AUTOMATIONDIRECT.com

IRONHORSE™

ES1 Series AC Drive
User Manual

IH_ES1_UMW

~ WARNING ~

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To minimize the risk of potential safety problems, you should follow all applicable local and national codes that regulate the installation and operation of your equipment. These codes vary from area to area and usually change with time. It is your responsibility to determine which codes should be followed, and to verify that the equipment, installation, and operation is in compliance with the latest revision of these codes.

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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Warnings and Cautions

WARNING: Read this manual thoroughly before using ES1 series AC Motor Drives.

WARNING: AC Input power must be disconnected before performing any maintenance. Do not connect or disconnect wires or connectors while power is applied to the circuit. Maintenance must be performed only by a qualified technician.

WARNING: There are highly sensitive MOS components on the printed circuit boards, and these components are especially sensitive to static electricity. To avoid damage to these components, do not touch the components or the circuit board with metal objects or your bare hands.

WARNING: After switching the unit off, allow the power LED to fully turn off before switching the unit back on. Failure to do so can result in the drive becoming inoperable.

WARNING: A charge may still remain in the DC-Link capacitor with hazardous voltages, even if the power has been turned off. To avoid personal injury, do not remove the cover of the AC drive until ALL power has been removed. Please note that there are live components exposed within the AC drive. Do not touch these live parts.

WARNING: Ground the ES1 Series AC Drive using the ground terminal. The grounding method must comply with the laws of the country where the AC drive is to be installed. Refer to the wiring diagrams.

WARNING: The AC drive may be destroyed beyond repair if incorrect cables are connected to the input/output terminals. Never connect the AC drive output terminals U, V, and W directly to the AC main circuit power supply.

WARNING: Do not operate the drive with wet hands. Doing so may result in electric shock.

WARNING: Check the information about the protection level for the circuits and devices. The following connection terminals and devices are the Protective Class 0. This means the circuit protection level depends on the basic insulation. If the basic insulation has failed, it may cause accidental electric shock. When installing or wiring the connection terminals and devices, take the same protective action as with the power wire. Terminals: P7-1 through P7-10
The protection level of the drive is the Protective Class I.

CAUTION: Do not modify the interior workings of the drive. Doing so will void the warranty.
• The drive is designed for 3-phase motor operation. Do not use the drive to operate a single phase motor.
• Do not place heavy objects on top of electric cables. Doing so may damage the cable and result in an electric shock.
• Do not operate Disconnect Switch when motor is operating.

CAUTION: Maximum allowed prospective short-circuit current at the input power connection is defined in IEC 60439-1 as 5 kA. Depending on the selected MCCB, the ES1 series is suitable for use in circuits capable of delevering a maximum of 5 kA RMS symmetrical amperes at the drive's maximum rated voltage. See the Fuse table for more information.

CAUTION: We do not recommend using the Ironhorse ES1 AC Drive with GFCI (Ground Fault Circuit Interrupt).

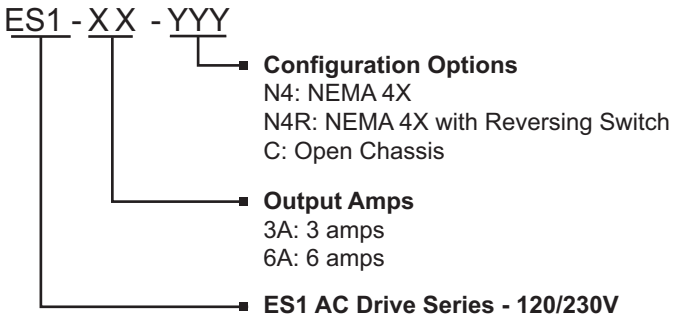
Introduction

The Ironhorse ES1® Series is a Volts/Hz variable frequency drive for 3-phase, 230 VAC inverter duty AC motors. The Ironhorse ES1® comes in two styles – open chassis for control panel installation, and a stand-alone NEMA 4X enclosed model. The Ironhorse ES1® is suited for both constant torque (ex: conveyor, auger) and variable torque (ex: fans, blowers and centrifugal pumps). Care must be taken with variable torque applications not to exceed the load current ratings of the Ironhorse ES1®.

General Features

- *Digital Signal Processor provides digital accuracy, repeatability, and stability in industrial environments*
- *Suitable for constant and variable torque applications where the input load does not exceed 1400 Watts continuous (Supply Voltage x Supply Current)*
- *Dual Voltage input accepts supply voltage of 115 or 230 VAC @50/60Hz*
- *Transient voltage protection protects device in harsh industrial environments*
- *Open frame or NEMA 4X enclosed housing*
- *Spring clamp terminal strip for control inputs and outputs; 1/4" male spade terminals for supply voltage and motor connections*
- *Wide operating temperature -10°C to +45°C (14°F to 113°F) Chassis or -10°C to +35°C (14°F to 95°F) Enclosed*
- *Selectable fwd/rev input terminal allows you to choose the motor direction*
- *Run/enable terminal provides a means to start and stop the drive without a full power down. It also allows for resetting the drive after a fault*
- *Brake terminal allows for a controlled stop with adjustable DC injection braking at stop to hold motor in position*
- *Easily adjustable control functions such as Min/Max Frequency, Acceleration/Deceleration time, Current limit, DC injection brake time and torque boost, that can be adjusted on the fly*
- *Easy full range speed adjustment via a speed pot*

Model Number Explanation



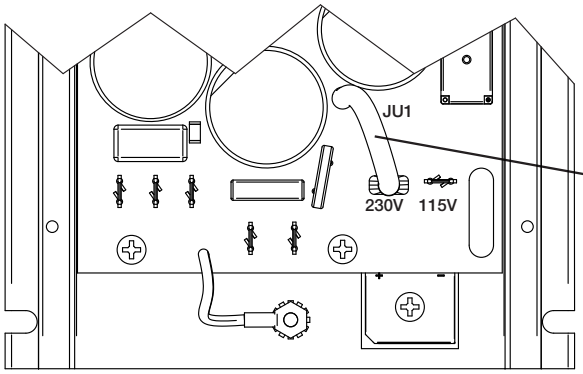
Initial Setup

Verify correct supply voltage jumper selection and Current Limit (CL) Trimpot setting.

JU1 115V/230V Input VAC Jumper Selection

Before powering on up your Ironhorse ES1 you should always verify the correct VAC Input Jumper Selection Setting. For single phase 208/230Vac inputs the jumper should be connected to the 230V spade pin. For 115Vac inputs the jumper should be connected to the 115V spade pin.

Refer to the diagram below:



Verify Correct Supply Voltage Jumper Selection

115/230 VAC Jumper Selection

Factory set for 208/230V.

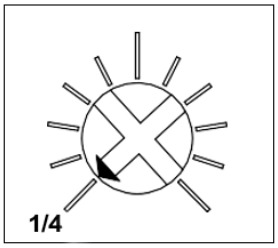
If 115V is being used, you MUST move this jumper to the 115V pin before applying power or damage to the control may occur.

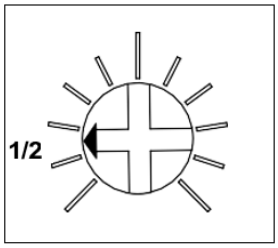
Verify Correct CL Trimpot Setting

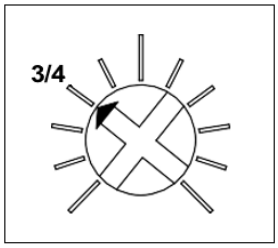
Before powering up your Ironhorse ES1 for the first time you should make sure to preset the CL trimpot to the correct setting to properly protect the motor. The CL pot is factory set for the highest rated motor horsepower that the control model is rated for. For ES1-3A models it is set at 3.8 A RMS and for ES1-6A models it is set at 7.2 A RMS. Refer to the following CL trimpot setting chart for other motor hp settings.

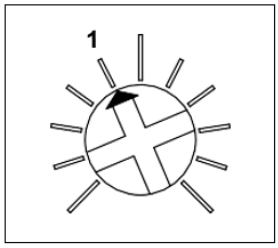
Preliminary CL Trimpot Settings

ES1-3A Models:

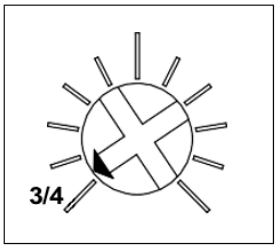


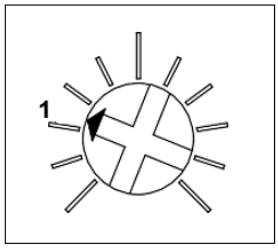


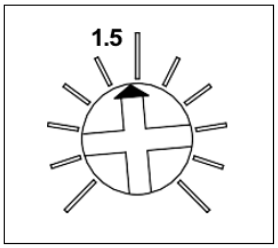


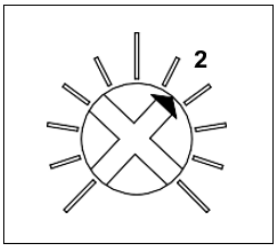


ES1-6A Models:









See the CL Trimpot section for additional setup and reset information.

Specifications

General Specifications

Ironhorse ES1 Class Specifications								
Model Name: ES1--xx-xxx			**3A-N4**	**3A-N4R**	**3A-C**	**6A-N4**	**6A-N4R**	**6A-C**
Drawing Link			[PDF]	[PDF]	[PDF]	[PDF]	[PDF]	[PDF]
Frame Size			1					
Housing Type			Nema4X	Nema4X	Open Chassis	Nema4X	Nema4X	Open Chassis
Applied Motor (hp)[1]	**115 V 1-phase input[2]**		0–0.75			1		
	230 V 1-phase input[2]					1–2		
Output Rating	**Output Rated Current (Amps)**	**115 V 1-phase input[2]**	3.0			4.0		
		230 V 1-phase input[2]				6.0		
	Output Voltage		230 VAC, 3-phase effective, ~340 Vpk PWM @ 8 KHz					
	Output Frequency		0–60 Hz 60.1–120 Hz with derating[3]					
Input Rating	**Input Rated Current (Amps)**	**115 V 1-phase input[2]**	10.3			14.8		
		230 V 1-phase input[2]	6.5			11.9		
	Input Voltage[2]		115 VAC ± 10% 230 VAC 1-phase +5%/-10%					
	Input Frequency		48–62 Hz					
	Speed Voltage Signal Input (Pot Wiper or Isolated Voltage Signal)		0–5 VDC					
Control	**Control Method**		V/Hz control, torque boost					
	Overload Capacity		Manual with Trimpot setup. Max 120% of Rated drive current default					
	Torque Boost		Manual with Potentiometer setup					
	Boost Slope		3 V / Hz					
Operating Characteristic	**Frequency Setting Signal**		0–5 VDC, Pot Wiper or Isolated Voltage Signal. Potentiometer included.					
	Main Functions		MIN, MAX, BOOST, ACCELERATION, DECELERATION, CURRENT LIMIT, DC INJECTION BRAKING					
	I/O	**Input**	3 - Run, Fwd/Rev, Brake					
		Run Relay Output	Form C SPDT contacts / NC or NO. 1 A @ 30 VDC or 120 VAC max					
Onboard Power Supply (Externally Accessible)			5 V @ 25 mA					
Carrier Frequency			8 KHz					
Reversing			Field install	Built-in	Field install	Field install	Built-in	Field install
Connector Style			1/4 inch male spade terminals for supply voltage and motor Spring clamp terminal for P7 terminal block and Form C Relay Output.					
Housing Material			6063-T6 aluminum / Sabic NORYL TYPE N190					
Dimensions			L: 7.150 inches [181.61 mm] W: 5.53 inches [140.46 mm] H: 5.942 inches [150.93 mm]					
Weight			3.363 lbs [152.43 g]					

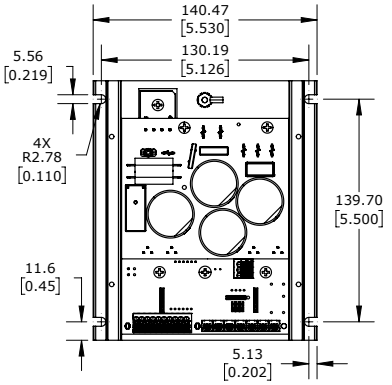
1 - The standard motor capacity is based on a standard 4-pole motor. Choose your ES1 model based on rated amps of the motor. Choose the larger size for extra capacity in case of higher loads.
2 - Jumper selectable, factory set to 230 V. Change jumper for 115 V input.
3 - Derate up to 20%; see derate curve for output frequencies above 60 Hz.

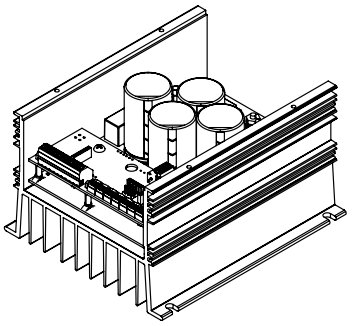
Environmental Specifications

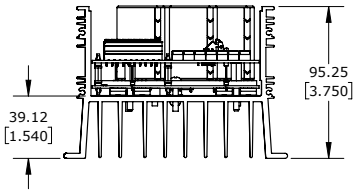
ES1 Environmental Specifications	
Operating Temperature Range	Chassis: -10°C to +45°C [14°F to 113°F] Enclosed: -10°C to +35°C [14°F to 95°F]
Operating Humidity Range	95%, non-condensing
Operating Altitude	2000M

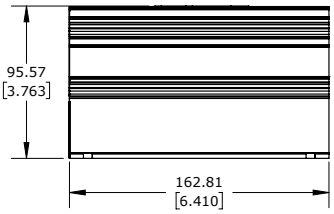
Mechanical Installation

Enclosed Dimensions

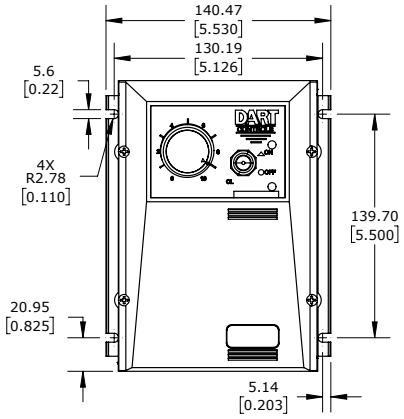


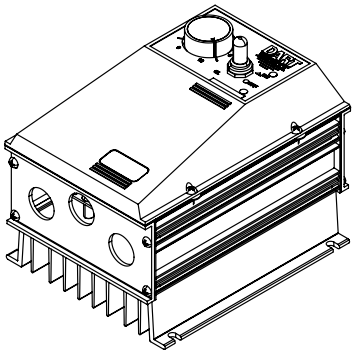


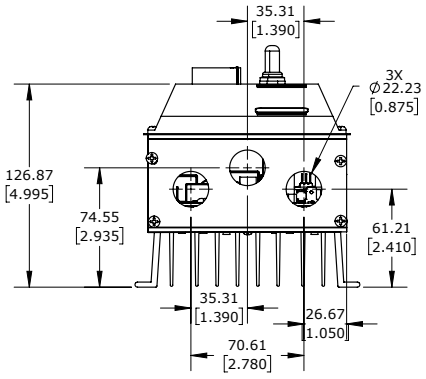


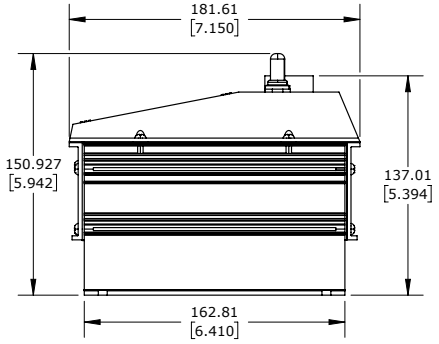


Chassis Dimensions







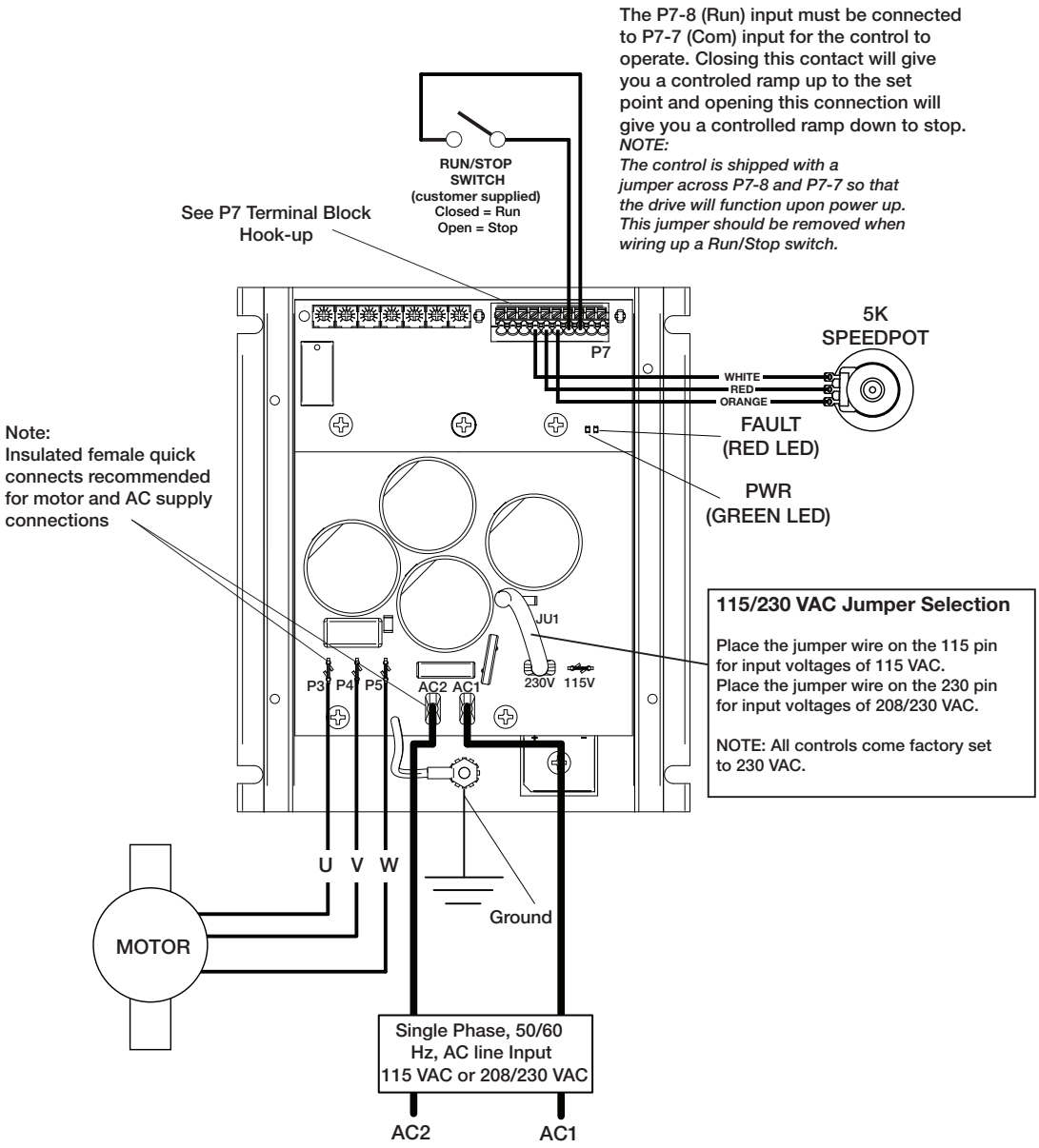


NOTE: Drive must be mounted such that the fins are in a vertical orientation. When mounted vertically, there must be adequate spacing between the fins and any other object to allow for sufficient air flow through the fins.

CAUTION: Do not mount where ambient temperature is outside the range appropriate for your drive type:
Chassis drive: -10°C to +45°C [14°F to 113°F]
Enclosed Drive: -10°C to +35°C [14°F to 95°F]

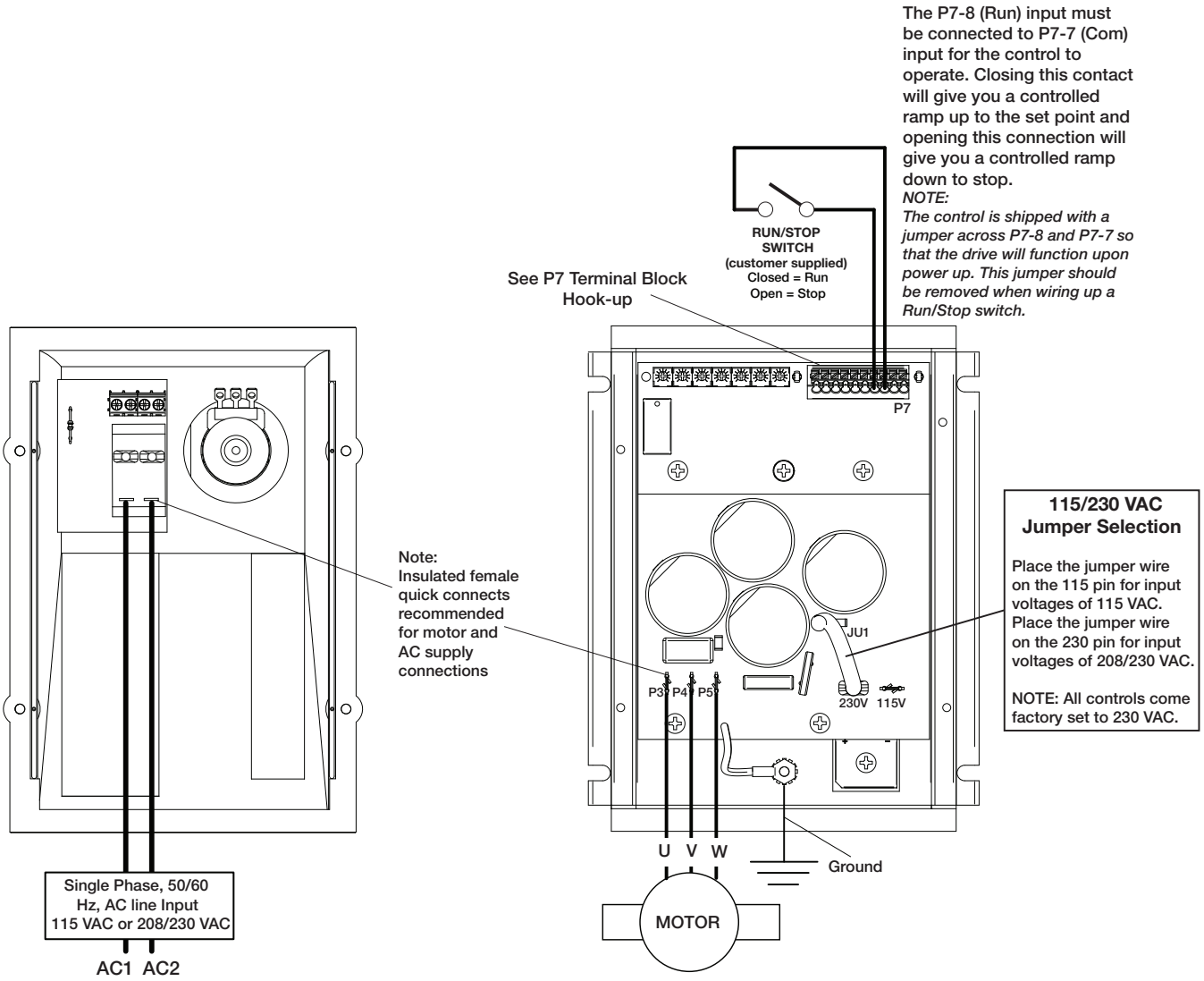
Installation and Diagrams

Chassis Hookup Diagram



Enclosed Hookup Diagram

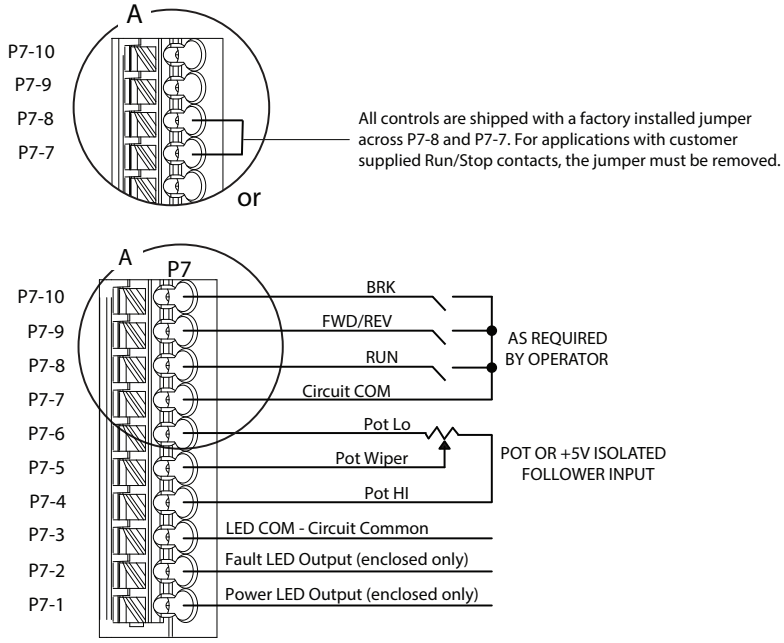
Inside of cover



NOTE: Before powering on up your Ironhorse ES1 you should always verify the correct VAC Input Jumper Selection Setting. For single phase 230 VAC inputs the jumper should be connected to the 230 V spade pin. For 115 VAC inputs the jumper should be connected to the 115 V spade pin. Refer to diagram above.

NOTE: Z+F disconnect terminals available at Automationdirect.com. Consider V70FV004009 for 12-10 AWG wire or V70FV004002 for 16-14 AWG wire.

P7 Terminal Block Hook Up Diagram



NOTE: All customer wired terminals for P7 should be wired with solid or stranded wire size between 16-24 AWG. The maximum terminations at any position is 2 conductors of identical size that do not exceed 0.643 mm (22 AWG) per conductor. Each conductor should use 75°C minimum rated insulation.

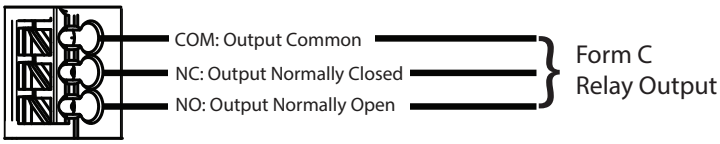
WARNING: The signal inputs of P7 must be isolated from the AC line. Any Earth grounding of the signal wiring will damage the drive and void the warranty. To avoid electrical shock or damage to the drive due to accidental grounding, power must always be turned off while connecting to these inputs.

P7 Terminal Block Descriptions

Terminal Block	Description
P7-1	Power LED Output (enclosed only).
P7-2	Fault LED Output (enclosed only).
P7-3	LED COM - Circuit Common used for LED return on enclosed models.
P7-4	HI: +5V pot Hi connection for 5K ohm speed pot.
P7-5	W: Wiper connection for 5K ohm speed pot. This input can also accept a 0-5 VDC isolated signal input. The wiper input can be used to reset a CL or Fault shutdown by bringing the wiper input from above 50% down to zero.
P7-6	LO: Circuit common connection for pot LO of the 5K ohm speed pot or common return for isolated 0-5 VDC signals.
P7-7	COM: Circuit common (Logic 'Low') connection for Run, Brake and Reverse inputs.
P7-8	RUN: This input floats 'Logic High' - must be connected via switch or jumper to P7-7(Common) for drive to Run. This input can also be used to clear a CL or Fault shutdown by opening the Run terminal and then closing it to Com again. *NOTE - Normal operational run and stop functions should always be performed using this Run/Stop input and not by turning on and off the Vac input power.*
P7-9	FWD/REV: To change motor direction, this input must be connected to P7-7 (Common).
P7-10	BRK: When connected to P7-7 (Common) the motor will decel to a stop and then provide DC injection braking at the rate set by the BRK trimpot. **NOTE:** A full ccw Brake trim pot setting disables braking.

Relay OUT Terminal Block Hook Up Diagram

RELAY OUT



NOTE: All customer wired terminals for RELAY OUT should be wired with solid or stranded wire size between 16-24 AWG. The maximum terminations at any position is 2 conductors of identical size that do not exceed 0.643 mm (22 AWG) per conductor. Each conductor should use 75˚C minimum rated insulation.

Run Relay Activation

The Run Relay is an SPDT user output relay that is normally activated if a run command is given. The output for both NC and NO can switch up to 1 A loads at 30 VDC or 120 VAC max.

NOTE: The relay output is active per the activation chart below regardless of the master potentiometer setting.

Run Input	Current Limit	IGBT Temperature Exceeded Shutdown Value	EEPROM Corruption	Relay State
Active	Not exceeded	Not Exceeded	Not detected	ON
Inactive	Not exceeded	Not Exceeded	Not detected	OFF
Active	Exceeded	Not exceeded	Not detected	OFF
Active	Not exceeded	Exceeded	Not detected	OFF
Active	Not exceeded	Not exceeded	Detected	OFF

Powering On and Powering Off the IronHorse ES1

After you have made sure the voltage jumper selector (JU1) has been set to the correct Vac line voltage input and you have preset the CL trim pot for the motor size being used, it is time to power on the control. For enclosed models, this is done using the ON/OFF toggle switch on the cover. When the power switch is toggled to the “ON” position, the IronHorse ES1 Series drive will begin the start up process of pre-charging the bus capacitors, and cycling through a start up check to verify that the load motor is properly connected with no phase-to-phase shorts. Once that has been completed the green power indicator will be steadily on, indicating that the control is safe to operate. This start up process takes approximately 5-8 seconds.

When you need to power off the IronHorse ES1 drive on the enclosed model, use the ON/OFF toggle switch on the cover. When the power switch is toggled to the “OFF” position, the ES1 drive will initiate a power down process that can take approximately 30-40 seconds to complete. (Warning: Never abort a shutdown once it has been initiated) During this time the bus capacitors are being discharged to a safe voltage level and the micro processor is storing critical settings before the power supply is shut off. Once the green “power on” light has completely turned off, the drive is safe to handle, work on, or restart.

CAUTION: Once a power off process has been initiated, that power off cycle should never be aborted before the power off process has been completed and the green power indicator light has shut off completely. Aborting the power off cycle before it has completed the shutdown may shorten the life cycle of the IronHorse ES1 drive and damage the power switch.

NOTE: The power switch used to turn on the Line Voltage input to the IronHorse ES1 drive should never be used for a repeated start/stop function during normal operational use. Turning the AC line voltage on and off should only be done at the beginning of operational use and at the end of operational use. Repeated start and stop operations or cycling functions during normal operational use should always be done via the the P7-8 (Run/Stop) input or one of the other selectable run/stop input functions such as Brake or Speed-pot commands.

Customer Installation, Wiring, & Fusing Requirements

- *Do not mount Ironhorse ES1® where ambient temperature is outside the range of -10°C to +45°C (14°F to 113°F) for chassis drives or -10°C to +35°C (14°F to 95°F) for enclosed drives.*
- *Installations in unventilated enclosures must be 1.5 times the controller dimensions or more, and the air temperature inside the enclosure and around the controller must remain between -10°C to +45°C (14°F to 113°F) or chassis drives or -10°C to +35°C (14°F to 95°F) for enclosed drives.*
- *Keep signal wires separate from the motor and AC lines when routed in conduit or wire trays.*
- *These drives do not provide motor over-temperature sensing or shutdown. The need for additional motor over-temperature protection should be determined based on conditions in the end installation in accordance with the NEC.*
- *Size all wires that carry motor or line currents as specified by applicable national, state, and/or local codes. All other wires may be 18AWG or smaller as permitted by code.*

Type	*Customer Wiring Temp Rating*
Customer terminal wiring	300V, 75°C [167°F] minimum

- *Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electrical Code and any additional local codes, or the equivalent.*
- *Fusing: The motor and control are protected against overloads by the current limit circuit, however this drive does not contain AC line fuses. Most electrical codes require that each hot AC Line conductor contain circuit protection. Install a fuse (See fusing chart below) or a circuit breaker in series with each hot AC Line. Do not fuse any of the motor leads. For recommended fuse size, see the chart below.*
- *The control and motor must be wired in accordance with the National Electrical Code requirements and other local codes that may apply.*

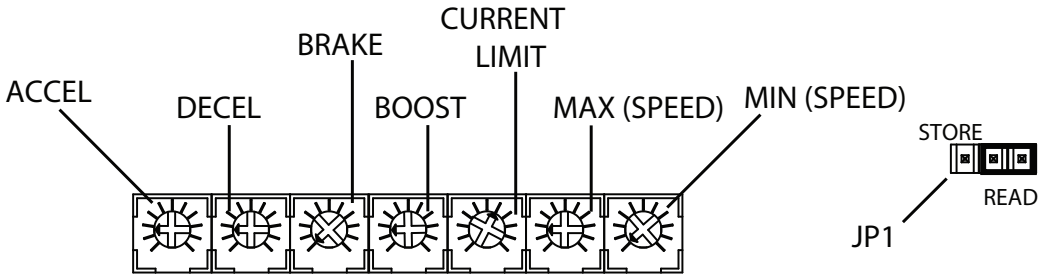
Fusing Added by Customer

Bussman ABC or Littelfuse 326 series fuses.

Model	*Motor hp (FLA) at 230 VAC*	*120 VAC Input*	*230 VAC Input*
ES1-3A-xxx	0.25 hp (1.2 A)	4 Amps	3 Amps
	0.5 hp (1.8 A)	8 Amps	5 Amps
	0.75 hp (2.8 A)	12 Amps	7.5 Amps
ES1-6A-xxx	1.0 hp (3.2 A)	15 Amps	10 Amps
	1.5 hp (4.5 A)	18 Amps	12 Amps
	2.0 hp (6.0 A)	--	15 Amps

Factory Default Trimpot and Jumper Settings

Initial Trimpot Settings



The trimpots are factory set for a 0-60 Hz 2 hp (ES1-6A) or 0.75 hp (ES1-3A) inverter duty motor. The initial settings are as follows:

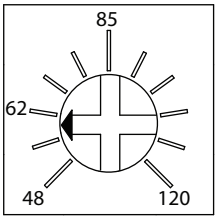
- *MIN, BRAKE Pots: Full CCW*
- *CURRENT LIMIT Pot: 2/3 CW – 7 on the trimpot face (7.2 A RMS for ES1-6A, 3.8 A RMS for ES1-3A)*
- *DECEL, ACCEL, MAX, BOOST: 1/4 CW - 2 to 3 on pot face*

JP1 Jumper

JP1: When set to READ the trimpots can be actively adjusted and tuned for the users specific application. Every trimpot can be adjusted and tested while running a motor. Once the drive has been tuned to the desired setting, those settings can be stored to memory and locked by moving the jumper to the STORE position.

Max (Speed) Trimpot

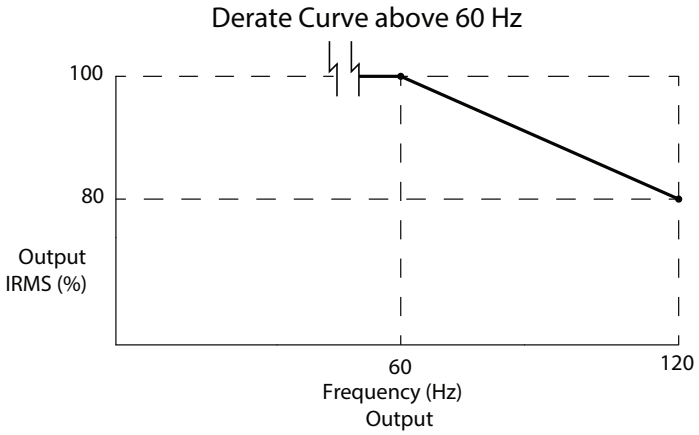
The MAX trimpot range is 48–120 Hz. The MAX trimpot factory default is 60 Hz. To decrease the MAX speed setting, turn the trimpot CCW to the desired speed. To increase the MAX speed setting, turn the trimpot CW to the desired speed. Refer to the MAX trimpot diagram for range settings.



MAX Hz

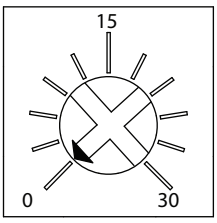
NOTE: Speed settings above 60 Hz will require the control RMS output current to be derated by up to 20% at 120 Hz. Refer to de-rate graph below.

CAUTION: Operating a motor above its rated speed may result in some motors running hotter than normal. When operating a motor beyond its normal speed range the motor manufacturer should be consulted to determine if de-rating or additional cooling methods may be required.



MIN (SPEED) TRIMPOT

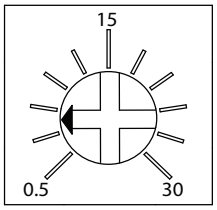
The MIN trimpot range is 5–30 Hz. The min pot is factory set at full CCW which is 0 Hz. To increase the min set point, set the master speedpot to 0 on the dial and then adjust the MIN trimpot CW to the desired minimum speed when the master speedpot is set to zero.



MIN Hz

ACCEL TRIMPOT

The adjustable range of ACCEL is a linear 0.5 to 30 second ramp from 0–60 Hz. The ACCEL pot is factory set to approx 2 sec from 0–60 Hz. A CCW adjustment will reduce the ramp time and a CW adjustment will increase the ramp time. Caution should be given to ACCEL ramp times below 2 seconds as this may result in an over current shutdown.

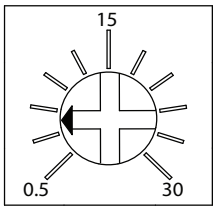


Rate 0–60 Hz
Time in seconds

NOTE: Higher MAX setting will result in longer ramp times. A MAX setting of 120 Hz will extend ACCEL range from 1-60 sec.

DECEL TRIMPOT

The adjustable range of DECEL is a linear 0.5 to 30 second ramp from 60–0Hz. The DECEL pot is factory set to approx 2 sec from 60–0 Hz. A CCW adjustment will reduce the ramp time and a CW adjustment will increase the ramp time. Caution should be given to DECEL ramp times below 2 seconds as this may result in an over current shutdown.



Rate 60–0 Hz
Time in seconds

NOTE: Higher MAX setting will result in longer ramp times. A MAX setting of 120 Hz will extend the DECEL range from 1-60 sec.

CL TRIMPOT

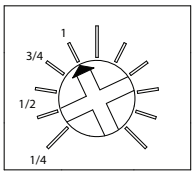
Overview

The control current limit operates as an over current shutdown that will trip the drive off in a safe manner any time the CL set point is exceeded. This can be caused by a sudden increase on the motor load, accel, or decel settings that are too aggressive for the motor load, or aggressive DC injection brake settings. When the CL set point has been tripped the Red Fault LED (located on lower right side of top board on a chassis model or on the cover of an enclosed model) will illuminate steadily when the drive is in a Current Limit state. The initial CL trips can easily be reset via the Run input or the Master Speedpot, however repeated CL trips will result in a CL Shutdown. (See “Resetting CL Trips and Shutdowns” below) The Current Limit (CL) trimpot is Factory set to 7.2 amps RMS for ES1-6A models and 3.8 amps RMS for ES1-3A models. A CW rotation of the CL trimpot will increase the CL set point. A CCW rotation of the trimpot will decrease the CL setpoint. CL should typically be set to approximately 120–150% of the rated motor phase current. A quick reference adjustment chart has been provided below for initial setup of various motor Hp setups. For more precise CL setup please refer to the “Setting CL” section below

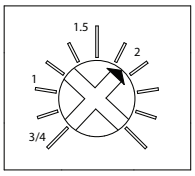
Setting CL

To adjust current limit for your specific application needs, place an RMS current meter in series with one of the motor phases. Using the master control speedpot, set the control output to between 60% and 80% of rated motor output speed. Load the motor to 150% of its rated motor phase current and gradually decrease the CL trimpot setting until the red Fault LED turns on and the output shuts off. Cease any further trimpot change and release the motor load. To verify the correct setting, follow the CL reset process that is outlined below and then slowly increase the motor load while monitoring the RMS current meter until you reach the CL trip point again to verify the correct setting.

Initial Motor Setting



ES1-3A Models

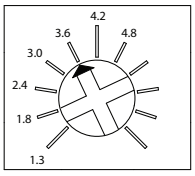


ES1-6A Models

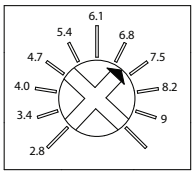
CL Trimpot Current Range Settings

CL Trimpot current load setting. This is an approximation and intended for a starting point setting. Final settings should be done per the setup instruction using an RMS AC current meter. Many things can affect the final peak current setting such as input line voltage, typical operating speed, type of load, and motor efficiency.

Initial Motor Setting



ES1-3A Models



ES1-6A Models

Resetting CL Trips and Shutdown

A current limit trip can be reset via the Master Speedpot or by the Run input. Using either method, both the Green Pwr LED and the Red Fault LED will cycle off and then the Green Pwr LED will cycle back on while the Red Fault LED will remain off. This indicates that the CL trip has been reset and the drive will return to a ready state.

1) Run Input: To reset the CL trip, open the 'Run' input (P9-9 to P9-8) until the Red and Green LED's turns off and the Green LED turns back on.
2) Master Speedpot: The speedpot must be set above 50% and then turned to full CCW until the Red and Green LED's turns off and the Green LED turns back on.
3) CL Shutdown: If the CL has been tripped more that 3 times and the Red Fault LED fails to reset via method 1 or 2 then the control is in CL shutdown.

To reset the drive from a CL shutdown it will be necessary to cycle power to the drive.

NOTE: Repeated CL trips and shutdowns are an indication of motor or system problems that should be evaluated further by a qualified systems technician.

BOOST Trimpot

The BOOST trimpot allows the the motor to overcome sluggish response at low speed starts or high startup loads by boosting the output. To increase the boost setting rotate the BOOST trimpot CW. To decrease the boost setting rotate the BOOST trimpot CCW.

To determine if boost is required for your application, use the following setup method. With a normal motor load applied, slowly turn the MIN trimpot CW until you reach 30% rotation. If your motor has started up you will likely not need to adjust the BOOST trimpot. However if your motor hasn't started then slowly increase the BOOST trimpot until your motor starts to turn. Return the MIN setting to 0 (full CCW) and repeat the test to make sure the motor starts at low speeds.

NOTE: Running a motor continuously at low speeds with Boost turned up may cause some motors to overheat.

BRAKE Trimpot

BRAKE is a DC Injection Brake function when the motor speed is 0 Hz. This function can be used to hold a motor position in between speed commands. To activate BRAKE a contact must be closed from the BRAKE terminal on P9-11 to circuit Common on P9-8. A CW trimpot rotation will increase the level of DC injection braking. A CCW trimpot rotation will lower the level of braking. If BRAKE is activated while the motor is running then the motor will reduce to 0 speed at the rate of the DECEL trimpot setting. When the motor has stopped, the DC Injection Braking will be applied at a level determined by the trimpot setting.

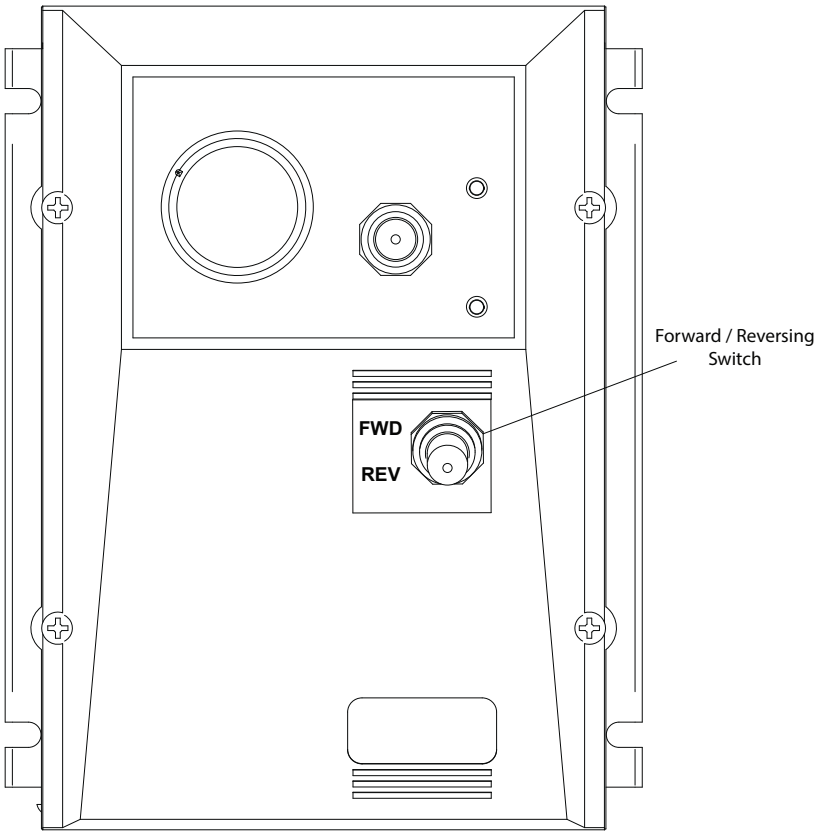
NOTE: When the BRAKE trimpot is at full CCW the Brake function is fully disabled even if the BRAKE to COM contact has been closed.

CAUTION: Although the brake function can be limited by your CL setting, using Brake even at lower levels to hold a motor at 0 speed for extended periods of time can cause excessive heating of the motor.

N4R Option - Manual Forward-Off-Reverse Switch

(Enclosed Only)

The manual Forward-Off-Reverse switch is a cover mounted toggle switch that allows the user to set the direction of motor travel from the front cover. When fwd/rev switch is toggled during operation, the output will ramp to a stop at the rate determined by the decel pot and then ramp back up in the selected direction of travel to the speed setting at the rate determined by the accel pot.



Troubleshooting

Technical Support Options

- *Visit the AutomationDirect Web Site at: www.automationdirect.com*
- *Technical support inquiries at: https://community.automationdirect.com/s/contactsupport*
- *Telephone technical support at 1-800-633-0405.*

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Drawing Number: A-5-4346B