

 AUTOMATIONDIRECT.com



# IRONHORSE™

GSD4 SERIES DC DRIVES USER MANUAL

USER MANUAL NUMBER: IH-GSD4\_UMP



**⚡ WARNING ⚡**

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At a minimum, you should follow all applicable sections of the National Fire Code, National Electrical Code, and the codes of the National Electrical Manufacturer's Association (NEMA). There may be local regulatory or government offices that can also help determine which codes and standards are necessary for safe installation and operation.

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**GSD4 DC DRIVES USER MANUAL OVERVIEW**

**OVERVIEW OF THIS PUBLICATION**

The IronHorse GSD4 Series DC Drives User Manual describes the installation, configuration, and methods of operation of the GSD4 Series DC Drives.

All information contained in this manual is intended to be correct. However, information and data in this manual are subject to change without notice. AutomationDirect (ADC) makes no warranty of any kind with regard to this information or data. Further, ADC is not responsible for any omissions or errors or consequential damage caused by the user of the product. ADC reserves the right to make manufacturing changes which may not be included in this manual.

**WHO SHOULD READ THIS USER MANUAL**

This manual contains important information for those who will install, maintain, and/or operate any of the GSD4 Series DC Drives.

**TECHNICAL SUPPORT**

By Telephone: 770-844-4200 (Mon.–Fri., 9:00 a.m.–6:00 p.m. E.T.)

On the Web: [www.automationdirect.com](http://www.automationdirect.com)

Our technical support group is glad to work with you in answering your questions. If you cannot find the solution to your particular application, or, if for any reason you need additional technical assistance, please call Technical Support at 770-844-4200. We are available weekdays from 9:00 a.m. to 6:00 p.m. Eastern Time.

We also encourage you to visit our web site where you can find technical and non-technical information about our products and our company. Visit us at [www.automationdirect.com](http://www.automationdirect.com).

**SPECIAL SYMBOLS**




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*WHEN YOU SEE THE “NOTEPAD” ICON IN THE LEFT-HAND MARGIN, THE PARAGRAPH TO ITS IMMEDIATE RIGHT WILL BE A SPECIAL NOTE.*

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*WHEN YOU SEE THE “EXCLAMATION MARK” ICON IN THE LEFT-HAND MARGIN, THE PARAGRAPH TO ITS IMMEDIATE RIGHT WILL BE A WARNING. THIS INFORMATION COULD PREVENT INJURY, LOSS OF PROPERTY, OR EVEN DEATH (IN EXTREME CASES).*

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## IRONHORSE GSD4 SERIES DC DRIVES GENERAL INFORMATION

IronHorse GSD4 DC drives are designed to control DC Permanent Magnet, Shunt Wound, and some Universal (AC/DC) motors. Incoming AC voltage is converted to adjustable full-wave rectified DC voltage to operate the DC motor. Also, a full-wave field voltage is provided for shunt wound motors.



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*CAREFULLY CHECK THE DC DRIVE FOR SHIPPING DAMAGE. REPORT ANY DAMAGE TO THE CARRIER IMMEDIATELY. DO NOT ATTEMPT TO OPERATE THE DRIVE IF VISIBLE DAMAGE IS EVIDENT TO EITHER THE CIRCUIT OR TO THE ELECTRONIC COMPONENTS.*

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### **STANDARD FEATURES**

- Input voltages 24/36VAC or 120/240VAC @ 50/60Hz; output 0–24/36VDC or 0–90/180VDC.
- Adjustable horsepower settings.
- Barrier terminal strip.
- Full-wave bridge supply.
- 1% speed regulation with armature voltage feedback;  $\pm 1/2\%$  with tachometer feedback.
- Adjustable Minimum speed, Maximum speed, IR Compensation, Current Limit, Acceleration & Deceleration (enclosed models).
- Line voltage compensation.
- 5k $\Omega$  speed potentiometer with leads, dial, and knob included.
- 50:1 speed range.
- Transient voltage protection.
- Voltage following mode or DC tachometer follower by supplying ungrounded 0–12VDC analog input signal.
- DC tachometer feedback (6V at base speed).
- Inhibit circuit permits start & stop without breaking AC lines.
- Shunt field supply provided.
- GSD4-240-10N4X only: NEMA 4X enclosure, Power ON/OFF switch, Power ON indicator, Adjustable acceleration and deceleration.

## **CONTROL FEATURES**

**MINIMUM SPEED** – Allows adjustment of the motor speed when the speed pot is set at minimum (CCW). This permits the user to eliminate “Deadband” on the main speed control, permitting zero calibration. Clockwise rotation of “MIN” trim pot increases speed.

**MAX SPEED** (Maximum Speed) – Allows adjustment of the motor speed when the speed pot is set at maximum (CW). This permits the user to eliminate the top end “Deadband”, which will provide full speed at maximum rotation. Rotation of the “MAX” trim pot in the clockwise direction increases the maximum motor speed.

**I.R. COMP** (Speed Regulation) – This allows for adjustment of the circuitry that controls the speed regulation of the motor. The circuitry controls armature speed by changing the armature voltage to compensate for increased or decreased motor loading. Clockwise rotation of the “IR COMP” trim pot will increase compensation.

**CUR. LIM.** (Current Limit) – Provides protection from excessive armature current by limiting the maximum armature current the drive can provide. This enables adjustment of the maximum torque the motor can deliver. Torque adjustment (Cur. Lim.) is preset at 125% of rated motor torque (current) based on horsepower. Clockwise rotation of the “CUR. LIM.” trim pot increases the torque (current) the drive will provide.

**INHIBIT TERMINAL PIN** – An adjustable acceleration ramp that allows the user a choice of stopping and starting hard (fast), or stopping hard with a soft start (without breaking the AC lines).

There are two ways to Inhibit a drive:

- 1) For all GSD drives (using the drive’s speed pot):

Remove power from the Speed Pot Wiper, which makes the input to the drive drop to Zero volts. A switch or contact can be placed in either the Speed Pot High lead, or in the Speed Pot Wiper lead.

- 2) For GSD4, GSD5, and GSD7 drives (using the drive’s inhibit feature):

The inhibit feature provides a way to start/stop output of these drives by using a low-power rated contact (12VDC, mA of current), as opposed to a high-power contact that would be required to switch the source power to the drive.

Close the circuit between the Inhibit pin (GSD4 & GSD5 Series) or the +TACH terminal (GSD7 only), and the drive’s Speed Pot Hi terminal. The drive will stop and start quickly – bypassing any fixed or adjustable ACCEL or DECEL setting. When this connection is CLOSED, the drive’s 12VDC logic supply is collapsed by connecting it to a chassis COMMON point – the board logic shuts down and output to the motor ceases. Output to the motor resumes when this contact is opened again.

## SELECTION AND SPECIFICATIONS

GSD4 Series DC Drives – Selection & Specifications				
Model	GSD4-24A-5C	GSD4-240-1C	GSD4-240-5C	GSD4-240-10N4X
Package Configuration	open frame			NEMA 4X
Power Quality Form Factor	1.4			
Input Voltage (@50/60Hz)	24/36 VAC ±10%	120/240 VAC ±10%		
Output Voltage	0–24/36 VDC	0–90/180 VDC		
Shunt Field Voltage	20VDC @ 24VAC in 30VDC @ 36VAC in (1A max)	100VDC @ 120VAC in 200VDC @ 240VAC in (1A max)	100VDC @ 120VAC in 200VDC @ 240VAC in (0.5A max)	
Motor Rating @ Low V (hp)	1/50 – 1/6	1/50 – 1/8 1/25 – 1/4	1/8 – 1/2 1/4 – 1	1/8 – 1 1/4 – 2
Motor Rating @ High V (hp)				
Output Current (continuous)	5.5A (DC)	1.2A (DC)	5.5A (DC)	10A (DC)
Current Overload Capacity	200% for 60s			
Current Limit (adjustable)	1–15A (DC)	0.3–2.5A (DC)	1–15A (DC)	
Transient Protection	–	Metal Oxide Varistor (MOV)		
I.R. Compensation	adjustable			
Speed Adjustment	Potentiometer	5kΩ potentiometer	5kΩ potentiometer or 0–10VDC isolated input signal (See "GSDA-AI-V4" on page 18.)	5kΩ potentiometer
	Current	4–20mA		n/a
	Voltage	n/a	0–5VDC thru 0–250VDC	
Speed Range	50:1			
Speed Regulation	±1% of base speed			
Maximum Speed	adjustable from 60% to 110% of base speed			
Minimum Speed	0–30% of adjustable maximum speed			
Acceleration	0.5 seconds			adjustable
Deceleration				0.5–8 seconds
Dynamic Braking	no			
Plugging Capability **	no			
Electrical Connections	8-position terminal strip; 22–14 AWG			
Fusing*** – External (required)	Fuse Amperages are based on motor HP; for details, refer to "Fusing" on page 8.			
Fusing*** – Internal (replaceable)	–			(1) 10A
Operating Temperature	-10 to 45 °C [14 to 113 °F]		-10 to 40 °C [14 to 104 °F]	
Thermal Protection	current limiting			
Mounting Orientation	can be mounted in any orientation			
Corrosive Gases	NOT compatible with any corrosive gases			
Weight	8.0 oz [203g]	37 oz [1049g]	10.5 oz [297g]	59.5 oz [1687g]
Agency Approvals	RoHS, CE	cUL <sub>US</sub> Listed (E198015), RoHS, CE	cUL <sub>US</sub> Listed (E198015), RoHS	
Optional Accessories *				
Replacement Potentiometer	GSDA-5K			
Digital Potentiometer	GSDA-DP			
Manual Reverse Switch	GSDA-MREV			
Accel/Decel Adjustment Card	GSDA-ACCDEC-4			–
Analog Current Input Card	GSDA-AI-A			–
Analog Voltage Input Card	–	GSDA-AI-V4		–
Heatsink	GSDA-HTSNK-4			–

\* For accessories details, please visit [www.AutomationDirect.com](http://www.AutomationDirect.com).

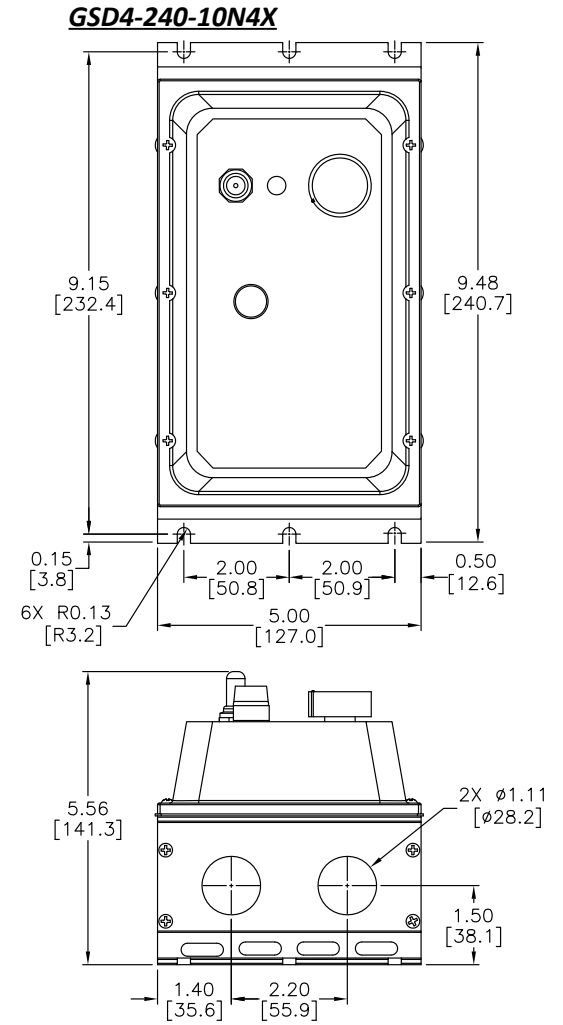
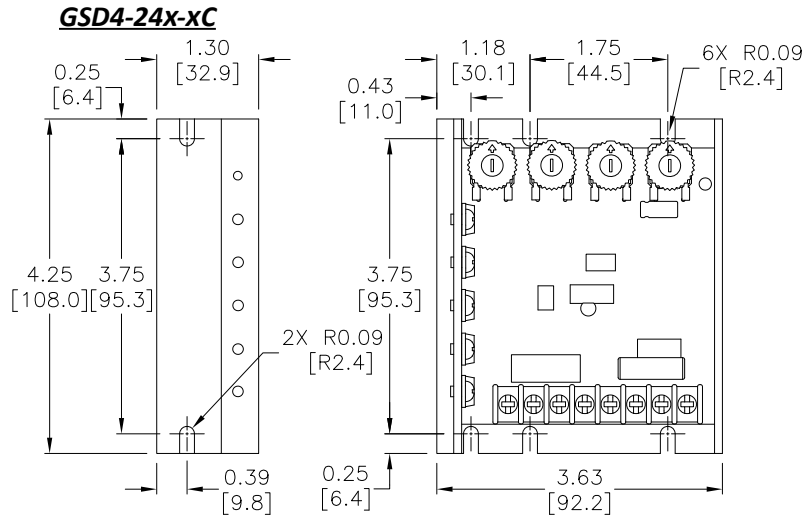
\*\* Plugging is a method of rapidly changing motor direction by reversing motor armature polarity, while the motor is still running.

\*\*\* Fuse type: Bussman/Edison ABC, Littlefuse 314 series, or equivalent. Fuse hot legs only; do not fuse AC neutrals.

(Edison ABC series fuses are available from AutomationDirect.)

## DIMENSIONS

(Dimensions = in [mm])





## INSTALLATION, WIRING, EXTERNAL FUSING



INSTALL OPEN-FRAME DRIVES IN AN ENCLOSURE WITH A VOLUME AT LEAST THREE TIMES THE VOLUME OF THE OPEN-FRAME DRIVE.



DO NOT MOUNT GSD4-24X-XXXXX DC DRIVE WHERE AMBIENT TEMPERATURE IS OUTSIDE THE RANGE OF -10 TO 45 °C (14 TO 113 °F).



SIZE ALL WIRES THAT CARRY ARMATURE OR LINE CURRENTS AS SPECIFIED BY APPLICABLE NATIONAL, STATE, AND/OR LOCAL CODES. ALL OTHER WIRES MAY BE 18AWG OR SMALLER AS PERMITTED BY THE CODES.



SEPARATE CONTROL WIRES FROM THE ARMATURE AND AC LINES WHEN ROUTED IN CONDUIT OR WIRE TRAYS.



THESE DRIVES DO NOT PROVIDE MOTOR OVER-TEMPERATURE SENSING OR MOTOR OVERLOAD PROTECTION. THE NEED FOR ADDITIONAL MOTOR OVERLOAD AND MOTOR OVER-TEMPERATURE PROTECTION SHALL BE DETERMINED BASED ON CONDITIONS IN THE END INSTALLATION IN ACCORDANCE WITH THE NEC.



**CAUTION!!** TURN POWER OFF WHILE MAKING WIRING CONNECTIONS.



IMPROPER INSTALLATION OR OPERATION OF THIS DC DRIVE MAY CAUSE INJURY TO PERSONNEL OR DRIVE FAILURE. THE DRIVE MUST BE INSTALLED IN ACCORDANCE WITH LOCAL, STATE, AND NATIONAL SAFETY CODES. MAKE CERTAIN THAT THE POWER SUPPLY IS DISCONNECTED BEFORE ATTEMPTING TO SERVICE OR REMOVE ANY COMPONENTS!!! IF THE POWER DISCONNECT POINT IS OUT OF SIGHT, LOCK IT IN DISCONNECTED POSITION AND TAG IT TO PREVENT UNEXPECTED APPLICATION OF POWER. ONLY A QUALIFIED ELECTRICIAN OR SERVICE PERSONNEL SHOULD PERFORM ANY ELECTRICAL TROUBLESHOOTING OR MAINTENANCE. AT NO TIME SHOULD CIRCUIT CONTINUITY BE CHECKED BY SHORTING TERMINALS WITH A SCREWDRIVER OR OTHER METAL DEVICE.



BEFORE ATTEMPTING TO WIRE THE DC DRIVE, MAKE SURE ALL POWER IS DISCONNECTED. RECHECK CODE DESIGNATION TO ASSURE PROPER VOLTAGE IS PRESENT FOR THE DC DRIVE. CAREFULLY SELECT PROPER WIRE SIZE FOR CURRENT AND VOLTAGE DROP. LIMIT THE VOLTAGE DROP THROUGH THE WIRING TO 5% OF THE LINE VOLTAGE AT FULL LOAD



**CAUTION!!** DO NOT ATTEMPT TO PERFORM A HI-POT TEST ACROSS THE AC LINES WITH THE DC DRIVE IN THE CIRCUIT. THIS WILL RESULT IN IMMEDIATE OR LONG-TERM DAMAGE TO THE DRIVE.



- 1) ENSURE THAT THE GSD4 DRIVE CHASSIS IS PROPERLY GROUNDED.
- 2) MOTOR ARMATURE CONNECTIONS MUST NOT BE SWITCHED OR BROKEN WHILE THE GSD4 DRIVE IS ON. SERIOUS DAMAGE MAY RESULT.
- 3) THE INPUTS TO THE SPEED POT TERMINALS (P1-6, P1-7, P1-8) MUST NOT BE GROUNDED. SERIOUS DAMAGE MAY RESULT.

### FUSING

External Fuse Selection *				
Motor HP	GSD4-24A-5C		Select fusing based on 200% of motor Full-Load Current	
	GSD4-240-xC		GSD4-240-10N4X	
	Fuse @ 120 VAC Input	Fuse @ 240 VAC Input	Fuse @ 120 VAC Input	Fuse @ 240 VAC Input
1/50	2A	–	–	–
1/20	2A	1A	–	–
1/8	3A	2A	2A	–
1/4	4A	3A	4A	2A
1/3	6A	3A	6A	3A
1/2	8A	4A	8A	4A
3/4	12A	6A	12A	6A
1.0	15A	8A	15A	8A
1.5	–	12A	–	12A
2.0	–	15A	–	15A

\* Fuse type: Bussman/Edison ABC, Littlefuse 314 series, or equivalent. Fuse hot legs only; do not fuse AC neutrals. (Edison ABC series fuses are available from AutomationDirect.)



## **WIRING TERMINALS**

<b>GSD4 Wiring Terminals</b>			
<b>Type</b>	<b>Wire Range</b>	<b>Customer Wiring Temp Rating</b>	<b>Tightening Torque</b>
8-position terminal strip	22–14 AWG	300V, 75 °C [167 °F] minimum	9.0 lb-in [1.0 N·m]

## **WIRING TERMINAL FUNCTIONS**

### **GSD4-xxx-xC WIRING TERMINALS**

<b>GSD4-xxx-xC Series DC Drives – Terminal Strip Functions</b>	
<b>CAUTION: BE SURE DRIVE HOUSING IS PROPERLY GROUNDED.</b>	
<b>Number</b>	<b>Purpose</b>
<b>P1-1</b>	(L / AC1) 120VAC – Connect incoming hot AC (black wire) to this terminal. (L / AC1) 240VAC – Connect either hot side. Connect ground (green wire) to drive chassis.
<b>P1-2</b>	(N / AC2) 120VAC – Connect the neutral AC (white wire) to this terminal. (N / AC2) 240VAC – Connect either hot side. Connect ground (green wire) to drive chassis.
<b>P1-3</b>	(+ ARM) – Connects to the plus (+) Armature wire on the motor. 0-90VDC for 120VAC input or 0-180VDC for 240 VAC input. See “SPECIFICATIONS” for output rating. <b>CAUTION: ARMATURE CONNECTION MUST NOT BE SWITCHED OR BROKEN WHILE DRIVE IS ON, OR SERIOUS DAMAGE TO THE DRIVE MAY RESULT.</b>
<b>P1-4</b>	(- ARM / -FIELD) – Connects to minus (-) Armature wire on the motor, and, if necessary, (-) Field wire of Shunt Wound motor.
<b>P1-5</b>	(+ FIELD) – DO NOT use for Permanent Magnet motor. This supplies (+) Field voltage for a Shunt Wound motor. For motors with dual voltage field (i.e. 50/100V or 100/200V), make sure the highest value is connected.
<b>P1-6</b>	(SPEEDPOT HI) – Connects to high side (white wire) of the Speed pot (CW end). This is internal +12 volts. <b>INPUT MUST NOT BE GROUNDED !</b>
<b>P1-7</b>	(SPEEDPOT WIPER) – Connects to the wiper (red wire) of the Speed pot (center lead). For voltage-follower applications, this <b>INPUT MUST NOT BE GREATER THAN +12V MAXIMUM AND MUST NOT BE GROUNDED !</b> Speed pot can be replaced by 0–10V analog signal. See “GSDA-AI-V4” on page 18, or use FC-33 or equivalent.
<b>P1-8</b>	(SPEEDPOT LO) – Connects to the low side (orange wire) of the 5kΩ Speed pot (normally the CCW end). This input is raised and lowered by the MIN trim pot. Electronic speed input voltage (voltage follower) may be referenced to Speed pot LO if the MIN trim pot adjustments are to be active. Otherwise, inputs may be referenced to -ARM (P1-4), which will bypass the MIN trim pot. <b>INPUT MUST NOT BE GROUNDED !</b>

### **GSD4-240-10N4X WIRING TERMINALS**

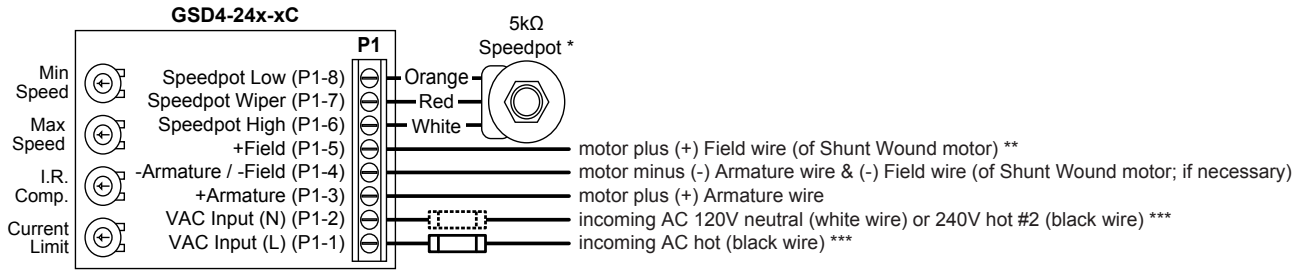
<b>GSD4-240-10N4X Series DC Drives – Terminal Strip Functions</b>	
<b>CAUTION: BE SURE DRIVE HOUSING IS PROPERLY GROUNDED.</b>	
<b>Number</b>	<b>Purpose</b>
<b>P4 – Terminal Strip for Power &amp; Motor Armature Wiring</b>	
<b>P4-1</b>	(L / AC1) 120VAC – Connect incoming hot AC (black wire) to this terminal. (L / AC1) 240VAC – Connect either hot side. Connect ground (green wire) to drive ground lug.
<b>P4-2</b>	(N / AC2) 120VAC – Connect the neutral AC (white wire) to this terminal. (N / AC2) 240VAC – Connect either hot side. Connect ground (green wire) to drive ground lug.
<b>P4-3</b>	(+ ARM) – Connects to the plus (+) Armature wire on the motor.
<b>P4-4</b>	(- ARM) – Connects to minus (-) Armature wire on the motor.
<b>P1 – Terminal Strip for Shunt-Wound Motor Field Wiring</b>	
<b>P1-4</b>	(-FIELD) – Connects to minus (-) Field wire of shunt-wound motors ONLY.
<b>P1-5</b>	(+ FIELD) – DO NOT use for Permanent Magnet motor. This supplies (+) Field voltage for a Shunt-Wound motor. For motors with dual voltage field (i.e. 50/100V or 100/200V), make sure the highest value is connected

**WIRING DIAGRAMS**

**GSD4-24X-XC BASIC WIRING DIAGRAM**

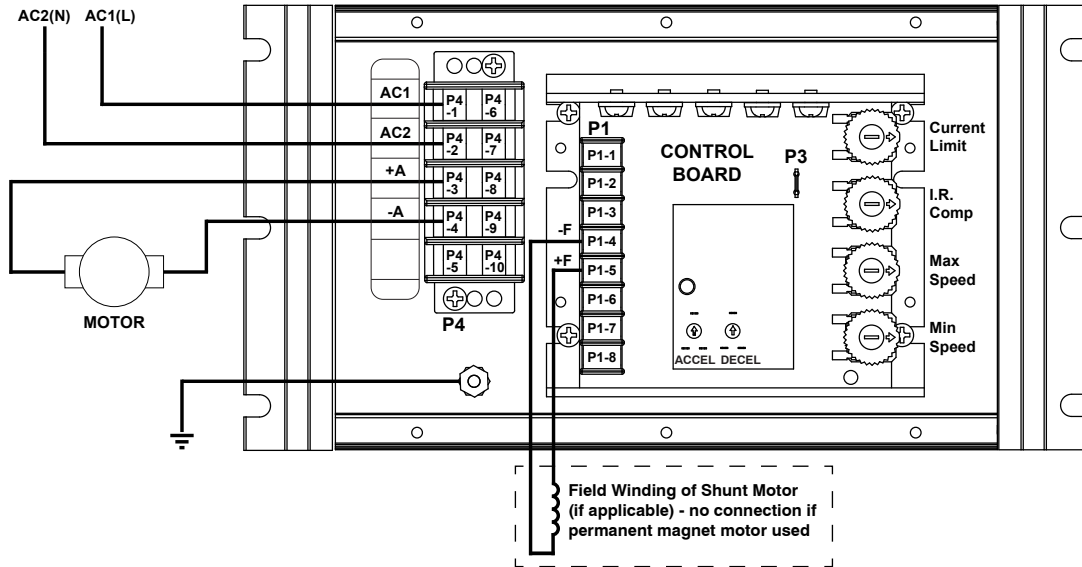


SPEED POT CAN BE REPLACED BY AN 0-10V ANALOG SIGNAL FOR SPEED CONTROL (FROM A PLC, ETC.). SEE "GSDA-AI-V4" ON PAGE 18.



- \* P1-6 has internal +12V, and connects to Speedpot High (white wire). THIS INPUT MUST NOT BE GROUNDED!  
For start-stop applications, the connection between P1-6 and Speedpot High can be opened and closed by a SPST switch.
- \* P1-7 connects to Speedpot Wiper (red wire). THIS INPUT MUST NOT BE GROUNDED!  
For Voltage-Follower applications, THIS INPUT MUST NOT BE GREATER THAN +12V MAXIMUM!
- \* P1-8 connects to Speedpot Low, and is raised and lowered by the Min Speed trimpot. THIS INPUT MUST NOT BE GROUNDED!  
Electronic speed input (voltage follower) may be referenced to this input if the Min Speed trimpot adjustments are to be active. Otherwise, inputs may be referenced to -Armature, which will bypass the Min Speed trimpot.
- \*\* +F connection is only for Shunt Wound motor; NOT for Permanent Magnet motor.  
For motors with dual voltage field, i.e. 50/100V or 100/200V, connect the highest value.
- \*\*\* Fuse hot AC inputs only; refer to Fusing section for size and type. Fuse both AC lines for 240 VAC input. Do NOT fuse AC(N) on 120V systems. Connect incoming AC ground (green wire) to GSD4 chassis.

**GSD4-240-10N4X BASIC WIRING DIAGRAM**

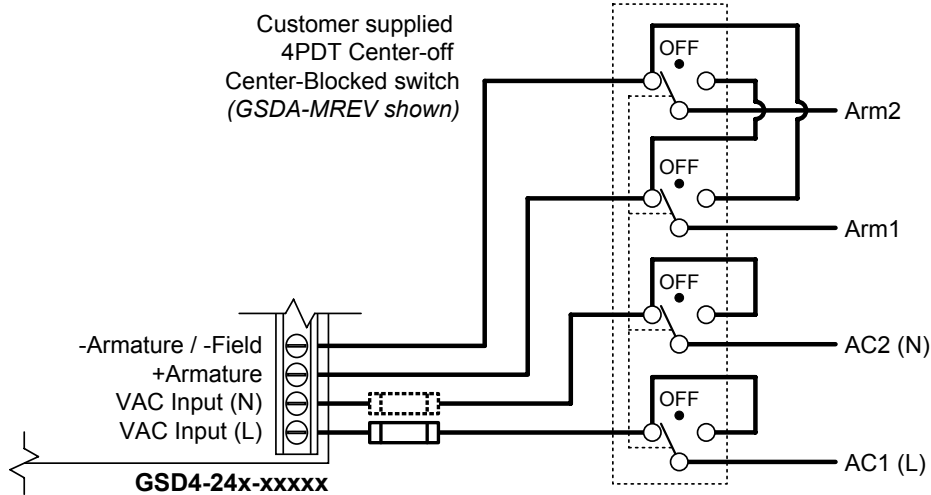


**INSTALLATION AND WIRING – WIRING DIAGRAMS (CONTINUED)**

**GSD4-24X-XXX REVERSING WIRING DIAGRAM**

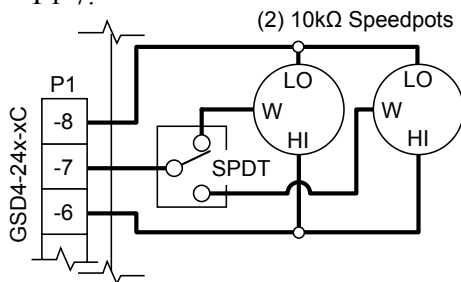


**CAUTION:** WHEN REVERSING A SPINNING PERMANENT MAGNET DC MOTOR, CAUTION MUST BE TAKEN THAT THE RESULTING CURRENT THROUGH THE ARMATURE OF THE MOTOR DOES NOT EXCEED THE OVERLOAD RATINGS OF THE DC DRIVE, OR THE DEMAGNETIZE RATING OF THE MOTOR BEING REVERSED. A CENTER-BLOCKED SWITCH WILL DELAY SWITCHING THE MOTOR DIRECTION. IF USING RELAYS TO AUTOMATICALLY REVERSE THE MOTOR, MAKE SURE TO HAVE A DELAY BETWEEN CHANGING MOTOR DIRECTIONS.



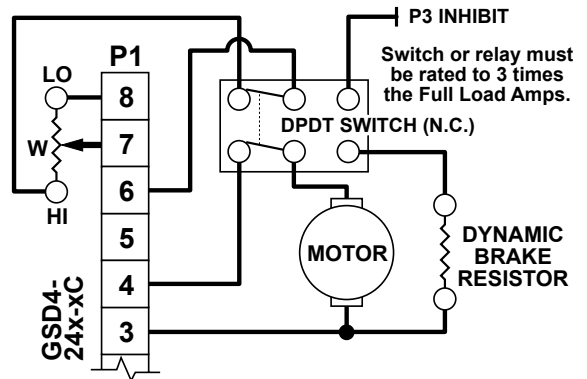
**GSD4-24X-XC TWO-SPEED OPERATION**

Two-speed operation is done using two 10 kΩ speed potentiometers in parallel, with both Highs connected to terminal P1-6, and both Lows connected to P1-8. A SPDT switch selects which pot Wiper is connected to terminal P1-7.



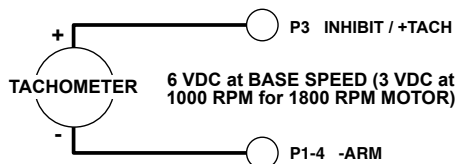
**GSD4-24X-XC DYNAMIC BRAKING**

A DPDT switch is used to control and to connect a customer-supplied Dynamic Braking Resistor (DBR). Typical values for the DBR are 35–50W at 5Ω for 120V, or 10Ω for 240V. Motor horsepower, inertia, and cycle time affect the sizing of the DBR.



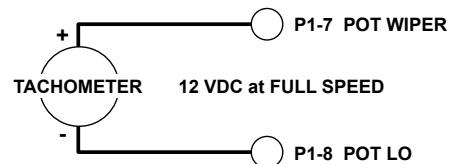
**GSD4-24X-XXX TACHOMETER FEEDBACK**

Improves regulation to ± 1/2% of base speed.



**GSD4-24X-XXX TACHOMETER FOLLOWER**

Allows drive output to follow tachometer voltage.



TACHOMETER CONTROL NEEDS TACHOMETER OUTPUT OF 7VDC/1000RPM WITH RIPPLE LIMITED TO 1% OR LESS.

**INSTALLATION AND WIRING – WIRING DIAGRAMS (CONTINUED)**

**INHIBIT FEATURE START/STOP CONTROL**

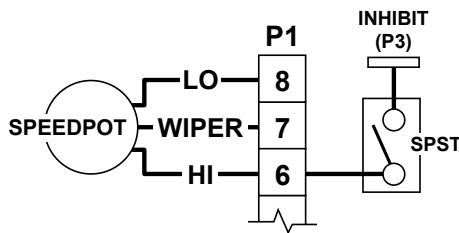
The inhibit feature allows the motor to be remotely started and stopped using a lower-rated 12VDC contact in the drive control circuit, instead of a higher-rated contact in the power circuit.

**GSD4-24X-XC INHIBIT (USED INDEPENDENTLY)**

This inhibit method bypasses the drive’s Accel and Decel settings to start and stop the motor. It instantly shuts off the drive’s output, and the motor freewheels to a stop. Start and stop rates are determined by the inertia of the load.

The customer-supplied SPST switch is connected in series between the Speed Pot High (P1-6) and the Inhibit pin (P3). To inhibit (stop motor), close Speed Pot High to the Inhibit pin. To restart, return the switch to open.

**Fast Stop & Start:**

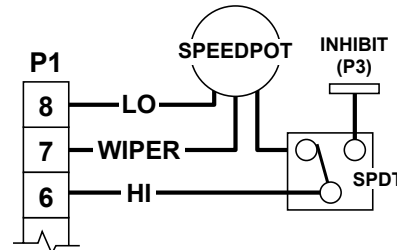


**GSD4-24X-XC INHIBIT (USED WITH SPEED POT)**

This inhibit method bypasses the drive’s Decel settings when stopping the motor, and the motor freewheels to a stop at a rate determined by the inertia of the load. However, the start rate is determined by drive’s Accel setting.

The common of the SPDT switch is connected to control pot High, and is switched between Speed Pot High (P1-6) and the Inhibit pin (P3). To inhibit (stop motor), Speed Pot High is closed to the Inhibit pin. To restart, return the switch to Speed Pot High.

**Fast Sop. Soft Start (thru accel range):**



- 
- 1) IN THE EVENT OF SCR FAILURE OR FALSE TRIGGERING, THE INHIBIT CIRCUIT WILL NOT STOP THE MOTOR.
  - 2) ALWAYS USE SHIELDED WIRE WHEN CONNECTING TO THE INHIBIT TERMINAL, AND CONNECT THE SHIELD TO THE -ARMATURE OR COMMON OF THE DRIVE.
- 

**START-UP**

**START-UP FOR GSD4-24X-XC**

- 3) Recheck all wiring. Accidental grounds, loose or pinched wires on armature or speed pot wires may damage the DC drive when power is applied.
- 4) Check to see that the incoming power is of the correct voltage.
- 5) Turn the speed pot to zero (fully CCW).
- 6) Turn power on, and advance the speed pot while observing motor.  
*Power must be turned off again before step 5 can be accomplished!*
- 7) If the motor rotation is incorrect, turn power off at external disconnect, and reverse the +ARM and -ARM connections.
- 8) Check for satisfactory operation throughout the speed range.
- 9) *If operation is satisfactory, no readjustments are needed.*
- 10) If instability or surging is observed, or if maximum speed is higher than desired, refer to the “Trim Pot Adjustments” section.”
- 11) For other problems, consult the “Troubleshooting” section.

**START-UP FOR GSD4-240-10N4X**

- 1) Safety Precautions:
  - a) Observe the normal safety precautions for the voltages involved. We strongly suggest that only qualified electricians or service people should install, troubleshoot, maintain, or service the drive, motor, and interconnect wiring.
  - b) Be sure power is disconnected or shut OFF at fuse box or circuit breaker when installing the drive and making adjustments (except running adjustments).
  - c) Remove the load from motor (or gearmotor) before running it.
  - d) Use an insulated screwdriver to make trim pot adjustments.



*WHEN MAKING RUNNING ADJUSTMENTS, BE VERY CAREFUL NOT TO TOUCH ANY COMPONENTS EXCEPT THE ADJUSTING POTS.*

- 2) On the drive front panel, turn the drive ON-OFF switch to off and set the drive pot knob fully counterclockwise (CCW) and check line fuse. The fuse should be as specified by the Fuse Selection Table.
- 3) Check all the connections at the drive terminals and at the motor. Make sure that they are tight and are made according to the “Installation and Wiring” section.
- 4) Rotate the motor’s shaft manually to make sure it turns freely. A slight resistance may be noticed.
- 5) Turn the drive ON-OFF switch to the ON position and then slowly turn the Speed Control knob clockwise (CW) while observing direction of motor rotation. If opposite direction of rotation is desired, correct by turning OFF the drive and then reverse the motor armature connections.
- 6) With AC line power and control back ON, slowly turn Speed Control knob fully CW while observing the motor. Motor should accelerate smoothly to top speed.
- 7) Turn OFF control and AC power to drive.
- 8) Reconnect the motor load that the motor will normally drive.
- 9) Turn AC power and the drive back ON and adjust the trim pots as shown below for the motor horsepower and voltage being used.

	CL	IR	MAX	MIN	HP
<b>GSD-240-10NX4</b>					<b>1/8</b>
					<b>1/4</b>
<b>INPUT 120 VAC</b>					<b>1/3</b>
					<b>1/2</b>
<b>OUTPUT 0-90 VDC</b>					<b>3/4</b>
					<b>1.0</b>

Operation of the control beyond ±10% of the normal line voltage could result in re-adjustment. These adjustments are permanent; periodic re-adjustment is normally not needed.

	CL	IR	MAX	MIN	HP
<b>GSD-240-10NX4</b>					<b>1/4</b>
					<b>1/3</b>
<b>INPUT 230 VAC</b>					<b>1/2</b>
					<b>3/4</b>
<b>OUTPUT 0-180 VDC</b>					<b>1.0</b>
					<b>1.5</b>
					<b>2.0</b>

- 10) Test the drive and motor under actual operating and load conditions; run the motor through the entire range of speeds required while it is fully loaded. Check motor speed with a tachometer. If control/motor performance is still not satisfactory, continue adjusting the control by following the procedures given in the “GSD4-240-10N4X Trim Pot Adjustment” section on page 15.

## TRIM POT ADJUSTMENTS

**NOTE:** A DC motor must be connected to the drive in order to make accurate trim pot adjustments.

If the system is unstable after the previous Start-Up procedure, then adjust the trim pots as described in this section.

### GSD4-24A-5C TRIM POT ADJUSTMENT

GSD4-24A-5C Trim Pot Adjustment *		
Trim Pot	Function	Adjustment
<b>Min</b>	Sets minimum motor speed when speed pot is set at zero. CW rotation will increase minimum motor speed.	<ol style="list-style-type: none"> <li>1) Set Speed pot to zero (fully CCW).</li> <li>2) Rotate MIN trim pot CW until motor starts to rotate.</li> <li>3) Slowly rotate MIN trim pot CCW until motor stops. <b>NOTE:</b> If motor rotation is desired, rotate MIN trim pot CW until desired MIN speed is reached.</li> </ol>
<b>IR Comp</b>	Provides a means of improving motor speed regulation in the armature feedback mode. If a slowdown due to load change is of no concern, rotate this trim pot fully CCW.	<ol style="list-style-type: none"> <li>1) Set Speed pot at 50%.</li> <li>2) Observe motor speed at no load condition.</li> <li>3) Apply full load to motor.</li> <li>4) Turn IR COMP trim pot CW to obtain the same motor speed as with no load.</li> </ol>
<b>Max</b>	Sets maximum motor speed when speed pot is set at maximum (fully CW rotation). CW rotation of MAX trim pot increases maximum motor speed.	<ol style="list-style-type: none"> <li>1) TURN DRIVE POWER OFF!!</li> <li>2) Connect a DC Voltmeter: + to +ARM; - to -ARM. <b>NOTE: Meter must not be grounded!!</b></li> <li>3) Set meter voltage range: (90 VDC for 120 VAC; 180 VDC for 240 VAC).</li> <li>4) Turn power on. Set Speed pot at 100%.</li> <li>5) Adjust MAX trim pot to rated motor armature voltage as shown on meter. <b>NOTE: A tachometer or strobe may be used in lieu of a meter.</b></li> </ol> <p>Follow above steps, except adjust MAX trim pot to rated motor base speed indicated by tachometer or strobe.</p>
<b>Cur Lim</b>	Limits DC motor armature current (torque) to prevent damage to the motor or drive. The current limit is set for the rated motor current. CW rotation of this trim pot increases the armature current (or torque produced).	<ol style="list-style-type: none"> <li>1) TURN DRIVE POWER OFF!</li> <li>2) Connect a DC Ammeter between A1 on motor and +ARM on drive. This is in series with the motor.</li> <li>3) Turn power on.</li> <li>4) Set Speed pot at the 50% position.</li> <li>5) Apply friction braking to motor shaft until motor stalls.</li> <li>6) With motor stalled, set current at 125% of rated motor armature current by adjusting CUR. LIM. trim pot.</li> </ol>

\* This adjustment procedure is only for the GSD4-24A-5C DC Drive. Adjustments are done with motor connected to drive.

### GSD4-240-XC TRIM POT ADJUSTMENT

Settings apply when using a 5K ohm master speedpot. This chart is used in conjunction with the adjustment procedure and is approximate.					
	C.L.	I.R.	MAX	MIN	HP
<b>GSD4-240-1C</b> 120 VAC input; 0-90 VDC output					<b>1/50</b>
					<b>1/20</b>
					<b>1/8</b>
<b>GSD4-240-5C</b> 120 VAC input; 0-90 VDC output					<b>1/8</b>
					<b>1/4</b>
					<b>1/3</b>
					<b>1/2</b>
					<b>3/4*</b>
					<b>1.0*</b>
					<b>1.0*</b>
Operation of the control beyond ±10% of the normal line voltage could result in re-adjustment. These adjustments are permanent; periodic re-adjustment is normally not needed.					

Settings apply when using a 5K ohm master speedpot. This chart is used in conjunction with the adjustment procedure and is approximate.				
HP	C.L.	I.R.	MAX	MIN
<b>1/20</b>				
<b>1/8</b>				
<b>1/4</b>				
<b>1/4</b>				
<b>1/3</b>				
<b>1/2</b>				
<b>3/4</b>				
<b>1.0</b>				
<b>1.5*</b>				
<b>2.0*</b>				

\* ADDITIONAL CUSTOMER HEATSINK REQUIRED for GSD4-240-5C with 120 VAC input & motors > 1/2 hp, and with 240 VAC input & motors > 1hp. Extrusion temperatures must not exceed 70 °C.

**TRIM POT ADJUSTMENTS (CONTINUED)**

**GSD4-240-10N4X TRIM POT ADJUSTMENT**

Use the applicable sections of the following procedures if the “Start-Up” procedures did not provide satisfactory motor/control performance. Follow the Safety Precautions given in the “Start-Up” section.

**MAX SETTING**

If a different maximum speed or voltage is desired, adjust the MAX trim pot (on circuit board) as follows:

- 1) Turn ON AC power to the control.
- 2) Set Speed Control knob fully (100%) CW.
- 3) Check motor speed and voltage with a tachometer and a DC Voltmeter.
- 4) Using an insulated handle screwdriver, adjust the MAX trim pot on the drive PC board. CW adjustment of the pot increases the maximum output to the motor; CCW adjustment decreases the maximum output to the motor.

NOTE: Do not increase maximum motor speed above 1800 RPM for motors rated at 1725 RPM. Do not operate motor continuously above the rated DC voltage.

**MIN SETTING**

If a minimum speed is desired, adjust as follows:

- 1) Turn ON AC power to the drive.
- 2) Turn Speed Control knob CCW as far as possible.
- 3) Check motor output speed or voltage
- 4) Adjust the MIN trim pot on the drive PC board. CW adjustment of the pot increases output to the motor; CCW adjustment decreases.

NOTE: Typically the MIN pot should be set at Deadband which is the point in the CW rotation just before getting an output.

**IR SETTING**

If better speed regulation is needed, then adjust the IR pot as follows:

- 1) Set speed at 50%.
- 2) Check speed with Tach at no load.
- 3) Apply normal load to the motor.
- 4) Adjust the IR pot CW to increase speed regulation or CCW to decrease speed regulation until loaded motor speed is equal to unloaded motor speed.

**CUR LIM SETTING**

Limits DC motor current to prevent damage to the motor or drive. CW rotation of this trim pot increases the maximum allowable armature current (or torque produced). To set:

- 1) Connect a DC current meter between A1 on motor and +ARM on the control (in series with the motor).
- 2) Set Speed pot at 50% or above.
- 3) Turn CL trim pot full CCW.
- 4) Stall and lock motor shaft so it can not spin.
- 5) With motor stalled, set current at 125% of rated motor current by adjusting CL trim pot CW.

**ACCEL/DECEL SETTING**

Individually Adjustable Linear Accel and Decel. These trim pots provide independently adjustable linear accel and decel from 0.5 to 8.0 seconds. Adjustment of both trim pots are accomplished via the labeled access holes on adder board. Full CCW rotation equals minimum accel or decel time, and full CW rotation equals maximum accel or decel time. Note: Each trim pot operates independently of the other.



## TROUBLESHOOTING

If a newly installed DC Drive will not operate, it is likely that a terminal connection is loose. Check the terminal connections and ensure that they are secure and correct. If the drive is still inoperative, refer to the Troubleshooting Table.

Troubleshooting		
<i><b>Problem</b></i>	<i><b>Possible Cause(s)</b></i>	<i><b>Corrective Action</b></i>
<i><b>Motor doesn't run</b></i>	<ol style="list-style-type: none"> <li>1) Blown fuse or circuit breaker</li> <li>2) Incorrect or no power</li> <li>3) Speed pot set at zero</li> <li>4) Worn motor brushes</li> </ol>	<ol style="list-style-type: none"> <li>1) Replace fuse or reset breaker</li> <li>2) Install proper power service</li> <li>3) Rotate Speed pot CW to start</li> <li>4) Replace motor brushes</li> </ol>
<i><b>Armature output voltage cannot be adjusted; output is a constant DC level</b></i>  <i><b>Motor stalls, or runs very slowly with speed control set fully CW</b></i>	<ol style="list-style-type: none"> <li>1) No motor or load connected</li> <li>2) Speed pot low connection open</li> <li>3) Low voltage</li> <li>4) Overload condition</li> <li>5) Worn motor brushes</li> <li>6) Max speed set incorrectly</li> </ol>	<ol style="list-style-type: none"> <li>1) Ensure that motor or load is connected to armature terminals</li> <li>2) Ensure that Speed pot Low wire is connected</li> <li>3) Ensure that VAC is above 100VAC</li> <li>4) Reduce load or increase motor size Current Limit setting</li> <li>5) Replace brushes</li> <li>6) Consult "Trim Pot Adjustments" section</li> </ol>
<i><b>Motor "hunts"</b></i>	<ol style="list-style-type: none"> <li>1) Motor current less than 150 mA</li> <li>2) Too much IR Comp</li> <li>3) Motor is in Current Limit</li> <li>4) Motor speed is above rated speed</li> <li>5) Max set too high</li> </ol>	<ol style="list-style-type: none"> <li>1) Motor current must be greater than 150 mA (DC)</li> <li>2) Consult "Trim Pot Adjustments" section</li> <li>3) Consult "Trim Pot Adjustments" section</li> <li>4) Reduce speed</li> <li>5) Consult "Trim Pot Adjustments" section</li> </ol>
<i><b>Repeated fuse blowing</b></i>	<ol style="list-style-type: none"> <li>1) Low voltage</li> <li>2) Overload condition</li> <li>3) Worn motor brushes</li> <li>4) Defective motor bearings</li> <li>5) Defective electrical components</li> </ol>	<ol style="list-style-type: none"> <li>1) Ensure that VAC is above 100 VAC for 120V systems and above 200V for 240V systems</li> <li>2) Reduce load – disconnect to test</li> <li>3) Replace brushes</li> <li>4) Replace bearings</li> <li>5) Contact AutomationDirect "Product Returns" for replacement</li> </ol>

## GSD4 SERIES ACCESSORIES

### **GSDA-5K**

Spare/Replacement potentiometer for all GSD4-24x-xxxxx DC drives.  
 For installations instructions, please refer to product insert sheet at [AutomationDirect.com](http://AutomationDirect.com).

### **GSDA-AI-A**

Optional analog current input card for open-frame GSD4-24x-xC DC drives only.  
 For installations instructions, please refer to product insert sheet at [AutomationDirect.com](http://AutomationDirect.com).

### **GSDA-DP**

Optional digital potentiometer for all GSD4-24x-xxxxx DC drives.  
 For installations instructions, please refer to product user manual at [AutomationDirect.com](http://AutomationDirect.com).

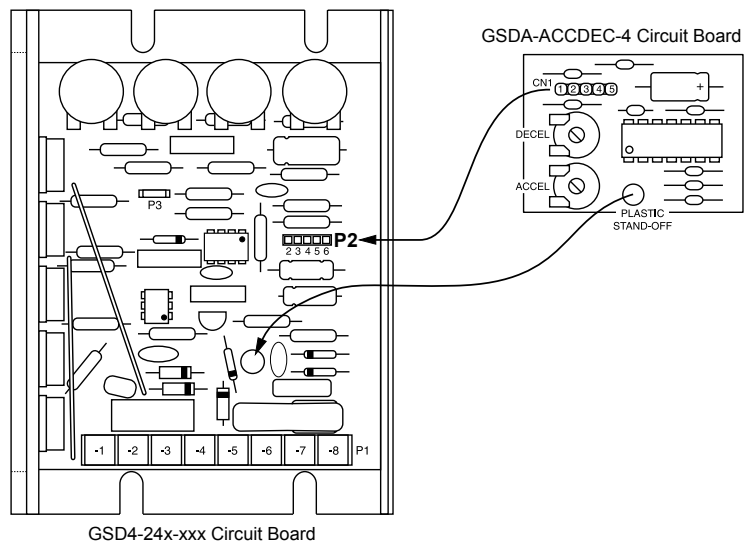
### **GSDA-MREV**

Optional manual reverse switch for all GSD4-24x-xxxxx DC drives.  
 For installations instructions, please refer to product insert sheet at [AutomationDirect.com](http://AutomationDirect.com).

### **GSDA-ACCDEC-4**

Optional individually-adjustable linear accel and decel card for open-frame GSD4-24x-xC DC drives only.

This option card plugs into the five position expansion connector on the GSD4 main circuit board. The GSDA-ACCELDEC-4 option card overrides the fixed accel ramp built into the GSD4 drive, providing independently adjustable linear acceleration and deceleration from 0.5 to 8.0 seconds. To install, flip over the option card so that the printed circuit lines are visible. Align the male connector CN1 (option card) with the female connector P2 (GSD4 drive) so terminal CN1-1 fits into P2-6, CN1-2 into P2-5, etc. Align the plastic stand-off on the option card with the hole shown on the GSD4 main board. Once connectors and stand-off are aligned, snap into place. Adjustment of both trim pots is accomplished via the labeled access holes on the back side of the option card. Full CCW rotation equals minimum accel or decel time, and full CW rotation equals maximum accel or decel time. Each trim pot operates independently of the other.



**GSDA-AI-V4**

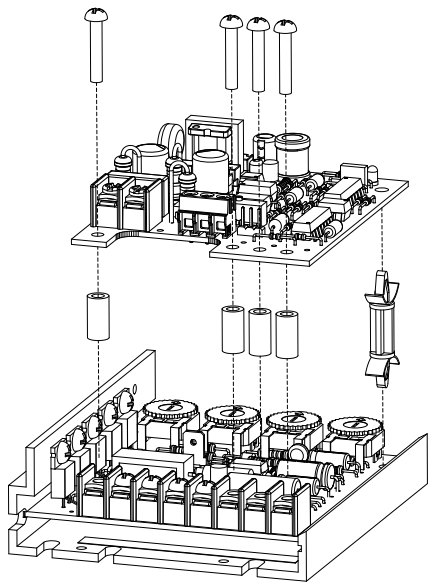
Optional analog voltage signal card for 240V open-frame GSD4-240-xC DC drives only

This option card allows for the use of either a grounded or non-grounded remote DC signal such as 0–5 VDC through 0–250 VDC, 4–20mA current, or a remote speed pot. The DC input signal type can be selected for voltage (Vin) or current (4–20mA) via the JP2 jumper clip. There is a Hi/Lo range jumper selection that should be set to the (Lo) setting when using a 4–20mA signal or voltage ranges of 0–5 VDC through 0–24 VDC or less. When using voltage ranges of 0–25 VDC through 0–250 VDC, this jumper must be set to (Hi). The GAIN trim pot is used to set full linear output in reference to the input signal range. The output of this remote signal isolation board is a linear signal that is proportional to the remote input signal being supplied.

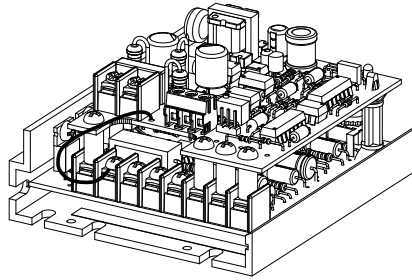
Items supplied with the GSDA-AI-V4 optional input card:

- (1) option card with (1) black wire and (1) plastic standoff attached
- (4) spacers (0.25 x 0.5 in)
- (4) Phillips-head screws (#6-32 x 0.75 in)

**GSDA-AI-V4 MOUNTING AND WIRING**



- 1) Remove (4) screws from GSD4 terminal block for AC1(L), HI, W, and LO connections.
- 2) Place (4) 3/4-in screws through GSDA-AI-V4 option board and spacers, and screw into place in GSD4 terminals.
- 3) Snap plastic standoff into GSD4 circuit board.
- 4) Connect pre-installed black wire from option board to GSD4 screw terminal AC2(N).

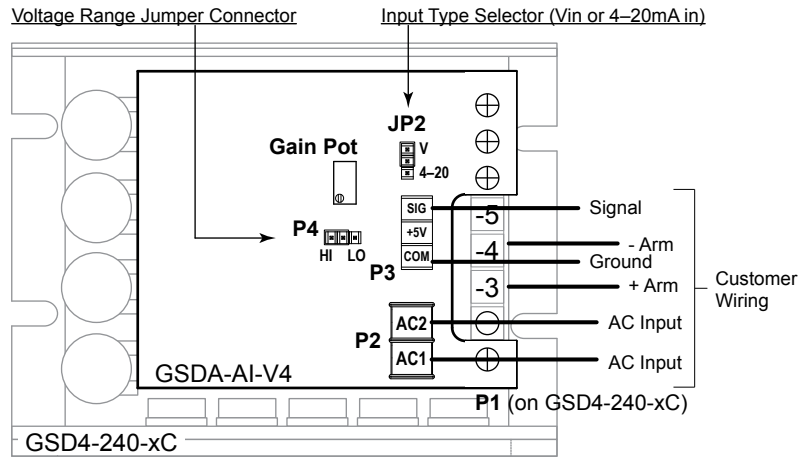


**GSDA-AI-V4 SETUP PROCEDURE**

- 1) With NO power to the drive, connect a DC voltmeter to drive outputs as follows: Meter COMMON to the -ARM terminal, and Meter POSITIVE to the +ARM terminal. Select correct meter range (0–90V or 0–180V).
- 2) Preset GAIN pot on the remote signal board fully CCW.
- 3) Place the JP2 jumper clip in the proper position based on the input signal being used.
- 4) Place the P4 jumper clip in the Lo position for 4–20mA signals or voltage signals less than 25VDC. Place the P4 jumper clip in the Hi position for voltage signals greater than 25VDC. (NOTE: Never exceed 250VDC)
- 5) Ensure that all connections are properly made per the wiring connection diagram, and then apply the proper AC power to the controller.
- 6) Set the remote input signal to its lowest setting. Adjust the MIN trim pot to deadband (the point just before an increase causes an output).
- 7) Apply the maximum remote input signal. Motor should start to run. Adjust the GAIN pot CW until no further increase in drive output voltage occurs, and then decrease the gain pot slowly until output voltage to the motor drops approximately 5VDC.
- 8) Set the MAX trim pot on the drive to the correct motor voltage.
- 9) Some interaction between trim pots may occur. Recheck the Min trim pot setting and repeat steps 6 through 8 as needed.

**GSDA-AI-V4 WIRING DIAGRAM**

**Diagram**



**Terminal Connections**

- Terminal P1** (on GSD4-240-xC)
- #3 = +ARM
  - #2 = connect JU4 pre-installed black jumper wire from GSDA-AI-V4 (not shown on drawing)
  - #4 = -ARM
- Terminal P2** (on GSDA-AI-V4)
- AC1 = customer AC input, L1
  - AC2 = customer AC input, N or L2
- Terminal P3** (on GSDA-AI-V4)
- COM = customer analog common
  - +5V = no customer connection
  - SIG = customer analog signal
- Jumper P4** (on GSDA-AI-V4)
- Set to Lo for 4–20mA input or 0–5 ≤ V ≤ 0–25 input
  - Set to Hi for 0–25 < V < 0–250 input
- Jumper JP2** (on GSDA-AI-V4)
- Set to V for voltage input
  - Set to 4–20 for current input

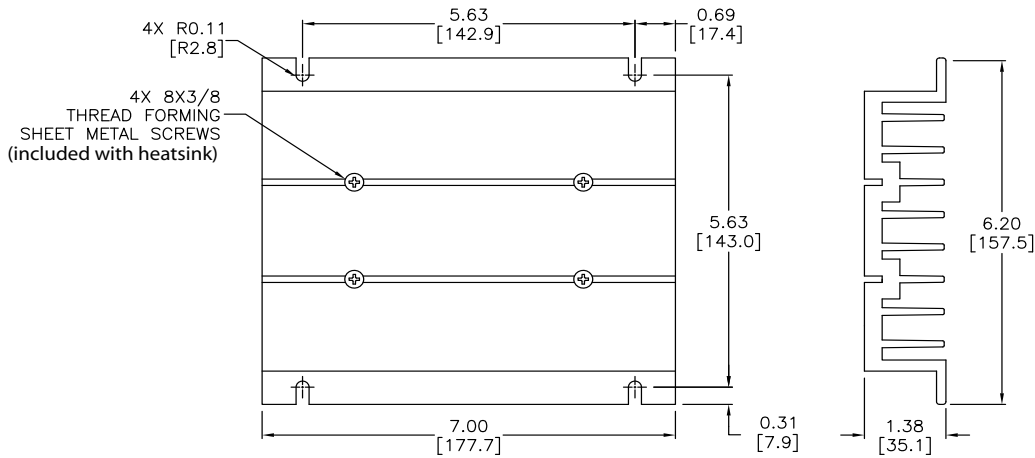
**GSDA-HTSNK-4**

Optional heat sink for open-frame GSD4-24x-xC DC drives only.

Increases the output current capability for GSD4-xxx-xC drives.

Increases the output current capability to 10A for GSD4-240-5C drives (*for non-UL applications only*).

**GSDA-HTSNK-4 DIMENSIONS** (in [mm])



Literature Number: LT138

Drawing Number: A-5-3902C