

Accessories



Appendix

A

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FUSES/CIRCUIT BREAKERS

Protection devices are essential to prevent damage to your GS30 drive and application equipment. Please use the fuse specification chart below to select fuses that are applicable to your GS30 drive. Only use UL-certified fuses which comply with your local regulations.

Fuse Specification Chart GS30 DURAPULSE Drives									
Drive Model	HP	Input Power		Input Fuse				Circuit Breaker	
		Ø	Volts	GS30 Input Amps	Fuse Amps	Fast Acting Class T	Edison Class J*	Size	Note
GS31-20P5	1/2	1		8.3	15	TJN15	JHL15	20	GCB100S-3FF20LL
GS31-21P0	1			11.3	20	TJN20	JHL20	30	GCB100S-3FF30LL
GS31-22P0	2			18.5	35	TJN35	JHL35	45	GCB100S-3FF40LL
GS31-23P0	3			27.5	50	TJN50	JHL50	70	GCB100S-3FF70LL
GS33-20P5	1/2	230		3.8	15	TJN15	JHL15	15	GCB100S-3FF15LL
GS33-21P0	1			6	20	TJN20	JHL20	16	GCB100S-3FF15LL
GS33-22P0	2			9.6	35	TJN35	JHL35	25	GCB100S-3FF25LL
GS33-23P0	3			15	50	TJN50	JHL50	40	GCB100S-3FF40LL
GS33-25P0	5			23.4	80	TJN80	JHL80	60	GCB100S-3FF60LL
GS33-27P5	7 1/2			32.4	60	TJN60	JHL60	63	GCB100S-3FF60LL
GS33-2010	10			43.2	80	TJN80	JHL80	90	GCB100S-3FF90LL
GS33-2015	15			61.2	110	TJN110	JHL110	125	GCB150S-3FF125LL
GS33-2020	20			82.8	150	TJN150	JHL150	160	BW250JAGU- 3P160SB
GS33-2025	25			85.0	170	TJN175	JHL175	175	GCB250S-3FF175LL
GS33-2030	40			103.0	206	TJN200	JHL200	200	GCB250S-3FF200LL
GS33-2040	40			126.0	252	TJN250	JHL250	225	GCB250S-3FF225LL
GS33-2050	50			151.0	302	TJN300	JHL300	300	GCB400S-3FF300LL
GS33-40P5	1/2	3		2	10	TJS10	JHL10	15	GCB100S-3FF15LL
GS33-41P0	1			3.3	15	TJS15	JHL15	15	GCB100S-3FF15LL
GS33-42P0	2			5.1	20	TJS20	JHL20	15	GCB100S-3FF15LL
GS33-43P0	3			7.2	25	TJS25	JHL25	20	GCB100S-3FF20LL
GS33-45P0	5			11.6	45	TJS45	JHL45	30	GCB100S-3FF30LL
GS33-47P5	7 1/2			17.3	35	TJS35	JHL35	32	GCB100S-3FF30LL
GS33-4010	10			22.6	45	TJS45	JHL45	45	GCB100S-3FF40LL
GS33-4015	15			30.8	60	TJS60	JHL60	60	GCB100S-3FF60LL
GS33-4020	20			39.6	80	TJS80	JHL80	80	GCB100S-3FF80LL
GS33-4025	25			45.7	90	TJS90	JHL90	90	GCB100S-3FF90LL
GS33-4030	30			53.9	110	TJS110	JHL110	100	GCB100S-3FF100LL
GS33-4040	40			72.5	150	TJN150	JHL150	125	GCB150S-3FF125LL
GS33-4050	50			77.0	160	TJN175	JHL175	150	GCB150S-3FF150LL
GS33-4060	60			97.0	200	TJN200	JHL200	175	GCB250S-3FF175LL
GS33-4075	75			123.0	250	TJN250	JHL250	225	GCB250S-3FF225LL
GS33-4100	100			173.0	350	TJN350	JHL350	300	GCB400S-3FF300LL

* High-speed Class J.

Note: JHL fuses can be used with GS and DURAPULSE drives in non-UL applications. Fuse the drive according to NEC guidelines (NEC Article 430). For UL applications, GS, and DURAPULSE drives require Class T fuses.

RECOMMENDED FUSE SPECIFICATIONS FOR THE DC SIDE OF COMMON DC BUS

These fuses are applicable only when connecting input power directly to the DC bus with terminals DC+ and DC-.

- The fuse current specifications in table below are based on overloading. If there is no possibility of overloading during use then fuses with a lower rating than the table below are allowed. The DC-side current calculation method described below can be used to calculate a suitable fuse rating for drive with DC current. Special cases such as overload or emergency stop must be considered however.
- For the DC-side fuse, please select a DC fuse or refer to the DC voltage specifications from the fuse parameters. The DC voltage rating must be higher than the operating voltage.
- Fuse selection should take into account operating class (e.g. High-speed or general purpose) and overloading.
 - a) If the drive is subject to overloading and high-speed fuses are used: Due to the speed of response the chosen fuse should be rated double that of the calculated maximum instantaneous DC current.
 - b) If the drive is subject to overloading and normal fuses are used: Fuse selection should be based on the calculated maximum instantaneous current during overloading.
 - c) If drive is not subject to overloading: Select fuses with a current rating close to that of the calculated DC current.
- UL-listed fuse suitable for short-circuit protection of inputs. "In the United States, branch circuits must comply with the US National Electrical Code (NEC) and its local directives." Please select a UL-listed fuse to comply with local regulations.
- "In Canada, branch circuits must comply with the Canadian Electrical Code and its local directives." Please select a UL-listed fuse to comply with local regulations.

GS30 - DC Bus Fusing			
Requirement	Drive Model	230V Drives	460V Drives
DC Bus Voltage Level	all models	350	700
DC Bus Fuse Voltage Rating	all models	690	1250
	0P5 (1/2HP)	10	10
	1P0 (1HP)	16	10
	2P0 (2HP)	25	16
	3P0 (3HP)	40	20
	5P0 (5HP)	63	30
	7P5 (7.5HP)	80	40
	010 (10HP)	100	55
	015 (15HP)	160	80
	020 (20HP)	200	100
	025 (25HP)	-	125
	030 (30HP)	-	160

DC SIDE CURRENT CALCULATION

Different motors and loads will produce different DC current values. When the motor power and efficiency parameters are known, use the following formula to calculate the DC current:

$$I_{dc} = P_{motor} / (1.35 * V_{Line} * \eta_{motor})$$

Where

- V_{Line} = Output voltage
- η_{motor} = motor efficiency
- P_{motor} = Motor power

If the input DC voltage, output load, and output power factor are known then the following formulation can be used as well:

$$I_{dc} = (V_{line} * \sqrt{3} * I_o * \cos\theta / 0.95) / VDC$$

For example:

$V_{line}=220V$, motor power factor $\cos\theta=0.8$, drive efficiency 0.95 (generally 0.94~0.98), output current $I_o=11A$, $VDC=360V$

$$I_{dc} = (220V * \sqrt{3} * 11 * 0.8 / 0.95) / 360$$
$$I_{dc} = 9.8A$$

STANDARD FOOTPRINT EMC FILTER AND ZERO PHASE REACTOR

Use EMC filters to enhance the EMC performance for the environment and machines and to comply with EMC regulations, further reducing EMC problems. If you purchase a motor drive without a built-in EMC filter, we recommend that you select an EMC filter as shown below. GS30 drives will mount on top of these footprint filters for Frames A–D. For some motor drive models, you need to work with zero phase reactors to be compliant with EMC regulations. Refer to the table and figure below for the recommended model, setting method, and maximum motor cable length of the EMC filter and zero phase reactor.

GS30 EMC Filter and Zero Phase Reactor													
Frame	Drive Model	Input Current (A)	Footprint Filter** Model #	Filter Dimensions	Recom- mended Zero Phase Reactor	Conducted Emission			Radiated Emission				
						C1-motor cable length-30m	C2- motor cable length-100m	C2-motor cable length-100m					
									Zero Phase Reactor Position*				
1	2	3	n/a	1	2	3							
A	GS31-20P5	6.7	EMF11AM21A	PDF	RF008X00A		✓	✓	N/A		✓	✓	
	GS33-20P5	3.8	EMF10AM23A	PDF			✓	✓			✓	✓	
	GS33-21P0	6	EMF10AM23A				✓	✓			✓	✓	
	GS33-40P5	2.5	EMF6A0M43A			PDF				✓			✓
	GS33-41P0	4.2	EMF6A0M43A					✓				✓	
B	GS31-21P0	10.5	EMF11AM21A	PDF				✓		✓		✓	✓
	GS33-22P0	9.6	EMF10AM23A	PDF			✓	✓			✓	✓	
	GS33-42P0	6.4	EMF6A0M43A	PDF				✓				✓	
C	GS31-22P0	17.9	EMF27AM21B	PDF				✓				✓	
	GS31-23P0	26.3	EMF27AM21B					✓				✓	
	GS33-23P0	15	EMF24AM23B	PDF			✓	✓			✓	✓	
	GS33-25P0	23.4	EMF24AM23B				✓	✓			✓	✓	
	GS33-43P0	7.2	EMF12AM43B			PDF							
	GS33-45P0	11.6	EMF12AM43B				✓	✓			✓	✓	
D	GS33-27P5	32.4	EMF33AM23B	PDF			✓	✓				✓	✓
	GS33-47P5	17.3	EMF23AM43B	PDF		✓	✓	✓			✓	✓	
	GS33-4010	22.6	EMF23AM43B			✓	✓	✓			✓	✓	
E	GS33-2010	43.2	B84143D0050R127			PDF		✓		✓			✓
	GS33-2015	61.2	B84143D0075R127				✓	✓				✓	✓
	GS33-4015	30.8	B84143D0050R127										
	GS33-4020	39.6	B84143D0050R127		✓		✓			✓	✓		
F	GS33-2020	82.8	B84143D0090R127	PDF		✓	✓			✓	✓		
	GS33-4025	45.7	B84143D0050R127			✓	✓			✓	✓		
	GS33-4030	53.9	B84143D0075R127			✓	✓			✓	✓		
Continued on next page													
Note: It is not necessary to add a zero phase reactor for passing the C2 conducted emission test.													
* See diagram on the next page for installation positions.													
** The B8 series filters are not footprint filters, they must be mounted separately.													

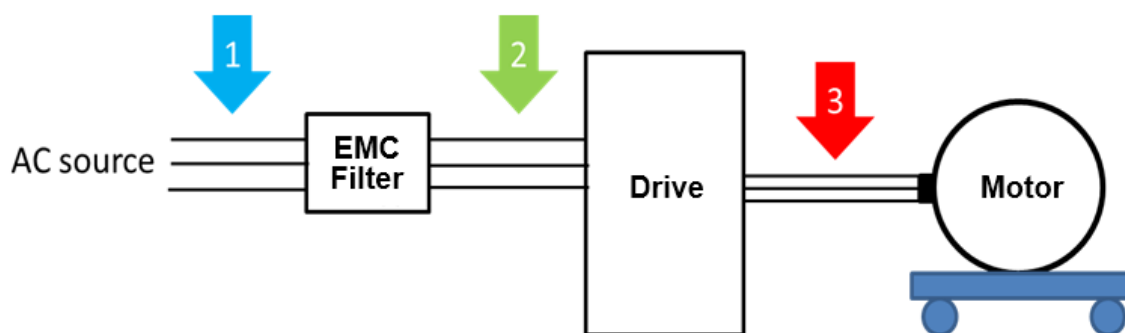
GS30 EMC Filter and Zero Phase Reactor																		
Frame	Drive Model	Input Current (A)	Footprint Filter** Model #	Filter Dimensions	Recommended Zero Phase Reactor	Conducted Emission									Radiated Emission			
						C1-motor cable length-10m	C2-motor cable length-20m	C3-motor cable length-100m							C2-motor cable length-100m			
						Zero Phase Reactor Position*												
						1	2	3	1	2	3	1	2	3	1	2	3	
G	GS33-2025	85	B84143A0120R105	PDF	RF008X00A		✓	✓			✓					✓	✓	
	GS33-2030	103	B84143A0120R105				✓	✓			✓					✓	✓	
	GS33-4040	72.5	B84143A0120R105			✓		✓			✓							
H	GS33-4050	77	B84143D0150R127	PDF	RF002X00A**	✓		✓			✓					✓	✓	
	GS33-4060	97	B84143D0150R127			✓		✓			✓					✓	✓	
I	GS33-2040	126	B84143D0200R127	PDF		✓	✓	✓									✓	✓
	GS33-2050	151	B84143D0200R127			✓	✓										✓	✓
	GS33-4075	123	B84143D0200R127				✓											
	GS33-4100	173	B84143D0200R127				✓											

Note: It is not necessary to add a zero phase reactor for passing the C2 conducted emission test.

* See diagram below for installation positions.

** The B8 series filters are not footprint filters, they must be mounted separately.

Zero phase reactor installation position diagram:



- 1: Install at the cable between the power supply and the EMC filter.
- 2: Install at the cable between the EMC filter and the drive.
- 3: Install at the cable between the drive and the motor.



Example of drive installed with footprint filter

HIGH PERFORMANCE EMI INPUT FILTERS

The optional accessories listed in this chapter are available for use with the GS30 drive. Selection of these accessories is application specific and may improve drive performance. Additional information regarding filter installation and operation is available in the AutomationDirect white paper, “[Applied EMI/RFI Techniques Overview](#).”

EMI Filters Selection			
Model	Description	EMI Filter*	
		Roxburgh Filters Chassis 1ph	Roxburgh Filters C2 Rated
GS31-20P5	230V 1ph 0.5 hp	RES90F10	MIF10
GS31-21P0	230V 1ph 1.0 hp	RES90F16	MIF16
GS31-22P0	230V 1ph 2.0 hp	RES90S20	MIF23
GS31-23P0	230V 1ph 3.0 hp	RES90S30	MIF330B
GS33-20P5	230V 3ph 0.5 hp	-	KMF306A
GS33-21P0	230V 3ph 1.0 hp	-	KMF306A
GS33-22P0	230V 3ph 2.0 hp	-	KMF318A
GS33-23P0	230V 3ph 3.0 hp	-	KMF318A
GS33-25P0	230V 3ph 5.0 hp	-	KMF325A
GS33-27P5	230V 3ph 7.5 hp	-	KMF336A
GS33-2010	230V 3ph 10hp	-	KMF350A
GS33-2015	230V 3ph 15hp	-	KMF370A
GS33-2020	230V 3ph 20hp	-	KMF3100A
GS33-2025	230V 3ph 25hp	-	KMF3100A
GS33-2030	230V 3ph 30hp	-	KMF3100A
GS33-2040	230V 3ph 40hp	-	MIF3150
GS33-2050	230V 3ph 50hp	-	MIF3150
GS33-40P5	460V 3ph 0.5 hp	-	KMF306A
GS33-41P0	460V 3ph 1.0 hp	-	KMF306A
GS33-42P0	460V 3ph 2.0 hp	-	KMF306A
GS33-43P0	460V 3ph 3.0 hp	-	KMF310A
GS33-45P0	460V 3ph 5.0 hp	-	KMF318A
GS33-47P5	460V 3ph 7.5 hp	-	KMF318A
GS33-4010	460V 3ph 10hp	-	KMF325A
GS33-4015	460V 3ph 15hp	-	KMF336A
GS33-4020	460V 3ph 20hp	-	KMF350A
GS33-4025	460V 3ph 25hp	-	KMF350A
GS33-4030	460V 3ph 30hp	-	KMF370A
GS33-4040	460V 3ph 40hp	-	KMF370A
GS33-4050	460V 3ph 50hp	-	KMF370A
GS33-4060	460V 3ph 60hp	-	KMF3100A
GS33-4075	460V 3ph 75hp	-	MIF3150
GS33-4100	460V 3ph 100hp	-	MIF3150

* All specs for the EMI filters can be found at www.automationdirect.com or by clicking the following links: [-KMF Series Filters](#)
[-MIF Series Filters](#)
[-RES90 Series Filters](#)

EMI FILTER INSTALLATION

Electrical equipment like the GS30 drive, will generate electrical noise when in operation and may interfere with the normal operation of peripheral equipment. The use of an EMI filter will mitigate this type of power supply interference. Other measures may be required for reduction or mitigation of radiated emissions. Roxburgh EMI filters have been tested with the GS30 family of drives and are recommended for the mitigation of interference and the highest performance. When the GS30 drive and Roxburgh EMI filter are installed and wired according to the user manual, the installation will conform to the following rules:

- EN61000-6-4
- EN61800-3: 1996
- EN55011 (1991) Class A Group 1 (1st Environment, restricted distribution)

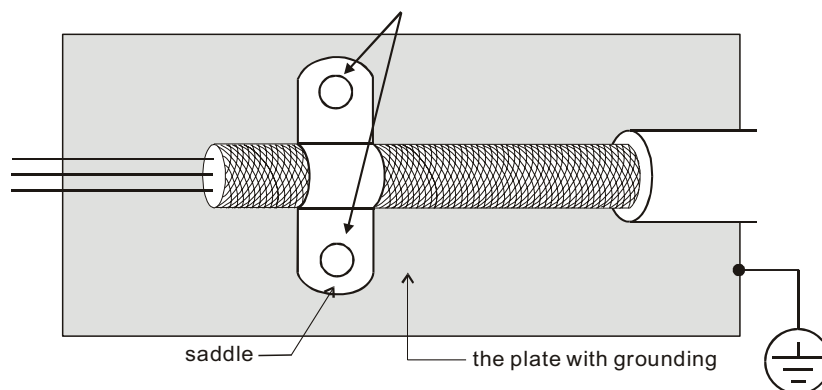
GENERAL PRECAUTION

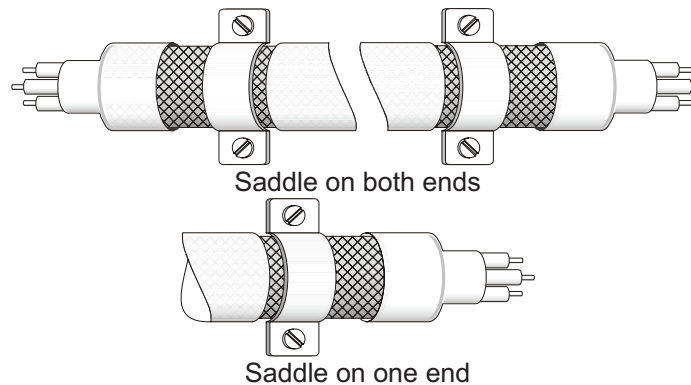
- 1) Install the EMI filter and GS30 drive on the same subpanel or metal plate.
- 2) Install the EMI filter as close as possible to the GS30 drive.
- 3) Keep wiring between the EMI filter and GS30 drive as short as possible.
- 4) The subpanel or metal plate used to support the EMI filter and GS30 drive should be well grounded (minimal resistance to ground is typically less than 1Ω).
- 5) To insure that the EMI filter and GS30 drive are adequately grounded, insure that both are securely attached to the subpanel or plate.

CHOOSE SUITABLE MOTOR CABLE AND PRECAUTIONS

Proper installation and the choice of good motor cable will positively affect the performance of the filter. When selecting motor cable, please observe the following precautions.

- 1) Cable shielding (double shielding is best).
- 2) Ground the shield on both ends of the motor cable. Maintain minimum length and employ strong mechanical connection to ground.
- 3) Remove paint on the metal saddle, subpanel or plate to insure good contact to ground.

**Figure 1**

EMI FILTER INSTALLATION (CONTINUED)**Figure 2****REFLECTIVE WAVE PHENOMENON**

The inverter section of a PWM drive like the GS30 does not produce sinusoidal output voltage wave forms. Rather, the output voltage produced is a continuous train of width modulated pulses, sent to the motor terminals via the motor cable.

Peak pulse voltage at the GS30 drive is equal to the drive DC bus voltage and contains steep rise and fall times, the result of the IGBT switching device used in the drive inverter section.

Peak pulse voltage at the motor terminals may exceed the drive DC bus voltage and is dependent on the dynamics of the drive output voltage rise time, cable transmission line characteristics, cable length and motor impedance.

The voltage pulse train at the motor terminals experiences momentary transient over voltage as the IGBT transistors switch. The result being voltage levels at the motor terminals double that of the drive bus voltage.

Over voltage of this type has the potential to stress the motor insulation, damaging the motor.

RECOMMENDED MOTOR CABLE LENGTH

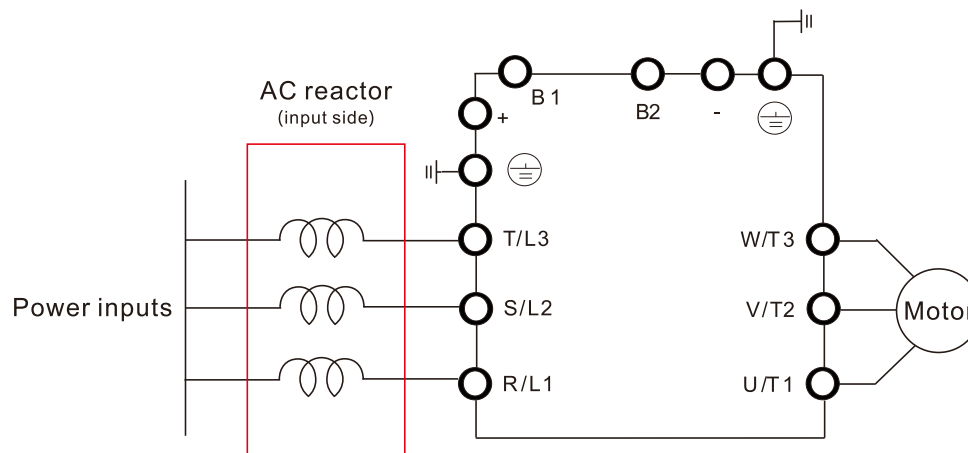
- 1) Never connect phase lead capacitors or surge absorbers to the output terminals of the drive.
- 2) As cable length increases, capacitance between cables will increase and may result in leakage current and over current faults with the possibility of damage to the GS30 drive.
- 3) If more than one motor is connected to the drive, the total cable length is the sum of the cable lengths from the GS30 drive to each motor.
- 4) Should an overload relay malfunction occur, lower the GS30 drive carrier frequency (P2.10) or install an output reactor.
- 5) When operating an AC motor with a PWM drive like the GS30, the motor may experience reflective wave as described above. To prevent this situation, please observe the recommendations below:
 - a) Use a motor with enhanced insulation. (1000V, 1200V, 1600V, higher is better)
 - b) Connect an output reactor (optional) to the output terminals of the drive.
 - c) Keep motor cable length as short as possible. (65ft, 20m, or less)
 - d) Where motor cable lengths will exceed 65ft (20m), refer to "Maximum Recommended Cable Length - GS30" on page A-16.

LINE REACTORS / VOLTAGE TIME FILTERS

LINE REACTOR

Installing an AC reactor on the input side of an AC motor drive can increase line impedance, improve the power factor, reduce input current, increase system capacity, and reduce interference generated from the motor drive. It also reduces momentary voltage surges or abnormal current spikes from the mains power, further protecting the drive. For example, when the main power capacity is higher than 500 kVA, or when using a phase-compensation capacitor, momentary voltage and current spikes may damage the AC motor drive's internal circuit. An AC reactor on the input side of the AC motor drive protects it by suppressing surges.

Install an AC input reactor in series between the main power and the three input phases R S T, as shown in the figure below:

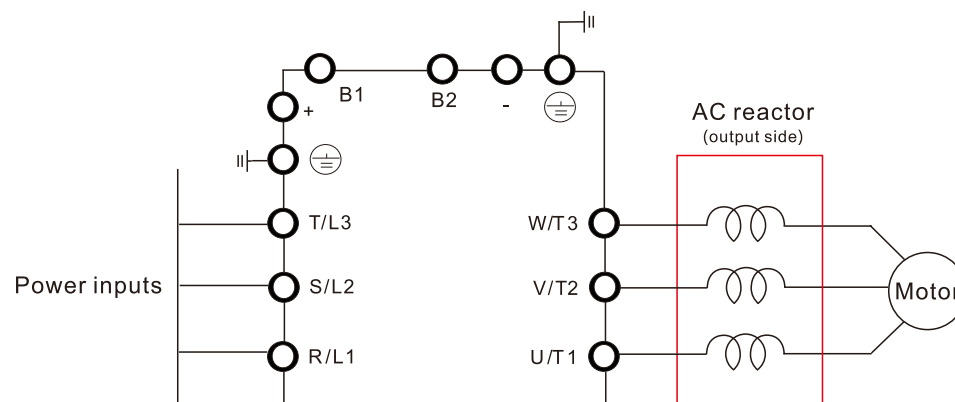


LOAD REACTOR/VOLTAGE TIME FILTER

When using drives in long wiring output application, ground fault (GFF), over-current (OC) and motor over-voltage (OV) often occur. GFF and OC cause errors due to the drive's self-protective mechanism; over-voltage damages motor insulation.

The excessive length of the output wires makes the grounded stray capacitance too large, increases the three-phase output common mode current, and the reflected wave of the long wires makes the motor dv/dt and the motor terminal voltage too high. Thus, installing a reactor on the drive's output side can increase the high-frequency impedance to reduce the dv/dt and terminal voltage to protect the motor. For distances greater than 100 feet, a dv/dt filter (VTF Series) is recommended for best performance.

Install an AC output reactor or voltage time filter in series between the three output phases U V W and the motor, as shown in the figure below:

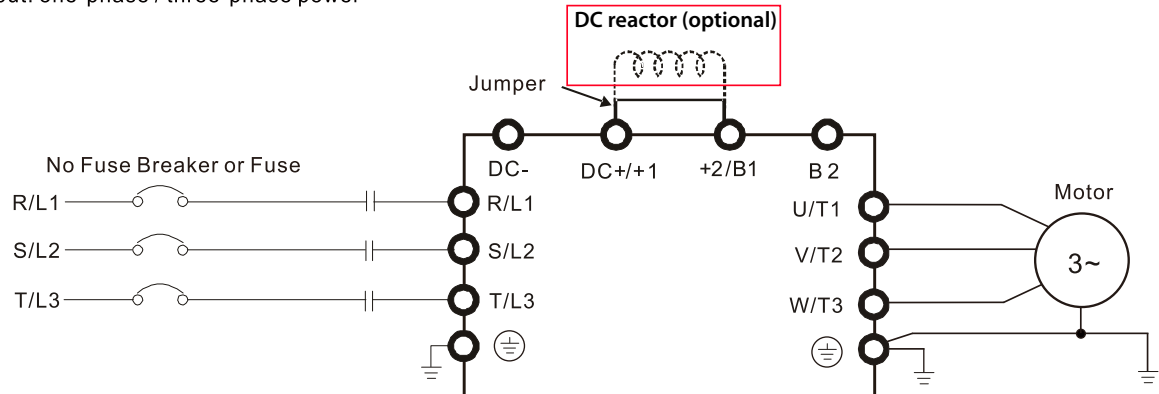


DC REACTOR

A DC reactor can also increase line impedance, improve the power factor, reduce input current, increase system power, and reduce interference generated from the motor drive. A DC reactor stabilizes the DC bus voltage. Compared with an AC input reactor, a DC reactor is in smaller size, lower price, and lower voltage drop (lower power dissipation).

Install a DC reactor between terminals +1 and +2. Remove the jumper, as shown in the figure below, before installing a DC reactor.

Input: one-phase / three-phase power



When the GS30 drive is connected directly to a large-capacity power transformer (600kVA or above) or when a power correction capacitor is switched on, excessive peak currents may occur in the input power circuit resulting in damage to the GS30 drive.

To avoid this, install a line reactor in series with the GS30 drive on the input side. The installation of a line reactor will reduce input current peaks and improve the output power efficiency.

Line (load) reactors installed on the output side protect the motor insulation against AC drive short circuits and IGBT reflective wave damage, and also allow the motor to run cooler by “smoothing” the motor current waveform. They are recommended for operating “non-inverter-duty” motors, and for any motors where the length of wiring between the AC drive and motor is less than or equal to 100 feet. For AC drive-to-motor wiring distances over 100 feet, use of the VTF series output filter is recommended.

LINE/LOAD REACTORS SELECTION CHARTS

GS30 Line/Load Reactor, AC Output Filter, & DC Reactor Selections							
GS30 Model	CT Output Amps (rms)	Saturation Amps (rms)	Motor HP	Line Reactor (LR2)**	Load Reactor (LR2)**	AC Output Filter (VTF)**	DC Reactor Delta P/N*
GS31-20P5	2.8	5.6	1/2	LR2-20P5-1PH	LR2-20P5	VTF-246-CFG	DR008D0366
GS31-21P0	4.8	9.6	1	LR-23P0	LR2-21P0	VTF-24-FH	DR011D0266
GS31-22P0	7.5	15	2	LR2-22P0-1PH	LR-22P0	VTF-246-HKL	DR017D0172
GS31-23P0	11	22	3	LR-27P5	LR-25P0	VTF-24-JL	DR025D0117
GS33-20P5	2.8	5.6	1/2	LR2-20P5	LR2-20P5	VTF-246-DGH	DR005D0585
GS33-21P0	4.8	9.6	1	LR2-20P7	LR2-20P7	VTF-24-FH	DR005D0585
GS33-22P0	7.5	15	2	LR-22P0	LR-22P0	VTF-246-HKL	DR008D0366
GS33-23P0	11	22	3	LR-25P0	LR-25P0	VTF-24-JL	DR011D0266
GS33-25P0	17	34	5	LR-27P5	LR-25P0	VTF-46-LM	DR017D0172
GS33-27P5	25	50	7 1/2	LR-2010	LR-2010	VTF-46-NP	DR025D0117
GS33-2010	33	66	10	LR-2015	LR-2010	VTF-246-LPQ	DR033DP851
GS33-2015	46	92	15	LR-2020	LR-2015	VTF-246-NRS	DR049DP574
GS33-2020	65	130	20	LR-2030	LR-2020	VTF-246-PSU	DR065DP432
GS33-2025	75	140	25	LR-2030	LR-2025	VTF-246-PSU	DR090DP325
GS33-2030	90	180	30	LR-2030	LR-2030	VTF-246-RUV	n/a
GS33-2040	120	240	40	LR-2040	LR-2040	VTF-246-RUV	n/a
GS33-2050	146	292	50	LR-2050	LR-2050	n/a	n/a
GS33-40P5	1.5	3	1/2	LR2-40P5	LR2-40P5	VTF-46-DE	DR003D1870
GS33-41P0	2.7	5.4	1	LR2-41P0	LR2-41P0	VTF-246-CFG	DR003D1870
GS33-42P0	4.2	8.4	2	LR2-43P0	LR2-42P0	VTF-24-FH	DR004D1403
GS33-43P0	5.5	11	3	LR2-45P0	LR2-43P0	VTF-24-FH	DR006D0935
GS33-45P0	9	18	5	LR2-47P5	LR2-45P0	VTF-246-HKL	DR009D0623
GS33-47P5	13	26	7 1/2	LR-4010	LR2-47P5	VTF-24-JL	DR012D0467
GS33-4010	17	34	10	LR-4015	LR-4010	VTF-24-JL	DR018D0311
GS33-4015	25	50	15	LR-4015	LR-4015	VTF-246-LPQ	DR024D0233
GS33-4020	32	64	20	LR-4020	LR-4020	VTF-246-LPQ	DR032D0175
GS33-4025	38	76	25	LR-4030	LR-4025	VTF-246-MQR	DR038D0147
GS33-4030	45	90	30	LR-4040	LR-4030	VTF-246-NRS	DR045D0124
GS33-4040	60	120	40	LR-4050	LR-4040	VTF-246-NRS	DR060DP935
GS33-4050	75	150	50	LR-4050	LR-4050	VTF-246-PSU	n/a
GS33-4060	91	182	60	LR-4060	LR-4060	VTF-246-PSU	n/a
GS33-4075	112	224	75	LR-4100	LR-4075	VTF-246-RUV	n/a
GS33-4100	150	300	100	LR-4100	LR-4100	VTF-246-SVW	n/a

* Not available at AutomationDirect.com

** Reactor sizing is based on rated HP NEMA motor load, not drive output amp load. Size the reactor based on the motor nameplate current. All specs for the LR2 and VTF can be found at www.automationdirect.com or by clicking the following links::

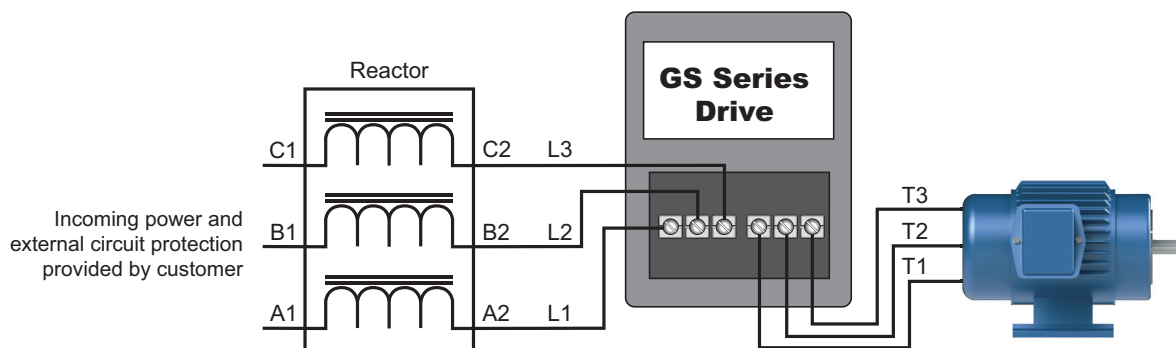
-[LR2 Line Reactors](#)

-[VTF Output Filters](#)

LINE REACTOR APPLICATIONS AND WIRING CONNECTIONS

INPUT SIDE OF AC DRIVE

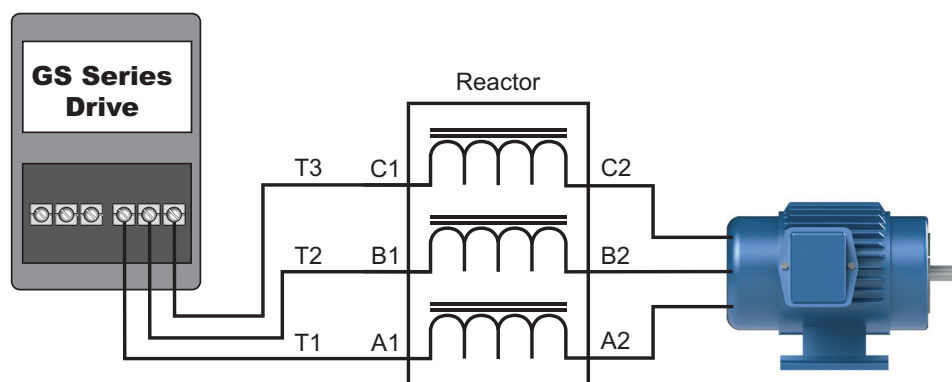
When installed on the input side of the GS30 drive, a line reactor will reduce line notching, current peaks, voltage spikes and surges from the incoming line, as well as reduce the available short circuit current. A line reactor will also reduce harmonic distortion from the GS30 drive onto the line. The line reactor is installed in front of the GS30 drive as shown.



Please refer to "Chapter 2: Installation and Wiring" for detailed wiring information for the GS30 drive.

OUTPUT SIDE OF AC DRIVE

When installed on the output side of the GS30 drive, line (load) reactors help to protect the GS30 drive from short circuits at the load. Voltage and current waveforms from the GS30 drive are enhanced, reducing motor overheating and noise emissions.



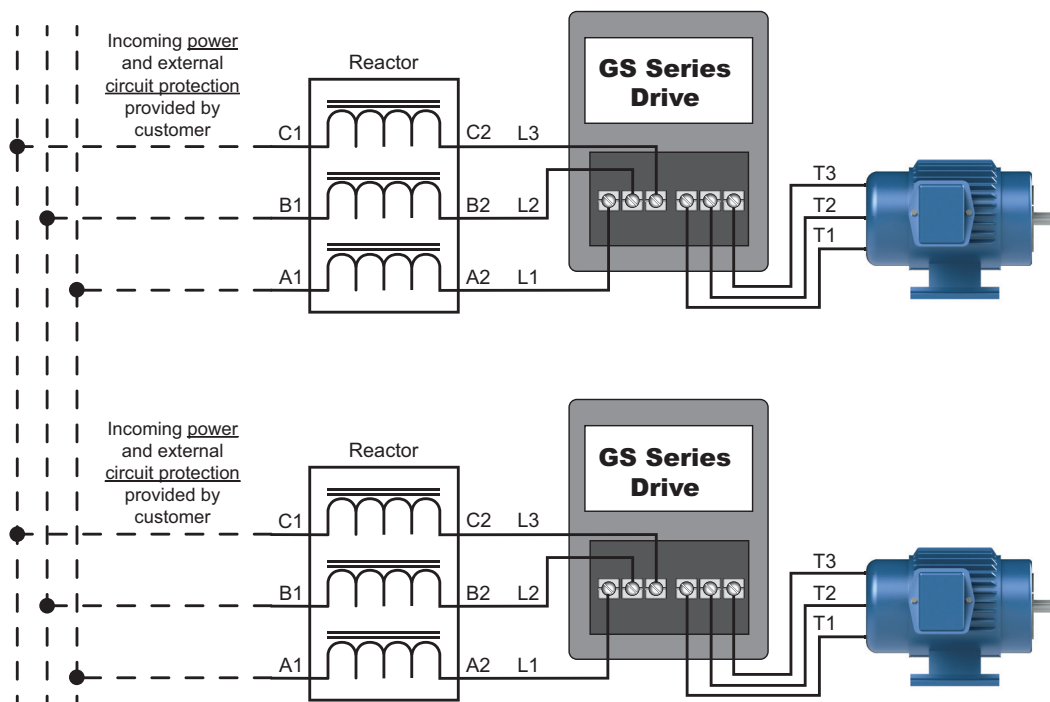
Please refer to "Chapter 2: Installation and Wiring" for detailed wiring information for the GS30 drive.



Single phase line reactors should NOT be installed on the output side of an AC Drive. Use only three-phase reactors on drive outputs, and only for three-phase motors.

MULTIPLE AC DRIVES

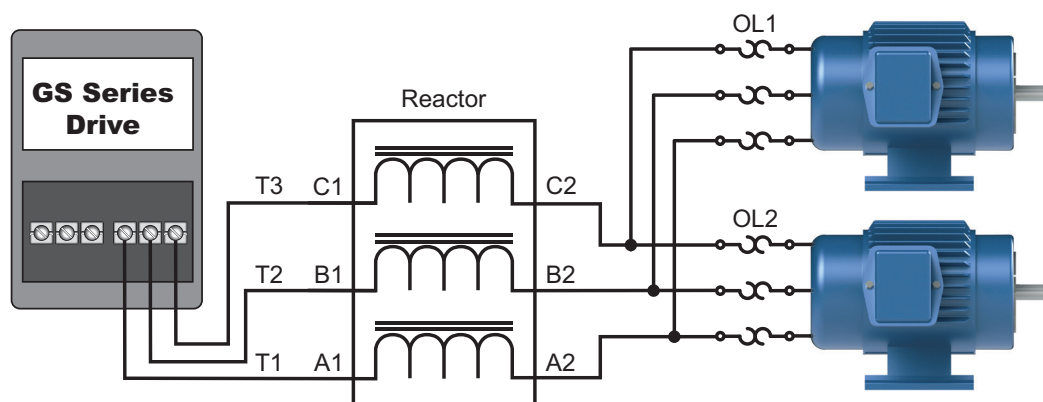
Individual line reactors are recommended when installing multiple GS30 drives on the same power line. Individual line reactors eliminate cross-talk between multiple GS30 drives and provide isolated protection for each GS30 drive for its own specific load.



Please refer to "Chapter 2: Installation and Wiring" for detailed wiring information for the GS30 drive.

MULTIPLE MOTORS

A single output (load) reactor can be used with multiple motors on the same GS30 drive, but only if the motors operate simultaneously. Size the reactor based upon the total horsepower of all the motors, and select a reactor with a current rating greater than the sum of the motor full-load currents. Overload relays are required for use in multi-motor applications.



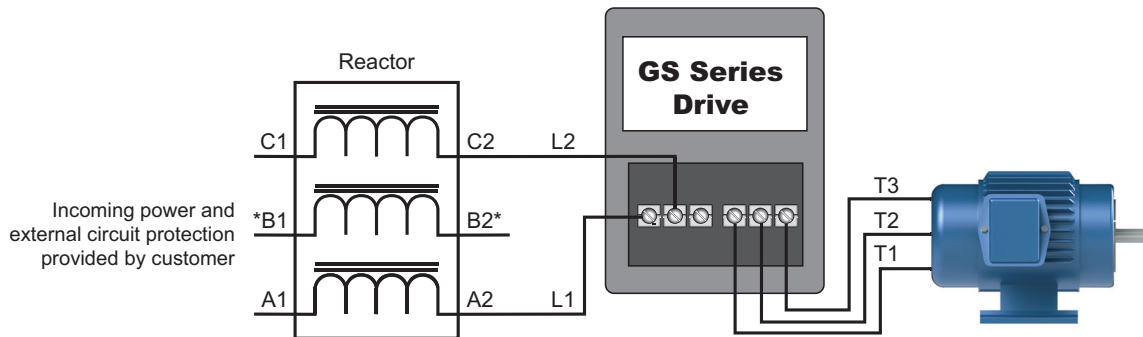
Please refer to "Chapter 2: Installation and Wiring" for detailed wiring information for the GS30 drive.



A single reactor should be used with multiple motors **ONLY** when the motors will operate simultaneously from a single AC drive. **OVERLOAD RELAYS** are required for use in multiple motor applications.

SINGLE-PHASE APPLICATIONS

Some three-phase line reactors are listed for use with single-phase input power. Follow the connection diagram shown below. Make sure that terminals B1 and B2, if present, are properly insulated before any connections are made. If a 3-phase reactor is used on the line side of a single-phase input drive application, ensure that the actual single-phase current does not exceed the Line Reactor's current rating (example: a 3-phase, 5hp Line Reactor and 3-phase 5hp drive will not handle enough current to power a 5hp motor on a single-phase supply - both the drive and the Line Reactor will have to be upsized).



*LR series 1-phase reactors do not include a B-phase winding. For LR2 series reactors on single phase drive inputs, use terminals A and C. B is left unconnected.

Please refer to "Chapter 2: Installation and Wiring" for detailed wiring information for the GS30 drive.



ENSURE THAT YOU PROPERLY INSULATE TERMINALS B1 AND B2 BEFORE MAKING ANY CONNECTIONS TO SINGLE-PHASE POWER.

RECOMMENDED CABLE LENGTH**Motor Leakage Current**

If the cable length is too long, the stray capacitance between cables increases and may cause leakage current. This activates over-current protection, increases leakage current, or may affect the current display. In the worst case, it may damage the AC motor drive. If more than one motor is connected to one AC motor drive, the total wiring length should be the sum of the wiring length from AC motor drive to each motor.

For the 460V series AC motor drive, when you install an overload thermal relay between the drive and the motor to protect the motor from overheating, the connecting cable must be shorter than 50m; however, an overload thermal relay malfunction may still occur. To prevent the malfunction, install an output reactor (optional) to the drive or lower the carrier frequency setting (see P00.17 Carrier Frequency).

Motor Surge Voltage

When a motor is driven by a PWM-type AC drive, the motor terminals experience surge voltages (dv/dt) due to power transistor conversion of the drive. For very long motor cable (especially for the 460V series), surge voltages (dv/dt) may damage the motor insulation and bearing. To prevent this, follow these rules:

- Use a motor with enhanced insulation.
- Reduce the cable length between the AC drive and motor to suggested values.
- Connect an output reactor (optional) to the output terminals of the AC drive.

Refer to the following tables for the suggested motor shielded cable length. For drive models < 480V, use a motor with a rated voltage ≤ 500 VAC and an insulation level ≥ 1.35 kVp-p in accordance with IEC 60034-17.

Maximum Recommended Cable Length - GS30							
GS30 Model	Input Power		VT Rated Current (Arms)	Without Output AC Reactor (meters)		With Output AC Reactor (meters)	
	Ø	Volts		Shielded Cable	Unshielded Cable	Shielded Cable	Unshielded Cable
GS31-20P5	1	230	3.2	50	75	75	115
GS31-21P0			5				
GS31-22P0			8.5				
GS31-23P0			12.5				
GS33-20P5	3		3.2	100	150	150	225
GS33-21P0			5				
GS33-22P0			8				
GS33-23P0			12.5				
GS33-25P0			19.5				
GS33-27P5			27				
GS33-2010			36				
GS33-2015			51				
GS33-2020			69				
GS33-2025			81				
GS33-2030			102				
GS33-2040			134				
GS33-2050			160				
GS33-40P5	460	1.8	35	50	50	90	
GS33-41P0		3					
GS33-42P0		4.6					
GS33-43P0		6.5	50	75	75	115	
GS33-45P0		10.5					
GS33-47P5		15.7					
GS33-4010		20.5	100	150	150	225	
GS33-4015		28					
GS33-4020		36					
GS33-4025		41.5					
GS33-4030		49					
GS33-4040		69					
GS33-4050		85					
GS33-4060		108					
GS33-4075		128					
GS33-4100		180					

DYNAMIC BRAKING

Dynamic braking resistors dissipate the regeneration energy of AC motors when they are being controlled to a stop faster than a coasting stop. Most general purpose and heavy-duty AC drives have the braking circuit built-in. All GS30 drives have this feature. Drives 230V 40/50 hp and 460V 50hp+ require a separate dynamic braking unit. To utilize dynamic braking:

- 1) Wire the appropriate braking resistor to terminals B1/B2 (refer to page 2–20)
- 2) Set parameter **P07.00 Software Brake Chopper Action Level** for the application. When the DC bus voltage rises above this setpoint, the dynamic braking circuit will activate.



TO AVOID POSSIBLE INJURY, PLEASE REFER TO CHAPTER 2 OF THIS MANUAL FOR CORRECT WIRING OF THE RESISTORS AND DBUs.

DRIVE UNIT DYNAMIC BRAKING SPECIFICATIONS

GS30 AC Drive Dynamic Braking Specifications								
Drive V Rating	Motor Power		Drive Model	Dynamic Braking Unit		Drive Braking Circuit B1/B2		
	(hp)	(kW)		Qty.	Part #	Min Resistor Value (Ω)	Max Total Brake Current (A)	Peak Power (kW)
230V	0.5	0.4	GS31-20P5	–	n/a	95.0	4	1.5
	1	0.75	GS31-21P0			63.3	6	2.3
	2	1.5	GS31-22P0			47.5	8	3.0
	3	2.2	GS31-23P0			38.0	10	3.8
	0.5	0.4	GS33-20P5			95.0	4	1.5
	1	0.75	GS33-21P0			63.3	6	2.3
	2	1.5	GS33-22P0			47.5	8	3.0
	3	2.2	GS33-23P0			38.0	10	3.8
	5	3.7	GS33-25P0			19.0	20	7.6
	7.5	5.5	GS33-27P5			16.5	23	8.7
	10	7.5	GS33-2010			14.6	26	9.9
	15	11	GS33-2015			12.6	29	11.0
	20	15	GS33-2020			8.3	46	17.5
	25	18.5	GS33-2025			8.3	46	17.5
	30	22	GS33-2030			5.8	66	25.1
	40	30	GS33-2040	2	GS-1DBU	4.8	79	30.1
	50	57	GS33-2050	2	GS-2DBU	3.2	119	45.1
460V	0.5	0.4	GS33-40P5	–	n/a	380.0	2	1.5
	1	0.75	GS33-41P0			190.0	4	3.0
	2	1.5	GS33-42P0			126.7	6	4.6
	3	2.2	GS33-43P0			108.6	7	5.3
	5	3.7	GS33-45P0			84.4	9	6.8
	7.5	5.5	GS33-47P5			50.7	15	11.4
	10	7.5	GS33-4010			40.0	19	14.4
	15	11	GS33-4015			33.0	23	17.5
	20	15	GS33-4020			26.2	29	22.0
	25	18	GS33-4025			26.2	29	22.0
	30	22	GS33-4030			23.0	33	25.1
	40	30	GS33-4040			15.2	50	38.0
	50	37	GS33-4050	1	GS-4DBU	12.7	60	45.5
	60	45	GS33-4060	1	GS-4DBU	12.7	60	45.5
	75	55	GS33-4075	2	GS-3DBU	9.5	80	60.8
	100	75	GS33-4100	2	GS-4DBU	6.3	121	91.7

* 10% Duty Cycle with maximum ON (braking) time for 10 seconds.



For a full list of all brake resistors compatible with GS30 drives, please see the GS30 series braking technical specification: <https://cdn.automationdirect.com/static/specs/gs30braking.pdf>.

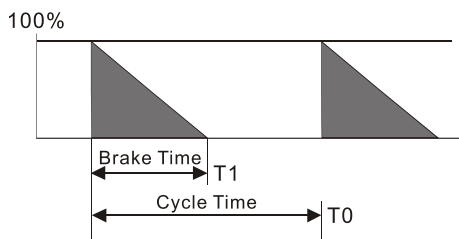


Please refer to DURAPULSE Dynamic Braking User Manual for detailed information on DBU installation and wiring. You can download it from the AutomationDirect online store [here](#).

CHOOSING AND INSTALLING A BRAKING RESISTOR

- 1) Select the resistance value, power and brake usage (ED %).

Definition for Brake Usage ED%:



$$ED\% = T1 / T0 \times 100(\%)$$

Explanation:

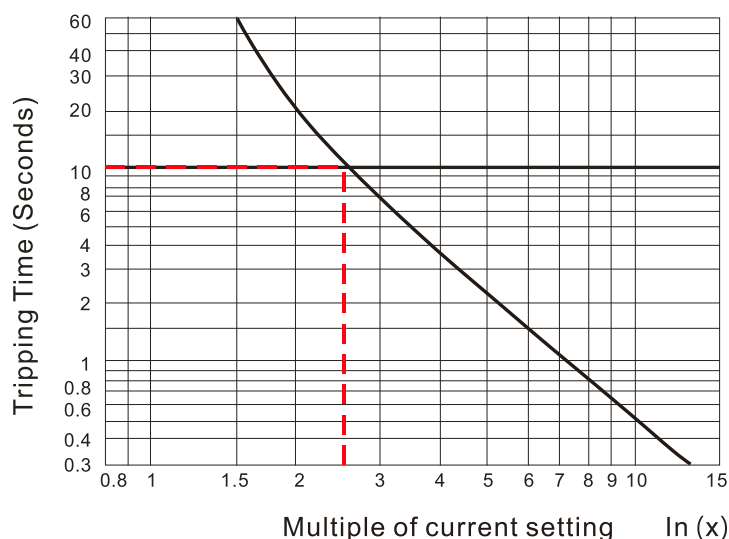
Brake usage ED (%) is the amount of time needed for the brake unit and brake resistor to dissipate heat generated by braking. When the brake resistor heats up, the resistance increases with temperature, and braking torque decreases accordingly.

For safety, install a thermal overload relay (O.L) between the brake unit and the brake resistor in conjunction with the magnetic contactor (MC) before the drive for additional protection. The thermal overload relay protects the brake resistor from damage due to frequent or continuous braking. Under such circumstances, turn off the power to prevent damage to the brake resistor and drive.



Note: Never use the thermal overload relay to disconnect the brake resistor.

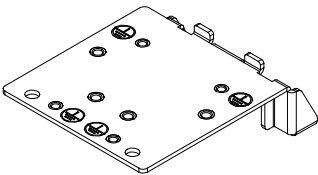
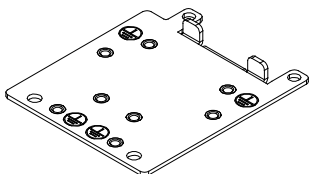
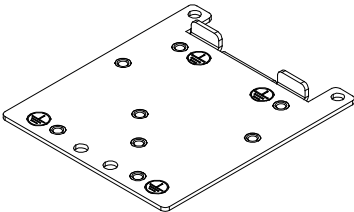
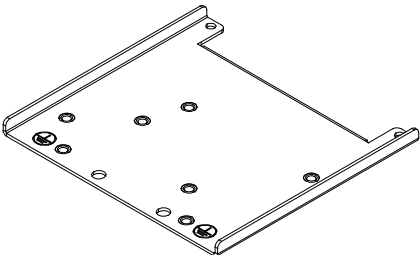
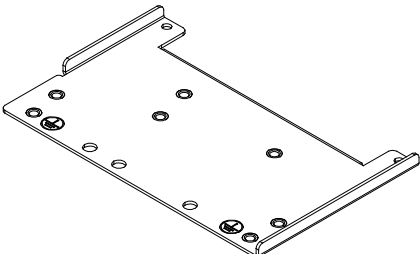
- 2) Any damage to the drive or other equipment caused by using brake resistors and brake modules that are not provided by AutomationDirect voids the warranty.
- 3) Consider environmental safety factors when installing the brake resistors. If you use the minimum resistance value, consult AutomationDirect for the power calculation.
- 4) Refer to the ADC Dynamic Braking unit User Manual for more detail on braking resistors (https://cdn.automationdirect.com/static/manuals/gs3dbm/gs-db_ump.pdf)
- 5) The selection tables are for 10% duty cycle. If the AC motor drive requires frequent braking, increase the Watts by two to three times.
- 6) Thermal Overload Relay (TOR):
Thermal overload relay selection is based on its overload capacity. A standard braking capacity of the GS30 is 10% ED (Tripping time=10 s). As shown in the figure below, a 460V, 1kw GS30 required the thermal relay to take 260% overload capacity for 10 seconds (hot starting) and the braking current is 24A. In this case, select a thermal overload relay rated at 10A ($10 \times 260\% = 26 \text{ A} > 24 \text{ A}$). The property of each thermal relay may vary among different manufacturers. Carefully read the specification before using it.

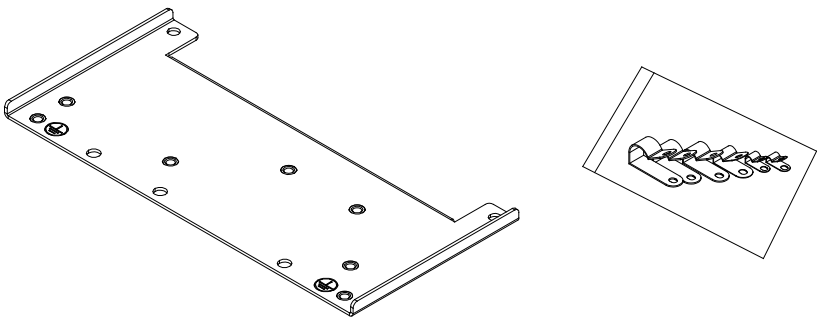
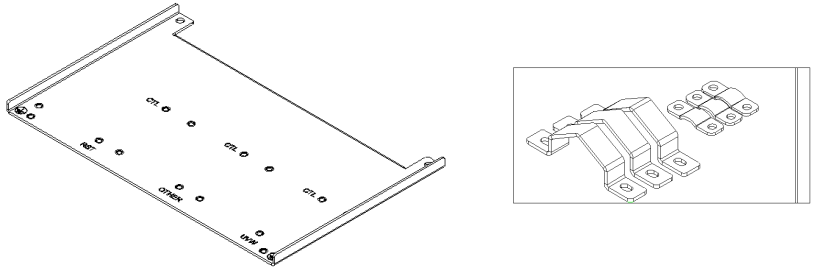
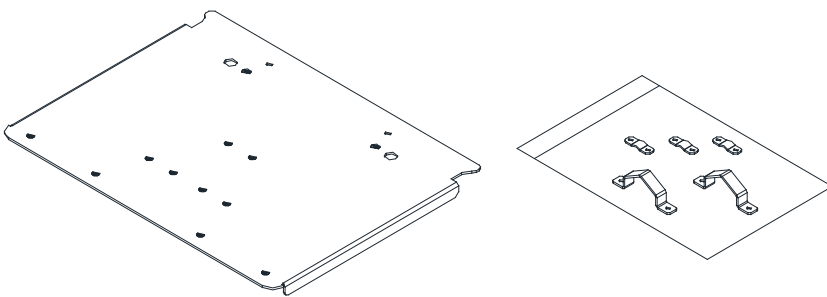
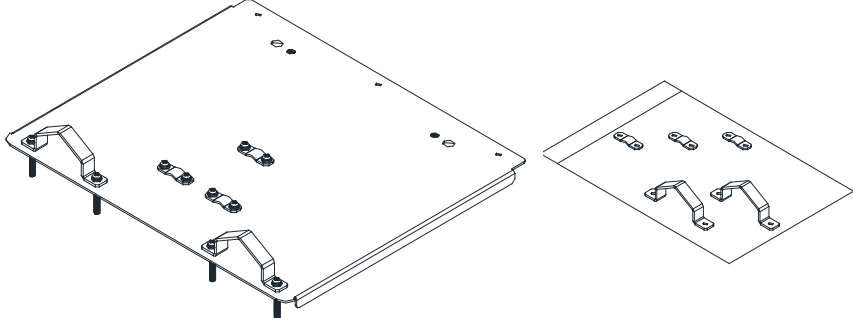


EMC SHIELD & EARTHING PLATES

GS30 EMC SHIELD PLATES

EMC shield plates are available for use with shielded cable and your GS30 drive (some parts shared with GS20). Find the frame type from the specification tables of your GS30 and reference the table below:

GS30 EMC Shield Plate Selection		
Frame	EMC Shield Plate Model	Reference Drawing
A	GS20A-ESP-A	
B	GS20A-ESP-B	
C	GS20A-ESP-C	
D	GS20A-ESP-D	
E	GS20A-ESP-E	

GS30 EMC Shield Plate Selection		
Frame	EMC Shield Plate Model	Reference Drawing
F	GS20A-ESP-F	
G	GS30A-ESP-G	
H	GS30A-ESP-H	
I	GS30A-ESP-I	

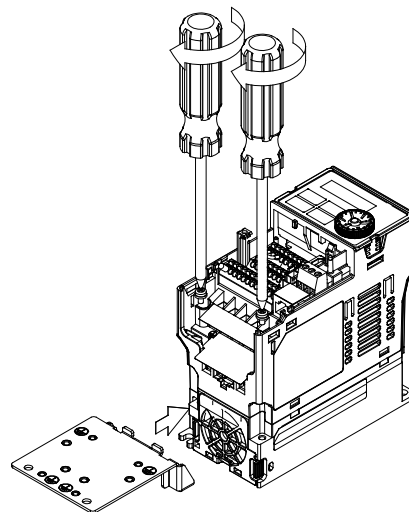
EMC SHIELD PLATE INSTALLATION

The steps below show how to install the EMC shield plate on a GS30 drive. The diagram examples use an A frame model.

- 1) Attach the shield plate to the GS30 drive as shown in the diagram to the right.

Torque the screws per the table below:

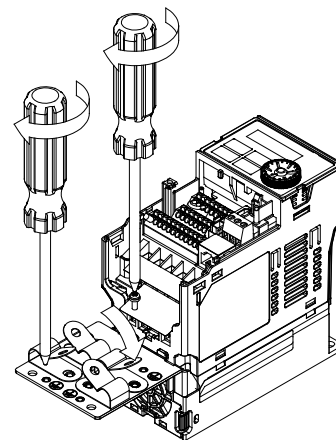
Frame	Screw	Torque
A	M3.5	6–8 kg-cm (5.2–6.9 lb-in.) [0.59–0.78 N•m]
B	M4	6–8 kg-cm (5.2–6.9 lb-in.) [0.59–0.78 N•m]
C	M4	6–8 kg-cm (5.2–6.9 lb-in.) [0.59–0.78 N•m]
D	M3	4–6 kg-cm (3.5–5.2 lb-in.) [0.39–0.59 N•m]
E	M3	4–6 kg-cm (3.5–5.2 lb-in.) [0.39–0.59 N•m]
F	M4	6–8 kg-cm (5.2–6.9 lb-in.) [0.59–0.78 N•m]
G	M5	10–12 kg-cm (8.7–10.4 lb-in.) [0.98–1.18 N•m]
H	M4x2	14–16 kg-cm (12.1–13.9 lb-in.) [1.38–1.56 N•m]
	M8x2	75–85 kg-cm (65.0–73.7 lb-in.) [7.35–8.33 N•m]
I	M4x3	14–16 kg-cm (12.1–13.9 lb-in.) [1.38–1.56 N•m]
	M8x2	175–185 kg-cm (151.9–160.6 lb-in.) [17.16–18.14 N•m]



- 2) Select an R-clip suitable for the wire gauge used and then fix the R-clip to the shield plate as shown in the diagram to the right.

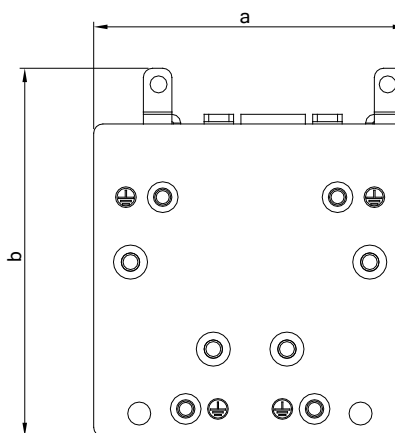
Torque the R-clip screws per the table below:

Screw	Torque
M4	6–8 kg-cm (5.2–6.9 lb-in.) [0.59–0.78 N•m]



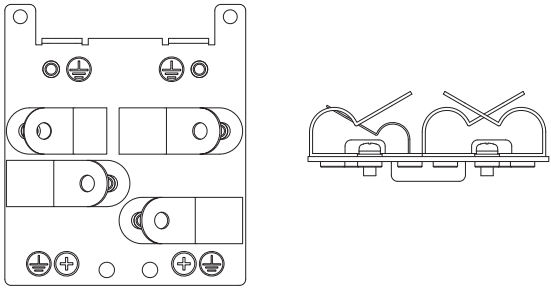
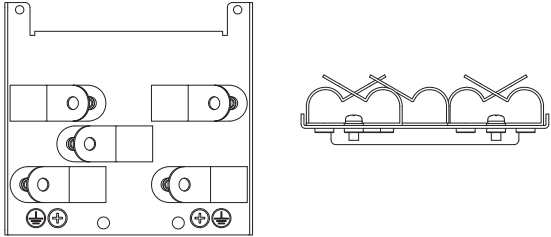
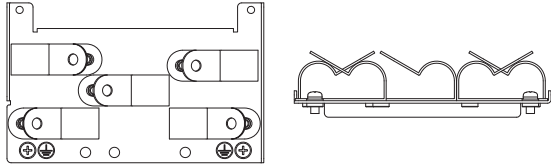
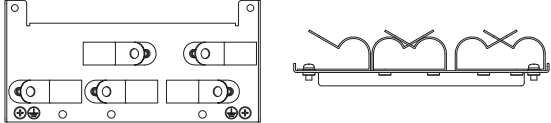
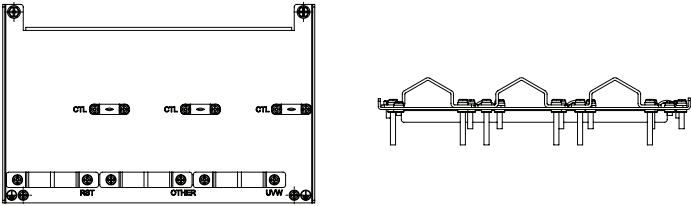
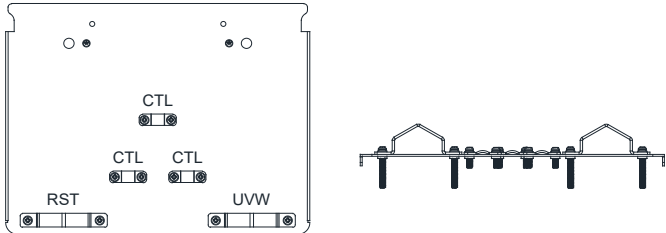
EMC Shield Plate Dimensions

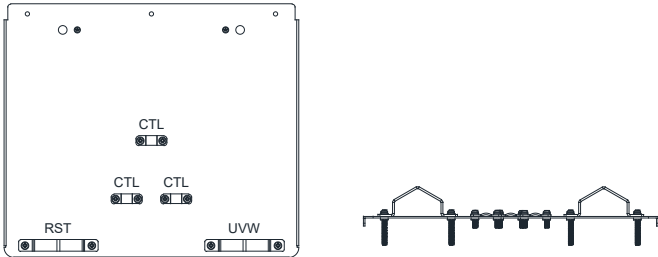
EMC Shield Plate Dimensions		
Model	Dimensions mm [inch]	
	a	b
GS20-ESP-A	69.3 [2.73]	80.0 [3.15]
GS20-ESP-B	67.7 [2.67]	79.7 [3.14]
GS20-ESP-C	78.0 [3.07]	91.0 [3.58]
GS20-ESP-D	103.4 [4.07]	97.0 [3.82]
GS20-ESP-E	124.3 [4.89]	77.4 [3.05]
GS20-ESP-F	168.0 [6.61]	80.0 [3.15]
GS30-ESP-G	243.5 [9.59]	154.9 [6.10]
GS30-ESP-H	262.0 [10.31]	201.9 [7.95]
GS30-ESP-I	304.0 [11.97]	260.7 [10.26]

**RECOMMENDED WIRING METHOD**

The diagrams below show the recommended R-clip configuration for wiring shielded cable to each frame type/EMC shield plate model.

EMC Shield Plate Wiring Methods		
Frame	EMC Shield Plate Model	Reference Drawing
A	GS20A-ESP-A	
B	GS20A-ESP-B	

EMC Shield Plate Wiring Methods		
Frame	EMC Shield Plate Model	Reference Drawing
C	GS20A-ESP-C	
D	GS20A-ESP-D	
E	GS20A-ESP-E	
F	GS20A-ESP-F	
G	GS30A-ESP-G	
H	GS30A-ESP-H	

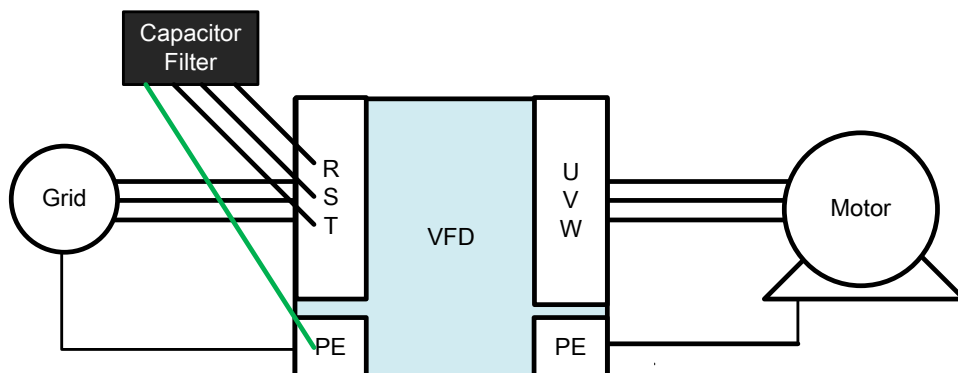
EMC Shield Plate Wiring Methods		
Frame	EMC Shield Plate Model	Reference Drawing
I	GS30A-ESP-I	

CAPACITIVE FILTER (GS20A-CAPF)

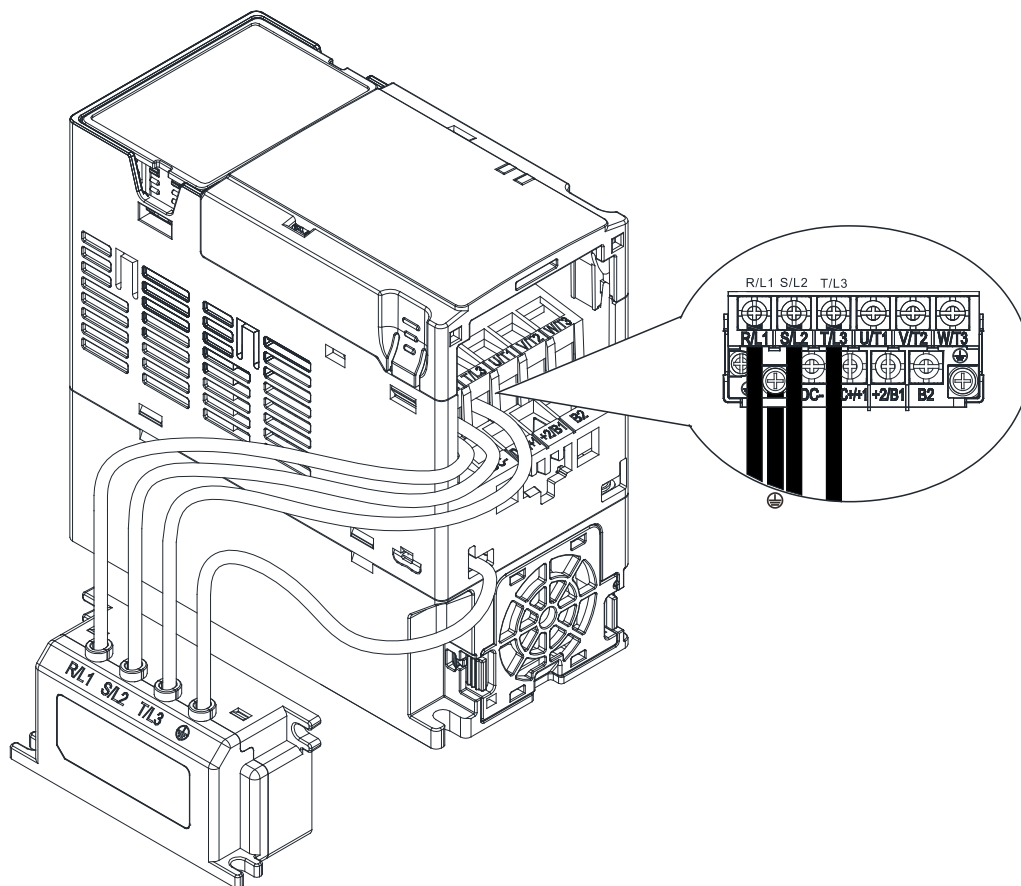
The GS20A-CAPF capacitive filter supports basic filtering and noise interference reduction for models 460V and below.

GS20A-CAPF Specifications			
Model	Applicable Voltage	Temperature Range	Capacitance
GS20A-CAPF	110–480 VAC	–40–85°C	Cx: 1uF ± 20% Cy: 0.1uF ± 20%

Installation diagram:

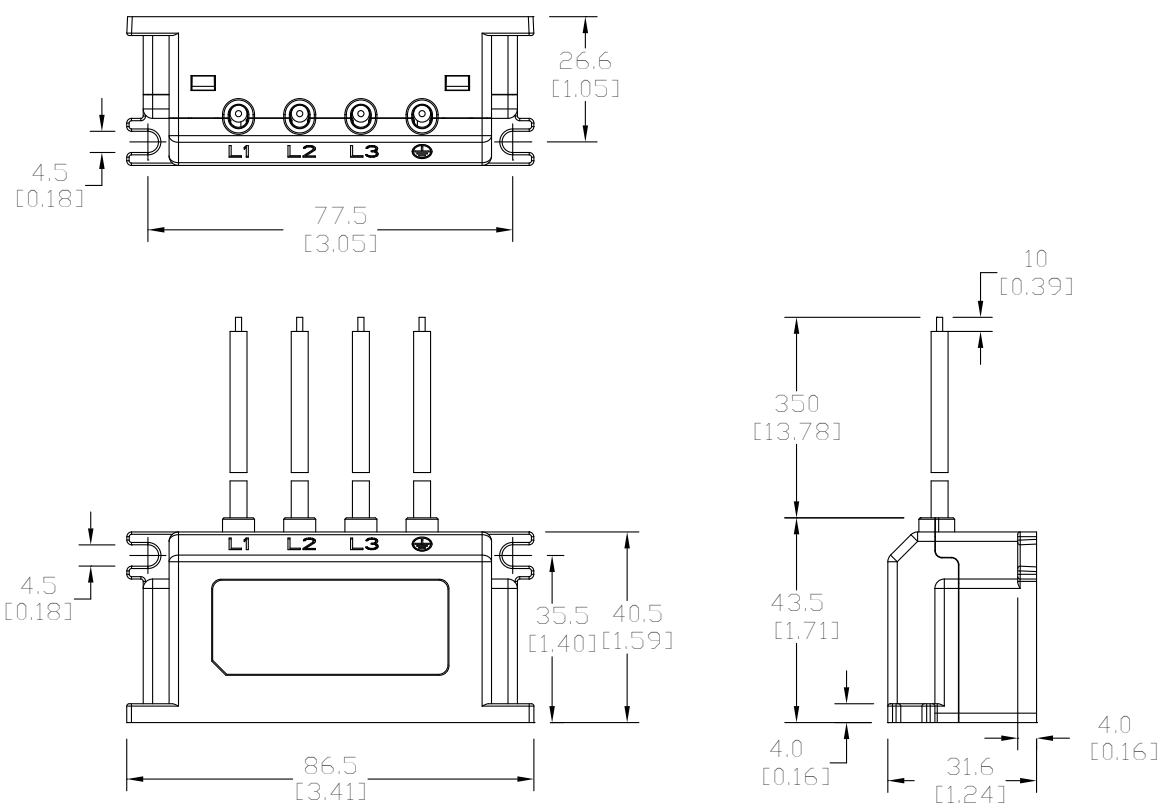


Filter and Drive Wiring



GS20A-CAPF DIMENSIONS

Units = mm [inch]



CONDUIT BOX

NEMA 1 / UL Type 1 compliant conduit boxes are available for all frame sizes (A–F).

CONDUIT BOX DIMENSIONS

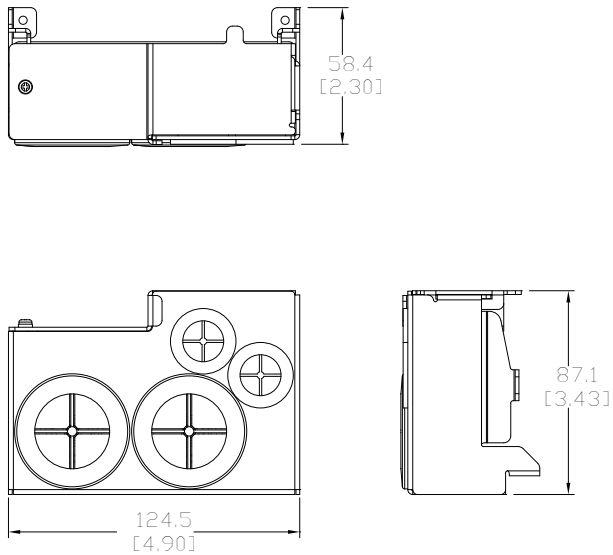
Units = mm [inch]

<p>Frame A1, A2, A3</p> <p>Applicable models GS31-20P5, GS33-20P5, GS33-21P0, GS33-40P5, GS33-41P0</p> <p>Conduit Box GS30-N1A</p>	<p>Frame B1, B2</p> <p>Applicable models GS31-21P0, GS33-22P0, GS33-42P0</p> <p>Conduit Box GS30-N1B</p>
<p>Frame C</p> <p>Applicable models GS31-22P0, GS33-23P0, GS33-25P0, GS33-43P0, GS33-45P0</p> <p>Conduit Box GS30-N1C</p>	<p>Frame D</p> <p>Applicable models GS33-27P5, GS33-47P5, GS33-4010</p> <p>Conduit Box GS30-N1D</p>

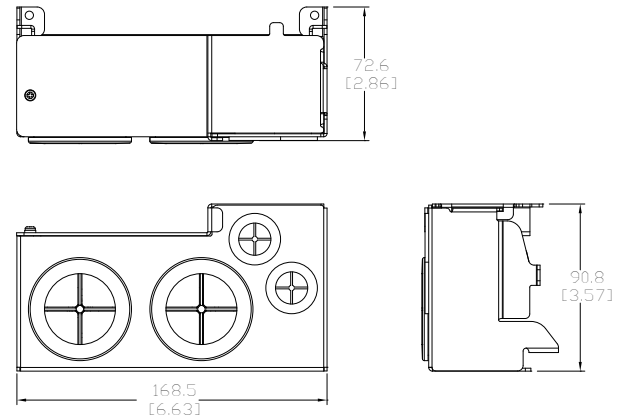
Units = mm [inch]

Frame E**Applicable models**

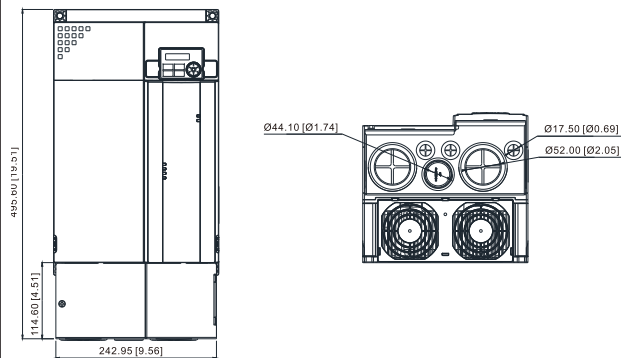
GS33-2010, GS33-2015, GS33-4015, GS33-4020

Conduit Box GS30-N1E**Frame F****Applicable models**

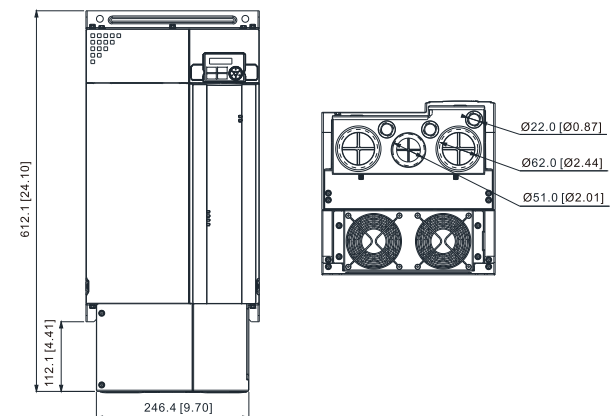
GS33-2020, GS33-4025, GS33-4030

Conduit Box GS30-N1F**Frame G****Applicable models**

GS33-2025, GS33-2030, GS33-4040

Conduit Box GS30-N1G**Frame H****Applicable models**

GS33-4050, GS33-4060

Conduit Box GS30-N1H

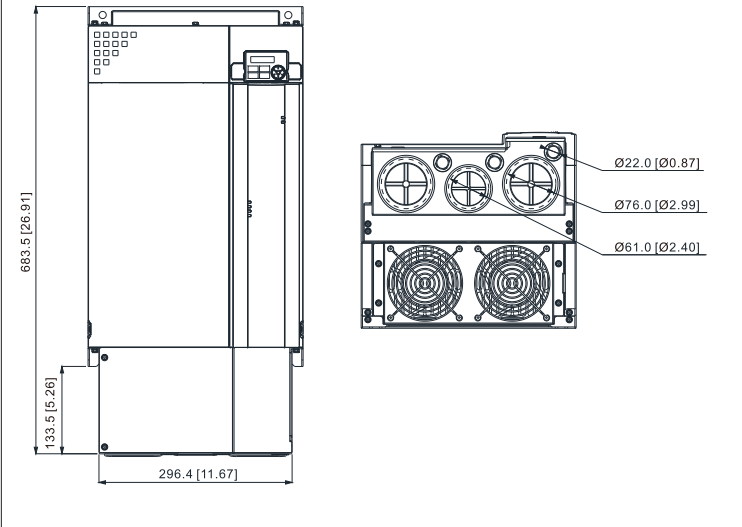
Units = mm [inch]

Frame I

Applicable models

GS33-2040, GS33-2050, GS33-4075, GS33-4100

Conduit Box GS30-N1I



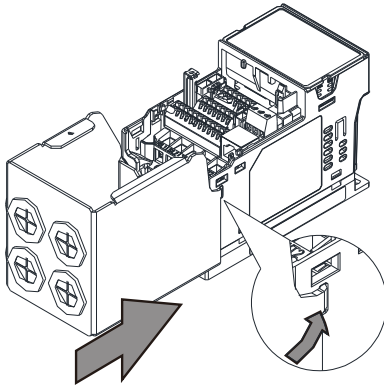
CONDUIT BOX INSTALLATION

Follow the steps below to install a conduit box to your GS30 drive. The first set of instructions are for Frame A drives, the second set of instructions is for Frame B–I drives.

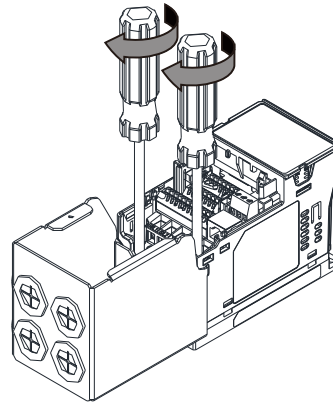
Recommended Screw Size and Torque Value	
Screw	Torque
M3	4–6 kg-cm (3.5–5.2 lb-in.) [0.39–0.59 N•m]
M3.5	4–6 kg-cm (3.5–5.2 lb-in.) [0.39–0.59 N•m]
M4	6–8 kg-cm (5.2–6.9 lb-in.) [0.59–0.78 N•m]

Frame A Conduit Box Installation:

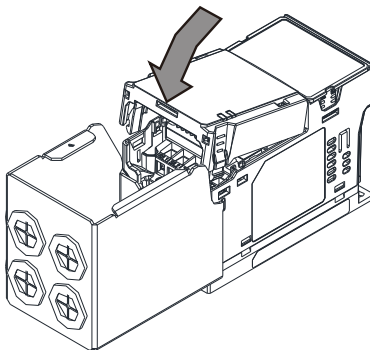
1)



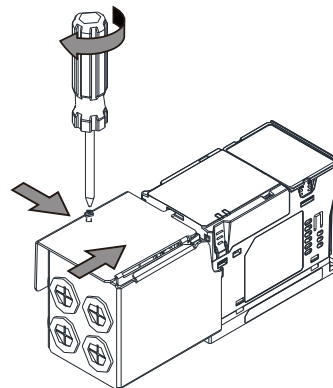
2)



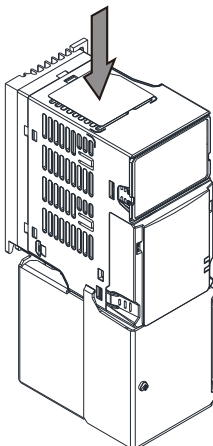
3)



4)

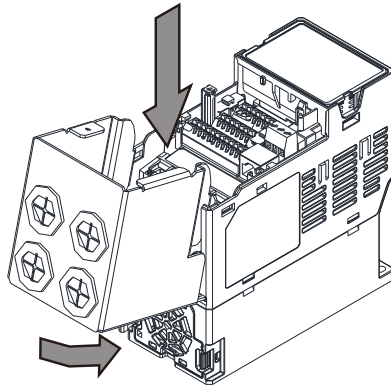


5)

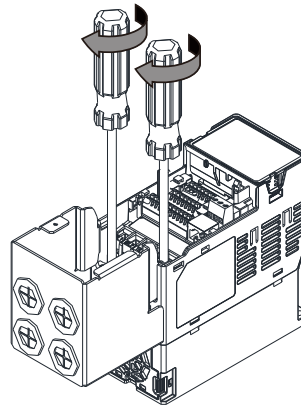


Frame B-I Conduit Box Installation:

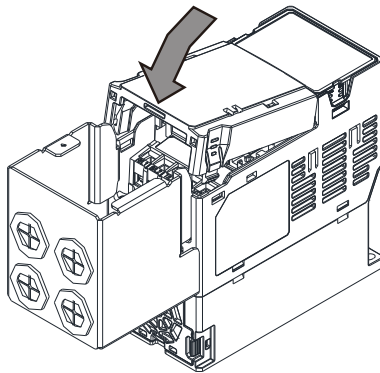
1)



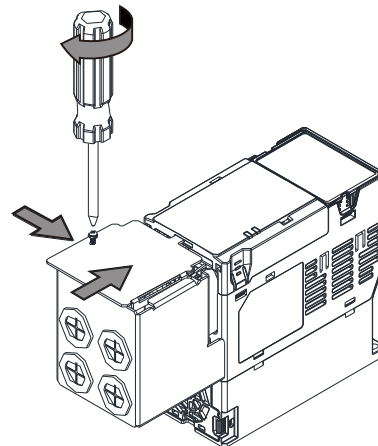
2)



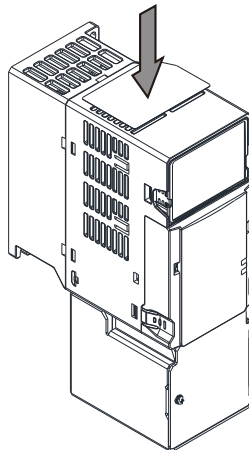
3)



4)

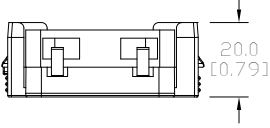
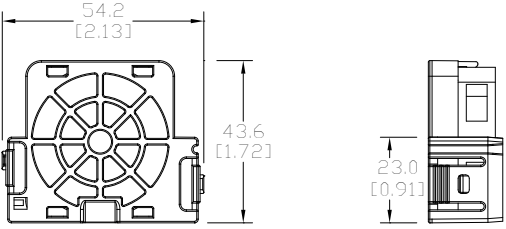
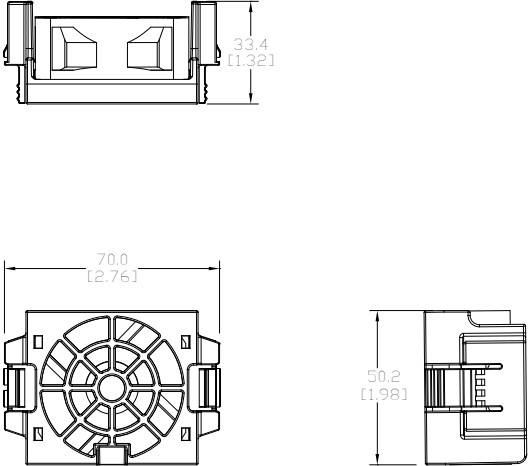
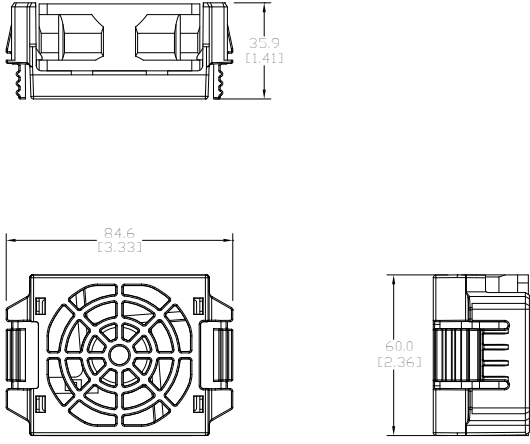


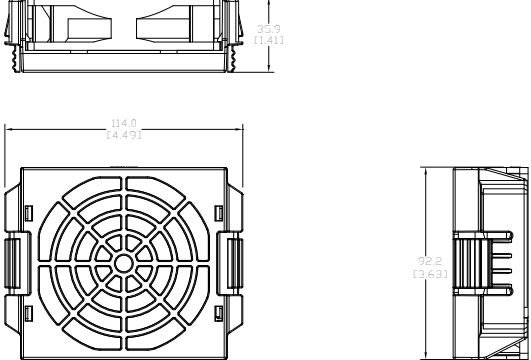
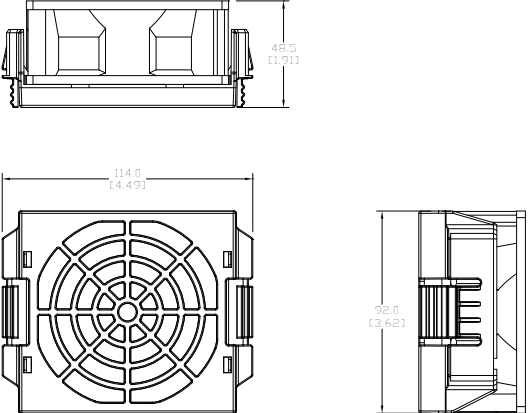
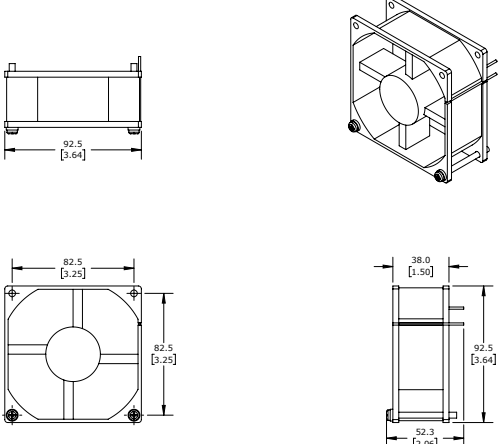
5)

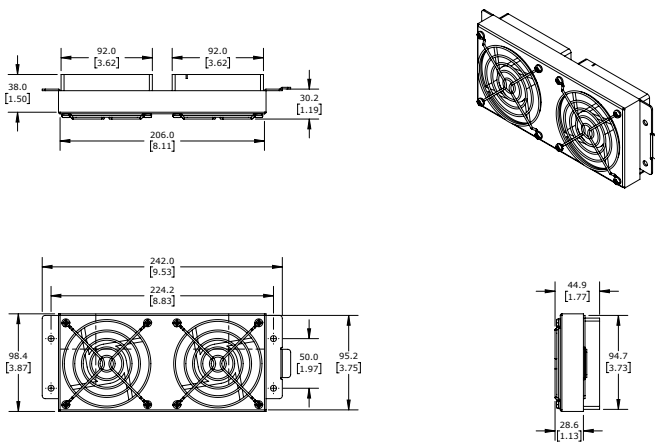
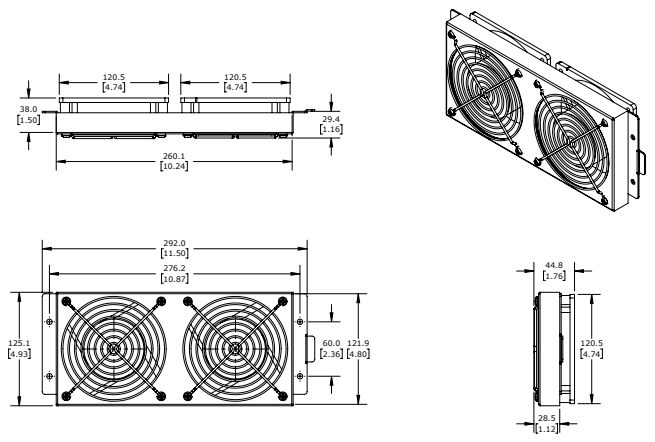


REPLACEMENT FAN KIT

Most GS30 drives come equipped with a fan that can be replaced if needed. Many of the GS30 models share parts with the GS20. Use the table below to select the right fan for your drive, then remove and replace the existing fan.

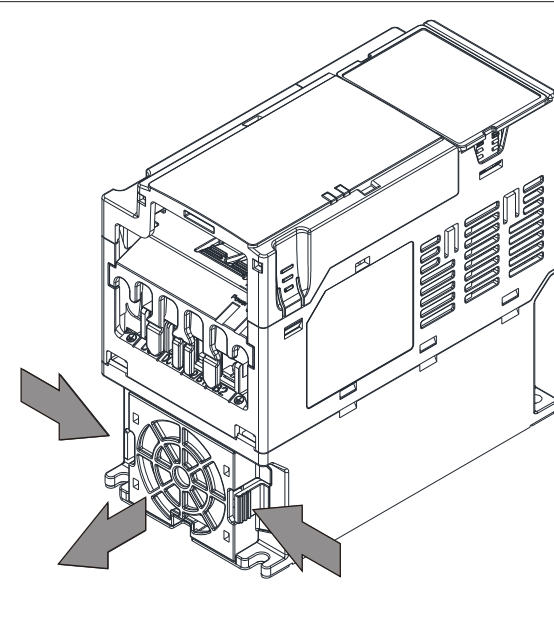
GS30 Fan Kit Selector			
Frame	Drive Series	Fan Kit Model	Reference Drawing (units = mm [inch])
A	GS30	n/a	
B	GS30	GS20A-FAN-B	
C	GS30	GS20A-FAN-C	
D	GS30	GS20A-FAN-D	

GS30 Fan Kit Selector (continued)			
Frame	Drive Series	Fan Kit Model	Reference Drawing (units = mm [inch])
E	GS30	GS20A-FAN-E	
F	GS30	GS20A-FAN-F	
G	GS30	GS30A-FAN-G	

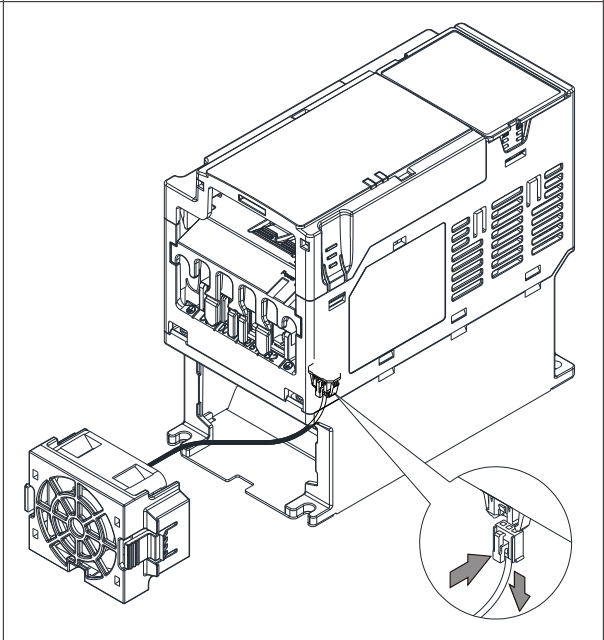
GS30 Fan Kit Selector (continued)			
Frame	Drive Series	Fan Kit Model	Reference Drawing (units = mm [inch])
H	GS30	GS30A-FAN-H	 <p>Top view dimensions: 92.0 [3.62] (twice), 206.0 [8.11], 38.0 [1.50], 30.2 [1.19].</p> <p>Front view dimensions: 242.0 [9.53], 224.2 [8.83], 98.4 [3.87], 50.0 [1.97], 95.2 [3.75].</p> <p>Side view dimensions: 44.9 [1.77], 94.7 [3.73], 28.6 [1.13].</p>
I	GS30	GS30A-FAN-I	 <p>Top view dimensions: 120.5 [4.74] (twice), 260.1 [10.24], 38.0 [1.50], 29.4 [1.16].</p> <p>Front view dimensions: 292.0 [11.50], 276.2 [10.87], 125.1 [4.93], 60.0 [2.36], 121.9 [4.80].</p> <p>Side view dimensions: 44.8 [1.76], 120.5 [4.74], 28.5 [1.12].</p>

GS30 SERIES FAN REMOVAL

- 1) As shown in the figure below, press the tabs on both sides of the fan to remove it.



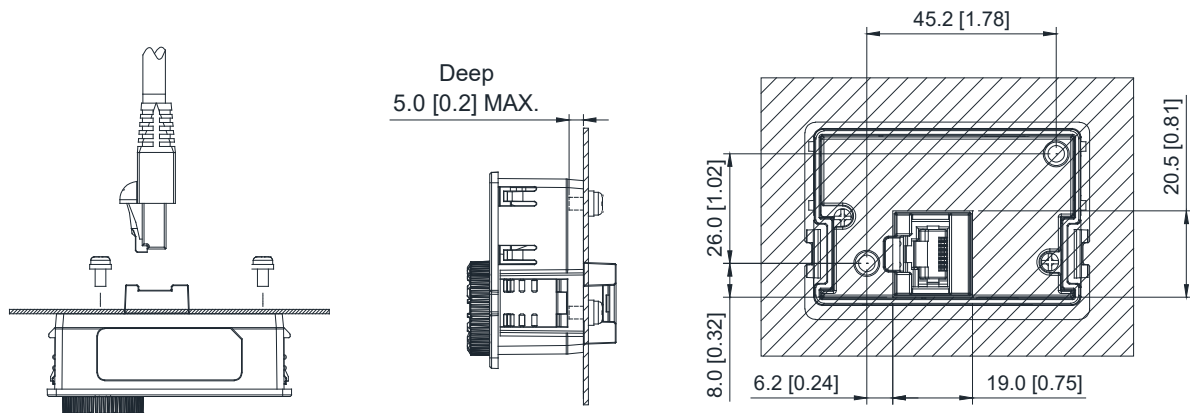
- 2) Disconnect the power cable while removing the fan.



REMOTE KEYPAD MOUNTING

The GS30 keypad can detach from the drive and be mounted remotely. Use an extension cable and screws to create a remote access keypad for the drive. The keypad can be mounted either directly on a plate, or embedded in a plate. Use the reference material below to mount and connect your GS30 keypad.

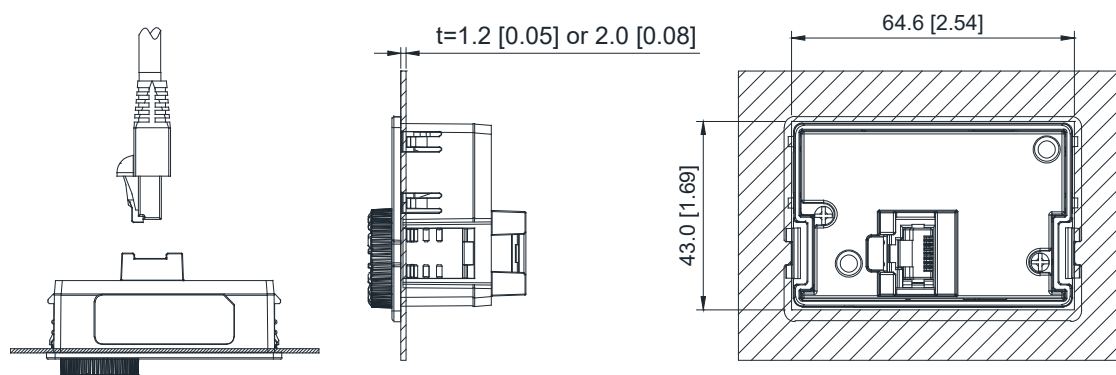
DIRECT MOUNTING ON A PLATE



Screw	Torque
M3	8–9 kg-cm (6.94–7.81 lb-in.) [0.78–0.88 N•m]

EMBEDDED MOUNTING IN A PLATE

Plate Thickness (mm[inch]) = 1.2 [0.05] or 2.0 [0.08]



AVAILABLE EXTENSION CABLES

Any standard Ethernet cable up to 5 meters (16.4 feet) in length.

DIN RAIL MOUNTING

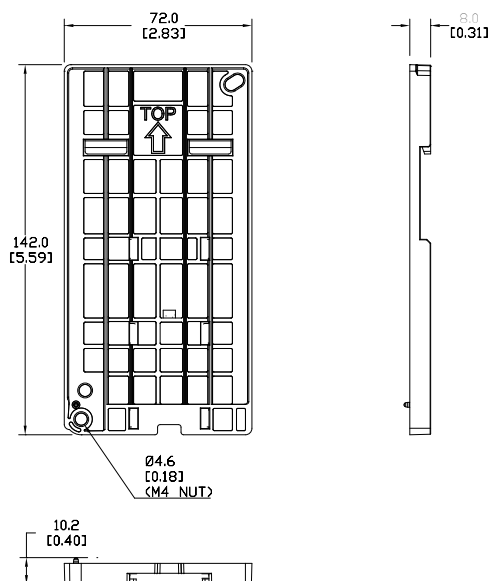
Frame A, B, and C GS30 drives can be DIN rail mounted using a DIN rail mounting kit. One kit is used for A and B frame drives, while a second kit is used for C frame drives.

GS30 DIN Rail Mounting Compatibility		
Drive Model	Frame	Mounting Plate
GS31-20P5	A2	GS20A-DR-AB
GS33-20P5	A2	
GS33-40P5	A2	
GS33-21P0	A3	
GS33-41P0	A3	
GS33-22P0	B1	
GS33-42P0	B1	
GS31-21P0	B2	
GS31-22P0	C1	GS20A-DR-C
GS33-23P0	C1	
GS33-25P0	C1	
GS33-43P0	C1	
GS33-45P0	C1	

GS20A-DR-AB

Used with Frame A and B GS30 drives.

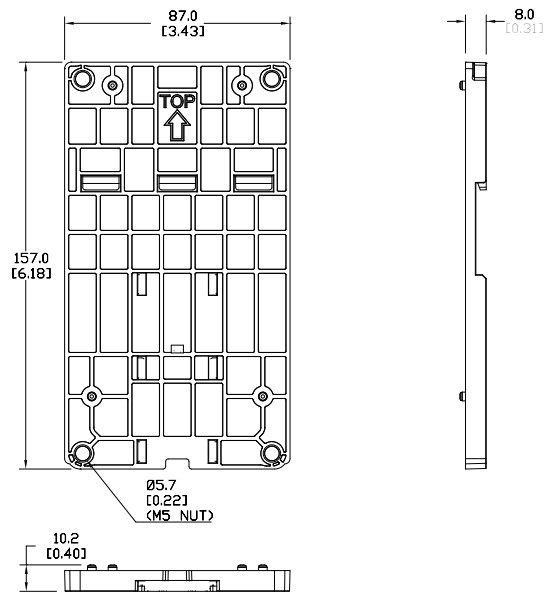
Screw	Torque
M4 x 2	8–10 kg-cm (6.9–8.7 lb-in.) [0.78–0.98 N•m]



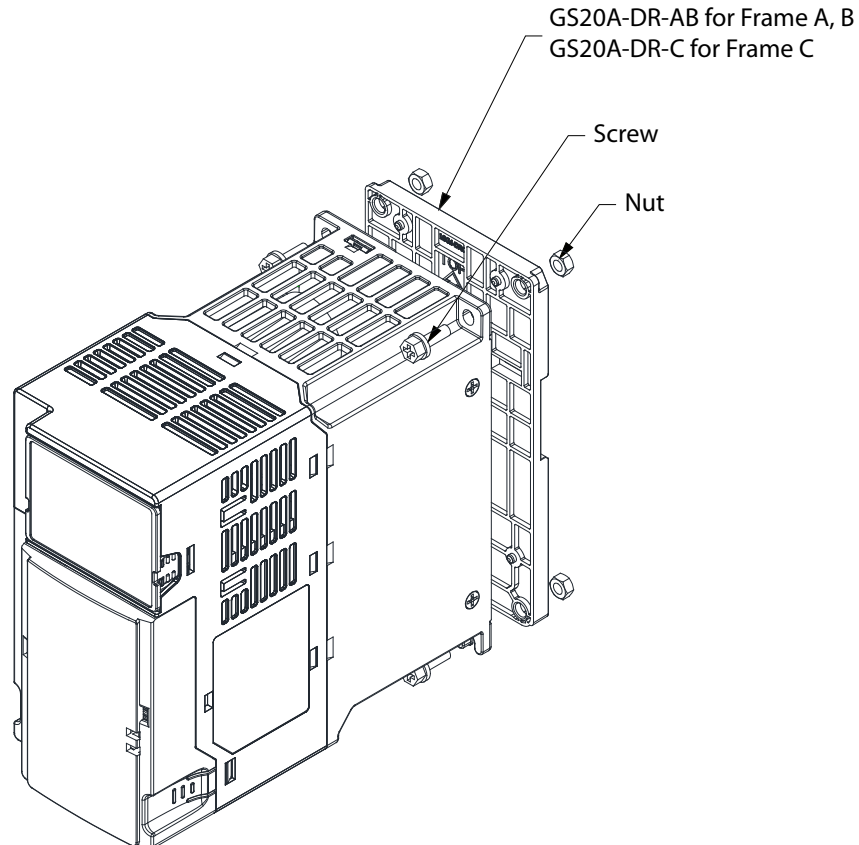
GS20A-DR-C

Used with Frame C GS30 drives.

Screw	Torque
M5 x 4	10–12 kg-cm (8.7–10.4 lb-in.) [0.98–1.18 N•m]

**GS30 DIN RAIL INSTALLATION**

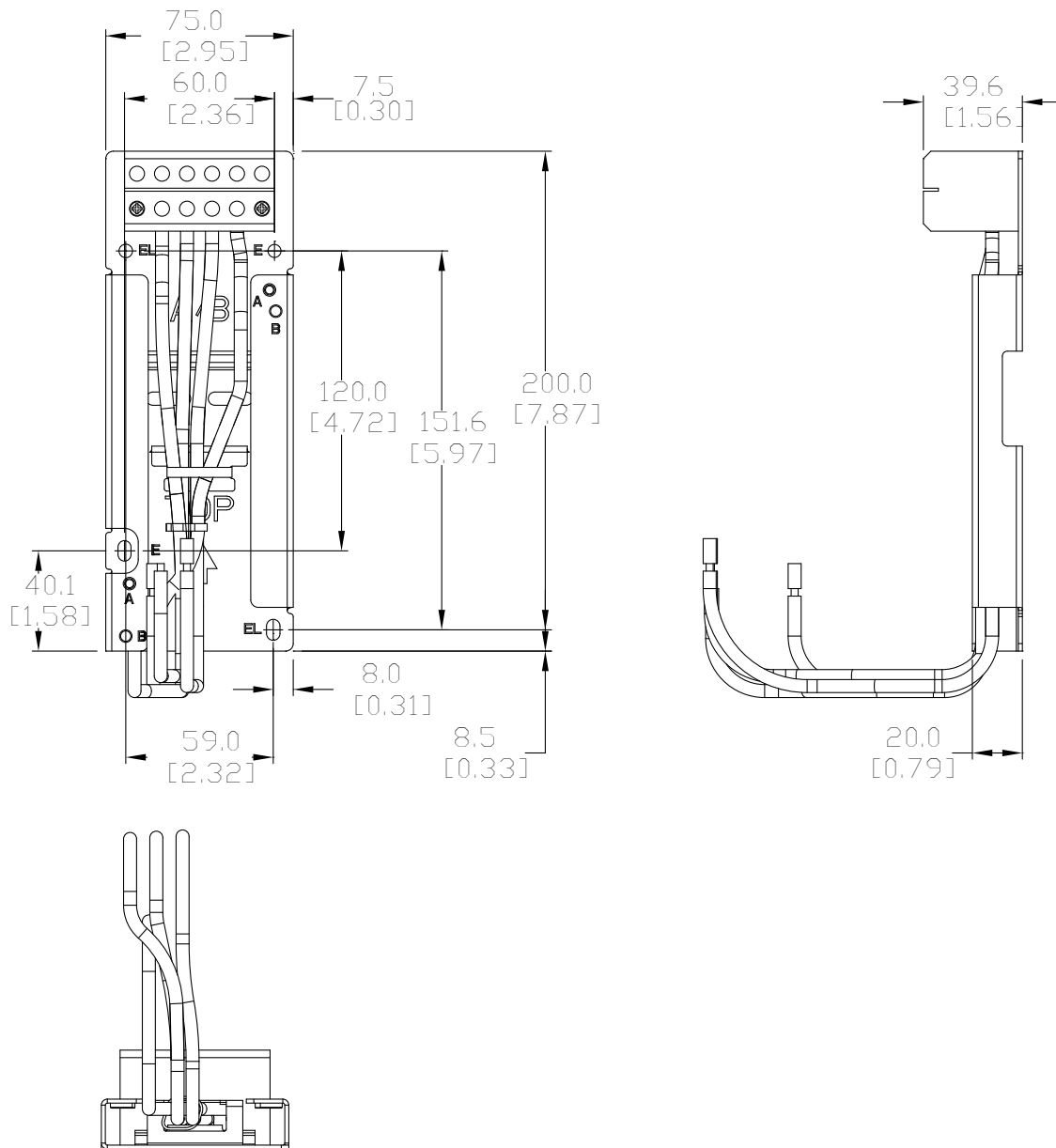
Attach the GS30 drive to the DIN rail kit mounting bracket as shown below. The diagram is for a Frame C drive, for Frame A or B, use one screw at the top and one at the bottom.



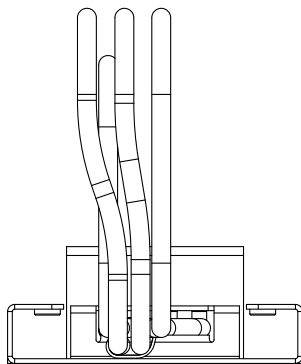
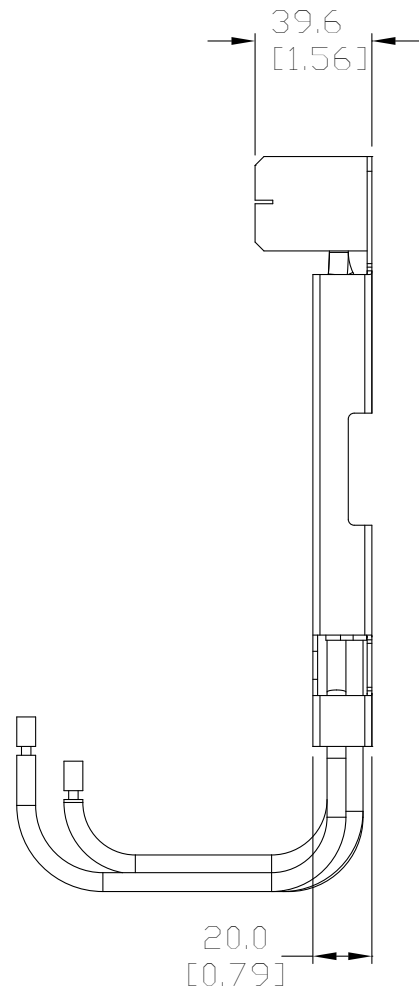
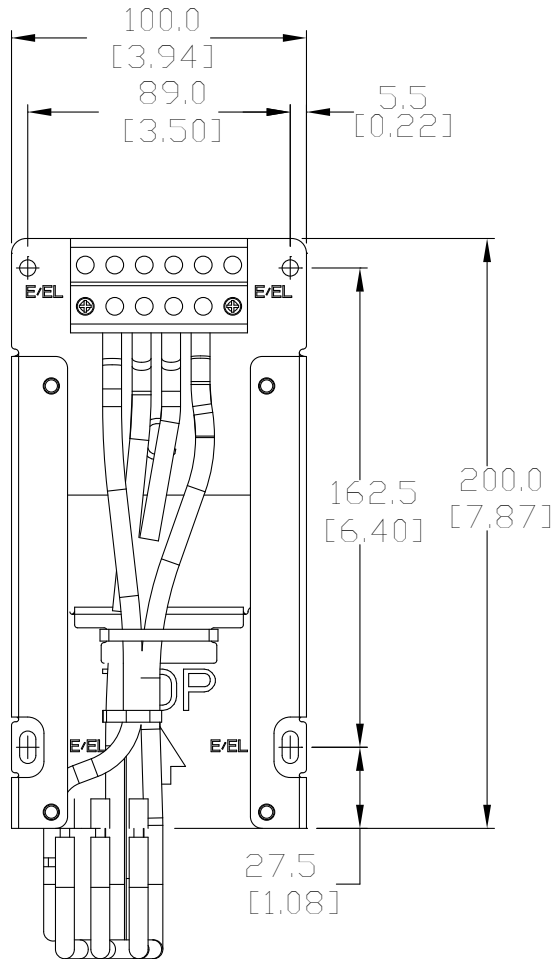
MOUNTING ADAPTER PLATE

The mounting adapter plate can be used to change the wiring method for the GS30 series and provides flexibility for installation. This accessory changes the wiring method from the “bottom-mains input/ bottom-motor output” to the “top-mains input/bottom-motor output” for GS30. Use the table below to select the correct mounting plate for your drive.

GS30 Mounting Adapter Compatibility		
<i>Drive Model</i>	<i>Frame</i>	<i>Mounting Plate</i>
GS31-20P5	A2	GS20A-MP-AB
GS33-20P5	A2	
GS33-40P5	A2	
GS33-21P0	A3	
GS33-41P0	A3	
GS33-22P0	B1	
GS33-42P0	B1	
GS31-21P0	B2	
GS31-22P0	C1	GS20A-MP-C
GS33-23P0	C1	
GS33-25P0	C1	
GS33-43P0	C1	
GS33-45P0	C1	

MOUNTING ADAPTER PLATE DIMENSIONS**GS20A-MP-AB**

GS20A-MP-C

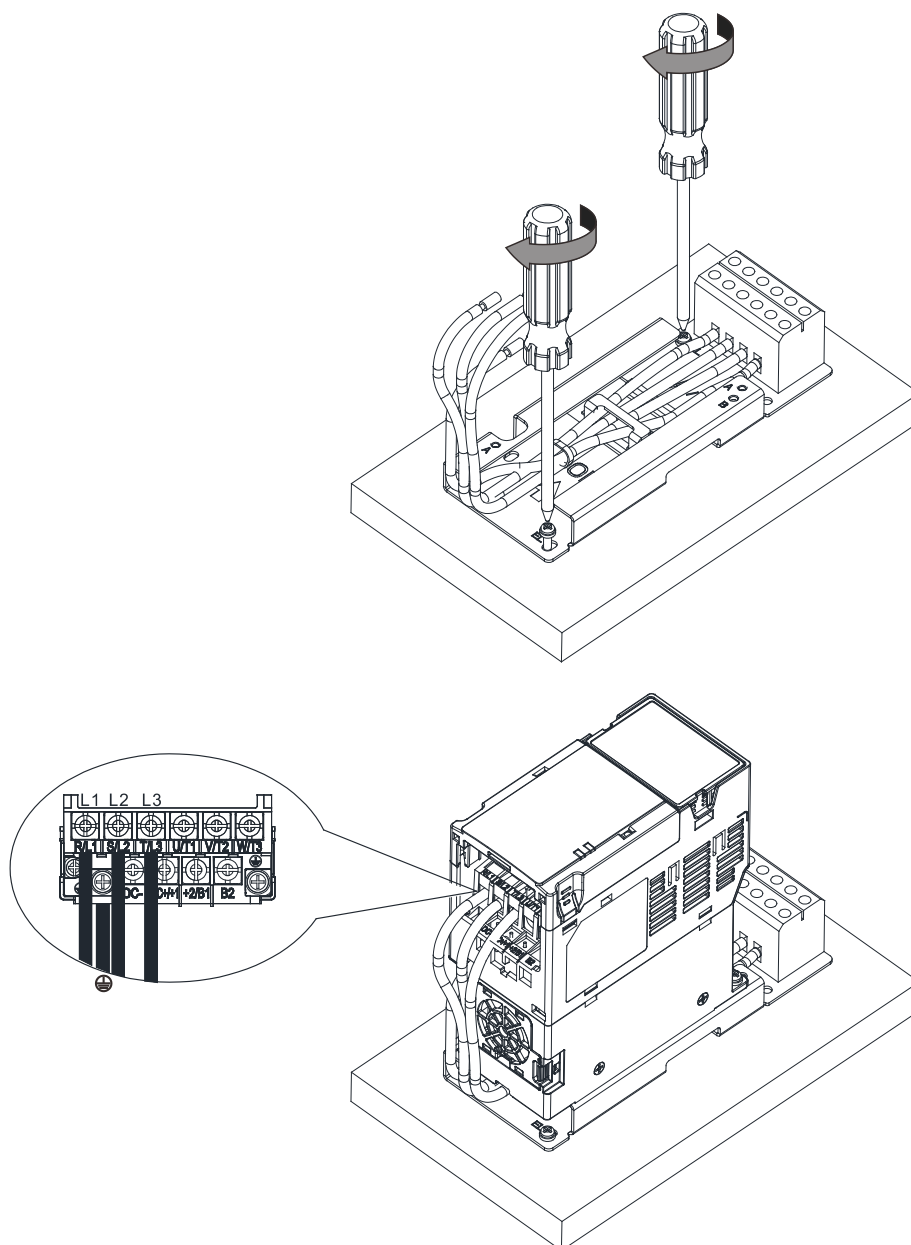


MOUNTING ADAPTER PLATE INSTALLATION

Use the diagrams below and on the following page to install the mounting adapter plate and reroute the wiring.

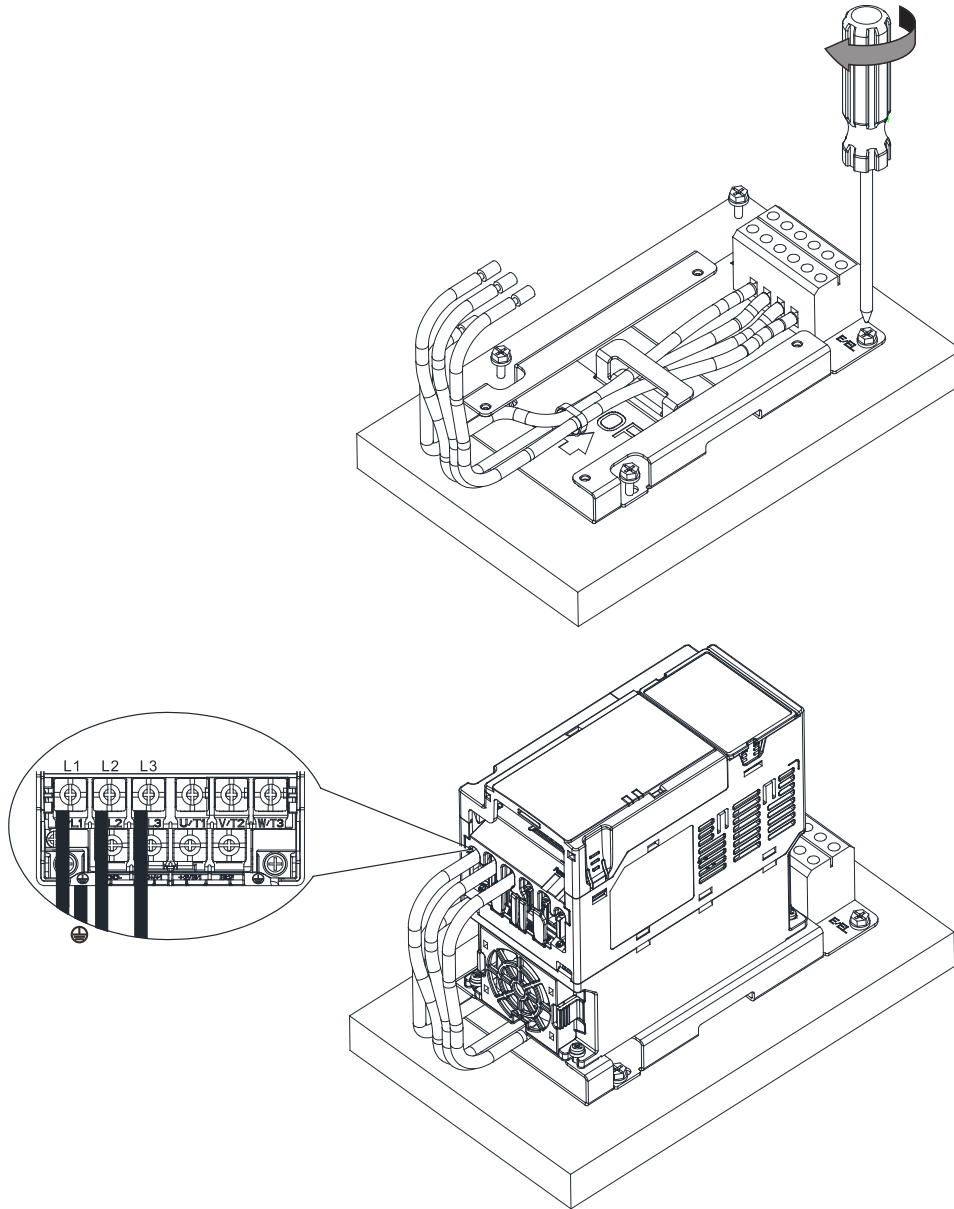
GS20A-MP-AB

GS20A-MP-AB Screw Size and Torque Value	
Screw	Torque
M4	14–16 kg-cm (12.4–13.9 lb-in.) [1.37–1.57 N•m]
M5	16–20 kg-cm (13.9–17.4 lb-in.) [1.57–1.96 N•m]



GS20A-MP-C

GS20A-MP-C Screw Size and Torque Value	
Screw	Torque
M4	14–16 kg-cm (12.4–13.9 lb-in.) [1.37–1.57 N•m]
M5	16–20 kg-cm (13.9–17.4 lb-in.) [1.57–1.96 N•m]



OPTIONAL ADVANCED KEYPAD

GS4-KPD

The GS4-KPD can be used with GS30 drives and offers a more advanced interface with additional features. The keypad can be installed flat on the surface any control panel (with or without bezel GS4-BZL). The front cover is IP56 rated.

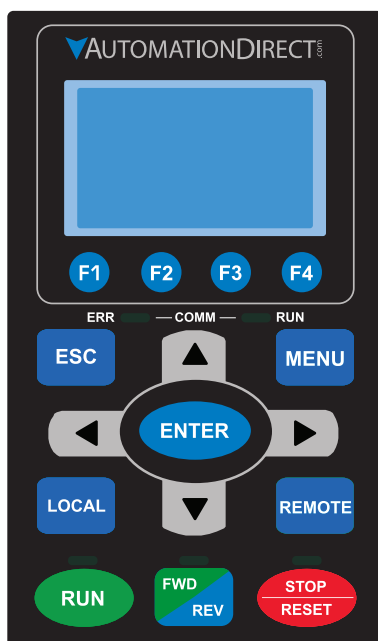
The maximum RJ45 extension lead is 5m (16ft). The keypad communication connection to the drive when mounted remotely can be accomplished by using a standard RJ45 CAT5e straight through patch cable. No other wiring is required. The small RJ45 plastic connector that comes standard with each GS4-KPD kit is not used with GS30.

The communication protocol for GS4-KPD is RTU 19200, 8, N, 2. Therefore, you must set GS30 communication parameters so as to connect with the digital keypad GS4-KPD. The setting steps are as follows:

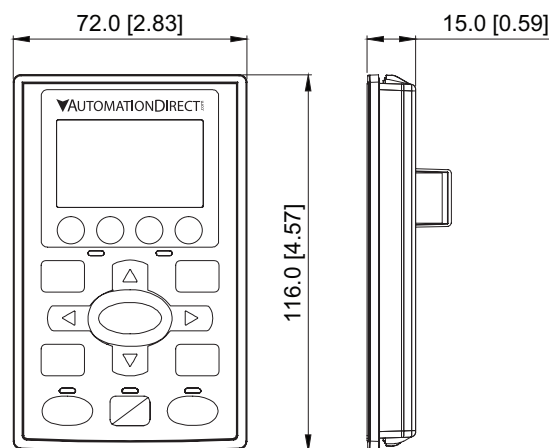
- 1) Set P09.00 communication address = 1
- 2) Set P09.01 COM1 transmission speed (Baud rate) = 19.2 Kbps
- 3) Set P09.04 COM1 communication protocol = 13: 8N2 (RTU)

To control the GS30 drive motion and speed with the keypad, the setting steps are as follows:



- 1) Frequency control - Parameter P00.20 and/or P00.30 to 1:RS-485 input
- 2) Operation control- Parameter P00.21 and/or P00.31 to 2: RS-485 input.





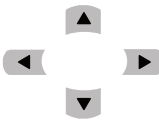









RJ45 Connector
(included, not used)



Dimensions mm [in]

Descriptions of Keypad Functions	
	RUN Key 1) It is only valid when the source of operation command is from the advanced keypad via RS-485. 2) It can operate the AC motor drive by the function setting and the RUN LED will be ON. 3) RUN can be pressed even when drive is in process of stopping. 4) When enabling "LOCAL" mode, it is only valid when the source of operation command is from the advanced keypad via RS-485.
	STOP/RESET Key <i>This key has the highest processing priority in any situation.</i> 1) When it receives STOP command, whether or not the AC drive is in operation or stop status, the AC motor drive will execute a "STOP" command. 2) The RESET key can be used to reset the drive after the fault occurs. For those faults that can't be reset by the RESET key, see the fault records after pressing MENU key for details.
Continued on next page.	

Descriptions of Keypad Functions (<i>continued</i>)		
	Operation Direction Key 1) This key only controls the operation direction and does NOT activate the drive. FWD: forward. REV: reverse. 2) Refer to the LED descriptions for more details.	
	ENTER Key Press ENTER and go to the next menu level. If it is the last level, then press ENTER to execute the command.	
	ESC Key The ESC key function serves to leave the current menu and return to the last menu. It also functions as a return key while in the sub-menu.	
	MENU Key Press MENU to return to the main menu. Menu Content:	
	1) Param Setup 2) Quick Start 3) Keypad Lock 4) Fault Record	5) PLC 6) Copy Param 7) Copy PLC 8) Displ Setup 9) Time Setup 10) Language 11) Start-up
	Direction: Left/Right/Up/Down 1) In the numeric value setting mode, it is used to move the cursor and change the numeric value. 2) In the menu/text selection mode, it is used for item selection.	
	Function Keys 1) F1 is JOG function 2) The F2, F3, F4 keys are reserved for future use.	
	LOCAL Key 1) This key is executed by the parameter settings of the source of Local frequency and Local operation. The factory settings of both source of Local frequency and Local operation are the digital keypad. 2) Pressing the LOCAL key with the drive stopped will switch the operation and frequency to the LOCAL source. Pressing the LOCAL key with the drive running will stop the drive, with "AHSP" warning displayed and when stopped, will switch the operation and frequency source to the LOCAL source. 3) The selected mode, LOCAL or REMOTE, will be displayed on the GS4-KPD. 4) When P00.29=0 then LOCAL correlates to HAND mode. The Digital Input Definition must not be set to 56 (LOC/REM Switch). <i>Refer to P00.29 for more detail and other options on how the drive behaves when switching between LOCAL and REMOTE.</i>	
	REMOTE Key 1) This key is executed by the parameter settings of the source of Remote frequency and Remote operation. The digital keypad is the the factory default source for both Remote frequency and Remote operation. 2) Pressing the REMOTE key with the drive stopped will switch the operation and frequency to the REMOTE source. Pressing the REMOTE key with the drive running will stop the drive, with "AHSP" warning displayed and when stopped, will switch the operation and frequency source to the REMOTE source. 3) The selected mode, LOCAL or REMOTE, will be displayed on the GS4-KPD. 4) When P00.29=0 then LOCAL correlates to HAND mode. The Digital Input definition must not be set to 56 (LOC/REM Switch). <i>Refer to P00.29 for more detail and other options on how the drive behaves when switching between LOCAL and REMOTE.</i>	

Descriptions of LED Functions	
	<p>Steady ON: Operation indicator of the AC motor drive, including DC brake, zero speed, standby, restart after fault and speed search.</p> <p>Blinking: Drive is decelerating to stop or in the status of base block.</p> <p>Steady OFF: Drive is not currently executing an operational (RUN) command.</p>
	<p>Steady ON: Stop indicator of the AC motor drive.</p> <p>Blinking: Drive is in the standby status.</p> <p>Steady OFF: Drive is not currently executing an operational (STOP) command.</p>
	<p>Operation Direction LED</p> <ol style="list-style-type: none"> 1) Green light is on, the drive is running forward or will run forward when given a run command. 2) Red light is on, the drive is running backwards or will run backwards when given a run command. 3) Alternating green/red light: the drive is changing direction.
	<p>ERR_COMM_RUN</p> <p>Descriptions reserved for future use.</p>

GS30 DISPLAY SCREENS FOR GS4-KPD

START-UP DISPLAY



At power up, the Start-up Page displays the *DURAPULSE*, GS30 logo. This page is replaced by the Status Page in 3 seconds.

Pressing the UP Arrow while the Start-up Page is displayed will show the current keypad firmware.

STATUS PAGE

			LOCAL
▲	F	60.00	Hz
▼	H	0.00	Hz
	v	0.00	Vdc
JOG		14:35:36	

Drive status:

Press the LOCAL key to allow local control of the drive.

Press the REMOTE key to allow remote control of the drive.

Pressing the Up and Down Direction keys allow the user to scroll through the Status Page items.

F X.xx Hz (actual GS30 command frequency)

H X.xx Hz (actual GS30 output frequency)

U XXX.x User defined value (in this example P00.04 = 3 DC bus voltage*)

A X.xx Amp (output amperage)

JOG and time:

JOG appears above the F1 key and is the function assigned to that key.

The internal clock is displayed, center bottom.



NOTE: When Power is applied, the keypad will display the startup Page followed by the Status Page. The Status Page displays the GS30 default settings F/H/U/A. While the order F/H/U/A is always fixed, P00.03 can be used to set which value appears on the top row at power-up. The UP and DOWN Arrows will scroll through the display options.



NOTE: If an "Err" appears on the keypad after pressing <Enter> in any menu or parameter, then the action did not take affect. The keypad will report back "End" if the action was performed correctly. Ex: writing a value out of range to a parameter will cause a "Err" message.



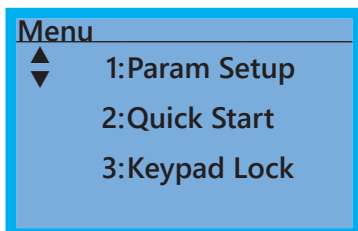
* **NOTE:** Refer to Parameter P00.04 in Chapter 4, AC Drive Parameters for a complete list of the values that can be displayed on line 3 of the keypad display. The value in P00.04 is the value that will be shown when the drive powers up. By scrolling to the User Defined row, the Left and Right Direction keys can be used to display any of the other selections available.



NOTE: The GS4-KPD is connected to the GS30 by the RJ45 communications port with a standard ethernet cable. The following communications settings must be used: P09.01=19.2 (kBps) and P09.04=13 (8N2 RTU).

MENU PAGE

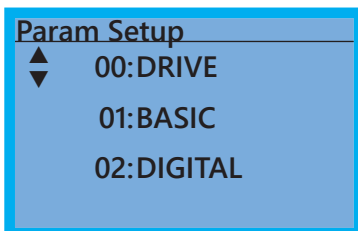
Press the Menu button from any page to access the Menu Page. Use the Up and Down Direction keys to scroll through the Menu content. Press the Enter key to open the selected Menu content item.



- 1: Param Setup - Parameter Setup:
Set up the individual drive parameters.
- 2: Quick Start - This function not available for GS30.
- 3: Keypad Lock:
Lock the Keypad.
- 4: Fault Record:
Display fault information for the drive.
- 5: PLC:
Run the current PLC program.
- 6: Copy Param - Copy Parameters:
Save drive parameters to the keypad or drive.
- 7: Copy PLC:
Copy a previously saved PLC program to the keypad or drive.
- 8: Displ Setup:
Adjust contrast and backlight settings for the display.
- 9: Time Setup:
Set the time.
- 10: Language:
Set the display language.
- 11: Start-up:
Set the Start-up Page display.

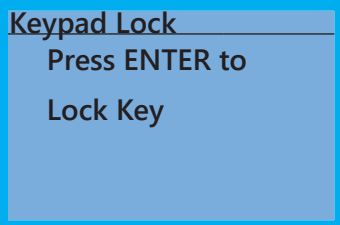
PARAM SETUP - PARAMETER SETUP PAGE

See the individual parameter summary tables in *Chapter 4 - AC Drive Parameters* for specific parameter explanations and settings.



- 00: DRIVE
- 01: BASIC
- 02: DIGITAL
- 03: ANALOG
- 04: SPEED
- 05: MOTOR
- 06: PROTECT
- 07: SPECIAL
- 08: PID
- 09: COMMUNICATION
- 10: FEEDBACK
- 11: ADVANCED
- 13: USER
- 14: PROTECT(2)

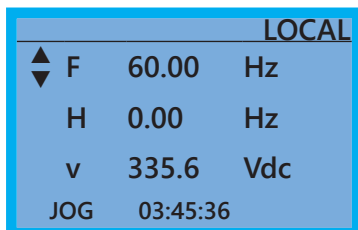
KEYPAD LOCK - KEYPAD LOCK PAGE



Keypad Lock is used to lock the keypad from unintentional activation during operation.

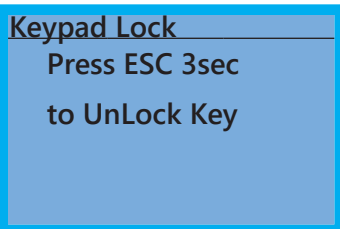
ENTER

Press the Enter key to lock the keypad.



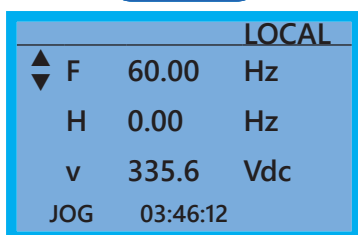
The Status Page will again display.

RUN



Pressing ANY key will display the message Press ESC to UnLock Key.

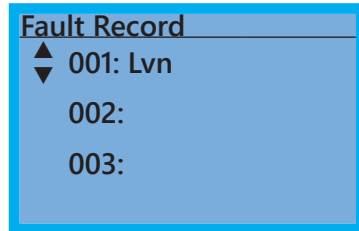
ESC



Press and hold the ESC key for 3 seconds to unlock the keypad. The display will return to the Status Page.

FAULT RECORD - FAULT RECORD PAGE

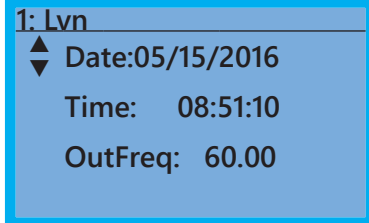
GS30 drive faults are stored from 1: to 20:. Refer to *Chapter 6: Maintenance and Troubleshooting* for a complete list of fault messages that may appear. Use the Up and Down Direction keys to scroll through the list.



1:
2:
3:
▲
▼
18:
19:
20:

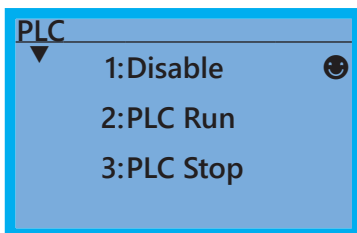
ENTER

Press the Enter key to display information about the drive status when the fault occurred.



Date: 00/00/0000
Time: 00:00:00
OutFreq: 0.00
OutAmp: 0.00
OutVolt 0.0
DCBus: 0.0

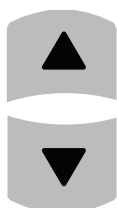
PLC - PLC FUNCTION PAGE



PLC Function is used to Enable/Disable and Run/Stop the internal PLC. The active selection is marked by a smiley face character on the far right of the display.



WARNING: ON A POWER CYCLE THE PLC RUN/STOP STATE WILL BE DETERMINED BY THE LAST STATE THE KEYPAD WAS PLACED IN, OR BY THE CONFIGURED DIGITAL INPUTS. IF THE STATE WAS CHANGED VIA GSLOGIC, THAT RUN/STOP STATE MAY NOT BE TRUE ON A POWER CYCLE.



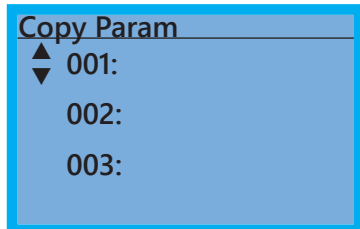
Use the Up and Down Direction keys to select Disable, PLC Run or PLC Stop.



Press the Enter key to confirm the selection.

	PLC/RUN	LOC
▲ F	60.00	Hz
H	0.00	Hz
v	335.6	Vdc
JOG	04:10:16	

Selecting PLC Run will activate the GS30 internal PLC. The keypad status Page will display PLC/RUN at the top, center of the display. If PLC Stop is selected, the PLC program will stop and the Status Page will display PLC/STOP at the top center of the page. Selecting Disable will disable the GS30 internal PLC and return control to the drive. Selecting PLC Run or PLC Stop also can determine whether the physical I/O are controlled by the Drive or are controlled by the PLC. See Chapter 8 for more information on the integrated PLC and GSLogic software.

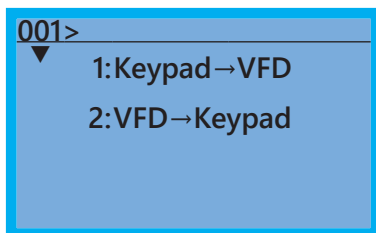
COPY PARAM - COPY PARAMETERS PAGE (KEYPAD COPY)

Copy Parameters is used to save up to four drive configurations into the keypad. The keypad can then download any of these configurations into the drive, or it can be moved to a different drive and download the parameter settings of the original drive. Use the Up and Down Direction keys to scroll through the four available copy parameter locations. If a field is blank, then no copy has been made to that location.

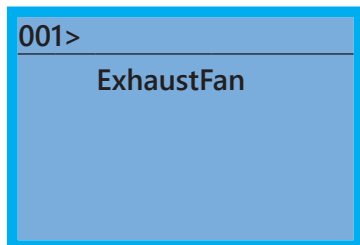
001: ExhaustFan
002: IntakeFan1
003: Filename02
004:

ENTER

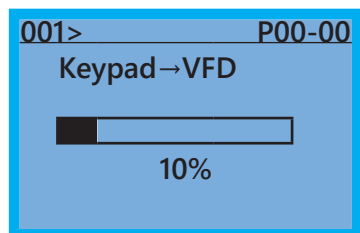
Press the Enter key to select the desired location for writing the current parameter settings.



Use the Up and Down Direction keys to select Keypad→VFD to copy the current parameter settings from the keypad to the drive or VFD→Keypad to write the current parameter settings from the drive to the keypad. Press the Enter key.

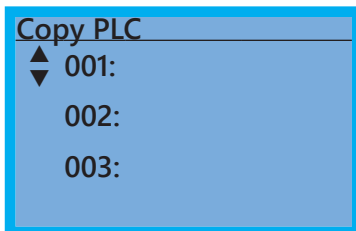
VFD → KEYPAD

After VFD→Keypad is selected, the keypad will prompt you for a filename to save the existing configuration into. Use the Left/Right Arrows to scroll from character to character and the Up/Down Arrows to change the alphanumeric character. Pressing Enter will begin the transfer of parameters from the drive into the keypad.

KEYPAD → VFD

When Keypad→VFD is selected, the keypad will begin the transfer of the preselected file parameters from the keypad into the drive. As shown in the example to the left, “001” is the file to be transferred. Pressing F4 while in the Copy Param menu will prompt you to Delete All 4 saved programs (“Press ENTER to clear”).

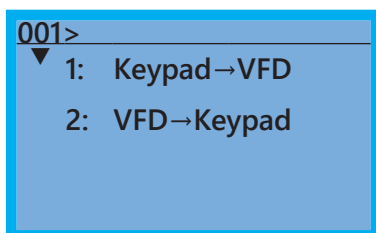
COPY PLC - COPY PLC PAGE



Copy PLC is used to copy previously saved PLC program from the keypad to the drive or from the drive to the keypad. Use the Up and Down Direction keys to scroll through the four available Copy PLC locations. If the field is blank, then no copies have been made. The keypad can store both the parameters and the PLC program at the same time.

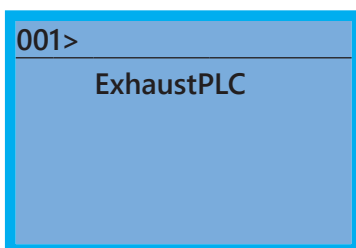


Press the Enter key to select the desired location for writing the current program.



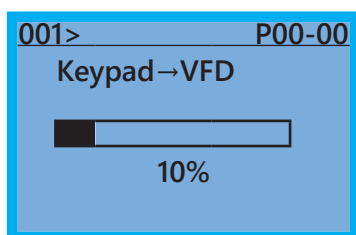
Use the Up and Down Direction keys to select Keypad→VFD to copy the previously saved PLC settings from the keypad to the drive or VFD→Keypad to write the current PLC program from the drive to the keypad.

VFD → KEYPAD

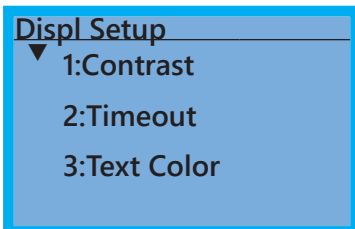


When VFD→Keypad is selected, the keypad will prompt you for a filename to save the existing configuration into. Use the Left/Right arrows to scroll from character to character and the Up/Down arrows to change the alphanumeric character. Pressing Enter will begin the transfer of PLC program from the drive into the keypad.

KEYPAD → VFD

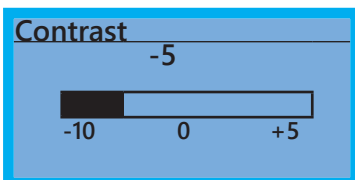


When Keypad→VFD is selected, the keypad will begin the transfer of PLC program from the keypad into the drive.

DISPL SETUP - DISPLAY SETUP PAGE

The Display Setup Page allows the user to adjust the Contrast, Backlight time and Text Color of the display.

- 1: Contrast
- 2: Timeout
- 3: Text Color

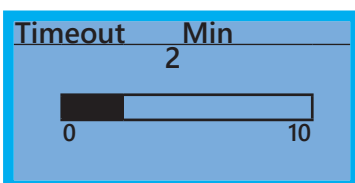


Use the Up and Down direction arrows to adjust the Contrast to the desired setting.

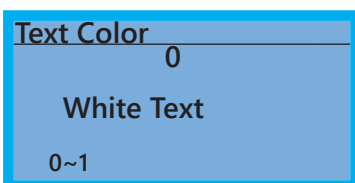
The range of adjustment is from -20 to +20.

The default value is 0.

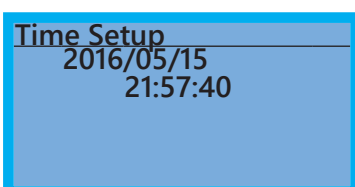
Entering a value of 0 will keep the backlight ON all the time.



Use the Up and Down direction arrows to adjust the time when the display backlight turns off. The range of adjustment is from 0 to 10 minutes. The default value is 5 minutes.



Use the Up and Down direction arrows to select from white text or blue text for the display.

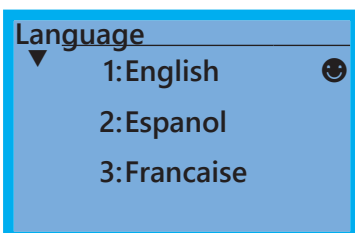
TIME SETUP - TIME SETUP PAGE

The Time Setup Page allows the user to change the date and time.

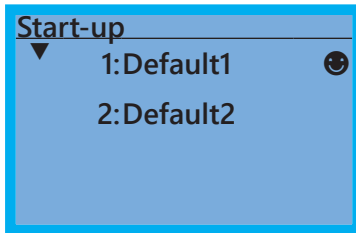
The date format is Year/Month/Day. Time is displayed in 24-hour clock format and is displayed as Hours:Minutes:Seconds. Use the Right and Left Arrow keys to move the cursor to the desired location and use the Up and Down Arrow keys to adjust the setting.

After adjusting the time, move the cursor to the Seconds entry before pressing the Enter Key.

The real time clock (RTC) is maintained in the keypad. A capacitor is used to provide power for the RTC during power loss. The capacitor can maintain power for the RTC for 7 days with no drive power applied.

LANGUAGE - LANGUAGE PAGE

The Language Page sets the language shown on the display. Select from English, Spanish or French. The translation applies to the keypad menu structure only. The Detailed parameter settings will remain in English.

START-UP - START-UP PAGE

The Start-up Page allows the user to select from two different screens that display during initial start-up. Default1 setting displays the GS30 logo screen, Default2 setting displays “Initializing, Please Wait.”

KEYPAD FAULT CODES

Following are the fault codes and descriptions for the GS4-KPD. To reset the fault codes press the Enter and Reset buttons simultaneously. These faults indicate either a communication error between the keypad and the drive or a keypad failure. To correct: 1) Inspect and clean the RJ45 connectors on the back of the keypad and the RJ45 connector leading into the drive. 2) Replace the cable and/or RJ45 M-M adapter with a standard Ethernet patch cable. 3) If the RJ45 connections are OK, replace the keypad.

- ①

②

③

Fault LOCAL

FrEr

kpdFlash Read Er

① Display error signal

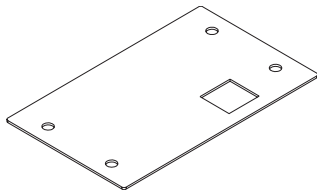
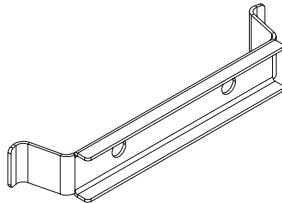
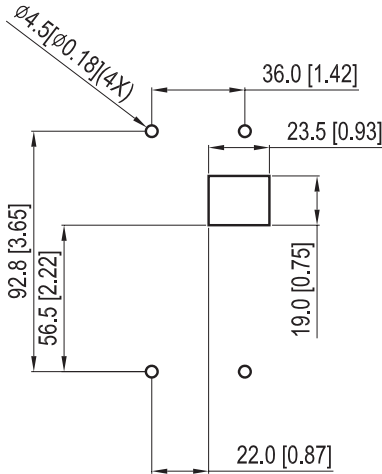
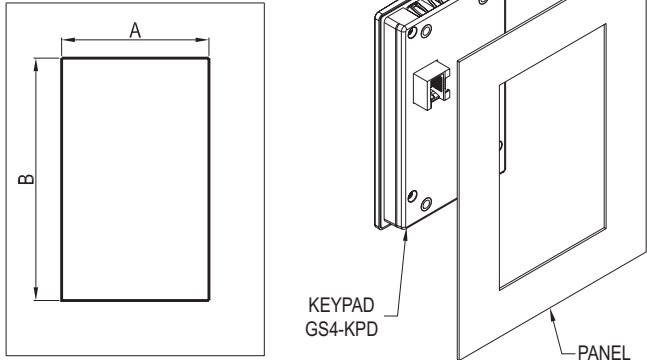
② Abbreviated error code
The code is displayed as shown on GS4-KPD

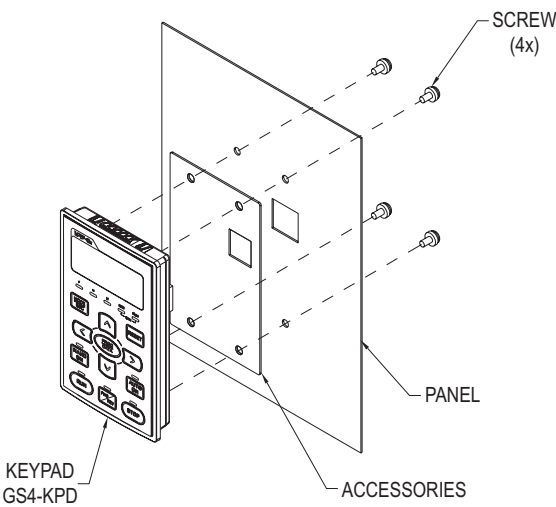
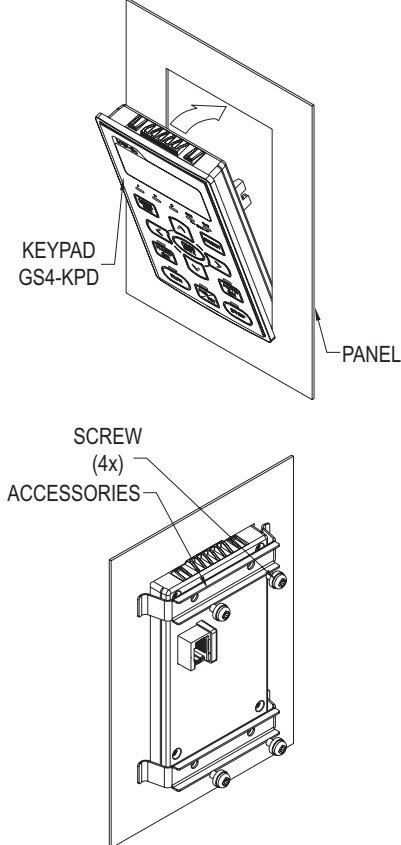
③ Display error description

ID No.	Description	Corrective Actions
<div style="border: 2px solid blue; padding: 10px; text-align: center;"> Fault LOCAL FrEr kpdFlash Read Er </div>	Keypad flash memory read error.	An error has occurred on keypad's flash memory. 1. Press RESET on the keypad to clear the error. 2. Verify what kind of error has occurred on keypad's flash memory. 3. Shut down the system, wait 10 minutes and power up the system. If the error remains contact technical support.
<div style="border: 2px solid blue; padding: 10px; text-align: center;"> Fault LOCAL FSEr kpdFlash Save Er </div>	Keypad flash memory save error.	An error has occurred on keypad's flash memory. 1. Press RESET on the keypad to clear the error. 2. Verify what kind of error has occurred on keypad's flash memory. 3. Shut down the system, wait 10 minutes and power up the system. If the error remains contact technical support.
<div style="border: 2px solid blue; padding: 10px; text-align: center;"> Fault LOCAL FPEr kpdFlash Pr Er </div>	Keypad flash memory parameter error.	Errors occurred on factory setting parameters possibly caused by firmware update. 1. Press RESET on the keypad to clear the error. 2. Verify if there is a problem on the FLASH IC. 3. Shut down the system, wait 10 minutes and power up the system. If the error remains contact technical support.
<div style="border: 2px solid blue; padding: 10px; text-align: center;"> Fault LOCAL VFDr Read VFD Info Er </div>	Keypad flash memory when read AC data error.	Keypad can't read data from drive. 1. Verify if the keypad is properly connected to the drive with the RJ45 connector. 2. Press RESET on the keypad to clear the error. 3. Shut down the system, wait 10 minutes and power up the system. If the error remains contact technical support.
<div style="border: 2px solid blue; padding: 10px; text-align: center;"> Fault LOCAL ERR88 Type Mismatch </div>	Keypad/Drive parameter file mismatch.	There has been an attempt to copy an incorrect file between the keypad and the drive. Ensure that there is a valid file in the keypad (if attempting Keypad → VFD transfer).

KEYPAD PANEL MOUNTING KIT GS4-BZL

This panel mounting kit can be used for wall mounting or embedded mounting of the GS4-KPD.

Wall Mounting	Embedded Mounting																																				
Accessory 1	Accessory 2																																				
																																					
Screws: (4) M4*p 0.7 *L8mm Torque: 10-12 kg·cm (8.7-10.4lb-in.)	Screws: (4) M4*p 0.7 *L8mm Torque: 10-12 kg·cm (8.7-10.4 lb-in)																																				
																																					
Panel cutout dimensions mm [in]	Normal cutout dimension																																				
	<table><tr><td>Panel Thickness</td><td>1.2 mm</td><td>1.6 mm</td><td>2.0 mm</td></tr><tr><td>A</td><td colspan="3">66.4 [2.614]</td></tr><tr><td>B</td><td>110.2 [4.339]</td><td>111.3 [4.382]</td><td>112.5 [4.429]</td></tr><tr><td colspan="4">* Deviation: ± 0.15 mm / ± 0.0059 in</td></tr><tr><td colspan="4">Cutout dimension (Waterproof level: IP56)</td></tr><tr><td>Panel Thickness</td><td>1.2 mm</td><td>1.6 mm</td><td>2.0 mm</td></tr><tr><td>A</td><td colspan="3">66.4 [2.614]</td></tr><tr><td>B</td><td colspan="3">110.8 [4.362]</td></tr><tr><td colspan="4">* Deviation: ± 0.15 mm / ± 0.0059 in</td></tr></table>	Panel Thickness	1.2 mm	1.6 mm	2.0 mm	A	66.4 [2.614]			B	110.2 [4.339]	111.3 [4.382]	112.5 [4.429]	* Deviation: ± 0.15 mm / ± 0.0059 in				Cutout dimension (Waterproof level: IP56)				Panel Thickness	1.2 mm	1.6 mm	2.0 mm	A	66.4 [2.614]			B	110.8 [4.362]			* Deviation: ± 0.15 mm / ± 0.0059 in			
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	B	110.8 [4.362]																																			
	* Deviation: ± 0.15 mm / ± 0.0059 in																																				
Continued on next page.																																					

Wall Mounting	Embedded Mounting
 <p>The diagram illustrates the wall mounting process. A keypad labeled 'KEYPAD GS4-KPD' is shown being aligned with a 'PANEL'. Four screws, labeled 'SCREW (4x)', are shown being inserted through the panel into the wall. The panel also has a section labeled 'ACCESSORIES'.</p>	 <p>The diagram illustrates the embedded mounting process. The top part shows the 'KEYPAD GS4-KPD' being inserted into a 'PANEL'. The bottom part shows the keypad fully embedded within the panel, secured by four screws labeled 'SCREW (4x)'. The panel is labeled 'ACCESSORIES'.</p>