Guide to Installing DC1 Series 50 Drives D2-3164-1

VS® DRIVES

RELIANCE ELECTRIC

Sept. 1991

The products described in this instruction manual are distributed by Reliance® Electric Industrial Company.

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.

This guide covers required information for installing the DC1 Series 50 D-C V★S Drive. For specifications and detailed Installing, Startup, Operating and Maintenance information refer to Instruction Manual D2-3099.

TABLE OF CONTENTS

- Service factor 1.0
- Continuous Duty
- Load capacity: 150% for 1 minute
- Line voltage variations: ± 10% of rated
- Line frequency: 48 to 62 Hertz
- Maximum allowable symmetrical A-C line fault current: 10,000 amperes
- Controller ratings by motor horsepower: Refer to Table 1.
- Ambient temperature: 0^{o} to 55^{o}C (32^{o} to 131^{o}F)
- Storage: Relative humidity (non condensing): 5-95%
- Altitude: 3300 feet (1000 meters) maximum

Table 1. Controller Ratings by Motor Horsepower.

Motor HP	Rated A-C Line (amps) (1)	Input KVA	D-C Armature Voltage	Rated Armatue Current (amps)	Available Field Voltage	Available Field Current (amps)
115 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
3/4	9.4	1.0	90	7.5	50	2.0
1(2)	12.5	1.4	90	10.0	50	2.0
230 Volt A-C Input						
1/2	3.1	.71	180	2.5	100	2.0
3/4	4.7	1.0	180	3.7	100	2.0
1	6.2	1.4	180	5.0	100	2.0
1-1/2	9.4	2.2	180	7.5	100	2.0
2(2)	12.5	2.9	180	10.0	100	2.0

(1) Includes motor field current

(2) DC1-50, -52, -53, -and 54 plate design must be mounted to a steel plate 18" by 18" to meet 1 HP @ 115 VAC and 2 HP @ 230 VAC, or an optional Heatsink (HSI-50) can be purchased. (See Figure 1.)

*Note: Essential under certain conditions. Refer to these Instructions.

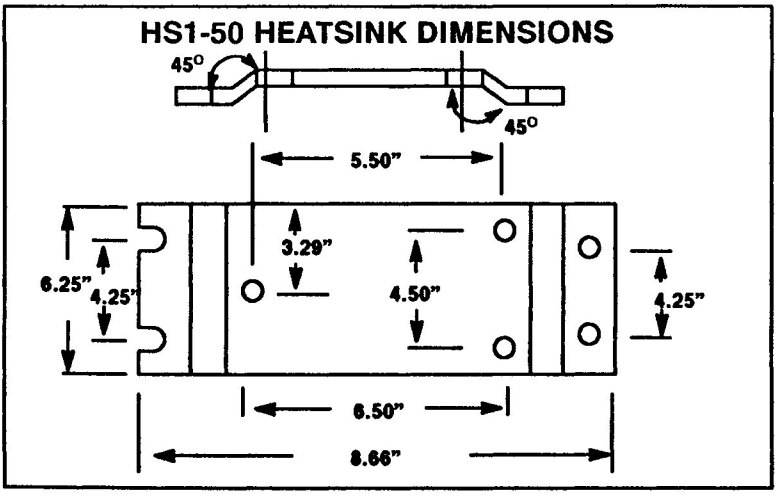


Figure 1. HS1 Heatsink Dimensions (for series 50 Plate Design)

Mount the Controller

1. Locate the controller where it will have an unrestricted ventilation area and allow one inch clearance around the controller for service access. For the heatsink versions, allow for unrestricted air flow over the rear cooling fins and sides. **Allow at least 4" above the controller to access the fuse cap.** For the flat plate designs, allow 1" around the controller for service access. Also note that an 18" x 18" steel plate is required to meet the 1 HP @ 115 VAC and 2 HP @ 230 VAC.

2. Make sure that ambient temperatures in the controller area are within 0°C and 55°C (32°F and 131°F). Controller cooling is achieved partially through the heat-sink action of the mounting surface. Temperature, size and airflow at the mounting surface are factors in adequate cooling.
3. Mount the controller with the fuse on the right side. See Figure 2 for dimension and mounting details.

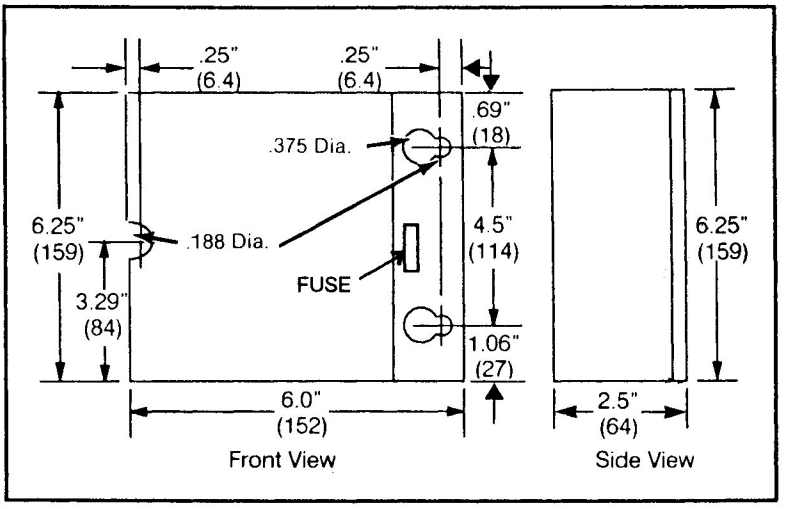


Figure 2. Dimension and Mounting Data.

Connections

DANGER

THE USER IS RESPONSIBLE FOR CONFORMING TO THE NATIONAL ELECTRICAL CODE (NEC) AND ALL OTHER APPLICABLE LOCAL CODES WITH RESPECT TO WIRING PRACTICES, GROUNDING, DISCONNECTS, AND OVERCURRENT PROTECTION. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

DANGER

TO INSURE THAT DRIVE IS NOT UNEXPECTEDLY STARTED, TURN OFF AND LOCK OUT OR TAG POWER SOURCE BEFORE PROCEEDING. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

CAUTION

WHEN A FUSED DISCONNECT IS USED, THE FUSE MUST BE A ONE-TIME CLASS K5. DO NOT USE DUAL ELEMENT, SLOW BLOW CLASS K5 FUSE. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN DAMAGE TO, OR DESTRUCTION OF THE EQUIPMENT.

1. Provide a fused disconnect or circuit breaker in the incoming A-C line according to NEC. See Figure 3.

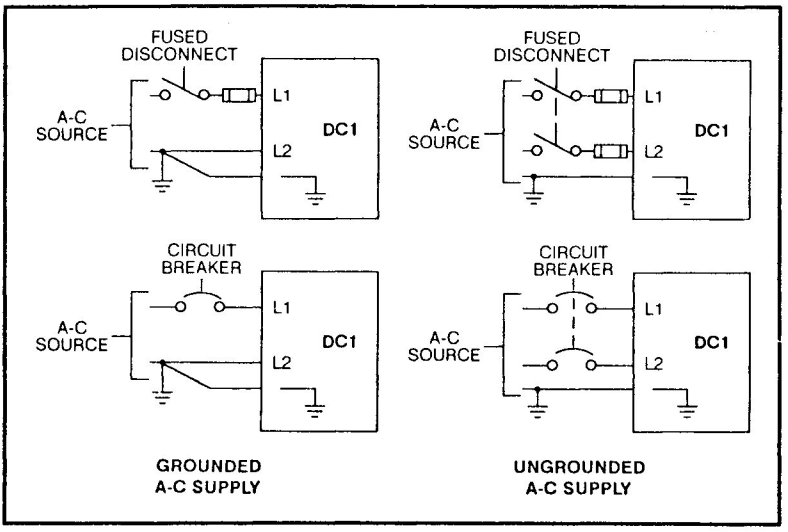


Figure 3. Fused Disconnect or Circuit Breaker.

2. For models supplied without a fuse on the panel, the customer must provide an external fuse **in addition to** the normal branch circuit protection (See Figure 4.) The recommended fuse is component (JDYX2), Bussman Part Number ABC-20, 250V, 20A, non-time delay, fast acting fuse (or equivalent).

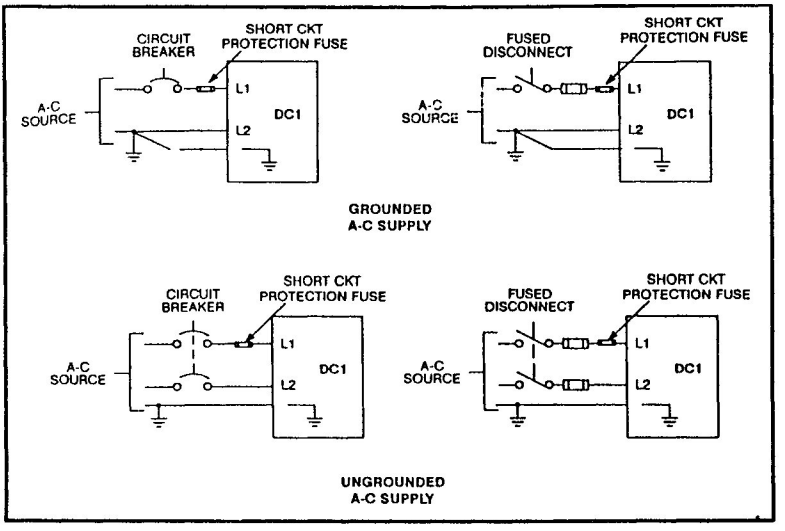


Figure 4. Additional External Fuse for Flat Plate Design.

3. This controller can be used with motors with 90 VDC or 180 VDC armatures. Motor voltage determines the power supply requirement. Reliance shunt wound D-C motors are supplied with 90 VDC or 180 VDC armatures, and dual voltage, reconnectable fields, 50/100 volts or 100/200 volts. Connect the motor field leads as follows:
   - 115 VAC input (low voltage): connect field for 50 VDC.
   - 230 VAC input (high voltage): connect field for 100 VDC.

   The A-C input voltage must be selected according to the motor armature voltage:
   - 90 VDC armature: 115 VAC.
   - 180 VDC armature: 230 VAC.
4. Verify that the field is connected as shown on the motor nameplate or the connection diagram in the terminal box on the motor.
5. Wire the A-C line, armature, and field circuits according to the appropriate connection diagram (Figures 5 through 8 at the end of this booklet). Use the connection diagram for all wiring connections.

Speed Reference Potentiometer (Pot)

DANGER

BECAUSE THE REFERENCE POT IS CONNECTED THROUGH THE REGULATOR TO THE ARMATURE POWER CIRCUIT, THE POT TERMINALS ARE AT LINE POTENTIAL. USE A POT 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.

Install a 5K ohm, 0.25 watt reference pot having an insulated operator knob. Wire this pot using #16 AWG unshielded cable that is twisted triple conductor with at least two twists per inch and run in separate conduit from the A-C and D-C power wiring.

Process Control Signal (Option)

Wire the process control input to TB2-6(+) and TB2-5(-) using #16 AWG unshielded cable that is twisted double conductor with at least two twists per inch. Connect the buffered process control reference output TB2-16(+) to the controller reference input TB2-326. If required, install and wire an Auto/Manual switch.

D-C Tachometer Speed Feedback Signal (Option)

DANGER

BECAUSE THE TACHOMETER GENERATOR (AND ANY METERING WIRING, IF APPLICABLE) IS CONNECTED THROUGH THE REGULATOR TO THE POWER CIRCUIT THE TACHOMETER CIRCUITS ARE AT LINE POTENTIAL. DISCONNECT POWER TO THE CONTROLLER BEFORE TOUCHING TACHOMETER OR SPEED INDICATOR LEADS. USE AN ISOLATION TRANSFORMER TO ISOLATE CONTROL CIRCUITS FROM GROUND. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

Wire the tach from the motor to the controller using #16 AWG unshielded twisted double conductor with at least two twists per inch. The tach must have a voltage range of 18.5 to 21 volts per 1000 RPM, maximum of 37 volts at maximum speed. Also, the tach can only function for one controller. Make sure the negative lead is connected to TB2-419 and the positive to TB2-519 for the desired direction of rotation. Reverse connection will cause the motor to run at maximum uncontrolled speed.

An isolation transformer must be installed between the A-C power source and each controller having the tach option. Size the isolation transformer as follows:

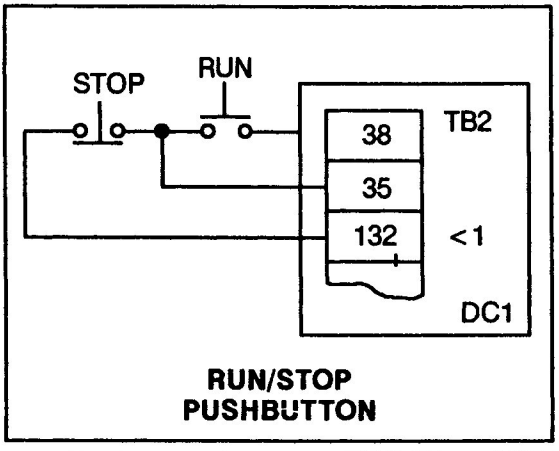
Motor HP	Transformer KVA
1/4	0.50
1/3	0.75
1/2	1.0
3/4	1.5
1	2
1-1/2	3
2	5

Run/Stop Circuit

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 CLOSE TO THE OPERATOR'S START/STOP CONTROLS BECAUSE 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.

Remove the factory-installed jumper between TB2-35 and TB2-132. Mount the run/stop controls remote from the controller but close to the A-C fused disconnect or circuit breaker. This is required because the DC1 does not have an armature loop contactor and a single fault like a thyristor short may cause the motor to rotate when in the Stop mode.



RUN/STOP PUSHBUTTON

<1 Remove the jumper between TB2-35 and TB2-132 if a Remote Start/Stop Device is used.

Jumper and Wire Wrap Pin Positions

Refer to controller or Figure 9 at the end of this manual for exact position of jumpers.

J4: A-C Input Voltage Jumper is factory set for 230 VAC. Verify that J4 is positioned to match A-C input line power.

J3: Armature/Field Voltage Jumper is factory set for 230 volts to provide 180 volts armature/100 volts field supply to the motor. Verify that J3 is positioned to match A-C input line voltage selected with jumper J4. Note that, when a D-C tachometer is used for speed feedback, remove J3 jumper.

J5: Controller Output Current Jumper is factory set for 2.5 amperes. Position J5 for the appropriate controller output current rating according to Table 2 below.

Table 2. Controller D-C Output Current Rating.[1]

Motor HP	Controller Output Current Rating by Input Voltage Rating	
	115 Volts	230 Volts
1/4	2.5	-
1/3	3.7	-
1/2	5	2.5
3/4	7.5	3.7
1	10	5
1-1/2	-	7.5
2	-	10

(1) Measured with average reading D-C ammeter.

J8: Process Control Interface Jumper is on process control interface controller Models DC1-52 and -54. Select the J8 jumper position based on the process control signal to be used (See Figure 9 in this manual):

Process Signal	Jumper Position
1 - 5 mA	5 mA
4 - 20 mA	50 mA
10 - 50 mA	50 mA
0 - 10 VDC	0 - 10 V

J1 and J2: Acceleration Rate Wire Wrap Pins are factory set to provide approximately 6 seconds acceleration time to full speed. To adjust this acceleration rate, select the time desired from the list below and note the capacitance required to achieve that acceleration rate.

Time	Capacitance (Between J1 and J2)(1)
17.5 seconds	3.00 μF
10.0 seconds	1.68 μF
6.0 seconds	as shipped (2)
4.5 seconds	.68 μF
3.3 seconds	.47 μF
1.8 seconds	.22 μF
1.1 seconds	.10 μF
0.6 seconds	0

(1) Use low leakage type capacitors. Leakage current should be less than 0.1 microamp at 15V and 70° ambient. If a polarized capacitor is used, install with J1 as the positive with respect to J2.

(2) Unit is shipped with a .94 μF capacitor. This capacitor consists of two .47 μF units in parallel.

If the selected time is more than 6 seconds, add the appropriate capacitor between J1 and J2. If the selected time is less than 6 seconds, cut the capacitor between J1 and J2 and replace with the appropriate capacitor.

Before proceeding with startup of the drive, and before applying power, check all external connections for correctness, and pre-set the potentiometer according to the following:

Pot Positions

Operator's speed or torque pot fully - CCW.

Circuit board pots for DC1-50 and -52 Speed Control Models

- Maximum Speed - fully CCW
- Minimum Speed - fully CCW
- IR Drop Compensation - fully CCW
- Current Limit - 60% of full scale
- Process Interface Gain on DC1-52 Process Control models only - fully CCW
- Process Interface Bias on DC1-52 Process Control models only - fully CCW

Circuit board pots for DC1-53 and -54 Torque Control Models

- Maximum Torque - fully CCW
- Minimum Torque - fully CCW
- Speed Limit - 60% of full scale
- Process Interface Gain on DC1-54 Process Control models only - fully CCW
- Process Interface Bias on DC1-54 Process Control models only - fully CCW

Switch Positions

With DC1-52 and -54 Models, put the Auto/Manual switch in Manual mode, if applicable.

DANGER

THE REMAINING STEPS ARE MADE 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.

Be sure all the steps in the Installation section of this guide have been properly completed.

Check Direction of Motor Rotation (All Models)

1. Apply A-C input power.
2. Press the Run button and quickly press the Stop switch. If the motor shaft doesn't rotate because all pots are set to minimum levels, turn the Speed or Torque pot slightly CW and repeat this start/stop operation.
3. If motor shaft rotation is incorrect, press the Stop switch and wait for the motor to completely stop. Disconnect all power and reverse the motor armature power leads A1 and A2. Re-apply A-C input power and repeat the direction of rotation check.

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.

Adjust Speed Range (DC1-50 and -52)

- Measure armature voltage, which should be approximately proportional to speed
  (115 volt control: 90 VDC = 100% speed;
  230 volt control: 180 VDC = 100% speed).
- Press the Run button and slowly turn the Speed pot to maximum (fully CW). The motor should run at about 50% of maximum.
- Slowly turn the Maximum Speed pot CW until about 80% speed is reached.
- Turn the Speed pot fully CCW.

- Turn the Minimum Speed pot CW until the desired minimum speed is reached.
- Repeat this procedure until the desired maximum and minimum speeds are reached.

Adjust Current Limit (DC1-50 and -52)

The maximum D-C current output from the controller with the Current Limit pot turned CW is about 150% 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 the Current Limit pot CCW until an adequate setting is obtained.

Adjust IR Drop Compensation (DC1-50 and -52)

If the torque demand on the drive motor is relatively uniform, IR drop compensation is not required. Turn the IR Drop Compensation pot to zero (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. Turn the IR Drop Compensation pot slightly CW until this drop is minimized. Recheck the maximum and minimum speed settings. Note that excessive IR drop compensation can cause motor instability and hunting.

Adjust Torque Range (DC1-53 and -54)

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.

- Before applying power, provide a means of measuring torque, such as measuring armature current.
- Load the motor with a reasonable constant load over the speed range.
- Re-establish the torque load on the motor and load the torque cell for maximum torque.
- Press the Run button and slowly turn the Torque pot to maximum (fully CW).

- Slowly turn the Maximum Torque pot CW until the maximum desired torque is reached.
- Turn the Torque pot fully CCW.
- Slowly turn the Minimum Torque pot CW until the minimum desired torque is reached.
- Repeat this procedure until the desired maximum and minimum torques are reached.

Adjust Speed Limit (DC1-53 and -54)

- With minimum load torque (motor uncoupled), turn the Torque pot fully CW.
- Adjust speed limit with the Speed Limit pot for maximum desired motor application speed or 90/180 VDC on the armature.
- Return the Torque pot fully CCW.

Process Control

1. Push the Auto/Manual switch to Auto.

WARNING

THE PROCESS CONTROL SIGNAL INPUT TERMINALS TB2-5 AND TB2-6 ARE FLOATING AT LINE POTENTIAL WITH LIMITED POWER WHEN THE INPUT CIRCUIT IS OPEN. CONNECTION OF THE SIGNAL SOURCE CIRCUIT WILL DECREASE THIS OPEN CIRCUIT SIGNAL TO ZERO. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

2. Apply A-C input power and press the Start button.
3. Command minimum reference from your process control unit and adjust the Process Interface (PI) Bias pot to the desired minimum operating speed or torque.
4. Increase the process control reference signal to maximum and adjust the Process Interface (PI) Gain pot to the desired maximum operating speed or torque. Repeat Steps 3 and 4 until proper maximum and minimum speed or torque are attained.
5. Press the Stop switch and wait for the motor to completely stop. Remove A-C input power.

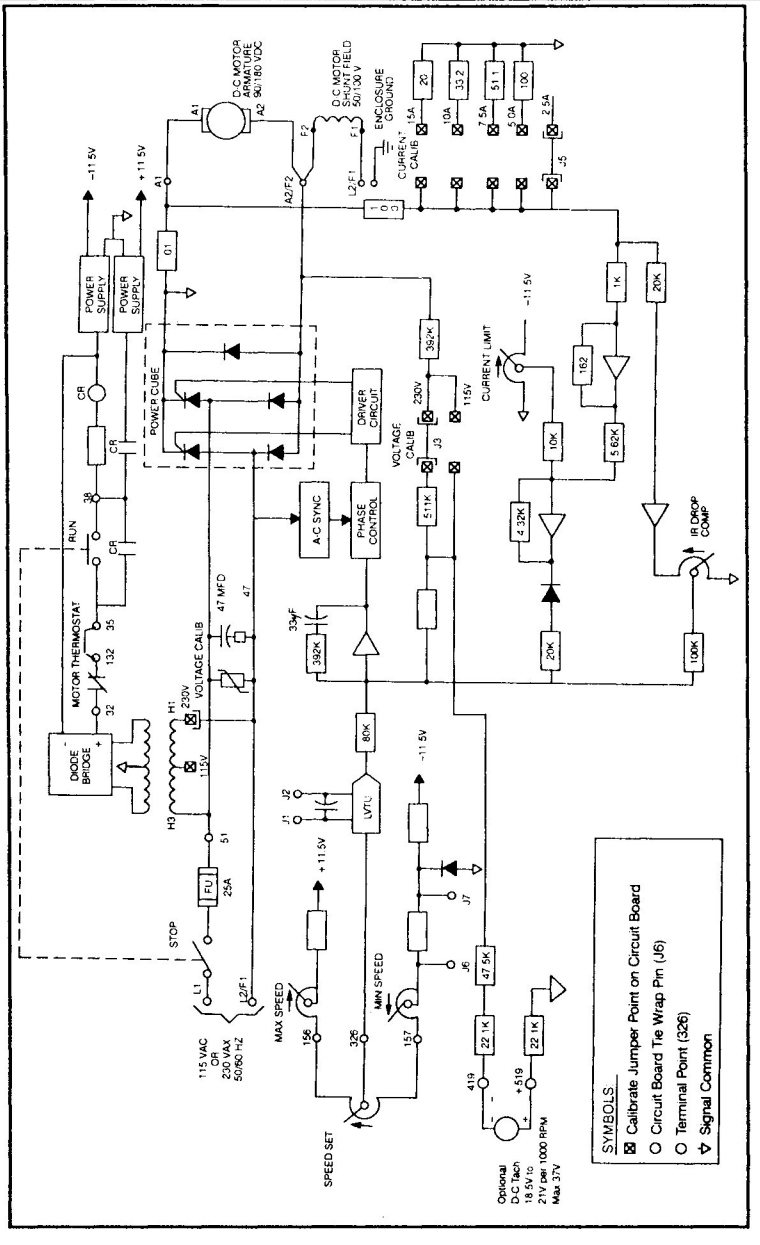


Figure 5. Wiring Diagram of DC1-50. (Speed Control)

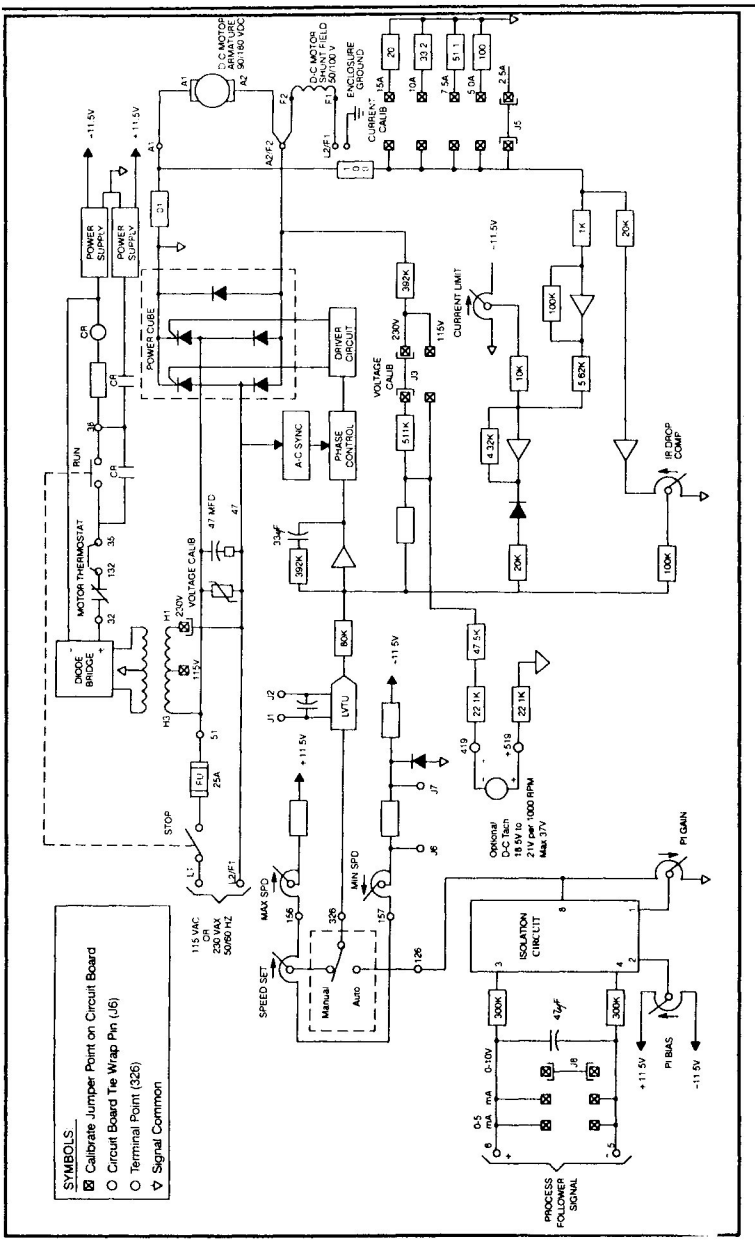


Figure 6. Wiring Diagram of DC1-52.(Speed Control with Process Control.)

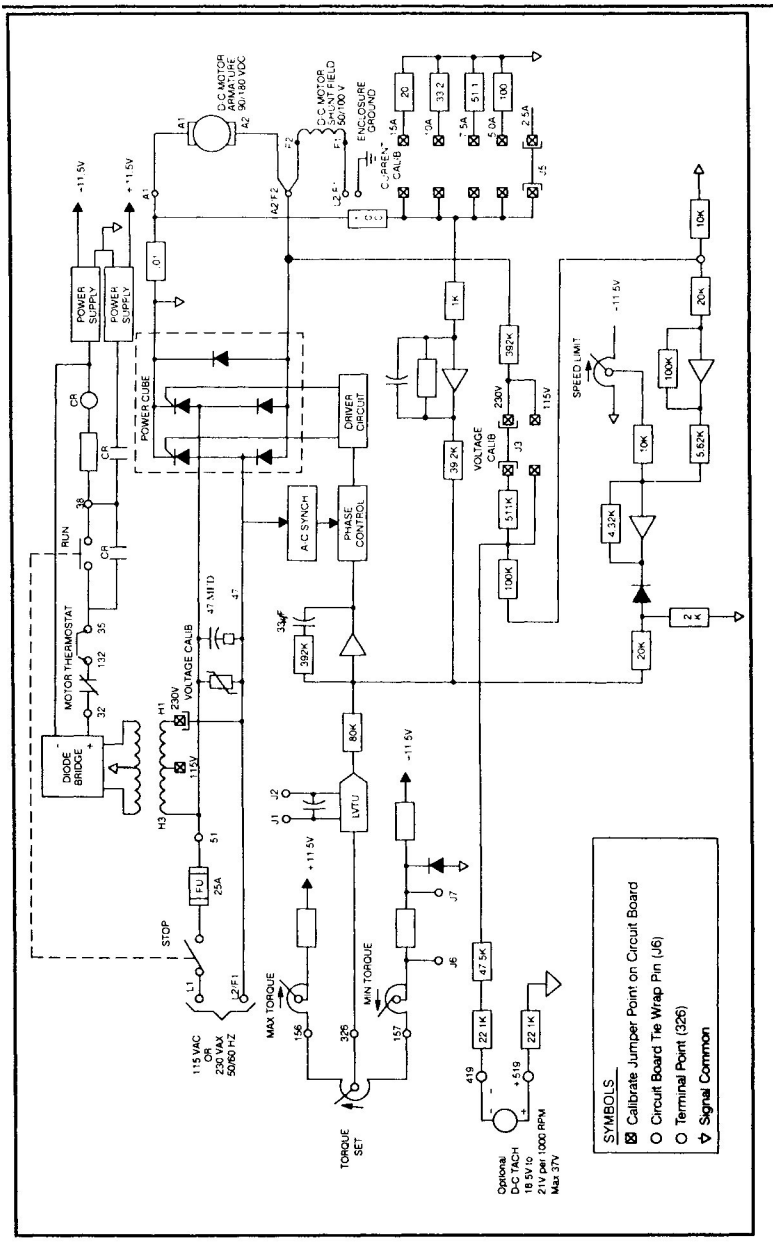


Figure 7. Wiring Diagram of DC1-53. (Torque Control)

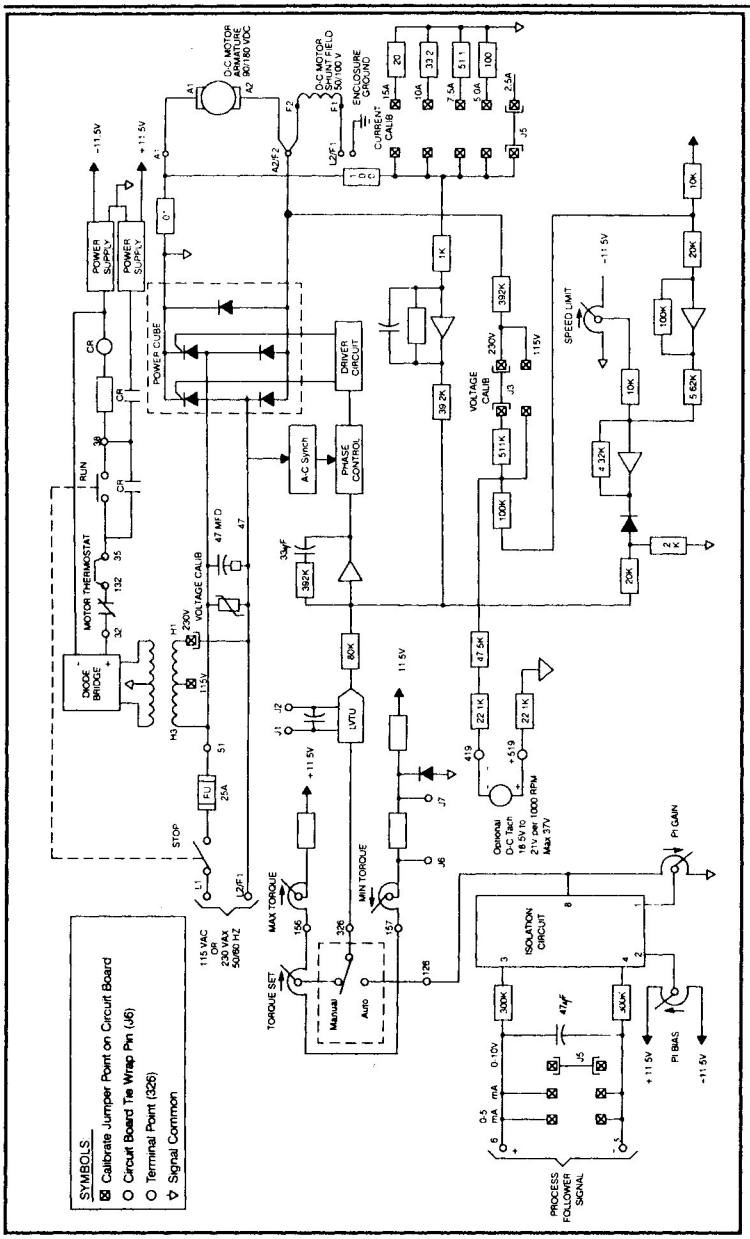


Figure 8. Wiring Diagram of DC1-54. (Torque Control with Process Control).

Should you encounter any difficulty with the operation of your controller, review Table 5-2, "Servicing Steps" in Instruction Manual D2-3099 before performing any troubleshooting on the drive.

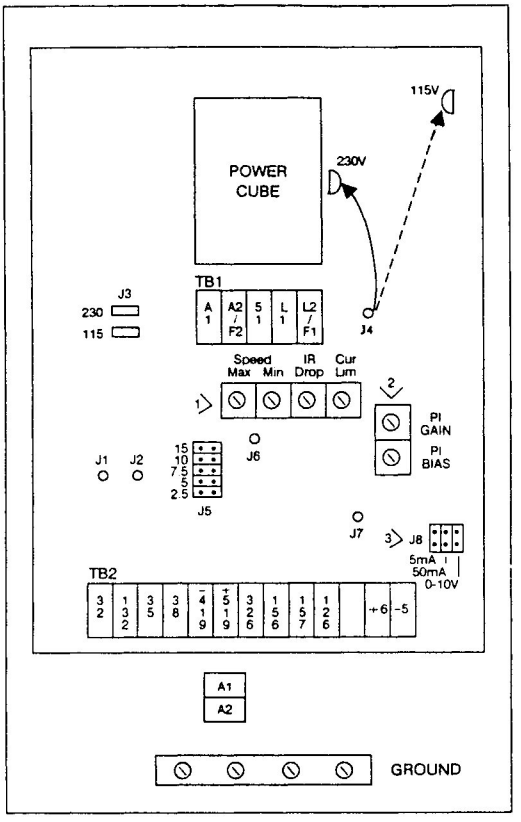
DANGER

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 3. Controller Replacement Parts. (1)

Description	Reliance Part Number
Line Fuse (20A)	64676-35G
Power Cube	701819-14AB
Circuit Board	
DC1-50	0-57210-20
DC1-52	0-57210-23
DC1-53	0-57210-21
DC1-54	0-57210-22
Speed Pot	401286-41H
Run/Stop Switch	49869-17A

(1) Available from your local Reliance Electric Distributor or directly from Reliance:
Reliance Electric
Cleveland Service Center
4950 East 49th Street
Cleveland, Ohio 44125
Order Entry Phone: 216-266-7247



1> Pots on torque models are from left:
Max Torque
Min Torque
IR Drop Not Supplied
Speed Limit

2> Pots PI (Process Interface) Gain and PI (Process Interface) Bias only on process follower models

3> Jumper circuit J8 only on process follower models

Figure 9. Locate Jumpers, Pins and Pots on Controller Circuit Board

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