Information for Replacement of FR-HC Converters

Replacement model
FR- XC(-PWM) Converters

Size, connection, parameters, options concerning replacement are stated on the following pages.

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1. Size

The following table shows the installation space comparison for the replacement of the FR-HC series converter with the FR-XC(-PWM) converters used in common bus regeneration mode (harmonic suppression enabled).
For more information about the product size, refer to the outline dimension drawings on the following pages.

Input voltage	Existing high power factor converter	Reactor 1	Reactor 2	Outside box	New multifunction regeneration converter	Box-type reactor	Installation space comparison			
							High power factor converter	Panel cutout size	Reactor 1 Reactor 2	Outside box/Box-type reactor
Three-phase 200 V	FR-HC-55K	FR-HCL01-55K	FR-HCL02-55K	FR-HCB-55K	FR-XC-55K FR-XC-55K-PWM	FR-XCB-55K	Different	Different	Built into box-type reactor	Different
Three-phase 400 V	FR-HC-H55K	FR-HCL01-H55K	FR-HCL02-H55K	FR-HCB-H55K	FR-XC-H55K FR-XC-H55K-PWM	FR-XCB-H55K	Different	Different	Built into box-type reactor	Different

The harmonic suppression function is not pre-enabled in the FR-XC. Change the "9999" setting of **Pr.416 Control method selection** to "1" (harmonic suppression enabled).
The harmonic suppression function is pre-enabled in the FR-XC-PWM.
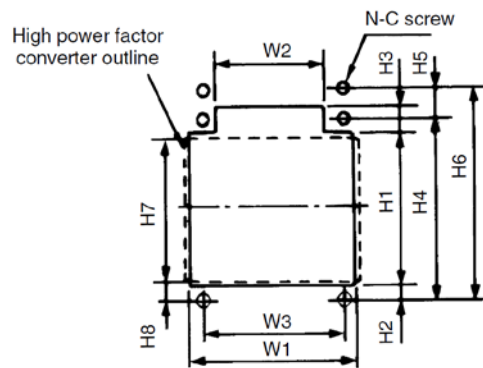Install the FR-XCB vertically.

Outline dimension drawings (Unit: mm)
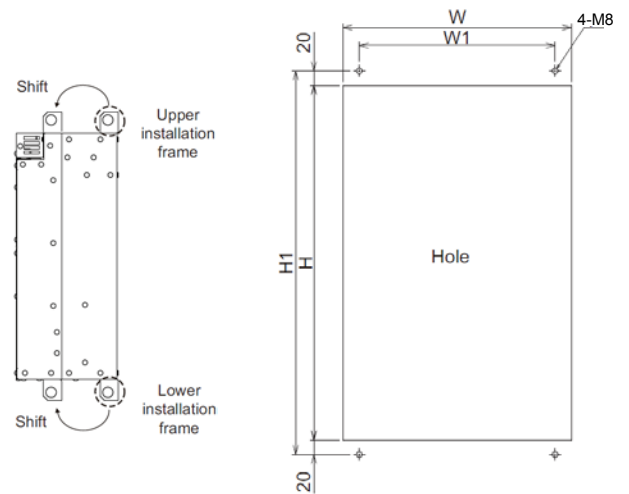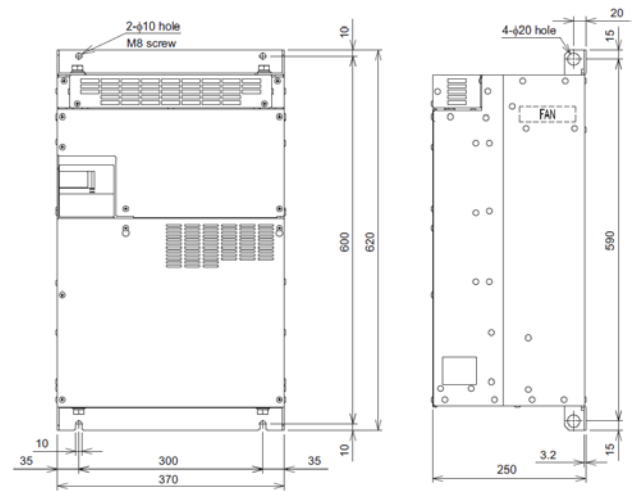## [Converter: 200 V class]

■FR-HC-55K
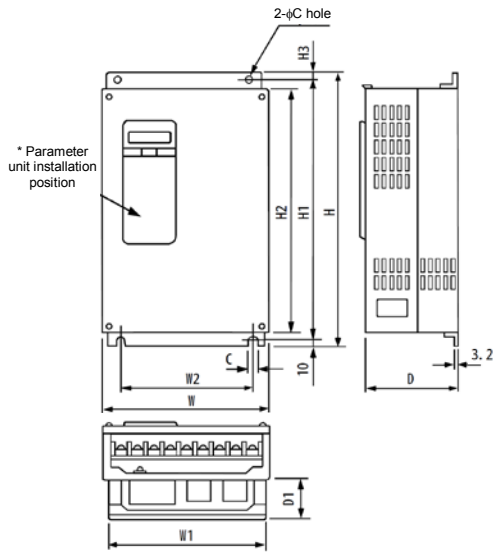
Converter model	W	W1	W2	H	H1	H2	D	C	H3	D1
FR-HC-55K	480	464	410	700	675	645	250	12	15	130

Panel cut dimensions
(when using the attachment FR-ACN08)

Converter model	W1	W2	W3	H1	H2	H3	H4	H5	H6	H7	H8	N	C
FR-HC-55K	470	390	430	650	15	70	-	-	730	645	24.5	4	M10

■FR-XC-55K(-PWM)

Converter model	W	W1	H	H1
FR-XC-55K	360	300	560	600

[Outside box: 200 V class]
■FR-HCB-55K
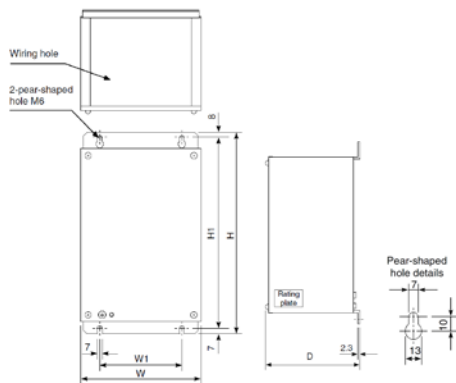
Model	H	H1	W	W1	D
FR-HCB-55K	450	435	270	200	203

[Reactor 1: 200 V class]

■FR-HCL01-55K
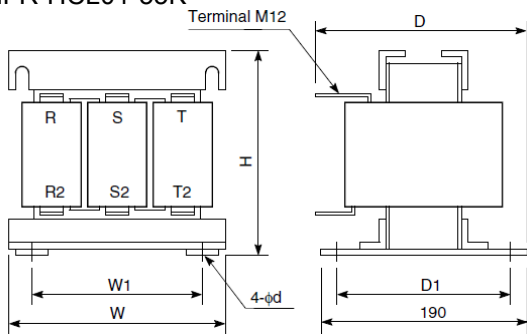
Model	H	W	H1	D	D1	d
FR-HCL01-H55K	260	210	165	225	160	8

[Reactor 2: 200 V class]

■FR-HCL02-55K
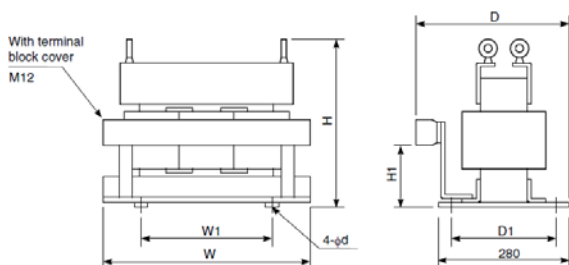
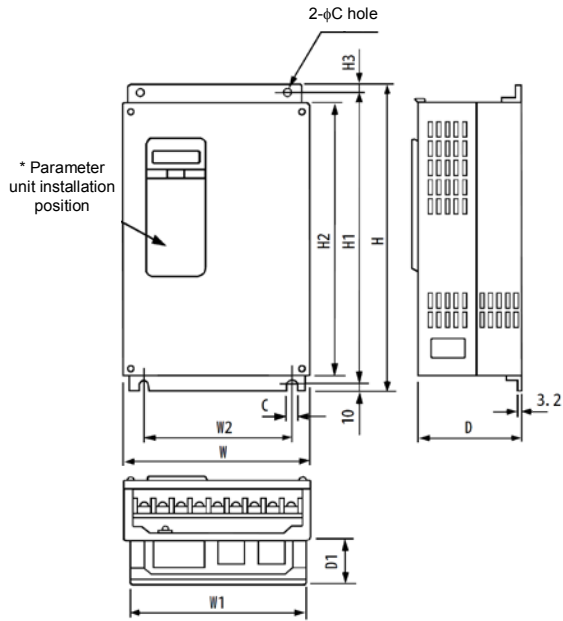| Model	H	H1	W	W1	D	D1	d
FR-HCL02-55K	470	240	430	270	360	240	10

■FR-XCB-55K
Reactors 1 and 2 are built into the box.
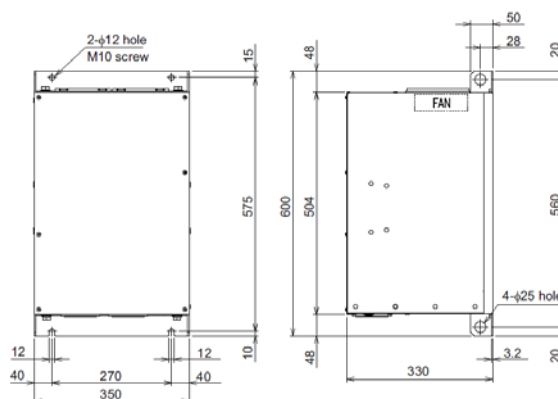
[Converter: 400 V class]

■FR-HC-H55K

Converter model	W	W1	W2	H	H1	H2	D	C	H3	D1
FR-HC-H55K	480	464	410	700	675	645	250	12	15	130

Panel cut dimensions
(when using the attachment FR-ACN08)
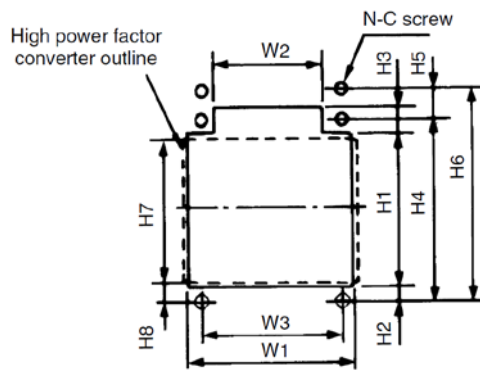
Converter model	W1	W2	W3	H1	H2	H3	H4	H5	H6	H7	H8	N	C
FR-HC-H55K	470	390	430	650	15	70	-	-	730	645	24.5	4	M10

■FR-XC-H55K(-PWM)
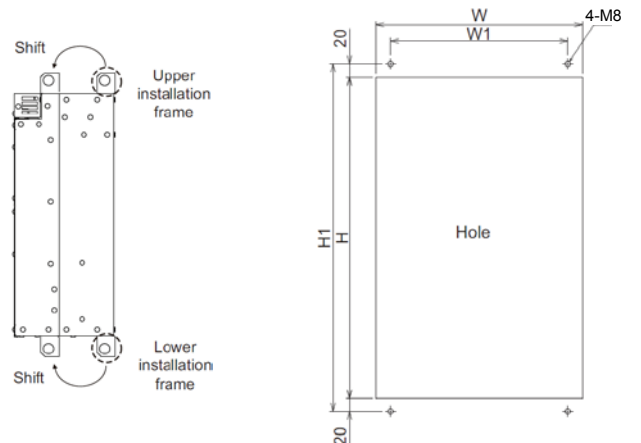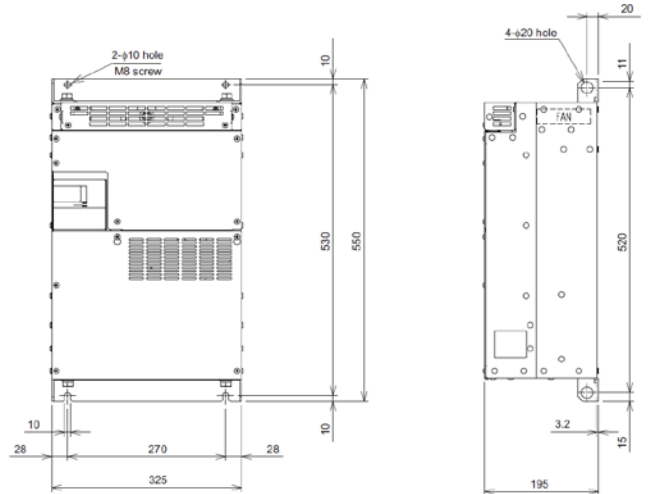
Converter model	W	W1	H	H1
FR-XC-H55K	315	270	490	530

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[Outside box: 400V class]
■FR-HCB-H55K

2-pear-shaped hole M6

Rating plate

Pear-shaped hole details
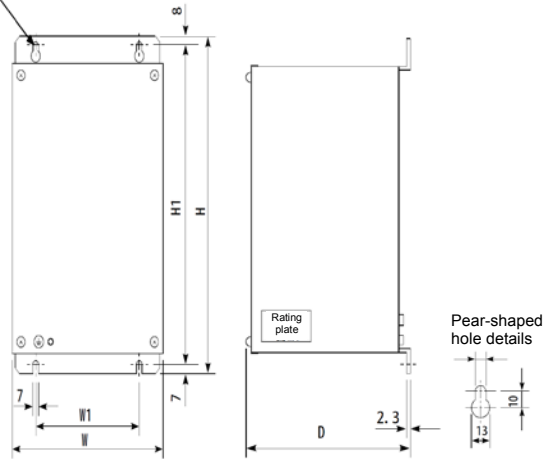
Model	H	H1	W	W1	D
FR-HCB-H55K	450	435	270	200	203

[Reactor 1: 400V class]
■FR-HCL01-H55K

4-φd
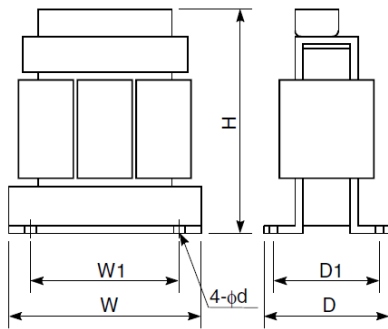
Model	H	W	W1	D	D1	d
FR-HCL01-H55K	255	280	255	190	112	8

[Reactor 2: 400V class]

■FR-HCL02-H55K

4-φd
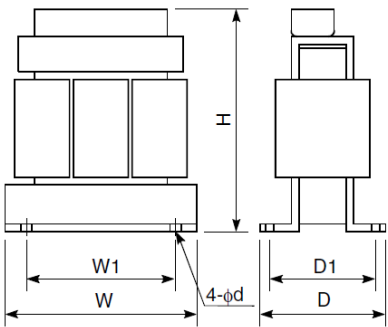
Model	H	W	W1	D	D1	d
FR-HCL02-H55K	380	400	270	285	240	10

■FR-XCB-H55K
  Reactors 1 and 2 are built into the box.

2-φ12 hole M10 screw

FAN

4-φ25 hole

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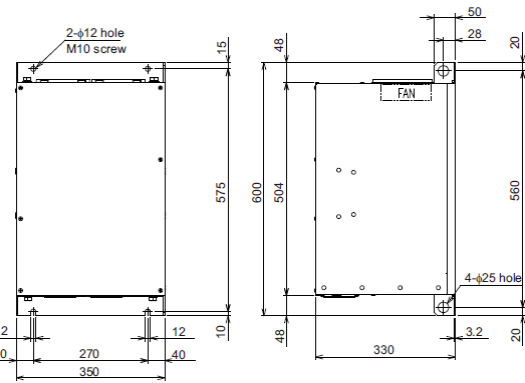
2. Wiring

The wiring of the new converters can follow the one of the existing converters as the terminal names between them are almost the same.

	Type			FR-HC terminal name	FR-XC(-PWM) compatible terminal name	Remarks
High power factor converter	Main circuit			R, S, T	R/L1, S/L2, T/L3	
				R4, S4, T4	R2/L12, S2/L22, T2/L32	Connect these terminals on the FR-XC(-PWM) to terminals of the same name on the FR-XCB.
				R1, S1	R1/L11, S1/L21	Terminals R1 and S1 on the FR-HC are not used.
				P, N	P/+, N/−	Do not use terminal P4 on the FR-XC(-PWM).
				⏚	⏚	
	Control circuit/input signal	Contact		MC1	-	An inrush current limit circuit is built into the FR-XC(-PWM).
				MC2		
				RES	RES	
				SOF	SOF	
				-	LOH	This is used to monitor the speed of cooling fan in the FR-XCB for overheat protection. In the sink logic, connect this terminal to terminal LOH1 on the FR-XCB.*1
				X1	-	The FR-XC(-PWM) does not have the compatible terminals.
				X2	-	
				SD	SD	
				-	PC	The FR-HC does not have terminal PC.
	Control circuit/output signal	Relay		A, B, C	A, B, C	
		Open collector		RDY	RYB	The number of terminals is different (FR-HC: Six, FR-XC(-PWM): Four).
				CV0	-	
				OL	-	
				Y1	-	
				Y2	-	
				RSO	RSO	
				SE	SE	To assign the IPF signal (used in the FR-HC), use terminal RYA.
					RYA	
		Pulse		FM	-	The FR-XC(-PWM) does not have terminal FM. Output for monitoring is enabled through CC-Link or RS-485 communication.
		Fan power		-	FAN	These are used for a power supply for the FR-XCB fan. Connect them to terminals FAN1 and SD on the FR-XCB.
					SD	
	Communi-cation	RS-485		-	PU connector	RS-485 communication is not available on the FR-HC.
	Function selection switch assembly			-	SW2	**Do not change the settings from the initial state.**
Reactor 1	Main circuit			R, S, T	-	The box-type reactor FR-XCB contains reactors 1 and 2, and only the FR-XCB is installed as the stand-alone reactor. It is not a fault if noise comes from the FR-XCB.
				R2, S2, T2	-	
				⏚	-	
Reactor 2	Main circuit			R3, S3, T3	-	
				R4, S4, T4	-	
				⏚	-	
Box-type reactor	Main circuit			-	R/L1, S/L2, T/L3	
				-	R2/L12, S2/L22, T2/L32	
				-	⏚	
				-	L0H1 *1	*1 In the sink logic, connect terminal LOH1 to the converter terminal LOH, and terminal LOH2 to the converter terminal SD. In the source logic, refer to the Instruction Manual of the converter.
				-	LOH2 *1	
				-	FAN1	
				-	SD	
Outside box	Main circuit			R2, S2, T2	-	
				R3, S3, T3		
				⏚		
	Control circuit output signal	Contact		MC1	-	
				MC2		

Main circuit terminal layout

The following shows the main circuit terminal layouts of the FR-HC series converters and the FR-XC(-PWM) series converters.
The main circuit terminal layout and the position of the earth (ground) terminal may differ depending on the capacity. Check the terminal names and positions before performing wiring.
If the cable used for the FR-HC series converters are not long enough for wiring of the FR-XC series converters, replace them with longer ones.

[200 V class]

■FR-HC-55K

■FR-HCL01-55K, FR-HCL02-55K
Screw size M12

■FR-HCB-55K
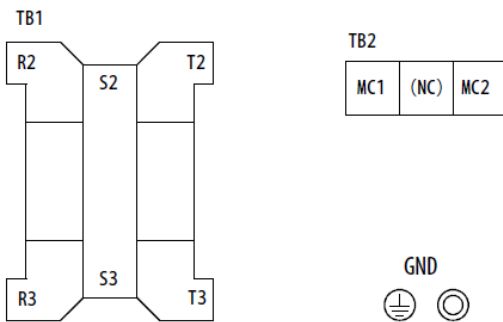
Model	TB1	TB2	GND
FR-HCB-55K	M8	M3.5	M6

■FR-XC-55K(-PWM)

■FR-XCB-55K

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[400 V class]

■FR-HC-H55K

Control circuit terminal block

Screw size M4

R1 S1

Charge lamp (yellow)

| R | S | T |

Screw size M5

| MC1 | (NC) | MC2 |

Screw size M3.5

| R4 | S4 | T4 |

| N | (NC) | P |

Screw size M8

(M6)
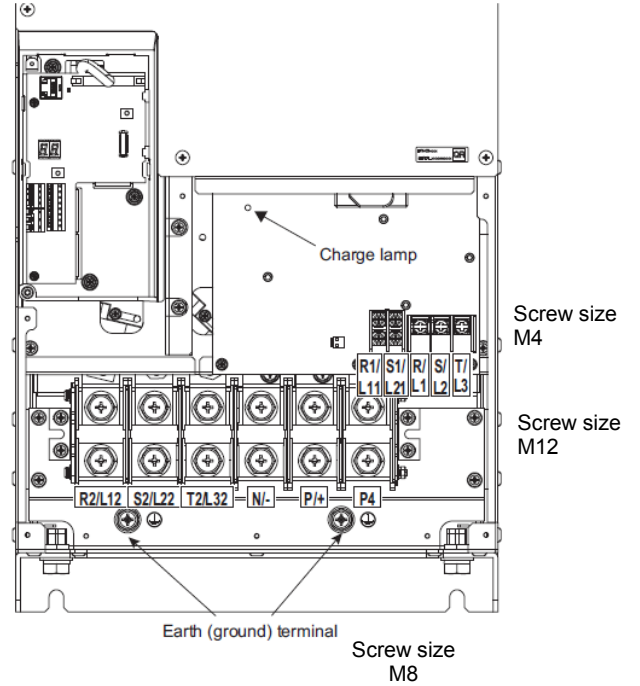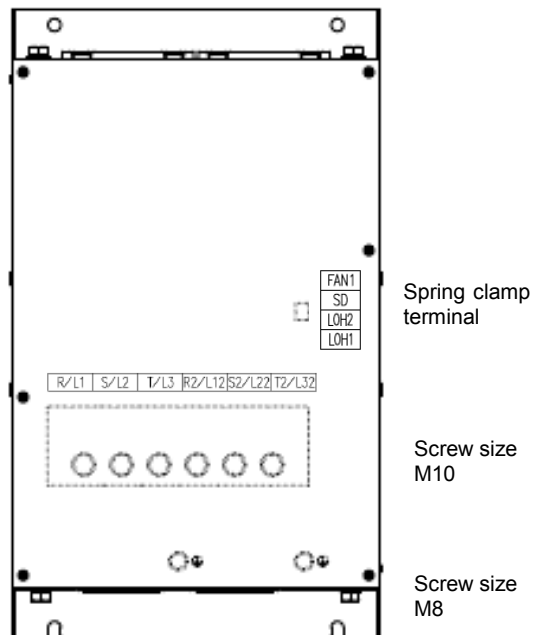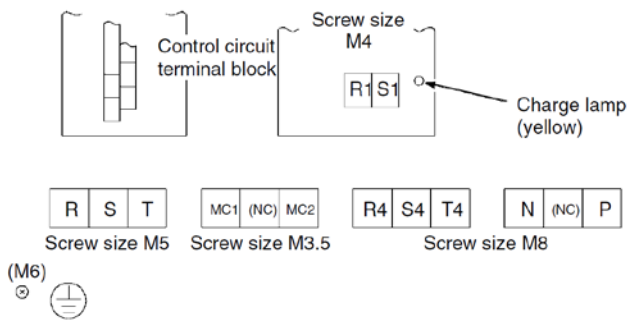
■FR-HCL01-H55K, FR-HCL02-H55K
Screw size M8

■FR-HCB-H55K

TB1

R2		T2
	S2	
	S3	
R3		T3

TB2

| MC1 | (NC) | MC2 |

GND

Model	TB1	TB2	GND
FR-HCB-H55K	M8	M3.5	M6

■FR-XC-H55K(-PWM)

Charge lamp

Screw size M4

R1/L11 S1/L21 R/L1 S/L2 T/L3

Screw size M8

R2/L12 S2/L22 T2/L32 N/- P/+ P4

Earth (ground) terminal

Screw size M8

■FR-XCB-H55K

FAN1
SD
LOH2
LOH1

Spring clamp terminal

R/L1 S/L2 T/L3 R2/L12 S2/L22 T2/L32

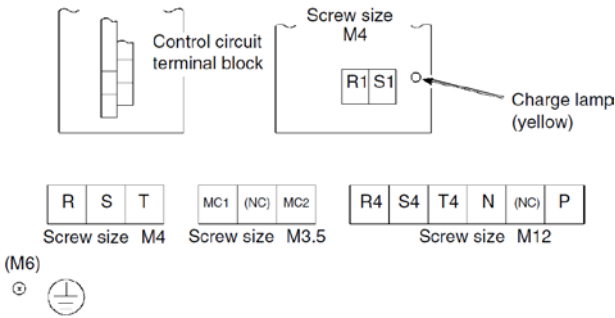Screw size M8

Screw size M8

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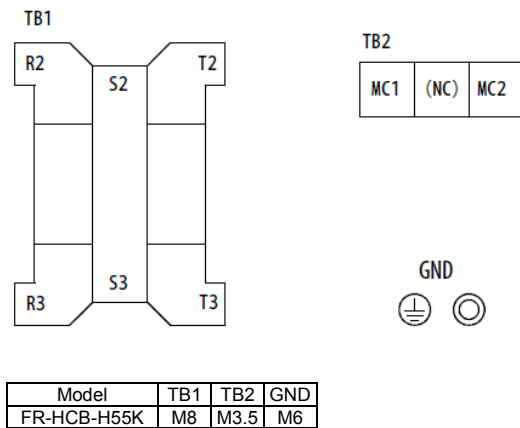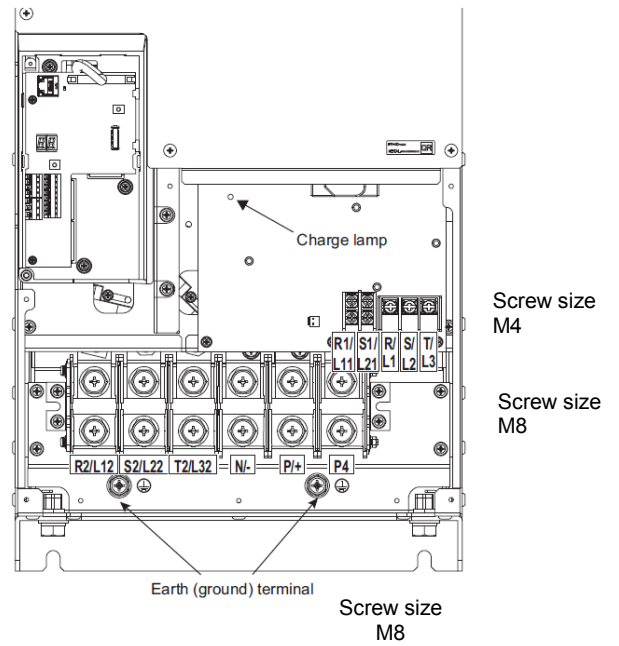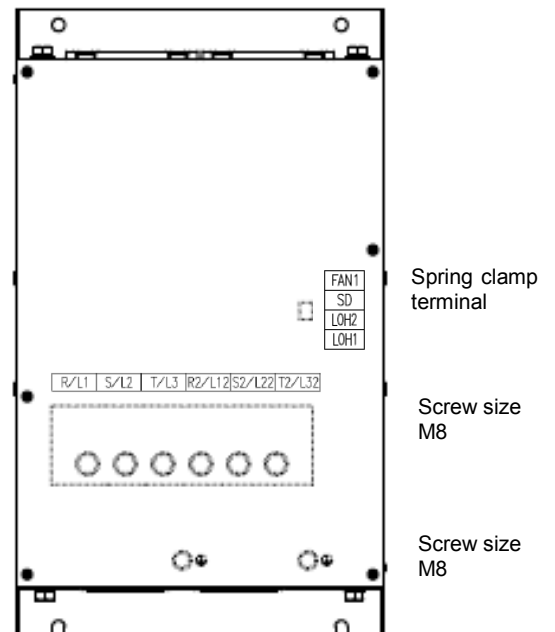
Control circuit terminal layout

The following shows the control circuit terminal layouts of the FR-HC series and the FR-XC(-PWM) series.
The control circuit terminal layout differs between the FR-HC and the FR-XC(-PWM) series. Check the terminal names and positions before performing wiring.

■FR-HC series converters

Terminal screw size：M3

Use wires whose gauge is 0.75 mm² or less.

■FR-XC(-PWM) series converters
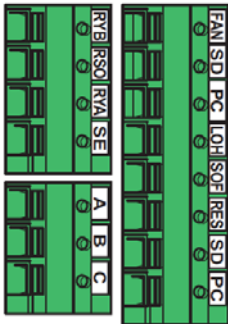
The recommended wire gauge is 0.3 to 1.25 mm².

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

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

(2) Use appropriate crimp terminals (ferrules, blade terminals, etc.).
Insert wires to the crimp terminal, and check that the wires come out for about 0 to 0.5 mm from a sleeve. Check the condition of the crimp terminals after crimping. Do not use the crimp terminals of which the crimping is inappropriate, or the face is damaged.
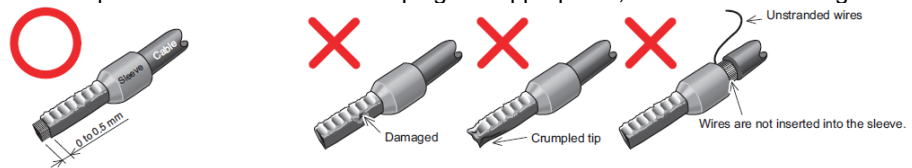
• Crimp terminals commercially available (as of January 2017)
Phoenix Contact Co., Ltd.

| Wire gauge (mm²)	Ferrule part No.			Crimping tool model No.
	With insulation sleeve	Without insulation sleeve	For UL wire*1	
0.3	AI 0,34-10TQ	—	—	CRIMPFOX 6
0.5	AI 0,5-10WH	—	AI 0,5-10WH-GB	
0.75	AI 0,75-10GY	A 0, 75-10	AI 0,75-10GY-GB	
1	AI 1-10RD	A 1-10	AI 1-10RD/1000GB	
1.25, 1.5	AI 1,5-10BK	A 1,5-10	AI 1,5-10BK/1000GB*2	
0.75 (two-wire product)	AI-TWIN 2×0,75-10GY	—	—	

*1 A ferrule with an insulation sleeve compatible with the MTW wire which has a thick wire insulation.
*2 Applicable for terminals A, B, and C.

NICHIFU Co., Ltd.

Wire gauge (mm²)	Blade terminal part No.	Insulation cap part No.	Crimping tool model No.
0.3 to 0.75	BT 0.75-11	VC 0.75	NH 69

(3) Insert each wire into the terminal.
When using single wire or stranded wires without a crimp terminal, push the open/close button all the way down with a flathead screwdriver, and insert the wire.

Wiring of main circuit

The following shows the connection diagram examples of the FR-HC series converters and the FR-XC(-PWM) series converters.
Note that some of the wiring are different for the high power factor converters.
Additionally, the wiring varies depending on the series of the inverter used with the converter. Before wiring, check the wiring shown on the Instruction Manual of the inverter.

■Connection example of the FR-HC series converters

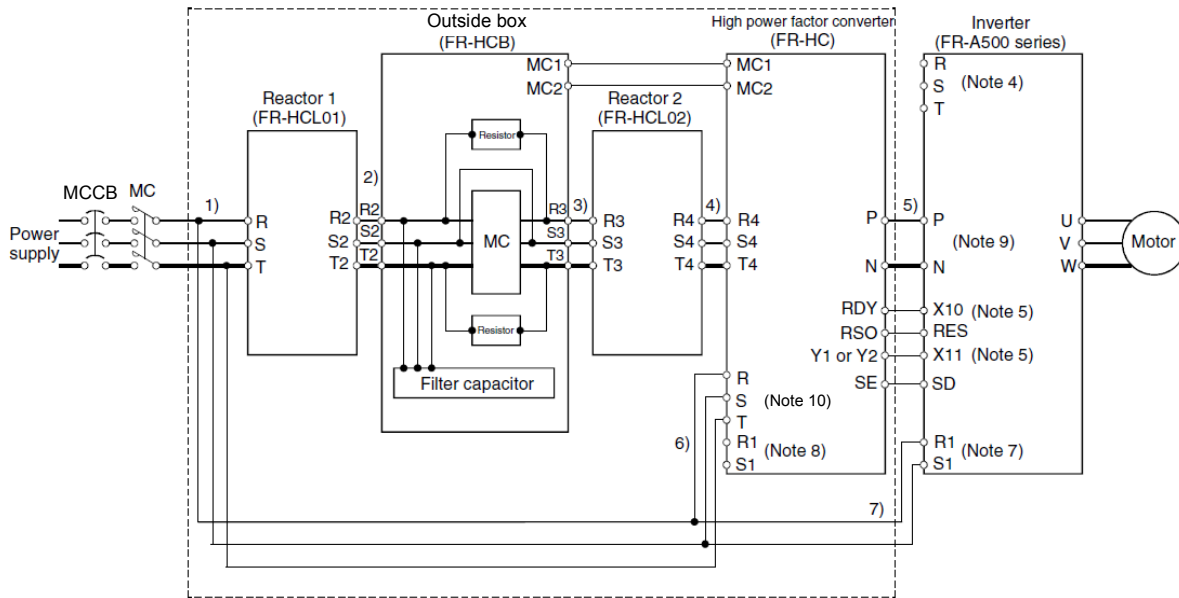Note: 1. Use care to minimize the wiring distance between respective terminals.
2. Before starting wiring, cover the top ventilation hole to prevent wire offcuts from entering.
3. Use the ground terminal to ground the equipment securely.
4. Keep the inverter's power input terminals R, S, T open. The inverter will be damaged if they are connected accidentally. Also, opposite polarity of terminals P, N will damage the high power factor converter and inverter.
5. The terminals used with the X10, X11 signals require their functions to be set. (Refer to the inverter instruction manual for details.)
6. Match the power supply phases before connecting terminals R4, S4, T4 and terminals R, S, T.
7. A different power supply may be supplied to terminals R1 and S1.
8. Keep the high power factor converter's terminals R1, S1 unconnected.
9. Do not insert the NFB between terminals P-N (P-P, N-N).
10. The R, S, T terminals of the high power factor converter (FR-HC) must be connected to the power supply. Running the inverter without connecting the terminals to the power supply will damage the high power factor converter (FR-HC).
11. Do not install an MCCB or MC between the branch points of wires for the input terminals R, S, and T of the converter and the input terminals R4, S4, and T4 of the converter (between point 1 to 4 in the diagram) on the power input cables. The inverter will not operate properly.

Number	Wiring
1)	Between the power supply and reactor 1
2)	Between the reactor 1 and outside box
3)	Between the outside box and reactor 2
4)	Between the reactor 2 and high power factor converter
5)	Between the high power factor converter and inverter
6)	Between the reactor 1 and high power factor converter
7)	Between the power supply and inverter
8)	Between the outside box and high power factor converter

■Connection example of the FR-XC(-PWM) series converters
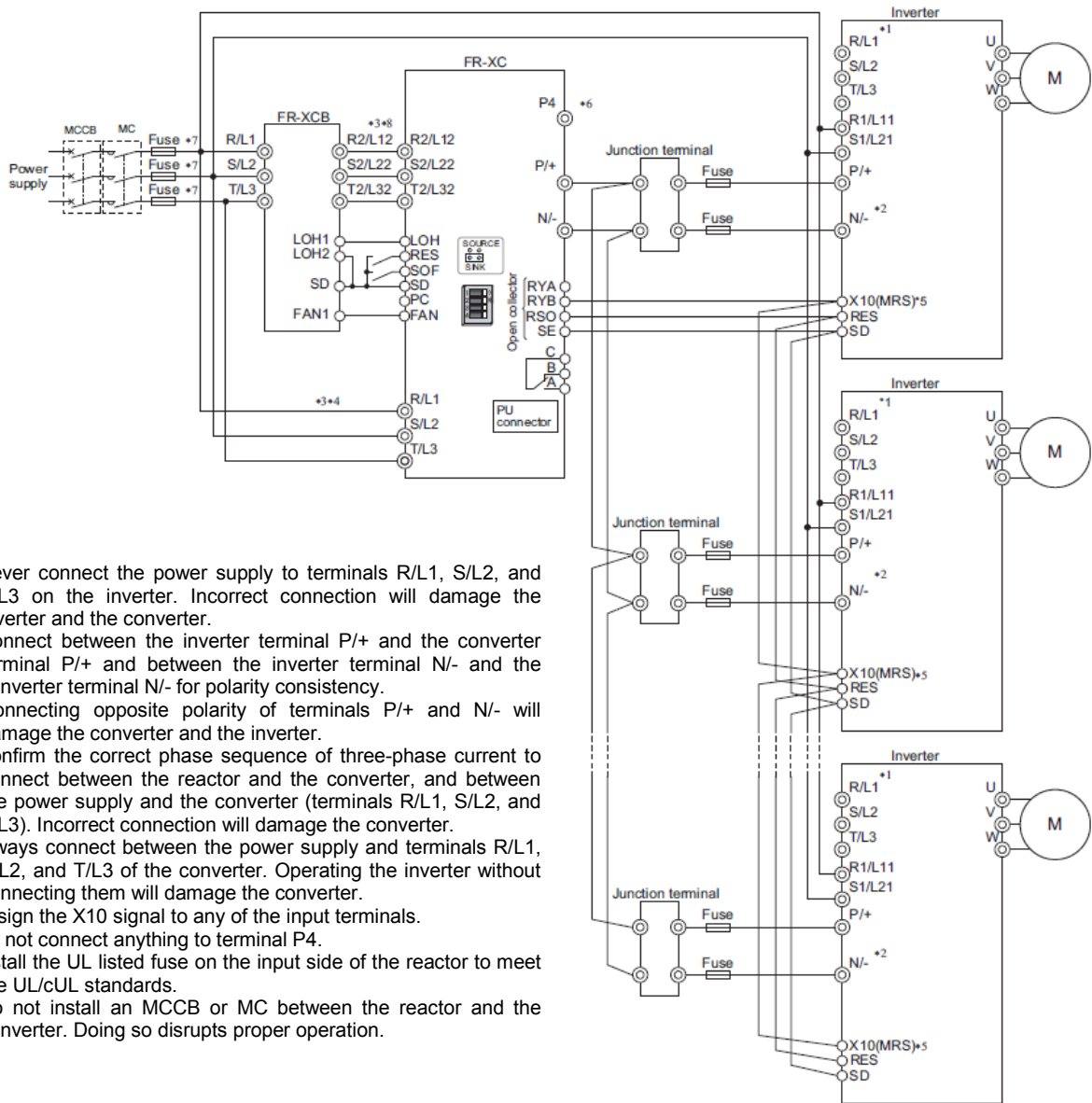
*1 Never connect the power supply to terminals R/L1, S/L2, and T/L3 on the inverter. Incorrect connection will damage the inverter and the converter.
*2 Connect between the inverter terminal P/+ and the converter terminal P/+ and between the inverter terminal N/- and the converter terminal N/- for polarity 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 converter (terminals R/L1, S/L2, and T/L3). Incorrect connection will damage the converter.
*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.
*6 Do not connect anything to terminal P4.
*7 Install the UL listed fuse on the input side of the reactor to meet the UL/cUL standards.
*8 Do not install an MCCB or MC between the reactor and the converter. Doing so disrupts proper operation.

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.

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3. Parameter

Some parameter numbers and setting values differ between two series converters. Refer to the remarks in the following table to set the parameters.

The harmonic suppression function is pre-enabled in the FR-XC-PWM. For the FR-XC series converters other than the FR-XC-PWM, change the **Pr.416** setting from "9999 (initial value)" to "1" (harmonic suppression enabled). In addition, switch the connection mode in the function selection switch assembly (SW2) to the common bus regeneration mode.

The number of the parameter in ▨ is different from that of the FR-HC series converters.

Setting ◎ : Use the same setting of the FR-HC converter.
△ : Change the setting of the FR-HC converter as needed.
× : Adjust and set the FR-XC(-PWM) parameter independently.

FR-HC parameter				FR-XC(-PWM) compatible parameter				Description about parameter setting	
Pr.	Name	Setting range	Initial value	Pr.	Name	Setting range	Initial value	Setting	Remarks
1	Power supply frequency 1	(Read only)	60.00 Hz	1	Maximum power supply frequency	(Read only)	60 Hz	◎	
2	Power supply frequency 2	(Read only)	50.00 Hz	2	Minimum power supply frequency	(Read only)	50 Hz	◎	
22	Overload signal detection level	0 to 200%	150%	22	Current limit level	0 to 190%	150%	◎	
40	Output terminal assignment	0 to 33	1	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	△	The number of terminals is different (FR-HC: Six, FR-XC(-PWM): Four).
				12	RYA terminal function selection		0	△	To assign the IPF signal (used in the FR-HC), use terminal RYA
				16	ABC terminal function selection		99	△	
51	Input power monitoring reference	0 to 100 kW	Rated power	-					This function is not available since the FR-XC(-PWM) does not have terminal FM.
52	PU main display data selection	0 to 3333	123	52	PU main monitor selection	0, 5 to 10, 25, 28	0	×	The initial value differs between two series converters.
53	Input voltage monitoring reference	0 to 500.0 V	220 V/ 440 V	-					This function is not available since the FR-XC(-PWM) does not have terminal FM.
54	FM terminal function selection	0 to 3333	123	-					
55	Bus voltage monitoring reference	0 to 1000.0 V	340 V/ 680 V	-					
56	Current monitoring reference	0 to 500 A	Rated current	-					
57	Restart selection	0.9999	9999	57	Restart selection	0, 9999	9999	◎	
65	Retry selection	0, 1, 2, 3	0	65	Retry selection	0 to 4	0	×	When not using the retry function, set **Pr.67** to "0".
67	Number of retries at alarm occurrence	0 to 10, 101 to 110	0	67	Number of retries at fault occurrence	0 to 10, 101 to 110, 1000 to 1010, 1100 to 1110	0	△	
68	Retry waiting time	0.1 to 360.0 s	1.0 s	68	Retry waiting time	0.1 to 600.0 s	1.0 s	◎	
69	Retry count display erasure	0	0	69	Retry count display erase	0	0	◎	
77	Parameter write disable selection	1, 2	2	77	Parameter write selection	1, 2	2	◎	
145	Parameter unit language switching	0, 1, 2, 3	0	145	PU display language selection	0 to 7	0	△	
-				415	SW2 setting status	0 to 15 (Read only)	15		The setting of the function selection switch assembly (SW2) can be checked. **Set the connection mode in the SW2 to the common bus regeneration mode.**
-				416	Control method selection	0, 1, 9999	9999	×	For the FR-XC, set **Pr.416** to "1" (harmonic suppression enabled). The harmonic suppression function is pre-enabled in the FR-XC-PWM.
900	FM terminal calibration	—	—	-					This function is not available since the FR-XC(-PWM) does not have terminal FM.

Pr.30 Regenerative function selection in the inverter parameters must be set.

To use the converter in the common bus regeneration mode, select the setting for a power regeneration common converter or high power factor converter (Example: Set "2" in **Pr.30** in the FR-A800 inverters).

When **Pr.416** in the FR-XC(-PWM) converter = "1", set the rated motor voltage in **Pr.19 Base frequency voltage** (under V/F control) or **Pr.83 Rated motor voltage** (under control other than V/F control) in the inverter.

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