9 Specifications

9-1 Standard Specifications

Item		Specifications			
Inverter type		**GSX600-0.4-S**	**GSX600-0.75-S**	**GSX600-1.5-S**	**GSX600-2.2-S**
Nominal applied motor [1] [kW]		0.4	0.75	1.5	2.2
Output ratings	Rated output capacity [2] [kVA]	0.95	1.5	2.6	3.8
	Voltage [V]	• 3-phase, 200V/50Hz, 200, 220, 230V/60Hz (Proportional to input voltage)			
	Rated current [A]	2.5	4.0	7.0	10.0
	Overload capacity	• 150% of rated current for 1 min			
	Rated frequency	• 50, 60 Hz			
Input power supply	Phases, Voltage, Frequency	• Single-phase 200 to 240V 50/60Hz			
	Voltage/ frequency variations	• Voltage: +10% to -10%, Frequency: +5% to -5%			
	Capability for voltage dip [3]	• When the input voltage drops 165V or more, the inverter can be operated continuously. When the input voltage drops below 165V from rated voltage, the inverter can be operated for 15ms.			
	Rated input current [6] [A] (with DCR)	3.5	6.5	11.8	17.7
	(without DCR)	6.4	11.4	19.8	28.5
	Required power supply capacity [4] [kVA]	0.7	1.3	2.4	3.6
Braking	Braking torque [5] [%]	100		50	30
	DC injection braking	• Starting frequency: 3Hz (fixed), Braking current (0 to 100%), Braking time (0.0 to 30.0s)			
Protective structure (IEC60529)		• Closed type IP20			
Cooling method		• Self-cooling		• Fan cooling	
Mass [kg]		0.7	0.9	1.6	2.2

Notes:
1) A 4-pole standard motor is assumed as a nominal applied motor.
2) Inverter output capacity (kVA) at 220V.
3) When a momentary power failure occurs, while rated voltage is applied 85% of load of nominal motor is given.
4) When an optional power-factor correcting DC reactor is used.
5) Average braking torque where an unloaded motor decelerates and stops from 60Hz operation. (Varies according to the motor efficiency)
6) The specification is calculated on assumption that the inverter is connected to a 500 kVA-equivalent power transformer.

9-2 Common Specifications

Item			Specifications	Remarks
Output frequency	Setting	Maximum output frequency	• 50 to 120Hz (in 1Hz steps)	
		Base frequency	• 50 to 120Hz (in 1Hz steps)	
		Starting frequency	• 1 to 6Hz (in 1Hz steps)	
		Carrier frequency	• 0.75 to 15kHz (Vector-distribution PWM control selectable at 7kHz or less) When operating at a carrier frequency of 9kHz or above, the frequency may automatically drop to 8kHz to protect the inverter.	

Item		Specifications	Remarks
Output frequency	Accuracy	• Analog setting: ±1.0% of maximum frequency (at 25 ±10°C) • Keypad panel setting: ±0.01% of maximum frequency (at -10 to +50°C)	
	Setting resolution	• Analog setting: 1/256 of Maximum frequency • Keypad panel setting: 0.1Hz (99.9Hz or less), 1Hz (100Hz or more)	
Control	Voltage/freq. Characteristic	• Output voltage proportional to input voltage. Base frequency adjustable from 50 to 120Hz.	
	Torque boost	• Manual setting by code 0 to 31. (setting for variable torque load available)	
	Starting torque	• 150% or more (at 6Hz)	
	Control method	• Sinusoidal PWM control (with simplified current-vibration suppression)	
	Operation method	• Keypad operation: RUN or STOP key: Input signal: Forward/Reverse/Stop command, Coast-to-stop command, Trip command (External alarm), Alarm reset	
	Frequency setting (Multistep) (Linked operation)	• Keypad operation: Digital setting by ∧ or ∨ key • Built-in potentiometer • Analog input: 0 to +5VDC, 0 to +10VDC, 4 to 20mADC • Up to 4 multistep frequencies can be set in 2-bit external signal by terminal function selection • Setting by RS485 serial communication (Option)	
	Acceleration/ deceleration time	• 0.01 to 60.0s (Independently adjustable acceleration and deceleration)	

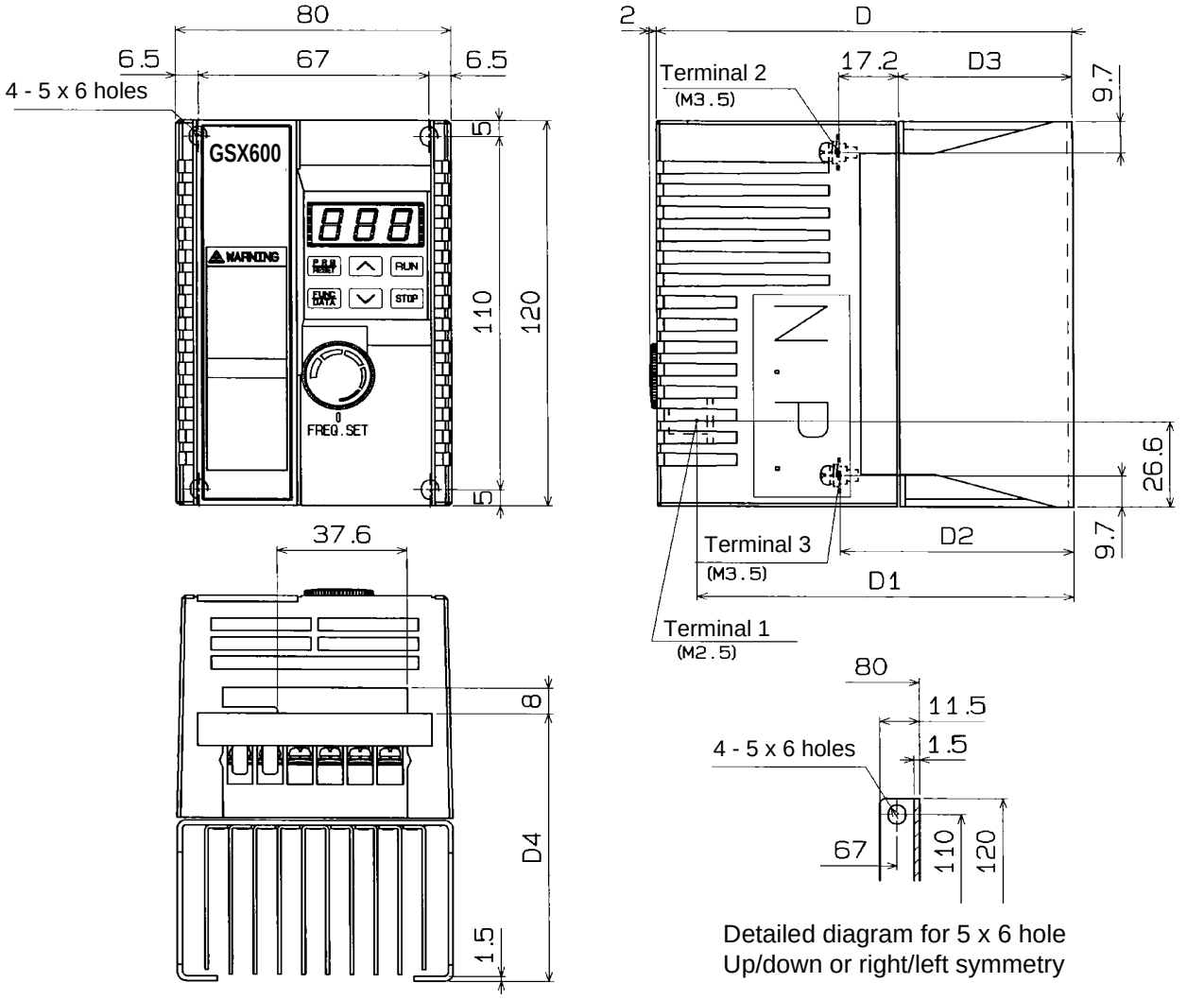
Item		Specifications	Remarks
Control	Frequency limiter	• High and low limits can be set for output frequency between 0 to 100% in Hz	
	Bias frequency	• The bias frequency can be set from -100 to +100% in Hz.	
	Gain (frequency setting signal)	• 5VDC or 10VDC gain can be selected.	
	Frequency jump control	• Jump frequency (3 points) and jump hysteresis width (1 point) can be preset.	
	Restart after momentary power failure	• Inverter restarts without causing inverter-trip when power supply recovers.	
	PID control	• PID control function is provided standard.	
Enclosure		• IP20	
Cooling method		• Natural cooling for 0.75kW or less. Fan cooling for 1.5kW or more.	
Indication	Running, stopped	• Output frequency, output current, and PID reference value/feedback value. The CRG lamp is on when the capacitor is charged.	
	Program mode	• Function code and data code	

Item		Specifications	Remarks
Indication	Tripped	[Cause of trip by code] ● OC1 (Overcurrent: during acceleration) ● OC2 (Overcurrent: during deceleration) ● OC3 (Overcurrent: while running at constant speed) ● OU1 (Overvoltage: during acceleration) ● OU2 (Overvoltage: during deceleration) ● OU3 (Overvoltage: while running at constant speed) ● LU (Undervoltage) ● OH1 (Overheating: Heat sink) ● OH2 (Overheating: External alarm) ● OL (Overload: Motor) ● OLU (Overload: Inverter) ● Er1 (Memory error) ● Er3 (CPU error) ● Er8 (RS485 communication error) ● Lin (Input phase failure)	
	Running, Tripped	● Fault history data is stored and indicated for the past four trips. Data is retained while power is off.	
Protection	Overload	● Internal electronic thermal overload relay protects inverter overload.	
	Overvoltage	● Detect the excessive DC link circuit voltage to stop inverter.	
	Overcurrent	● Detect overcurrent due to overload on inverter output side to protect inverter	
	Incoming surge	● Detect incoming surge voltage between AC power and the earth to protect inverter.	
	Undervoltage	● Detect the DC link circuit undervoltage to stop inverter	
	Overheating	● Detects the cooling fan fault or abnormal temperature rise of inverter to protect inverter.	
	Short-circuit	● Detect overcurrent due to short-circuit on inverter output side to protect inverter.	

Item		Specifications	Remarks
Protection	Ground fault	• Detects overcorrect due to ground fault on inverter output side to protect inverter. (Detect at starting)	
	Motor protection	• Protect general-purpose motor with electronic thermal overload.	
	Input phase failure protection (only for 3-phase 200V series)	• The inverter is protected against phase failure on the input side or over-current due to inter-phase imbalance.	
	Stall prevention	• Controls frequency to prevent OC trip in case of the output current exceeds the limit value during acceleration. • Lowers the frequency to hold almost constant torque in case of the output current exceeds the limit value during constant speed running. • Controls frequency to prevent OU trip in case of the DC link circuit voltage exceeds the limit value during deceleration.	
	Retry	• "Retry" function can be set for the protective functions OC1 to OC3 and OU1 to OU3. (No. of times of retry: 5, waiting time: 0.5s fixed).	
	Dielectric strength test	• At 2000Vac for 1 min. between any main circuit terminals and ground. (10mA or less)	
	Megger test	• At 500VDC megger test between any main circuit terminals and ground (5MΩ or more)	
Environment	Installation location	• Indoor use only. Do not install a dusty location (Degree of pollution: 2) or expose to direct sunlight, corrosive gases, flammable gases.	
	Ambient temperature	• -10 to +50°C	
	Ambient humidity	• 5 to 95% RH (No condensation)	
	Altitude	• 1000 m or less	

Item		Specifications	Remarks
Environment	Vibration	• 3 mm: 2 to less than 9 Hz • 9.8m/s^2: 9 to less than 20 Hz • 2m/s^2: 20 to less than 55 Hz • 1m/s^2: 55 to less than 200 Hz	
	Storage temperature	• -25 to +65°C	
	Storage humidity	• 5 to 95% RH (No condensation)	
Others	Higher harmonics current suppression	• Terminal for connecting power-factor correcting DC reactor (DCR) is provided as standard.	P1, P(+) terminal
	Charging suppression resistor	• Charging suppression resistor is built-in for all inverter unit.	
	Cooling fan ON/OFF control	• Cooling fan can be automatically stopped when inverter is stopped.	

9-3 Dimensions



Detailed diagram for 5 x 6 hole
Up/down or right/left symmetry

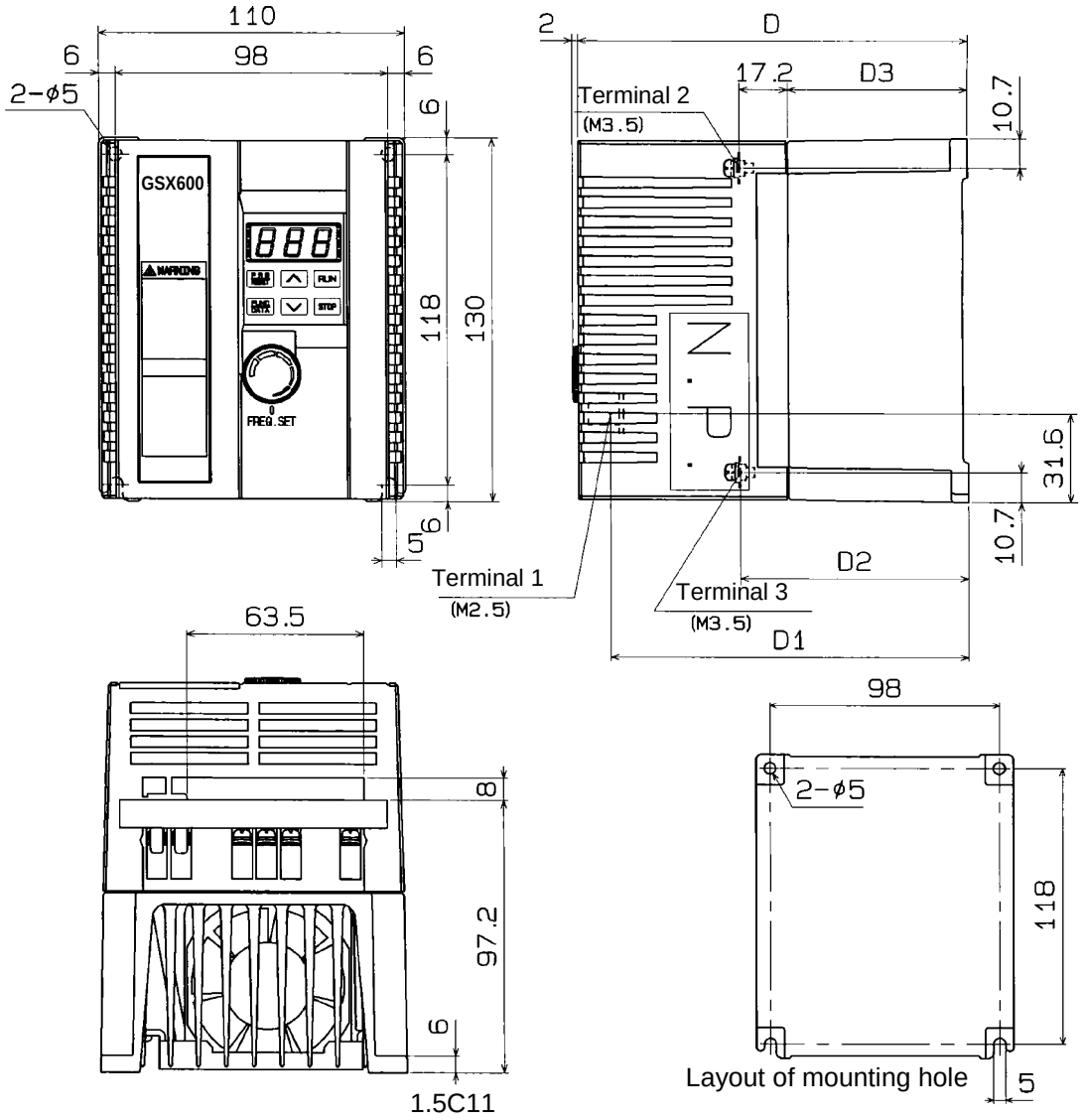
TERMINAL 1	30A	30B	30C	FM	X1	X2	X3	FWD	REV	P24/ CM	11	12	13	C1

TERMINAL 2	⏚G	L1/L		L2/N	P1	P(+)

Single phase 200V series

TERMINAL 3	P(+)	N(-)	U	V	W	⏚G

Series	Type	Nominal applied motor (kW)	Dimensions (mm)				
			D	D1	D2	D3	D4
Single phase 220V	GSX600-0.4-S	0.4	115	103.5	42.2	25	58.2
	GSX600-0.75-S	0.75	140	128.5	67.2	50	83.2



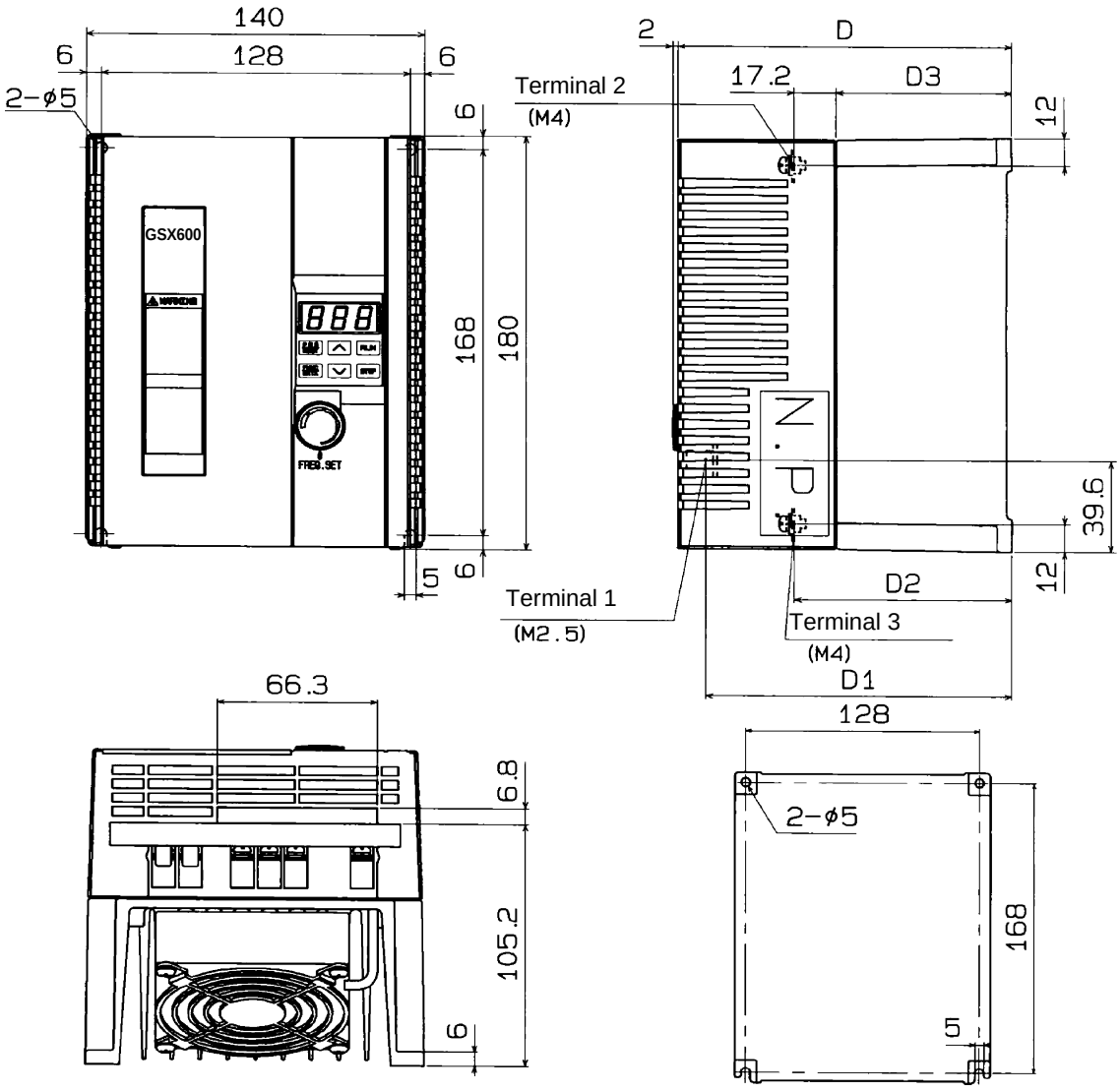
TERMINAL 1	30A	30B	30C	FM	X1	X2	X3	FWD	REV	P24/ CM	11	12	13	C1

TERMINAL 2	⏚G	L1/L		L2/N	P1	P(+)

Single phase 200V series

TERMINAL 3	P(+)	N(-)	U	V	W	⏚G

Series	Type	Nominal applied motor (kW)	Dimensions (mm)			
			D	D1	D2	D3
Single phase 200V	GSX600-1.5-S	1.5	149	137.5	81.2	64



2.2C11S

Layout of mounting hole

TERMINAL 1	30A	30B	30C	FM	X1	X2	X3	FWD	REV	P24/ CM	11	12	13	C1

TERMINAL 2	⏚G	L1/L		L2/N	P1	P(+)

Single phase 200V series

TERMINAL 3	P(+)	N(-)	U	V	W	⏚G

Series	Type	Nominal applied motor (kW)	Dimensions (mm)			
			D	D1	D2	D3
Single phase 200V	GSX600-2.2-S	2.2	137	125.5	89.2	72

9-4 Selection of Peripheral Device

It is recommended to use a prescribed wire according to the EN60204 Appendix C.

Power supply voltage	Nominal applied motor (kW)	Inverter type	Molded case circuit breaker [1] (MCCB) Earth-leakage circuit breaker (ELCB or RCD) rated current (A)		Magnetic contactor (MC)			Recommended wire size (mm^2)				
					Input circuit Single-phase 200V [L1/L, L2/N]		Output circuit [U,V,W]	Input circuit Single-phase 200V [L1/L, L2/N]		Output circuit [2] [U,V,W]	DCR circuit [2] [P1][P(+)]	Control wiring
			Using with DCR.	Not using with reactor. [3]	Using with DCR.	Not using with reactor. [3]		Using with DCR.	Not using with reactor. [3]			
Single phase 200V	0.4	GSX600-0.4-S	6	10	SC-05			[4] 2.5	[4] 2.5	[4] 2.5	[4] 2.5	0.5
	0.75	GSX600-0.75-S	10	16								
	1.5	GSX600-1.5-S	16	20					[4] 4.0			
	2.2	GSX600-2.2-S	20	32	SC-5-1			[5] 4.0	[5] 6.0	[5] 2.5	[5] 4.0	

Table 9-4-1 Peripheral device selection

1) The frame size and the series for the applicable molded-case circuit breaker (MCCB) and earth-leakage circuit breaker (ELCB or RCD) differ according to the capacity of transformer in the facility. Refer to each technical document for details.
2) The recommended wire size in the main circuit is for when the ambient temperature is 40°C and conforming to LVD requirements. The wire size in ( ) is minimum size for IV wire when no necessary of conforming to LVD.
3) Power supply impedance without a reactor must be 0.1% or equivalent by converting to the inverter capacity. Based on the voltage imbalance, a current imbalance of 10% is expected.
4) Crimp terminals up to 7.4mm in width (including tolerance) can be used.
5) Crimp terminals up to 9.5mm in width (including tolerance) can be used.

10 Options

10-1 Built-in Options

There is an optional built-in card for RS485 serial communication. Ask at the inverter distributor for details.

10-2 External Options

Molded case circuit breaker	The molded case circuit breaker (MCCB) is connected for protecting the main circuit wiring to the inverter and for turning power on and off. The rated current or the rated interrupting capacity varies according to the power supply specifications.
For input power-factor correcting AC reactor (ACR) DC reactor (DCR)	This is connected in the following cases. 1. When the power transformer capacity is more than 500 kVA 2. To reduce input harmonic current The input power factor is improved to 0.75 to 0.85 (ACR). The input power factor is improved to 0.9 to 0.95 (DCR). 3. If there is a thyristor load in the same power supply, if the capacitor for power-factor correcting is turned on or off, or if the surge voltage in the power supply is large (ACR only) * The DC reactor is unnecessary when the AC reactor is used.
Magnetic contactor (MC)	The inverter can be operated without connecting the magnetic contactor. When the inverter protective function is activated, this should be connected to turn off the power for safety.
Surge absorber	This is connected to suppress the surge generated by the exciting coil when switching on or off the magnetic contactor and the control relay. S2-A-0 (for magnetic contactor), S1-B-0 (for mini control relay)
Frequency setting POT (VR)	This is connected when the frequency is set from the control circuit terminal using inverter power.

Table 10-2-1 External Options

11 Applicable reactors

Applicable inverter type	Input power-factor correcting DC reactor (DCR)
GSX600-0.4-S	DCR2-0.75
GSX600-0.75-S	DCR2-1.5
GSX600-1.5-S	DCR2-2.2
GSX600-2.2-S	DCR2-3.7

Table 11-1-1 List of applicable reactors

Connection method

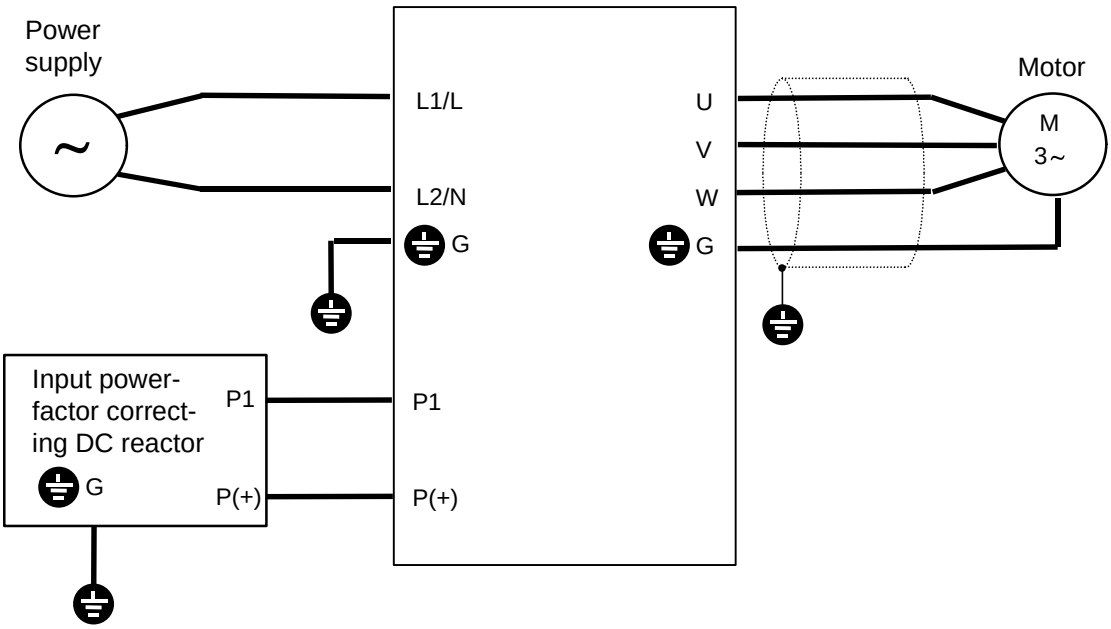


Fig. 11-1-1 Connection method of Input power-factor correcting DC reactor (DCR)

12 Compliance with standards

12-1 UL/cUL standards [Applicable to products with UL/cUL mark]

12-1-1 General

The UL standards stand for Underwriters Laboratories Inc. and they are safety standards aiming at prevention of fire and other accidents in the United States, thereby providing protection for operators, service personnel and other persons.
The cUL standards are established by UL in the view of compliance with the CSA standards. The effect of products certified for the cUL standards is equal to that of products certified for the CSA standards.

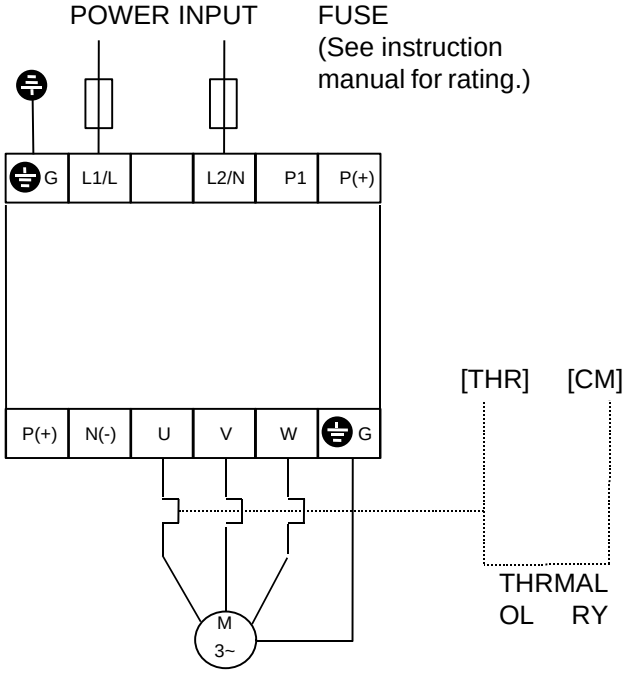


Fig. 12-1-1 Recommended wiring

12-1-2 Precautions

When using the UL/cUL certified product, refer to "Compliance with UL/cUL standards" on page 2.
For connection, refer to Fig. 12-1-1.

- Open Type Equipment "indoor use only"
- Suitable for use on a circuit capable or delivering not more than 5,000 rms symmetrical amperes, 240V maximum.
- When Protected by Class J Fuses.
- Use 60/75 C CU wire only.
- A Class 2 circuit wired with Class 1 wire.
- Field wiring connection must be made by a UL Listed and CSA Certified closed-loop terminal connector sized for the wire gauge involved. Connector must be fixed using the crimp tool specified by the connector manufacturer.
- Solid state motor overload protection is provided in each model.

12-2 Compliance with EMC directive in EU [Applicable to products with CE mark]

12-2-1 General

The CE mark indicated on the GSX600 series concerns with European minister directorate directive 89/336/EEC concerning the environmental electromagnetic compatibility EMC, and other directives are not included.

The CE mark does not prove that the entire machine or system housing our product complies with the EMC directive. Therefore indication of the CE mark to the entire machine or system will be done at the responsibility of the manufacturer or the machine. This is because:

1. The CE mark attached on our product supposes operation of the product under certain conditions. Satisfaction of the conditions is up to the manufacturer of the machine.
2. Generally speaking, various devices are used in a machine or system as well as our product. Therefore consideration for the entire machine or system must be paid by the manufacturer of the machine.

The EMC directive includes immunity to the incoming noise and emission of outgoing noise. The general purpose inverter houses an internal element switching at a high speed which generates electric noise.

Applicable standards
Immunity: EN 61800-3
Emission: EN 61800-3

Above-mentioned "certain conditions" include installation of a dedicated RFI filter in a metallic control panel.
Refer to in exclusive Instruction Manual for RFI Filter for details.

12-3 Compliance with low voltage directive in EU [Applicable to products with TÜV or CE mark]

12-3-1 General

The general purpose inverter is applicable for the low voltage directive in EU. Compliance of the GSX600 series with EN 50178/1997 has been obtained from a testing organization in EU and compliance with the low voltage directive is asserted.

12-3-2 Precautions

Refer to "Compliance with low voltage directive in EU" on pages 2 and 3 when using our product as one complying with the low voltage directive in EU.

13 Electromagnetic Compatibility (EMC)

13-1 General

In accordance with the provisions described in the European Commission Guidelines Document on Council Directive 89/336/EEC,
Bonfiglioli Group, Silectron sistemi division, has chosen to classify the GSX600 range of Inverters as "Complex Components".

Classification as a "Complex Components" allows a product to be treated as an "apparatus", and thus permits compliance with the essential requirements of the EMC Directive to be demonstrated to both an integrator of GSX600 Inverters and to his customer or the installer and the user.

GSX600 Inverters is supplied 'CE-marked', signifying compliance with EC Directive 89/336/EEC when fitted with specified filter units installed and earthed in accordance with this sheet.
This Specification requires the following performance criteria to be met.

EMC product standard **EN61800-3/1996**

Immunity:
Second environment
(Industrial environment)
Emission:
First environment
(Domestic environment)

Finally, it is customer's responsibility to check whether the equipment conforms to EMC directive.

13-2 RFI Filters

It is strongly recommended that the appropriate GSX600 input filter is used, as shown in the followings, to limit RF current flowing into the main supply circuit.
Without an input filter a GSX600 installation may not meet statutory requirement. GSX600 Inverters contain high-power semi-conductor devices which are switched at high speeds to synthesize a near-sinusoidal current wave form across the frequency range of output.
Rapidly-changing voltages and currents will generate some degree of electromagnetic emission. Emissions will be predominantly conducted through the motor and the mains supply cables, although some radiated emissions will be detected in close proximity to the drive system.
It is essential that precautions are taken both at the design stage and at the time of installation to prevent radio frequency interference (RFI) from the drive system affecting sensitive equipment in close proximity.

The RFI filters range are designed especially for the GSX600 Inverter and help to ensure EMC compliance of machinery and installations using the Inverters.
The Inverters may be mounted on top of the filter using the integral fixing positions, the intention being that valuable space inside wiring cabinets may be saved. (Refer to Table 13-2-1)

Applied Inverter	Filter Type	Rated Current	Max. Rated Voltage	Dimensions LxWxH [mm]	Mount Dims Y x X [mm]	Wiring L' [mm]	Total[1)] Weight [kg]	Inverter Fixings	Fig.
GSX600-0.4-S GSX600-0.75-S	EFL-0.75C11-7	12A	1ph 240Vac	180x86x38	155.5x60	125	Approx. 0.7	M4 x 12 (4)	Fig. 13-2-1
GSX600-1.5-S	EFL-1.5C11-7	20A		190x117x46	165x89	140	Approx. 1.2	M4 x 16 (4)	Fig. 13-2-2
GSX6002.2-S	EFL-2.2C11-7	29A		240x148x46	216x118	150	Approx. 1.5	M4 x 16 (4)	Fig. 13-2-2

Table 13-2-1 RFI filters Dimensions

Note: For detail, refer to the instruction manual that came with the RFI filters.

Remark: The EMC compliance tests have been carried out on the basis of the EN61800-3. Measurements were done with 50m motor cable (EN55011/ class A) and 10m motor cable (EN55011/ class B).

Remark: To minimize the conducted radio disturbance in the power distribution system, the length of motor cable should be as short as possible. And it is user's responsibility to confirm that the apparatus, which the inverters installed in, conforms to EMC directive when longer motor cable is used or other installation conditions are different from those described in this manual.

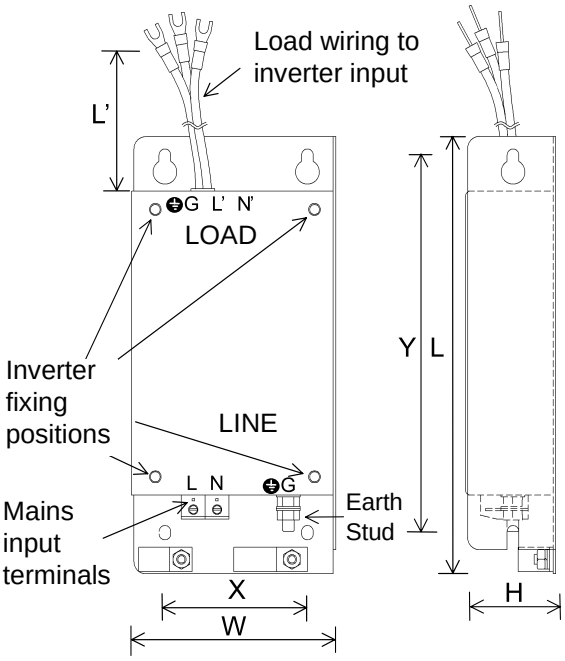


Fig. 13-2-1 RFI Filters

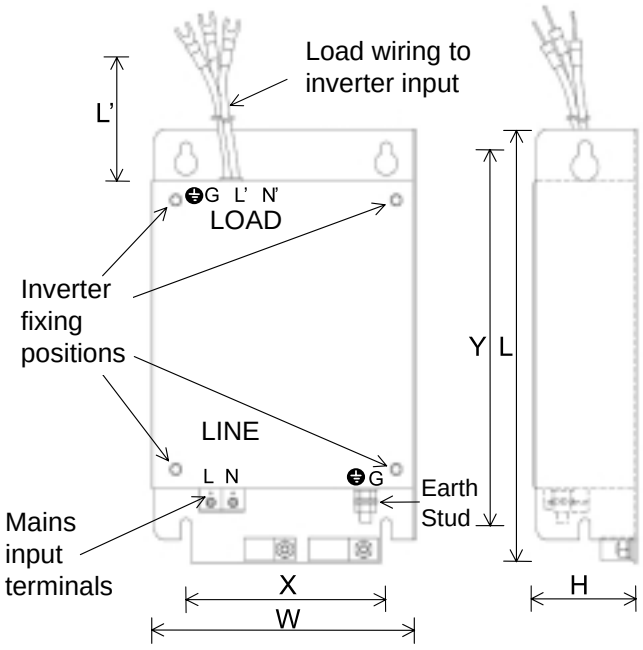


Fig. 13-2-2 RFI Filters

13-3 Recommended Installation Instructions

It is necessary that these instructions must be followed to conformed to EMC Directive.
Follow the usual safety procedures when working with electrical equipment. All electrical connections to the filter, Inverter and motor must be made by a qualified electrical technician.
(Refer to Fig. 13-3-1 and Fig. 13-3-2)

1. Use the correct filter according to Table 13-2-1.
2. Install the Inverter and filter in the electrically shielded metal wiring cabinet.
3. The back panel of the wiring cabinet of board should be prepared for the mounting dimensions of the filter. Care should be taken to remove any paint etc. from the mounting holes and face area of the panel. This will ensure the best possible earthing of the filter.
4. Use the screened cable for the control , motor and other main wiring which are connected to the Inverter, and these screens should be securely earthed.
5. It is important that all wire lengths are kept as short as possible and that incoming mains and outgoing motor cables are kept well separated.

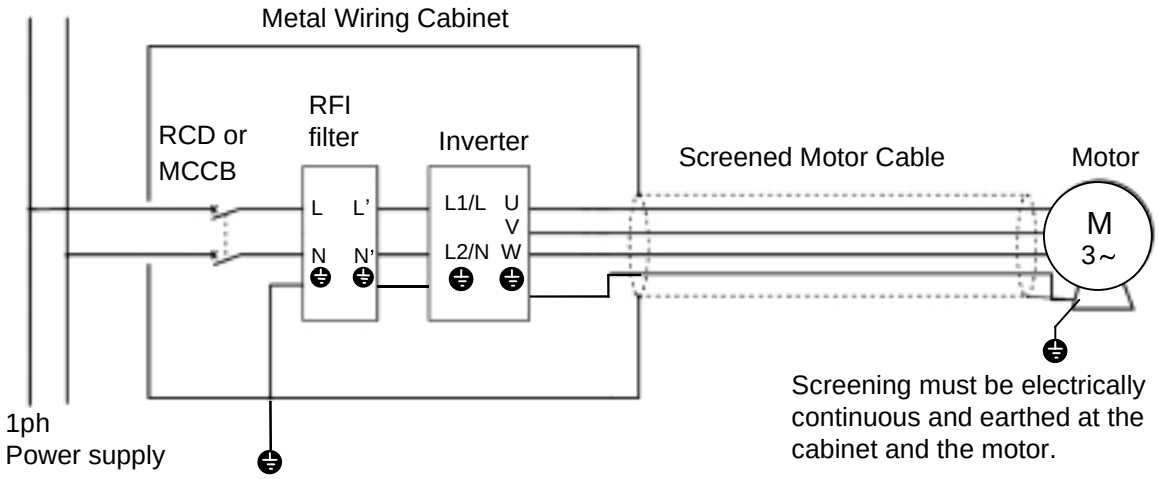


Fig. 13-3-1 Recommended Installation

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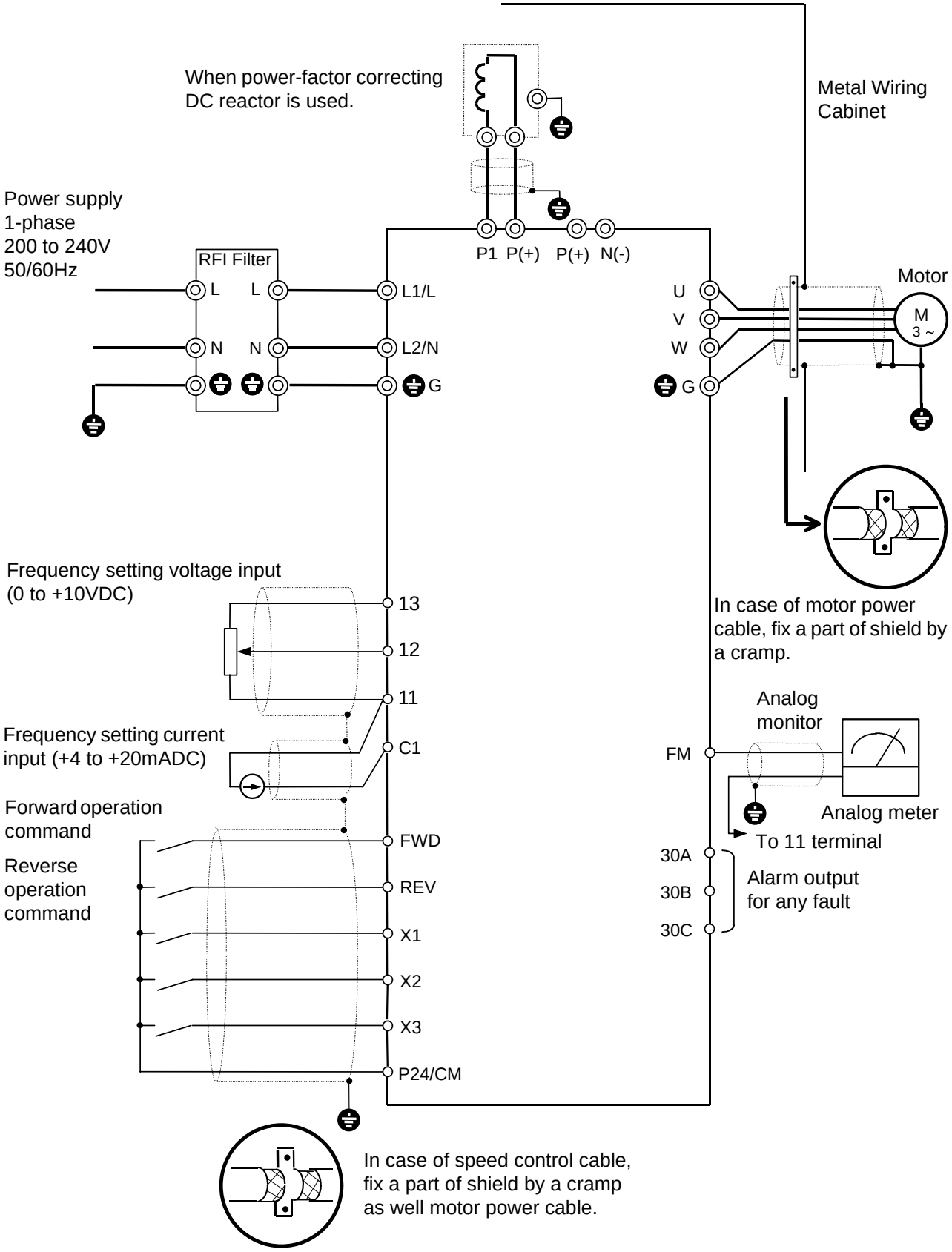

Fig. 13-3-2 Recommended installation detail inside the enclosure (SW7 set to P24)

EC Declaration of Conformity

Distributor:	**Bonfiglioli Riduttori S.p.A.**
Address:	**via Giovanni XXIII, 7/A** **40012 Lippo di Calderara di Reno** **Bologna (Italy)**

Product Identification

Product:	**Inverter**
Brand:	**Bonfiglioli Riduttori S.p.A.**
Model/type:	**GSX600-0.4-S** **GSX600-0.75-S** **GSX600-1.5-S** **GSX600-2.2-S**

Above listed products are in accordance with the regulations of following council directives and their amendments:

EMC Directive 89/336/EEC (Electromagnetic Compatibility)

Low Voltage Directive 73/23/EEC (LVD)

For assessment of conformity the following relevant standards have been taken into consideration:

EN61800-3:1996
EN50178:1997

The conformity with regulations of the EMC directive have been, as far as required, certified by competent body:

TÜV Rheinland Product Safety GmbH

Address: **Am Grauen Stein**
D-51105 Köln
Germany

Number of Certificate: **CC2050317** Date of issue: 27th Mar. 2000

Year of appending CE mark for LVD: **2000**

Bonfiglioli Riduttori S.p.A.
Dated: 27th April 2000

Francesco Petilli
Chief Executive Officer

This declaration verifies the accordance with the mentioned directives, but retains no assurance of properties.
The safety and installation instructions of the product documentation which is included in the shipping have to be considered.