Information for Replacement of FR-RC Series with FR-XC Series

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

1. Size

The following table shows the installation size required when replacing the FR-RC series converter with the FR XC-series converter.

For details of the sizes, refer to the outline dimension drawings on the following pages.

Power supply voltage	Existing product		New product (Selection condition: FR-RC capacity = motor capacity)∗3			Installation size comparison		
	Power regeneration converter	Power factor improving AC reactor (option)	Multifunction regeneration converter	Function selection switch	Dedicated stand-alone reactor (option) ∗2	Converter	Stand-alone reactor	Panel cutting
Three-phase 200 V	FR-RC-15K	FR-BAL-15K/22K	FR-XC-15K *1 encased in enclosure with its heatsink protruded	Common bus regeneration mode	FR-XCL-15K	Different	Different	Different
			FR-XC-15K *1 encased in enclosure using FR-XCCP02	Common bus regeneration mode				
	FR-RC-30K	FR-BAL-30K/37K	FR-XC-30K *1 encased in enclosure with its heatsink protruded	Common bus regeneration mode	FR-XCL-30K	Different	Different	Different
			FR-XC-30K *1 encased in enclosure using FR-XCCP03	Common bus regeneration mode				
	FR-RC-55K	FR-BAL-55K	FR-XC-55K encased in enclosure	Common bus regeneration mode	FR-XCL-55K	Different	Different	Different
Three-phase 400 V	FR-RC-H15K	FR-BAL-H15K/H22K	FR-XC-H15K *1 encased in enclosure with its heatsink protruded	Common bus regeneration mode	FR-XCL-H15K	Different	Different	Different
			FR-XC-H15K *1 encased in enclosure using FR-XCCP02	Common bus regeneration mode				
	FR-RC-H30K	FR-BAL-H37K	FR-XC-H30K *1 encased in enclosure with its heatsink protruded	Common bus regeneration mode	FR-XCL-H30K	Different	Different	Different
			FR-XC-H30K *1 encased in enclosure using FR-XCCP03	Common bus regeneration mode				
	FR-RC-H55K	FR-BAL-H55K	FR-XC-H55K encased in enclosure	Common bus regeneration mode	FR-XCL-H55K	Different	Different	Different

∗1 Slim design model.

∗2 Install the FR-XCL on a horizontal surface.

∗3 The product selection on the other selection conditions are as follows.

FR-RC-(H)15K

Selection condition Capacity ratio of the FR-RC and a motor	FR-XC function selection switch	FR-XC-(H) capacity	FR-XCL-(H) capacity
FR-RC capacity > motor capacity	Common bus regeneration mode (motor capacity: 7.5K to 22K)	Motor capacity∗	
FR-RC capacity = motor capacity			
FR-RC capacity < motor capacity			

1. For the 18.5 kW motor, select the FR-XC-(H)22K and FR-XCL-(H)22K.
2. ∗ shows the selection criteria on the condition where the inverter capacity equals to the motor capacity. Select either the inverter capacity, whichever is larger.
3. If it is required to achieve K32 (the conversion factor) = 1.8 shown in the Harmonic suppression guideline as is the case in the existing converter, connect two FR-XCL reactors in series.

FR-RC-(H)30K

Selection condition Capacity ratio of the FR-RC and a motor	FR-XC function selection switch	FR-XC-(H) capacity	FR-XCL-(H) capacity	Capacity and required number of AC reactor FR-HAL-(H)
FR-RC capacity > motor capacity	Common bus regeneration mode (motor capacity: 15K to 45K)	Motor capacity∗		Not required
FR-RC capacity = motor capacity				
FR-RC capacity < motor capacity	Power regeneration mode (motor capacity: 45K)	37 K		45 K, 1

1. For the 18.5 kW motor, select the FR-XC-(H)22K and FR-XCL-(H)22K. For the 45 kW motor used with the FR-XC series converter in the common bus regeneration mode, select the FR-XC-(H)55K and FR-XCL-(H)55K.
2. If the FR-XC-(H)37K converter and FR-XCL-(H)37K reactor are selected for the 30 kW motor instead of the 30K converter and reactor, this selection enables easier replacement as the dimensions of them are less than almost all of the existing products. For details, refer to the selection table.
3. The FR-XC-(H)37K and FR-XCL-(H)37K can be selected for the 45 kW motor when the motor is used with the FR-XC series converter in the power regeneration mode. However, this selection requires the additional installation of AC reactor FR-HAL, and they need more installation spaces than those of the existing products. For details, refer to the selection table.
   If the use of the FR-BAL-30K/(H)37K which has been used with the existing products does not bring low insulation resistance, they can be used instead of the FR-HAL-(H)45K.
4. ∗ shows the selection criteria on the condition where the inverter capacity equals to the motor capacity. Select either the inverter capacity, whichever is larger.
5. If it is required for the FR-XC series converter in the common bus regeneration mode to achieve K32 (the conversion factor) = 1.8 shown in the Harmonic suppression guideline as is the case in the existing converter, connect two FR-XCL reactors in series.

FR-RC-(H)55K

Selection condition Capacity ratio of the FR-RC and a motor	FR-XC function selection switch	FR-XC-(H) capacity	FR-XCL-(H) capacity
FR-RC capacity > motor capacity	Common bus regeneration mode (motor capacity: 30K to 55K)	Motor capacity∗	
FR-RC capacity = motor capacity			

1. For the 45K motor, select the FR-XC-(H)55K and FR-XCL-(H)55K.
2. If the FR-XC-(H)37K converter and FR-XCL-(H)37K reactor are selected for the 30 kW motor instead of the 30K converter and reactor, this selection enables easier replacement as the dimensions of them are less than almost all of the existing products. For details, refer to the selection table.
3. ∗ shows the selection criteria on the condition where the inverter capacity equals to the motor capacity. Select either the inverter capacity, whichever is larger.
4. If it is required to achieve K32 (the conversion factor) = 1.8 shown in the Harmonic suppression guideline as is the case in the existing converter, connect two FR-XCL reactors in series.

For details, refer to the following selection table.

Existing FR-RC replacement selection table

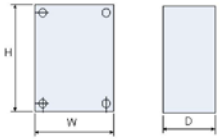
Voltage	FR-RC model name	Function selection		Motor capacity (inverter capacity) 7.5 kW	11 kW	15 kW	18.5 kW	22 kW	30 kW	37 kW	45 kW	55 kW
200 V	FR-RC-15K	Common bus regeneration mode*2	FR-XC model name	FR-XC-7.5K FR-XCL-7.5K	FR-XC-11K FR-XCL-11K	FR-XC-15K FR-XCL-15K	FR-XC-22K FR-XCL-22K					
			Additional space required for installation of new products	Depth of the FR-XC When encased in enclosure: +120 mm When encased in enclosure with its heatsink protruded: +92 mm (inside enclosure), +6 mm (protrusion)		Depth of the FR-XC When encased in enclosure: +125 mm When encased in enclosure with its heatsink protruded: +92 mm (inside enclosure), +6 mm (protrusion)	Depth of the FR-XC When encased in enclosure: +121 mm When encased in enclosure with its heatsink protruded: +92 mm (inside enclosure), +13 mm (protrusion) Max. depth of the FR-XCL: +7 mm					
	FR-RC-30K	Common bus regeneration mode*2	FR-XC model name			FR-XC-15K FR-XCL-15K	FR-XC-22K FR-XCL-22K		FR-XC-30K FR-XCL-30K	FR-XC-37K FR-XCL-37K	FR-XC-37K FR-XCL-37K	FR-XC-55K FR-XCL-55K
			Additional space required for installation of new products			Depth of the FR-XC When encased in enclosure: +125 mm When encased in enclosure with its heatsink protruded: +95 mm (inside enclosure), +3 mm (protrusion)	Depth of the FR-XC When encased in enclosure: +121 mm When encased in enclosure with its heatsink protruded: +95 mm (inside enclosure), +10 mm (protrusion)		Depth of the FR-XC When encased in enclosure with its heatsink protruded: +95 mm (inside enclosure), +10 mm (protrusion)	Depth of the FR-XC When encased in enclosure with its heatsink protruded: +15 mm (protrusion) Max. depth of the FR-XCL: +20 mm	All dimensions of the FR-XC When encased in enclosure: W +30 mm, H +20 mm, D +55 mm When encased in enclosure with its heatsink protruded: W +30 mm, H +20 mm, D +10 mm (inside enclosure), +45 mm (protrusion) Max. depth of the FR-XCL: +41 mm	
		Power regeneration mode	FR-XC model name								FR-XC-37K FR-XCL-37K FR-HAL-45K×1 *1	
			Additional space required for installation of new products								Depth of the FR-XC When encased in enclosure with its heatsink protruded: +15 mm (protrusion) Installation space for FR-XCL is required.	
	FR-RC-55K	Common bus regeneration mode*2	FR-XC model name						FR-XC-30K FR-XCL-30K	FR-XC-37K FR-XCL-37K	FR-XC-37K FR-XCL-37K	FR-XC-55K FR-XCL-55K
			Additional space required for installation of new products						Depth of he FR-XC When encased in enclosure: +66 mm When encased in enclosure with its heatsink protruded: +85 mm (inside enclosure)			Max. depth of the FR-XCL: +20 mm
400 V	FR-RC-H15K	Common bus regeneration mode*2	FR-XC model name	FR-XC-H7.5K FR-XCL-H7.5K	FR-XC-H11K FR-XCL-H11K	FR-XC-H15K FR-XCL-H15K	FR-XC-H22K FR-XCL-H22K					
			Additional space required for installation of new products	Depth of the FR-XC When encased in enclosure: +120 mm When encased in enclosure with its heatsink protruded: +95 mm (inside enclosure), +3 mm (protrusion)		Depth of the FR-XC When encased in enclosure: +125 mm When encased in enclosure with its heatsink protruded: +95 mm (inside enclosure), +3 mm (protrusion) Max. depth of the FR-XCL: +5 mm	Depth of the FR-XC When encased in enclosure: +121 mm When encased in enclosure with its heatsink protruded: +95 mm (inside enclosure), +10 mm (protrusion) Max. depth of the FR-XCL: +20 mm					
	FR-RC-H30K	Common bus regeneration mode*2	FR-XC model name			FR-XC-H15K FR-XCL-H15K	FR-XC-H22K FR-XCL-H22K		FR-XC-H30K FR-XCL-H30K	FR-XC-H37K FR-XCL-H37K	FR-XC-H37K FR-XCL-H37K	FR-XC-H55K FR-XCL-H55K
			Additional space required for installation of new products			Depth of the FR-XC When encased in enclosure: +125 mm When encased in enclosure with its heatsink protruded: +95 mm (inside enclosure), +3 mm (protrusion)	Depth of the FR-XC When encased in enclosure: +121 mm When encased in enclosure with its heatsink protruded: +95 mm (inside enclosure), +10 mm (protrusion)		Depth of the FR-XC When encased in enclosure: +121 mm When encased in enclosure with its heatsink protruded: +95 mm (inside enclosure), +10 mm (protrusion)	Depth of the FR-XC When encased in enclosure with its heatsink protruded: +15 mm (protrusion) Max. depth of the FR-XCL: +11 mm	Depth of the FR-XC When encased in enclosure with its heatsink protruded: +15 mm (protrusion) Max. depth of the FR-XCL: +11 mm	
		Power regeneration mode	FR-XC model name								FR-XC-H37K FR-XCL-H37K FR-HAL-H45K×1 *1	
			Additional space required for installation of new products								Depth of the FR-XC When encased in enclosure with its heatsink protruded: +15 mm (protrusion) Installation space for FR-XCL is required.	
	FR-RC-H55K	Common bus regeneration mode*2	FR-XC model name						FR-XC-H30K FR-XCL-H30K	FR-XC-H37K FR-XCL-H37K	FR-XC-H37K FR-XCL-H37K	FR-XC-H55K FR-XCL-H55K
			Additional space required for installation of new products						Depth of the FR-XC When encased in enclosure: +66 mm When encased in enclosure with its heatsink protruded: +85 mm (inside enclosure)	Max. depth of the FR-XCL: +11 mm		Max. depth of the FR-XCL: +11 mm

*1 The FR-XC-(H)37K and FR-XCL-(H)37K can be selected for the 45 kW motor when the motor is used with the FR-XC series converter in the power regeneration mode. However, the AC reactor FR-HAL is required and this selection has a disadvantages on installation size. For details, refer to the selection table.
If the use of the FR-BAL-30K / (H)37K which has been used with the existing products does not bring low insulation resistance, they can be used instead of the FR-HAL-(H)45K.

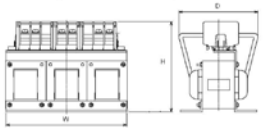
*2 If it is required for the FR-XC series converter in the common bus regeneration mode to achieve K32 (the conversion factor) = 1.8 shown in the Harmonic suppression guideline as is the case in the existing converter, connect two FR-XCL reactors in series.

Product outline for W × H × D

FR-XC (vertical installation)



FR-XCL (horizontal installation)

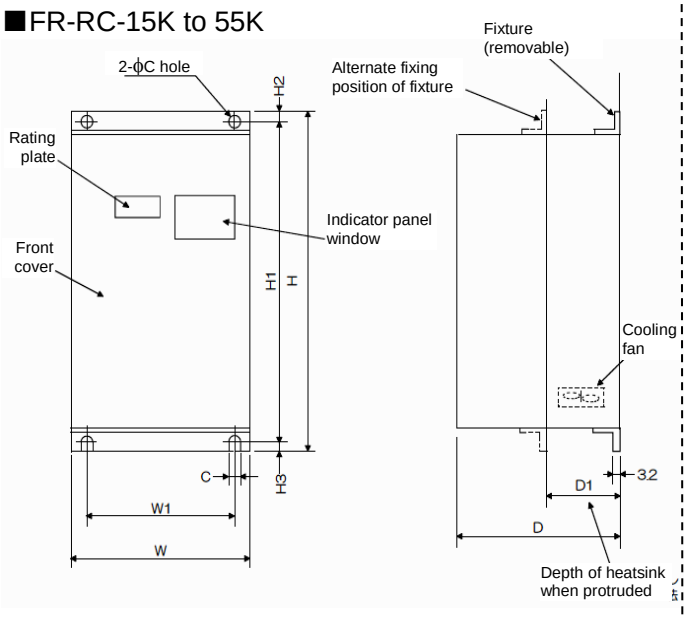


Outline dimension drawings (Unit: mm)

【Power regeneration converter】

200 V class

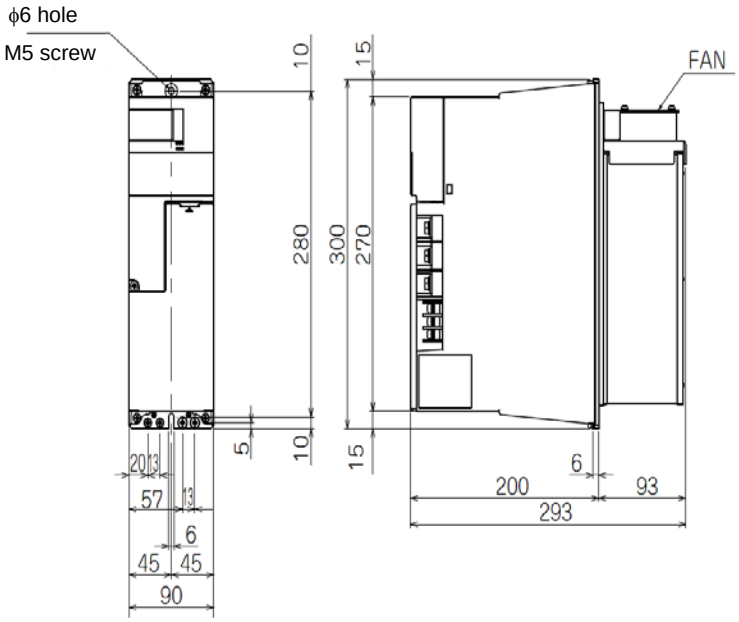
■FR-RC-15K to 55K



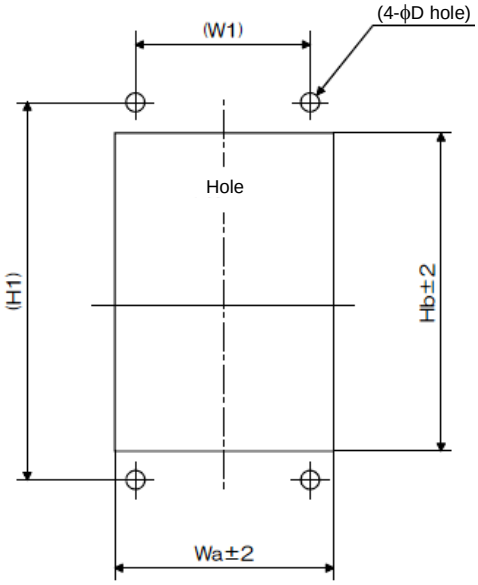
	Model	W	W1	H	H1	H2	H3	D	D1	C
200 V	FR-RC-15K	270	200	450	432	10	8	195	87	10
	FR-RC-30K	340	270	600	582	10	8	195	90	10
	FR-RC-55K	480	410	700	670	15	15	250	135	12

For installation in an enclosure with its heatsink protruded

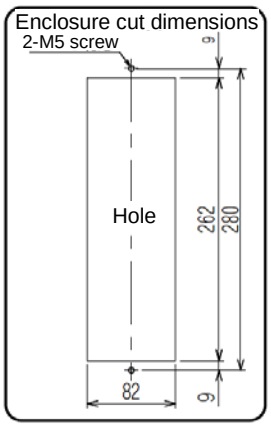
■FR-XC-7.5K, 11K



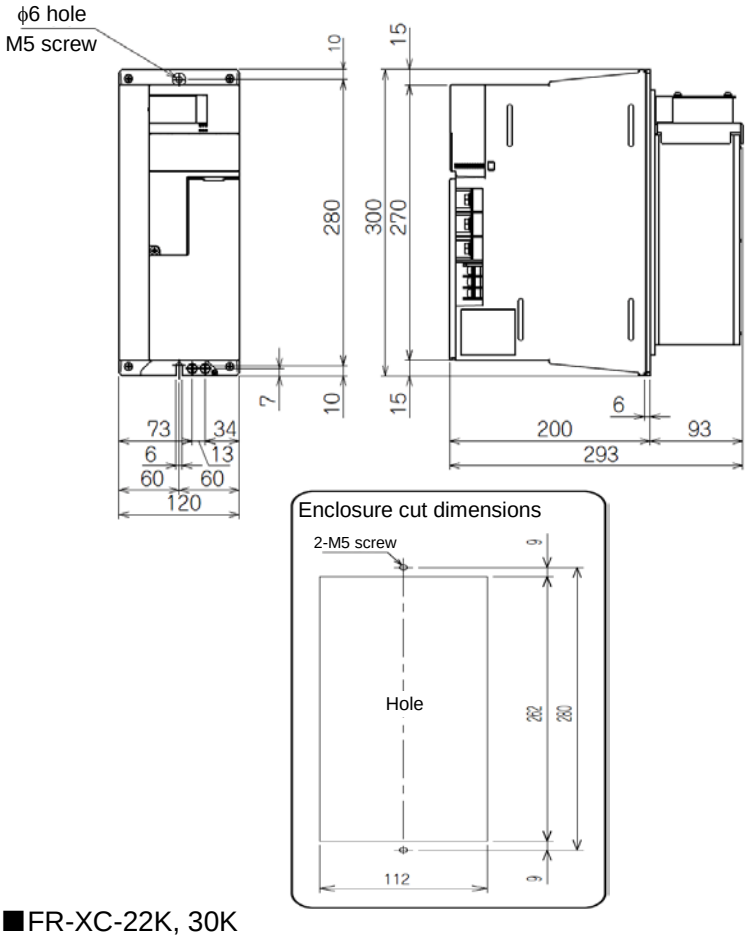
Enclosure cut dimensions



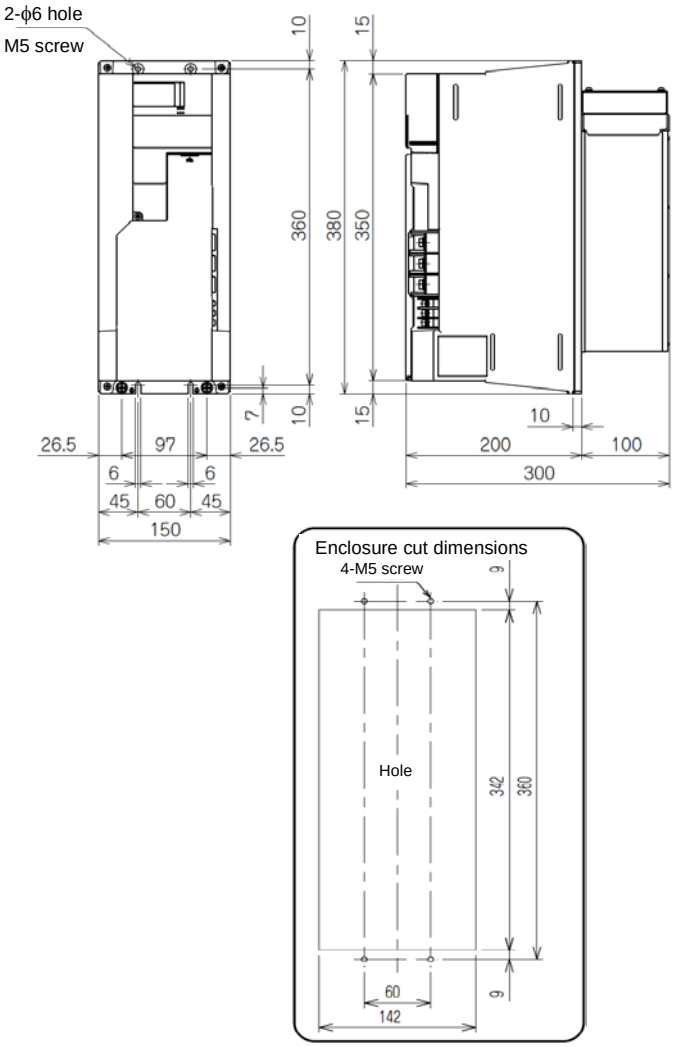
	Model	Wa	Hb	D
200 V	FR-RC-15K	260	412	10
	FR-RC-30K	330	562	10
	FR-RC-55K	470	642	12



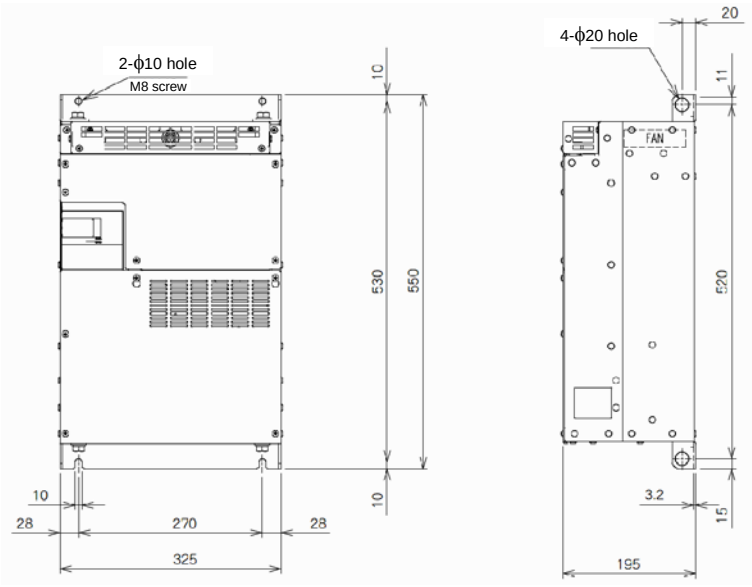
■FR-XC-15K



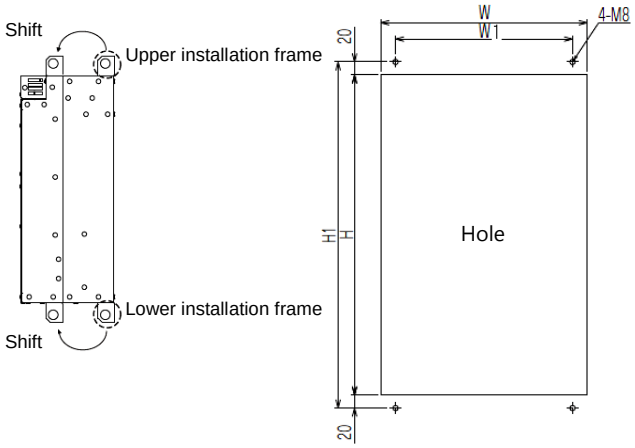
■FR-XC-22K, 30K



■FR-XC-37K

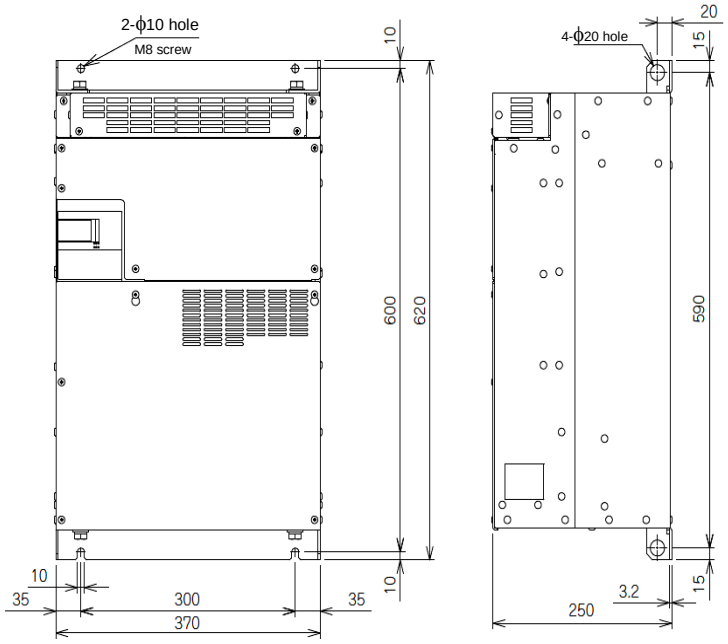


Enclosure cut dimensions

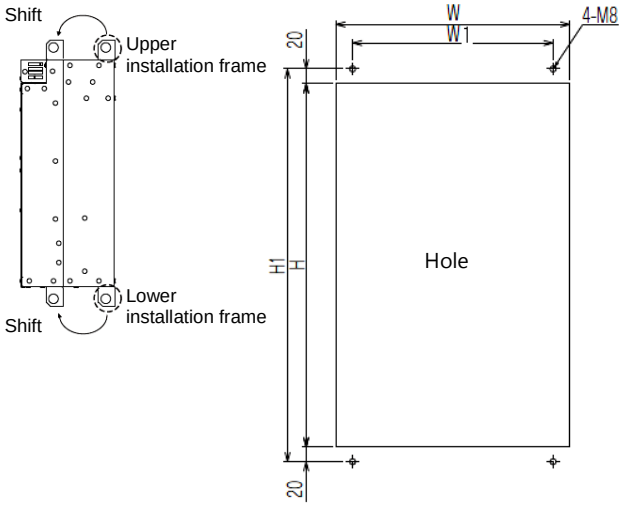


Model	W	W1	H	H1
FR-XC-37K	315	270	490	530

■FR-XC-55K

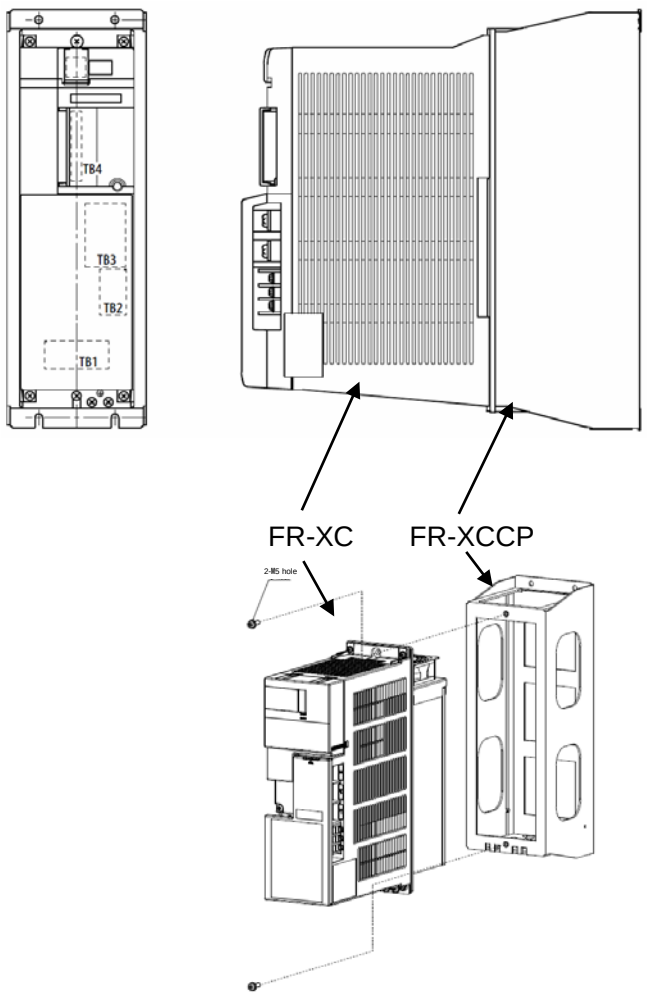


Enclosure cut dimensions



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

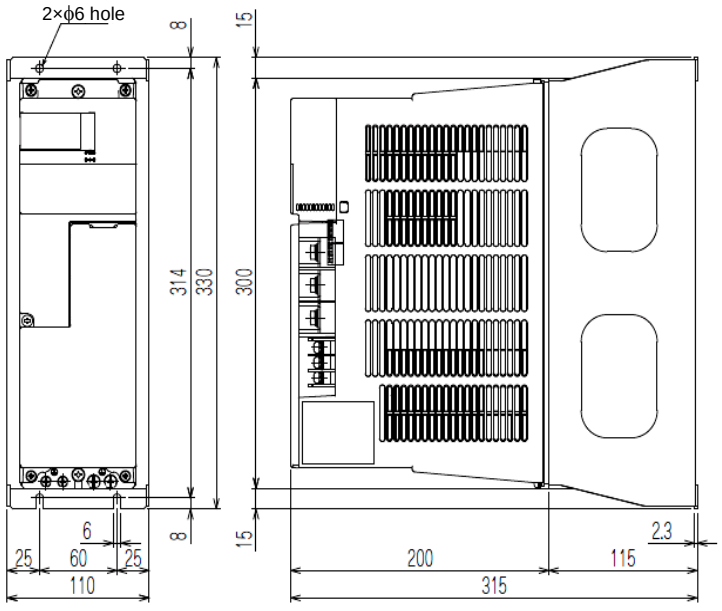
For installation with all components encased in an enclosure



Use the FR-XCCP, converter installation attachment for enclosure (option), to install the multifunction regeneration converter inside an enclosure.

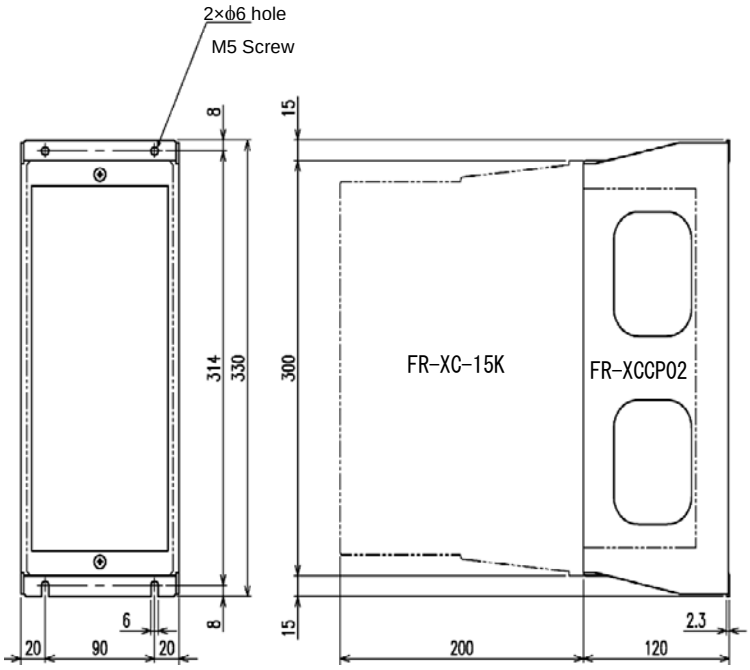
■FR-XC-7.5K, 11K with FR-XCCP01

Fit the FR-XCCP01 (optional converter installation attachment for enclosure) to the back of the FR-XC-7.5/11K.



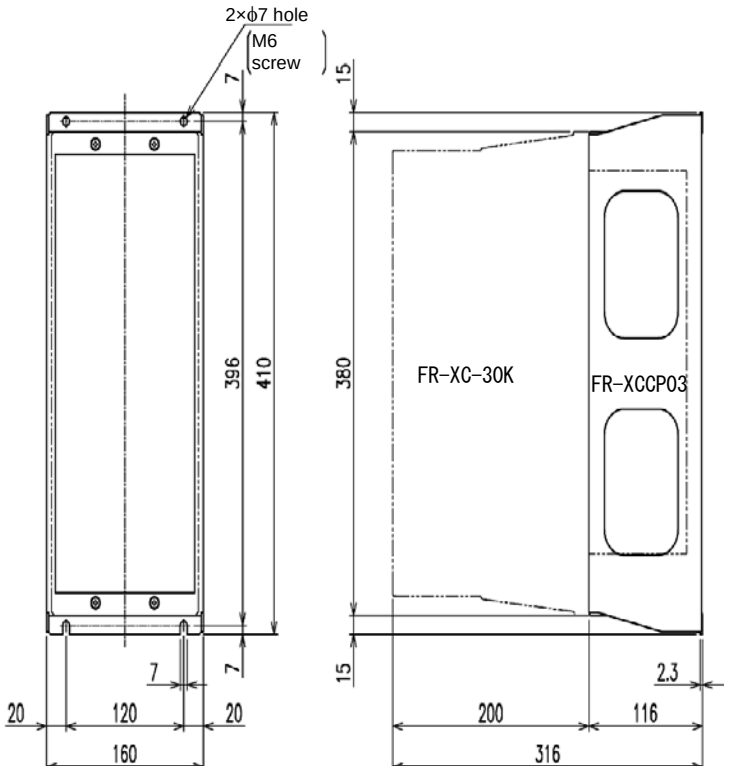
■FR-XC-15K with FR-XCCP02

Fit the FR-XCCP02 (optional converter installation attachment for enclosure) to the back of the FR-XC-15K.



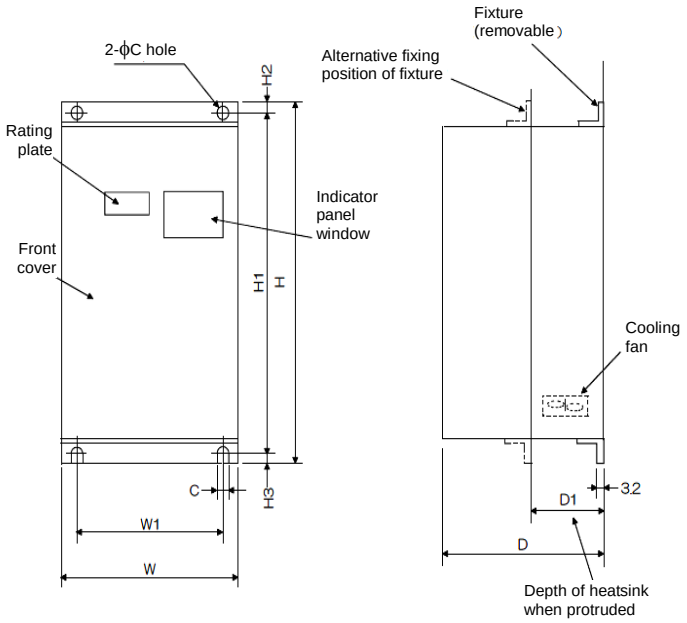
■FR-XC-22K, 30K with FR-XCCP03

Fit the FR-XCCP03 (optional converter installation attachment for enclosure) to the back of the FR-XC-22K/30K.



400 V class

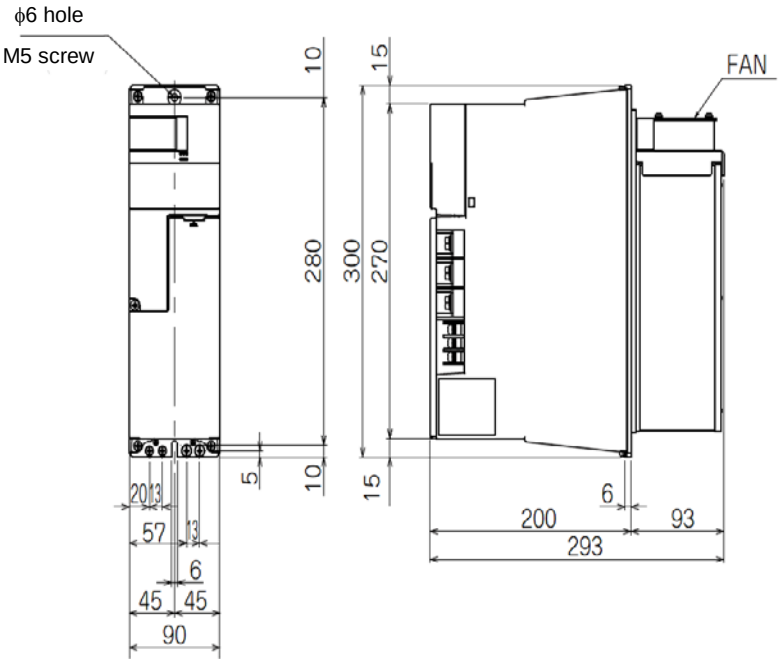
■FR-RC-H15K to H55K



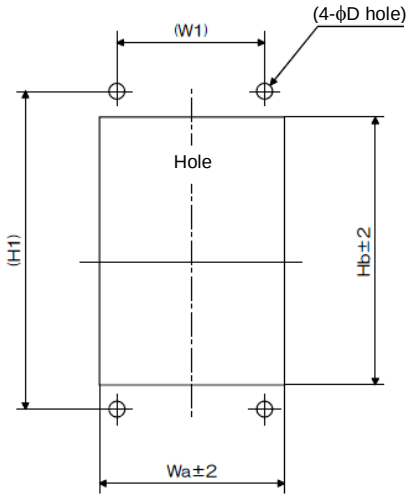
Model		W	W1	H	H1	H2	H3	D	D1	C
400 V	FR-RC-H15K	340	270	600	582	10	8	195	90	10
	FR-RC-H30K	340	270	600	582	10	8	195	90	10
	FR-RC-H55K	480	410	700	670	15	15	250	135	12

For installation in an enclosure with its heatsink protruded

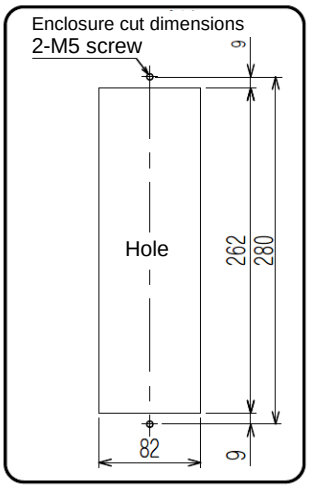
■FR-XC-H7.5K, H11K



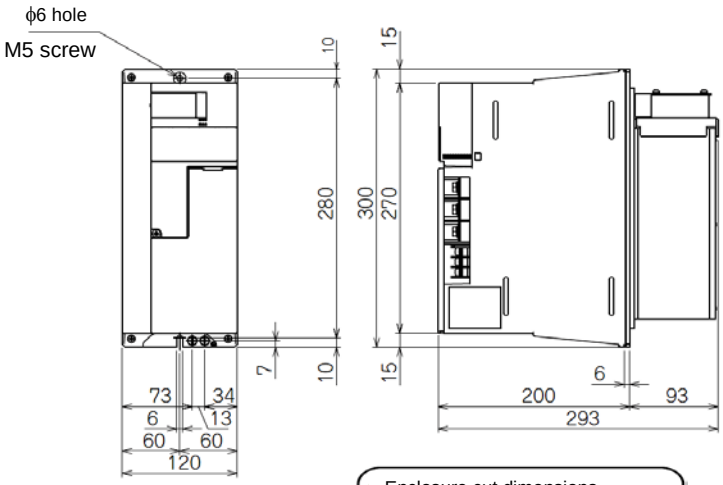
Enclosure cut dimensions

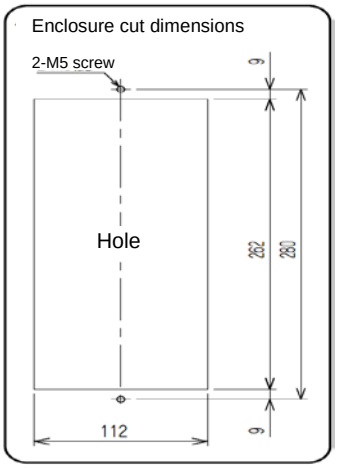


Model		Wa	Hb	D
400 V	FR-RC-H15K	330	562	10
	FR-RC-H30K	330	562	10
	FR-RC-H55K	470	642	12

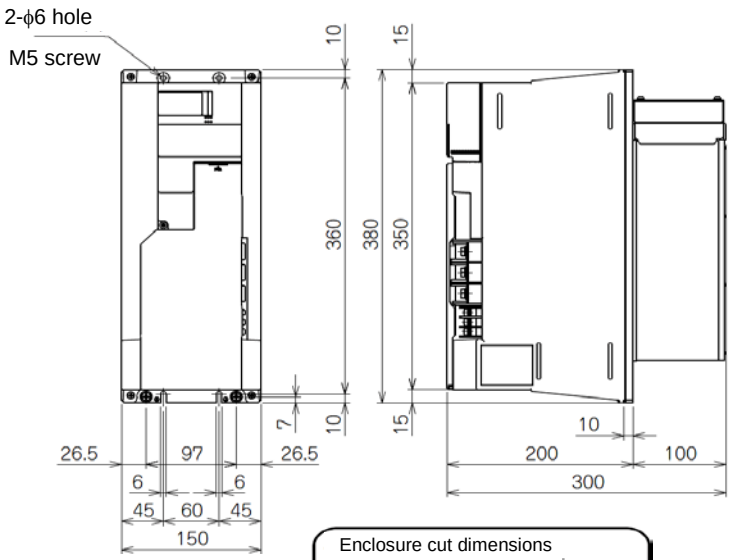


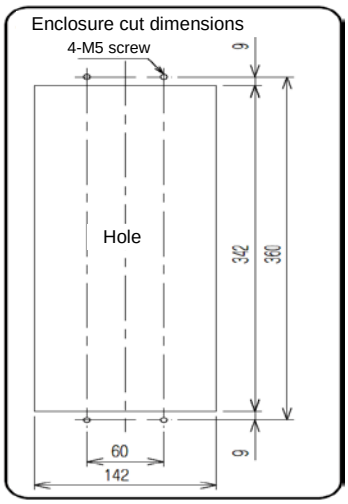
■FR-XC-H15K



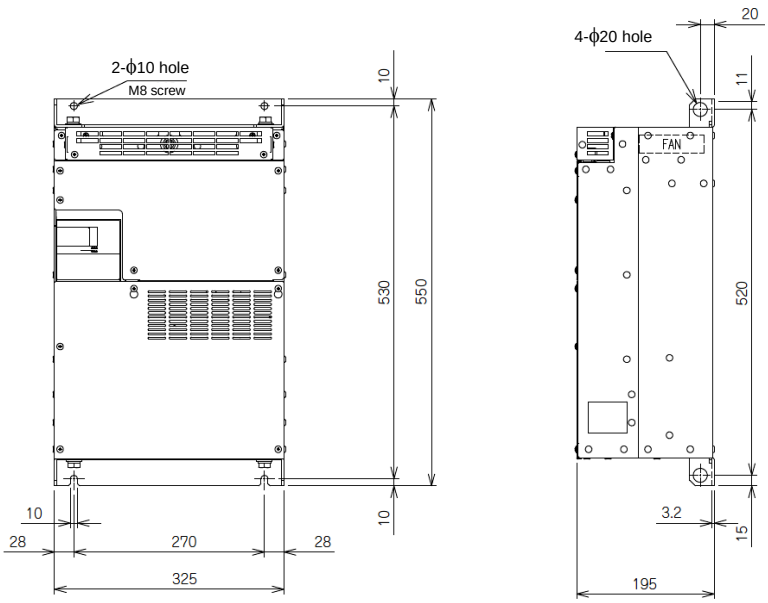


■FR-XC-H22K, H30K

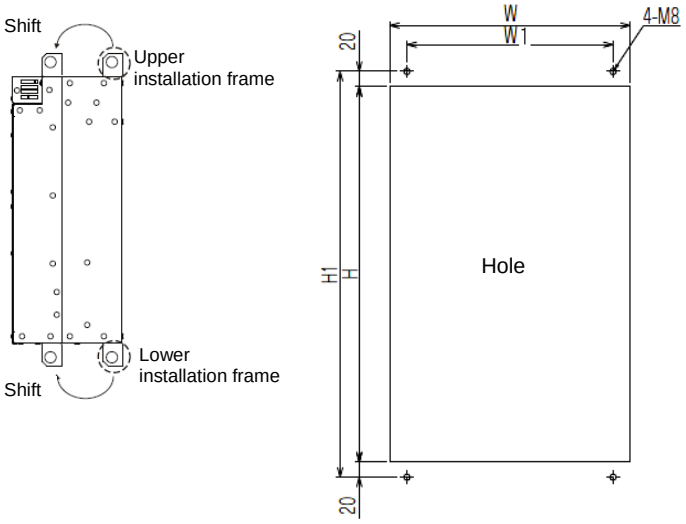




■FR-XC-H37K, H55K

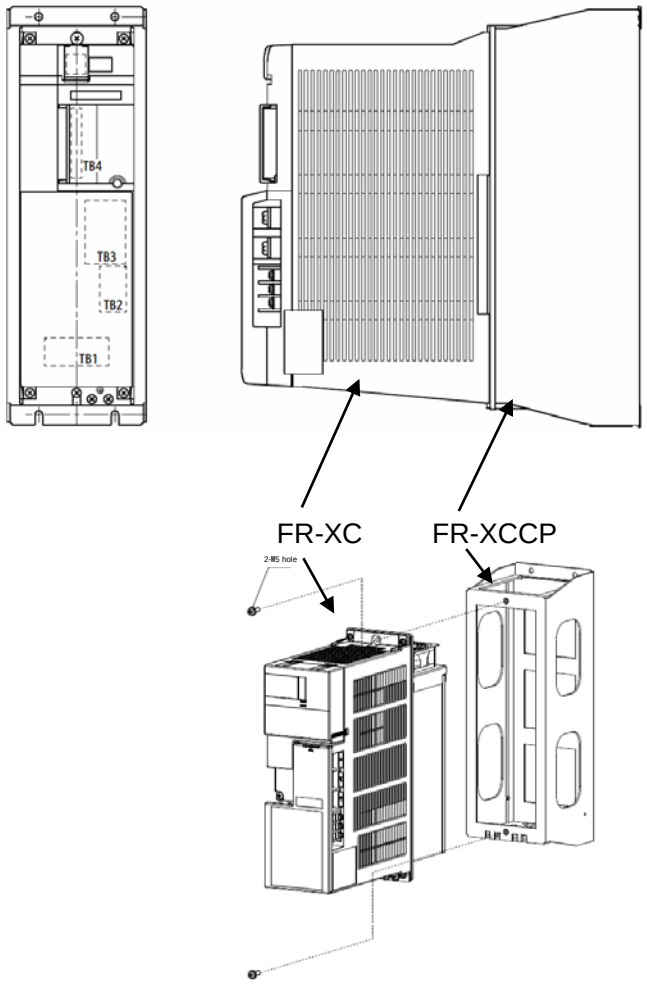


Enclosure cut dimensions



Model	W	W1	H	H1
FR-XC-H37K, H55K	315	270	490	530

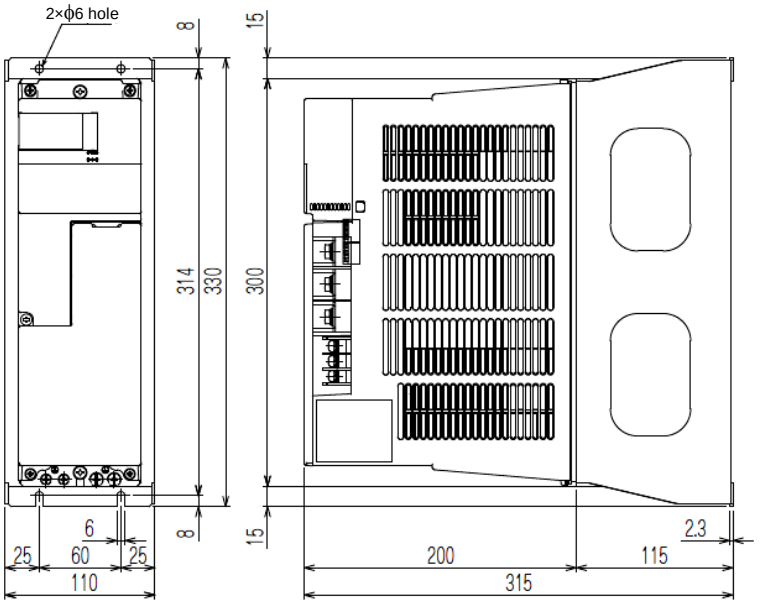
For installation with all components encased in an enclosure



Use the FR-XCCP, converter installation attachment for enclosure (option), to install the multifunction regeneration converter inside an enclosure.

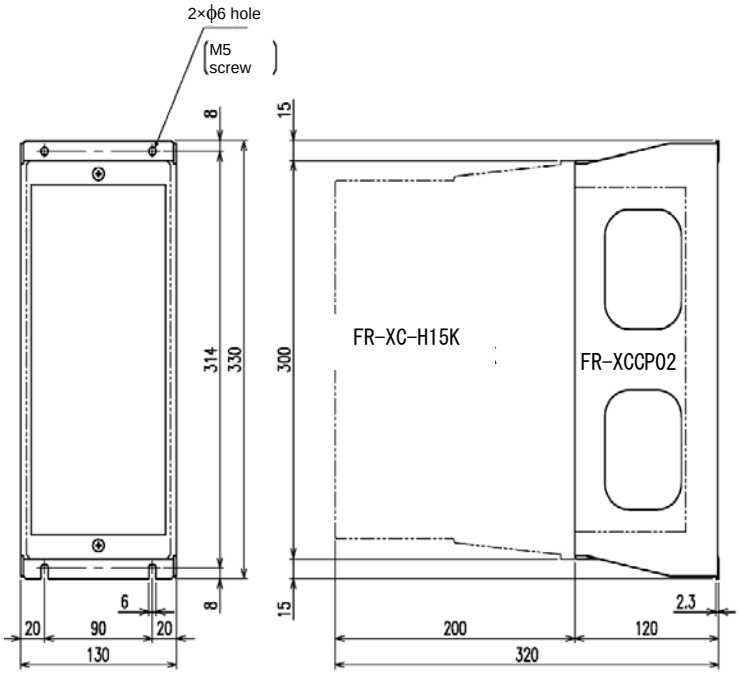
■FR-XC-H7.5K, H11K with FR-XCCP01

Fit the FR-XCCP01 (optional converter installation attachment for enclosure) to the back of the FR-XC-H7.5K/11K.



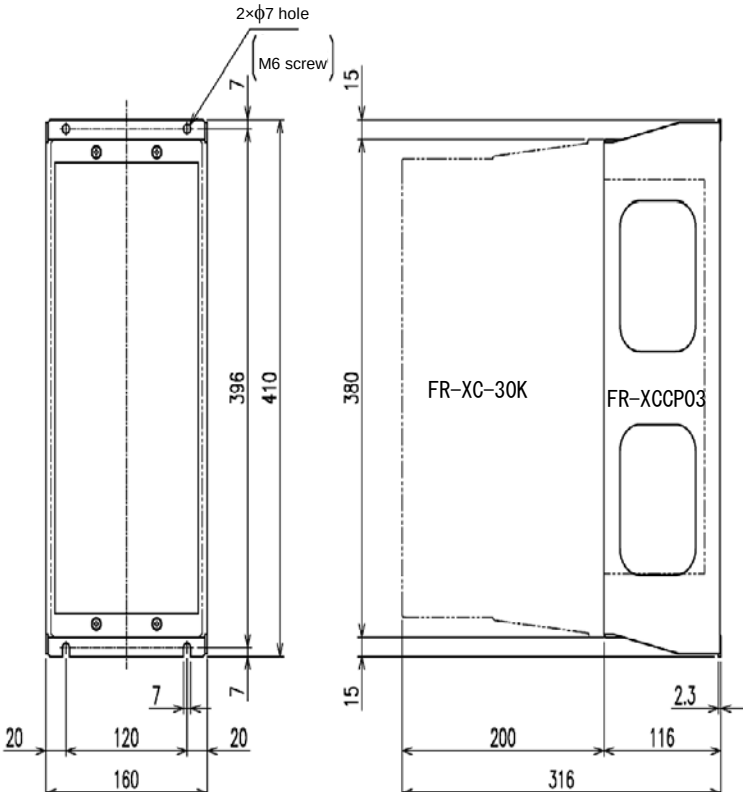
■FR-XC-H15K with FR-XCCP02

Fit the FR-XCCP02 (optional converter installation attachment for enclosure) to the back of the FR-XC-H15K.



■FR-XC-H22K, H30K with FR-XCCP03

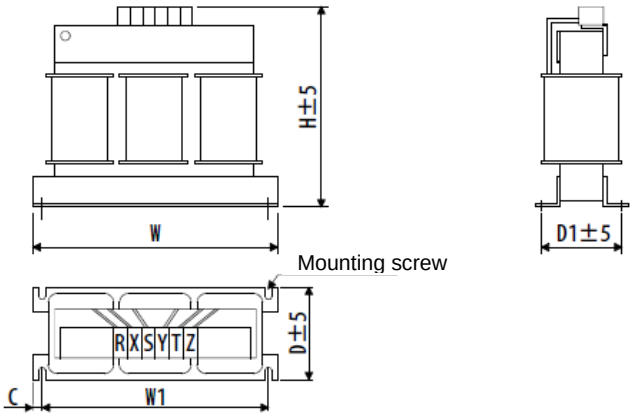
Fit the FR-XCCP03 (optional converter installation attachment for enclosure) to the back of the FR-XC-22K/30K.



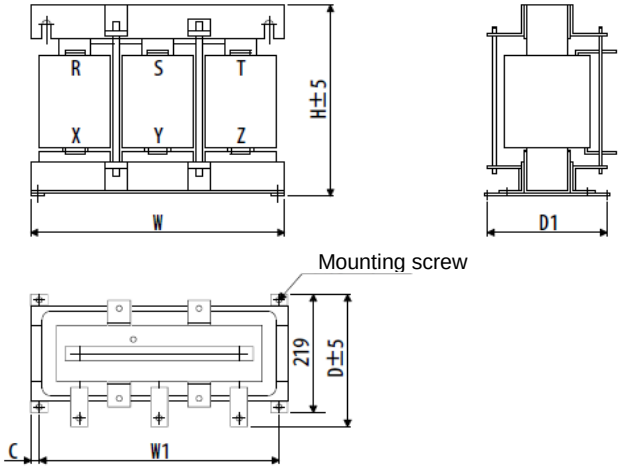
【Reactor】

200 V class

■FR-BAL-15K to 30K

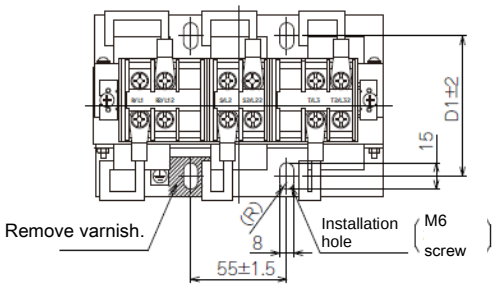


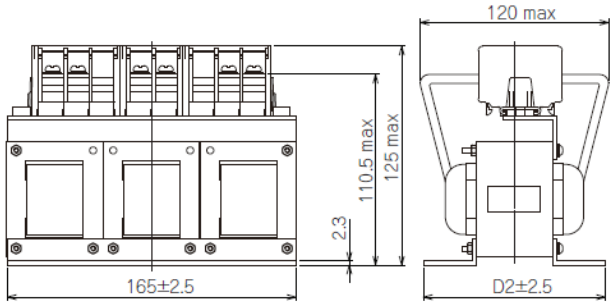
■FR-BAL-37K, 55K



Model	Motor capacity	W	W1	H	D	D1	C	Mounting screw size	Terminal screw size
FR-BAL-15K	15 kW	295	270	275	133	110	12.5	M6	M6
FR-BAL-22K	22 kW	290	240	301	199	170	25	M8	M8
FR-BAL-30K	30 kW	290	240	301	219	190	25	M8	M8
FR-BAL-37K	37 kW	330	270	306	235	190	30	M10	M10
FR-BAL-55K	55 kW	330	270	356	240	190	30	M10	M12

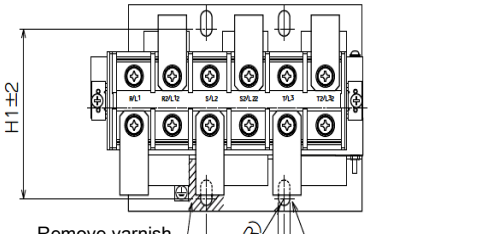
■FR-XCL-7.5K, 11K

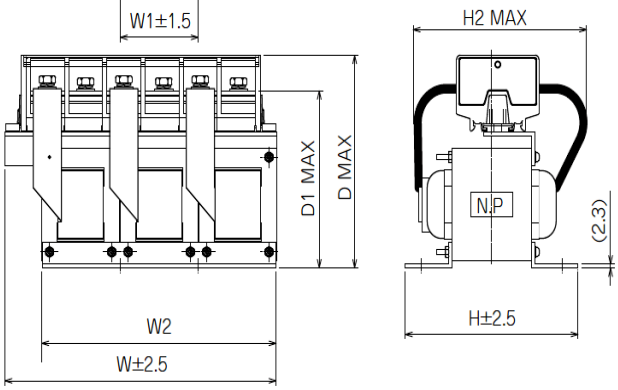




Model	D1	D2
FR-XCL-7.5K	80	104
FR-XCL-11K	73	97

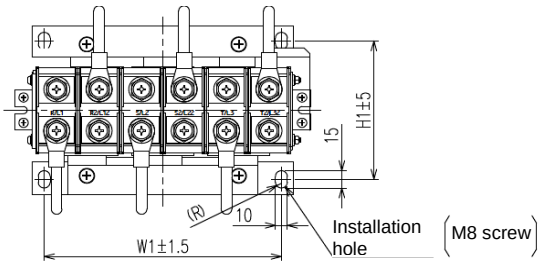
■FR-XCL-15K, 22K, 30K

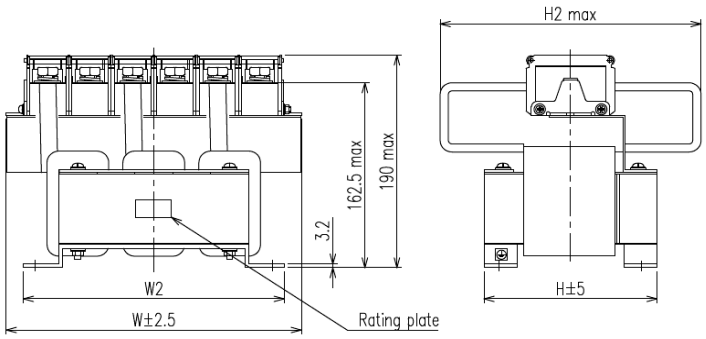




Model	W	W1	W2	H	H1	H2	D	D1
FR-XCL-15K	192	55	165	122	100	130	130	110.5
FR-XCL-22K	192	55	165	132	110	140	130	110.5
FR-XCL-30K	240	70	215	145	119	160	150	125.5

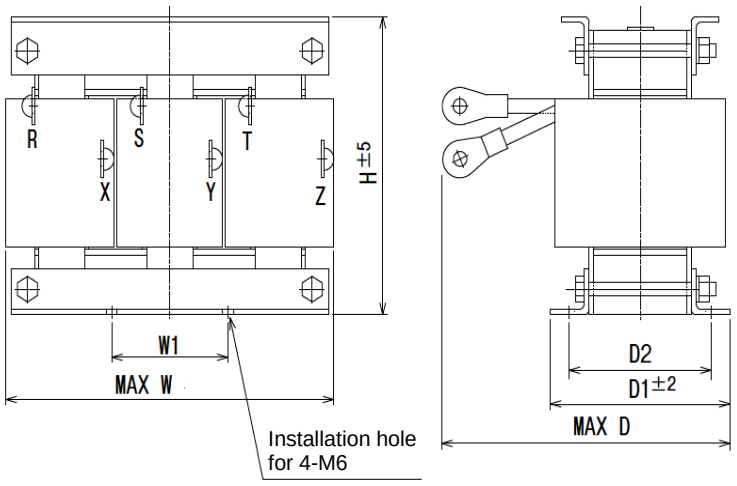
■FR-XCL-37K, 55K





Model	W	W1	W2	H	H1	H2
FR-XCL-37K	248	200	220	146	120	240
FR-XCL-55K	250	225	250	173	135	260

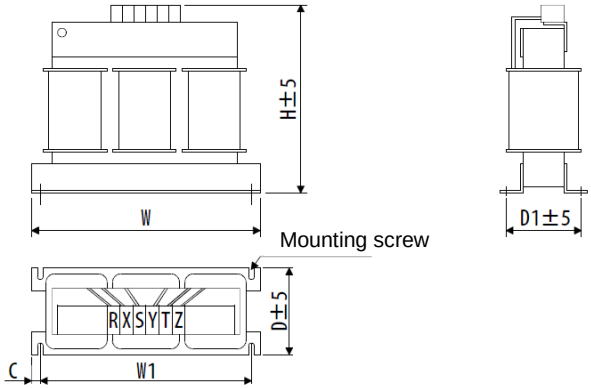
■FR-HAL-45K



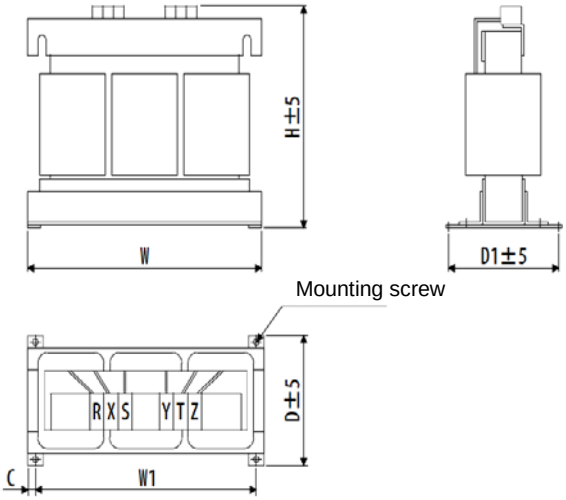
Model	W	W1	H	D	D1	D2
FR-HAL-45K	210	75	175	191	116	97

400 V class

■FR-BAL-H15K, H22K

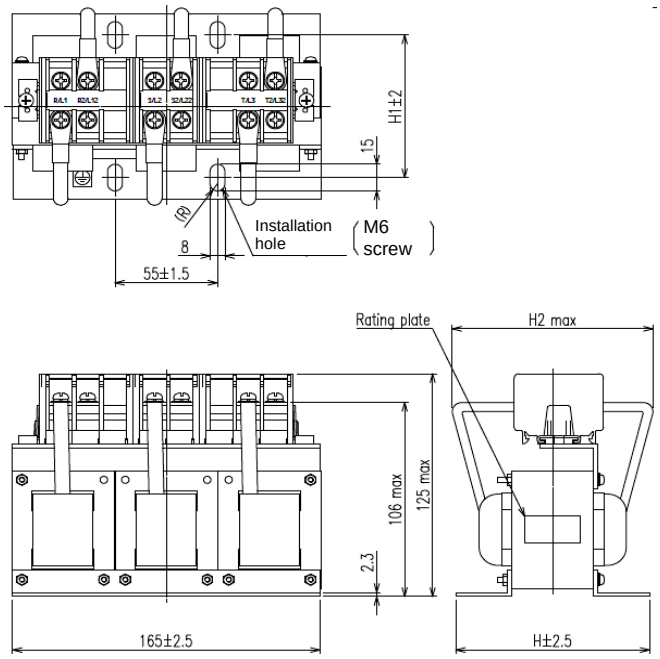


■FR-BAL-H37K, H55K



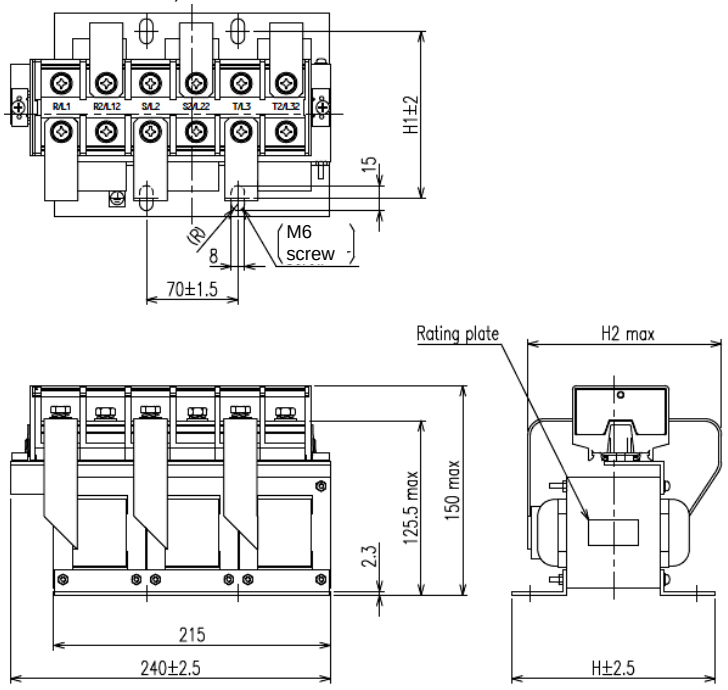
Model	Motor capacity	W	W1	H	D	D1	C	Mounting screw size	Terminal screw size
FR-BAL-H15K	15 kW	295	270	244	130	110	12.5	M6	M5
FR-BAL-H22K	22 kW	290	240	269	199	170	25	M8	M8
FR-BAL-H37K	37 kW	330	270	304	219	190	30	M10	M8
FR-BAL-H55K	55 kW	330	270	336	219	190	30	M10	M8

■FR-XCL-H7.5K, H11K, H15K



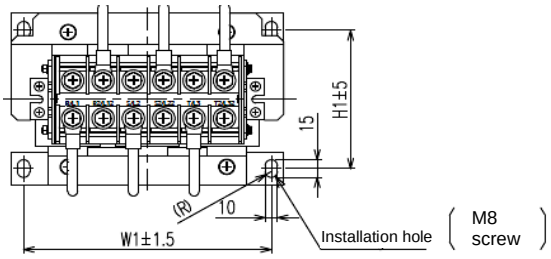
Model	H	H1	H2
FR-XCL-H7.5K	97	73	120
FR-XCL-H11K	104	80	120
FR-XCL-H15K	132	110	135

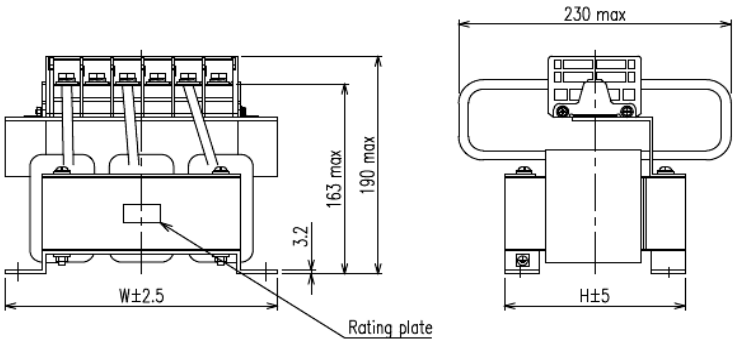
■FR-XCL-H22K, H30K



Model	H	H1	H2
FR-XCL-H22K	135	109	150
FR-XCL-H30K	155	129	170

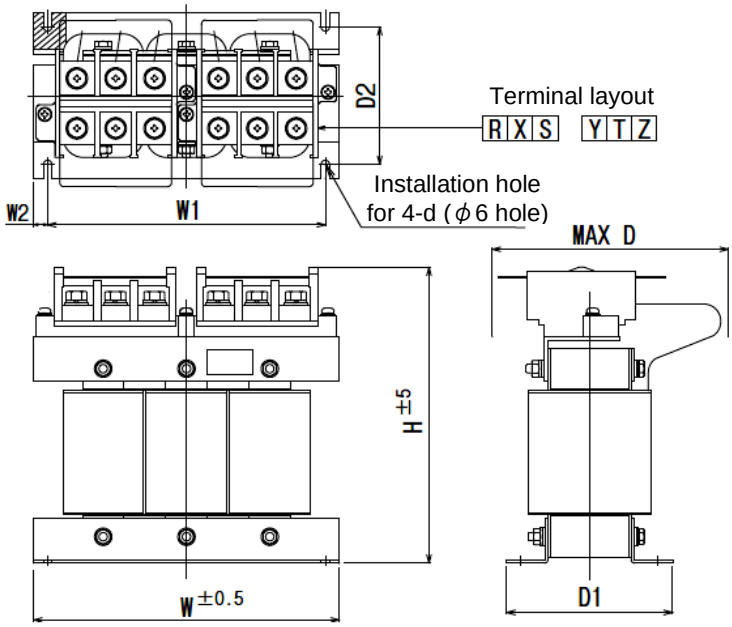
■FR-XCL-H37K, H55K





Model	W	W1	H	H1
FR-XCL-H37K	220	200	146	120
FR-XCL-H55K	250	225	173	135

■FR-HAL-H45K

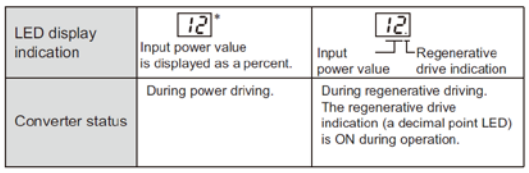
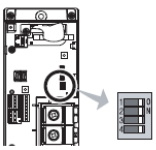


Model	W	W1	W2	H	D	D1	D2
FR-HAL-H45K	280	255	12.5	245	165	111	80

2. Wiring

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

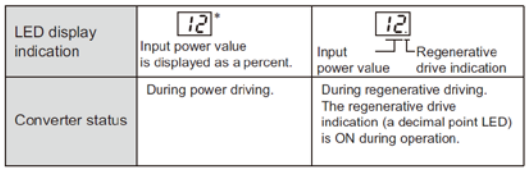
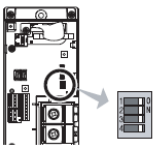
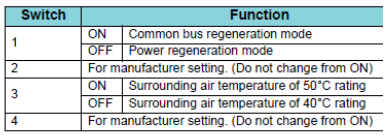
Common bus regeneration mode

	Type		FR-RC terminal name	FR-XC compatible terminal name	Remarks
Power regeneration converter	Main circuit		R/L1, S/L2, T/L3	R2/L12, S2/L22, T2/L32	Connect these terminals on the FR-XC to terminals R2/L12, S2/L22, and T2/L32 on the reactor FR-XCL.
			P/+, N/-	P/+, N/- ∗1	Do not use terminal P4 in the common bus regeneration mode.
			R1/L11, S1/L12	R1/L11, S1/L21 ∗2	In the initial state, these terminals are connected to terminals R/L1 and S/L2 (AC power input terminals for the FR-RC, power supply phase detection terminals for the FR-XC).
			R, RX, S, SX, T, TX	R/L1, S/L2, T/L3	The terminals on the FR-XC is used to detect the phase and voltage of the power supply, and to input power to the control circuit. Connect each of them to the terminals R/L1, S/L2, T/L3 on both the power supply and the reactor FR-XCL.
			⏚	⏚	
	Control circuit input signal	Contact	RES	RES	
			SD	SD	
	Control circuit output signal	Relay	ABC	ABC	
		Open collector	RDY	-	
			-	RYB	**Always connect the terminal RYB to an inverter terminal to which the X10 signal is assigned (terminal MRS in the initial state). Always connect the terminal SE to the inverter terminal SD.**
			-	RS0	Connect this terminal to the inverter terminal to which the RES signal is assigned.
			SE	SE	
	LED display and indicator		Indicator panel including the indicator of capacitor charge, power supply, and alarm	7-segment LED in two digits for the operating status display	FR-XC  ∗ An example of the indications of power value.
	Function selection switch			SW2	 Switch / Function 1: ON Common bus regeneration mode; OFF Power regeneration mode 2: For manufacturer setting. (Do not change from ON) 3: ON Surrounding air temperature of 50°C rating; OFF Surrounding air temperature of 40°C rating 4: For manufacturer setting. (Do not change from ON) **Do not change the switch settings from the initial state when using the FR-XC converter in the common bus regeneration mode.**
Dedicated standalone reactor	Type		FR-BAL terminal name	FR-XCL terminal name	Remarks
	Main circuit		R, S, T	R/L1, S/L2, T/L3	
			⏚, Z	R2/L12, S2/L22, T2/L32	
				⏚	

∗1 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/+ an N/- will damage the converter and the inverter.

∗2 When a power supply for the control circuit is separate from the one for main circuit, the warning indication “LG” is displayed while only the control circuit power is turned ON. However, it is not a fault.

Power regeneration mode
(when using a 45 kW motor, replacing the FR-RC(H)30K with the FR-XC-(H)37K and FR-XCL-(H)37K)

<table>
<tr><td rowspan="12">Power regeneration converter</td><td colspan="2">Type</td><td>FR-RC terminal name</td><td>FR-XC compatible terminal name</td><td>Remarks</td></tr>
<tr><td colspan="2" rowspan="4">Main circuit</td><td>R/L1, S/L2, T/L3</td><td>R2/L12, S2/L22, T2/L32</td><td>Connect these terminals on the FR-XC to terminals R2/L12, S2/L22, and T2/L32 on the reactor FR-XCL.</td></tr>
<tr><td>P/+, N/-</td><td>P4, N/- ∗1</td><td>Do not use terminal P/+ in the power regeneration mode.</td></tr>
<tr><td>R1/L11, S1/L12</td><td>R1/L11, S1/L21 ∗2</td><td>In the initial state, these terminals are connected to terminals R/L1 and S/L2 (AC power input terminals for the FR-RC, power supply phase detection terminals for the FR-XC).</td></tr>
<tr><td>R, RX, S, SX, T, TX</td><td>R/L1, S/L2, T/L3</td><td>The terminals on the FR-XC is used to detect the phase and voltage of the power supply, and to input power to the control circuit. Connect each of them to the terminals R/L1, S/L2, T/L3 on both the power supply and the reactor FR-XCL.</td></tr>
<tr><td colspan="2">⏚</td><td>⏚</td><td></td></tr>
<tr><td rowspan="2">Control circuit input signal</td><td>Contact</td><td>RES
SD</td><td>RES
SD</td><td></td></tr>
<tr><td rowspan="3">Control circuit output signal</td><td>Relay</td><td>ABC</td><td>ABC</td><td></td></tr>
<tr><td rowspan="2">Open collector</td><td>RDY
SE</td><td>RYA (RDY)
SE</td><td></td></tr>
<tr><td colspan="2">LED display and indication</td><td>Indicator panel including the indicator of capacitor charge, power supply, and alarm</td><td>7-segment LED in two digits for the operating status display</td><td>FR-XC
 
</td></tr>
<tr><td colspan="2">Function selection switch</td><td></td><td>SW2</td><td> 


Set switch 1 in SW2 to the OFF position when using the FR-XC converter in the power regeneration mode.</td></tr>
<tr><td rowspan="3">Power factor improving reactor</td><td colspan="2">Type</td><td>FR-BAL terminal name</td><td>FR-HAL terminal name</td><td>Remarks</td></tr>
<tr><td colspan="2" rowspan="2">Main circuit</td><td>R, S, T
X, Y, Z</td><td>R, S, T
X, Y, Z</td><td rowspan="2">To use the FR-XC converter in the power regeneation mode for a 45 kW motor, the FR-HAL-45K is required in addition to the FR-XCL. For details, refer to the selection table.</td></tr>
<tr><td>⏚</td><td>⏚</td></tr>
<tr><td rowspan="3">Dedicated standalone reactor</td><td colspan="2">Type</td><td>–</td><td>FR-XCL terminal name</td><td>Remarks</td></tr>
<tr><td colspan="2" rowspan="2">Main circuit</td><td></td><td>R/L1、S/L2、T/L3</td><td rowspan="2"></td></tr>
<tr><td></td><td>R2/L12、S2/L22、T2/L32</td></tr>
<tr><td></td><td></td><td></td><td>⏚</td><td></td></tr>
</table>

∗1 Always connect the inverter terminal P/+ with the converter terminal P4, and the inverter terminal N/- with the converter terminal N/- for polarity consistency. Because the P, N inverse connection protective function is not provided, connecting opposite polarity of the terminals P/+ and N/- will damage the inverter.

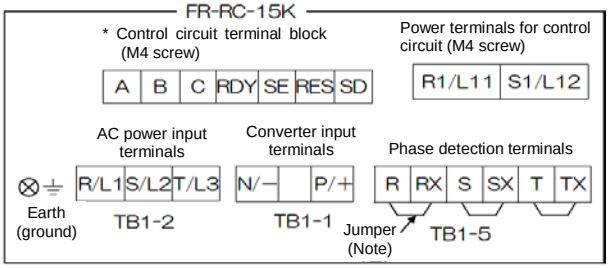
∗2 When a power supply for the control circuit is separate from the one for main circuit, the warning indication “LG” is displayed while only the control circuit power is turned ON. However, it is not a fault.

Main circuit terminal layout

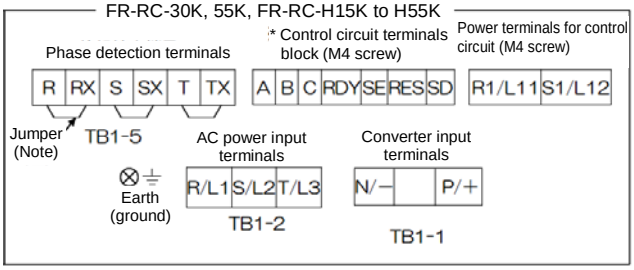
The following shows the main circuit terminal layouts of the FR-RC series converters and the FR-XC series converters.
The main circuit terminal layout and the position of the earth (ground) terminal may differ depending on the capacity.
Check the terminal names and positions before performing wiring.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

【Power regeneration converter】

■FR-RC-15K



■FR-RC-30K, 55K, FR-RC-H15K to H55K

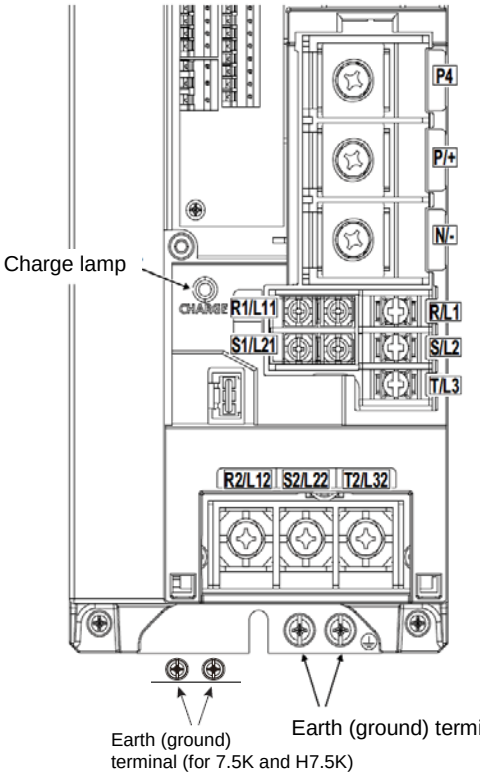


(Note) Do not remove the jumpers except when taking measures for preventing overcurrent due to power supply distortion.

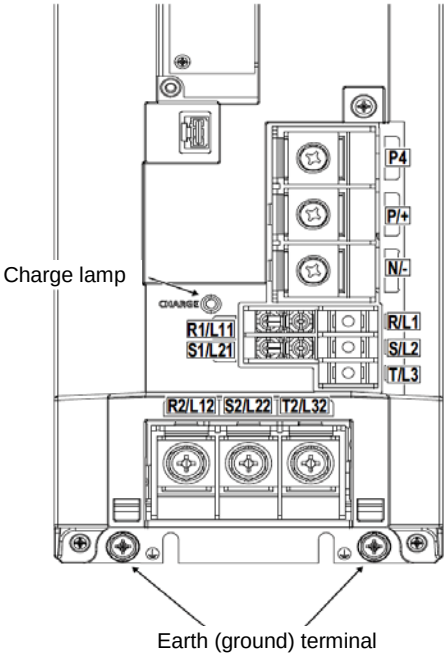
Terminal screw size

	Model	TB1-1	TB1-2	TB1-5	Earth (ground) terminal
200 V	FR-RC-15K	M5	M5	M3.5	M6
	FR-RC-30K	M6	M6	M3.5	M6
	FR-RC-55K	M8	M8	M3.5	M6
400 V	FR-RC-H15K	M6	M6	M3.5	M6
	FR-RC-H30K	M6	M6	M3.5	M6
	FR-RC-H55K	M6	M6	M3.5	M6

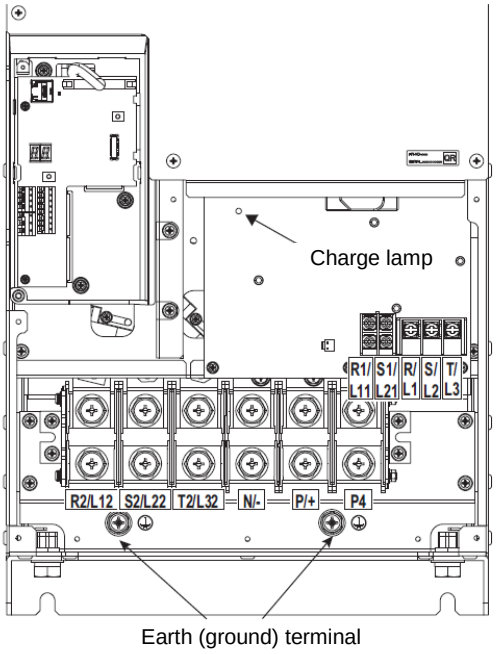
■FR-XC-(H)7.5K, (H)11K, (H)15K



■FR-XC-(H)22K, (H)30K



■FR-XC-(H)37K, (H)55K



Screw size
M4

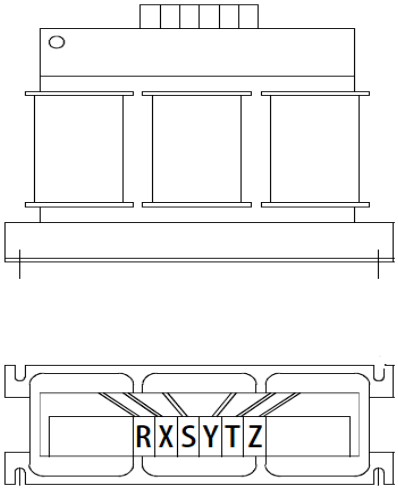
Screw size
M10 for 37K
M12 for 55K
M8 for H37K and H55K

Screw size
M8

【Reactor】

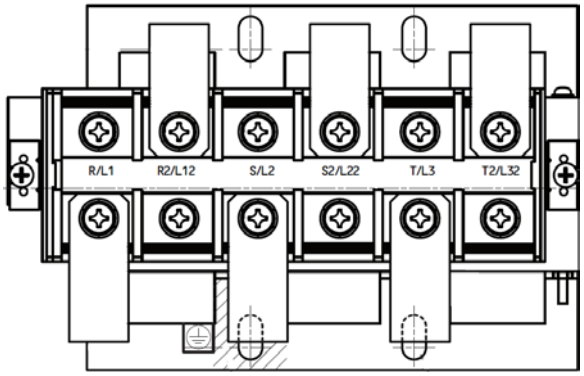
200 V class

■FR-BAL-15K to 30K



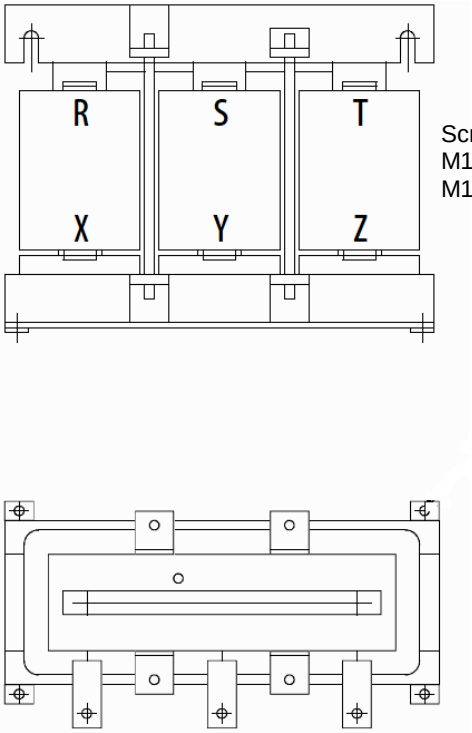
Screw size
M6 for 15K
M8 for 22K and 30K

■FR-XCL-7.5K, 11K, 15K, 22K, 30K



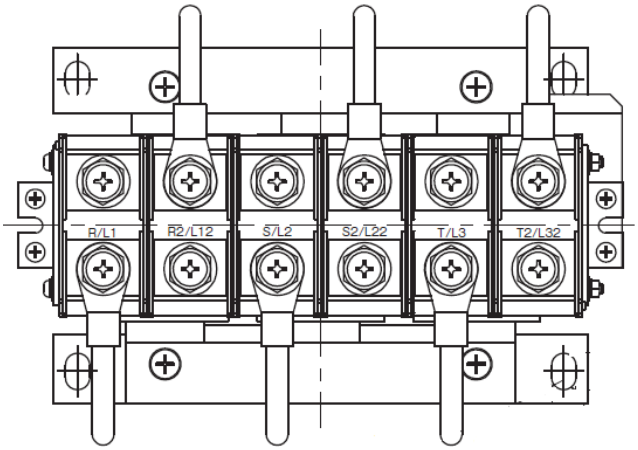
Screw size
M5 for 7.5K and 11K
M6 for 15K, 22K, and 30K

■FR-BAL-37K,55K



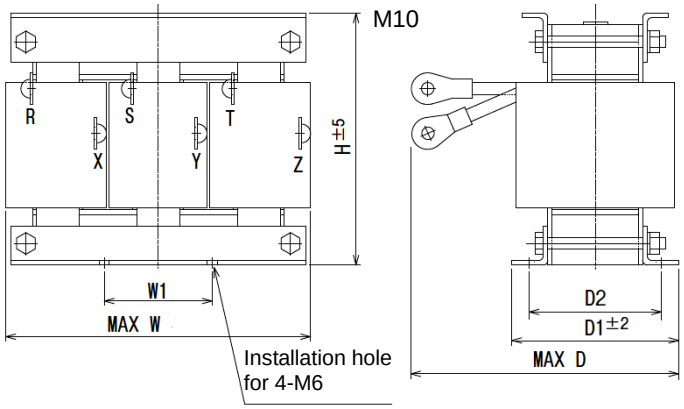
Screw size
M10 for 37K
M12 for 55K

■FR-XCL-37K, 55K



Screw size
M10

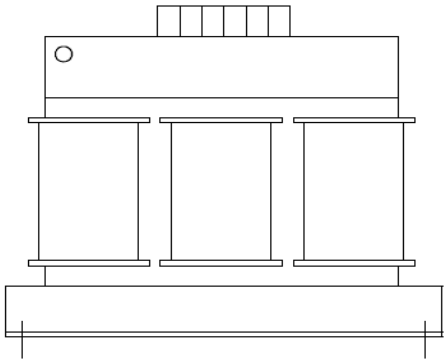
■FR-HAL-45K

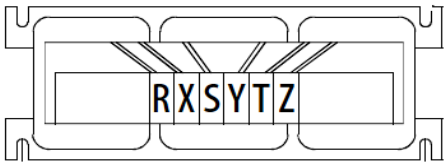


Screw size
M10

400 V class

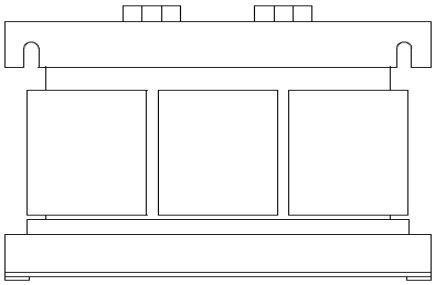
■FR-BAL-H15K, H22K

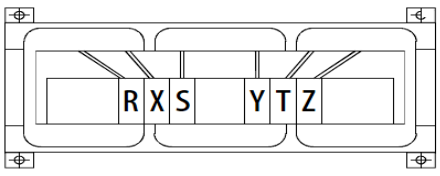




Screw size
M5 for H15K
M8 for H22K

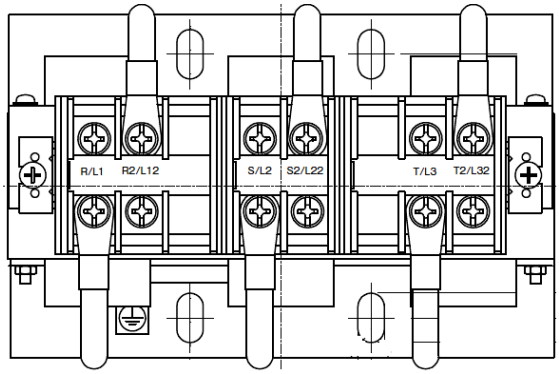
■FR-BAL-H37K, H55K





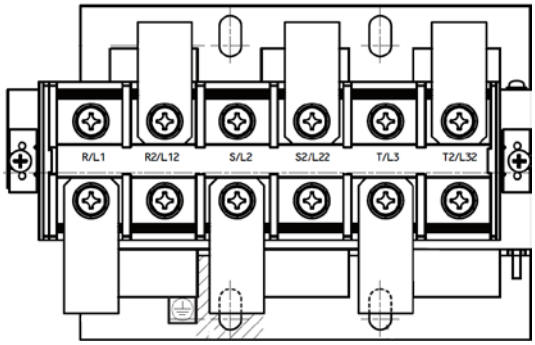
Screw size
M8

■FR-XCL-H7.5K, H11K, H15K



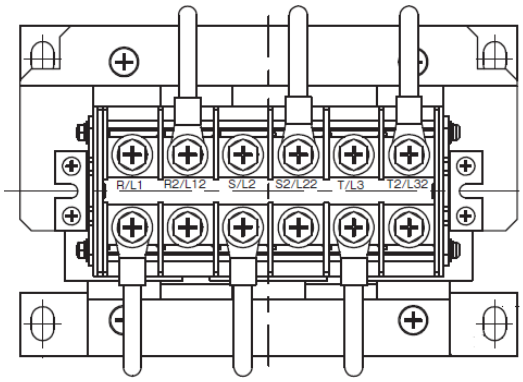
Screw size
M5

■FR-XCL-H22K, H30K



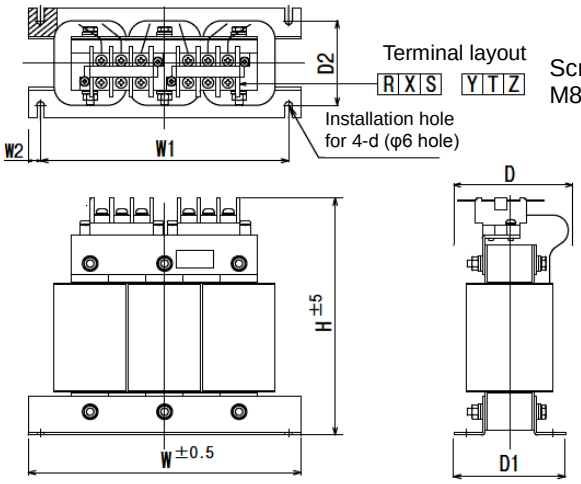
Screw size
M6

■FR-XCL-H37K, H55K



Screw size
M8

■FR-HAL-H45K

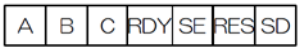


Screw size
M8

Control circuit terminal layout

The following shows the control circuit terminal layouts of the FR-RC series converters and the FR-XC series converters.
The control circuit terminal layout of the FR-RC series converters differs from that of the FR-XC series converters. Check the terminal names and positions before performing wiring.

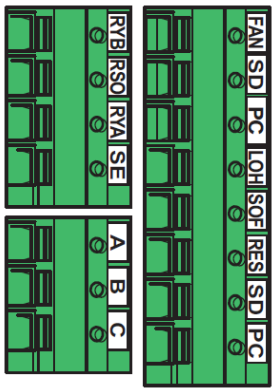
■FR-RC series converters



Terminal block (M4 screw)
The recommended wire size is 1.25 to 2 mm^2.

■FR-XC series converters

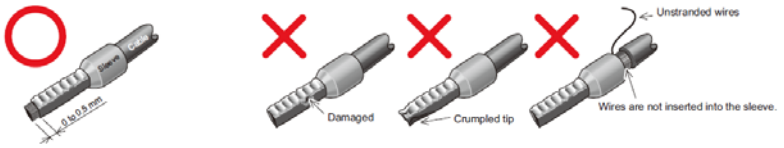
The recommended wire size is 0.3 to 1.25 mm^2.



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 (mm^2)	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.

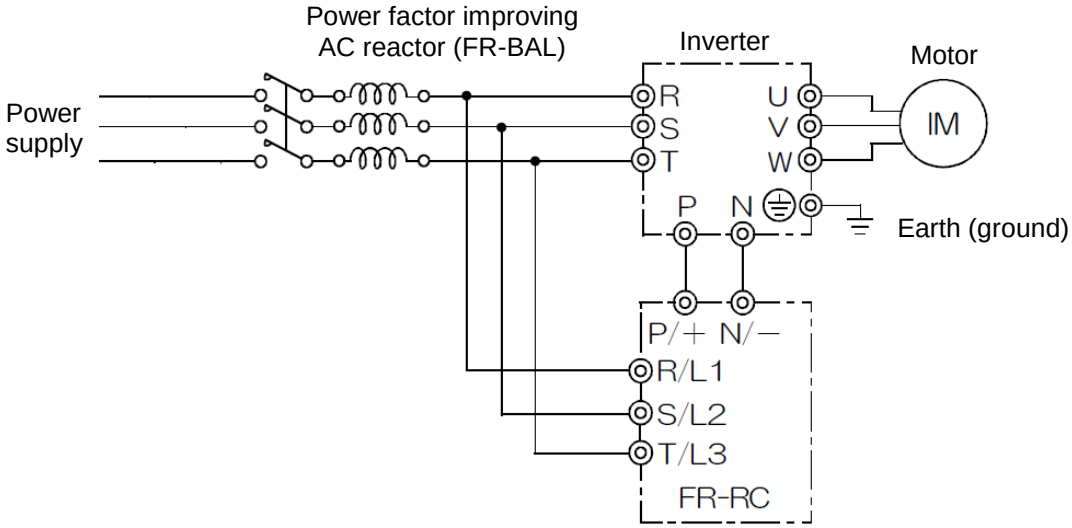
NICHIFU Co., Ltd.

Wire gauge (mm^2)	Blade terminal part No.	Insulation cap 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.

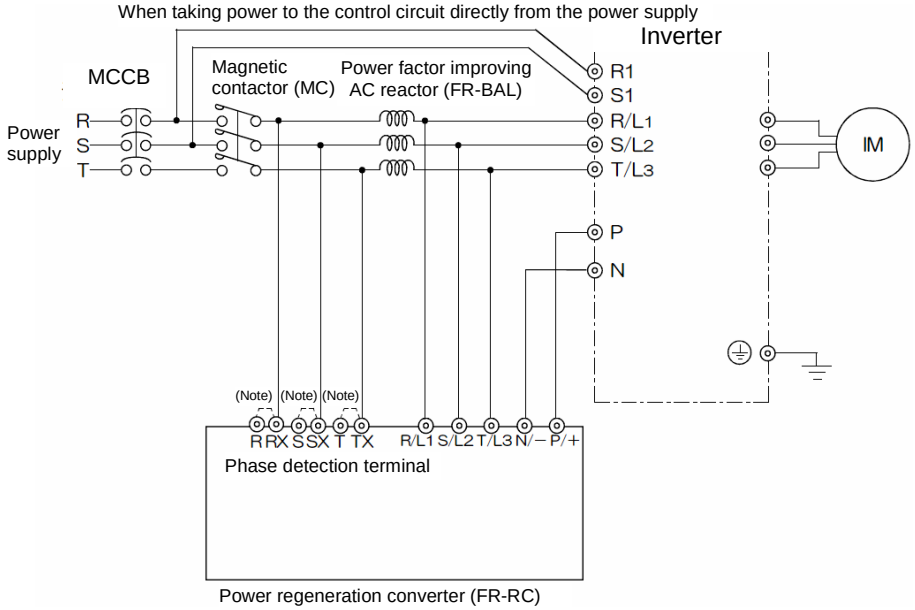
Wiring of main circuit
The following shows the connection examples of the FR-RC series converters and the FR-XC series converters.
Note that some of the wiring are different.
Additionally, the wiring varies depending on the series of the inverter used with the converter. Before wiring, check the wiring shown on the Instruction Manual of the inverter.

■Connection example of the FR-RC series converter



To prevent overcurrent due to distortion

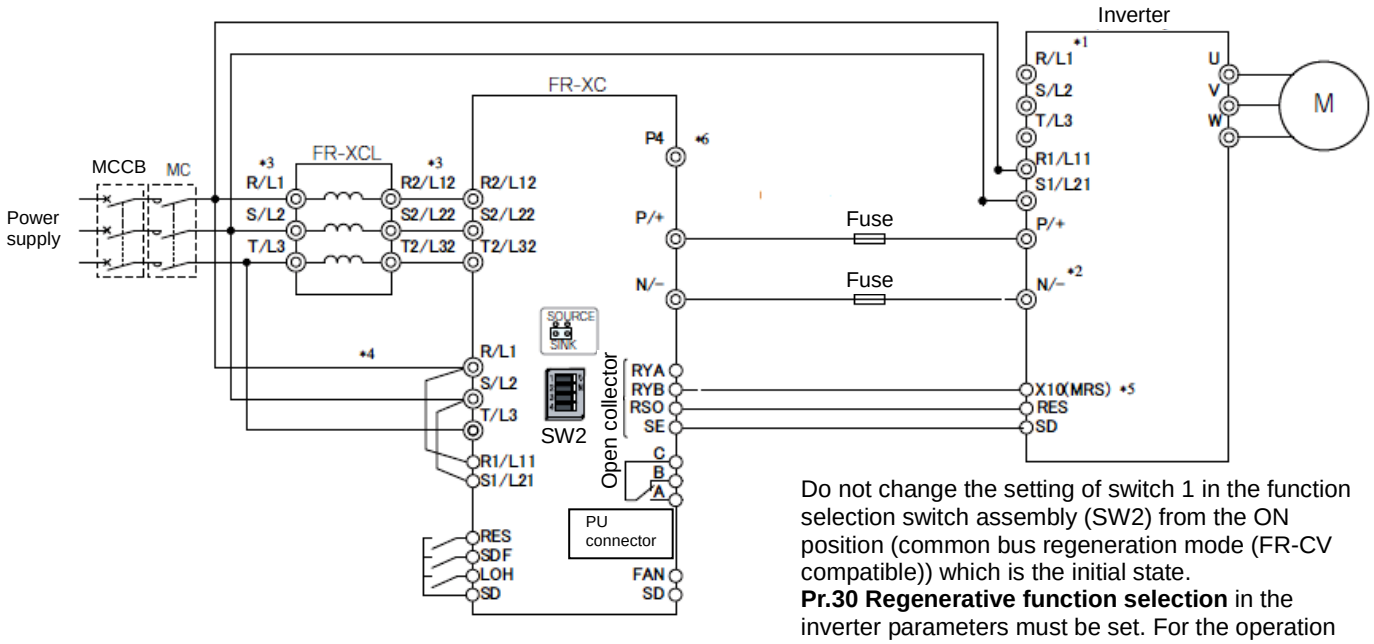
If a current of approx. 180% of the rated current flows in the power regeneration converter, the distortion of the voltage waveform may increase, activating the protect function and the fault indication “OCT” is displayed.
Remove the jumpers across the phase detection terminals R and RX, across terminals S and SX, and across terminals T and TX on the power regeneration converter, and wire the phase detection terminals RX, SX, and TX to the input side of the power factor improving reactor (FR-BAL).
Keep the phase detection terminals R, S, and T open.



Note: When not using the phase detection terminals, do not remove the jumpers across R and RX, across terminals S and SX, and across terminals T and TX.
The FR-RC converter does not operate with the jumpers removed.

■Connection example of the FR-XC series converter

Common bus regeneration mode with harmonic suppression disabled



Do not change the setting of switch 1 in the function selection switch assembly (SW2) from the ON position (common bus regeneration mode (FR-CV compatible)) which is the initial state.
Pr.30 Regenerative function selection in the inverter parameters must be set. For the operation in the common bus regeneration mode, set "2" in **Pr.30**.

∗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/+ an 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 in the common bus regeneration mode.

∗7 To use separate power supply for the control circuit, remove each jumper at terminal R1/L11 and terminal S1/L21.

∗8 If it is required to achieve K32 (the conversion factor) = 1.8 shown in the Harmonic suppression guideline as is the case in the existing converter, connect two FR-XCL reactors in series.

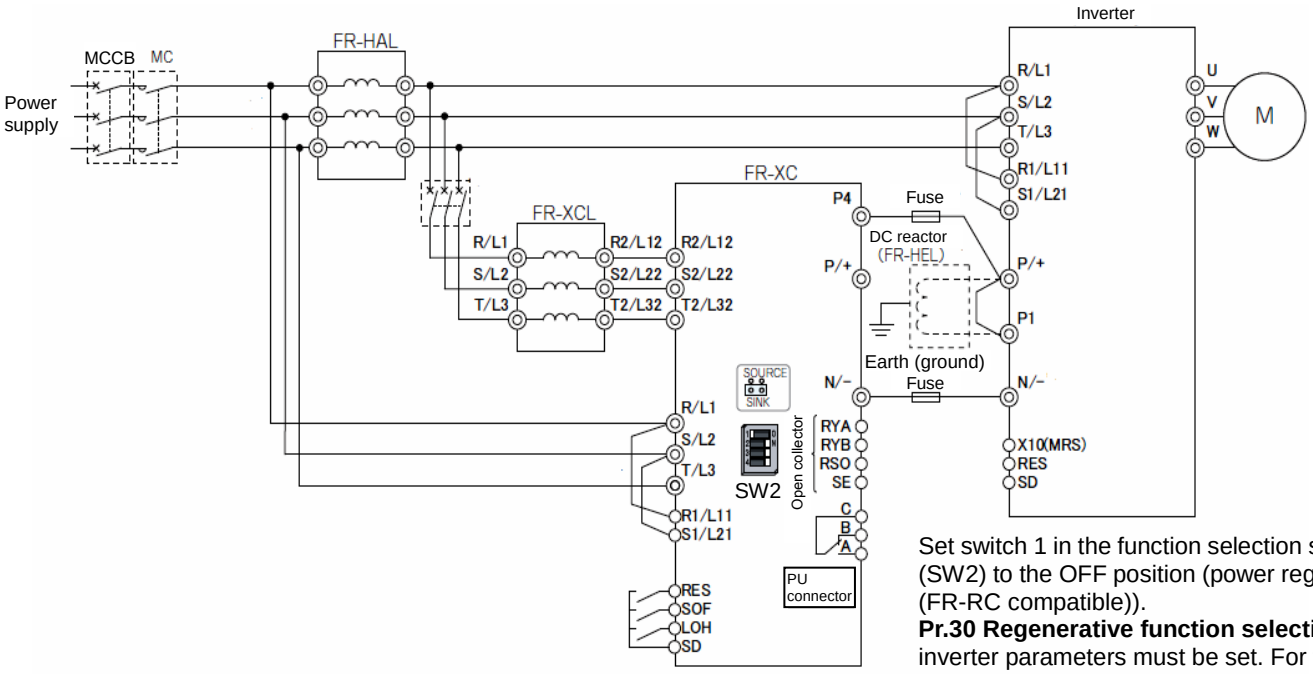
For details, refer to the Instruction Manual.

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.

■Connection example of the FR-XC series converter

Power regeneration mode

(when using a 45 kW motor, replacing the FR-RC(H)30K with the FR-XC-(H)37K and FR-XCL-(H)37K)



Set switch 1 in the function selection switch assembly (SW2) to the OFF position (power regeneration mode (FR-RC compatible)).
Pr.30 Regenerative function selection in the inverter parameters must be set. For the operation in the common bus regeneration mode, set "0" in **Pr.30**.

∗1 Always connect the inverter terminal P/+ with the converter terminal P4, and the inverter terminal N/- with the converter terminal N/- for polarity consistency. Because the protective function to guard against polarity reverse connection is not provided, connecting opposite polarity of the terminals P/+ and N/- will damage the inverter.

∗2 Confirm the correct phase sequence of three-phase current to connect the dedicated stand-alone reactor FR-XCL with the converter, and the power supply with the converter (terminals R/L1, S/L2, and T/L3). Incorrect connection will damage the converter.
Do not install a molded case circuit breaker (MCCB) or magnetic contactor (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 To use the FR-XC converter in the power regeneation mode for a 45 kW motor, the FR-HAL-45K is required.
If the use of the FR-BAL-30K/(H)37K which has been used with the existing products does not bring low insulation resistance, they can be used instead of the FR-HAL.
For details, refer to the selection table.

∗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.

3. Parameters

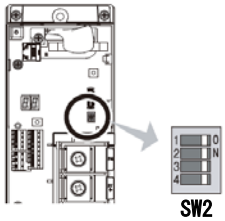
No parameters need to be set in the FR-RC series converters.
When replacing the FR-RC series converter with the FR-XC series converter, the setting of the parameters in the FR-XC series converter are not necessary to be changed from the initial values.
However, **be sure to set switch 1 in the SW2 to the ON position for the operation in the common bus regeneration mode, and set it to the OFF position for the operation in the power regeneration mode.**
The switch setting can be checked with **Pr.415**.
The changed switch setting of the SW2 is applied at the next power-ON or converter reset.

FR-XC parameter				Parameter setting	
Pr	Name	Setting range	Initial value	Setting	Remarks
0	Simple mode selection	0, 9999	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	5		
4	SOF terminal function selection		0		
7	RES terminal function selection		3		
8	SOF input selection	0, 1, 2	0		
9	OH input selection	0, 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		
12	RYA terminal function selection		0		
16	ABC terminal function selection		99		
22	Current limit level	0 to 190%	150		
23	Current limit level (regenerative)	0 to 190%, 9999	9999		
31	Life alarm status display	0, 1, 4, 5, 8, 9, 12, 13 (Read only)	0		
32	Inrush current limit circuit life display	0 to 100% (Read only)	100%		
33	Control circuit capacitor life display	0 to 100% (Read only)	100%		
34	Maintenance timer	0 (1 to 9998)	0		
35	Maintenance timer warning output set time	0 to 9998, 9999	9999		
44	Instantaneous power failure detection signal clear	0, 9999	9999		
46	Watt-hour meter clear	0, 10, 9999	9999		
47	Energization time carrying-over times	Read only	0		
48	Cumulative power monitor digit shifted times	0 to 4, 9999	9999		
52	PU main monitor selection	0, 5 to 10, 25, 28	0		
57	Restart selection	0, 9999	9999		
58	Free parameter 1	0 to 9999	9999		
59	Free parameter 2	0 to 9999	9999		
61	Key lock operation selection	0, 10	0		
65	Retry selection	0 to 4	0		
67	Number of retries at fault occurrence	0 to 10, 101 to 110, 1001 to 1010, 1101 to 1110	0		
68	Retry waiting time	0.1 to 600 s	1 s		
69	Retry count display erase	0	0		
75	Reset selection / disconnected PU detection / PU stop selection	0 to 3, 14 to 17	14		
77	Parameter write selection	1, 2	2		

FR-XC parameter				Parameter setting	
Pr	Name	Setting range	Initial value	Setting	Remarks
80	Voltage control proportional gain	0 to 1000%	100		
81	Voltage control integral gain	0 to 1000%	100		
82	Current control proportional gain	0 to 200%	100		
83	Current control integral gain	0 to 200%	100		
117	PU communication station number	0 to 31	0		
118	PU communication speed	48, 96, 192, 384	192		
119	PU communication stop bit length	0, 1, 10, 11	1		
120	PU communication parity check	0, 1, 2	2		
121	PU communication retry count	0 to 10, 9999	1		
123	PU communication waiting time setting	0 to 150 ms, 9999	9999		
124	PU communication CR/LF selection	0, 1, 2	1		
145	PU display language selection	0 to 7	0		
342	Communication EEPROM write selection	0, 1	0		
415	SW2 setting status	0 to 15 (Read only)	15		Check that the setting value is 11 or 15 in the common bus regeneration mode, or 10 or 14 in the power regeneration mode. *
416	Control method selection	0, 1, 9999	9999		Set 0 or 9999 to disable the harmonic function.
500	Communication error execution waiting time	0 to 999.8 s	0 s		
501	Communication error occurrence count display	0	0		
502	Stop mode selection at communication error	0, 3	0		
542	Station number (CC-Link)	1 to 64	1		
543	Transmission speed selection (CC-Link)	0 to 4	0		
544	CC-Link extended setting	0, 1, 12	0		
896	Power unit cost	0 to 500	0		
990	PU buzzer control	0, 1	1		
991	PU contrast adjustment	0 to 63	58		

* Set switch 1 in the function selection switch assembly (SW2) to the ON (common bus regeneration mode (FR-CV compatible)) position for the operation in the common bus regeneration mode.
Set it to the OFF (power regeneration mode (FR-RC compatible)) position for the operation in the power regeneration mode.
The changed switch setting is applied at the next power-ON or converter reset.

The function can be changed by the function selection switches.



Switch	Function	
1	ON	Common bus regeneration mode
	OFF	Power regeneration mode
2	For manufacturer setting. (Do not change from ON)	
3	ON	Surrounding air temperature of 50°C rating
	OFF	Surrounding air temperature of 40°C rating
4	For manufacturer setting. (Do not change from ON)	

Pr.30 Regenerative function selection in the inverter parameters must be set.
Set **Pr.30** to "2" for the operation in common bus regeneration mode or "0" for the operation in the power regeneration mode.

The converter parameters can be set on the inverter operation panel DU08 or optional parameter unit when it is installed on the converter. Use the optional FR-CB2[] cable.
To install the operation panel, the optional connector (FR-ADP) is also required.