-phase bridge	K5 = 0	PWM converter (Multifunction regeneration converter)

The total harmonic distortion of the input current (THDi) is 5% or less*1, which facilitates compliance with the overseas standards related to harmonic suppression.

*1: When the input voltage is distorted, harmonic contents increase because power harmonics flow into the FR-XC series converter.

- The waveform with high peaks, which is typical of the input current to the inverter section from the converter section in an inverter unit, is rounded to make a sine wave with a lower input current effective value.



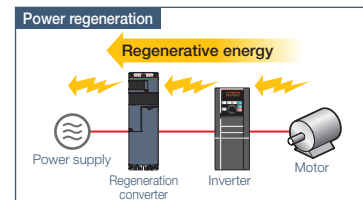
Power supply capacity reduced by power factor improvement

- With the reduced effective value of the input current to the inverter section, it is possible to install a power transformer, MCCB, cables, etc. with smaller capacity on the converter input side to reduce the equipment cost.

Power regeneration contributing to energy saving

While the motor rotates to drive the machine during power driving, the machine rotates the motor during regenerative driving, which results in energy saving since the motor serves as a generator which returns the power to the power supply. For example, when a power of 70 kW is required for power driving and a power of 30 kW is required for regenerative driving, the power consumption is reduced by 30%.

One of the two regeneration modes can be selected depending on the application.



Common bus regeneration mode

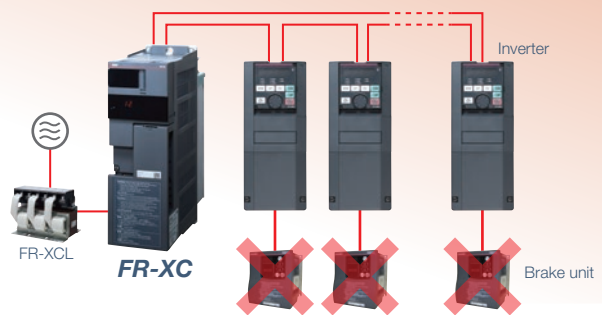
Total cost reduction by connecting up to 10 inverters

The FR-XC series converter can connect to up to 10 inverters together, though its predecessor FR-CV series converter is designed to connect to up to 6 inverters. The power returned from an inverter during regenerative driving can be supplied to another inverter, saving the overall energy. None of the inverters requires a brake unit, which enables total space and cost reduction.

FR-XC + FR-XCL
FR-XC + FR-XCB

Harmonic suppression function available

The harmonic suppression function can also be enabled while the converter is used as a common converter.



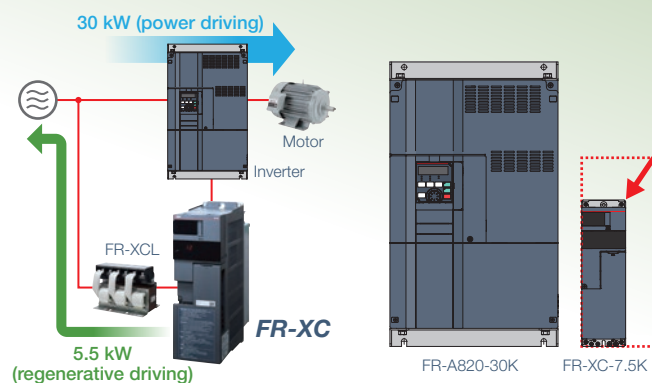
Power regeneration mode

Space saving achievable depending on the regenerative power

For power driving, the inverter supplies power. For regenerative driving, the FR-XC series converter returns power to the power supply. (In this mode, the FR-XC series converter cannot be used as a common converter.)

The capacity of the FR-XC series converter is selectable according to the regenerative power of the system. Thus, the compact converter is applicable for the regenerative power smaller than the inverter capacity, which contributes to space saving. (Refer to page 16 for selection.)

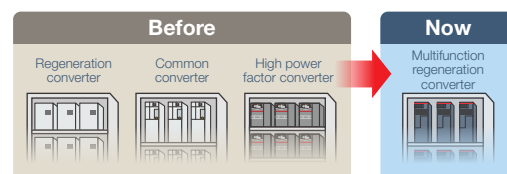
For example, if you use the 30 kW inverter and the regenerative power of your system is 5.5 kilowatts, you can choose the 7.5 kW converter instead of the 30 kW converter. The converter with its harmonic suppression function disabled can be used in the power regeneration mode.



Single converter usable in different modes or with the control function enabled/disabled

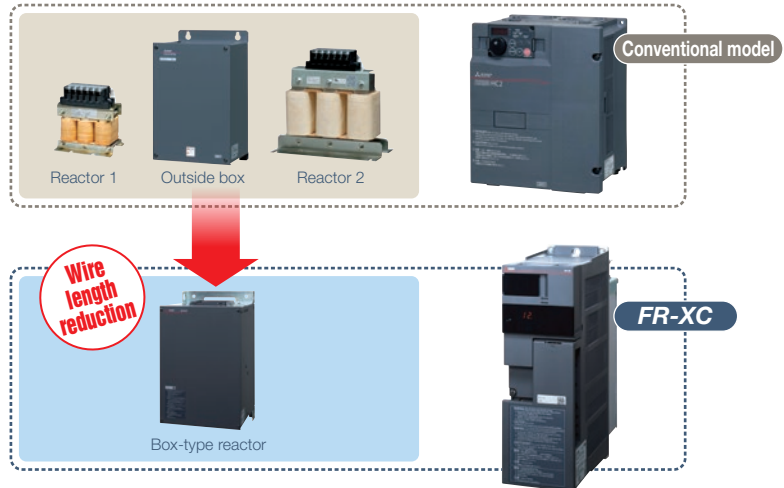
The regeneration mode is changed with the selection switch, and the harmonic suppression function is enabled or disabled according to the parameter setting.

A single FR-XC series converter can be used as a backup converter for different applications. (Use the converter in combination with the dedicated stand-alone reactor (FR-XCL) or the dedicated box-type reactor (FR-XCB).)



Total wire length reduction

The FR-XCB is used in combination with the FR-XC series converter for harmonic suppression. The FR-XCB contains a reactor, circuit, etc. in its small body, which contributes to wire length and space saving.



Installation inside the enclosure Option

The FR-XC series converter can be installed inside the enclosure using the optional installation attachment (FR-XCCP).



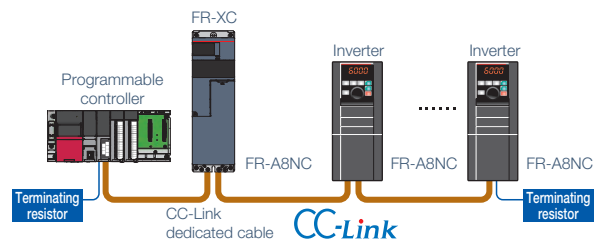
Network compatibility

RS-485 communication is supported as standard. With the FR-A8NC communication option, the converter also supports CC-Link communication.

- As power can be monitored during both power driving and regenerative driving, the energy saving effect can be checked any time.
- Monitoring of faults and the voltage of each phase allows you to analyze the fault cause easily.

Space saving by increasing the current rating

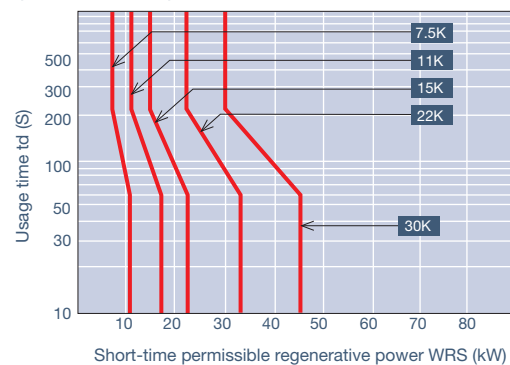
When the 40°C rating of surrounding air temperature is selected within the temperature derating range, the current rating and the current to be applied can be increased. When the FR-XC series converter is intended for the use at the surrounding air temperatures less than 40°C, a model with a smaller capacity is applicable. (Refer to page 16 for selection.) With smaller converter, less space is required.



Large braking force

The power regeneration function offers a large braking force, eliminating the need for brake units. (Power regeneration is available continuously with 100% torque, or for 60 seconds with the maximum of 150% torque.)

Regenerative braking torque (FR-XC-7.5K, 11K, 15K, 22K, and 30K)



Easy wiring of the control circuit

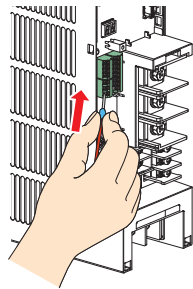
Spring clamp terminals (control circuit terminals)

Spring clamp terminals*¹ provide high reliability and easy wiring.

*1: The main circuit terminals are screw terminals.

- Easy wiring

Wiring is completed only by inserting the dedicated blade terminal of each cable. Without using the blade terminal, the loose wires can also be connected using a flathead screwdriver.

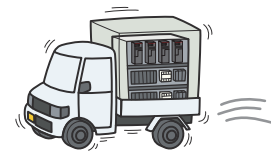


- High reliability

Internal terminal contacts are spring-type. Therefore, wires can be protected against loosening or contact faults due to vibrations during operation on a bogie or during transport.

- Maintenance-free

No additional screw tightening is required.



(Example: transport of the converters)

Long life components and life check function

Long life components

- The service life of the cooling fans is designed for 10 years*¹.
- The capacitors' life is also designed for 10 years*¹⁺².
- Estimated service lifespan of the long-life parts

Components	Estimated lifespan	Guideline of JEMA* ³
Cooling fan	10 years	2 to 3 years
Main circuit smoothing capacitor	10 years	5 years
Printed board smoothing capacitor	10 years	5 years

*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 converter rating

*3 Excerpts from "Periodic check of the transistorized inverter" of JEMA (Japan Electrical Manufacturer's Association).

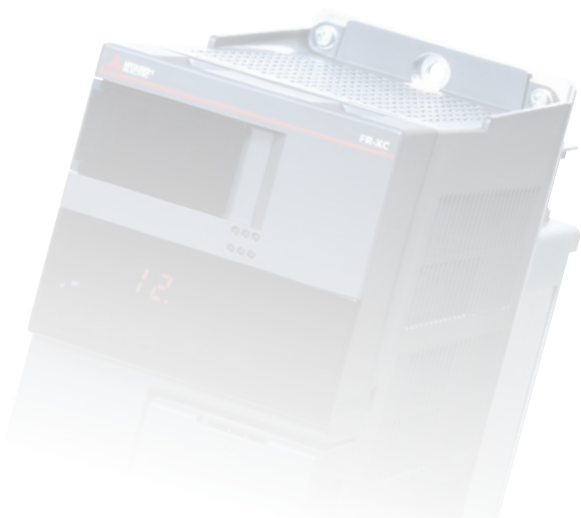
*4 A warning is output when any of the control circuit capacitors, inrush current limit circuit, and cooling fan reaches its output level.

Life check function

- The remaining life can be estimated for the main circuit capacitor, cooling fan, and inrush current limit circuit by checking the deterioration.
- Using the self-diagnosis function, the part life warning can be output*⁴ to prevent a fault.

Protection against hazardous environments

The FR-XC series converters with circuit board coating (IEC 60721-3-3 3C2/3S2) and plated conductors are available for improved environmental resistance. (The converter model name ends with "-60" or "-06".)



Global compatibility

- The FR-XC converter is compliant with UL, cUL, EC Directives (CE marking), and Radio Waves Act (South Korea, KC marking). It is also certified as compliant with the Eurasian Conformity (EAC).
- The converter is 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.

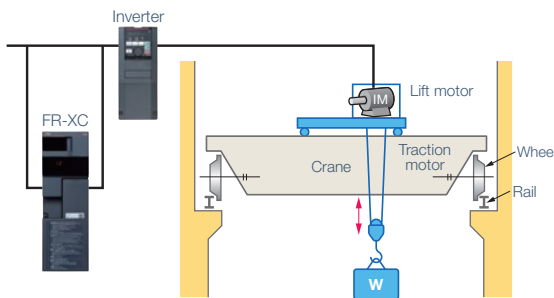


Application Examples

Ceiling crane



Due to the power regeneration function, a brake unit is not required for each inverter. Connect the mechanical brake to the line between the FR-XCL and its power source.



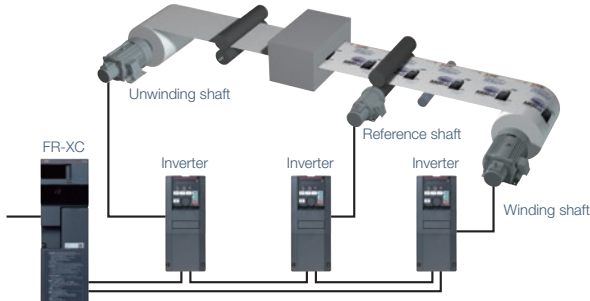
Power regeneration mode



Printing machines



Inverters can be connected to a common bus. When the harmonic suppression function is enabled, power supply harmonics of inverters can be suppressed.



Common bus regeneration mode

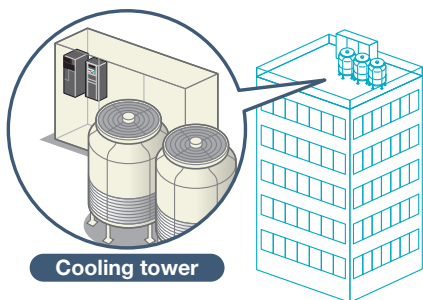
Harmonic suppression



Air conditioning of buildings



Power supply harmonics of inverters can be suppressed, minimizing the effects on other equipment. Central control of the systems is made possible by networking the systems.



Cooling tower

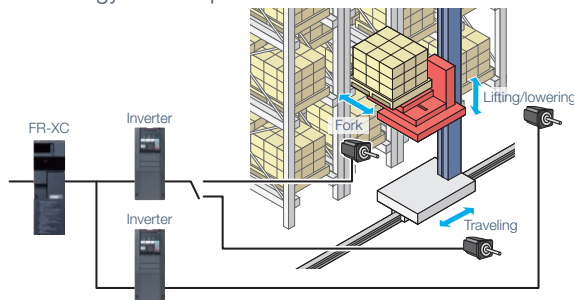
Harmonic suppression



Conveyor



The regenerated energy of the inverter for the lift application is used by another inverter for the driving application. If there is still an excess, it is returned to the power supply, saving on the energy consumption.



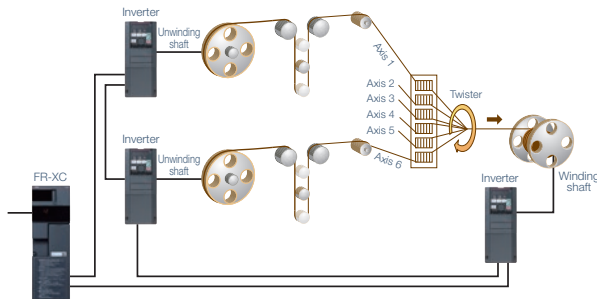
Common bus regeneration mode



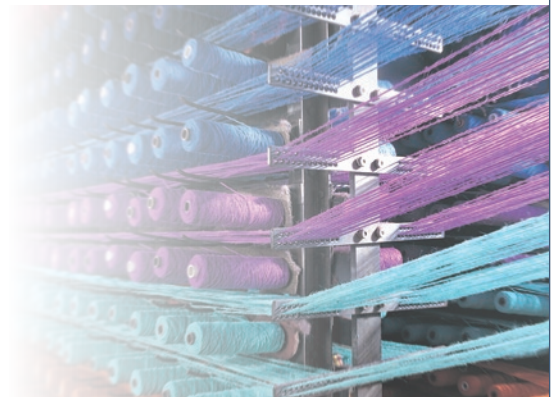
Spinning



The FR-XC series converter supports the system with more than 6 inverters (up to 10 inverters).



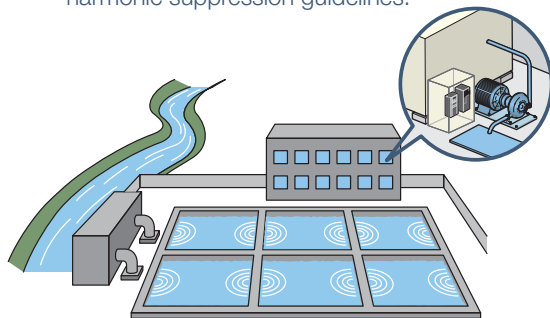
Common bus regeneration mode



Pump (water treatment plant)



Power supply harmonics of inverters can be suppressed, allowing the compliance with the harmonic suppression guidelines.



Harmonic suppression



Lineup

●: Released, ○: To be released, —: Not applicable
 Specifications of the models to be released are subject to change without prior notice.

Multifunction regeneration converter model

FR - XC - [] 22 K - [] []

Symbol	Voltage
None	200 V class
H	400 V class

Converter capacity
Capacity (kW)

Symbol	Circuit board coating	Plated conductor
None	Without	Without
60	With	Without
06	With	With

Symbol	Functional specification ^{*1}
None	Harmonic suppression disabled
PWM	Harmonic suppression enabled

For selection, refer to page 16.

*1: Pr.416 = "9999"

Voltage	Model	7.5	11	15	18.5	22	30	37	55	75	90	110	160	220	280
200 V	FR-XC-[]K	●	●	●	—	●	●	○	○	—	—	—	—	—	—
	FR-XC-[]K-PWM	—	—	—	●	●	—	○	○	○	○	—	—	—	—
400 V	FR-XC-H[]K	○	○	○	—	○	○	○	○	○	—	—	—	—	—
	FR-XC-H[]K-PWM	—	—	—	○	○	—	○	○	○	○	○	○	○	○

Dedicated stand-alone reactor (option) model

FR - XCL - [] 22 K

Symbol	Voltage
None	200 V class
H	400 V class

Reactor capacity
Capacity (kW)

Voltage	Model	7.5	11	15	22	30	37	55
200 V	FR-XCL-[]K	●	●	●	●	○	○	○
400 V	FR-XCL-H[]K	○	○	○	○	○	○	○

Dedicated box-type reactor (option) model

FR - XCB - [] 18.5 K []

Symbol	Voltage
None	200 V class
H	400 V class

Symbol	Circuit board coating
None	Without
-60	With

Voltage	Model	18.5	22	37	55	75	90	110	160	220	280
200 V	FR-XCB-[]K	●	●	○	○	○	○	—	—	—	—
400 V	FR-XCB-H[]K	○	○	○	○	○	—	○	○	○	○

Reactor capacity
Capacity (kW)

Converter installation attachment for enclosure (option) model

FR - XCCP 03

Symbol	Applicable converter
01 to 03	Refer to the table below.

Model	01	02	03
FR-XCCP-[]K	●	●	●

Combination matrix of FR-XCL and FR-XC(-PWM)

Multifunction regeneration converter	Dedicated stand-alone reactor
FR-XC-7.5K	FR-XCL-7.5K
FR-XC-11K	FR-XCL-11K
FR-XC-15K	FR-XCL-15K
FR-XC-22K ^{*2}	FR-XCL-22K
FR-XC-30K ^{*3}	FR-XCL-30K

*2: The FR-XC-18.5K-PWM is also applicable if Pr.416 Function enable/disable selection = 0.
 *3: The FR-XC-22K-PWM is also applicable if Pr.416 Function enable/disable selection = 0.

Combination matrix of FR-XCCP and FR-XC(-PWM)

Multifunction regeneration converter	Converter installation attachment for enclosure
FR-XC-7.5K	FR-XCCP01
FR-XC-11K	
FR-XC-15K	FR-XCCP02
FR-XC-22K	
FR-XC-30K	FR-XCCP03
FR-XC-18.5K-PWM	
FR-XC-22K-PWM	

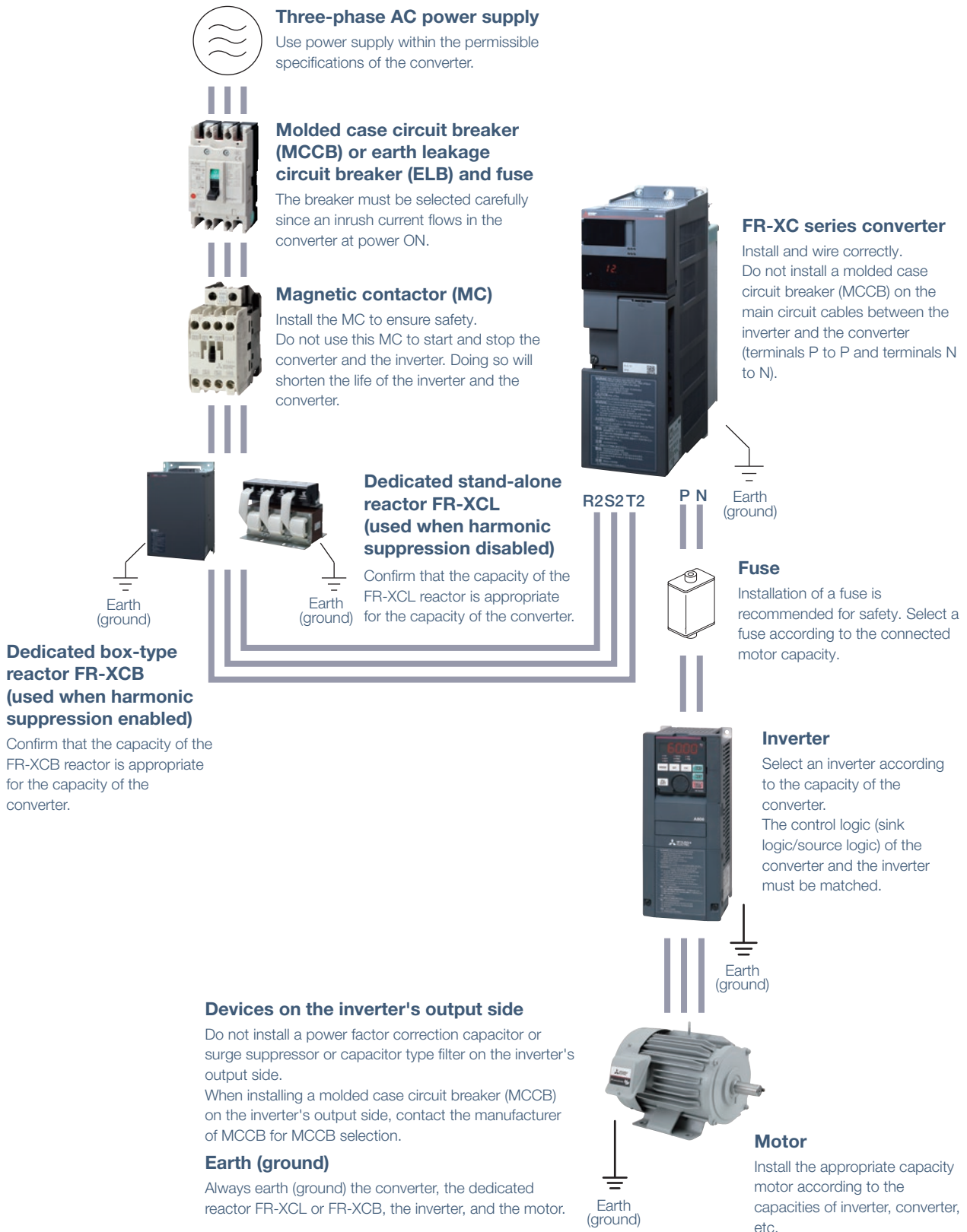
Combination matrix of FR-XCB and FR-XC(-PWM)

Multifunction regeneration converter	Dedicated box-type reactor
FR-XC-18.5K-PWM ^{*4}	FR-XCB-18.5K
FR-XC-22K-PWM ^{*5}	FR-XCB-22K

*4: The FR-XC-22K is also applicable if Pr.416 Function enable/disable selection = 1.
 *5: The FR-XC-30K is also applicable if Pr.416 Function enable/disable selection = 1.

Example Connection

Example for the common bus regeneration mode



Standard Specifications

◆ Rating

• FR-XC-[]K

Model FR-XC-[]K*1			7.5	11	15	22	30		
		Harmonic suppression							
Input / applicable inverter (Common bus regeneration mode)	50°C rating	Applicable inverter capacity (kW)	Disabled	7.5	11	15	22	30	
			Enabled	—	—	—	18.5	22	
		Applicable motor current (A)	Disabled	33	46	61	90	115	
			Enabled	—	—	—	76	90	
		Rated input current (A)	Disabled	Power driving	33	47	63	92	124
				Regenerative driving	26	37	51	74	102
	Enabled		Power/regenerative driving	—	—	—	69	82	
	Overload current rating			100% continuous / 150% 60 s					
	Power supply capacity (kVA)*2	Disabled	17	20	28	41	52		
		Enabled	—	—	—	30	35		
	40°C rating	Applicable inverter capacity (kW)	Disabled	7.5	11	15	22	30	
			Enabled	—	—	—	18.5	22	
		Applicable motor current (A)	Disabled	36	50	67	99	127	
			Enabled	—	—	—	83	99	
Rated input current (A)		Disabled	Power driving	36	51	69	101	136	
			Regenerative driving	28	40	56	81	112	
		Enabled	Power/regenerative driving	—	—	—	75	90	
Overload current rating			100% continuous / 150% 60 s						
Power supply capacity (kVA)*2		Disabled	19	22	31	45	57		
		Enabled	—	—	—	32	38		
Input (Power regeneration mode)	50°C rating	Potential regenerative capacity (kW)		5.5	7.5	11	18.5	22	
		Rated current (A) (regenerative driving)		19	26	37	62	74	
		Overload current rating			100% continuous / 150% 60 s				
	40°C rating	Potential regenerative capacity (kW)		5.5	7.5	11	18.5	22	
		Rated current (A) (regenerative driving)		21	28	40	68	81	
		Overload current rating			100% continuous / 150% 60 s				
Power source	Rated input AC voltage/frequency	Disabled	Three-phase 200 to 240 V, 50/60 Hz						
		Enabled	—	—	—	Three-phase 200 to 230 V, 50/60 Hz			
	Permissible AC voltage fluctuation	Disabled	Three-phase 170 to 264 V, 50/60 Hz						
		Enabled	—	—	—	Three-phase 170 to 253 V, 50/60 Hz			
	Permissible frequency fluctuation	Disabled	±5%						
Enabled		—	—	—	±5%				
Input power factor		Enabled	—	—	—	0.99 or more (when load ratio is 100%)			
Protection rating of structure (IEC 60529)			Open type (IP00)*3						
Cooling system			Forced air						
Number of connectable inverters			10*4						
Approx. mass (kg)*5			5	5	6	10.5	10.5		

*1 The harmonic suppression function is not pre-enabled in this model.

*2 Selection example for 220 V power supply voltage.

*3 IP00 for the FR-XCL.

*4 One inverter for operation in the power regeneration mode.

*5 Mass of the FR-XC alone.

• FR-XC-[]K-PWM

Model FR-XC-[]K-PWM*1			18.5	22		
			Harmonic suppression			
Input / applicable inverter (Common bus regeneration mode)	50°C rating	Applicable inverter capacity (kW)	Disabled	22	30	
			Enabled	18.5	22	
		Applicable motor current (A)	Disabled	90	115	
			Enabled	76	90	
		Rated input current (A)	Disabled	Power driving Regenerative driving	92	124
			Enabled	Power/ regenerative driving	74	102
	Overload current rating		100% continuous / 150% 60 s			
	Power supply capacity (kVA)*3	Disabled	41	52		
		Enabled	30	35		
	40°C rating	Applicable inverter capacity (kW)	Disabled	22	30	
			Enabled	18.5	22	
		Applicable motor current (A)	Disabled	99	127	
			Enabled	83	99	
		Rated input current (A)	Disabled	Power driving Regenerative driving	101	136
Enabled			Power/ regenerative driving	81	112	
Overload current rating		100% continuous / 150% 60 s				
Power supply capacity (kVA)*3	Disabled	45	57			
	Enabled	32	38			
Input (Power regeneration mode*2)	50°C rating	Potential regenerative capacity (kW)		18.5	22	
		Rated current (A) (regenerative driving)		62	74	
		Overload current rating		100% continuous / 150% 60 s		
	40°C rating	Potential regenerative capacity (kW)		18.5	22	
		Rated current (A) (regenerative driving)		68	81	
		Overload current rating		100% continuous / 150% 60 s		
Power source	Rated input AC voltage/ frequency	Disabled	Three-phase 200 to 240 V, 50/60 Hz			
		Enabled	Three-phase 200 to 230 V, 50/60 Hz			
	Permissible AC voltage fluctuation	Disabled	Three-phase 170 to 264 V, 50/60 Hz			
		Enabled	Three-phase 170 to 253 V, 50/60 Hz			
Permissible frequency fluctuation	Disabled	±5%				
	Enabled	±5%				
Input power factor		Enabled	0.99 or more (when load ratio is 100%)			
Protection rating of structure (IEC 60529)		Open type (IP00)*4				
Cooling system		Forced air				
Number of connectable inverters		10*5				
Approx. mass (kg)*6		10.5	10.5			

- *1 The harmonic suppression function in this model is enabled initially.
- *2 The converter with its harmonic suppression function disabled can be set in the power regeneration mode.
- *3 Selection example for 220 V power supply voltage.
- *4 IP20 for the FR-XCB.
- *5 One inverter for operation in the power regeneration mode.
- *6 Mass of the FR-XC alone.

◆ Common specifications

Control	Input frequency range		50 to 60 Hz
	Operation	Input signal (4)	
Output signal Open collector output (3)*6 Relay output (1)		The following signals can be assigned to Pr.11, Pr.12, or Pr.16 (Output terminal function selection) : Inverter run enable (RDY), During converter reset (RSO), Converter running (CVO), Overload warning (OL), Power supply phase detection (PHS), Instantaneous power failure detection (IPF), Regenerative drive recognition (Y7), Electronic thermal O/L relay pre-alarm (THP), Fan fault output (FAN), Heatsink overhear pre-alarm (FIN), During retry (RTY), Life alarm (Y14), Maintenance timer alarm (Y15), Instantaneous power failure detection hold (Y16), PU stopped (PS), Box-type reactor overhear pre-alarm (FTP), Alarm (LF), and Fault (ALM).	
Operation status			
Indication	Status monitoring	Converter	Input power value (with regenerative driving indication)
		FR-DU08/ FR-PU07	Power supply frequency, input current, input voltage, fault indication, bus voltage (output voltage), electronic thermal relay load factor, cumulative energization time, cumulative power, input power (with regenerative driving indication), I/O terminal status, electricity cost, option connector status
	Fault monitoring	Converter	When a protective function is activated, a fault indication is displayed.
		FR-DU08/ FR-PU07	When a protective function is activated, a fault indication is displayed, and the latest monitored value of input voltage, input current, bus voltage, cumulative energization time are recorded. The last eight fault records are stored.
Protective function	Fault		Overcurrent trip, Overvoltage trip, Converter overload trip (electronic thermal relay function), Heatsink overhear, Instantaneous power failure, Undervoltage, Input phase loss, External thermal relay operation*3, Communication option fault*4, Parameter storage device fault, PU disconnection*3, Retry count excess*3, CPU fault, Internal circuit fault, 24 VDC power output short circuit, Inrush current limit circuit fault, Connection mode fault, Unsupported control selection, Box-type reactor overhear protection, Box-type reactor power supply short circuit protection, Option fault*4, Main circuit power supply detection fault, Input power supply fault 1
	Alarm, Warning, Error message		Overload signal detection, Electronic thermal relay function pre-alarm, PU stop, Maintenance signal output*3, Power supply not detected, Converter operation disabled, Box-type reactor overhear pre-alarm, Fan alarm, Operation panel lock*5, Write disable error*5, Copy operation fault*5
Environment	Surrounding air temperature		-10 to +50°C (non-freezing)*1
	Surrounding air humidity		90% RH or less (non-condensing)
	Storage temperature*2		-20 to +65°C
	Atmosphere		Indoors (without corrosive gas, flammable gas, oil mist, dust and 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 -10 to +40°C (non-freezing) at the 40°C rating.
- *2 Applicable to conditions for a short time, for example, in transit.
- *3 Not enabled in the initial state.
- *4 Available when the FR-A8NC is installed.
- *5 Displayed on the operation panel (FR-DU08) only.
- *6 Signal assignment is not available for one of the three terminals (terminal RYB).

◆ Inverter selection

Connectable inverter models depend on the operation mode of the FR-XC series converter, the common bus regeneration mode or the power regeneration mode.

- Common bus regeneration mode
Observe the following inverter selection conditions.

Item	Condition
Inverter capacity	The total capacity of the connected inverters (regardless of the rating or model of the inverters) must not exceed the applicable inverter capacity (kW) shown in the converter's rated specifications (refer to page 14). ^{*1}
Inverter rated current	The total of the rated current of the connected inverter (rated current for the selected rating) must not exceed the applicable motor current (A) shown in the converter's rated specifications (refer to page 14). ^{*1}
Number of inverters	The number of inverters actually connected must not exceed the number of connectable inverters shown in the converter's rated specifications (refer to page 14).
Inverter with the HD rating	For the HD rating, 200% of the total rated current of the connected inverters must not exceed 150% of the applicable motor current (A) shown in the converter's rated specifications.

- *1 Note that the applicable inverter capacity and the applicable motor current are different if using the FR-XC-22K and 30K with its harmonic suppression enabled or the FR-XC-PWM with its harmonic suppression function disabled (refer to **page 14**).

NOTE

- For details of the inverter capacity, refer to the rating specifications in the Instruction Manual of the inverter.

Example: FR-A820

Model FR-A820-[]	00046	00077	0010E
	0.4K	0.75K	1.5K
SLD	0.75	1.5	2.2

- For the FR-V500 inverter, the capacity used for selection is as follows.

Capacity of the FR-V500 (kW)	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55
Capacity used for selection (kW)	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	55

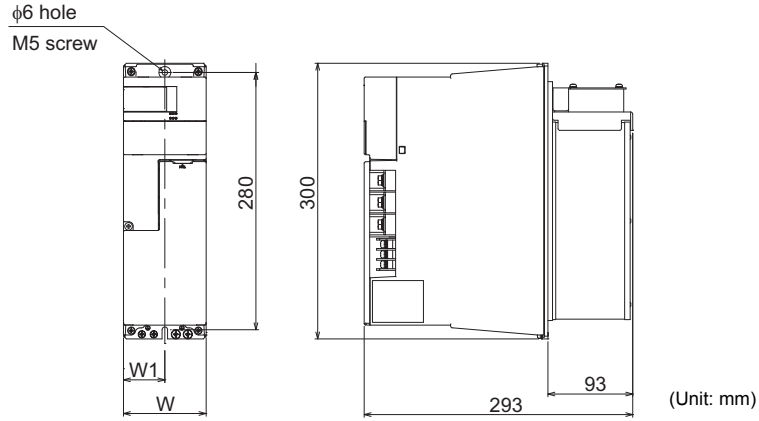
- The power factor improving AC reactor or DC reactor cannot be used.

- Power regeneration mode
The regenerative power of the system must not exceed the potential regenerative capacity (kW) shown in the converter's rated specifications (refer to **page 14**).
When the converter is used in the power regeneration mode, it cannot be used as a common converter.

Outline Dimensions

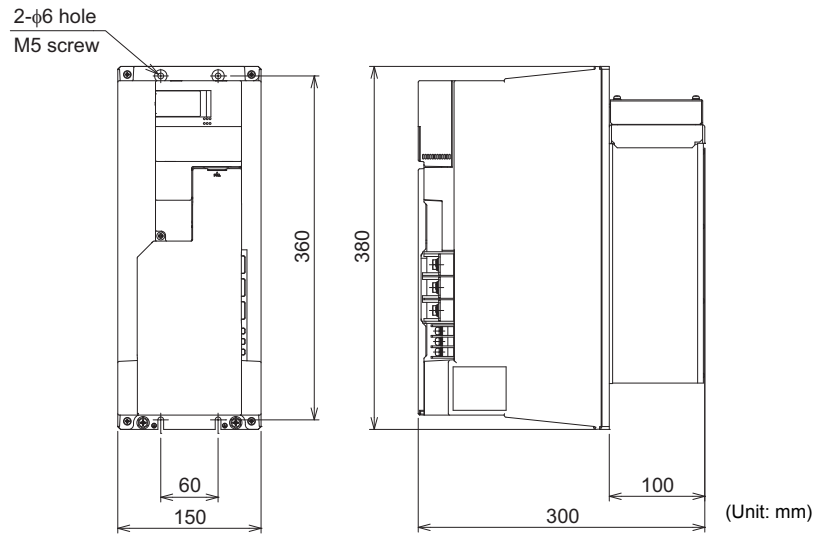
◆ FR-XC series multifunction regeneration converter

- FR-XC-7.5K, 11K, 15K



Model	W	W1
FR-XC-7.5K, 11K	90	45
FR-XC-15K	120	60

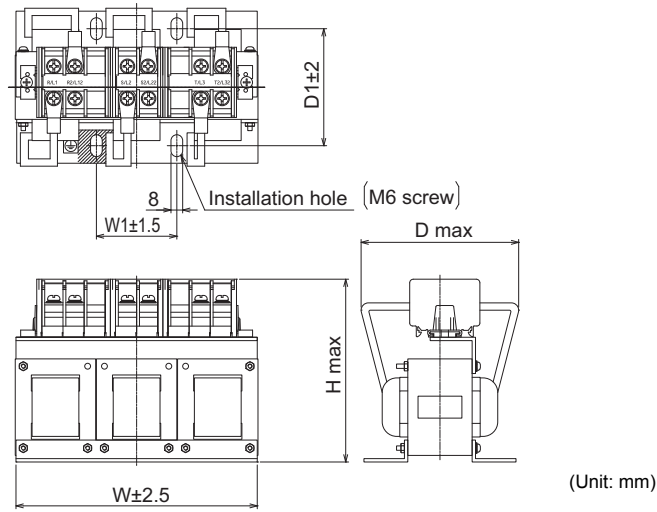
- FR-XC-22K, 30K
- FR-XC-18.5K-PWM, 22K-PWM



Outline Dimensions

◆ FR-XCL (Dedicated stand-alone reactor option)

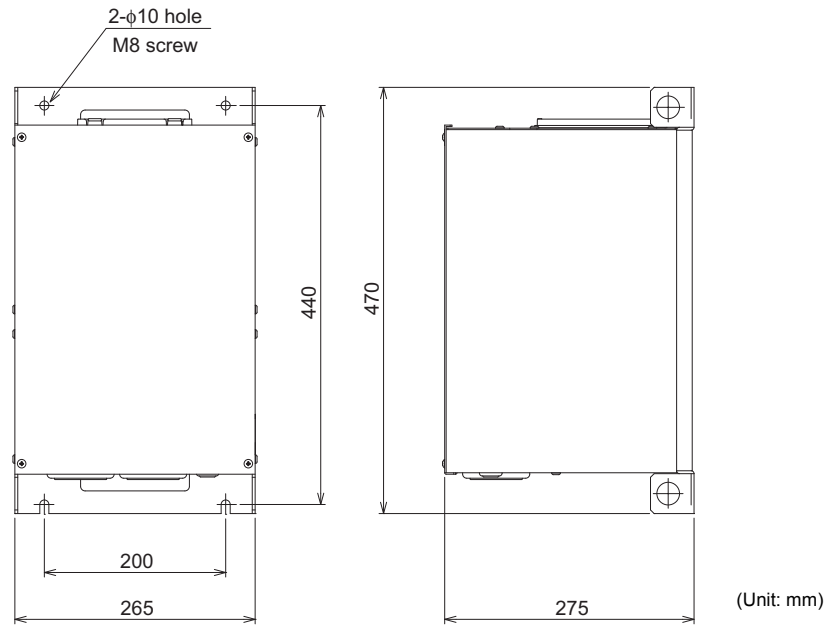
- FR-XCL-7.5K, 11K, 15K, 22K, 30K



Model	W	W1	H	D	D1	Terminal screw size	Mass
FR-XCL-7.5K	165	55	125	120	80	M5	3.9 kg
FR-XCL-11K					73		3.6 kg
FR-XCL-15K	192	55	130	130	100	M6	5.5 kg
FR-XCL-22K				140	110		6.3 kg
FR-XCL-30K	240	70	150	160	119		10 kg

◆ FR-XCB (Dedicated box-type reactor option)

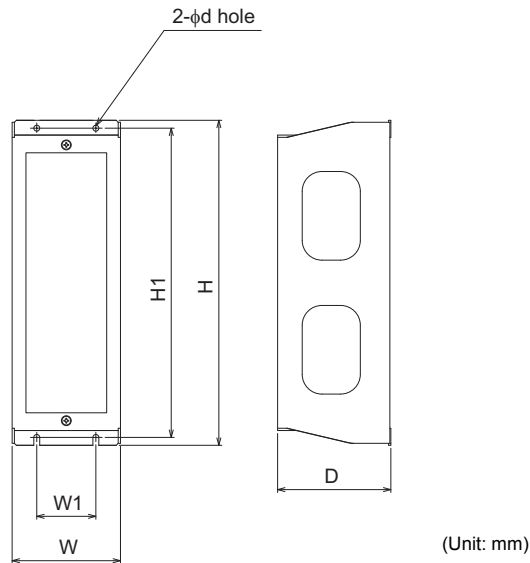
- FR-XCB-18.5K, 22K



Model	Mass
FR-XCB-18.5K, 22K	26 kg

◆ FR-XCCP (Converter installation attachment option for enclosure)

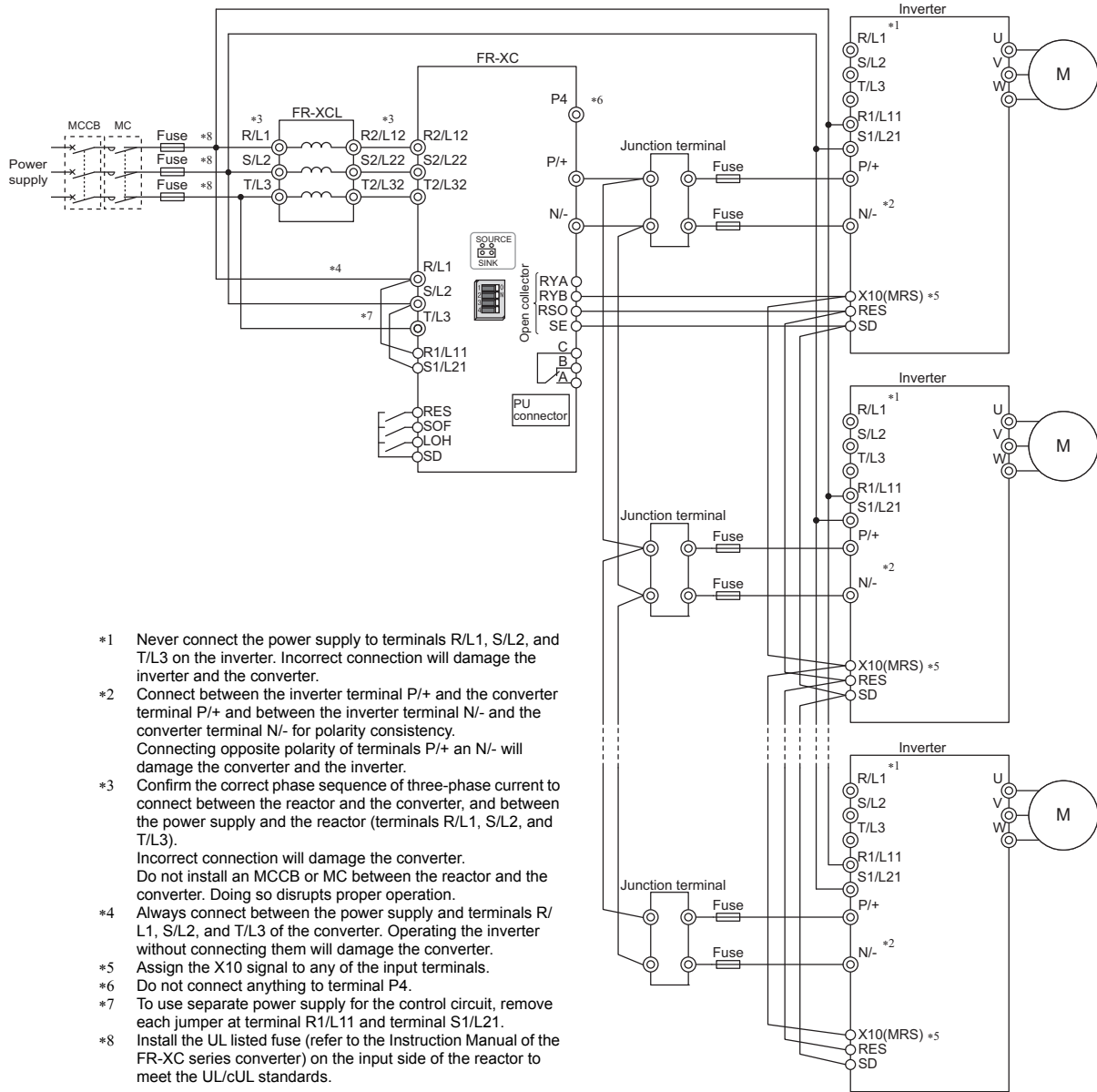
- FR-XCCP01, 02, 03



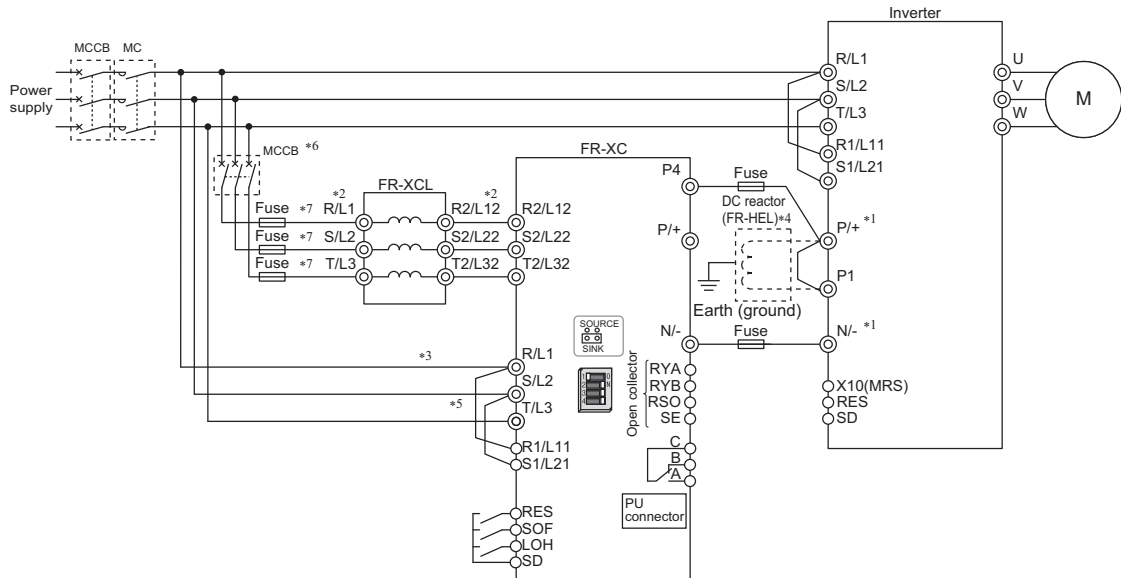
Model	W	W1	H	H1	D	d	Screw size
FR-XCCP01	110	60	330	314	115	6	M5
FR-XCCP02	130	90			120		
FR-XCCP03	160	120	410	396	116	7	M6

Terminal Connection Diagrams

◆ Common bus regeneration mode with harmonic suppression disabled

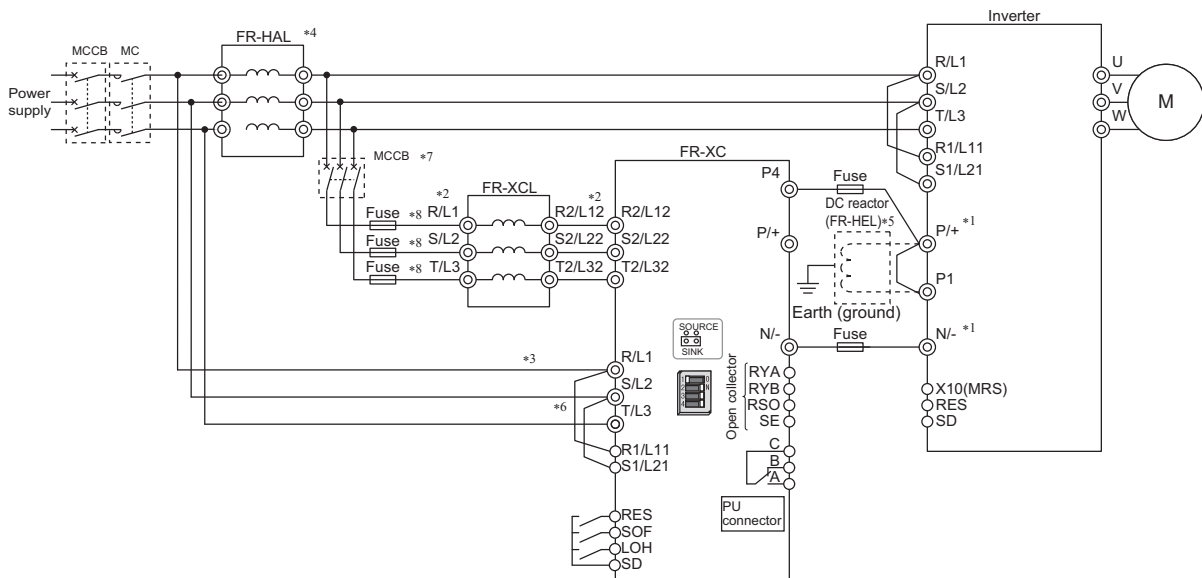


◆ Power regeneration mode



- *1 Connect between the inverter terminal P/+ and the converter terminal P4 and between the inverter terminal N/- and the converter terminal N/- for polarity consistency. Connecting opposite polarity of terminals P/+ and N/- will damage the converter and the inverter.
- *2 Confirm the correct phase sequence of three-phase current to connect between the reactor and the converter, and between the power supply and the reactor (terminals R/L1, S/L2, and T/L3). Incorrect connection will damage the converter. Do not install a molded case circuit breaker (MCCB) or MC between the reactor and the converter. Doing so disrupts proper operation.
- *3 Always connect between the power supply and terminals R/L1, S/L2, and T/L3 of the converter. Operating the inverter without connecting them will damage the converter. A branch point to each of these terminals must be placed between the power supply and a branch point to the FR-XCL reactor.
- *4 To connect a DC reactor, remove a jumper installed across terminals P1 and P/+ before installing the DC reactor.
- *5 To use separate power supply for the control circuit, remove each jumper at terminal R1/L11 and terminal S1/L21.
- *6 For selection of an MCCB, refer to **page 31**.
- *7 Install the UL listed fuse (refer to the Instruction Manual of the FR-XC series converter) on the input side of the FR-XCL reactor to meet the UL/cUL standards.

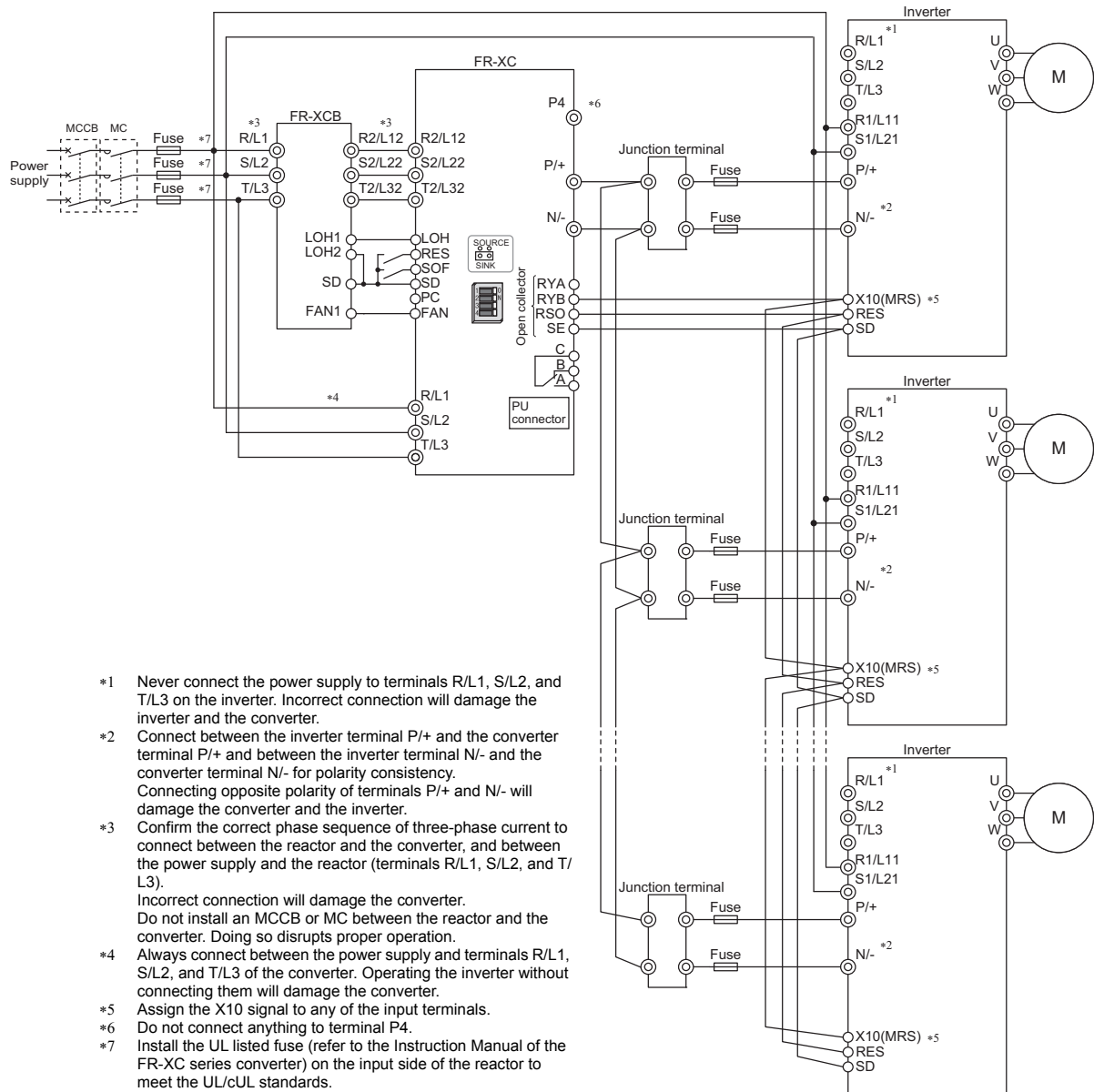
◆ Power regeneration mode (with the FR-HAL installed)



- *1 Connect between the inverter terminal P/+ and the converter terminal P4 and between the inverter terminal N/- and the converter terminal N/- for polarity consistency. Connecting the opposite polarity of terminals P/+ and N/- will damage the converter and the inverter.
- *2 Confirm the correct phase sequence of three-phase current to connect between the FR-XCL reactor and the converter, and between the power supply and the FR-XCL reactor (terminals R/L1, S/L2, and T/L3). Incorrect connection will damage the converter. Do not install an MCCB or MC between the reactors and the converter. Doing so disrupts proper operation.
- *3 Always connect between the power supply and terminals R/L1, S/L2, and T/L3 of the converter. Operating the inverter without connecting them will damage the converter. A branch point to each of these terminals must be placed between the power supply and the FR-HAL reactor.
- *4 Install the FR-HAL reactor between the node points joined to the converter terminals R/L1, S/L2, and T/L3 and the node points joined to the FR-XCL reactor.
- *5 To connect a DC reactor, remove a jumper installed across terminals P1 and P/+ before installing the DC reactor.
- *6 To use separate power supply for the control circuit, remove each jumper at terminal R1/L11 and terminal S1/L21.
- *7 For selection of an MCCB for the converter, refer to **page 31**.
- *8 Install the UL listed fuse (refer to the Instruction Manual of the FR-XC series converter) on the input side of the FR-XCL reactor to meet the UL/cUL standards.

Terminal Connection Diagrams


◆ Common bus regeneration mode with harmonic suppression enabled



- *1 Never connect the power supply to terminals R/L1, S/L2, and T/L3 on the inverter. Incorrect connection will damage the inverter and the converter.
- *2 Connect between the inverter terminal P/+ and the converter terminal P/+ and between the inverter terminal N/- and the converter terminal N/- for polarity consistency. Connecting opposite polarity of terminals P/+ and N/- will damage the converter and the inverter.
- *3 Confirm the correct phase sequence of three-phase current to connect between the reactor and the converter, and between the power supply and the reactor (terminals R/L1, S/L2, and T/L3).
Incorrect connection will damage the converter.
Do not install an MCCB or MC between the reactor and the converter. Doing so disrupts proper operation.
- *4 Always connect between the power supply and terminals R/L1, S/L2, and T/L3 of the converter. Operating the inverter without connecting them will damage the converter.
- *5 Assign the X10 signal to any of the input terminals.
Do not connect anything to terminal P4.
- *7 Install the UL listed fuse (refer to the Instruction Manual of the FR-XC series converter) on the input side of the reactor to meet the UL/cUL standards.

Terminal Specifications

■ indicates that terminal functions can be selected using **Pr.3**, **Pr.4**, or **Pr.7 (Input terminal function selection)** or **Pr.11**, **Pr.12**, or **Pr.16 (Output terminal function selection)**.

Type	Terminal symbol	Terminal name	Description		
Main circuit	R/L1, S/L2, T/L3	Power supply phase detection	These terminals are used to detect the phase and voltage of the power supply, and to input power to the control circuit. Connect each of them to terminals of the same name on both the power supply and the reactor. Operating the inverter without connecting them will damage the converter.		
	R2/L12, S2/L22, T2/L32	AC power input	Connect each of them to terminals of the same name on the reactor.		
	R1/L11, S1/L21	Power supply for the 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 through these terminals.		
	P/+, N/-	DC power supply for the common bus regeneration mode	Connect them to the inverter terminals P/+ and N/-.		
	P4, N/-	DC power supply for the power regeneration mode	Connect them to the inverter terminals P/+ and N/-.		
		Earth (ground)	For earthing (grounding) the converter chassis. This must be earthed (grounded).		
Control circuit/contact input	RES	Reset	Use this signal to reset a fault output provided when a protective function is activated. Turn ON the RES signal for 0.1 seconds or longer, then turn it OFF.	Input resistance: 4.7 kΩ, voltage when contacts are open: 21 to 27 VDC, current when contacts are short-circuited: 4 to 6 mADC	
	SOF	Converter stop	Turn ON this signal to stop the regenerative driving. The function can be changed using Pr.4 .		
	LOH	Box-type reactor overheat protection	Used to monitor the speed of cooling fan in the FR-XCB reactor for overheat protection. Connect it to terminal LOH1 on the reactor.		
	SD	Contact input common (sink) (initial setting)	Common terminal for the contact input terminal (sink logic).	—	
		External transistor common (source)	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 0.1A power supply (PC terminal). Isolated from terminals 5, SE, and SE2.		
	PC	External transistor common (sink) (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 sink logic to avoid malfunction by undesirable current.	Power supply voltage range: 19.2 to 28.8 VDC, permissible load current: 100 mA	
		Contact input common (source)	Common terminal for contact input terminal (source logic)		
24 VDC power supply		Can be used as a 24 VDC 0.1 A power supply.			
Control circuit/output signal	Open collector	RYA	Inverter run enable (NO contact)	Permissible load: 24 VDC (27 VDC at maximum) 0.1 A (The voltage drop is 2.8 V at maximum while the signal is ON.)	
		RYB	Inverter run enable (NC contact)		Turns ON at alarm occurrence and reset (RES) signal input. Connect this terminal to the inverter terminal which the X10 signal is assigned to or the inverter terminal MRS. Terminal RYB is used with the normally closed (NC contact) specification. Turning ON the RYB signal stops the inverter. Signal OFF: Inverter can run Signal ON: Inverter cannot run
		RSO	Converter reset		Turns ON during a converter reset (RES-ON). Connect this terminal to the inverter terminal which the RES signal is assigned to. Turning ON the RSO signal resets the inverter.
	SE	Open collector output common	Common terminal for terminals RYA, RYB, and RSO. Connect it to the inverter terminal SD (sink logic).		
	Relay	A, B, C	Fault contact		1 changeover contact output that indicates that a converter'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)
Power supply for fan	FAN	Reactor fan power supply	Power supply terminal for the fan on the FR-XCB reactor. Connect it to terminal FAN1 on the reactor.		
	SD	Reactor fan power supply common	Common terminal for terminal FAN. Connect it to terminal SD on the FR-XCB reactor. Use it in either the sink or source logic.		
RS-485	—	PU connector	RS-485 communication can be made through the PU connector (for connection on a 1:1 basis only). Conforming standard: EIA-485 (RS-485) Transmission format: Multidrop link Communication speed: 4800 to 38400 bps Wiring length: 500 m		

Parameter List

Parameter List

Parameter read/write requires the inverter operation panel (FR-DU08) or the optional parameter unit. The PU can be installed on an enclosure surface. Use the option FR-CB2[] or the following connector and cable available on the market. (To install the operation panel, the optional connector (FR-ADP) is also required.)

NOTE

- ◎ indicates simple mode parameters.
- The setting of parameters in highly colored cell () is changeable during operation even if "1" (write disabled) is set to Pr.77 Parameter write selection.

Pr.	Name	Setting range	Minimum setting increment	Initial value	Customer setting
◎0	Simple mode selection	0, 9999	0	0	
◎1	Maximum power supply frequency	60 Hz (Read only)	—	60 Hz	
◎2	Minimum power supply frequency	50 Hz (Read only)	—	50 Hz	
3	LOH terminal function selection	0, 3 to 5, 9999	1	5	
4	SOF terminal function selection		1	0	
7	RES terminal function selection		1	3	
8	SOF input selection	0 to 2	1	0	
9	OH input selection	0, 1	1	0	
11	RSO terminal function selection	0 to 4, 6 to 11, 14 to 18, 98, 99, 101 to 104, 106 to 111, 114 to 118, 198, 199, 9999	1	1	
12	RYA terminal function selection		1	0	
16	ABC terminal function selection		1	99	
◎22~4	Current limit level	0 to 220%	0.1%	150	
23~4	Current limit level (regenerative)	0 to 220%, 9999	0.1%	9999	
31	Life alarm status display	0, 1, 4, 5, 8, 9, 12, 13 (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 warning output set time	0 to 9998, 9999	1	9999	
44	Instantaneous power failure detection signal clear	0, 9999	1	9999	
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	
◎52	PU main monitor selection	0, 5 to 10, 25, 28	1	0	
◎57	Restart selection	0, 9999	1	9999	
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 to 4	1	0	
◎67	Number of retries at fault occurrence	0 to 10, 101 to 110, 1001 to 1010, 1101 to 1110	1	0	
◎68	Retry waiting time	0.1 to 600 s	0.1 s	1 s	
◎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	
80~4	Voltage control proportional gain	0 to 1000%	1%	100	
81~4	Voltage control integral gain	0 to 1000%	1%	100	
82~4	Current control proportional gain	0 to 200%	1%	100	
83~4	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	PU communication retry count	0 to 10, 9999	1	1	
123	PU communication waiting time setting	0 to 150 ms, 9999	1 ms	9999	

Pr.	Name	Setting range	Minimum setting increment	Initial value	Customer setting
124	PU communication CR/LF selection	0 to 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	
415	SW2 setting status	0 to 15 (Read only)	1	15	
416	Control method selection	0, 1, 9999	1	9999	
Ⓢ500 ⁺¹	Communication error execution waiting time	0 to 999.8 s	0.1 s	0 s	
Ⓢ501 ⁺¹	Communication error occurrence count display	0	1	0	
Ⓢ502 ⁺¹	Stop mode selection at communication error	0, 3	1	0	
520	Parameter for manufacturer setting. Do not set.				
Ⓢ542 ^{+1, +2, +3}	Station number (CC-Link)	1 to 64	1	1	
Ⓢ543 ^{+1, +2, +3}	Transmission speed selection (CC-Link)	0 to 4	1	0	
Ⓢ544 ^{+1, +2}	CC-Link extended setting	0, 1, 12	1	0	
896	Power unit cost	0 to 500	0.01	0	
989	Parameter for manufacturer setting. Do not set.				
990	PU buzzer control	0, 1	1	1	
991	PU contrast adjustment	0 to 63	1	58	
Pr.CLR	Parameter clear	(0), 1	1	0	
ALL.C	All parameter clear	(0), 1	1	0	
Err.CL	Fault history clear	(0), 1	1	0	
Pr.CPY	Parameter copy	(0), 1 to 3	1	0	

*1 The setting is available only when a communication option (FR-A8NC) is installed.

*2 The setting is applied after the converter reset or next power-ON.

*3 [L.ERR] LED indicator on the FR-A8NC blinks when a setting is changed. The setting is applied after the converter reset, and the [L.ERR] turns OFF.

*4 The setting is available only when the harmonic suppression is enabled.

Protective Functions

When a fault occurs in the converter, a protective function is automatically activated to shut off the converter output and show an indication on the PU and on the operation status 7-segment LED display of the converter.

Indication on the operation status 7-segment LED display of the converter		Name	
Error message*2	—	—	Operation panel lock
	—	—	Write disable error
	—	—	Copy operation fault
Warning*3	Lb	LB	Overload signal detection
	Lc	LC	Electronic thermal relay function pre-alarm
	Ld	LD	PU stop
	Le	LE	Maintenance signal output*7
	Lg	LG	Power supply not detected
	Lh	LH	Converter operation disabled
Alarm*4	Lj	LJ	Box-type reactor overheat pre-alarm
	La	LA	Fan alarm
Fault*5	Ea	E.A	Overcurrent trip
	Eb	E.B	Overvoltage trip
	Ec	E.C	Converter overload trip (electronic thermal relay function)*1
	Ed	E.D	Heatsink overheat
	Ee	E.E	Instantaneous power failure
	Ef	E.F	Undervoltage
	EG	E.G	Input phase loss
	EH	E.H	External thermal relay operation*6*7
	Ej	E.J	PU disconnection*7
	Ek	E.K	Retry count excess*7
	El	E.L	CPU fault
			Internal circuit fault
	Em	E.M	24 VDC power output short circuit
	En	E.N	Inrush current limit circuit fault
	Ep	E.P	Parameter storage device fault
	Eq	E.Q	Communication option fault
	Et	E.T	Connection mode fault
	Eu	E.U	Unsupported control selection
	Ev	E.V	Box-type reactor overheat protection
	EW	E.W	Box-type reactor power supply short circuit protection
E1	E.1	Option fault	
E6	E.6	Main circuit power supply detection fault	
E8	E.8	Input power supply fault 1	

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

*2 A message regarding an operational fault or a setting fault on the PU is displayed. The converter output is not shut off.

*3 The converter output is not shut off even when a warning is displayed. However, failure to take appropriate measures will lead to a fault.

*4 The converter output is not shut off. The Alarm (LF) signal can be output depending on the parameter setting.

*5 When a protective function is activated, the converter output is shut off and the Fault (ALM) signal is output.

*6 A protective function leading to the External thermal relay operation fault is enabled only when the OH signal is assigned to an input terminal by using Pr.3, Pr.4, or Pr.7 (Input terminal function selection).

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

Option and Peripheral Devices

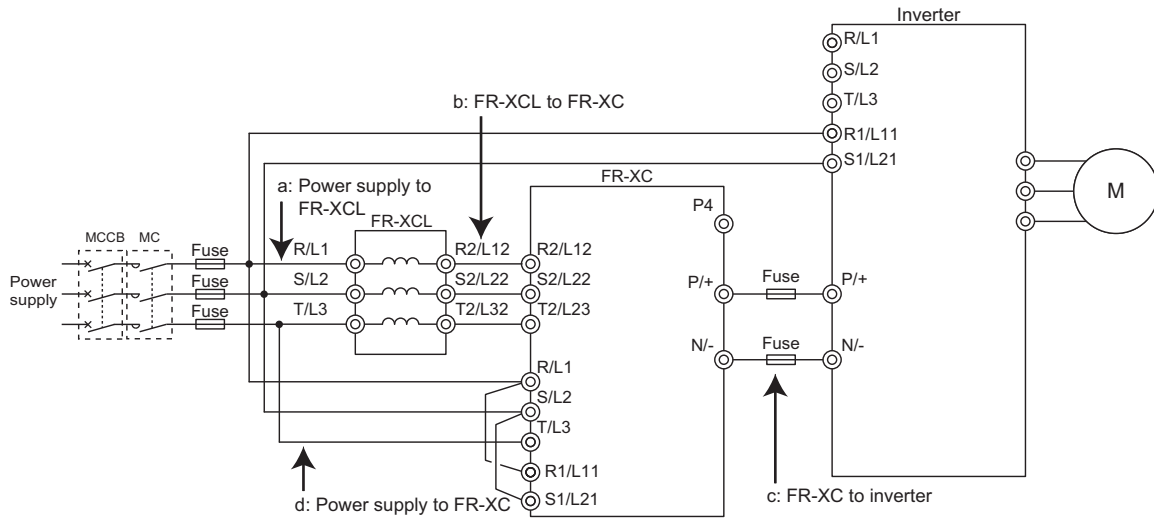
◆ Option list

Name		Model	Applications, Specifications, etc.
Dedicated stand-alone	Stand-alone reactor dedicated to the FR-XC series converter	FR-XCL-[]K	Used for the FR-XC series converter with its harmonic suppression function disabled.
	Box-type reactor dedicated to the FR-XC series converter	FR-XCB-[]K	Used for the FR-XC series converter with its harmonic suppression function enabled.
	Converter installation attachment for enclosure	FR-XCCP[]	Used to install the FR-XC series converter in an enclosure.
Plug-in	Communication CC-Link communication	FR-A8NC	Used to give commands to the FR-XC series converter from a programmable controller for operating or monitoring the converter or changing the parameter settings in the converter.
Common stand-alone	Parameter unit (8 languages)	FR-PU07	Parameters can be set in an interactive manner on the LCD display.
	Parameter unit with battery pack	FR-PU07BB	Parameters can be set without power supply from the FR-XC series converter.
	Parameter unit connection cable	FR-CB20[]	Cable for connection of operation panel or parameter unit [] indicates a cable length. (1 m, 3 m, 5 m)
	Operation panel connection connector	FR-ADP	Used for the connection between the inverter operation panel (FR-DU08) and the parameter unit connection cable.
	Radio noise filter	FR-BIF(H)	Used for line noise reduction (when installed on the input side of the converter).
	Line noise filter	FR-BSF01/FR- BLF	For line noise reduction

Option and Peripheral Devices

◆ Cable gauge

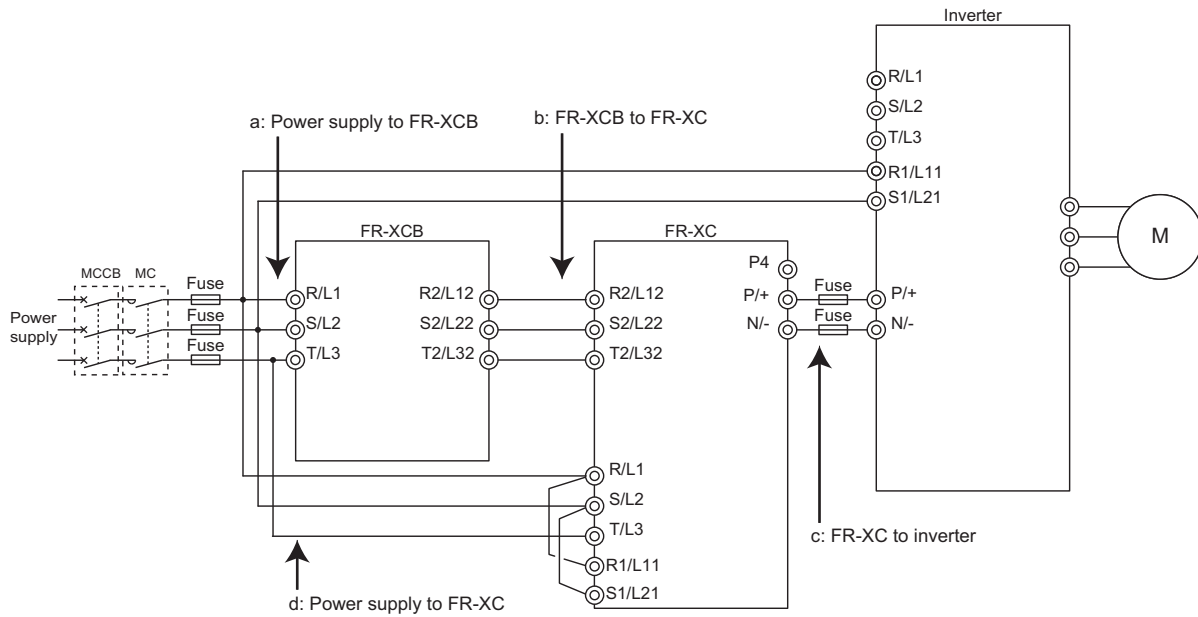
- Common bus regeneration mode with harmonic suppression disabled



Model	Rating	HIV cables, etc. (mm ²) *1				AWG/MCM *2			PVC cables, etc. (mm ²) *3			
		Location in the connection diagram			Earth (ground)	Location in the connection diagram			Location in the connection diagram			Earth (ground)
		a, b	c *4	d		a, b	c	d	a, b	c	d	
FR-XC-7.5K	50°C	8	8	1.25	5.5	8	8	16	10	10	1.5	10
	40°C	5.5										
FR-XC-11K	50°C	14	14	1.25	8	6	6	16	10	16	1.5	16
	40°C											
FR-XC-15K	50°C	22	22	1.25	14	4	4	16	16	25	1.5	16
	40°C											
FR-XC-22K FR-XC-18.5K-PWM	50°C	38	38	1.25	22	2	2	16	25	25	1.5	16
	40°C											
FR-XC-30K FR-XC-22K-PWM	50°C	60	60	1.25	22	1	1/0	16	35	50	1.5	25
	40°C					1/0						

- *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 less (40°C or less for the 40°C rating) and the wiring distance of 20 m or less from the power supply to the converter.
- *2 The cable size is that of the THHW cable with continuous maximum permissible temperature of 75°C. It assumes a surrounding air temperature of 40°C or less and the wiring distance of 20 m or less from the power supply to the converter. (For the use in the United States or Canada, refer to the Instruction Manual of the FR-XC series converter.)
- *3 For the FR-XC-15K or lower, 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 less and the wiring distance of 20 m or less from the power supply to the converter. For the FR-XC-22K / FR-XC-18.5K-PWM or higher, it is the gauge of a cable with the continuous maximum permissible temperature of 90°C (PVC cable). It assumes a surrounding air temperature of 40°C or less and the wiring distance of 20 m or less from the power supply to the converter. (Selection example mainly for use in Europe.)
- *4 If a cable thinner than the recommended cable size is used, it may not be protected by the DC fuse. (Refer to **page 32** for the fuse selection.)

- Common bus regeneration mode with harmonic suppression enabled

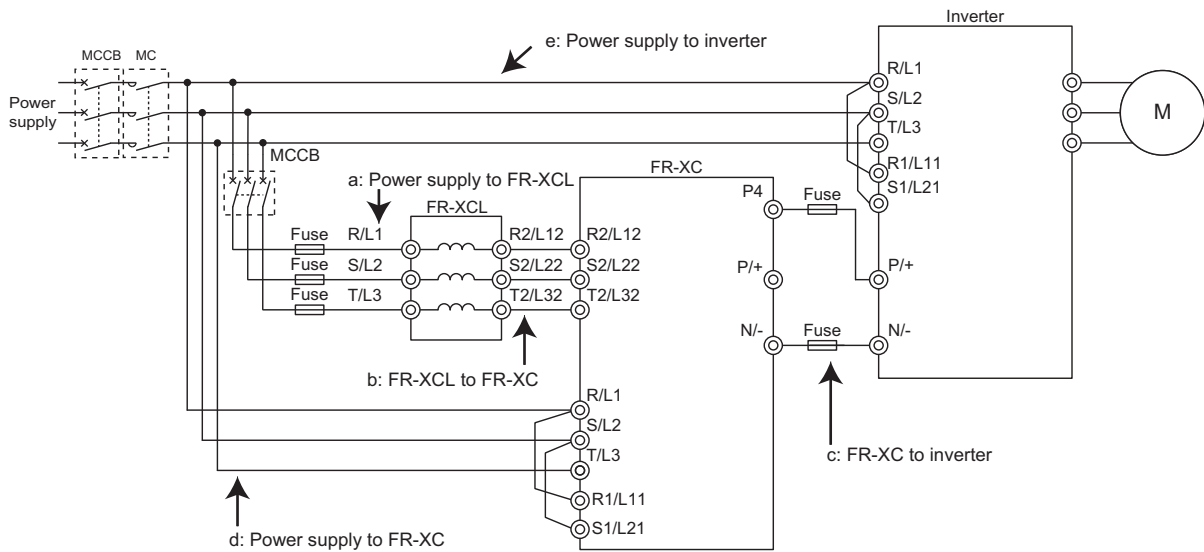


Model	Rating	HIV cables, etc. (mm ²)* ¹			Earth (ground)	AWG/MCM * ²			PVC cables, etc. (mm ²) * ³			
		Location in the connection diagram				Location in the connection diagram			Location in the connection diagram			
		a, b	c * ⁴	d		a, b	c	d	a, b	c	d	Earth (ground)
FR-XC-22K FR-XC-18.5K-PWM	50°C	22	38	1.25	22	4	4	16	16	16	1.5	16
	40°C						2			25		
FR-XC-30K FR-XC-22K-PWM	50°C	38	38	1.25	22	4	2	16	16	25	1.5	25
	40°C					2			25			

- *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 less (40°C or less for the 40°C rating) and the wiring distance of 20 m or less from the power supply to the converter.
- *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 less and the wiring distance of 20 m or less from the power supply to the converter. (For the use in the United States or Canada, refer to the Instruction Manual of the FR-XC series converter.)
- *³ It is the gauge of a cable with the continuous maximum permissible temperature of 90°C (PVC cable). It assumes a surrounding air temperature of 40°C or less and the wiring distance of 20 m or less from the power supply to the converter. (Selection example mainly for use in Europe.)
- *⁴ If a cable thinner than the recommended cable size is used, it may not be protected by the DC fuse. (Refer to **page 32** for the fuse selection.)

Option and Peripheral Devices

- Power regeneration mode



Model	Rating	HIV cables, etc. (mm ²) *1					AWG/MCM *2					PVC cables, etc. (mm ²) *3				
		Location in the connection diagram				Earth (ground)	Location in the connection diagram				Location in the connection diagram				Earth (ground)	
		a, b	c *4	d	e		a, b	c	d	e	a, b	c	d	e		
FR-XC-7.5K	50°C	3.5	5.5	1.25	*5	5.5	14	12	16	*5	4	4	1.5	*5	10	
	40°C		3.5				6									
FR-XC-11K	50°C	5.5	8	1.25	*5	8	10	10	16	*5	6	6	1.5	*5	16	
	40°C		5.5													10
FR-XC-15K	50°C	8	14	1.25	*5	14	8	8	16	*5	10	10	1.5	*5	16	
	40°C															10
FR-XC-22K FR-XC-18.5K-PWM	50°C	22	22	1.25	*5	22	6	4	16	*5	10	16	1.5	*5	16	
	40°C						4				16					
FR-XC-30K FR-XC-22K-PWM	50°C	38	38	1.25	*5	22	4	2	16	*5	16	16	1.5	*5	25	
	40°C											22				25

- *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 less (40°C or less for the 40°C rating) and the wiring distance of 20 m or less from the power supply to the converter.
- *2 The cable size is that of the THHW cable with continuous maximum permissible temperature of 75°C. It assumes a surrounding air temperature of 40°C or less and the wiring distance of 20 m or less from the power supply to the converter. (For the use in the United States or Canada, refer to the Instruction Manual of the FR-XC series converter.)
- *3 For the FR-XC-15K or lower, 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 less and the wiring distance of 20 m or less from the power supply to the converter. For the FR-XC-22K / FR-XC-18.5K-PWM or higher, it is the gauge of a cable with the continuous maximum permissible temperature of 90°C (PVC cable). It assumes a surrounding air temperature of 40°C or less and the wiring distance of 20 m or less from the power supply to the converter. (Selection example mainly for use in Europe.)
- *4 If a cable thinner than the recommended cable size is used, it may not be protected by the DC fuse. (Refer to **page 32** for the fuse selection.)
- *5 Refer to the Inverter Instruction Manual.

◆ **Circuit breaker and magnetic contactor**

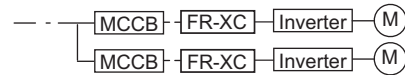
Check the model of the purchased multifunction regeneration converter. Appropriate peripheral devices must be selected according to the capacity.

- Common bus regeneration mode
For the converter in common bus regeneration mode, refer to the following table to prepare appropriate peripheral devices.

FR-XC series converter model		Molded case circuit breaker (MCCB)*1/ earth leakage circuit breaker (ELB) (NF, NV type)		Magnetic contactor (MC)*2	
		50°C rating	40°C rating	50°C rating	40°C rating
FR-XC-7.5K		60 A	60 A	S-T35	S-T35
FR-XC-11K		75 A	75 A	S-T35	S-T35
FR-XC-15K		125 A	125 A	S-T50	S-T50
FR-XC-22K FR-XC-18.5K-PWM	Harmonic suppression disabled	175 A	175 A	S-T65	S-T80
	Harmonic suppression enabled	125 A	125 A	S-T50	S-T50
FR-XC-30K FR-XC-22K-PWM	Harmonic suppression disabled	225 A	225 A	S-T100	S-T100
	Harmonic suppression enabled	125 A	125 A	S-T65	S-T65

*1 Select an MCCB according to the power supply capacity. Install one MCCB per converter. (For the use in the United States or Canada, refer to the Instruction Manual of the FR-XC series converter.)

*2 The 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 stops during motor driving, the electrical durability is 25 times. If using an MC for emergency stop during motor driving or using it on the motor side during commercial power supply operation, select an MC with the class AC-3 rated current for the rated motor current.



- Power regeneration mode
To use the converter in power regeneration mode, select a circuit breaker and a magnetic contactor (MC) for the inverter according to the inverter capacity. For details, refer to the Instruction Manual of each inverter. Additionally, install a molded case circuit breaker (MCCB) or earth leakage circuit breaker (ELB) with the rating shown in the following table on the input side of the FR-XCL reactor. For the information of the installation location, refer to **page 21**.

FR-XC series converter model	Molded case circuit breaker (MCCB)/ earth leakage circuit breaker (ELB) (NF, NV type)
FR-XC-7.5K	50 A
FR-XC-11K	60 A
FR-XC-15K	75 A
FR-XC-22K FR-XC-18.5K-PWM	125 A
FR-XC-30K FR-XC-22K-PWM	175 A

NOTE

- If any breaker trips, check for the wiring fault (such as short circuit), damage to internal parts of the multifunction regeneration converter, etc. The cause of the trip must be identified and removed before turning ON the power of the breaker.

◆ Fuse

Installation of a fuse between the multifunction regeneration converter and the inverter is recommended.

When using the converter in the common bus regeneration mode, select a fuse according to the capacity of the connected motor.

When using a motor whose 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.

When using the converter in power regeneration mode, select a fuse according to the capacity of the converter.

[Fuse selection table]

- Common bus regeneration mode

Motor capacity (kW)	Fuse rating (A)	Model*1	Fuse holder (2 poles)
0.1	5	6.900 CP GR 10.38 0005 (FR10GR69V5)	US102 (without fuse light melting indicator) or US102I (with fuse light melting indicator)
0.2	10	6.900 CP GR 10.38 0010 (FR10GR69V10)	
0.4	16	6.900 CP GR 10.38 0016 (FR10GR69V16)	
0.75	20	6.900 CP GR 10.38 0020 (FR10GR69V20)	
1.5	25	6.900 CP GR 10.38 0025 (FR10GR69V25)	
2.2	50	6.9 URD 30 TTF 0050	—
3.7	63	6.9 URD 30 TTF 0063	—
5.5	100	6.9 URD 30 TTF 0100	—
7.5	125	6.9 URD 30 TTF 0125	—
11	160	6.9 URD 30 TTF 0160	—
15	200	6.9 URD 30 TTF 0200	—
18.5	250	6.9 URD 30 TTF 0250	—
22	315	6.9 URD 30 TTF 0315	—
30	400	6.9 URD 30 TTF 0400	—
37	500	6.9 URD 30 TTF 0500	—
45	630	6.9 URD 31 TTF 0630	—
55	700	6.9 URD 31 TTF 0700	—
75	800	6.9 URD 31 TTF 0800	—

- Power regeneration mode

FR-XC series converter capacity (kW)	Fuse rating (A)	Model*1	Fuse holder (2 poles)
FR-XC-7.5K	125	6.9 URD 30 TTF 0125	—
FR-XC-11K	160	6.9 URD 30 TTF 0160	—
FR-XC-15K	200	6.9 URD 30 TTF 0200	—
FR-XC-22K FR-XC-18.5K-PWM	315	6.9 URD 30 TTF 0315	—
FR-XC-30K FR-XC-22K-PWM	400	6.9 URD 30 TTF 0400	—

*1 Manufacturer: Mersen Japan KK
Contact: Sun-Wa Technos Corporation

NOTE

- Install fuses across terminals P/+ and P/+, and across terminals N/- and N/- of the multifunction regeneration converter and the inverter.

[Estimated lifespan of fuses]

Components	Estimated lifespan*1	Replacement method
Fuse	10 years	Replace by new one

*1 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. Find out the cause and remove it before replacing the fuse.

Precaution on Selection and Operation

◆ Safety instructions

- To use the product safely and correctly, make sure to read the Instruction Manual of the product before the use.
- This product has not been designed or manufactured for use with any equipment or system operated under life-threatening conditions.
- Please contact our sales representative when 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, 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.
- Use only dedicated inverters.

◆ Precautions for installation

- Wiring distance:
For the wiring length, refer to the following tables.
[Wiring between the FR-XC series converter and the inverter]

	Common bus regeneration mode		Power regeneration mode
	Harmonic suppression disabled	Harmonic suppression enabled	
Main circuit	5 m or less	50 m or less	5 m or less
Control circuit	30 m or less	30 m or less	30 m or less

[Wiring between the FR-XCL reactor and the FR-XC series converter]

	Common bus regeneration mode		Power regeneration mode
	Harmonic suppression disabled	Harmonic suppression enabled	
Main circuit	10 m or less	—	10 m or less

[Wiring between the FR-XCB reactor and the FR-XC series converter]

	Common bus regeneration mode		Power regeneration mode
	Harmonic suppression disabled	Harmonic suppression enabled	
Main circuit	—	10 m or less	—
Control circuit	—	5 m or less	—

- Dedicated reactor installed between power supply and the FR-XC series converter:
The terminals R/L1, S/L2, and T/L3 on the converter are control terminals to detect power phases of the power supply. For wiring, the voltage phase must be consistent between terminals R2/L12, S2/L22, and T2/L32 and terminals R/L1, S/L2, and T/L3. If these terminals are not connected correctly, the converter does not operate properly.
If the inverter is operated while the converter terminals R/L1, S/L2, and T/L3 are not connected to the power supply, the converter will be damaged.
- In the common bus regeneration mode, always connect between the converter terminal RYB and the inverter terminal to which the X10 (MRS) signal is assigned, and also connect between the converter terminal SE and the inverter terminal SD. If the terminals are not connected, the converter may be damaged.
- For use of the FR-XC series converter in the common bus regeneration mode, the control logic (sink/source) of the converter and the inverter must be matched. The converter does not operate properly if the control logic is not consistent with each other. (Refer to the Instruction Manual of the converter for the switching of the control logic of the converter. Refer to the Instruction Manual of the inverter for the switching of the control logic of the inverter.)
- For use of the FR-XC series converter in the common bus regeneration mode, keep the wiring length between terminals as short as possible.

◆ Precautions for use

- Since the FR-XC series converter with its harmonic suppression function enabled achieves K5 (the conversion factor) = 0, it is assumed by the Harmonic suppression guidelines that the converter generates no harmonics. However, it does not mean that harmonic components completely disappear.

◆ Precautions for selecting inverter and reactor

- Applicable Inverter:
Prepare an inverter that is compatible with DC input.
For the MELTRAC series inverters and FR-A500L/F500L series inverters, make sure that an inverter to be applied is compatible with the FR-XC series converter. Use of the FR-XC series converter with an incompatible inverter will damage the inverter and the converter.
- Dedicated reactor:
Use the FR-XC series converter in combination with the dedicated stand-alone reactor (FR-XCL) or the dedicated box-type reactor (FR-XCB).
For use of the FR-XC series converter with its harmonic suppression function enabled, prepare the FR-XCB, dedicated box-type reactor (option). Otherwise, prepare the FR-XCL, dedicated stand-alone reactor (option).

Precaution on Selection and Operation

◆ Precautions on peripheral device selection

- Selection and installation of molded case circuit breaker

Install a molded case circuit breaker (MCCB) on the input side of the FR-XC series converter to protect the wiring on that side. For selection of the MCCB, refer to **page 31**. (Check the documents related to the applicable breaker.) As an earth leakage current breaker, use the Mitsubishi Electric earth leakage current breaker designed for harmonics and surge suppression.

- EMI measures

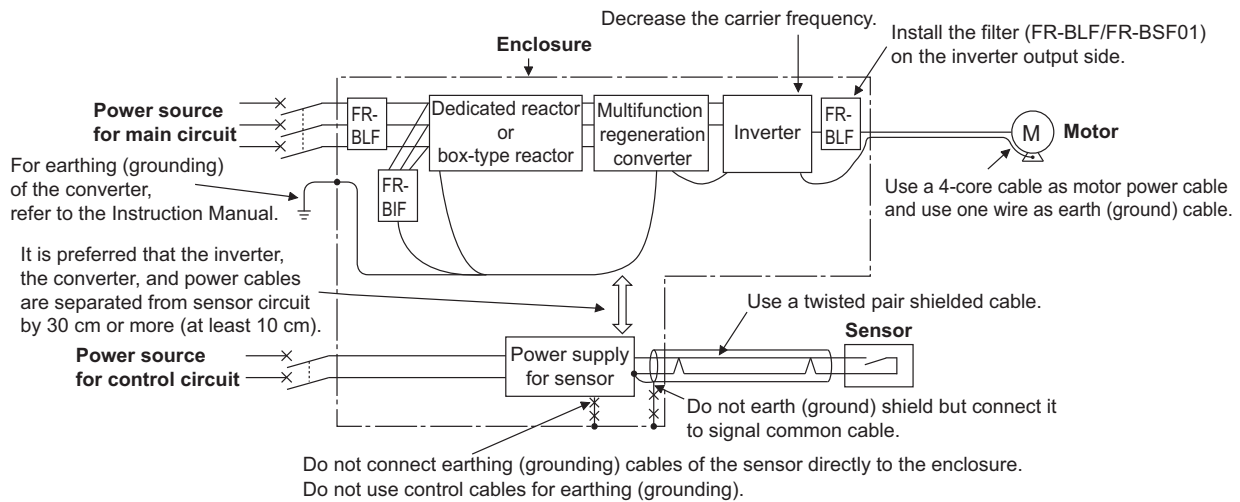
The FR-XC series converter can generate electromagnetic noises. In a system including the converter with its harmonic suppression function enabled, the noise created by the system increases when both the converter and an inverter are operated. If these noises cause peripheral devices to malfunction, EMI measures should be taken to suppress noises. Techniques differ slightly depending on EMI paths.

The FR-BIF radio noise filter is useful for suppressing noise on AM radio broadcasting.

The FR-BSF01/FR-BLF line noise filter is useful for preventing malfunction of sensors, etc.

As measures against the induced noise emitted from power cables of the converter and inverter, keep a distance of 30 cm or more (at least 10 cm) between the sensor circuit and the noise sources such as the converter, the inverter, and their power cables, and use shielded twisted pair cable for signal cables of the sensor. Do not earth (ground) the shield, and connect the shield to the signal common terminal.

[EMI measure example]



◆ Others

- When the power is distorted or falls off sharply during operation of the FR-XC series converter with its harmonic suppression function disabled, reactors installed in the system may generate abnormal acoustic noise. This acoustic noise is caused by the power supply fault and not by the damage of the converter.

Since high-frequency current flows in the system due to the switching in the circuit of the FR-XC series converter with its harmonic suppression enabled, the FR-XCB reactor generates noises caused by the carrier frequency. It is not a fault on the converter.

To reduce such noises, take measures on an enclosure in which each of the noise-generating reactors is installed.

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 Electric shall not be liable for compensation to:

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

5. Change of Product specifications

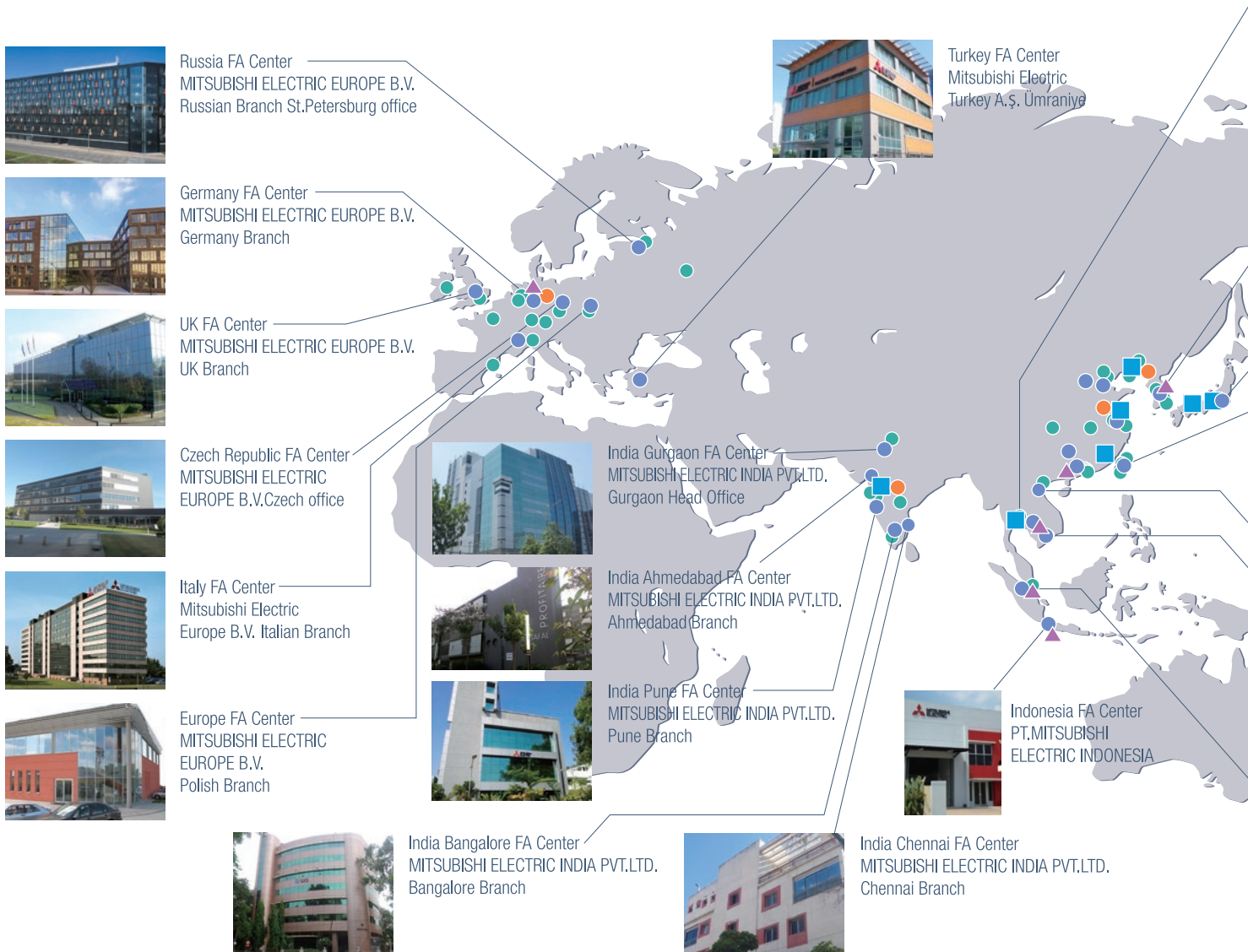
Specifications listed in our catalogs, manuals or technical documents may be changed without notice.

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.

Mitsubishi Electric's global FA network delivers reliable technologies and security around the world.

■ Production base
 ● Development center
 ● Global FA Center
 ▲ Mechatronics showroom
 ● Mitsubishi Electric sales office



Available services



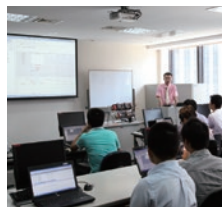
Technical consultation (engineering)

Our Japanese and/or local staff offer technical advice, and can also propose the best products and systems for a customer's specific application needs.



Showrooms

The latest automation technologies, including programmable controllers, HMI's, inverters, servo systems, and industrial automation machinery such as electrical-discharge machines, laser processing machines, CNCs, and industrial robots can be seen at Mitsubishi Electric showrooms.



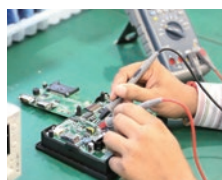
Training

From basic operations to applied programming, our training schools offer regular courses that use actual machines. We also offer customized training programs and onsite training sessions.



Technical support

Our FA centers and service shops work together to provide repairs, onsite engineering support, and spare parts.



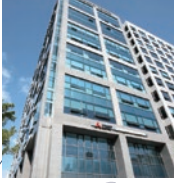
Repairs

Handle repairs of our FA products.

Thailand FA Center
 MITSUBISHI ELECTRIC FACTORY
 AUTOMATION (THAILAND) CO.,LTD



Korea FA Center
 MITSUBISHI ELECTRIC
 AUTOMATION KOREA CO.,LTD.



MITSUBISHI ELECTRIC CORPORATION
 Factory Automation Systems Group



Taichung FA Center
 MITSUBISHI ELECTRIC
 TAIWAN CO.,LTD



Taipei FA Center
 SETSUJO ENTERPRISE CO.,LTD



Ho Chi Minh FA Center
 MITSUBISHI ELECTRIC
 VIETNAM COMPANY
 LIMITED



Hanoi FA center
 Mitsubishi Electric
 Vietnam
 Company Limited
 Hanoi Branch



ASEAN FA Center
 MITSUBISHI ELECTRIC ASIA PTE.LTD.



Service bases are established around the world to provide the same services as in Japan globally. Overseas bases are opening one after another to support our customers' business expansion.

Area	Our overseas	FA centers
EMEA	26	7
China	17	4
Asia	31	13
Americas	15	6
Others	1	0
Total	90	30

-As of July 2017

North America FA Center
 MITSUBISHI ELECTRIC
 AUTOMATION,INC.



Mexico Monterrey FA Center
 Monterrey Office, Mitsubishi
 Electric Automation, Inc.



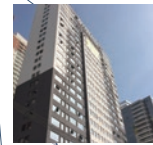
Mexico FA Center
 Querétaro Office, Mitsubishi
 Electric Automation, Inc.



Mexico City FA Center
 Mexico FA Center
 Mexico Branch, Mitsubishi
 Electric Automation, Inc.



Brazil FA Center
 Mitsubishi Electric do Brasil
 Comércio e Serviços Ltda.



Brazil Votorantim FA Center
 MELCO CNC do Brasil
 Comércio e Serviços S.A.

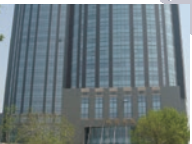


China

Beijing FA Center
 MITSUBISHI ELECTRIC
 AUTOMATION (CHINA)LTD.



Tianjin FA Center
 MITSUBISHI ELECTRIC
 AUTOMATION (CHINA)LTD.



Guangzhou FA Center
 MITSUBISHI ELECTRIC
 AUTOMATION (CHINA)LTD.



Shanghai FA Center
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 AUTOMATION (CHINA) LTD.

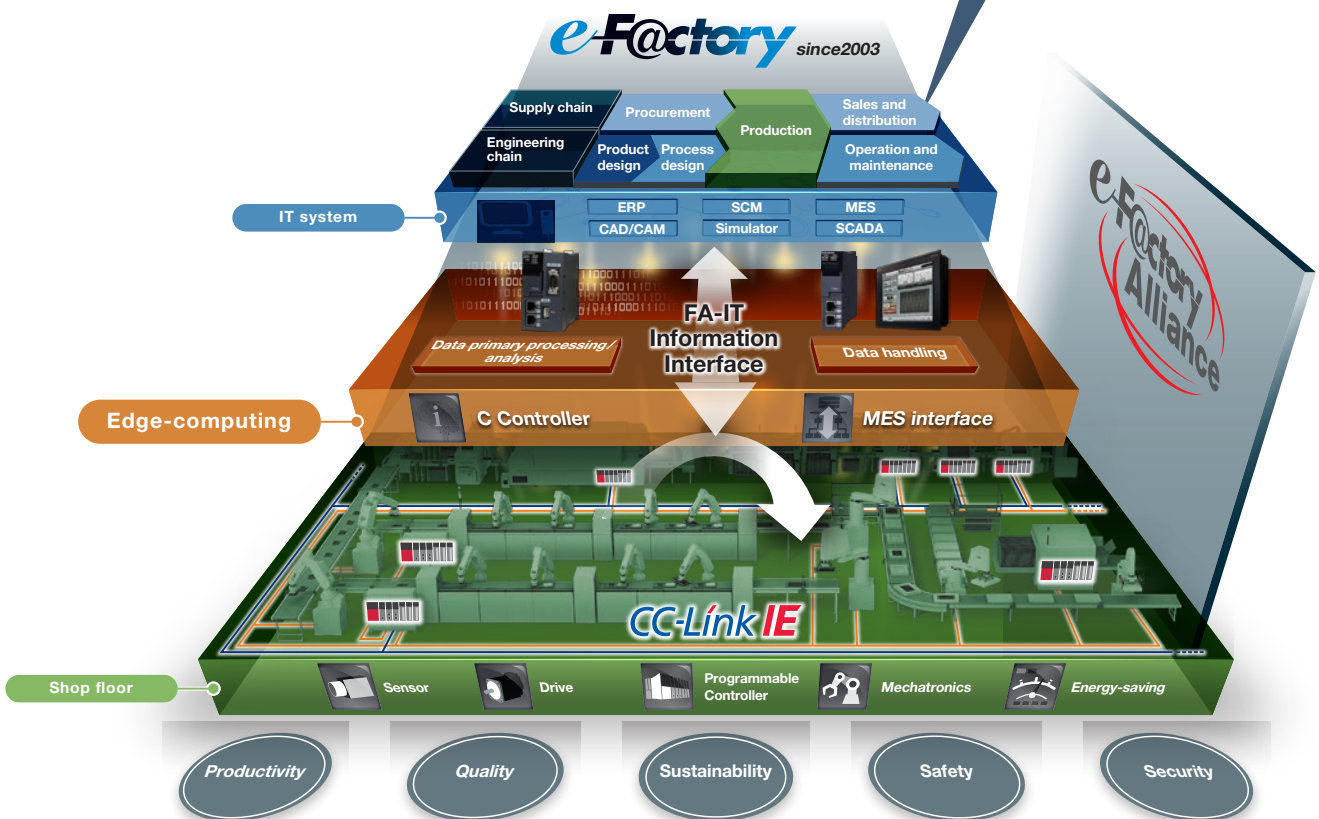
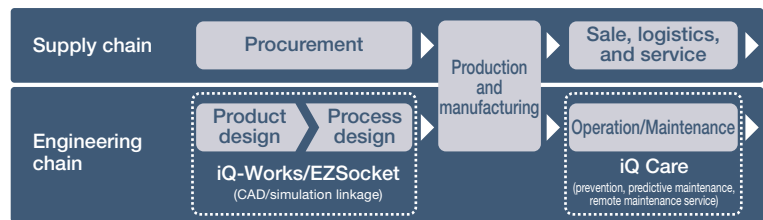


This solution solves customers' issues and concerns by enabling visualization and analysis that lead to improvements and increase availability at production sites.

Utilizing our FA and IT technologies and collaborating with e-Factory 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

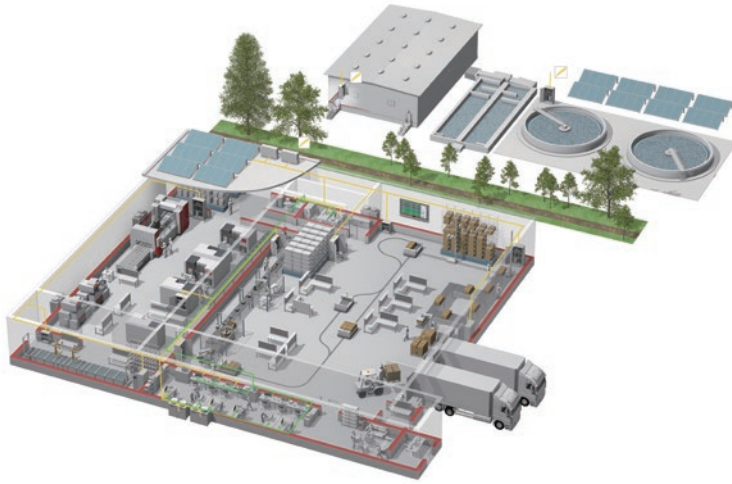


Overall production information is captured in addition to energy information, enabling the realization of efficient production and energy use (energy savings).

⚠ Safety Warning

To ensure proper use of the products listed in this catalog, please be sure to read the instruction manual prior to use.

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



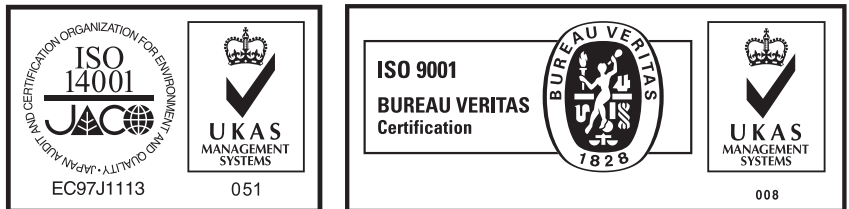
Processing machines: EDM, Lasers, IDS



Transformers, Air conditioning, Photovoltaic systems

* Not all products are available in all countries.

Mitsubishi Electric Corporation Nagoya Works is a factory certified for ISO14001 (standards for environmental management systems) and ISO9001 (standards for quality assurance management systems)



MITSUBISHI ELECTRIC CORPORATION

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