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RELIANCE ELECTRIC

Installing, Operating, and Maintaining DC2 V*S Drive





Instruction Manual D2-3231-4

Rockwell Automation

Scope of This Manual

The products described in this Instruction Manual are manufactured by Reliance Electric Industrial Company.

This Manual familiarizes you with the controller. It describes receiving, storage and installation procedures; provides an overview of specifications and operations; and includes troubleshooting, maintenance and replacement parts data.

Read this manual in its entirety before installing and starting the controller. Observe all dangers, warnings and cautions; these precautions point out potentially hazardous procedures. All three types of precautions are enclosed in a box to call attention to them.

- A **DANGER** alerts a person that high voltage is present that could result in severe bodily injury or loss of life.
- A **WARNING** alerts a person of potential bodily injury if procedures are not followed.
- A **CAUTION** alerts a person that, if procedures are not followed, damage to, or destruction of, equipment could result.

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1: Receive and Accept the Controller

Receive and Accept the Shipment

The Reliance® DC2 V★S Controller (herein referred to as controller) has been designed, manufactured and thoroughly tested to provide many years of reliable service. The shipping container in which you received your controller has been specifically designed to protect it during transportation and handling.

Reliance terms of sales, in all instances, are F.O.B. point of origin. It is your responsibility to thoroughly inspect the equipment before accepting shipment from the transportation company.

If any of the items called for on the bill of lading or express receipt are damaged or are not included, **do not** accept the shipment until the freight or express agent makes an appropriate notation on your freight bill or express receipt.

If any concealed loss or damage is discovered later, notify your freight or express agent within 15 days of receipt and request that he make an inspection of the shipment. Keep the entire shipment intact in its original shipping container.

The consignee is responsible for making claim against the Carrier for any shortage or damage occurring in transit. Claims for loss or damage in shipment must not be deducted from the Reliance Electric invoice, nor should payment of the Reliance invoice be withheld while awaiting adjustment of such claims since the carrier guarantees safe delivery.

If considerable damage has been incurred and the situation is urgent, contact the nearest Reliance Electric Sales Office for assistance. To find the nearest sales office, call toll-free 1-800-245-4501.

Store the Controller until Installation

After receipt inspection, repack the controller in its shipping container until installation. If a period of storage is expected, store in the original shipping container with its internal packing.

To ensure satisfactory drive operation at startup and to maintain warranty coverage, store the equipment:

- In its original shipping container in a clean, dry, safe place.
- In an ambient temperature that does not exceed 65°C (149°F) or go below −30°C (−22°F).
- Within a relative humidity range of 5 to 95% without condensation.
- Away from a highly corrosive atmosphere. In harsh environments, cover the shipping/storage container.

File a Return Request

1. To return equipment, send a written request to Reliance Electric sales/service within ten days of receipt.
2. Do not return equipment without a numbered authorization form (ERA form) from Reliance Electric.
3. Reliance Electric reserves the right to inspect the equipment on site to verify any claims.

To find the nearest sales/service office, call toll-free 1-800-245-4501.

2: Introduction to the Controller

Controller Configurations

The controller converts single-phase A-C line power to adjustable D-C power for either speed or torque control of D-C motors rated 1/4 through 2 HP. The controller is specifically performance matched to Reliance D-C Motors to provide a compact controller/motor package. It will operate all Reliance 1/4 through 2 HP permanent magnet or wound field D-C motors with compatible armature and field voltages.

The controller is available in a wide array of application-specific configurations, in flat plate chassis or open chassis designs as well as NEMA 12 or NEMA 4/4X/12 enclosure designs. Tables 2-1 through Table 2-3 list available configurations.

Note: Oil-tight and dust-tight conduit hole plugs (part 197308A) are standard on DC2 NEMA 12K designs. Conduit hubs are not supplied.

Note: Water-tight conduit hubs are standard on DC2 NEMA 4/4X/12 designs. Additional conduit hubs for NEMA 12 or NEMA 4/4X/12 designs can be ordered by referencing Reliance Part Number 608826-2A.

Note: Models DC2-95 and DC2-97 feature a special 10-turn speed potentiometer. Reference Reliance part number 600594-14SFX for replacement.

Note: When the RE020 D-C Tachometer is used, a controller isolation transformer must be used. See Install a Disconnect in Section 3 of this instruction manual for complete instructions.

Table 2-1. Open and Plate Style Chassis Controllers Listed by Features and Configuration.

	Controller Model Number by Configuration	
Controller Features	**Speed Control**	**Torque Control**
Basic	DC2-40U DC2-45U[1] DC2-50U DC2-55U[1]	DC2-43U DC2-53U
Basic plus Process Control Interface	DC2-42U DC2-46U[1] DC2-52U DC2-56U[1]	DC2-44U DC2-54U

[1] Special customer model.

Table 2-2. NEMA 12 Enclosed
Controllers Listed by Features and Configuration.

Controller Features	Controller Model Number by Configuration	
	Speed Control	**Torque Control**
Basic	DC2-60U DC2-65U[1] DC2-70U 2 DC2-75U [1 2]	DC2-63U DC2-73U[2]
Basic with Jog	DC2-60U DC2-79U[2]	Not Available
Basic plus Process Control	DC2-62U DC2-66U[1] DC2-72U[2] DC2-76U[1 2]	DC2-64U DC2-74U[2]
Basic plus Dynamic Braking (DB)/ Reversing	DC2-71U[2 3]	Not Available
Basic plus DB/ Reversing plus Jog	DC2-78U[2 3]	Not Available

1 Special customer model.
2 Includes operator's controls.
3 Cannot be used with D-C tachometer speed feedback

Table 2-3. NEMA 4/4X/12 Enclosed
Controllers Listed by Features and Configuration.

Controller Features	Controller Model Number by Configuration	
	Speed Control	**Torque Control**
Basic	DC2-80U DC2-90U[1] DC2-95U[1]	DC2-83U DC2-93U[1]
Basic with Jog	DC2-80U DC2-99U[1]	Not Available
Basic plus Process Control	DC2-82U DC2-92U[1] DC2-97U[1]	DC2-84U DC2-94U[1]
Basic plus DB/Reversing	DC2-91U[1 2]	Not Available
Basic plus DB/ Reversing plus Jog	DC2-98U[1 2]	Not Available

1 Includes operator's controls.
2 Cannot be used with D-C tachometer speed feedback

Controller Features

Standard DC2 controllers available are listed in Tables 2-1, 2-2 and 2-3.

Basic Controller Features (All Models)

- A-C line power reconnectable for single-phase 115 or 230 volts:
  - 115 volts A-C: 90 volt armature/50 volt field supply
  - 230 volts A-C: 180 volt armature/100 volt field supply
- 50 or 60 cycle power without modification
- Full-wave, half-controlled armature voltage rectifier with back diode for improved armature form factor
- Half-wave field supply for shunt wound D-C motors
- Optional short circuit protection by incoming line fuse.
- Line transient protection by metal oxide varistor and RC circuit
- Armature current scaling by reconnectable jumper for horsepower rating
- Unidirectional operation with coast-to-rest stop
- Motor overload protection by internal motor thermostat
- Provisions for remote start, remote stop and/or remote run/jog

Speed Control Features (Models DC2-40, 42, 45, 46, 50, 52, 55, 56, 60, 62, 65, 66, 70, 71, 72, 80, 82, 90, 91, 92, 95, 97, 99)

- All features listed in “Basic Controller Features (All Models)”
- Speed control by armature voltage regulation or motor mounted D-C tachometer (Except DC2-71, 78, 91 or 98)
- Potentiometer motor speed adjustment
- Separately adjustable maximum and minimum speeds
- Independently adjustable rates
- Adjustable current limit
- Jumper selectable Armature voltage feedback scaling (90 or 180 volts)
- Adjustable IR drop compensation

Speed Control with Reversing and Dynamic Braking (Models DC2-71, 78, 91, 98)

- All features listed in “Basic Controller Features (All Models)” and “Speed Control Features”
- Reversing direction of rotation by a FORWARD/OFF/REVERSE switch. The “off” position (or center position of the switch) applies dynamic braking (braking capabilities listed in Table 2-5)
- Selector switch has detent feature which requires release of pressure on the switch when passing from forward to reverse. When combined with the dynamic braking action, this feature minimizes the possibility of plug reversing the motor.

CAUTION: The drive must be at zero speed before changing the direction of rotation. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

Speed Control with Isolated Process Control Interface (Models DC2-42, 46, 52, 56, 62, 66, 72, 82, 92, 97)

- All features listed in "Basic Controller Features (All Models)" and "Speed Control Features"
- Motor speed adjustment by potentiometer (Manual mode) or process control output signal (Automatic mode)
- Manual/Automatic mode switching by selector switch
- Process control signal input selection by jumper: 1 to 5 mA, 4 to 20 mA, 10 to 50 mA, or 0 to 10 volts reference signal, grounded or ungrounded
- Isolated input 300K ohm differential
- Process interface (PI) gain adjustment
- Process Interface (PI) bias adjustment
- Ramp generator
- Auxiliary form C contact for run indication

Basic Torque Control Features (Models DC2-43, 44, 53, 54, 63, 64, 73, 74, 83, 84, 93, 94)

- All features listed in "Basic Controller Features (All Models)"
- Motor torque adjustment by potentiometer
- Independently adjustable maximum and minimum torque
- Independently adjustable rate reference timing
- Adjustable speed limit by voltage limit or motor mounted D-C tachometer feedback
- Jumper selectable armature voltage feedback scaling (90 or 180 volts)
- Ramp generator
- Auxiliary form C contact for run indication

Torque Control with Isolated Process Control Interface (Models DC2-44, 54, 64, 74, 84, 94)

- All features listed in "Basic Controller Features (All Models)" and "Basic Torque Control Features"
- Motor torque adjustment by potentiometer (Manual mode) or process control output signal (Automatic mode)
- Manual/Automatic mode switching by selector switch
- Process control signal input selection by jumper: 1 to 5 mA, 4 to 20 mA, 10 to 50 mA, or 0 to 10 volts reference signal, grounded or ungrounded
- Isolated input 300K ohm differential
- Process Interface (PI) gain adjustment

- Process Interface (PI) bias adjustment
- Ramp generator
- Auxiliary form C contact for run indication

Jog Functions
(Models DC2-40, 50, 60, 78, 79, 80, 98, 99)

- All features listed in "Basic Controller Features (All Models)"
- Controller offers Run/Jog capability for local or remote requirements.
- Available in chassis and enclosed controller designs.

Controller Specifications

Ratings

- Service factor 1.0
- Continuous duty
- Load capacity: 150% for 1 minute
- Line voltage variations: ±10% of rated
- A-C line frequency: 48 to 62 Hertz
- Maximum allowable symmetrical A-C line fault current: 10,000 amperes
- Maximum A-C line distribution system KVA capacity (1) (2)
  Maximum KVA:
  - 115-volt A-C input: 65.0 KVA
  - 230-volt A-C input: 32.5 KVA
- Controller ratings by motor horsepower: Refer to Table 2-4
- Ambient temperature:
  – Open chassis plate style models:
    0° to 55°C (32° to 131°F)
  – NEMA/UL 12 enclosed:
    0° to 40°C (32° to 104°F)
  – NEMA/UL 4/4X/12 enclosed:
    0° to 40°C (32° to 104°F)
- Altitude: 3300 feet (1000 meters) maximum
- Non-Condensing Relative Humidity 5 to 95%
- NEMA 12 enclosure is intended for indoor use. It provides protection against fibers, metal filings, lint, dust, dirt and light splashing, seepage, dripping and external condensation of non-corrosive liquids. It will not protect against internal condensation.
- NEMA 4/4X/12 enclosure is intended for use indoors to protect the enclosed equipment against splashing water, seepage of water, falling or hose-directed water, and severe external condensation. Conduit hubs for water-tight connection are provided at the conduit entrance and a means to mount these hubs external of the equipment cavity. The Reliance DC2 controller has passed the UL hosedown test to verify the washdown integrity of the controller.

(1) When applying DC2 drives to power distribution systems with a KVA capacity in excess of the maximum recommended KVA capacity, an isolation transformer or line reactor of similar impedance is required.

(2) Assumes a transformer impedance of 5%.

Controller Performance

- Efficiency (at rated speed and load):
  - Controller — 97%
  - Controller and motor — 78%
- Displacement power factor (at rated speed and load): 70%

Table 2-4. Controller Ratings by Motor Horsepower.

Motor HP	Rated A-C Line Amperes[1]	Input KVA	D-C Armature Voltage	Rated Armature Current (amperes)	Available Field Voltage	Available Field Current (amperes)
	115-Volt A-C Input					
	230-Volt A-C Input					
1/4	3.1	.36	90	2.5	50	2.0
	—	—	—	—	—	—
1/3	4.2	.48	90	3.7	50	2.0
	—	—	—	—	—	—
1/2	6.2	.71	90	5.0	50	2.0
	3.1	.71	180	2.5	100	2.0
3/4	9.4	1.00	90	7.5	50	2.0
	4.7	1.00	180	3.7	100	2.0
1[2]	12.5	1.40	90	10.0	50	2.0
	6.2	1.40	180	5.0	100	2.0
1-1/2	—	—	—	—	—	—
	9.4	2.20	180	7.5	100	2.0
2[2]	—	—	—	—	—	—
	12.5	2.90	180	10.0	100	2.0

[1] Includes motor field current.

[2] DC2-50, 52, 53, 54, 55 and 56 plate design controllers must be mounted to a metal plate 18" x 18" to meet 1 HP @ 115 VAC and 2 HP @ 230 VAC ratings, or an optional heatsink (model number HS1-50) can be purchased.

Table 2-5. Controller Isolation Transformer Ratings

HP	Transformer KVA
1/4	0.75
1/3	0.75
1/2	1.50
3/4	1.50
1	2.00
1-1/2	3.00
2	5.00

Speed Control Adjustment Ranges

NOTE: Full rotation of potentiometers may exceed the range specified.

- Maximum speed: 50 to 100% of motor base speed with speed setting pot at its maximum setting
- Minimum speed: 10 to 50% of maximum speed with speed setting pot at its minimum setting. With zero speed jumper, minimum speed range is 0 to 50% of maximum speed.
- Current limit: adjustable to 150% of selected current range
- IR drop compensation: 5% to 10% at rated armature voltage
- Speed regulation characteristics: refer to Table 2-6.
- Ramp time to maximum speed: 0.5 to 30 sec.
- Enhanced ramp time to maximum speed (0-57210-31 and -32 Regulator Boards only):
  - J-401, "slow" adjustable from 3.5 seconds to 40 seconds
  - J-401, "fast" adjustable from .3 seconds to 3.5 seconds
- Dynamic braking provided in Models DC2-71, 78, 91 and 98 only. This capability is designed for applications requiring infrequent stops of loads in which the inertia reflected to the motor is approximately equivalent to or less than the motor armature inertia. Refer to Table 2-7.

CAUTION: Do not use dynamic braking on applications with reflected inertias higher than motor armature inertia or when frequent stops are necessary. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

- Isolated process follower input:
  - P.I. Gain .5 to 2.5
  - P.I. Offset $\pm$25% of full reference

Torque Control Adjustment Ranges

- Maximum torque: 75 to 150% of rated motor torque with torque potentiometer at its maximum setting
- Minimum torque: 5 to 50% of maximum motor torque with torque potentiometer at its minimum setting
- Speed/Voltage limit: 20 to 110% base speed

Table 2-6. Speed Regulation Characteristics.[1]

Type of Regulation	Line Voltage ±10%	Load Change 95%	Regulated Speed Range	Temperature ±10°C	Field Heating Cold Normal[2]
Armature Feedback (Voltage)	0.1%	2-5%[3]	20:1	1.0%	5-12%
Tachometer Feedback (Speed)[4]	0.1%	1%	30:1	1.5%	0.5%

1 All percentages expressed relative to maximum speed.

2 Applies to wound field D-C motors only.

3 Dependent upon specific motor characteristics and IR drop compensation adjustment.

4 Applicable to non-reversing models only.

Table 2-7. Dynamic Braking Capabilities (with Switch Reversing Models DC2-71, 78, 91 and 98 only).

Description	Input Voltage	Motor Horsepower						
		1/4	1/3	1/2	3/4	1	1-1/2	2
Braking Torque (% Full Load Torque)	115	129	103	66	44	34	–	–
	230	–	–	200	190	130	88	62
Allowable Stops Per Minute	115	12	11	8	6	2	–	–
	230	–	–	8	6	1	1	1

3: Install and Wire the Drive

DANGER

ONLY QUALIFIED ELECTRICAL PERSONNEL FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF THIS EQUIPMENT AND THE HAZARDS INVOLVED SHOULD INSTALL, ADJUST, OPERATE AND/OR SERVICE THIS EQUIPMENT. READ AND UNDERSTAND THIS MANUAL IN ITS ENTIRETY BEFORE PROCEEDING. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

DANGER

THE USER IS RESPONSIBLE FOR CONFORMING TO THE NATIONAL ELECTRICAL CODE AND ALL OTHER APPLICABLE LOCAL CODES. WIRING PRACTICES, GROUNDING, DISCONNECTS, AND OVERCURRENT PROTECTION ARE OF PARTICULAR IMPORTANCE. FAILURE TO OBSERVE THIS PRECAUTIONS COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

DANGER

THIS EQUIPMENT IS AT LINE VOLTAGE WHEN A-C POWER IS CONNECTED. DISCONNECT AND LOCKOUT ALL UNGROUNDED CONDUCTORS OF THE A-C POWER LINE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

Install the Drive

Review all installation and wiring instructions thoroughly before proceeding. Throughout the installation and wiring procedures, use Figure 3-1 or Figure 3-1A to locate adjustment potentiometers, terminal boards, special selector jumpers and pins. Wiring diagrams are given in Figures 5-1, 5-1A, 5-2 and 5-3.

Install the Controller

1. Remove the controller cover and inspect for any physical damage. Report any shipping damage to the carrier.
2. Locate the controller where it will have the unrestricted ventilation area as indicated in Figures 3-2A and B. For the heatsink versions (all models except the DC2 Series 50 product), allow for unrestricted air flow over the rear cooling fins and sides. Allow at least 4" above the controller.

   For the flat plate chassis design controller (DC2 Series 50) allow 1" around the controller for service access. Also note that an 18" by 18" metal plate is required to meet the 1 HP @ 115 VAC and 2 HP @ 230 VAC. An optional heatsink, model # HS1-50, is avaiable for tighter areas (refer to Figure 3.2C).
3. Make sure that ambient temperatures in the controller area are within 0°C and 40°C (32°F and 104°F) for enclosed controllers or 0°C and 55°C (32°F and 131°F) for chassis design controllers.

4. Route power and control/signal wiring through separate conduit openings provided in the bottom of the enclosed controller. The area above the controller must be kept clear of live electrical circuits to avoid accidental contact. (See Figures 3-2A and B.)
5. Mount the controller in a vertical, upright position. Mount the flat plate chassis design with the ground lug located on the bottom right side. See Figure 3-2 for dimension and mounting details.
6. Seal the unused conduit entries of the NEMA 12 enclosed controller, using the supplied plug (part 197308A) to retain the NEMA 12 enclosure rating. Conduit connections should be made with accepted National Electrical Code (NEC) practices. For NEMA 4/4X/12 controllers use the watertight conduit hubs (part 608826-2A) supplied as standard to maintain the NEMA 4/4X/12 enclosure rating.

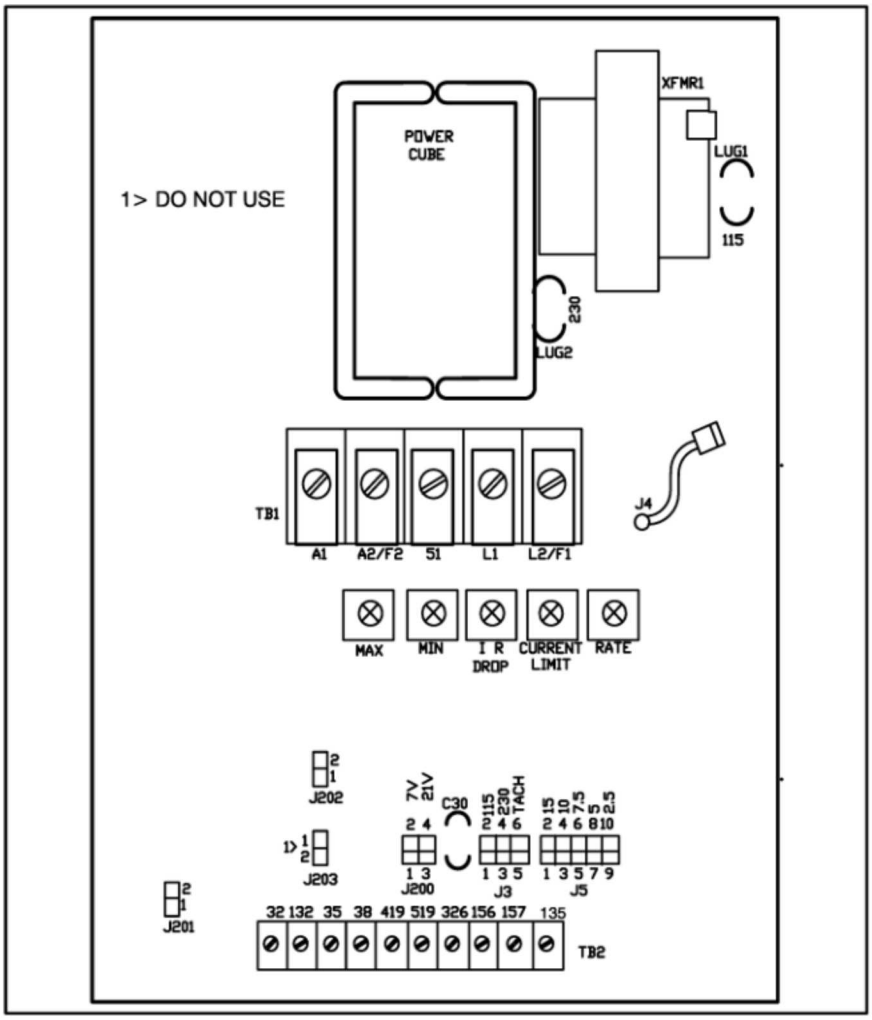


Figure 3-1. Controller Terminal Board Locations (0-57210-30 Regulator Boards only).

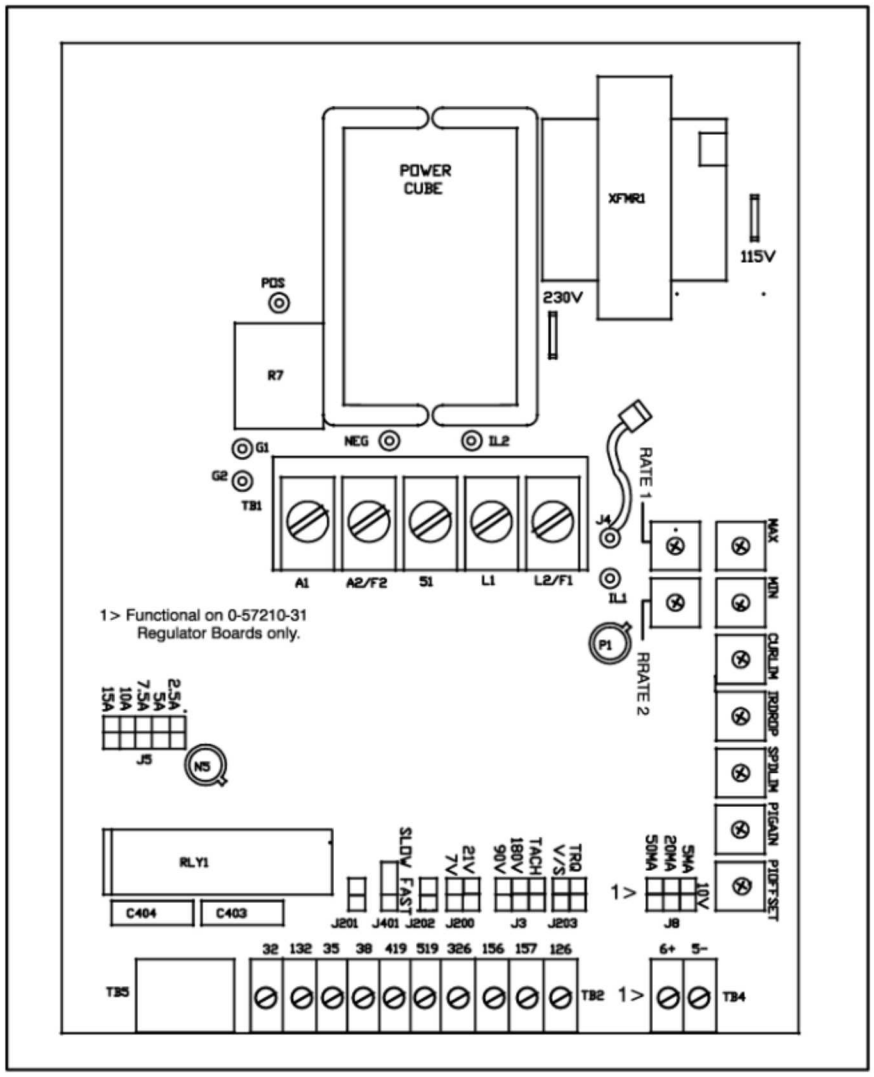


Figure 3-1A. Controller Terminal Board Locations (0-57210-31 and 0-57210-32 Regulator Boards Only)

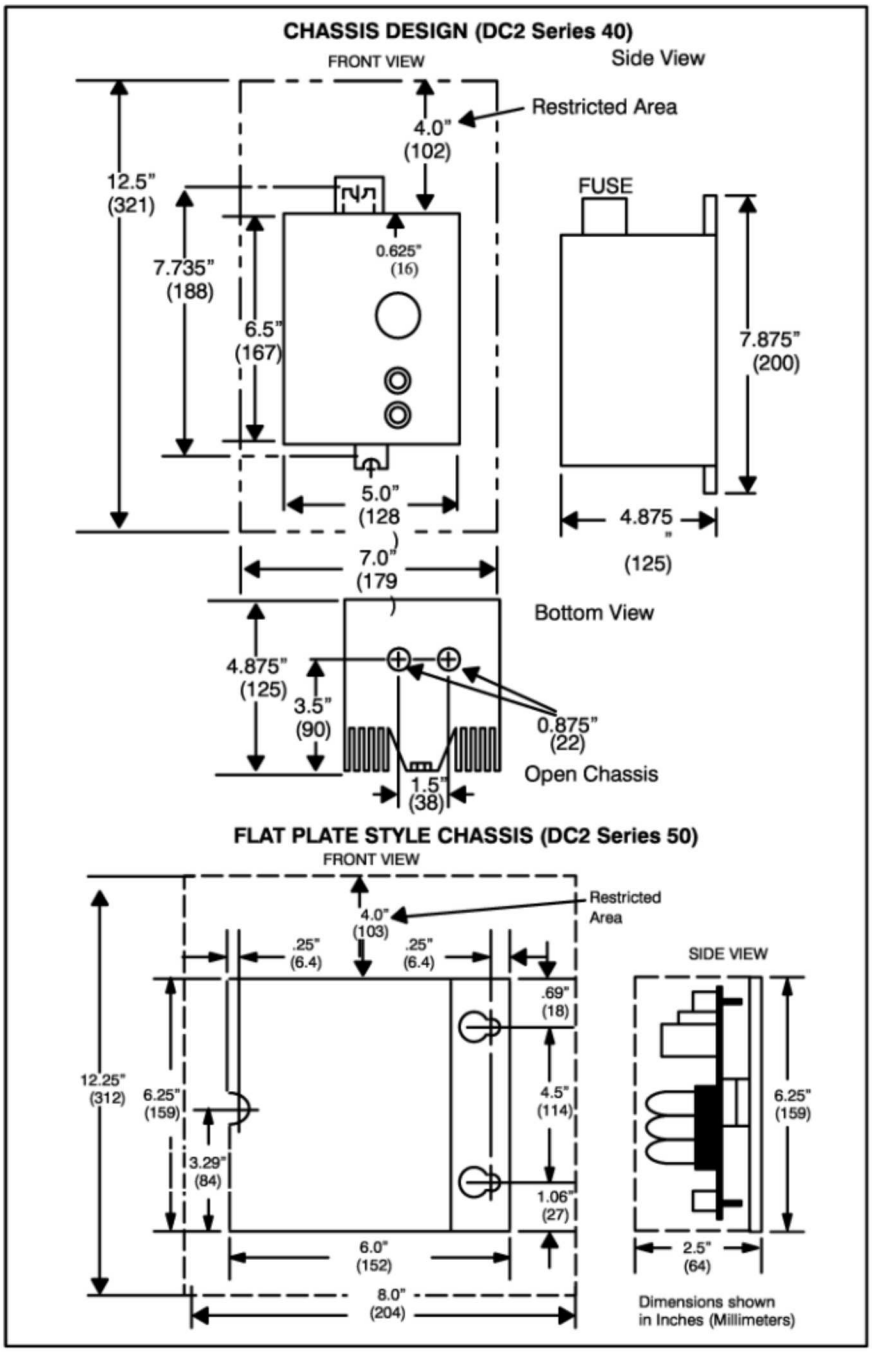


Figure 3-2A. Dimension and Mounting Data for Chassis Style Controllers.

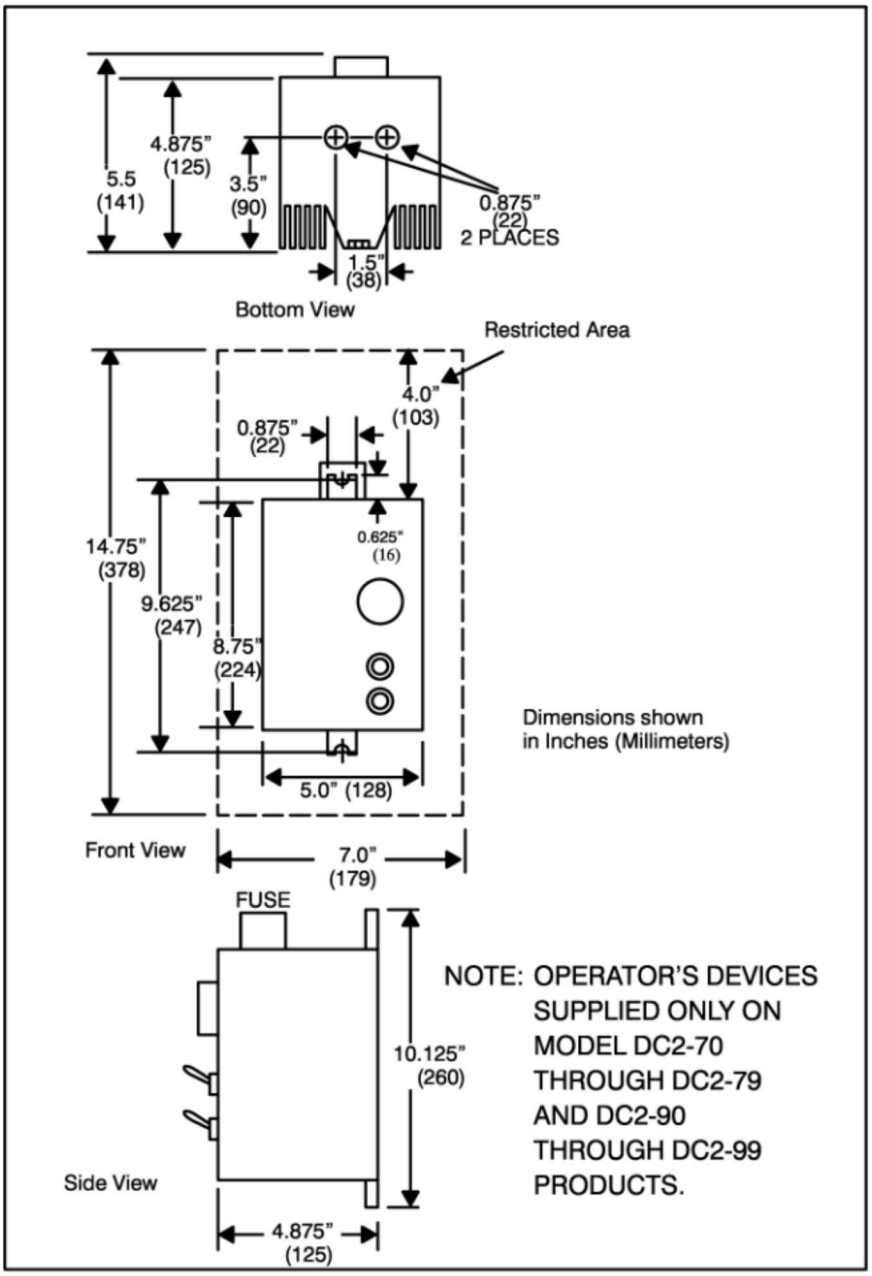


Figure 3-2B. Dimension and Mounting Data for Enclosed Controllers.

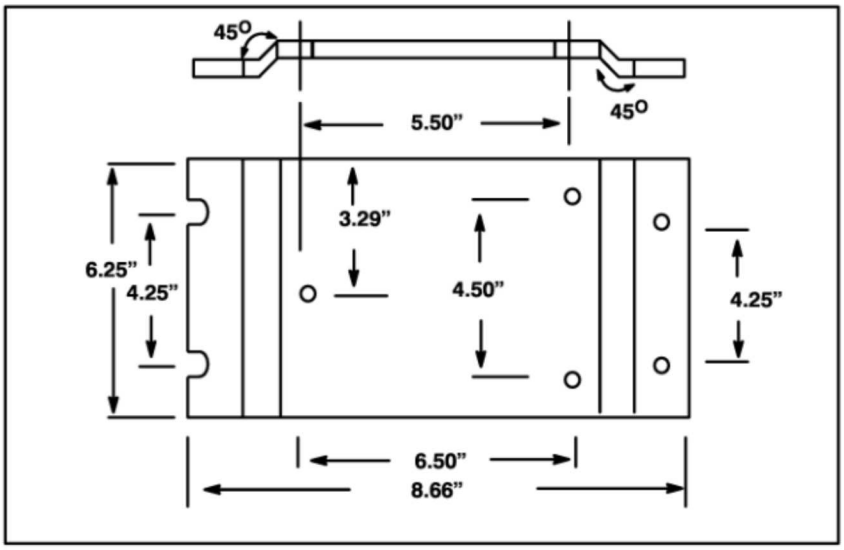


Figure 3.2C. HSI-50 Heatsink Dimensions

Install the Motor

1. Verify that the motor is the appropriate rating to use with the controller.
2. Install the D-C motor in accordance with its own installation instructions.
3. Make sure that coupled applications have proper shaft alignment with the driven machine or that belted applications have proper sheave/belt alignment to minimize unnecessary motor loading.

Install a Disconnect

DANGER

THIS EQUIPMENT IS AT LINE VOLTAGE WHEN A-C POWER IS CONNECTED, DISCONNECT AND LOCKOUT ALL UNGROUNDED CONDUCTORS OF THE A-C POWER LINE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

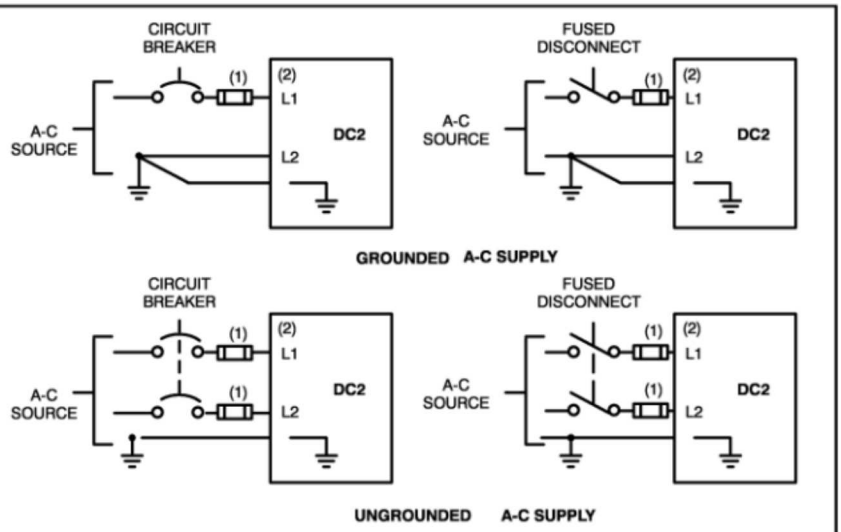
DANGER

SOME DRIVE MODELS ARE NOT EQUIPPED WITH A FUSE AS STANDARD. THE CUSTOMER MUST SUPPLY A CLASS J UL LISTED AND/OR CSA CERTIFIED 20 AMP, 600 V TIME-DELAY FUSE. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

1. Any fused disconnect or circuit breaker in the incoming A-C line must accommodate a maximum symmetrical A-C fault current of 10,000 amperes. See Figure 3-3.
2. Some drive models are shipped without a fuse on the panel (Exception – drive models DC2-71, -78, -91 and -98) therefore the customer must provide an external fuse (Class J UL listed and CSA certified 20 amp, 600 V time-delay fuse).
3. When the RE-020 D-C tachometer option is used, a controller isolation transformer must be used between the A-C power source and the controller to isolate the controller from the A-C power source ground. Each such controller must have its own isolation transformer. The controller chassis must still be tied to the building ground system at the grounding point provided. The transformer is sized per Table 2-4. To eliminate the need for an isolation transformer, use the insulated RE-007 tachometer option and DC2 controller. An auto transformer cannot be used since it will not provide isolation from ground.

WARNING

WHEN THE START/STOP SWITCH DOES NOT INCLUDE AN A-C POWER DISCONNECT FUNCTION IN THE STOP POSITION, THE A-C POWER DISCONNECT SWITCH MUST BE MOUNTED IN CLOSE PROXIMITY TO THE OPERATOR'S START/STOP CONTROLS. THIS IS REQUIRED AS THE DC2 DRIVE DOES NOT HAVE AN ARMATURE LOOP CONTACTOR AND A SINGLE FAULT LIKE A THYRISTOR SHORT MAY CAUSE MOTOR ROTATION WHEN IN THE STOP MODE. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.



(1) Class J UL listed and CSA certified 20 amp, 600 V, time-delay fuse for both drive and branch circuit protection.

(2) If a Class J UL listed and CSA certified 20 amp, 600 volt, time-delay fuse is not used, the customer must order a fuse kit. The fuse contained in the fuse kit provides drive protection only and is rated for 25 amps at 250 volts.

Figure 3-3. Fused Disconnect or Circuit Breaker Connections.

Wire the Drive

DANGER

THE USER IS RESPONSIBLE FOR CONFORMING TO THE NATIONAL ELECTRICAL CODE AND ALL OTHER APPLICABLE LOCAL CODES. WIRING PRACTICES, GROUNDING, DISCONNECTS AND OVERCURRENT PROTECTIONS ARE OF PARTICULAR IMPORTANCE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

DANGER

THIS EQUIPMENT IS AT LINE VOLTAGE WHEN A-C POWER IS CONNECTED. DISCONNECT AND LOCKOUT ALL UNGROUNDED CONDUCTORS OF THE A-C POWER LINE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

NOTE: All remote operation wiring should be no longer than 250 feet.

Ground the Controller and Enclosure, the Motor and the Operator's Control Station.

DANGER

CONNECT THE GROUND WIRE BROUGHT IN WITH THE INCOMING A-C POWER LINE TO THE CONTROLLER GROUND POINT. CONNECT AN APPROPRIATE EQUIPMENT GROUNDING CONDUCTOR UNBROKEN FROM THE CONTROLLER GROUND POINT, THE MOTOR FRAME, THE TRANSFORMER ENCLOSURE IF USED, THE CONTROLLER ELECTRICAL ENCLOSURE, THE WIRING CONDUITS, AND THE OPERATOR'S CONTROL STATION TO AN APPROPRIATE GROUNDING ELECTRODE. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

1. Locate the convienence ground point provided at the bottom edge of the heat sink.
2. Run a suitable equipment grounding conductor **unbroken** from this controller ground point to the plant ground (grounding electrode). A ring lug is recommended at the ground point.
3. Connect a suitable grounding conductor from each conduit to this controller ground point.
4. Connect a suitable equipment grounding conductor to the motor frame, the transformer enclosure if used, and the controller enclosure. Run this conductor **unbroken** to the grounding electrode.
5. Connect the ground wire brought in with the incoming A-C power line to the controller ground point.

Wire A-C Power to the Controller

DANGER

DO NOT OPERATE THE CONTROLLER WITH AVAILABLE SHORT-CIRCUIT CURRENTS IN EXCESS OF 10,000 AMPERES. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

1. Size the A-C line supply conductors for the specific controller rating and according to all applicable codes.
2. Run the A-C line supply through a conduit entry in the bottom of the controller to terminals TB1-L1 and TB1-L2/F1.

Wire the D-C Motor to the Controller

1. Size the motor armature circuit conductors A1 and A2 according to all applicable codes.
2. Run the D-C motor armature leads and the shunt field supply leads (if a permanent magnet field motor is not used) through the same conduit entry used for the A-C line supply.
3. Use the appropriate tightening torque as listed in Table 3-1 for wire connections to input and output terminals.

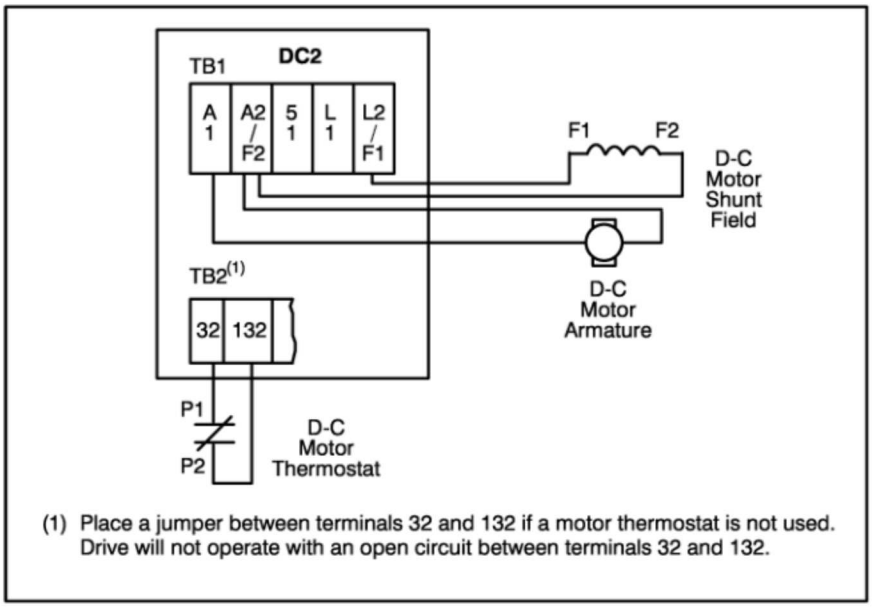
Table 3-1. Terminal Strip TB1/TB2 Tightening Torques (lbs-in).

TB	Terminals	Torque
TB1	Input Terminals 51, L1, L2/F1	All: 9 minimum – 12 maximum in-lbs
TB1	Output Terminals A1, A2/F2	
TB2	Thermostat 32, 132	4 in-lbs

CAUTION: If motors other than a straight shunt are used with the DC2 controller and an S1 and S2 winding is present on the motor, additional motor connections other than those detailed in this instruction manual are applicable. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

4. **For all models (except DC2-71, 78, 91 and 98 Reversing and Dynamic Braking Models):** If CCW motor rotation is desired looking from the back of the motor or the shaft end), connect motor armature leads A1 and A2 to controller terminals TB1-A1 and TB1-A2/F2, respectively, as shown in Figure 3-4. If CW motor rotation is desired (looking from the back of the motor or the shaft end), reverse the motor armature connections at the motor.

   For the Reversing and Dynamic Braking Models DC2-71, 78, 91 and 98 only: If CCW motor rotation is desired when the Forward/Off/Reverse switch is in the FORWARD position (looking from the back of the motor or the shaft end), connect motor armature leads A1 and A2 to controller terminals TB3-A1 and TB3-A2, respectively. If CW motor rotation is desired (looking from the back of the motor or the shaft end), reverse the motor armature connections at the motor.



(1) Place a jumper between terminals 32 and 132 if a motor thermostat is not used. Drive will not operate with an open circuit between terminals 32 and 132.

Figure 3-4. Armature, Field and Thermostat (CCW Rotation) Connections

5. Connect the motor shunt field supply leads F1 and F2 to controller terminals TB1-L2/F1 and A2/F2, respectively. See Figure 3-4.

   Some Reliance shunt wound D-C motors are supplied with dual voltage, reconnectable fields, 50/100 volts or 100/200 volts. Reference Table 2-4 (Controller Ratings by Motor Horsepower) in this manual and note the available field voltage(s). See Figure 3-5 for field connections.

6. Verify that the field is connected as shown on the motor nameplate or the connection diagram in the terminal box on the motor.

7. Connect the motor thermostat leads P1 and P2 to controller terminal TB2-32 and TB2-132, respectively, See Figure 3-4.

   If a motor thermostat is not used, another means of motor overload thermal protection must be used and a jumper must be placed between terminals 132 and 32 on TB2.

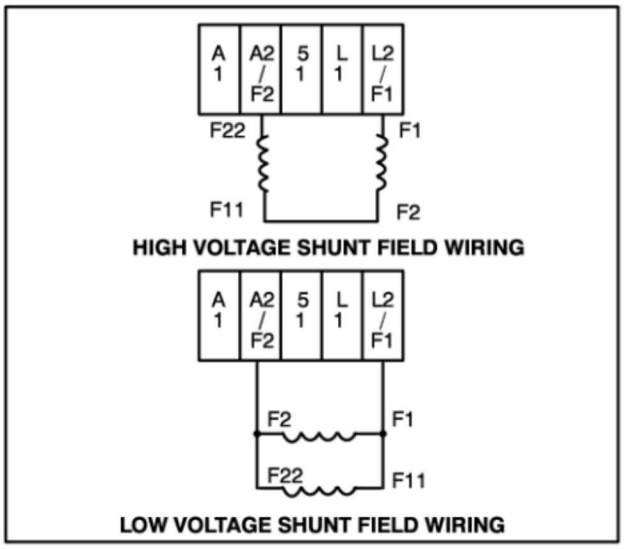


Figure 3-5. Connection for Dual Voltage Fields

Wire the Start/Stop Circuit

For drives without operator devices on the controller:

1. Run the Start/Stop pushbutton or normally open contact wiring in the remaining conduit entry separate from the A-C and D-C power wiring.

WARNING

THE FACTORY INSTALLED JUMPER MUST BE REMOVED FROM BETWEEN CONTROLLER TERMINALS 51 AND L1 IF THE STOP SWITCH IS TO BE WIRED TO THESE TERMINALS. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

WARNING

A MAINTAINED CLOSED CONTACT CAN CAUSE THE CONTROLLER TO AUTOMATICALLY RESTART IF LINE INPUT POWER IS REMOVED AND THEN RE-APPLIED. DO NOT USE A MAINTAINED CONTACT UNLESS THE MACHINE IS SUITABLY PROTECTED. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

2. Use the appropriate tightening torque as listed in Table 3-2 for wire connections to input and output terminals.

Table 3-2. Terminal Strip TB2/TB4 Tightening Torques (lbs-in).

TB	Terminals	Torque
TB2	32, 132, 35, 38, 419, 519, 326, 156, 157, 126	4 in-lbs
TB4	6+, 5–	4 in-lbs

3. Connect the Start/Stop pushbutton (Use Reliance part #49869-17A or equivalent) or normally open contact as shown in Figure 3-6.

4. If start/stop control is remote, remove the factory-installed jumper between terminals TB2-35 and TB2-132. See Figure 3-6. With the operator's start/stop controls mounted remotely from the controller, the A-C fused disconnect or circuit breaker must be mounted in close proximity to the operator controls.

WARNING

WHEN THE START/STOP SWITCH DOES NOT INCLUDE AN A-C POWER DISCONNECT FUNCTION IN THE STOP POSITION, THE A-C POWER DISCONNECT SWITCH MUST BE MOUNTED IN CLOSE PROXIMITY TO THE OPERATOR'S START/STOP CONTROLS. THIS IS REQUIRED AS THE DC2 DRIVE DOES NOT HAVE AN ARMATURE LOOP CONTACTOR. A SINGLE FAULT LIKE A THYRISTOR SHORT MAY CAUSE MOTOR ROTATION WHEN IN THE STOP MODE. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

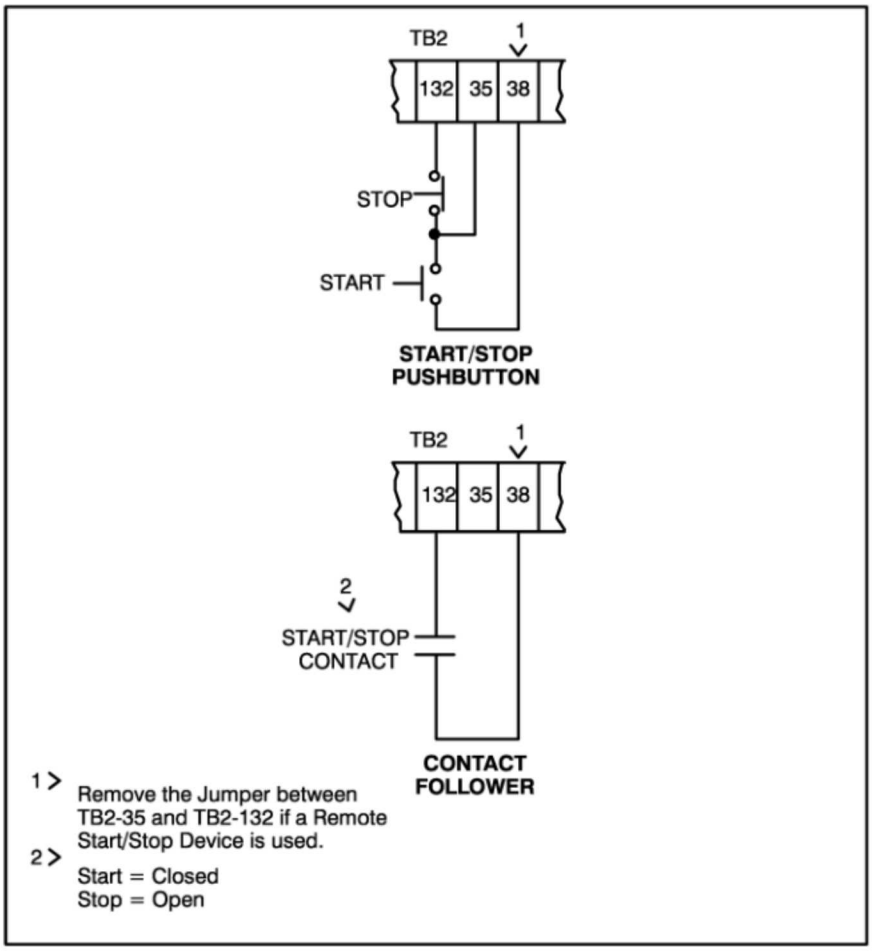
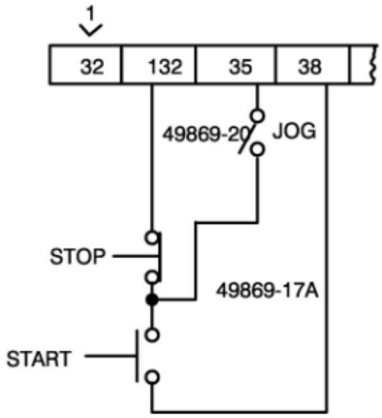


Figure 3-6. Start/Stop Circuit Connection.

Wire the Run/Jog Circuit

For drives without operator devices on the controller:

1. Run the Run/Jog wiring in conduit separate from the A-C and D-C power wiring.
2. Use the appropriate tightening torque as listed in Table 3-2 for wire connections to input and output terminals.
3. Wire the Run/Jog switch as indicated in Figure 3-6A.



1> Jumper 32 to 132 or connect a motor thermostat.

Figure 3-6A. Basic Run/Jog Circuit Connections.

Wire the Reference Signal Potentiometer

For drives without operator devices on the controller:

1. Run all reference wiring in the same conduit as the Start/Stop control wiring separate from the A-C and D-C power wiring.
2. Use the appropriate tightening torque as listed in Table 3-2 for wire connections to input and output terminals.
3. Use #16 AWG cable that is twisted triple conductor with at least two twists per inch.

DANGER

BECAUSE THE REFERENCE POTENTIOMETER IS CONNECTED THROUGH THE REGULATOR TO THE ARMATURE POWER CIRCUIT, ITS TERMINALS ARE AT LINE POTENTIAL. USE A POTENTIOMETER THAT HAS A PLASTIC SHAFT TO INSULATE THE OPERATOR KNOB FROM THIS POWER CIRCUIT AND THAT IS CAPABLE OF WITHSTANDING HI-POT TESTS AT 2000 VOLTS D-C FOR ONE MINUTE. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

4. Connect a 5K ohm, 0.25 watt pot having an insulated operator shaft and knob, such as Reliance Model 14C230 or equivallent, as shown in Figure 3-7.

Wire the Process Control and/or Automatic/Manual Devices (if required)

Selected controller models have a high impedance input to interface with process signals. If both manual control (controller responds to a reference potentiometer) and process control (controller responds to an automatic signal) are desired, an Automatic/Manual switch is included in selected controller models.

1. Use #16 AWG unshielded cable that is twisted double conductor with at least two twists per inch.
2. Use the appropriate tightening torque as listed in Table 3-2 for wire connections to input and output terminals.
3. Wire the process control signal to terminals TB4(6+) and TB4(5−). See Figure 3-7.
4. Wire the process control buffered output TB2-126 to TB2-326. See Figure 3-7.
5. Wire the Automatic/Manual switch, if required, as shown in Figure 3-7.

Wire the D-C Tachometer Speed Feedback Signal

DANGER

BECAUSE THE TACHOMETER IS CONNECTED THROUGH THE REGULATOR TO THE ARMATURE POWER CIRCUIT, THE TACHOMETER TERMINALS ARE AT LINE POTENTIAL. DISCONNECT ALL INPUT POWER TO THE DRIVE BEFORE SERVICING. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY OR LOSS OF LIFE.

All of the controllers, except the DC2-71, 78, 91 and 98 or one the user has configured for motor reversing, can utilize a D-C tachometer as speed feedback. The tachometer must have a voltage range of 18.5 to 21.0 volts per 1000 RPM or 6.5 to 7.0 volts per 1000 RPM, maximum of 37 volts at maximum speed.

1. Run the two tachometer signal leads in a separate conduit from the motor to the controller.
2. Use #16 AWG unshielded two wire cable that is twisted at least two twists per inch.
3. Use the appropriate tightening torque as listed in Table 3-2 for wire connections to input and output terminals.
4. Connect the D-C tachometer so that the tach lead connected to terminal 519 is more positive than the tach lead connected to terminal 419 for the desired direction of rotation. Refer to Figure 3-8.

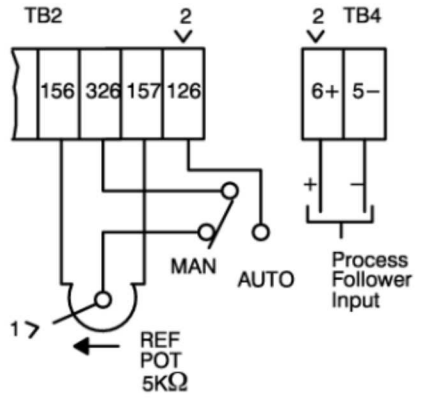
WIRING

REVERSE CONNECTION WILL CAUSE THE MOTOR TO RUN AT MAXIMUM UNCONTROLLED SPEED. THE D-C TACHOMETER MUST BE CONNECTED SUCH THAT THE TACH LEAD CONNECTED TO TERMINAL 519 IS MORE POSITIVE THAN THE NEGATIVE TACH LEAD CONNECTED TO TERMINAL 419 FOR THE DESIRED DIRECTION OF ROTATION. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

5. Connect an isolation transformer must be used between the A-C power source and the controller to isolate the controller from the A-C power source ground. Each such controller must have it's own isolation transformer.

   NOTE: Any DC2 controller used in a motor reversing application cannot employ a D-C tachometer speed feedback.

   NOTE: A D-C tachometer used as a speed feedback signal for one controller cannot be used as the speed reference signal for another controller.



1> The reference potentiometer must be 5KΩ, 0.25 Watt with a minimum dielectric strength of 2500 volts A-C RMS, such as Reliance Part Number 401286-41H, or equivalent

2> On 0-57210-31 Regulator Boards only

Figure 3-7. Reference Signal Connection.

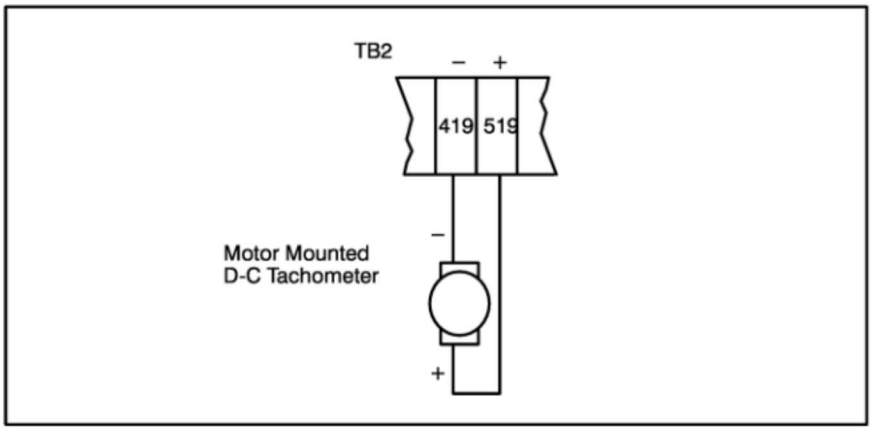


Figure 3-8. D-C Tachometer Connection.

4: Setup and Adjust the Drive

DANGER

ONLY QUALIFIED ELECTRICAL PERSONNEL FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF THIS EQUIPMENT AND THE HAZARDS INVOLVED SHOULD INSTALL, ADJUST AND/OR SERVICE THIS EQUIPMENT. READ AND UNDERSTAND THIS MANUAL IN ITS ENTIRETY BEFORE PROCEEDING. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

DANGER

THIS EQUIPMENT IS AT LINE VOLTAGE WHEN A-C POWER IS CONNECTED. DISCONNECT AND LOCKOUT ALL UNGROUNDED CONDUCTORS OF THE A-C POWER LINE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

Review all setup and adjustment instructions thoroughly before making any adjustments or applying power to the controller. For your convenience throughout the setup and adjustment procedures, use Figure 4-1 or Figure 4-1A to locate adjustment pots, terminal boards, special selector jumpers and pins. Wiring diagrams are given in Figures 5-1, 5-1A, 5-2 and 5-3.

Position the Controller Jumpers to Fit Application

The controller can operate on either 115V or 230V at multiple horsepower ratings and in various modes. Make sure the circuit jumpers are properly set for the application as described on the following pages. See Figure 4-1, which locates these special selector jumpers and pins.

J4: A-C Input Voltage Jumper

NOTE: This jumper is on all controller models and is factory set for 230 VAC.

1. Verify that J4 is positioned to match A-C input line power.
2. If operation is on 115V, relocate J4 to the 115-volt jumper position.

J3: Voltage/Tach Feedback Selection Jumper

NOTE: This jumper is on all controller models and is factory set for a voltage feedback of 180V.

1. If operation is to be on 115V with voltage feedback, relocate J3 to the 90V jumper position.
2. If a tachometer feedback is to be is used, relocate J3 to 'TACH' position irrespective of input voltage.

J200: Tachometer Scaling Jumper

NOTE: This jumper is on all controller models and is factory set for 7 VDC/1000 tachometer scaling (pins 1 and 2).

1. If 20.8 VDC/1000 tachometer scaling is desired, relocate jumper to the 21V position (pins 3 and 4).
2. If the controller is to be used as a voltage regulator, or torque regulator, leave this jumper set for the factory setting of 7 VDC/1000 (pins 1 and 2).

J5: Controller Output Current Jumper

NOTE: This jumper is on all controller models and is factory set for 2.5 amperes.

1. Select the appropriate controller output current rating from the Table 4-1.
2. Position J5 for the current rating selected in Step 2.

Table 4-1. Controller D-C Output Current Rating.[1]

Motor HP	Controller Output Current Rating by Input Voltage Rating	
	115 VAC	230 VAC
1/4	2.5	–
1/3	5.0	–
1/2	5.0	2.5
3/4	7.5	5.0
1	10.0	5.0
1-1/2	–	7.5
2	–	10.0

[1] Measured with average reading D-C ammeter.

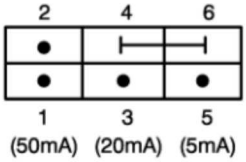
J8: Process Control Interface Jumper (On 0-57210-31 Regulator Boards only)

NOTE: This jumper is on process control interface controllers (Models DC2-42, 44, 46, 52, 54, 56, 62, 64, 66, 72, 74, 82, 84, 92, 94 and 97) and is factory set for a 10V input signal.

1. Select the J8 jumper position based on the process control signal to be used:

Process Control Signal	Jumper Position	Input Impedance
1 – 5 mA	5 mA (Pins 5 and 6)	2KΩ
4 – 20 mA	20 mA (Pins 3 and 4)	450Ω
10 – 50 mA	50 mA (Pins 1 and 2)	200Ω
0 – 10 VDC	10 V (Pins 4 and 6)	666Ω

NOTE: Rotate jumper 90° to select 5, 20, or 50 mA input signals.



J201: Minimum Speed Disable

WARNING

THE DRIVE IS INTENDED TO OPERATE AT A PREDETERMINED MINIMUM SPEED UNLESS DISCONNECTED FROM THE POWER SOURCE. IF THE APPLICATION REQUIRES ZERO SPEED OPERATION WITHOUT SUCH DISCONNECTION, THE USER IS RESPONSIBLE FOR ASSURING SAFE CONDITIONS FOR OPERATING PERSONNEL BY PROVIDING SUITABLE GUARDS, AUDIBLE OR VISUAL ALARMS, OR OTHER DEVICES. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

NOTE: A jumper (Reliance part # 405504-69D) is provided in a plastic bag shipped with the drive.

1. Place the jumper on position J201.
2. Turn MIN SPEED potentiometer fully counter-clockwise to obtain zero minimum speed.

J202: S-Curve Acceleration

NOTE: A 4.7 µFD (Reliance part #69380-51PS) capacitor is provided in a plastic bag shipped with the drive.

1. Attach the capacitor to J202 (pins 1 and 2) if S-Curve acceleration characteristics are desired.

J203: Regulation Mode Jumper

NOTE: Do not move this jumper on 0-57210-30 Regulator Boards.

1. For Voltage/Speed regulation, place jumper on pins 2 and 4.
2. For Torque regulation, place jumper on pins 1 and 3.

J401: Rate Range Jumper (On 0-57210-31 and 0-57210-32 Regulator Boards only)

NOTE: This jumper is factory set for the slow rate range (upper and middle pins). The slow rate range is 3.5 to 40 seconds.

1. Select the fast rate range for better resolution. To select the fast rate range (0.3 to 3.5 seconds), move this jumper to the lower and middle pins.

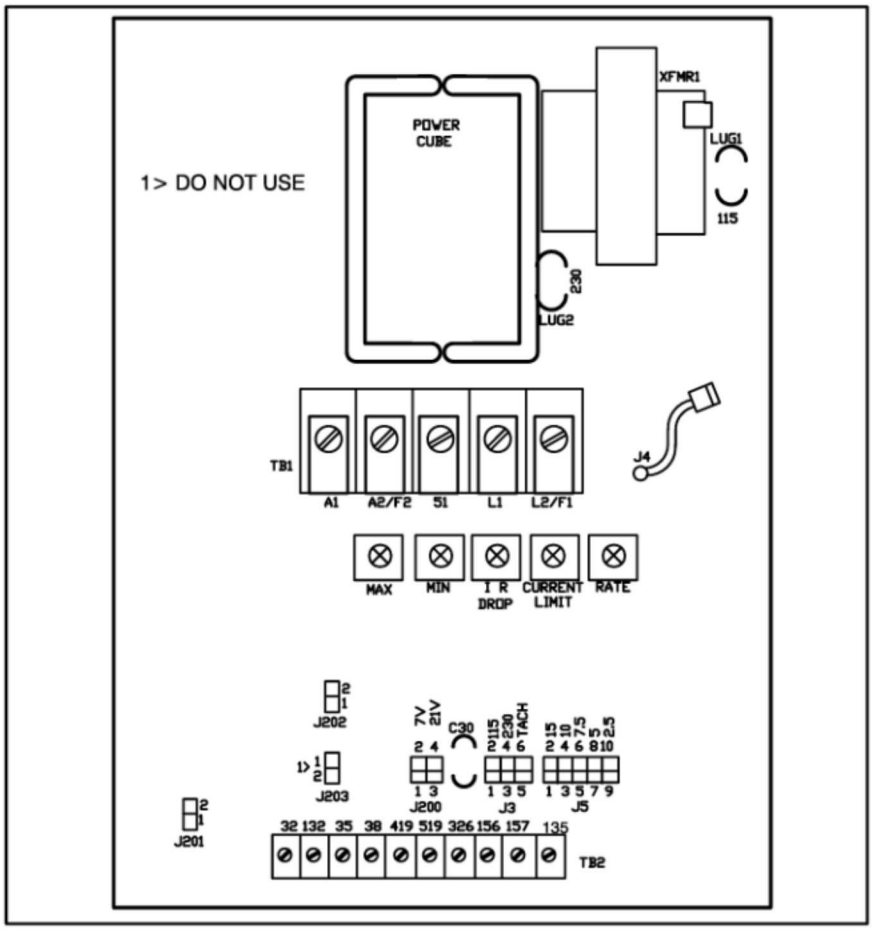


Figure 4-1. Controller Circuit Board Jumper, Pin and Potentiometer Locations (0-57210-30 Regulator Boards only).

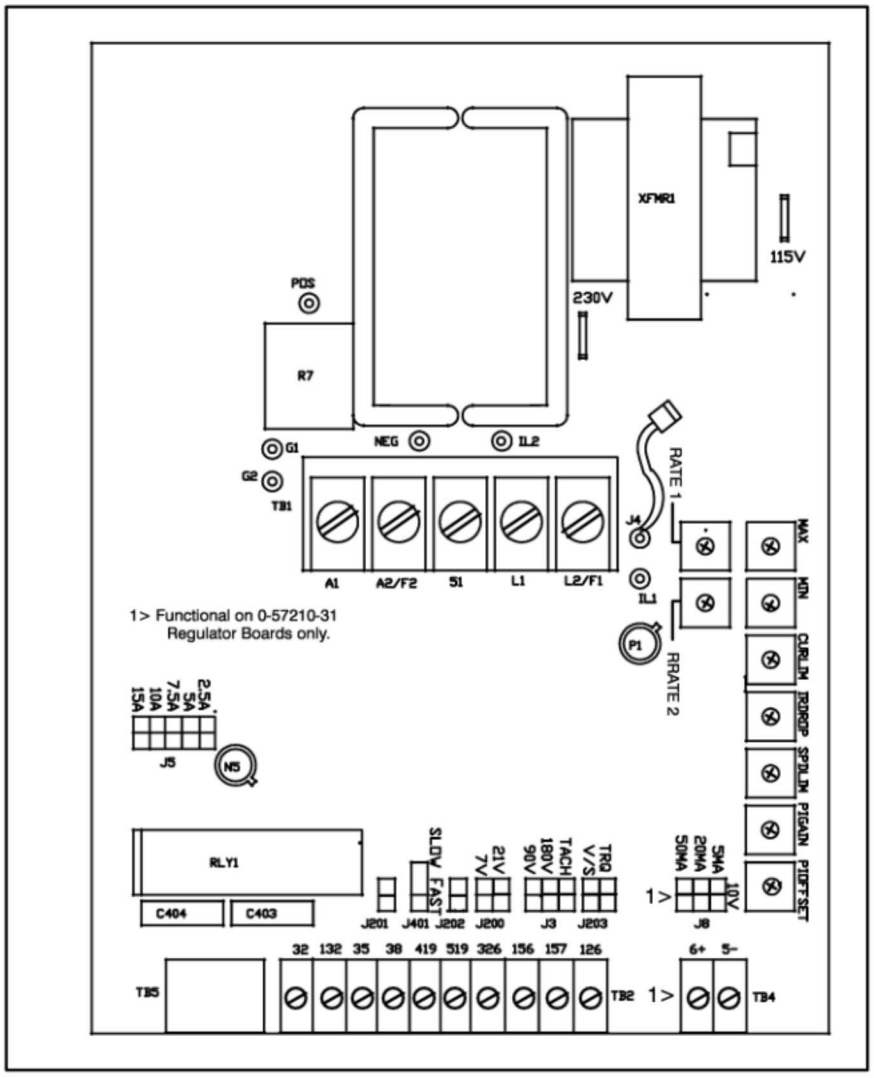


Figure 4-1A. Controller Circuit Board Jumper, Pin and Potentiometers Locations
(0-57210-31 and 0-57210-32 Regulator Boards only)

Startup and Adjust the Controller

NOTE: This procedure covers Speed Control, Process Control, and Torque Control controllers. Therefore, you will find references to "speed, process or torque" when the type of control is important.

1. Verify that the circuit board pots (Figure 4-1) are set as indicated below:

With Speed Control models:

- MAX – fully CCW
- MIN – fully CCW
- IR DROP – fully CCW
- CURRENT LIMIT – 50% of full scale
- RATE – 75% of full scale (A clockwise rotation decreases acceleration time and increases rate).
- PI GAIN (on Process Control models only) – fully CCW
- PI BIAS (on Process Control Models only) – fully CCW

With Torque Control models:

- MAX – fully CCW
- MIN – fully CCW
- IR DROP – fully CCW
- CURRENT LIMIT – 50% of full scale
- RATE 1 and RATE 2 – 75% of full scale
- PI GAIN (on Process Control models only) – fully CCW
- PI BIAS (on Process Control models only) – fully CCW
- SPD LIM – fully CCW

2. Set the operator's speed or torque potentiometer fully CCW.
3. If your controller includes process control, push the Automatic/Manual switch to Manual; otherwise proceed to Step 4.
4. If your controller includes a Forward/Off/Reverse switch, set the switch to the Forward position and proceed to Step 5.

DANGER

THE REMAINING STEPS ARE MADE WITH POWER ON. EXERCISE EXTREME CAUTION AS HAZARDOUS VOLTAGE EXISTS. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

5. Apply A-C input power.

6. Check the direction of motor rotation:
   - Press START and quickly press STOP to verify correct motor rotation. If the motor shaft doesn't rotate because all potentiometers are set to minimum levels, turn the Speed or Torque potentiometer slightly CW and repeat this start/stop operation.
   - If motor shaft rotation is incorrect, press the Stop switch and wait for the motor to completely stop. Remove A-C input power, and reverse the motor armature power leads A1 and A2 at the motor. Reapply A-C input power and repeat the direction of rotation check.
   - On applications utilizing D-C tachometer speed feedback, when the direction of rotation of the motor is changed, the polarity of the tachometer also changes. The connection of the tachometer must remain 419 negative with respect to 519 for a given direction or rotation.

DANGER

THE D-C TACHOMETER MUST BE CONNECTED WITH THE NEGATIVE LEAD TO TERMINAL 419 AND THE POSITIVE LEAD TO TERMINAL 519 FOR THE DESIRED DIRECTION OF ROTATION. REVERSE CONNECTION WILL CAUSE THE MOTOR TO RUN AT MAXIMUM UNCONTROLLED SPEED. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

7. On controllers employing D-C tachometer speed feedback, the following steps may be used to determine the correct direction of rotation and the correct polarity of the D-C tachometer speed feedback signal.
   - Turn off power.
   - Reconnect unit as a voltage regulator. Make sure J3 jumper is at the appropriate voltage level.
   - Remove the D-C tachometer leads from terminals 419 and 519, clearly marking the leads to distinguish one from the other, and connect a D-C voltmeter (0 to 60 volt scale) to the D-C tachometer leads.
   - Turn on power.
   - With the desired direction of motor rotation established, using the voltmeter that is connected to the D-C tachometer signal leads, determine the polarity of the D-C tachometer leads. Mark the negative polarity lead 419 and the positive lead 519.
   - Stop the controller, remove A-C power, replace the J3 jumper to the tachometer position and connect the D-C tachometer leads to the controller as noted above, (−) 419 and (+) 519.
8. Adjust the speed or torque range:

WARNING

DO NOT DEPEND ON THE MINIMUM POSITION OF THE SPEED OR TORQUE SETTING POT TO STOP THE MOTOR. IN THE MINIMUM POSITION, THE CONTROLLER AND MOTOR ARE STILL ENERGIZED. THE DRIVE MAY RESTART UNEXPECTEDLY. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

With Speed Control models:

- Use a hand-held tachometer to monitor motor speed; or use a multimeter to measure armature voltage, which is approximately proportional to speed (115-volt control: 90 VDC = 100% speed; 230-volt control: 180 VDC = 100% speed).
- Press the Start button and slowly turn the Speed potentiometer to maximum (fully CW). The motor should run at about 50% of maximum.
- Slowly turn MAX CW until about 80% speed is reached.
- Turn the Speed potentiometer fully CCW.
- Turn MIN CW until the desired minimum speed is reached.
- Since the MIN and MAX potentiometers interact, repeat the Speed Control procedure until the desired maximum and minimum speeds are reached.

With Torque Control models:

Torque control models must only be used when synchronizing this driven machine section with other process machine sections on which there is a drive that consistently and reliably establishes line speed.

- Load the motor with a reasonably constant load over the speed range. Such a system may be a pre loaded dancer loop preceding a center driven winder. See Figure 4-2.
- Provide a means of measuring torque, such as measuring armature current. For example, for a 1 HP motor at 180 VDC rated at a armature current of 5 amps and with a base speed of 1750 RPM:

$$\frac{1\ \text{HP} \times 5250}{1750\ \text{RPM}} = 3\ \text{ft-lbs}$$

  Therefore, 5 amps equals 3 ft-lbs.

- Re-establish the torque load on the motor and load the motor to maximum torque.
- Press the Start button and slowly turn the Torque potentiometer to maximum (fully CW).
- Slowly turn SPD LIM potentiometer CW until measured torque no longer increases.
- Slowly turn MAX (CW) until the maximum desired torque is reached.
- Turn the torque potentiometer fully CCW.
- Slowly turn MIN CW until the minimum desired torque is reached.
- Since the MIN and MAX potentiometers interact, repeat this Torque Control procedure until the maximum and minimum torques are reached.

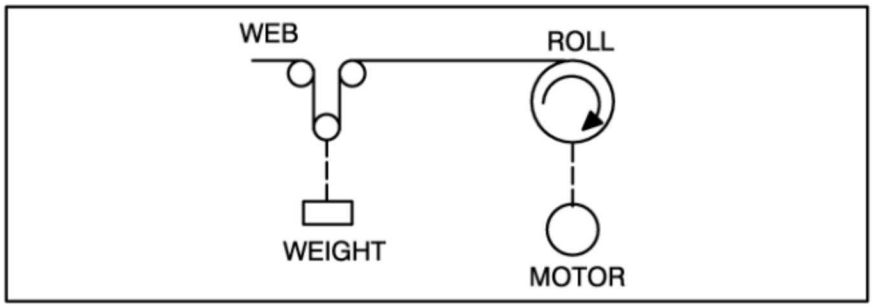


Figure 4-2. Pre-loaded Dancer Loop Preceding Winder.

9. Adjust the current or speed limit:

With Speed Control models:

The maximum D-C current output from the controller with CURRENT LIMIT potentiometer set full CW is greater than 150%, possibly 200% maximum, of the J5 armature current setting. If 150% of the J5 armature current is excessive for the application or if stress on the driven equipment must be reduced, turn CURRENT LIMIT in the CCW direction until adequate setting is obtained.

With Torque Control models:

- With minimum load torque (motor disconnected or an empty winder roll without web), turn the Torque potentiometer fully CW and SPD LIM fully CCW.
- Adjust speed limit with SPD LIM for maximum desired motor application speed or 90/180 VDC on the armature.
- Return the Torque potentiometer fully CCW.

10. Adjust the IR Comp:

With Speed Control models only: If the torque demand on the drive motor is relatively uniform, IR drop compensation is not required. Turn IR DROP to zero (CCW).

On models employing D-C tachometer speed feedback, the IR Drop Compensation potentiometer should be set at zero, fully CCW.

If the load torque is changing (i.e., a conveyor that can be empty and then some time later loaded with material), the increased load will cause a speed change. This speed change may be compensated with IR DROP. (Fig 4-3) Turn IR DROP slightly CW until this droop is minimized. After adjusting IR drop compensation to minimize speed change with load the maximum and minimum speed settings should be rechecked for proper settings. Note that excessive IR drop compensation can cause motor instability and hunting. A Tachometer should be used for better speed regulation.

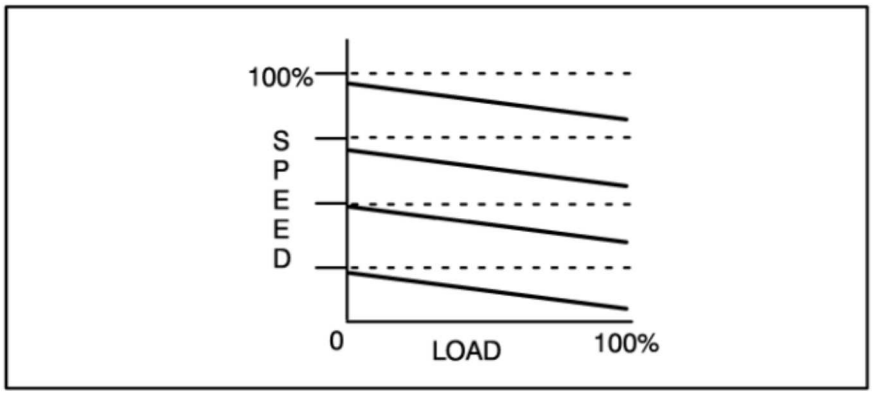


Figure 4-3. Fixed Speed Droop With Load Change

With Torque Control models:

- IR drop compensation is used to reduce the speed rise above the speed limit threshold due to a loss of load torque.
- Turn IR DROP to minimize speed rise due to loss of load.
- Note that excessive IR drop compensation can cause motor instability and hunting. Motors that have a speed drop that varies excessively with operating speed cannot use IR drop compensation. A tachomter should be used for better speed regulation.

11. Press the Stop switch and wait for the motor to completely stop. Remove A-C input power.
12. If you have a Process Control model, proceed to "Setup the Process Interface."

Setup for Process Interface (On 0-57210-31 Regulator Boards only)

NOTE: The process control input (plus and minus) is buffered from the armature circuit by 300K ohms of resistance. The buffered reference signal output on TB4-126 is positive with input TB4(6+) and TB4(5−). Inputs at TB4(6+) or TB4(5−) may be grounded or left ungrounded as required by the signal source equipment.

1. Disconnect power.
2. Push the Automatic/Manual switch to Auto.

DANGER

THE PROCESS INTERFACE SIGNAL INPUT TERMINALS TB4(6+) AND TB4(5−) ARE RESISTIVELY ISOLATED FROM LINE POTENTIAL WHEN A-C POWER IS CONNECTED. DISCONNECT AND LOCKOUT ALL UNGROUNDED CONDUCTORS OF THE A-C POWER LINE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

3. Verify that jumper J8 is properly positioned for your reference signal.
4. Apply A-C input power and then press the Start button.

WARNING

ADJUSTMENT OF THE PROCESS INTERFACE BIAS POTENTIOMETER COULD RESULT IN ZERO SPEED OPERATION OF THE CONTROLLER. THE DRIVE IS INTENDED TO OPERATE AT A PREDETERMINED MINIMUM SPEED UNLESS DISCONNECTED FROM THE POWER SOURCE. IF THE APPLICATION REQUIRES ZERO SPEED OPERATION WITHOUT SUCH DISCONNECTION, THE USER IS RESPONSIBLE FOR ASSURING SAFE CONDITIONS FOR OPERATING PERSONNEL BY PROVIDING SUITABLE GUARDS, AUDIBLE OR VISUAL ALARMS, OR OTHER DEVICES. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

5. Command minimum reference from your process control unit and adjust PI BIAS to the desired minimum operating speed or torque.
6. Increase the process control reference signal to maximum and adjust PI GAIN to the desired maximum operating speed or torque. It may be necessary to repeat Steps 5 and 6 until proper maximum and minimum speed or torque are attained because these adjustments interact.
7. Press the Stop switch and wait for the motor to completely stop.

Adjust Rate Potentiometer(s)

With Speed Control models:

Adjust RATE 1 and RATE 2 for desired acceleration and deceleration rates.

With Torque Control models:

1. Set J401 for Fast or Slow rate range:

NOTE: F (Fast) setting is used for finer resolution at faster rates.

S(Slow) – 3.5 to 40 seconds
F(Fast) – 0.3 to 3.5 seconds

2. Adjust RATE 1 for the desired acceleration rate.
3. Adjust RATE 2 for the desired deceleration rate.

5: Service the Drive

DANGER:

ONLY QUALIFIED ELECTRICAL PERSONNEL FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF THIS EQUIPMENT AND THE HAZARDS INVOLVED SHOULD INSTALL, ADJUST, AND/OR SERVICE THIS EQUIPMENT. READ AND UNDERSTAND THIS MANUAL IN ITS ENTIRETY BEFORE PROCEEDING. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

Should you encounter any difficulty with the operation of your controller, review Table 5-2 before performing any troubleshooting on the drive.

The controller contains all regulator circuitry on one printed circuit board and all power conversion components (thyristors and diodes) in one power cube. If you determine that there has been a failure in either of these, replacement parts are available from Reliance. Refer to Table 5-1 for specific DC2 parts. Figures 5-1, 5-2 and 5-3 are wiring diagrams of controller and operator device configurations.

Table 5-1. Controller Replacement Parts[1]

Description	Reliance Part Number
All models: Fuse (25A)	64676-61AR
Power Cube All models	701819-14AB
Circuit Board DC2-40, 45, 50, 60, 65, 70, 71, 75, 78, 80, 90, 91, 98, 99	0-57210-30
DC2-42, 44, 46, 54, −56, 64, 74, 84, 94 DC2- 52, 62, 66, 72, 76, 82, 92, 97	0-57210-31
DC2-43, 53, 63, 73, 83, 93	0-57210-32

1> These parts are available from your local Reliance Electric Distributor or direct from Reliance.

Reliance Electric Industrial Company
Cleveland Service Center
4950 East 49th Street
Cleveland, Ohio 44125
Order Entry Phone: 216-266-7247

Table 5-1. Controller Replacement Parts[1]
(Continued)

Description	Reliance Part Number
Speed Pot (1-turn) DC2-70, 71, 72, 73, 74, 75, 76 78, 79, 90, 91, 92, 93, 94, 96, 98, 99	401286-48SFX
Speed Pot (10-turn) DC2-95, 97	600594-14SFX
Start/Stop Switch DC2-70, 71, 72, 73, 74, 76, 78, 79, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99	49869-17A
Reversing Switch DC2-71, 78, 91, 98	608870-90R
Run/Jog Switch	49869-20A
Auto Manual Switch	49869-20A
Braking Resistor DC2-71, 78, 91, 98	63481-49AM
Toggle Switch Boots Controllers for NEMA 4/4X/12	4DC20000
Conduit Hole Plugs for NEMA 12 Controllers	197308A
Conduit Hubs for NEMA 4/4X/12 Controllers	608826-2A
Fuse Kits: – Customer Installed • For all models (except DC2-40 series and DC2-71, 78, 91 and 98) • DC2–40 series	 F2DC2000[2] F1DC2000[2]

1> These parts are available from your local Reliance Electric Distributor or direct from Reliance.

Reliance Electric Industrial Company
Cleveland Service Center
4950 East 49th Street
Cleveland, Ohio 44125
Order Entry Phone: 216-266-7247

2> Reference D2-3250 Instruction Manual for installation instructions.

DANGER

SERVICING IS DONE WITH POWER ON. EXERCISE EXTREME CARE AS HAZARDOUS VOLTAGE EXISTS. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

Table 5-2. Servicing Steps.

Indication	Possible Cause	Corrective Action
Controller incoming line fuse blows when power is applied to the controller.	Faulty incoming A-C line wiring or an inadvertent ground in the branch circuit or within the controller enclosure.	Check all incoming A-C wires and terminations to and within the controller. Correct any faulty wiring and remove any grounds. Replace blown fuse.
	Shorted SCR or faulty regulator	Replace entire controller.
Controller incoming line fuse blows when Start command is given	Motor armature shorted or grounded.	Repair or replace motor. Replace blown fuse.
	Shorted SCR or faulty regulator	Replace entire controller.
	Loose or corroded connection or faulty, incorrect or grounded wiring.	Check that all connections and wiring between the line, controller and motor are correct. Replace blown fuse.
	Sudden, severe application of overload to the motor.	Investigate driven equipment for possible cause and correct. Replace blown fuse.
	Circuit board faulty.	Replace entire controller.
Motor does not rotate.	Faulty, incorrect or grounded wiring.	Check all external wires and terminations at the controller. Check all wiring within the motor conduit box. Correct any faulty wiring.
	Incoming line fuse blown and/or upstream protection devices open.	Investigate upstream equipment for possible cause and correct. Replace blown fuse.
	Open or faulty manual speed or torque potentiometer.	Check all speed or torque pot wiring and the operation of speed or torque potentiometer. Correct.
	With Process Control models; faulty, misconnected or miscalibrated reference signal.	Check automatic reference signal for presence and value. Check for proper polarity. Check jumper for proper calibration. Correct as necessary.

Table 5-2. Servicing Steps. (Continued)

Indication	Possible Cause	Corrective Action
Motor does not rotate. (Continued)	Start/Stop or Forward/Off/ Reverse switch faulty or in the incorrect position.	Investigate and/or replace switch as necessary.
	Motor thermostat open. Open on 32 & 132	Check for continuity with ohmmeter. Let motor cool if found to be open.
	Open circuit between terminals 132 and 35. Either a jumper or normally closed remote stop device must be connected between these two terminals in order for the drive to operate.	Repair faulty switch or insert jumper as required.
	Current feedback jumper set lower than applied motor horsepower.	Recheck and reset as necessary.
Drive will not go to zero speed or torque.	**WARNING** **DO NOT DEPEND ON THE MINIMUM POSITION OF THE SPEED OR TORQUE SETTING POT TO STOP THE MOTOR. IN THE MINIMUM POSITION, THE CONTROLLER AND MOTOR ARE STILL ENERGIZED. NOISE, IMPROPER WIRING, POWER LINE DISTURBANCES, MALFUNCTIONING COMPONENTS, OR MECHANICAL BINDING MAY CAUSE THE DRIVE TO RESTART UNEXPECTEDLY. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.**	Follow the instructions provided in this manual to configure the drive for zero speed (J201: Minimum Speed Disable).
	Controller faulty.	Replace entire controller.

Table 5-2. Servicing Steps. (Continued)

Indication	Possible Cause	Corrective Action
Motor does not reach top speed or deliver rated torque.	Low line voltage.	Check for rated line voltage and correct if not within 10% of the input voltage rating.
	With Process Control models, improperly set maximum speed pots.	Reset maximum speed pots.
	With Process Control models, reference signal producing less than expected maximum value.	Adjust source of automatic reference signal or proper output signal range.
	Overload.	Check for cause of overload and correct.
	Improper position jumper.	Check and reconnect jumper(s) as necessary: • J200: Tach Scaling Jumper • J3: Controller Output Current Jumper
	Faulty circuit board.	Replace entire controller.
Unstable speed or poor regulation when applied as an armature voltage regulator.	Incorrectly set IR drop compensation pot.	Readjust IR drop compensation pot. Check tachometer.
	Faulty circuit board.	Replace entire controller.
Incorrect speed with tachometer feedback.	Improper feedback selection at J3.	Check J3 for proper feedback selection and reposition as required.
Motor runs at maximum uncontrolled speed with tachometer feedback	D-C tachometer polarity not correct for given direction of motor rotation, 419 negative with respect to 519.	Verify D-C tachometer polarity and lead connection.
	Open field for voltage Regulators only.	Measure motor field resistance from drive and connect the voltage field as required.
	No D-C tachometer output signal.	Verify tachometer voltage. Verify tachometer coupling.
Motor speed unstable with changing load. (Tach Feedback only)	IR drop compensation pot not set at zero (CCW).	Set IR drop compensation pot to zero (CCW).

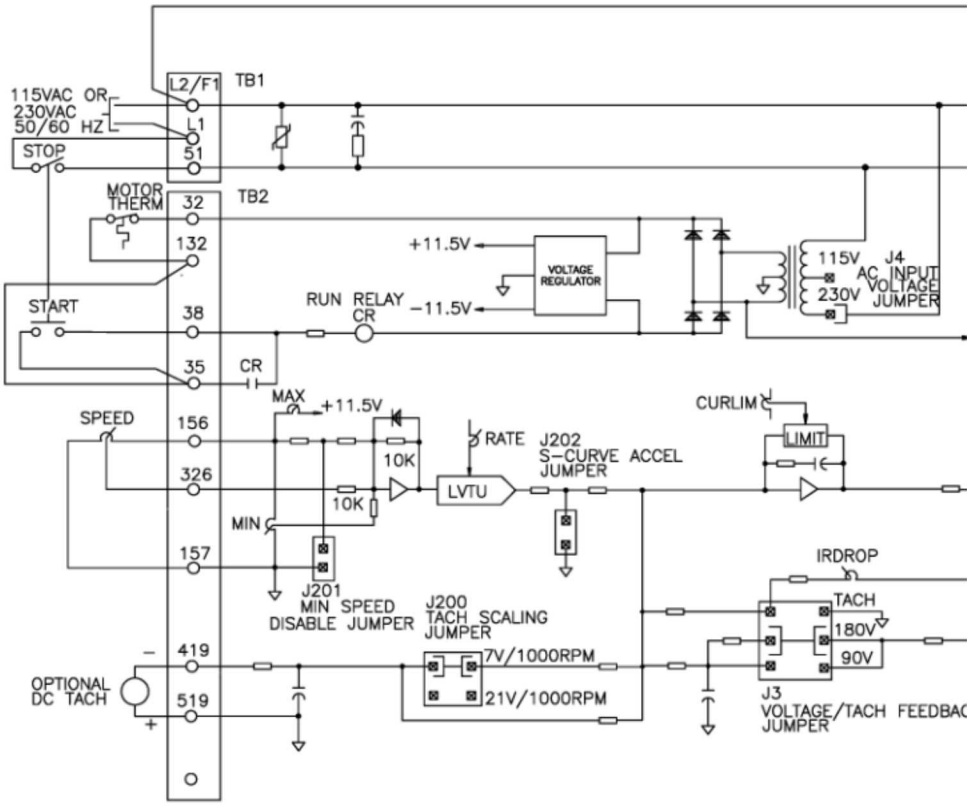
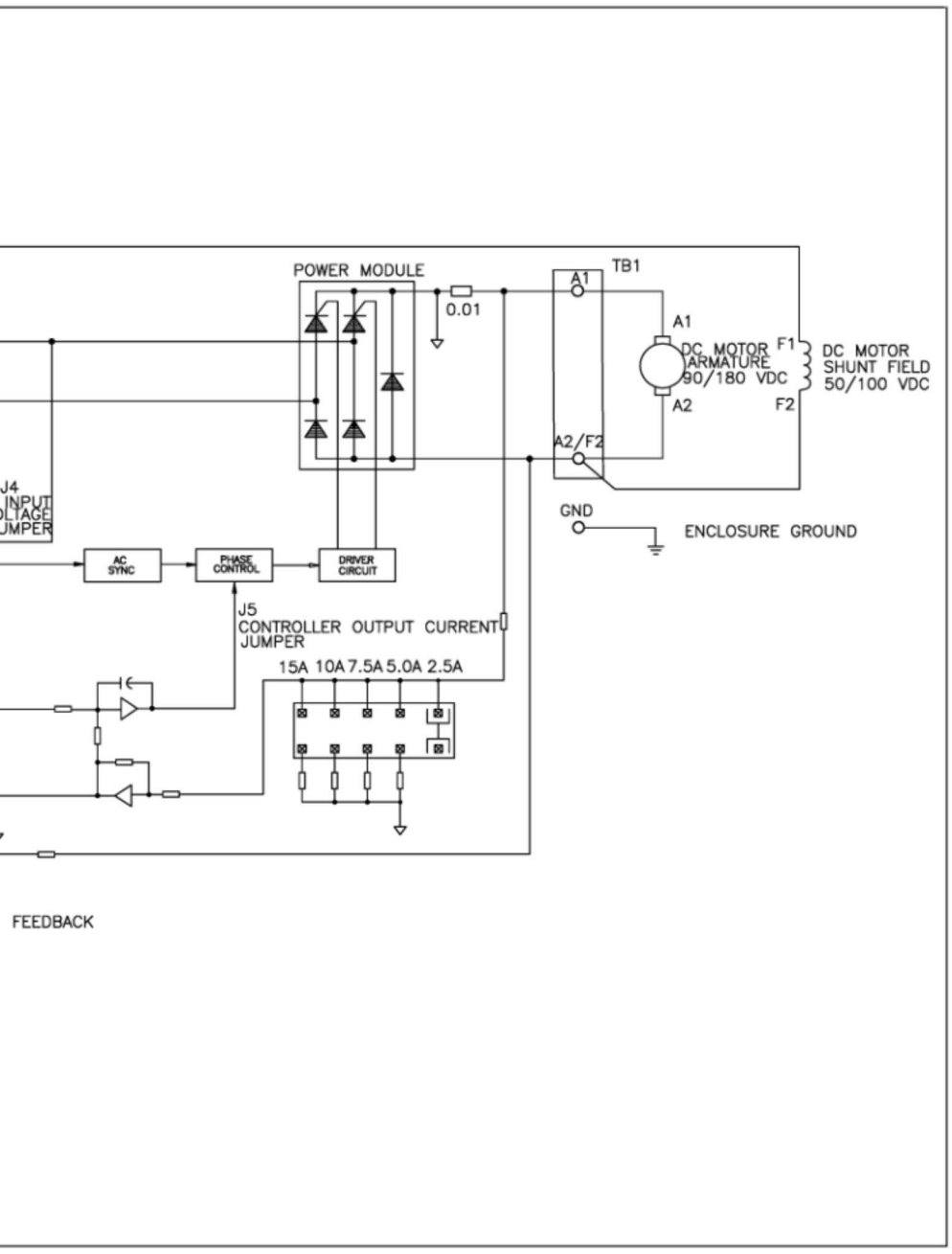


Figure 5-1. Wiring Diagram of Basic Speed Controller (0-57210-30).


POWER MODULE
0.01
TB1
A1
A1
DC MOTOR
ARMATURE
90/180 VDC
A2
F1
F2
DC MOTOR
SHUNT FIELD
50/100 VDC
A2/F2
GND
ENCLOSURE GROUND
J4
INPUT
OLTAGE
UMPER
AC
SYNC
PHASE
CONTROL
DRIVER
CIRCUIT
J5
CONTROLLER OUTPUT CURRENT
JUMPER
15A 10A 7.5A 5.0A 2.5A
FEEDBACK

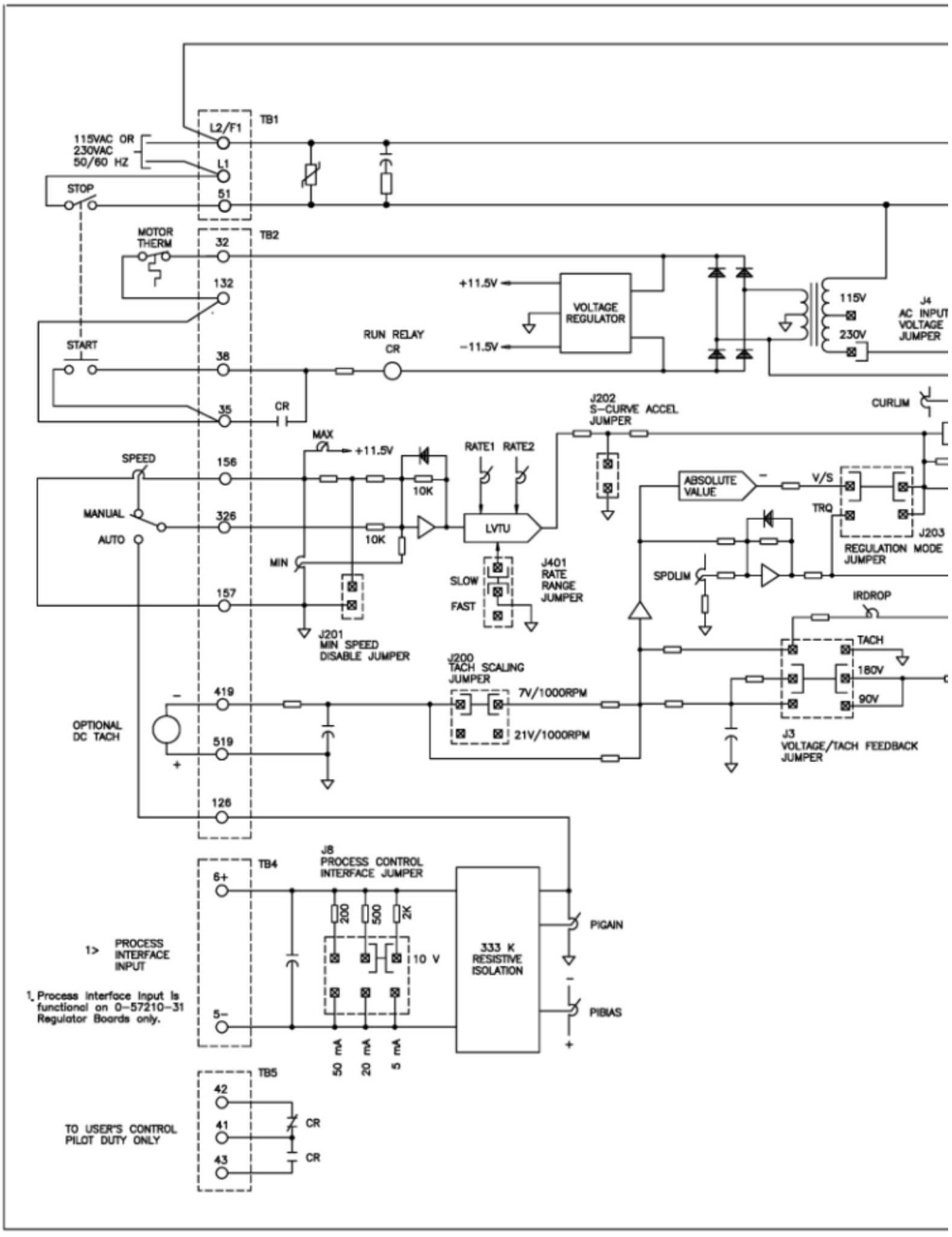
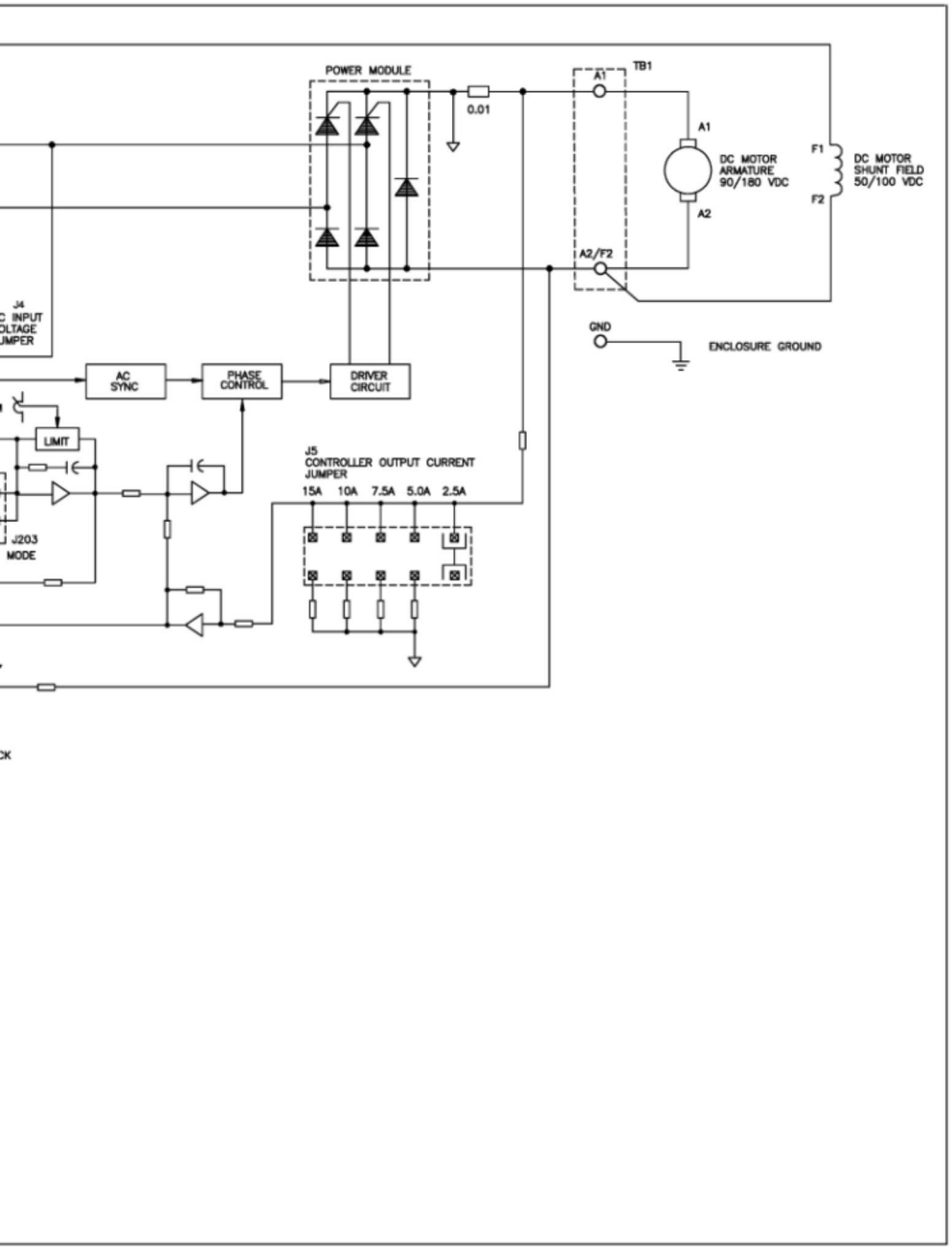


Figure 5-1A. Wiring Diagram of Torque and Process Interface Controller
(0-57210-31 and 57210-32 Regulator Boards only)


POWER MODULE
0.01
TB1
A1
A1
DC MOTOR
ARMATURE
90/180 VDC
A2
F1
F2
DC MOTOR
SHUNT FIELD
50/100 VDC
A2/F2
GND
ENCLOSURE GROUND
J4
INPUT
OLTAGE
UMPER
AC
SYNC
PHASE
CONTROL
DRIVER
CIRCUIT
LIMIT
J5
CONTROLLER OUTPUT CURRENT
JUMPER
15A 10A 7.5A 5.0A 2.5A
J203
MODE
CK

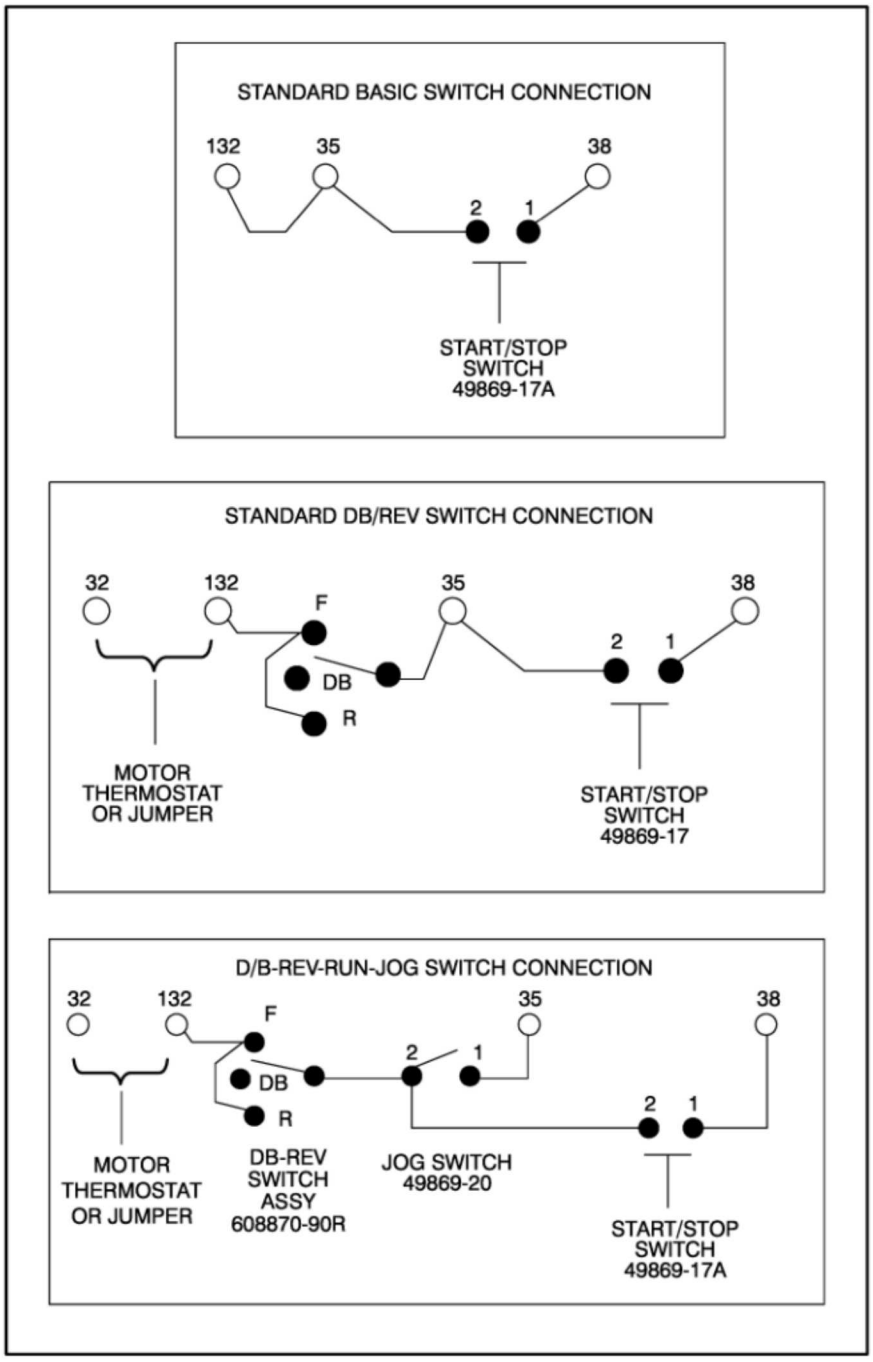


Figure 5-2. Switch Configurations.

DEVICE INTERCONNECTIONS

REVERSING SWITCH
CONTACT POSITION

CONTACT	1(*)	2(%)	3(&)
A	ON	OFF	ON
B	ON	OFF	ON
C	ON	OFF	ON
D	OFF	ON	OFF

(*) FORWARD POSITION
(%) DYNAMIC BRAKING (DB) POSITION
(&) REVERSING POSITION

BACK OF REVERSING SWITCH

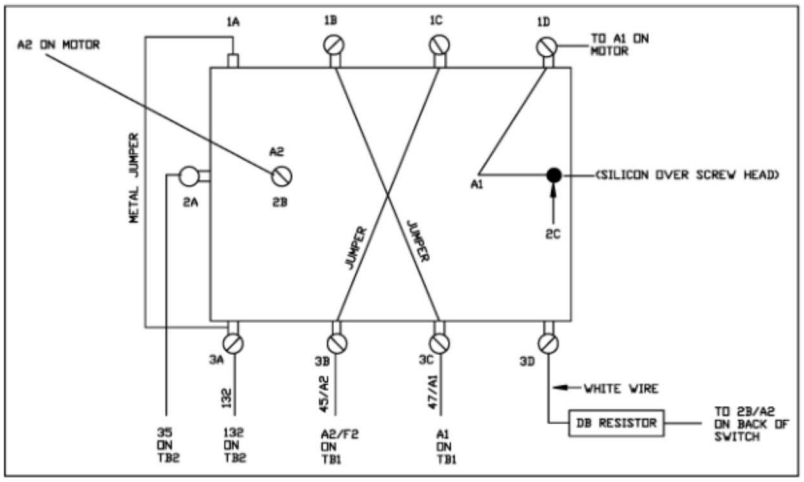


Figure 5-3. Operator Device Interconnections.

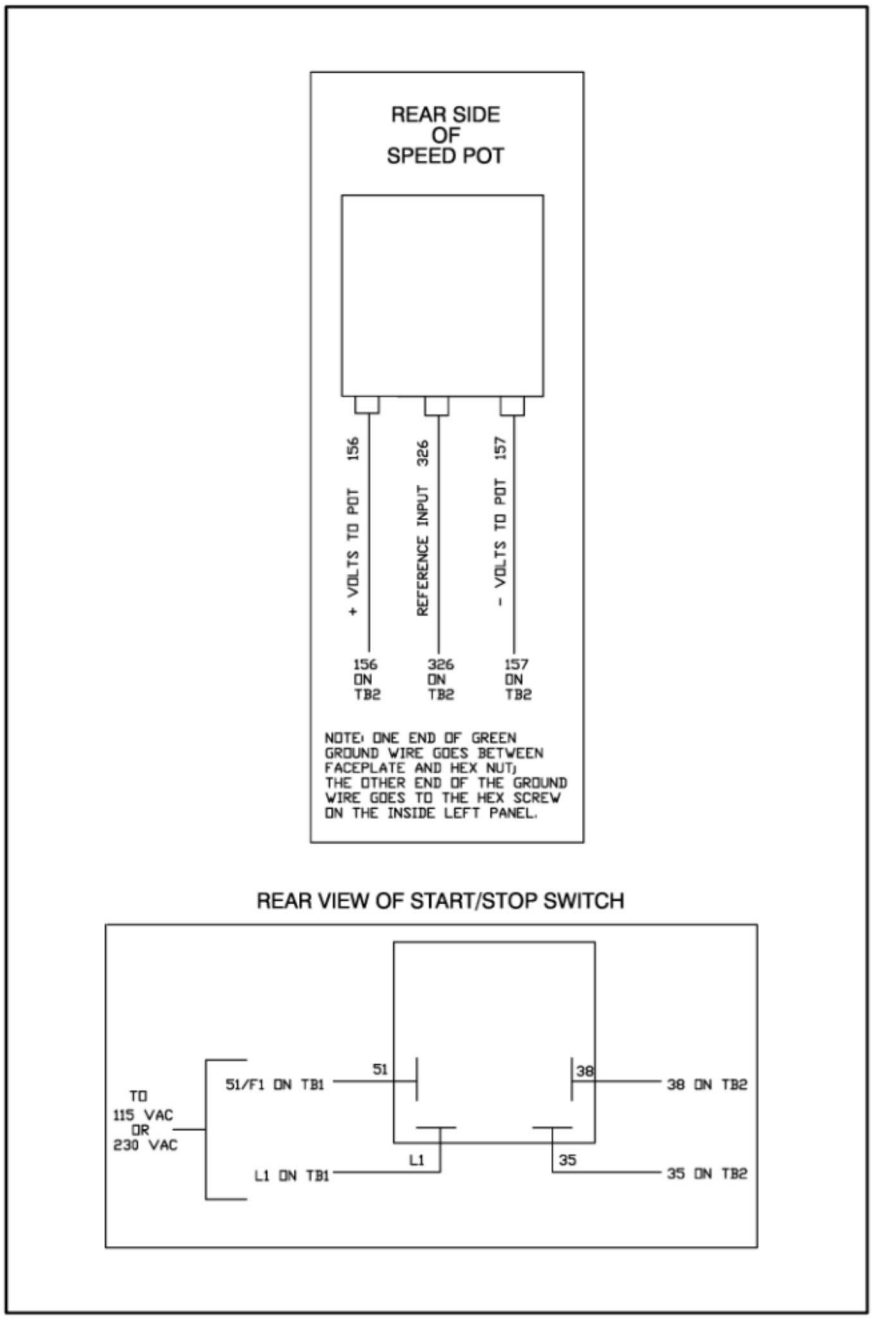


Figure 5-3. Operator Device Interconnections. (Continued)

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