Installation and Wiring

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Drive Models by Frame Size

GS10 *DURA*PULSE Drive Models by Frame Size	
Frame	***Drive***
A	GS11N-10P2, GS11N-10P5, GS11N-20P2, GS11N-20P5, GS13N-20P2, GS13N-20P5, GS13N-21P0, GS13N-40P5, GS13N-41P0
B	GS11N-21P0, GS13N-22P0, GS13N-42P0
C	GS11N-11P0,GS11N-22P0, GS11N-23P0, GS13N-23P0, GS13N-25P0, GS13N-43P0, GS13N-45P0
D	GS13N-27P5, GS13N-47P5, GS13N-4010

Installation

Install the AC drive in an enclosure that is specifically designed to house electrical and electronic control equipment. Provide proper spacing within the enclosure to allow the dissipation of heat produced by the drive and any other included electrical and electronic equipment. Ventilation or air conditioning may also be required, depending upon the application.

FAILURE TO OBSERVE THESE PRECAUTIONS MAY DAMAGE THE DRIVE AND VOID THE WARRANTY!

Improper installation of the AC drive will greatly reduce its life. Observe the following precautions when installing the drive:

- *Do not mount the AC drive near heat-radiating elements or in direct sunlight.*
- *Do not install the AC drive in a place subjected to high temperature, high humidity, excessive vibration, corrosive gases or liquids, or airborne dust or metallic particles.*
- *Install the AC drive in Pollution Degree 2 environments only.*
  Pollution Degree 2: Normally only non-conductive pollution occurs. Temporary conductivity caused by condensation is to be expected.
- *Install the AC drive in a cabinet. When installing one drive below another, use a metal separator between the drives to prevent mutual heating and to prevent the risk of fire.*
- *Mount the AC drive securely on a flat, rigid, non-flammable surface.*
- *Mount the AC drive vertically and do not restrict the air flow to the heat sink fins.*
- *Prevent fiber particles, scraps of paper, shredded wood saw dust, metal particles, etc. from adhering to the heat sink.*

AC DRIVES GENERATE A LARGE AMOUNT OF HEAT WHICH MAY DAMAGE THEM. AUXILIARY COOLING METHODS ARE TYPICALLY REQUIRED IN ORDER NOT TO EXCEED MAXIMUM AMBIENT TEMPERATURES.

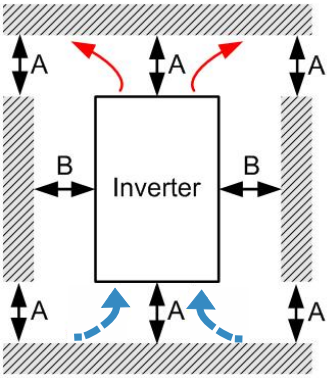
Minimum Clearances and Air Flow

Diagram Directional Arrows

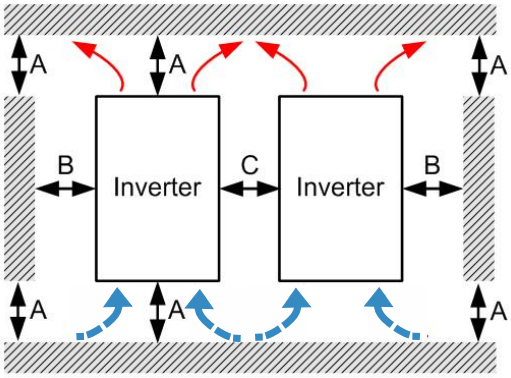
- *Air Inflow: Blue Arrow* → →
- *Air Outflow: Red Arrow* → →
- *Distance: Black Arrows* ↔ ↔

GS10 Series Minimum Clearance Distances

1) Single Drive Installation (Frames A–F)



2) Multiple Drives Side-By-Side



GS10 Minimum Mounting Clearances*					
Installation Method	***A (mm)***	***B (mm)***	***C (mm)***	***Operation Temperature (°C)***	
				Max (w/out derating)	***Max (Derating)***
Single drive installation	50	30	–	50	60
Side-by-side horizontal installation	50	30	30	50	60
Zero stack installation	50	30	0	40	50
** The minimum mounting clearances stated in this table apply to GS10 drives frames A to D. Failure to follow the minimum mounting clearances may cause the fan to malfunction and cause a heat dissipation problem.*					

GS10 Airflow and Power Dissipation

GS10 Airflow and Power Dissipation						
Model Number	Frame Size	Airflow Rate for Cooling		Power Dissipation (Watts)		
		Flow Rate (cfm)	Flow Rate (m^3/hr)	Loss External (Heat sink)	Internal	Total
GS11N-10P2	A	0	0	8	10	18
GS11N-10P5				14.2	13.1	27.3
GS11N-11P0	C	16	27.2	29.1	23.9	53
GS11N-20P2	A	0	0	8.6	10	18.6
GS11N-20P5				16.3	14.5	30.8
GS11N-21P0	B	10	16.99	29.1	20.1	49.2
GS11N-22P0	C	16	27.2	46.5	31	77.5
GS11N-23P0				70	35	105
GS13N-20P2	A	0	0	8.6	10	18.6
GS13N-20P5				16.5	12.6	29.1
GS13N-21P0				31	13.2	44.2
GS13N-22P0	B	10	16.99	50.1	24.2	74.3
GS13N-23P0	C	16	27.2	76	30.7	106.7
GS13N-25P0				108.2	40.1	148.3
GS13N-27P5	D	23.4	39.7	192.8	53.3	246.1
GS13N-40P5	A	0	0	17.6	11.1	28.7
GS13N-41P0				30.5	17.8	48.3
GS13N-42P0	B	10	16.99	45.9	21.7	67.6
GS13N-43P0	C	16	27.2	60.6	22.8	83.4
GS13N-45P0				93.1	42	135.1
GS13N-47P5	D	23.4	39.7	132.8	39.5	172.3
GS13N-4010				164.7	55.8	220.5

- Published flow rates are the result of active cooling using fans, factory installed in the drive.
- Unpublished flow rates (0.0) are the result of passive cooling in drives without factory installed fans.
- The required airflow shown in the chart is for installing a single GS10 drive in a confined space.
- When installing multiple GS10 drives, the required air volume would be the required air volume for a single GS10 drive multiplied by the number of GS10 drives.

- When calculating power dissipation (Watt Loss), use the Total value. Heat dissipation shown in the chart is for installing a single GS10 drive in a confined space.
- When installing multiple drives, the volume of heat/power dissipation should be the heat/power dissipated by a single GS10 drive multiplied by the number of GS10 drives.
- Heat dissipation for each model is calculated by rated voltage, current and default carrier frequency.

Dimensions

(Units = mm [in])

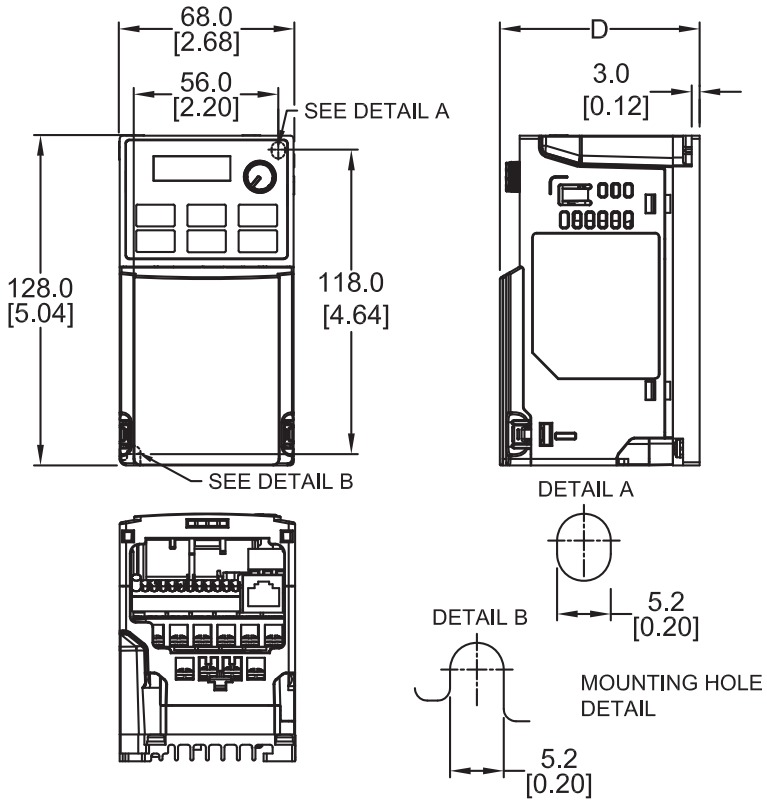
See our website: www.AutomationDirect.com for complete engineering drawings and 3D models.

GS10 DURApulse Frame Sizes by Drive Model					
115V		230V		460V	
Drive	Frame	Drive	Frame	Drive	Frame
GS11N-10P2	A1	GS11N-20P2	A1	GS13N-40P5	A4
GS11N-10P5	A3	GS11N-20P5	A3	GS13N-41P0	A6
GS11N-11P0	C1	GS11N-21P0	B2	GS13N-42P0	B1
		GS11N-22P0	C1	GS13N-43P0	C1
		GS11N-23P0	C1	GS13N-45P0	C1
		GS13N-20P2	A1	GS13N-47P5	D1
		GS13N-20P5	A2	GS13N-4010	D1
		GS13N-21P0	A5		
		GS13N-22P0	B1		
		GS13N-23P0	C1		
		GS13N-25P0	C1		
		GS13N-27P5	D1		

Dimensions (Units = mm [in])

See our website: www.AutomationDirect.com for complete engineering drawings and 3D models.

GS10 Frame Size A

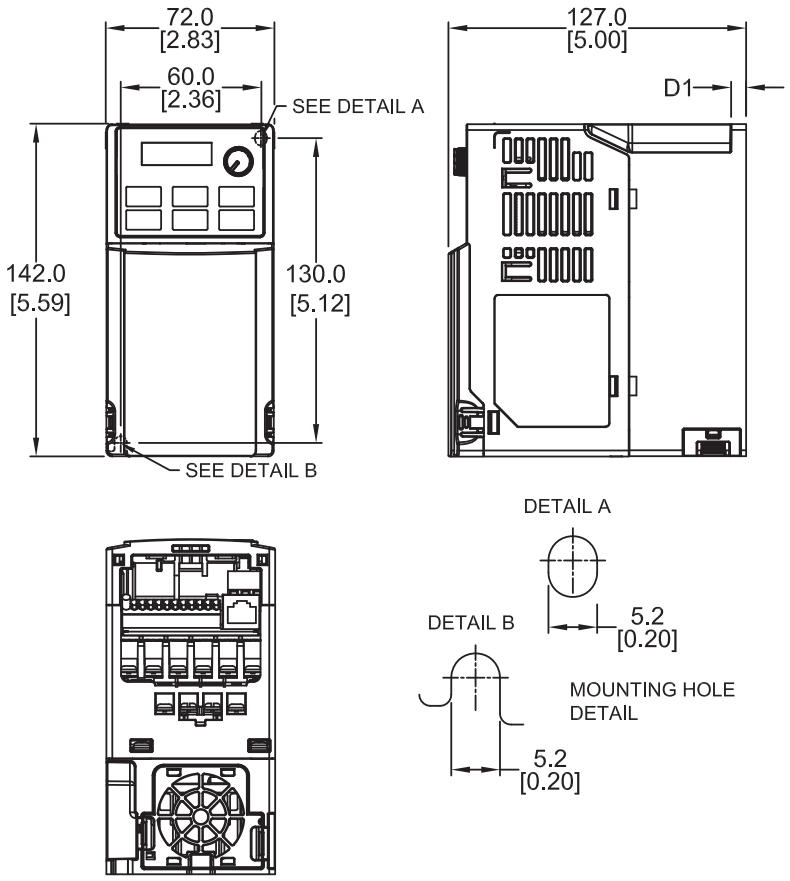


A Frame "D" Dimension	
Frame	**D mm [in]**
A1	78.0 [3.07]
A2	92.0 [3.62]
A3	107.0 [4.21]
A4	113.0 [4.45]
A5	125.0 [4.92]
A6	127.0 [5.00]

Dimensions (Units = mm [in])

See our website: www.AutomationDirect.com for complete engineering drawings and 3D models.

GS10 Frame Size B

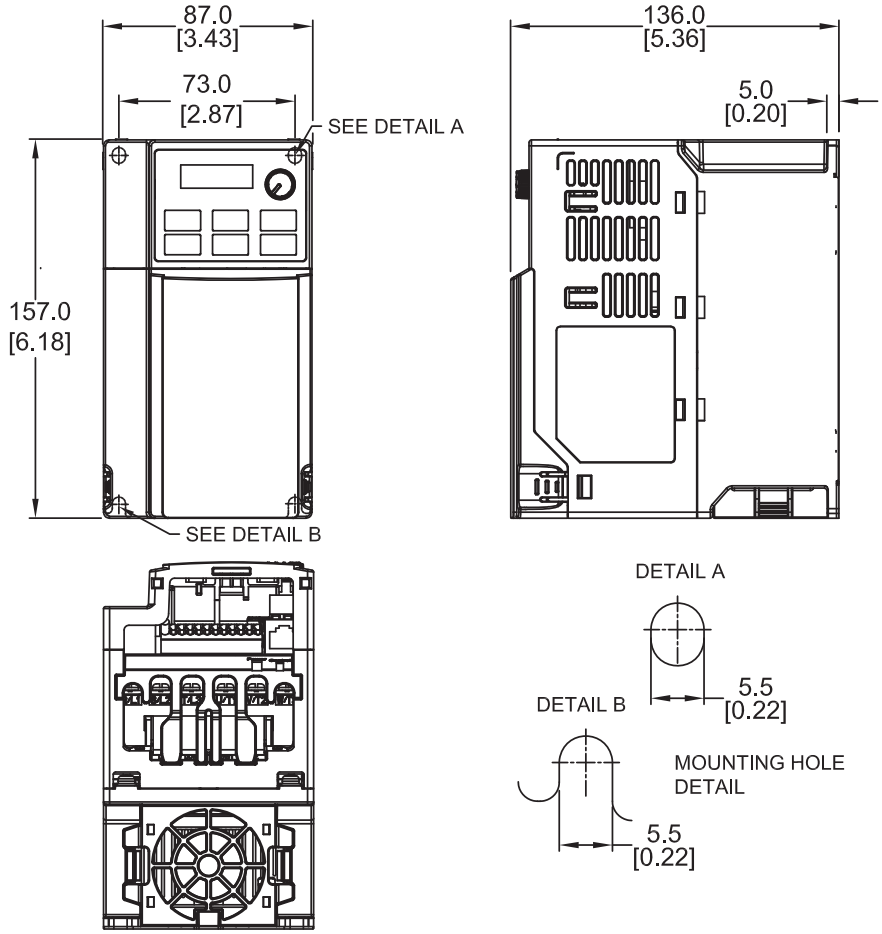


B Frame "D" & "D1" Dimensions		
Frame	**D mm [in]**	**D1 mm [in]**
B1	127.0 [5.00]	6.4 [0.25]
B2	127.0 [5.00]	3.0 [0.12]

Dimensions (Units = mm [in])

See our website: www.AutomationDirect.com for complete engineering drawings and 3D models.

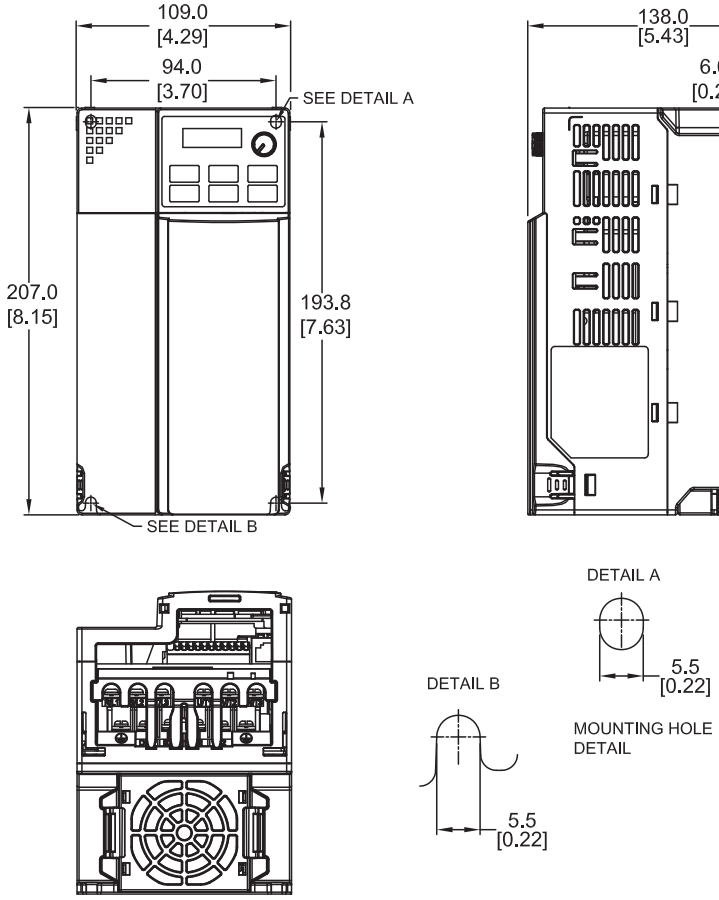
GS10 Frame Size C



Dimensions (Units = mm [in])

See our website: www.AutomationDirect.com for complete engineering drawings and 3D models.

GS10 Frame Size D



Circuit Connections – RFI Jumper

RFI Jumper: The GS10 drives may emit electrical noise. The drive contains Varistors / MOVs that are connected from phase to phase and from phase to ground to prevent the drive from unexpected stop or damage caused by mains surges or voltage spikes. Because the Varistors / MOVs from phase to ground are connected to ground with the RFI jumper, removing the RFI jumper disables the protection.

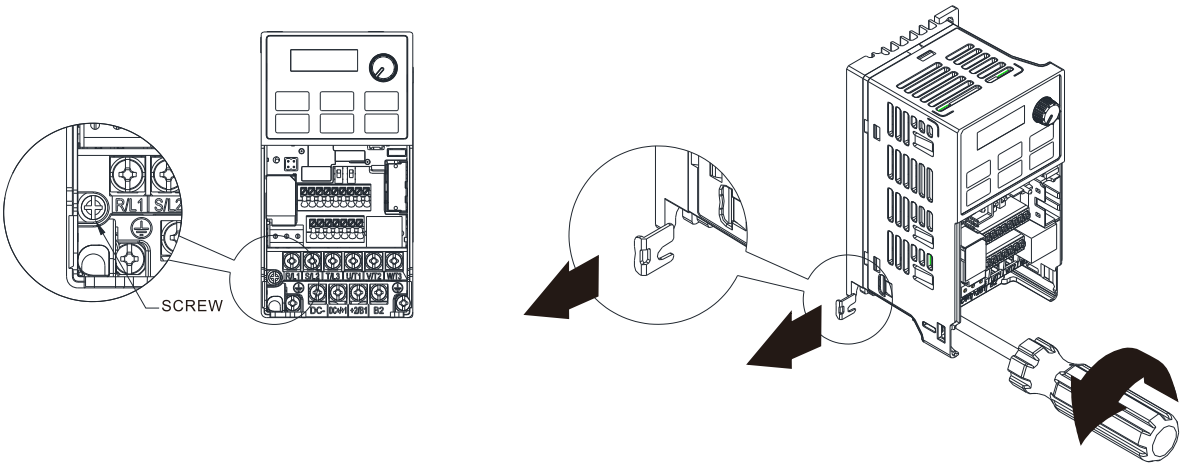
RFI Jumper Removal

The RFI jumper may need to be removed in some cases, such as situations in which the GS10 drive is powered from an Asymmetric Ground System (Corner Grounded TN System), as described on page 2–12.

GS10 Frames A~D

Screw Torque: 4~6 kg·cm [3.5~5.2 lb·in]

Loosen the screw indicated in the view below, and remove the RFI jumper. Tighten the screw to the specified torque after the RFI jumper is removed.



Isolating Main Power from Ground

WARNING: If the power distribution system supplying the GS10 drive is 120V single phase, the RFI jumper must be removed.

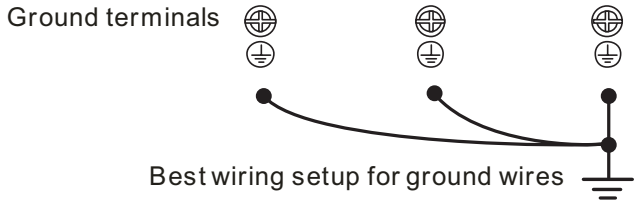
WARNING: If the power distribution system supplying the GS10 drive is a floating-ground system (IT) or an asymmetric-ground system (TN), the RFI jumper must be removed.

If the power distribution system supplying the GS10 drive is a floating ground system (IT) or an asymmetric ground system (TN), the RFI jumper must be removed. Removing the RFI jumper disconnects the internal RFI filter capacitor between the drive's frame and circuits to avoid damaging those circuits and to reduce ground leakage current.

Important points regarding ground connection

- *To ensure the safety of personnel, proper operation, and to reduce electromagnetic radiation, the GS10 drive must be properly grounded during installation.*
- *The diameter of the cables must meet the size specified by applicable codes and regulations.*
- *The shield of shielded cables must be connected to the ground of the GS10 drive to meet safety regulations.*
- *The shield of shielded cables can be used as the ground for equipment only when the aforementioned points are met.*

- *When installing multiple GS10 drives, do not connect the grounds of the AC motor drive in series. Instead, utilize a single-point grounding scheme (as shown below), or provide individual grounding rods for each GS10 drive.*



Pay particular attention to the following WARNINGS:

WARNING: Do not remove the RFI jumper while power is applied to the GS10 drive.

WARNING: For any 120V single phase input power drive, remove the RFI jumper.

WARNING: Cutting the RFI short-circuit cable will also cut off the conductivity of the capacitor. Gap discharge may occur once the transient voltage exceeds 1000V.

WARNING: The RFI jumper must NOT be removed if the main power is a symmetrically grounded power system.

WARNING: The RFI jumper must not be removed while conducting high voltage tests.

WARNING: When conducting a high voltage test to the entire facility, the main power and the motor must be disconnected if leakage current is too high.

Floating Ground System (IT Systems)

A floating ground system is also called an IT system, an ungrounded system, or a high impedance/ resistance grounding system (greater than 30Ω).

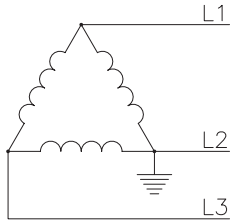
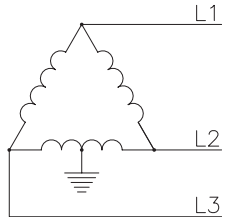
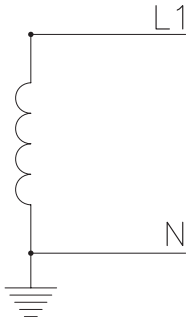
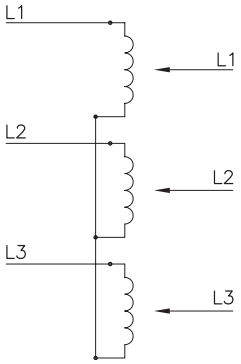
Disconnect the RFI Jumper

CAUTION: Do not install an external RFI/EMC filter! The EMC filter will pass through the RFI capacitor, thus connecting power input to ground. This is very dangerous and can easily damage the GS10 drive.

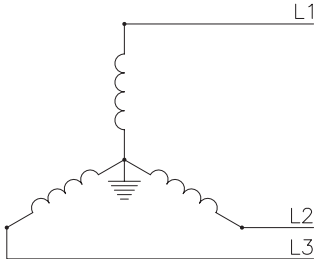
Asymmetric Ground System (Corner Grounded TN Systems)

CAUTION: Do not remove the RFI jumper while the input terminals of the GS10 drive carries power.

The RFI jumper must be removed in the following four situations. This is to prevent the system from grounding through the RFI capacitor, damaging the GS10 drive.

RFI Jumper Must Be Removed (Asymmetric Ground / Corner Grounded TN Systems)	
1) Grounding at a Corner of a Triangle Configuration 	2) Grounding at a Midpoint in a Polygonal Configuration 
3) Grounding at One End in a Single-Phase Configuration 	4) No Stable Neutral Grounding in a Three-Phase Autotransformer Configuration 

The RFI jumper should be left in place for a symmetrically grounded system.

RFI Jumper Left In Place (Symmetrical Ground System)	
Internal grounding through internal RFI filter, which reduces electromagnetic radiation. In a situation with higher requirements for electromagnetic compatibility, and using a symmetrical grounding power system, an EMC filter can be installed. As a reference, the diagram on the right is a symmetrical grounding power system.	

Circuit Connections – Warnings and Notes

Danger!

Hazardous Voltage! Before making any connection to the AC drive, disconnect all power to the AC drive, and wait five minutes for DC bus capacitors to discharge.

Warning: Any electrical or mechanical modification to this equipment will void all warranties, may result in a safety hazard, and may void the UL listing.

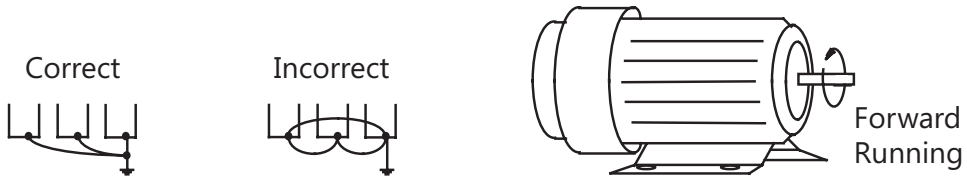
Warning: Do not connect the AC input power to the T1, T2, and T3 output terminals. Doing this will damage the AC drive.

Warning: Do not connect single-phase power to a 460V three-phase drive model.

Warning: Tighten all screws to the proper torque rating. See "Main Circuit Wiring" later in this chapter.

Wiring Notes: PLEASE READ PRIOR TO INSTALLATION.

1) During installation, follow all local electrical, construction, and safety codes for the country in which the AC drive is to be installed.
2) Refer to the "DURApulse GS10 Drive Specifications" in Chapter 1 for voltage and current requirements.
3) Torque the screws of the main circuit terminals to prevent loosening due to vibration.
4) The addition of a magnetic contactor (MC) in the AC line power input wiring is recommended to turn off power quickly and reduce the possibility of malfunction if the protection function of the GS10 AC drive is activated. Both ends of the MC should have an R-C surge absorber.
5) Do not use a power circuit contactor or disconnect switch for normal run/stop control of the GS10 AC drive and motor. This will reduce the operating life cycle of the AC drive. Cycling a power circuit switching device while the AC drive is in run mode should be done only in emergency situations.
6) Make sure the appropriate protective devices (circuit breaker or fuses) are connected between the power supply and AC drive.
7) Make sure that the leads are connected correctly and that the GS10 AC drive is properly grounded. (Ground resistance should not exceed 0.1Ω.)
8) Use ground leads that comply with AWG/MCM standards and keep them as short as possible.
9) Multiple GS10 AC drives can be installed in one location. All of the units should be grounded directly to a common ground terminal. The GS10 AC drive ground terminals may also be connected in parallel, as shown in the figure below.
   Make sure there are no ground loops.



10) When the GS10 AC drive output terminals T1, T2, and T3 are connected to the motor terminals T1, T2, and T3, respectively, the motor will rotate counterclockwise (as viewed from the shaft end of the motor) when a forward operation command is received. To reverse the direction of motor rotation, switch the connections of any of the two motor leads.
11) Make sure that the power source is capable of supplying the correct voltage and required current to the GS10 AC drive.
12) Do not attach or remove wiring when power is applied to the GS10 AC drive.
13) Do not inspect components unless inside "POWER" lamp is turned off.
14) Do not monitor the signals on the circuit board while the GS10 AC drive is in operation.
15) Route the power and control wires separately, or at 90 degree angle to each other.

16) Ground both ends of the shield wire or conduit for the power wiring.
    a) If using a "VFD cable," follow the manufacturer's recommendation for grounding the cable shield.
    b) If using conduit, bond and ground conduit according to applicable electrical codes.
17) If a filter is required for reducing EMI (Electro Magnetic Interference), install it as close as possible to the GS10 AC drive input. EMI can also be reduced by lowering the Carrier Frequency. Please refer to the "Applied EMI/RFI Techniques" white paper linked on the support resources section of the drive item page at www.automationdirect.com.
18) If the GS10 AC drive is installed in a place where a load reactor is needed, install the reactor close to the T1, T2, and T3 side of GS10 AC drive.
19) When using a GFCI (Ground Fault Circuit Interrupt), select current sensor with sensitivity of 200mA or higher, and not less than 0.1-second operation time to avoid nuisance tripping.

Main Power Terminals

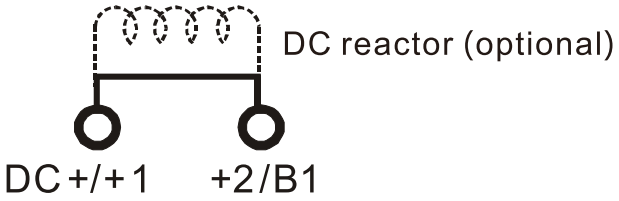
- *Do not supply GS10 460 VAC models with single-phase power. R/L1, S/L2, and T/L3 have no phase-sequence requirement; they can be wired in any order.*
- *Do NOT start/stop the GS10 AC drive by turning input power ON/OFF. Start/stop the GS10 AC drive using RUN/STOP commands via control terminals or the keypad. If you must start/stop the GS10 AC drive by turning power ON/OFF, it is recommended to do so only ONCE per hour.*

Output Terminals for Main Circuit

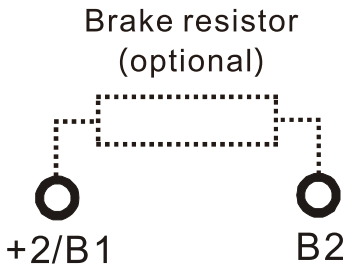
- *DO NOT connect phase-compensation capacitors or surge absorbers to the output terminals of the GS10 AC drive.*
- *Use a well-insulated motor suitable for inverter operation.*

Terminals for Connecting DC Reactor, External Brake Resistor, and DC Circuit

- *Terminals +1 and +2 are used to connect an optional DC reactor or choke to improve power factor. From the factory, these terminals are connected with a short-circuit jumper. Remove this jumper before connecting a DC reactor. Note that not all GS10 drives include terminal +1.*
- *Tighten the jumper if a DC reactor is not connected and DC+/+1 and +2/B1 terminals are used for common DC bus or brake resistors. This will prevent the AC motor drive from losing power and damage to the terminals. If the jumper is missing due to wiring, refer to the recommended main circuit terminal wire to short-circuit the DC+/+1 and +2/B1 terminals.*



- *When the GS10 AC Drive is connected directly to a large-capacity power transformer (600kVA or above) or when a phase lead capacitor is switched, peak currents may occur in the power input circuit due to the load change, resulting in damage to the converter section of the drive. To avoid this damage install a line reactor at the GS10 input terminals, R/L1, S/L2, and T/L3. The installation of a line reactor will reduce current and improve input power efficiency.*
- *Install an external brake resistor for applications in frequent deceleration to stop, short deceleration time (such as high frequency operation and heavy load operation), too low braking torque, or increased braking torque.*



- *For GS10 drives, the external brake resistor should be connected to the B1 and B2 terminals.*
- *If the terminals [+1], [+2], and [DC-] are not used, leave these three terminals open.*
- *To avoid personal injury and to prevent damage to the GS10 drive; DO NOT jumper DC- to DC+, DC- to +2/B1, DC- to B2. Connect braking resistors to B1 and B2 ONLY*
- *DC+ and DC- are connected for common DC bus, please refer to "Main Circuit Wiring Terminals" in this chapter for wiring terminal specification and wire gauge information.*
- *Please refer to the DURApulse Drives Dynamic Braking User Manual for more information on installing brake resistors.*
  (Available for free download at https://cdn.automationdirect.com/static/manuals/gs3dbm/gs-db_ump.pdf)

Motor Operation Precautions

1) When using the GS10 AC drive to operate an older standard 3-phase induction motor, the energy loss will be greater than with a modern inverter duty motor.
2) Running an ac induction motor at low speed can cause the motor temperature to exceed the motor rating due to limited airflow produced by the motor's fan. If running at low speeds, a high performance inverter duty motor is recommended.
3) If **100% output torque** is desired at low speed, it may be necessary to use a special **"high performance inverter-duty" motor**.

Short Circuit Withstand (SCCR)

All *DURAPULSE* GS10 series drives are suitable for use on a circuit capable of delivering not more than 100,000 rms symmetrical amperes.

Applicable Codes

All *DURAPULSE GS10* AC drives are Underwriters Laboratories, Inc. (UL) and Canadian Underwriters Laboratories (cUL) listed, and therefore comply with the requirements of the National Electrical Code (NEC) and the Canadian Electrical Code (CEC).

Installations intended to meet the UL and cUL requirements must follow the instructions provided in "Wiring Notes" as a minimum standard. Follow all local codes that exceed UL and cUL requirements. Refer to the technical data label affixed to the AC drive and the motor nameplate for electrical data.

The "Circuit Protection Devices" section in Appendix A lists the recommended fuse part number for each *DURAPULSE* part number. These fuses (or equivalent) must be used on all installations where compliance with U.L. standards is required.

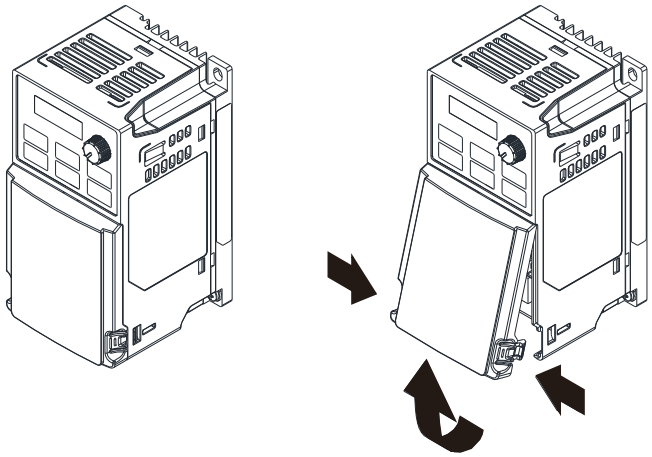
Wiring Terminal Access

Control Terminal Access

Remove the drive front cover to access and wire the multi-function input/output control terminals.

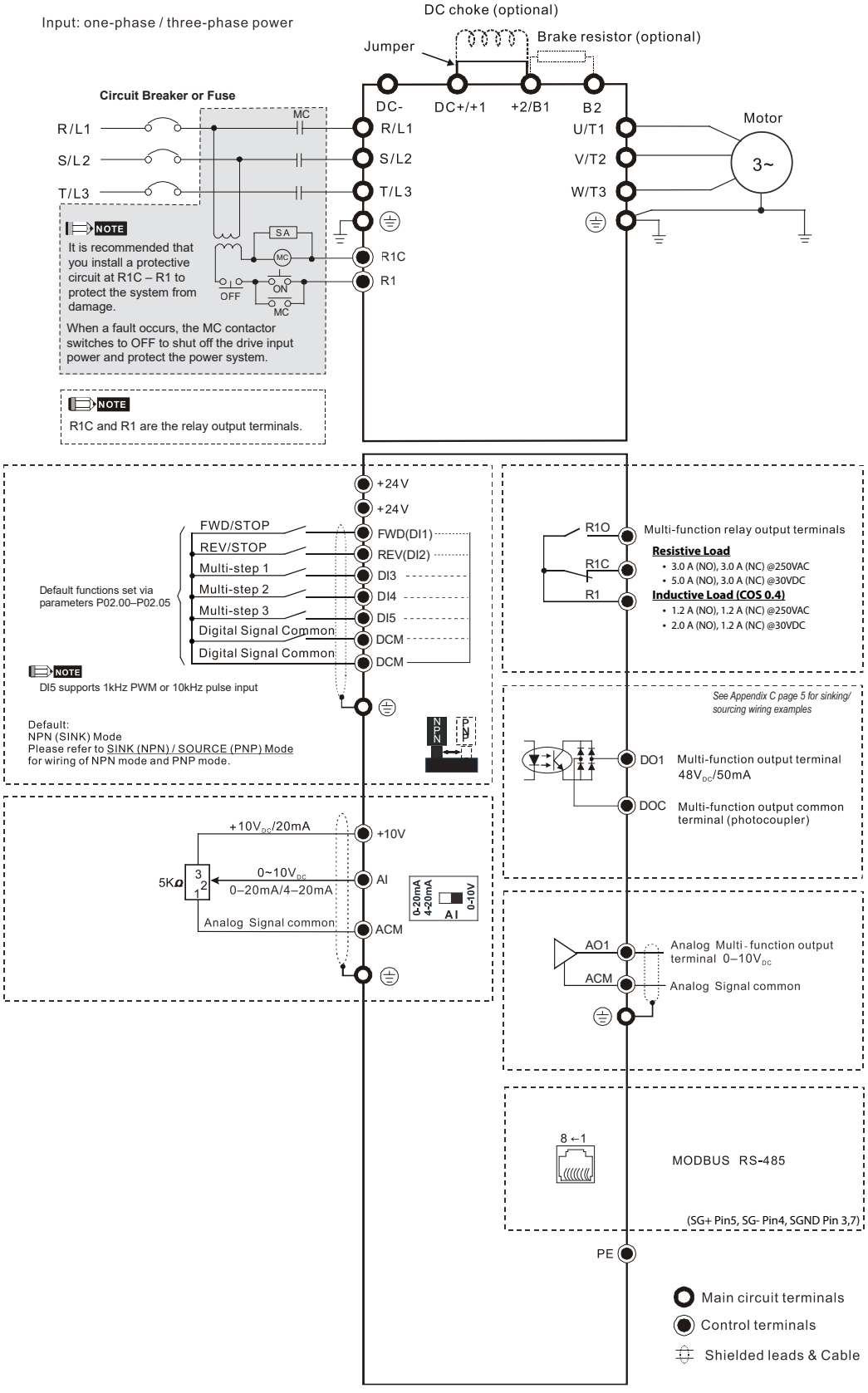
GS10 Drive Frames A ~ D

Press the tabs on both sides to remove the cover.



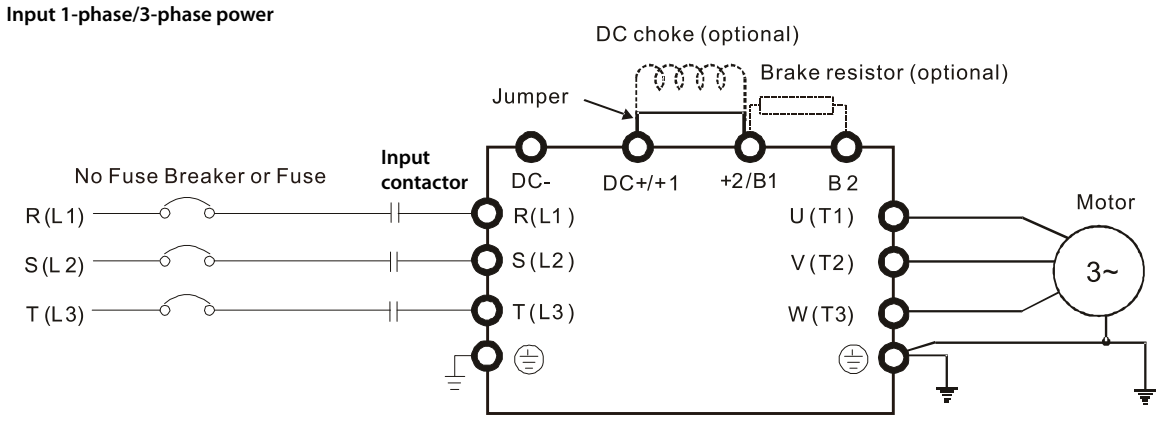
GS10 Wiring Diagrams and Terminals

Full I/O Wiring Diagram



Main Circuit Wiring Diagram

GS10 All Frame Sizes



Main Circuit Terminals	
Terminal	***Description***
R/L1, S/L2	Input Power – phase 1
R/L1, S/L2, T/L3	Input Power – phase 3
U/T1, V/T2, W/T3	AC Motor Drive Output
+1, +2	Connection for DC reactor (remove jumper before installing a DC reactor)
B1, B2	Braking Resistor Connection (optional)
DC+, DC-	Common DC Bus
⏚	Ground

NOTE: 120VAC models do not have DC bus terminals DC-, DC+/+1

Main Circuit Wiring Terminals

Main Terminal Specifications

GS10 Main Circuit Wiring Specifications							
AC Drive Frame Size	AC Drive Model	Main Circuit Terminals R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, DC-, DC+/+1, +2/B1, B2			Ground Terminals ⏚		
		Max Wire Gauge	Min Wire Gauge	Screw Size & Torque (±10%)	Max Wire Gauge	Min Wire Gauge	Screw Size & Torque (±10%)
A	GS11N-10P2	2.5 mm² [14 AWG]	2.5 mm² [14 AWG]	M3.5 9 kg-cm [7.8 in-lb] [0.88 N·m]	2.5 mm² [14 AWG]	2.5 mm² [14 AWG]	M3.5 9 kg-cm [7.8 in-lb] [0.88 N·m]
	GS11N-10P5						
	GS11N-20P2						
	GS11N-20P5		1.5 mm² [16 AWG]				
	GS13N-20P2		0.75 mm² [18 AWG]				
	GS13N-20P5						
	GS13N-21P0		1.5 mm² [16 AWG]				
	GS13N-40P5		0.75 mm² [18 AWG]				
	GS13N-41P0						
B	GS11N-21P0	4 mm² [12 AWG]	4 mm² [12 AWG]	M4 15 kg-cm [13.0 in-lb] [1.47 N·m]	4 mm² [12 AWG]	4 mm² [12 AWG]	M4 15 kg-cm [13.0 in-lb] [1.47 N·m]
	GS13N-22P0						
	GS13N-42P0		2.5 mm² [14 AWG]		2.5 mm² [14 AWG]	2.5 mm² [14 AWG]	
C	GS11N-11P0	10 mm² [8 AWG]	10 mm² [8 AWG]	M4 20 kg-cm [17.4 in-lb] [1.96 N·m]	10 mm² [8 AWG]	10 mm² [8 AWG]	M4 20 kg-cm [17.4 in-lb] [1.96 N·m]
	GS11N-22P0						
	GS11N-23P0						
	GS13N-23P0		6 mm² [10 AWG]		6 mm² [10 AWG]	6 mm² [10 AWG]	
	GS13N-25P0		10 mm² [8 AWG]		10 mm² [8 AWG]	10 mm² [8 AWG]	
	GS13N-43P0		2.5 mm² [14 AWG]		2.5 mm² [14 AWG]	2.5 mm² [14 AWG]	
	GS13N-45P0		4 mm² [12 AWG]		4 mm² [12 AWG]	4 mm² [12 AWG]	
D	GS13N-27P5	10 mm² [8 AWG]	10 mm² [8 AWG]	M4 20 kg-cm [17.4 in-lb] [1.96 N·m]	10 mm² [8 AWG]	10 mm² [8 AWG]	M4 20 kg-cm [17.4 in-lb] [1.96 N·m]
	GS13N-47P5		6 mm² [10 AWG]		6 mm² [10 AWG]	6 mm² [10 AWG]	
	GS13N-4010		10 mm² [8 AWG]		10 mm² [8 AWG]	10 mm² [8 AWG]	

UL installations must use 600V, 75˚C or 90˚C wires. Use copper wire only.

Wiring Terminal Connector Dimensions – Main-Circuit Terminals

Dimensions = mm

GS10 Drives, Frame Size A ~ D

NOTE: Heat shrink should comply with UL (600V, YDPU2).

Power Terminal Wiring Connectors:

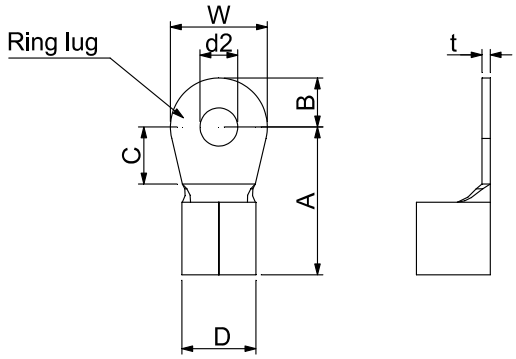


Figure 1.

Heat Shrink Tubing:

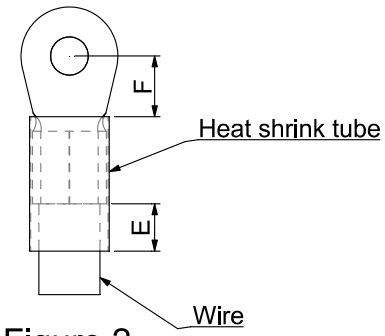


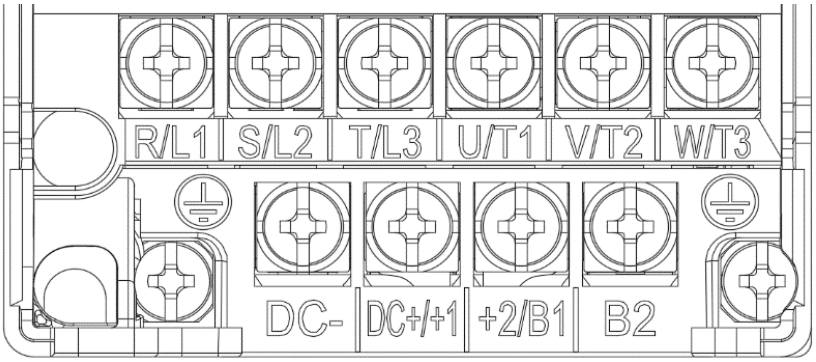
Figure 2.

GS10 Ring Lug Dimensions (mm)												
Frame	***AWG***	***Part Number (Manuf: K.S. Terminals)***	***A (Max)***	***B (Max)***	***C (Min)***	***D (Max)***	***d2 (Min)***	***E (Min)***	***F (Min)***	***W (Max)***	***t (Max)***
A	***18***	RNBS 1.3.7	9.8	3.2	4.8	4.1	3.7	13.0	4.2	6.6	0.8
	16	RNBS 2-3.7									
	14	RNBS 2-3.7									
B	***18***	RNBS1-4	12.1	3.6	6.1	5.6	4.3	13.0	4.5	7.2	1
	16	RNBS1-4									
	14	RNBS2-4									
	12	RNBS5-4									
C	***14***	RNBS2-4	17.8	5.0	6.1	7.2	4.3	13.0	5.5	10.5	1.2
	12	RNBS5-4									
	10	RNBS5-4									
	8	RNBS8-4									
D	***10***	RNBS5-4	17.8	5.0	6.1	7.2	4.3	13.0	5.5	10.5	1.2
	8	RNBS8-4									

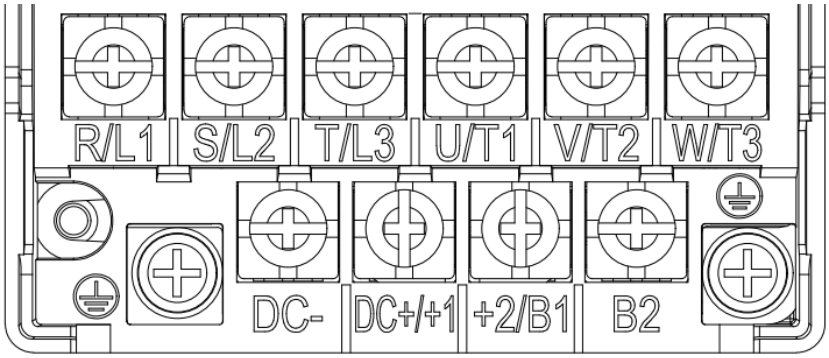
Main Terminal Diagrams

NOTE: 120VAC models do not have DC bus terminals DC-, DC+/+1

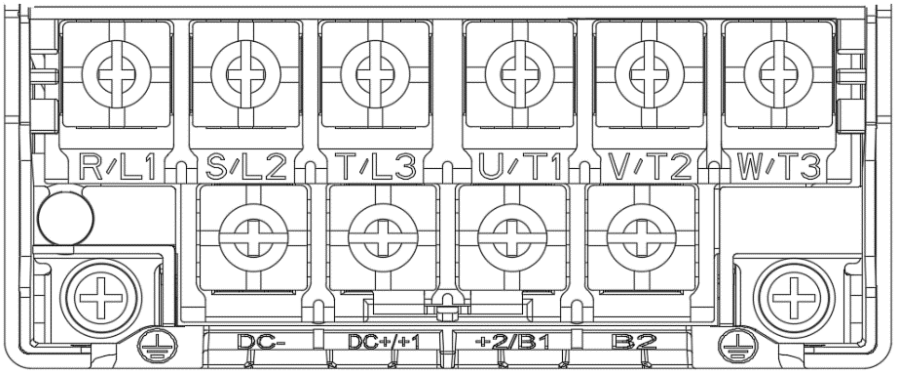
GS10 Frame Size A Main Terminals



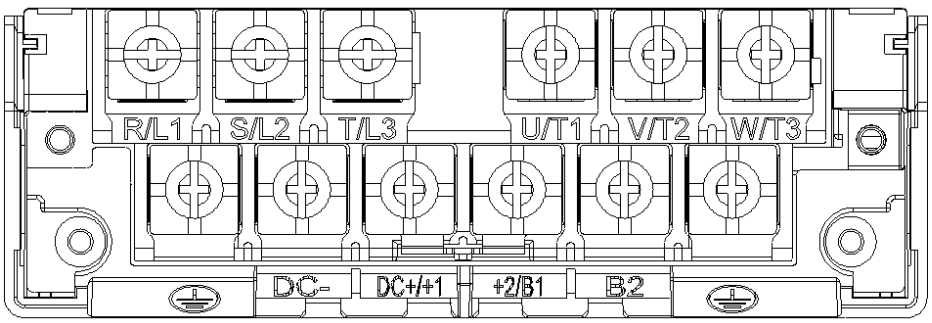
GS10 Frame Size B Main Terminals



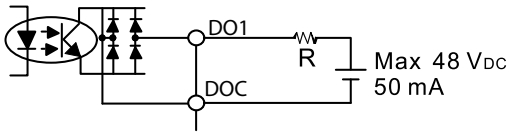
GS10 Frame Size C Main Terminals



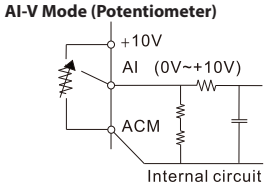
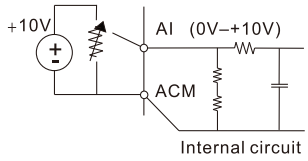
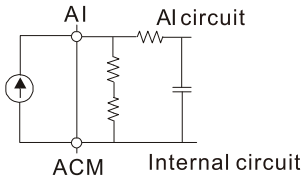
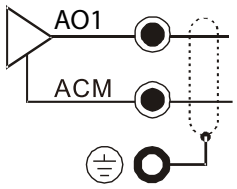
GS10 Frame Size D Main Terminals



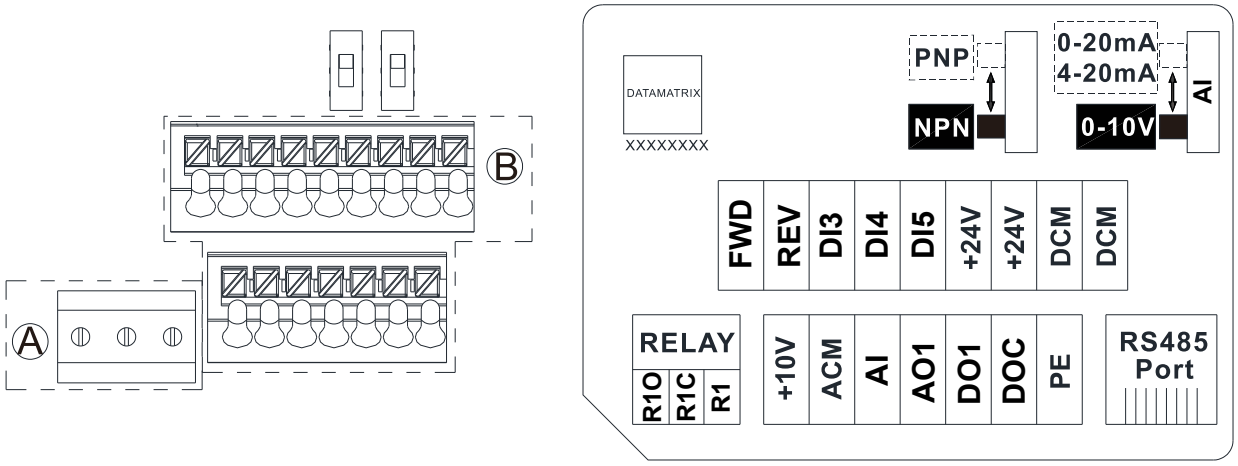
GS10 Control Terminal Specifications

Control Circuit Terminals		
Terminal Symbol	***Terminal Function***	***Description***
+24V	Digital control signal common (Source)	+24V ± 10% 100 mA
DCM	Digital control / Frequency signal common (Sink)	Digital control common.
FWD (DI1) ***REV (DI2)*** ***DI3 - DI5***	Digital input 1–5	Refer to P02.00–02.05 to program the digital inputs FWD (DI1), REV (DI2), DI3–DI5. **Source Mode:** ON: activation current 3.3 mA ≥ 11 VDC OFF: cut-off voltage ≤ 5 VDC **Sink Mode:** ON: activation current 3.3 mA ≤ 13 VDC OFF: cut-off voltage ≥ 19 VDC • When P02.00=0, FWD (DI1) and REV (DI2) can be programmed. • When P02.00≠0, the functions of FWD (DI1) and REV (DI2) act according to P02.00 setting. • When P02.05=0, DI5 is pulse input terminal. • When P00.20 = 4, DI5 is the speed command source. • When DI5 uses single pulse input, the maximum input frequency=10kHz. • When DI5 uses PWM pulse input, the maximum input frequency=1kHz. • Refer to P10.16 for DI5 pulse configuration.
DO1	Digital Output 1 (photo coupler)	The AC motor drive outputs various monitoring signals through a transistor (open collector). Refer to P2.16 to program the output. 
DOC	Digital Output Common (photo coupler)	
R1O	Relay Output 1 (N.O.)	The AC motor drive outputs various monitoring signals through a relay output. Refer to P2.13 to program the output. **Resistive Load** • 3.0 A (NO), 3.0 A (NC) @ 250VAC • 5.0 A (NO), 3.0 A (NC) @ 30VDC **Inductive Load (COS 0.4)** • 1.2 A (NO), 1.2 A (NC) @ 250VAC • 2.0 A (NO), 1.2 A (NC) @ 30VDC
R1C	Relay Output 1 (N.C.)	
R1	Relay Output 1 Common	
+10V	Potentiometer power supply	Power supply for analog frequency setting: +10.5 ± 0.5 VDC / 20 mA

(continued next page)

Control Circuit Terminals (continued)		
Terminal Symbol	**Terminal Function**	**Description**
AI	Analog voltage frequency command **AI-V Mode** **AI-V Mode (Potentiometer)**  **AI-V Mode (voltage input)**  **AI-C Mode**  	The AI default is 0–10 V (AI-V, voltage mode). To switch to the current mode, two steps are required: 1) A dip switch must be configured (follow the instructions on the inner side of the front cover or see page 2–xx) 2) Change P03.28 to 1 (0mA) or 2 (4mA) Use P03.00 to program AI functionality for Voltage or Current mode. AI resolution=12 bits **Voltage (AI-V) mode** • Impedance: 20 kΩ • Range 0–Max. Output Frequency (P01.00): 0 to 10 V • P03.28 = 0 **Current (AI-C) mode** • Impedance: 250 Ω • Range 0– Maximum Output Frequency (P01.00): 0–20 mA/4–20 mA • Range switching according to P03.28 = 1 (0mA) or 2 (4mA)
AO1	Multi-function analog voltage output  	AO1 outputs an analog voltage signal based on P03.20. • Range: 0–10 V (P03.21=0) corresponds to the maximum operating range of the control target • Max. output current: 2 mA • Max. Load: 5 kΩ • AO1 resolution=12 bits
ACM	Analog Signal Common	Analog signal common terminal
PE	RS485	The PE terminal is for shielded cable to ground to decrease interference when you use RS485 communication.
RJ45	PIN 1, 2, 6: Reserved PIN 3, 7: SGND PIN 4: SG- PIN 5: SG+ PIN 8: +10V power for optional GS4-KPD	The RJ45 port provides serial communications connection. Max Baud Rate = 38.4 kbps

Control Terminal Block Diagram & Wiring Specifications



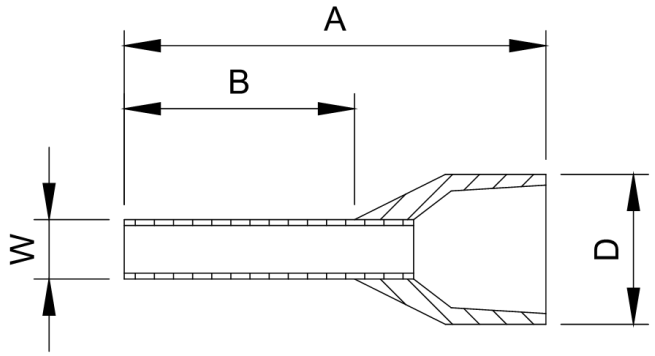
A = Relay terminal, PCB terminal block

B = Control terminal, spring clamp terminal block.

Wiring Specifications					
Terminal	**Wiring Type**	**Stripping Length (mm)**	**Maximum Wire Guage**	**Minimum Wire Gauge**	**Tightening Torque**
Relay	**Solid**	**9-10**	1.5 mm^2 (16 AWG)	0.25 mm^2 (24 AWG)	5 kg·cm [4.3 lb·in] [0.49 N·m]
	Strand				
Control	**Solid**	**9**	0.75 mm^2 (18 AWG)	0.25 mm^2 (24 AWG)	n/a (spring terminals)
	Strand				
	Stranded with ferrules with plastic sleeves		0.5 mm^2 (20 AWG)		

Recommended models or dimensions for ferrule terminals

Wire Gauge	Manufacturer	Model Name	A (MAX)	B (MAX)	D (MAX)	W (MAX)
0.25 mm2 [24 AWG]	PHOENIX CONTACT	AI 0,25- 8 YE	12.5	8	2.6	1.1
0.34 mm2 [22 AWG]	PHOENIX CONTACT	AI 0,34- 8 TQ	12.5	8	3.3	1.3
0.5 mm2 [20 AWG]	PHOENIX CONTACT	AI 0,5 - 8 WH	14	8	3.5	1.4
	Z+F	V30AE000006	14	8	2.6	1.15



Control Terminal Wiring Instructions

Digital Inputs

- *When using contacts or switches to control the digital inputs, use high quality components to avoid contact bounce.*

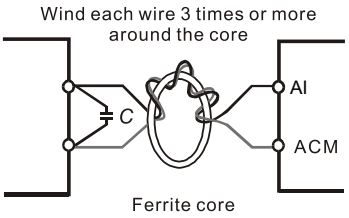
Wiring Multiple Drives Together – Digital Inputs

- *With drive Digital Inputs in SINKING mode: When connecting a single device to the Digital Inputs of multiple drives (Run, Stop, Reverse, etc.), the DCM (Digital Signal Common) terminals from each drive should be connected together. [Otherwise, do NOT connect the different drive DCM terminals together if the drive DI are sourcing.]*
- *With drive Digital Inputs in SOURCING mode (and the connected field devices are sinking): DO NOT connect the different drive DCM terminals together. [If the DCM terminals of multiple drives are connected together with the drive DI in sourcing mode, the inputs of some of the drives may inadvertently turn ON if another drive is powered OFF.]*
  Example: A switch is tied to Digital Input 1 of Drives A, B, C, and D. The Drive inputs are all set to Source current out to the field devices. If Drives A, B and C lose power, their Digital Inputs may sink enough current to inadvertently turn ON Digital Input 1 on Drive D.

WARNING: With drive Digital Inputs in SOURCING mode Do NOT connect the different drive DCM terminals together.

Analog Inputs

- *Analog input signals are easily affected by external noise. Use shielded wiring and keep it as short as possible (<20m) with proper grounding. If the noise is inductive, connect the shield to terminal ACM.*
- *Use twisted-pair wire*
- *If the analog input signals are affected by noise from the AC motor drive, please connect a capacitor and ferrite core as indicated in the diagram at right.*
  (Wind each wire around the core 3 times or more.)



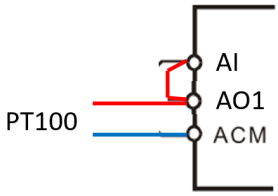
Transistor Outputs (DO1, DOC)

- *Make sure to connect the digital outputs to the correct polarity.*
- *When connecting a relay to the digital outputs, connect a surge absorber across the coil and check the polarity.*

PT100 RTD

PT100 RTD circuits should be wired and configured as follows:

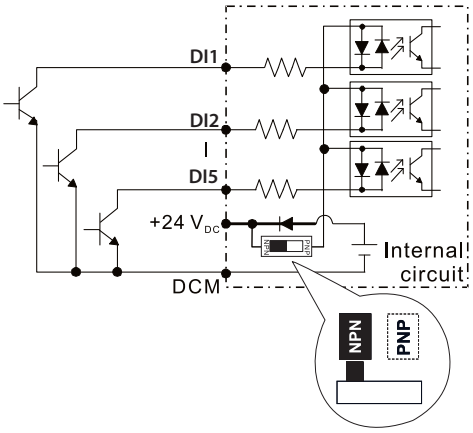
- *Set P03.00 = 1 (PT100 input)*



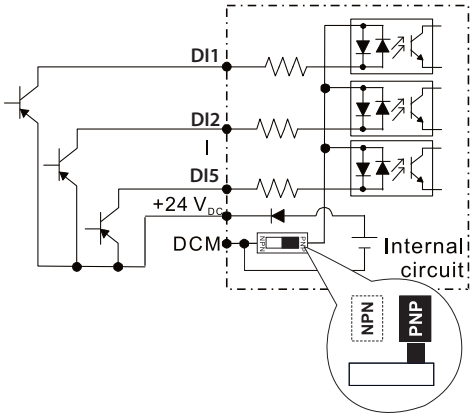
Control Circuit Wiring Diagrams

Digital Inputs

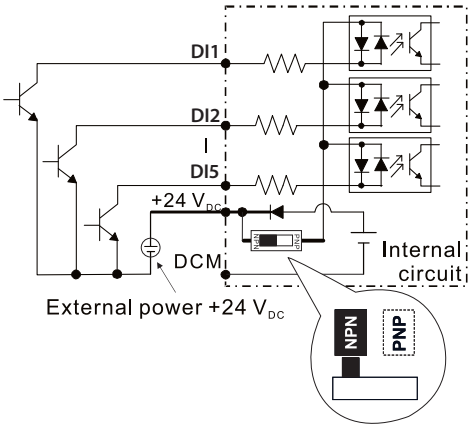
① Sink Mode
with internal power (+24 V_{DC})



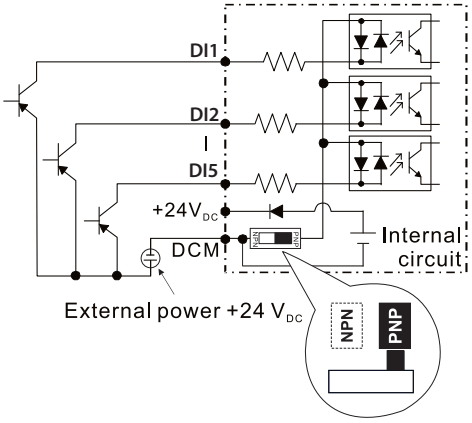
② Source Mode
with internal power (+24 V_{DC})



③ Sink Mode
with external power

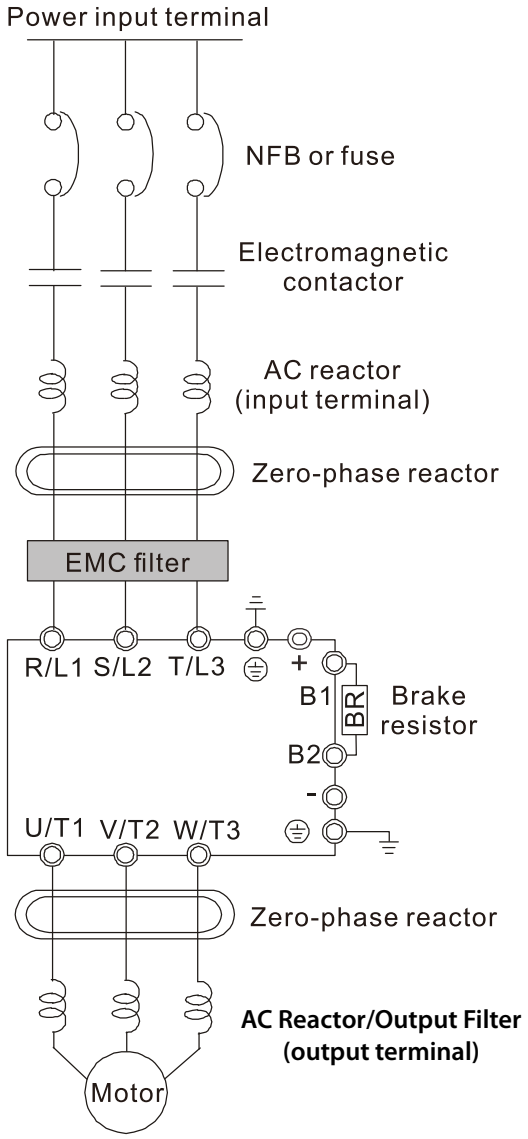


④ Source Mode
with external power



Control Circuit Wiring Diagrams (continued)

System Wiring Diagram



System Wiring Components	
Component	***Function***
Power input terminal	Supply power according to the rated power specifications indicated in the manual
NFB or fuse	There may be a large inrush current during power on. Select a suitable NFB (Non Fuse Breaker or Circuit Breaker) or Fuse.
Electromagnetic contactor	Switching the power ON/OFF on the primary side of the electromagnetic contactor can turn the drive ON/OFF, but frequent switching can cause machine failure. Do not switch ON/OFF more than once an hour. Do not use the electromagnetic contactor as the power switch for the drive; doing so shortens the life of the drive.
AC reactor (input terminal)	When the main power supply capacity is greater than 500 kVA, or when it switches into the phase capacitor, the instantaneous peak voltage and current generated may destroy the internal circuit of the drive. It is recommended that you install an input side AC reactor in the drive. This also improves the power factor and reduces power harmonics. The wiring distance should be within 10 m.
Zero phase reactor	Used to reduce radiated interference, especially in environments with audio devices, and reduce input and output side interference. The effective range is AM band to 10 MHz.
EMC filter	Can be used to reduce electromagnetic interference.
Brake module and Brake resistor (BR)	Used to shorten the deceleration time of the motor.
AC reactor (output terminal)	The motor cable length affects the size of the reflected wave on the motor end.