RELIANCE ELECTRIC

DC3N DC Drive
User Guide
1/4 to 2 HP, 115/230 VAC

Instruction Manual D2-3451

Rockwell Automation

The information in this manual is subject to change without notice.

Throughout this manual, the following notes are used to alert you to safety considerations:

ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss.

IMPORTANT: Identifies information that is critical for successful application and understanding of the product.

ATTENTION: The control circuit is at line potential when the drive is energized. Use a non-metallic screwdriver when making adjustments to the circuit board potentiometers. Exercise extreme caution as hazardous voltage exists. Failure to observe these precautions could result in severe bodily injury of loss of life.

ATTENTION: Only qualified 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 instruction manual in its entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.

ATTENTION: The user is responsible for conforming with all applicable local and national codes. Failure to observe this precaution could result in severe bodily injury or loss of life.

ATTENTION: It is possible for a drive to run at full speed as a result of a component failure. Please ensure that a master switch has been placed in the AC line to stop the drive in an emergency.

ATTENTION: Reduce the chance of an electrical fire, shock, or explosion by proper grounding, over-current protection, thermal protection and enclosure. Follow sound maintenance procedures.

ATTENTION: Starting and stopping with the inhibit terminal pins does not disconnect AC power in the stop position. A hardwired AC power disconnection switch must be mounted in close proximity to the operator's start/stop controls. This is required, as the DC3 drive does not have an armature loop contactor. A single fault like a power device short may cause motor rotation when in the stop mode. The user is responsible for assuring safe conditions for operating personnel by providing suitable guards, audio or visual alarms, or other devices.

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Failure to observe these precautions could result in bodily injury.
ATTENTION: This Drive contains ESD (Electric Static Discharge) sensitive parts and assemblies, Static control precautions are required when installing, testing, servicing, or repairing this assembly. Failure to observe these precautions could result in damage to, or destruction of, the equipment.

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Specifications

Model	Max. Armature Current (Amps DC)	HP Range with 115 VAC Applied	HP Range with 230 VAC Applied	Style
DC3N-12D-00-010-AN†	10.0	1/8–1	1/4–2	Chassis
DC3N-12D-01-010-AN‡	10.0	1/8–1	1/4–2	NEMA 1
DC3N-12D-4X-010-AN‡‡	10.0	1/8–1	1/4–2	NEMA12/4/4X

† Double maximum armature current and horsepower when drive is mounted on heat sink part number DC3N-HS-00.

‡ Double maximum armature current and horsepower when drive is mounted on heat sink part number DC3N-HS-01.

‡‡ Indoor use only

Motor HP	Rated AC Line Amps	Input KVA	DC Amature Voltage	DC Armature Current
1/4	4.5	0.5	90	2.7
	2.6	0.6	180	1.4
1/3	5.9	0.7	90	3.5
	3.1	0.7	180	1.8
1/2	7.8	0.9	90	5
	3.7	0.8	180	1.3
3/4	10.6	1.2	90	7.6*
	5.6	1.3	180	3.8
1	13	1.5	90	10*
	7	1.6	180	5
1 1/2	--	--	--	--
	10.1	2.3	180	7*
2	--	--	--	--
	12	2.8	180	9.2*

* Heatsink required for operation above 5 amps. Use DC3N-HS-00 for chassis drives and DC3N-HS-01 for NEMA 1 drives.

AC Line Voltage	115 VAC or 230 VAC ±10%, 50/60 Hz, single phase
Maximum Allowable Symmetrical AC Line Current	5000 Amps
Maximum AC Line Distribution kVA	
115 VAC Input	25 kVA
230 VAC Input	50 kVA
Motor Armature Voltage	
115 VAC Input	0–90 VDC
230 VAC Input	0–180 VDC
Adjustments and Application Data	
Form Factor	1.37 at base speed
Service Factor	1
Maximum Current Load	150% for 1 minute
Speed Regulation	1% with 95% load change

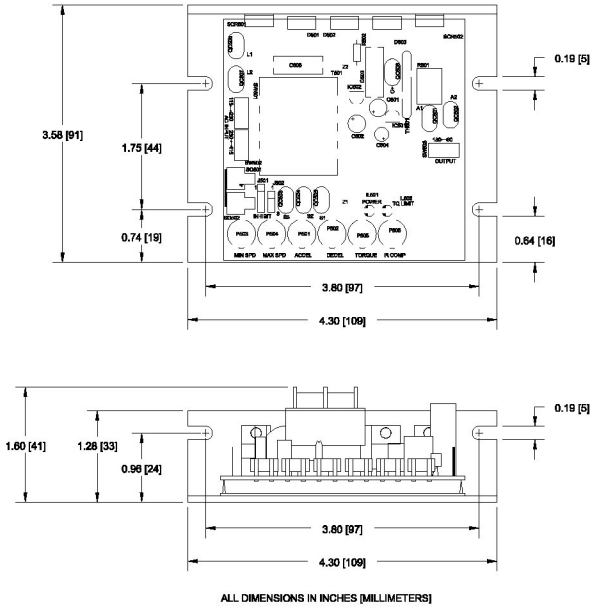
Adjustments and Application Data (cont.)

Speed Range	60:1
Accel. Time Range	
0–90 VDC Armature Voltage	0.5–17 seconds
0–180 VDC Armature Voltage	0.5–17 seconds
Decel. Time Range	
0-90 VDC Armature Voltage	0.5–17 seconds
0–180 VDC Armature Voltage	0.5–17 seconds
Current Limit Overload Range	150%
Analog Input Voltage Range (must be isolated; S1 to S2)	
for 0–90 VDC Armature Voltage	0–1.4 VDC
for 0–180 VDC Armature Voltage	0–2.8 VDC
Torque	150% of rated current
Input Impedance (S1 to S2)	100K ohms
Speed adjust potentiometer rating	10k ohm, 5W (5k ohms acceptable)
IR Drop Compensation (% of rated armature voltage)	0% to 15%
Service Conditions	
Elevation	3300 ft (1000 m) max without derating**
Vibration	0.5G max (0–50 Hz)
	0.1G max (>50 Hz)
Ambient Temperature Range	
Enclosed drive	10°C–40°C
Chassis drive	10°C–55°C
Non-condensing Relative Humidity	0% to 95%

** Derate the current by 1% for every 300 ft (90m) above 3300 ft. (1000m), up to 10,000 ft (3000m)

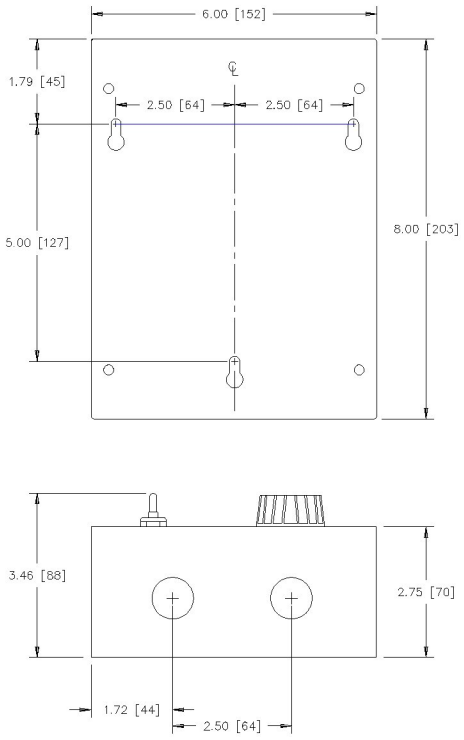
Safety Certification	
	UL Listed Component
	cUL Listed Component
	CE Certificate of Compliance

Dimensions



ALL DIMENSIONS IN INCHES [MILLIMETERS]

Figure 1. DC3N-12D-00-010-AN Dimensions



TWO 0.88 [22] CONDUIT HOLES

ALL DIMENSIONS IN INCHES [MILLIMETERS]

Figure 2. DC3N-12D-01-010-AN Dimensions

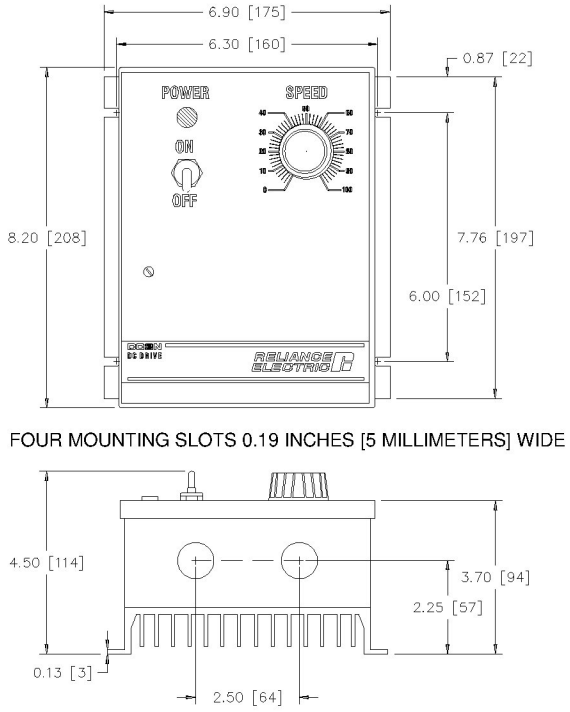
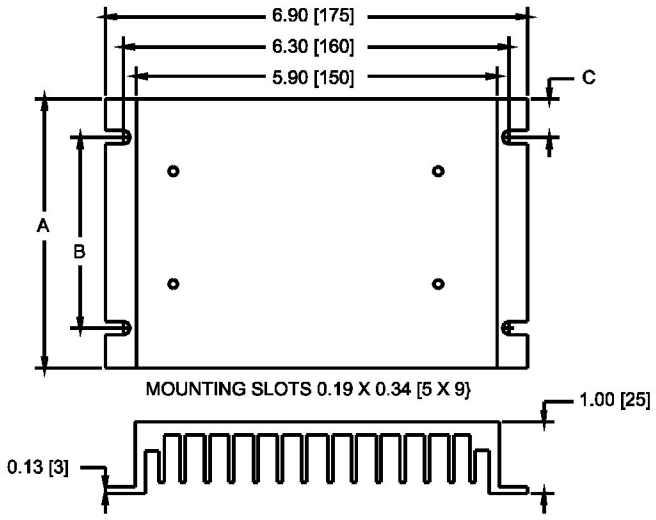


Figure 3. DC3N-12D-4X-010-AN Dimensions



PART NO.	DIM "A"	DIM "B"	DIM "C"
DC3N-HS-00	4.40 [112]	3.00 [76]	0.7 [18]
DC3N-HS-01	7.78 [198]	6.00 [152]	0.89 [23]

Heat sinks sold separately.

ALL DIMENSIONS IN INCHES [MILLIMETERS]

Figure 4. Heat Sink Dimensions

Installation

ATTENTION: Do not install, remove, or rewire this equipment with power applied. Doing so may cause fire or serious injury. Make sure you have read and understood the Attentions on page ii before attempting any of these procedures.

- Protect the drive from dirt, moisture, and accidental contact. Provide sufficient room for access to the terminal block and calibration trimpots.
- Mount the drive away from other heat sources. Operate the drive within the specified ambient operating temperature range.
- Prevent loose connections by avoiding excessive vibration of the drive.

Chassis drive

ATTENTION: This Drive contains ESD (Electric Static Discharge) sensitive parts and assemblies, Static control precautions are required when installing, testing, servicing, or repairing this assembly. Failure to observe these precautions could result in damage to, or destruction of, the equipment.

Mounting

Mount drive with its board in either a horizontal or vertical plane. Six 0.19 inch (5 mm) wide slots in the chassis accept #8 pan head screws. Fasten either the large base or the narrow flange of the chassis to the subplate.

The chassis must be earth grounded. To ground the chassis, use a star washer beneath the head of at least one of the mounting screws to penetrate the anodized chassis surface and to reach bare metal.

Wiring

ATTENTION: The control circuit is at line potential when the drive is energized. Use a non-metallic screwdriver when making adjustments to the circuit board potentiometers. Exercise extreme caution as hazardous voltage exists. Failure to observe these precautions could result in severe bodily injury of loss of life.

ATTENTION: Do not disconnect any of the motor leads from the drive unless power is removed or the drive is disabled. Opening any one motor lead may destroy the drive.

Use 18-24 AWG wire for speed adjust potentiometer wiring. Use 14–16 AWG wire for AC line (L1, L2) and motor (A1 and A2) wiring.

Shielding guidelines

ATTENTION: If it is not practical to shield power conductors, Reliance Electric recommends shielding all logic-level leads. If shielding is not practical, use twisted-pair control wiring to minimize induced electrical noise.

As a general rule, Reliance Electric recommends shielding of all conductors if:

- wire lengths exceed 4 inches and power and control wiring must be bundled together*;
- radiated and/or conducted noise must be minimized due to concerns about immunity or general compliance (CE, FCC, etc.)

It may be necessary to earth ground the shielded cable. If noise is produced by devices other than the drive, ground the shield at the drive end. If noise is generated by a device on the drive, ground the shield at the end away from the drive. Do not ground both ends of the shield.

If the drive continues to pick up noise after grounding the shield, it may be necessary to add AC line filtering devices, or to mount the drive in a less noisy environment.

Isolation

ATTENTION: Distribution system capacity above the maximum recommended system KVA requires the use of an isolation transformer, a line reactor, or other means of adding similar impedance to the drive power input. Failure to observe these precautions could result in damage to, or destruction of, the equipment.

Input isolation transformers might be needed to help eliminate the following:

- Damaging line voltage transients from reaching the drive.
- Line noise from the drive back to the incoming power source.
- Damaging currents that could develop if a point inside the drive becomes grounded.

*Reliance Electric considers this an unfavorable condition and does not recommend bundling of power and logic leads for any length.

Observe the following guidelines when installing an isolation transformer:

· A power disconnecting device must be installed between the power line and primary of the transformer.

· If the power disconnecting device is a circuit breaker, the circuit breaker trip rating must be coordinated with the in-rush current (10-12 times full load current) of the transformer.

Heat sinking

The DC3N chassis drive requires an additional heat sink, Reliance Electric® part number DC3N-HS-00, when the continuous armature current is above 5 ADC. Use a thermally conductive heat sink compound (such as Dow Corning® 340 Heat Sink Compound) between the drive chassis and heat sink surface for optimum heat transfer.

Line fusing

The DC3N drive chassis requires an external fuse for protection. Use fast acting fuses rated for 250 VAC or higher, and approximately 150% of the maximum armature current. Fuse only the hot leg of the AC line that connects to L1 and leave L2 unfused when the AC line voltage is 115 VAC. Fuse both L1 and L2 when the AC line voltage is 230 VAC. Fuse blocks are included on enclosed drives only. Table 1 lists the recommended line fuse sizes.

Table 1. Recommended Line Fuse Sizes

90 VDC Motor Horsepower	180 VDC Horsepower	Max. DC Armature Current (amps)	AC Line Fuse Size (amps)
1/4	1/2	2.6	5
1/3	3/4	3.5	8
1/2	1	5.0	10
3/4	1 1/2	7.6	15
1	2	10	15

Speed adjust potentiometer

ATTENTION: 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 insulating shaft to insulate the operator knob from this power circuit and that is capable of withstanding Hi-pot tests at 2000 Volts DC for one minute. Failure to observe this precaution could result in severe bodily injury or loss of life.

ATTENTION: Be sure that the potentiometer tabs do not make contact with the enclosure. Grounding the input will damage the drive.

On the chassis drive, install the circular insulating disk between the panel and the 10K ohm speed adjust potentiometer. Mount the speed adjust potentiometer through a 0.38 inch (10 mm) hole with the hardware provided (Figure 5). Twist the speed adjust potentiometer wire to avoid picking up unwanted electrical noise. If potentiometer leads are longer than 18 inch (457 mm), use shielded cable.

All enclosed controls come with the speed adjust potentiometer installed.

Alternate speed adjust potentiometer connections

Alternate speed adjust potentiometer connections may be found in the Application Notes section of this user guide.

IMPORTANT: The user may choose to install a 5K ohm speed adjust potentiometer; however, the MIN SPD and MAX SPD trimpots must be recalibrated if the 5K ohm potentiometer is used.

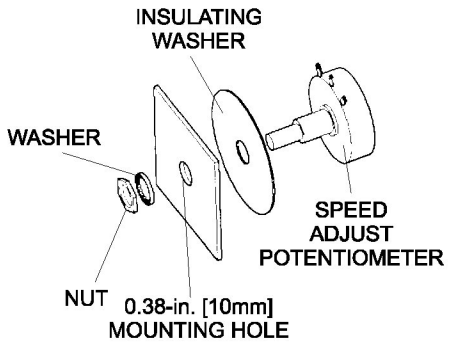


Figure 5. Speed Adjust Potentiometer Installation

Connections

ATTENTION: Do not connect this equipment with power applied. Failure to heed this directive may result in fire or serious injury.

Power, fuse and motor connections

Connect the power input leads, an external line fuse and a DC motor to the drive's printed circuit board (PCB) as shown in Figure 6.

Motor

ATTENTION: To provide the motor with overload protection, local, national, and international codes (e.g.,NEC/CEC) require that a motor thermostat, internal to the motor, be installed or an electronic thermal motor overload relay, sized to protect the motor, be installed between the motor and the drives output terminals.

Connect a motor to PCB terminals A1 and A2. Ensure that the motor voltage rating is consistent with the drive's output voltage.

Power input

Connect the AC line power leads to terminals L1 and L2, or to a double-throw, single-pole master power switch as shown in Figure 6 (recommended).

Master power switch

ATTENTION: Installation of a master power switch in the input line is required. This is the only way to disconnect power from the motor. The user is responsible for assuring safe conditions for operating personnel by providing suitable guards, audio or visual alarms, or other devices. Failure to observe these precautions could result in bodily injury.

Install a master power switch in the voltage input line, as shown in Figure 6. The switch contacts should be rated at a minimum of 200% of motor nameplate current and 250 volts.

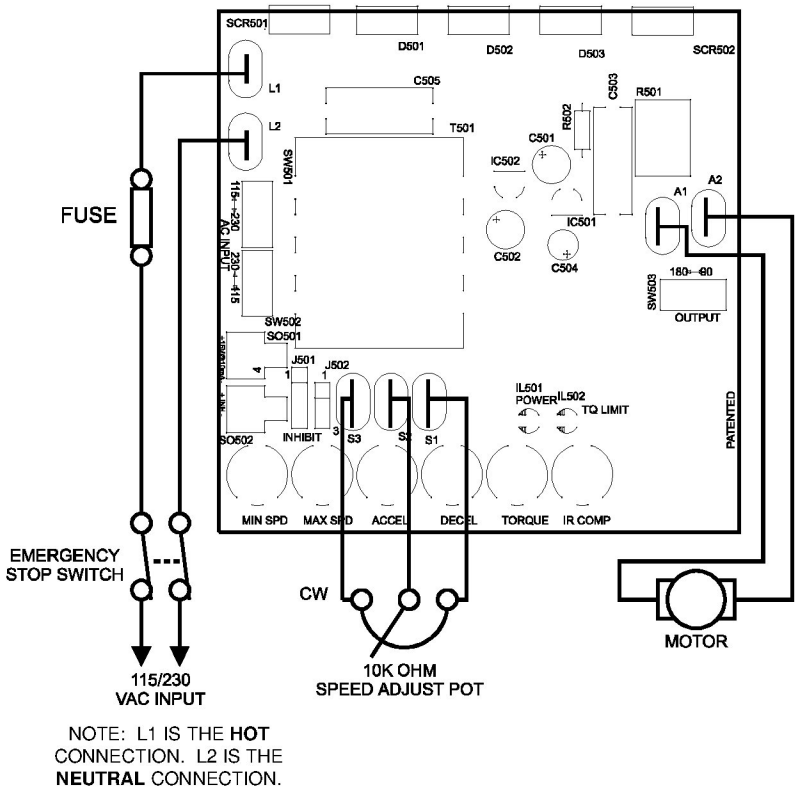


Figure 6. DC3N Chassis Drive Connections

Voltage follower

ATTENTION: The equipment is at line voltage when AC power is connected. Disconnect and lockout all ungrounded conductors of the AC power line. Failure to observe this precaution could result in severe bodily injury or loss of life.

Instead of using a speed adjust potentiometer, the drive may be wired to follow an analog input voltage signal that is isolated from earth ground (Figure 7). Connect the signal input (+) to S2. Connect the signal common (–) to S1. Make no connection to S3. A potentiometer can be used to scale the analog input voltage. An interface device may be used to scale and isolate an analog input voltage.

With either 115 VAC or 230 VAC line voltage, an isolated analog input voltage range of approximately 0–1.4 VDC is required to produce an armature voltage range of 0–90 VDC. With 230 VAC line voltage, an isolated analog input voltage range of approximately 0–2.8 VDC is required to produce an armature voltage range of 0–180 VDC.

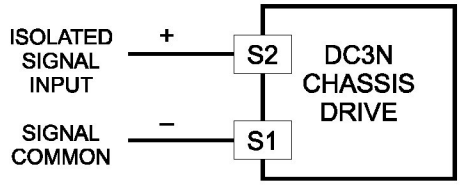


Figure 7. Voltage Follower Connections

Enclosed drive

Mounting (NEMA 1 enclosure)

The NEMA 1 enclosed drive comes with 0.88 inch (22 mm) conduit holes at the bottom of the enclosure. The units may be vertically wall mounted or horizontally bench mounted using the three keyholes on the back of the enclosure.

1. For access to the keyholes and the terminal strip, remove the two screws from the front of the enclosure by turning them counterclockwise. Grasp the front cover and lift it straight out.
2. Install the mounting screws in the three keyholes.
3. Install conduit hardware through the conduit holes at the bottom of the enclosure. Connect external wiring to the terminal block.
4. Reinstall the front cover. Avoid pinching any wires between the front cover and the enclosure.
5. Replace the two screws to the front cover. Turn the screws clockwise to tighten.
6. Set the POWER switch to the OFF position before applying the AC line voltage.

Mounting (NEMA 4X enclosure)

The NEMA 4X enclosed drive comes with two 0.88 inch (22 mm) conduit knockout holes at the bottom of the enclosure. The units may be vertically wall mounted using the four 0.19 inch (5 mm) slotted holes on the attached heat sink. For motor loads less than 5 ADC, the drive may be bench mounted horizontally, or operated without mounting.

1. Install the mounting screws.
2. For access to the terminal strip, turn the slotted screw on the front cover counterclockwise until it is free from the enclosure. The right side of the cover is hinged to the enclosure. Pull the slotted screw to open the enclosure.
3. Carefully remove the conduit knockouts by tapping them into the enclosure and twisting them off with pliers.
4. Install conduit hardware through the 0.88 inch (22 mm) knockout holes. Connect external wiring to the terminal block.
5. Grasp the slotted screw and tilt the front cover back into place. Avoid pinching any wires between the front cover and the enclosure.
6. Turn the slotted screw clockwise until tight to secure the front cover.
7. Set the POWER switch to the OFF position before applying the AC line voltage.

Heat sinking

The DC3N Plate Style and NEMA1 enclosed models require additional heat sinking when the continuous armature current is above 5 ADC. Use Reliance Electric part numbers:

- DC3N-HS-00 for the Plate Style drive
- DC3N-HS-01 for the NEMA 1 enclosed drive

NOTE: NEMA4X/12 models include a heatsink as standard.
All other enclosed drives have sufficient heat sinking in their basic configurations. Use a thermally conductive heat sink compound (such as Dow Corning® 340 Heat Sink Compound) between the back of the drive enclosure and heat sink surface for optimum heat transfer.

Line fusing

ATTENTION: Most code requires that upstream branch protection be provided to protect input power wiring. Failure to observe this precaution could result in severe bodily injury or loss of life.

15-amp line fuses are preinstalled on models DC3N-12D-01-010-AN and DC3N-12D-4X-010-AN. If the horsepower rating of the motor being used is less than the maximum horsepower rating of the drive, the line fuse may have to be replaced with a lower rated one. Refer to Table 1 on page 9 to install a lower rated fuse. External line fuses are not required.

Install the required, user-supplied branch circuit protection fuses according to the applicable local, national, and international codes (e.g., NEC/CEQ. The fuses must be installed in the line before the drive input terminals.

Connections

ATTENTION: Do not connect this equipment with power applied. Failure to observe this precaution may result in fire or serious injury.

Motor

ATTENTION: To provide the motor with overload protection, local, national, and international codes (e.g.,NEC/CEC) require that a motor thermostat, internal to the motor, be installed or an electronic thermal motor overload relay, sized to protect the motor, be installed between the motor and the drives output terminals.

Connect a motor to terminals A1 and A2 as shown in Figure 8. Ensure that the motor voltage rating is consistent with the drive's output voltage.

Power input

ATTENTION: Installation of a master power switch in the input line is required. This is the only way to disconnect power from the motor. The user is responsible for assuring safe conditions for operating personnel by providing suitable guards, audio or visual alarms, or other devices. Failure to observe these precautions could result in bodily injury.

Connect the AC line power leads to terminals L1 and L2 as shown in Figure 8, or to a double-pole, single-throw master power switch (recommended). Ensure that earth ground is connected to the green screw inside the case.

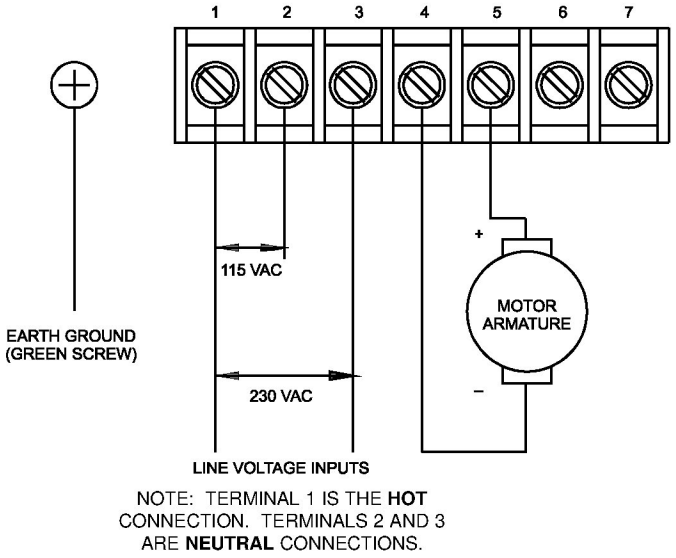


Figure 8. Enclosed Drive Connections

Operation

ATTENTION: Change voltage switch settings only when the drive is disconnected from AC line voltage. Make sure both switches are set to their correct position. If the switches are improperly set to a lower voltage position, the motor will not run at full voltage and may cause damage to the transformer. If the switches are improperly set to a higher voltage position, the motor will overspeed, which may cause motor damage, or result in bodily injury or loss of life.

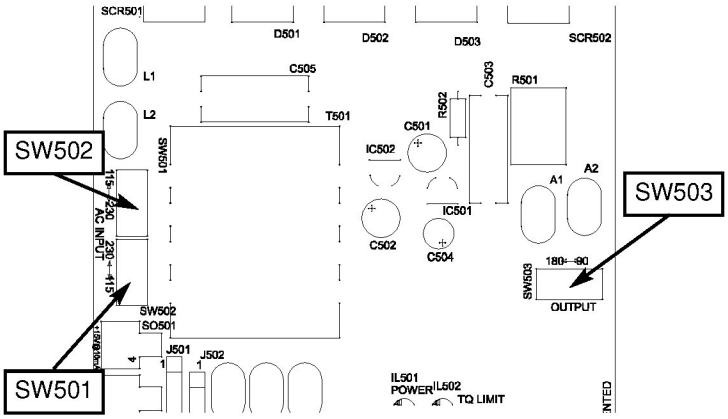


Figure 9. Voltage Switches

Before applying power

ATTENTION: If the motor or drive does not perform as described, disconnect the AC line voltage immediately. Refer to the *Troubleshooting* section, page 35, for further assistance.

- Set voltage switch SW501 and SW502 to either 115V or 230V to match the AC line voltage. Set voltage switch SW503 to either 90V or 180V to match the maximum armature voltage (Figure 9).
- Verify that no conductive material is present on the printed circuit board.
- If using a 90 VDC or 130 VDC motor with 230 VAC line voltage, derate the nameplate motor speed and torque by at least 30%. Contact the factory for details.

Drive Operation

ATTENTION: For frequent starts and stops, short the inhibit terminals, decelerate to a minimum speed, or apply a dynamic brake to the motor. Do not use any of these methods for emergency stopping. They may not stop a drive that is malfunctioning. Removing AC line power (both L1 and L2) is the only acceptable method for emergency stopping.

ATTENTION: Frequent starting and stopping can produce high torque. This may cause damage to motors, especially gearmotors that are not properly sized for the application.

ATTENTION: Starting and stopping with the inhibit terminal pins does not disconnect AC power in the stop position. A hardwired AC power disconnection switch must be mounted in close proximity to the operator's start/stop controls. This is required, as the DC3 drive does not have an armature loop contactor. A single fault like a power device short may cause motor rotation when in the stop mode. The user is responsible for assuring safe conditions for operating personnel by providing suitable guards, audio or visual alarms, or other devices. Failure to observe these precautions could result in bodily injury.

DC3N Chassis Drives

1. Turn the speed adjust potentiometer full counterclockwise (CCW).
2. Apply AC line voltage.
3. Slowly advance the speed adjust potentiometer clockwise (CW). The motor slowly accelerates as the potentiometer is turned CW. Continue until the desired speed is reached.
4. Remove AC line voltage from the drive to coast the motor to a stop.

DC3N Enclosed Drives (NEMA 1 and NEMA 4X)

1. Set the speed adjust potentiometer to "0" (full CCW).
2. Apply AC line voltage.
3. Set the POWER switch to the ON position.
4. Slowly advance the speed adjust potentiometer clockwise (CW). The motor slowly accelerates as the potentiometer is turned CW. Continue until the desired speed is reached.
5. Set the POWER switch to the OFF position to coast the motor to a stop.

Starting and stopping methods

ATTENTION: The equipment is at line voltage when AC power is connected. Disconnect and lockout all ungrounded conductors of the AC power line. Failure to observe this precaution could result in severe bodily injury or loss of life.

Line starting and line stopping

Line starting and line stopping (applying and removing AC line voltage) is recommended for infrequent starting and stopping of a drive only. When AC line voltage is applied to the drive, the motor accelerates to the speed set by the speed adjust potentiometer. When AC line voltage is removed, the motor coasts to a stop.

Starting and stopping using inhibit terminals

ATTENTION: Starting and stopping with the inhibit terminal pins does not disconnect AC power in the stop position. A hardwired AC power disconnection switch must be mounted in close proximity to the operator's start/stop controls. This is required, as the DC3 drive does not have an armature loop contactor. A single fault like a power device short may cause motor rotation when in the stop mode. The user is responsible for assuring safe conditions for operating personnel by providing suitable guards, audio or visual alarms, or other devices. Failure to observe these precautions could result in bodily injury.

Open or short the INHIBIT terminals to coast the motor to minimum or zero speed (see Figure 10 for INHIBIT terminal location). Reopen the INHIBIT terminals to accelerate the motor to set speed. An option is to install a single-pole, single-throw switch across the INHIBIT terminals (Figure 11).

Twist inhibit wires and separate them from other power-carrying wires or sources of electrical noise. Use shielded cable if the inhibit wires are longer than 18 inches (46 cm). If shielded cable is used, ground only one end of the shield to earth ground. Do not ground both ends of the shield. See *Shielding Guidelines* on page 8.

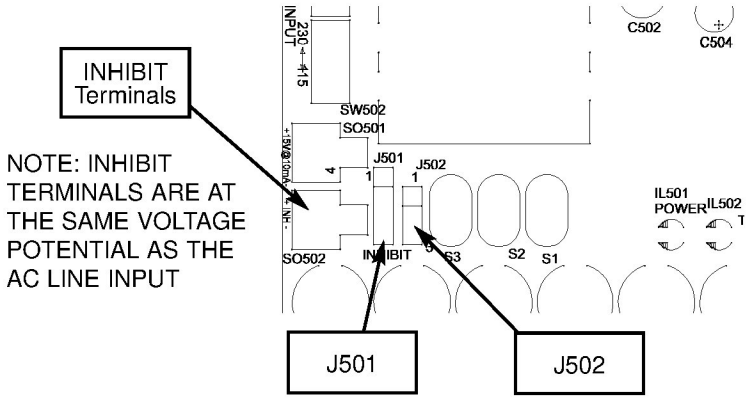


Figure 10. INHIBIT Terminals and Jumper Location

Configuring the inhibit response

> **ATTENTION:** The DC3 Drive is intended to operate at a predetermined minimum speed. If the application requires zero speed operation, the user is responsible for assuring safe conditions for operating personnel by providing suitable guards, audio or visual alarms, or other devices. Failure to observe these precautions could result in bodily injury.

The DC3N drive can be configured for any of four responses to the INHIBIT input, depending on the jumper settings (Figure 11). The options are : RUN (inhibit terminals shorted), RUN (inhibit terminals open), decelerate to minimum speed, and decelerate to zero speed. Minimum speed is set by the MIN SPD trimpot. Refer to *Calibration* for information on adjusting the minimum speed trimpot.

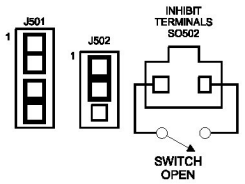
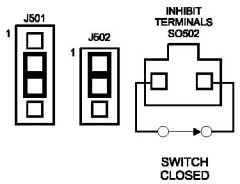
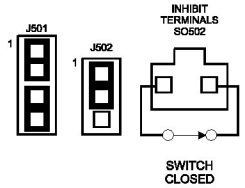
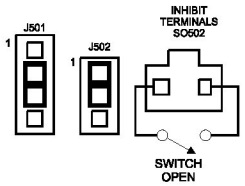
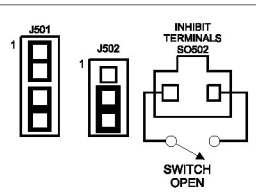
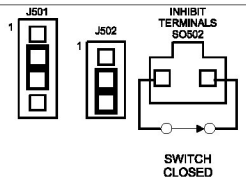
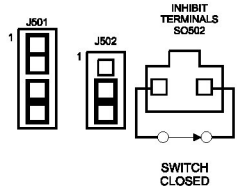
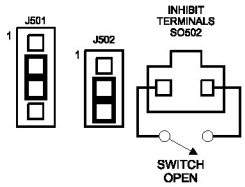
Description	Normally Open Terminals	Normally Closed Terminals
In this configuration, the control will run normally.		
In this configuration, the control will decelerate the motor to minimum speed.		
In this configuration, the control will run normally.		
In this configuration, the control will decelerate the motor to zero speed (stop).		

Figure 11. Inhibit Configuration

Decelerating to minimum speed

ATTENTION: The DC3 Drive is intended to operate at a predetermined minimum speed. If the application requires zero speed operation, the user is responsible for assuring safe conditions for operating personnel by providing suitable guards, audio or visual alarms, or other devices. Failure to observe these precautions could result in bodily injury.

The switch shown in Figure 12 may be used to decelerate a motor to a minimum speed. Closing the switch between S1 and S2 decelerates the motor from set speed to a minimum speed determined by the MIN SPD trimpot setting. If the MIN SPD trimpot is set full CCW, the motor decelerates to zero speed when the switch between S1 and S2 is closed. The DECEL trimpot setting determines the rate at which the drive decelerates. By opening the switch, the motor accelerates to set speed at a rate determined by the ACCEL trimpot setting.

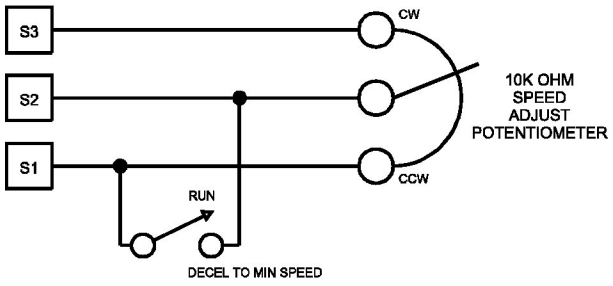


Figure 12. Run/Decelerate to Minimum Speed Switch

Dynamic braking

ATTENTION: Wait for the motor to completely stop before switching it back to RUN. This will prevent high armature currents from damaging the motor or drive.

ATTENTION: Armature output can drift full ON with the switch in the BRAKE position and will be driven full ON if the minimum speed option is selected with the inhibit circuit. Failure to observe this precaution could result in severe bodily injury or loss of life.

Dynamic braking may be used to rapidly stop a motor as shown in Figure 13 on page 24. For the RUN/BRAKE switch, use a two-pole, two-position switch rated for at least 250 VDC, 20 amps. For the dynamic brake resistor, use a 40-watt minimum, high power, wirewound resistor.

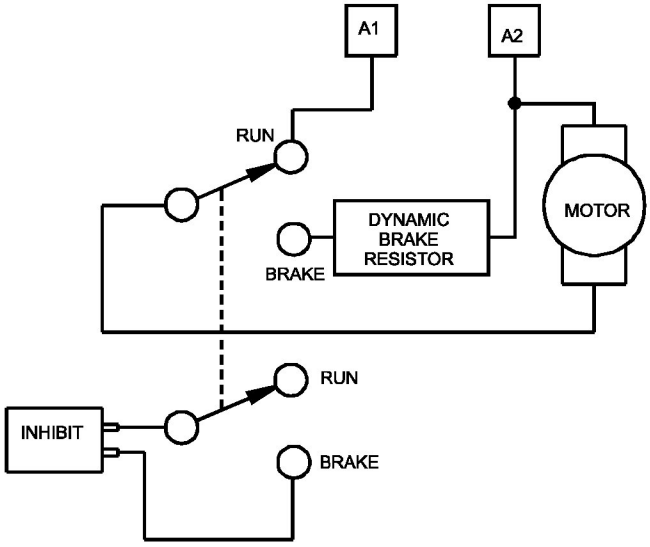
Dynamic brake resistor value

Sizing the dynamic brake resistor depends on load inertia, motor voltage, and braking time. Use a lower-value, higher-wattage dynamic brake resistor to stop a motor more rapidly.

IMPORTANT: For motors rated 1/17 horsepower and lower, a brake resistor is not necessary since the armature resistance is high enough to stop the motor without demagnetization. Replace the dynamic brake with 12 gauge wire.

Table 2. Recommended Dynamic Brake Resistor Sizes

Motor Armature Current Rating	Minimum Dynamic Brake Resistor Value	Minimum Dynamic Brake Resistor Wattage
Less than 2 ADC	1 ohm	1W
2–3 ADC	5 ohm	5W
3–5 ADC	10 ohm	10W
5–10 ADC	20 ohm	20W
10–17 ADC	40 ohm	50W



NOTE: SWITCH MUST BE RATED FOR AC LINE INPUT VOLTAGE

Figure 13. Dynamic Brake Connection

Power supply header block

The power supply header block can supply an unregulated +9 VDC (5 mA) to external devices when the motor and the power supply of the drive are fully loaded. More current is available with less motor loading. The power supply can supply an unregulated +15V (10 mA) signal in typical applications.

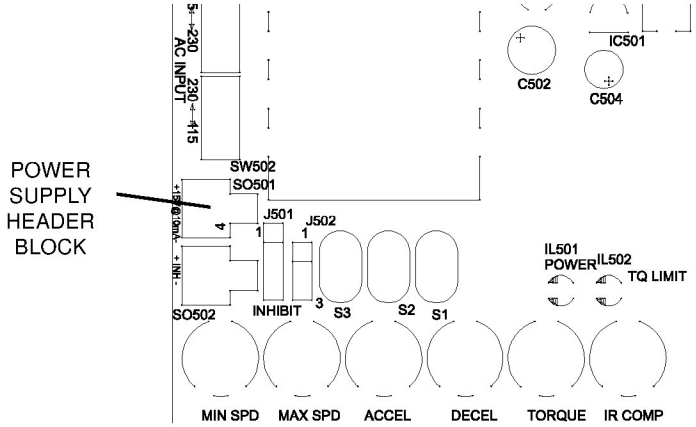


Figure 14. Power Supply Header Block

Calibration

ATTENTION: Dangerous voltages exist on the drive when it is powered, and up to 30 seconds after power is removed and the motor stops. When possible, disconnect the voltage input from the drive before adjusting the trimpots. If the trimpots must be adjusted with power applied, use insulated tools and the appropriate personal protection equipment. BE ALERT. High voltages can cause serious or fatal injury.

ATTENTION: The control circuit is at line potential when the drive is energized. Use a non-metallic screwdriver when making adjustments to the circuit board potentiometers. Exercise extreme caution as hazardous voltage exists. Failure to observe these precautions could result in severe bodily injury of loss of life.

The DC3N chassis drive has six user adjustable trimpots: MIN SPD, MAX SPD, TORQUE, IR COMP, ACCEL, and DECEL. Each drive is factory calibrated to its maximum horsepower rating. Readjust the calibration trimpot settings to accommodate lower horsepower motors.

All trimpot settings increase with clockwise (CW) rotation, and decrease with counterclockwise (CCW) rotation. Use a non-metallic screwdriver for calibration. Each trimpot is identified on the printed circuit board. Refer to Figure 15 for locations.

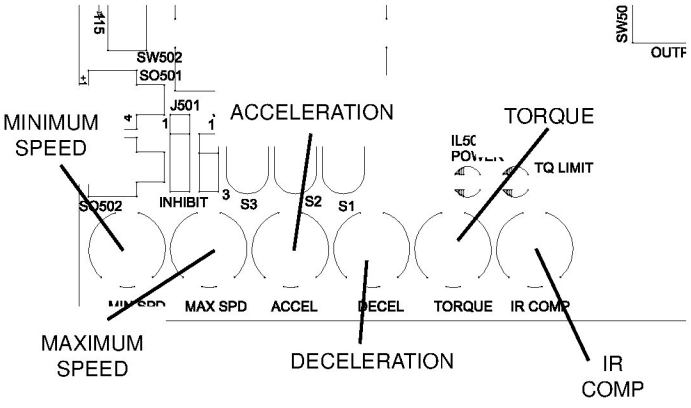


Figure 15. Calibration Trimpot Layout

MIN SPD

ATTENTION: The DC3 Drive is intended to operate at a predetermined minimum speed. If the application requires zero speed operation, the user is responsible for assuring safe conditions for operating personnel by providing suitable guards, audio or visual alarms, or other devices. Failure to observe these precautions could result in bodily injury.

The MIN SPD setting determines the motor speed when the speed adjust potentiometer is turned full CCW. It is factory set to zero speed.

To calibrate, turn the speed adjust potentiometer full CCW. Adjust the MIN SPD trimpot until the motor has stopped (for zero speed setting), or is running at the desired minimum speed.

MAX SPD

The MAX SPD setting determines the motor speed when the speed adjust potentiometer is turned full CW. It is factory set for maximum rated speed.

To calibrate, turn the speed adjust potentiometer full CW. Adjust the MAX SPD trimpot until the motor is running at the desired maximum speed.

ACCEL

The ACCEL setting determines the time the motor takes to ramp to a higher speed. See *Specifications* on page 1 for approximate acceleration times. ACCEL is factory set for the fastest acceleration time (full CCW).

To set the acceleration time:

1. Set the speed adjust potentiometer full CCW. The motor should run at minimum speed.
2. Turn the speed adjust potentiometer full CW and measure the time it takes the motor to go from minimum to maximum speed.
3. If the time measured in step 2 is not the desired acceleration time, turn the ACCEL trimpot CW for a slower acceleration time, or CCW for a faster acceleration time. Repeat steps 1 through 3 until the acceleration time is correct.

DECEL

The DECEL setting determines the time the motor takes to ramp to a lower speed. See Specifications on page 1 for approximate deceleration times. DECEL is factory set for the fastest deceleration time (full CCW).

To set the deceleration time:
1. Set the speed adjust potentiometer full CW. The motor should run at maximum speed.
2. Turn the speed adjust potentiometer full CCW and measure the time it takes the motor to go from maximum to minimum speed.
3. If the time measured in step 2 is not the desired deceleration time, turn the DECEL trimpot CW for a slower deceleration time, or CCW for a faster deceleration time. Repeat steps 1 through 3 until the deceleration time is correct.

TORQUE

> ⚠ **ATTENTION:** Although the TORQUE trimpot is set to 150% of motor nameplate current rating, continuous operation beyond that rating may damage the motor.

The TORQUE setting, commonly referred to as "current limit", determines the maximum torque for accelerating and driving the motor. TORQUE is factory set at 150% of rated motor current.

To calibrate TORQUE:
1. With the power disconnected from the drive, connect a DC ammeter in series with the armature.
2. Set the TORQUE trimpot to minimum (full CCW).
3. Lock the motor shaft. Be sure that the motor is firmly mounted to withstand maximum torque generated by the motor.
4. Connect power to the drive.
5. Set the speed adjust potentiometer to maximum reverse speed.
6. Adjust the TORQUE trimpot CW slowly until the armature current is 150% of motor rated armature current.
7. Set the speed adjust potentiometer to minimum and remove power.
8. Remove the shaft lock from the motor.

See Figure 16 for recommended TORQUE settings.

IR COMP

The IR COMP trimpot setting determines the degree to which motor speed is held constant as the motor load changes. It is factory set for optimum motor regulation.

To calibrate IR COMP (exact calibration):

1. Turn the IR COMP trimpot full CCW.
2. Set the speed adjust potentiometer until the motor runs at midspeed without load (for example, 900 RPM for an 1800 RPM motor) A hand held tachometer may be used to measure motor speed.
3. Load the motor armature to its full load armature current rating. The motor should slow down.
4. While keeping the load on the motor, rotate the IR COMP trimpot until the motor runs at the speed measured in step 2.

Approximate calibration:
If the motor does not maintain set speed as the load changes, gradually rotate the IR COMP trimpot CW. If the motor oscillates (overcompensation), the IR COMP trimpot may be set too
high (CW). Turn the IR COMP trimpot CCW to stabilize the motor speed.

See Figure 16 for recommended IR COMP settings.

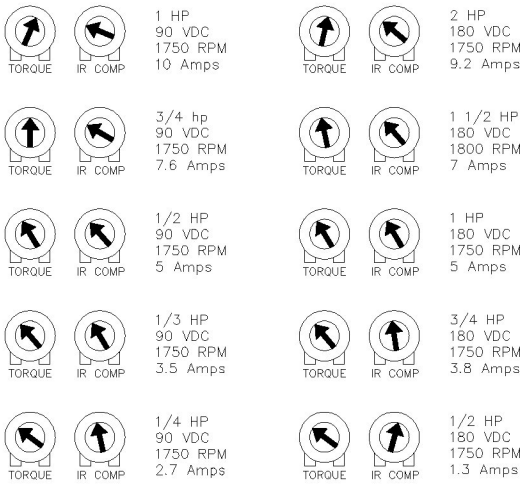


Figure 16. Recommended Torque and IR COMP Settings (actual settings may vary with each application)

Application Notes

Multiple fixed speeds

Replace the speed adjust potentiometer with series resistors with a total series resistance of 5K ohm or 10K ohms (Figure 17). Add a single pole, multi-position switch with the correct number of positions for the desired number of fixed speeds.

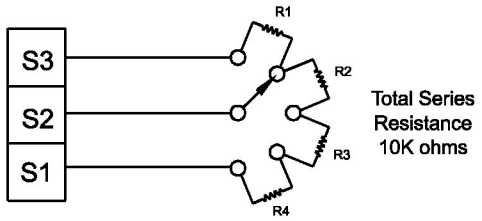


Figure 17. Multiple Fixed Speeds

Adjustable speeds using potentiometers in series

Replace the speed adjust potentiometer with a single pole, multi-position switch, and two or more potentiometers in series, with a total series resistance of 10K ohms. Figure 18 shows a connection for fixed high and low speed adjust potentiometers.

If desired, you can use two 5K ohm or 10K ohm potentiometers in parallel; however, the maximum speed adjust trimpot must then be recalibrated. Refer to the Max Spd section (page 32) of Calibration for more information.

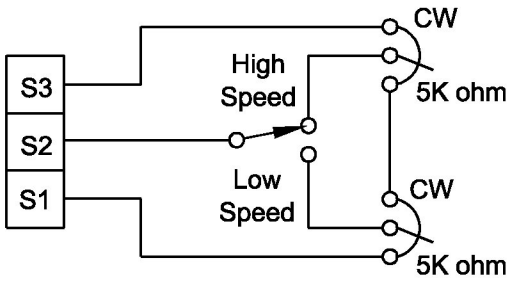


Figure 18. Adjustable Fixed Speeds Using Potentiometers in Series

Independent adjustable speeds

Replace the speed adjust potentiometer with a single pole, multi-position switch, and two or more potentiometers in parallel, with a total parallel resistance of 10K ohms. Figure 19 shows the connection of two independent speed adjust potentiometers that can be mounted at two separate operating stations.

If desired, you can use two 5K ohm or 10K ohm potentiometers in parallel; however, the maximum speed adjust trimpot must then be recalibrated. Refer to the Max Spd section of Calibration for more information.

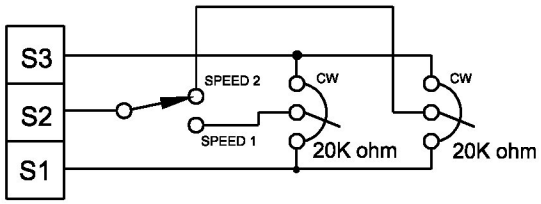


Figure 19. Independent Adjustable Speeds

RUN/JOG switch

ATTENTION: Starting and stopping with the inhibit terminal pins does not disconnect AC power in the stop position. A hardwired AC power disconnection switch must be mounted in close proximity to the operator's start/stop controls. This is required, as the DC3 drive does not have an armature loop contactor. A single fault like a power device short may cause motor rotation when in the stop mode. The user is responsible for assuring safe conditions for operating personnel by providing suitable guards, audio or visual alarms, or other devices. Failure to observe these precautions could result in bodily injury.

Using a RUN/JOG switch is recommended in applications where quick stopping is not needed and frequent jogging is required. Use a single pole, two position switch for the RUN/JOG switch, and a single pole, normally closed, momentary operated pushbutton for the JOG pushbutton.

In the first wiring option, connect the RUN/JOG switch and JOG pushbutton to the inhibit plug as shown in Figure 20. The motor coasts to a stop when the RUN/JOG switch is set to JOG. Press the JOG pushbutton to jog the motor. Return the RUN/JOG switch to RUN for normal operation.

In the second wiring option, connect the RUN/JOG switch and the JOG pushbutton as shown in Figure 21. When the RUN/JOG switch is set to JOG, the motor decelerates to minimum speed (minimum speed is determined by the MIN SPD trimpot setting). Press the JOG pushbutton to jog the motor. Return the RUN/JOG switch to RUN for normal operation.

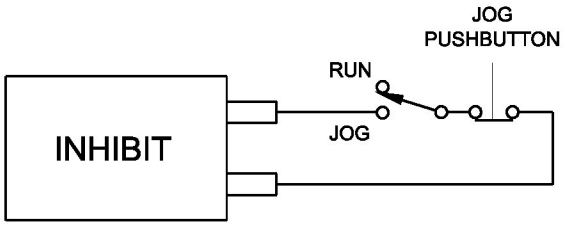


Figure 20. RUN/JOG Switch Connection to Inhibit Plug

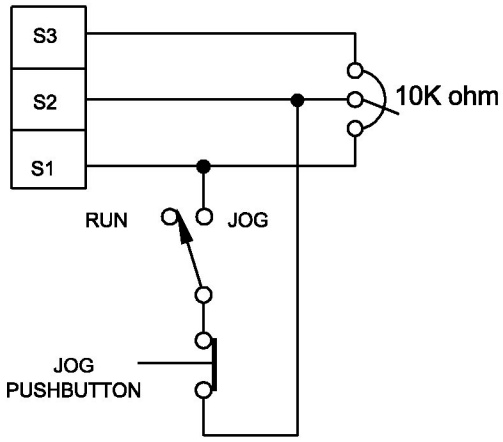


Figure 21. RUN/JOG Switch Connection to Speed Adjust Potentiometer

Reversing

ATTENTION: At very low input levels, noise or drift could cause analog input polarity to change. This could cause the motor to rotate in the opposite direction. Proper precautions should be taken as this could result in damage to, or destruction of, the equipment.

A dynamic brake may be used when reversing the motor direction (Figure 22). Use a three pole, three position switch rated for at least the maximum DC armature voltage and maximum braking current. Wait for the motor to stop completely before switching it to either the forward or reverse direction. See the Dynamic braking section for recommended dynamic brake resistor sizes.

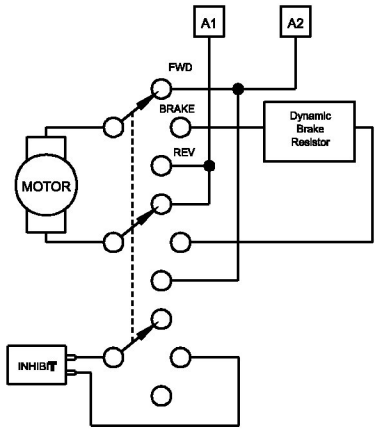


Figure 22. Reversing Circuit Connection

Troubleshooting

ATTENTION: This equipment is at line voltage when AC power is connected. Disconnect and lockout all ungrounded conductors of the AC power line before working on the unit. Failure to observe this precaution could result in severe bodily injury or loss of life.

Before troubleshooting

Perform the following steps before starting any procedure in this section:

- Disconnect AC line voltage from the drive.
- Check the drive closely for damaged components.
- Check that no conductive or other foreign material has become lodged on the printed circuit board.
- Verify that every connection is correct and in good condition.
- Verify that there are no short circuits or grounded connections.
- Check that the voltage selection switch settings match the AC line and output voltages.
- Check that the drive's rated armature and field outputs are consistent with the motor ratings.

Diagnostic LEDs

The DC3N chassis drive is equipped with two diagnostic LEDs. Refer to Figure 23 for LED location.

Power (PWR):
Lights whenever the AC line voltage is applied to the drive.

Current Limit (CURR LIMIT or CL):
Lights whenever the drive reaches current limit.

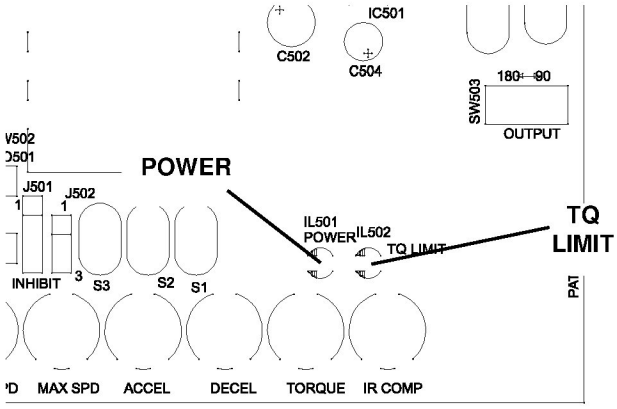


Figure 23. Diagnostic LED Locations

Problem	Possible Causes	Suggested Solutions
Line fuse blows.	1. Line fuse is the wrong size. 2. Motor cable or armature is shorted to ground. 3. Nuisance tripping caused by a combination of ambient conditions and high-current spikes (i.e. reversing).	1. Check that the line fuse is correct for the motor size. 2. Check motor cable and armature for shorts. 3. Add a blower to cool the drive components; decrease TORQUE settings, **or** resize motor and drive for actual load demand, **or** check for incorrectly aligned mechanical components or “jams”.
Line fuse does not blow, but the motor does not run.	1. Speed adjust potentiometer is set to zero speed. 2. INHIBIT terminals are jumpered. 3. S2 is shorted to S1. 4. Drive is in current limit. 5. Drive is not receiving AC line voltage. 6. Motor is not connected.	1. Increase the speed adjust potentiometer setting. 2. Remove jumper from the INHIBIT terminals. 3. Remove short. 4. Verify that motor is not jammed. Increase TORQUE setting if they are set too low. 5. Apply AC line voltage to L1 and L2. 6. Connect motor to A1 and A2.

Problem	Possible Causes	Suggested Solutions
Motor does not stop when the speed adjust potentiometer is full CCW.	MIN SPD setting is too high.	Calibrate MIN SPD.
Motor runs in the opposite direction (non-reversing drives).	Motor connections to A1 and A2 are reversed.	Reverse connections to A1 and A2.
Motor runs too fast.	1. MAX SPD and MIN SPD are set too high.	1. Calibrate MAX SPD and MIN SPD.
Motor will not reach the desired speed.	1. MAX SPD setting is too low. 2. IR COMP setting is too low. 3. TORQUE setting is too low. 4. Motor is overloaded.	1. Increase MAX SPD setting. 2. Increase IR COMP setting. 3. Increase TORQUE setting. 4. Check motor load. Resize the motor if necessary.
Motor pulsates or surges under load.	1. IR COMP is set too high. 2. Motor bouncing in and out of current limit.	1. Adjust the IR COMP setting slightly CCW until the motor speed stabilizes. 2. Make sure motor is not undersized for load; adjust TORQUE trimpot CW.

Functional Diagrams

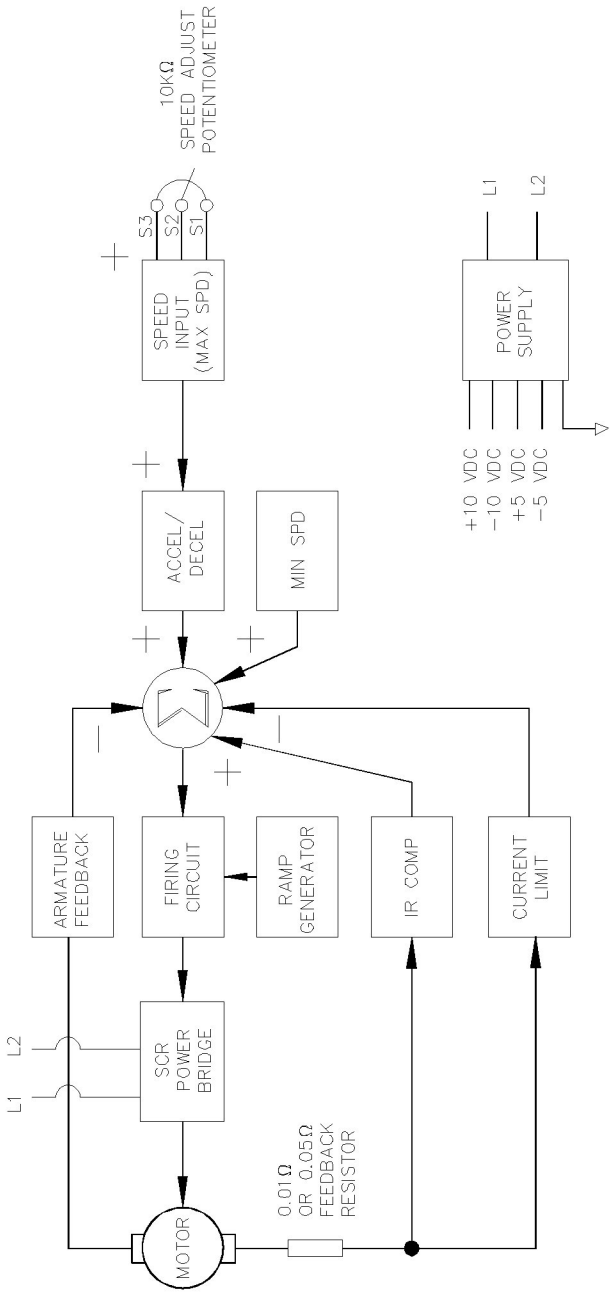


Figure 24. DC3N Series Block Diagram

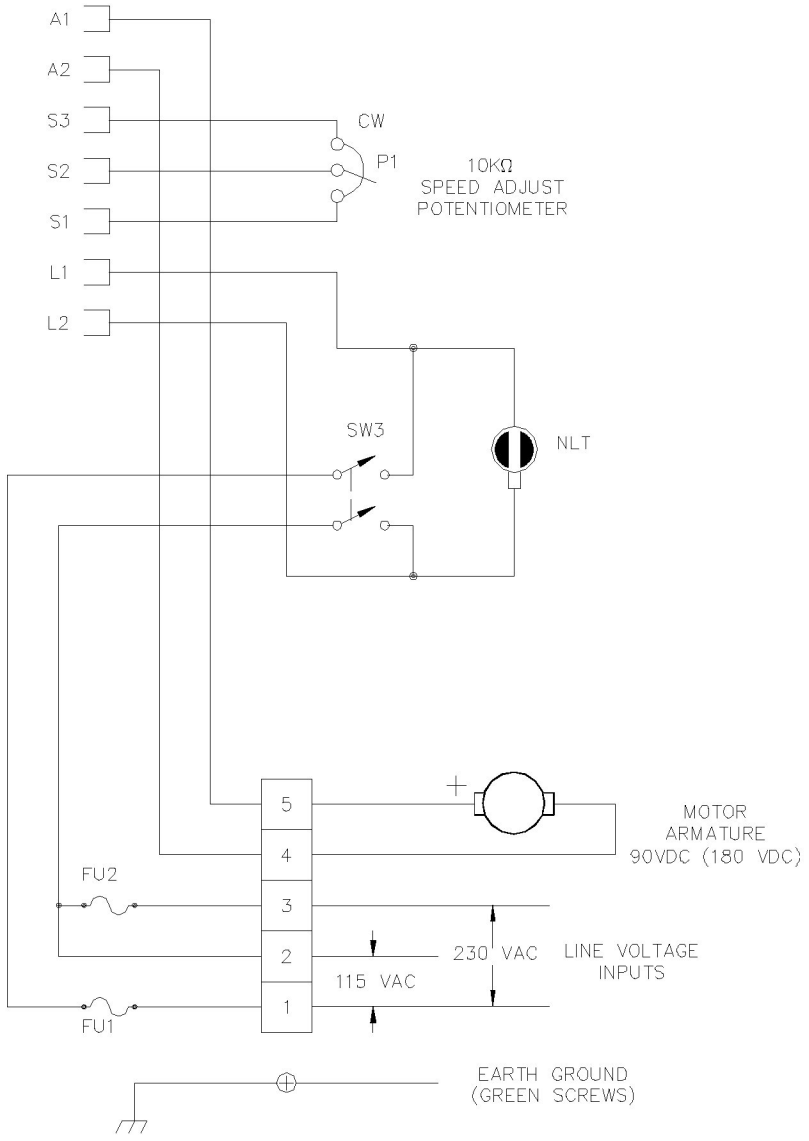


Figure 25. Terminal Block Connections for DC3N Enclosed Drives

CE Compliance

Reliance Electric Corporation hereby certifies that its DC3N series drives have been approved to bear the "CE" mark provided the conditions of approval have been met by the end user.

The DC3N series has been tested to the following test specifications:

EN55011:1991 (emissions), and
EN50082-1:1992 (immunity)

Compliance allows Reliance Electric's DC3N series to bear the CE mark.

The end user, as described herein, falls into one of two categories:

1. The Consumer will deploy a stand-alone unit as an integral, yet external, portion of the machine being operated.
2. The Original Equipment Manufacturer (OEM) will implement the product as a component of the machine being manufactured.

External filtering

In addition to EMI/RFI safeguards inherent in the DC3N series' design, external filtering is required. If the end-user is using a CE-approved motor, the correct line filter listed below is all that is necessary to meet the EMC directives listed herein.

Line filters

Reliance Electric requires the Corcom® line filters listed below.

Table 3. Corcom® Filters

Nameplate Current of Motor Wired to the Drive	Corcom® Filter Part Number
0 to 4 amps	6VV1
4.1 to 13 amps	20VV1

If the exact line filter is not available, the specifications are as follows:

L = (1.73 + 0.03) milliHenries.
C = (0.27 + 0.54) microFarads (X); 0.0055 microFarads (Y).
R = 330Kohms.
Rated current: 1.4 times maximum DC motor current.
Filter type: Balanced 2-section.

The line filters should be wired to the AC line within 0.25 meters of the drive. The ground connection from the line filter must be wired to solid earth ground (resistance less than 500 ohms); not machine ground. This is very important!

Armature filters

If the end-user is not using a CE-approved motor, a second filter on the armature must be deployed. This filter will have the Reliance Electric part number CEXXMM, where XX is the motor current rating listed on the nameplate. Reliance Electric® Filters are listed below.

Table 4. Reliance Electric® Filters

Nameplate Current of Motor Wired to the Drive	Reliance Electric® Filter Part Number
0 to 4 amps	CE4MM
4.1 to 13 amps	CE20MM

The filters listed above are Real-Pole Balanced-Pi 3-pole filters. If the exact filter is not available, the specifications are as follows:

L & L1 = 2 * (0.8) milliHenries.
C & C1 = 2 * (0.1) microFarads @ 400W VDC.
Rin = 0.1 ohm; Rout = 1.2 ohm.

The filters listed above must be wired to the DC output of the drive, as close to the drive as possible.

The end user must use the filters listed in this section to comply with CE. The OEM may choose to provide alternative filtering that encompasses the Reliance Electric drive and other electronics within the same panel.

The OEM has this liberty because CE is a machinery directive. Whether or not every component in the OEM's machinery meets CE, the OEM must still submit his machine for CE approval.

Thus, no component must necessarily meet CE within the machine, as long as the OEM takes the necessary steps to guarantee the machine does meet CE. By the same token, even if every component in the OEM's machine does meet CE, the machine will not necessarily meet CE as a machine.

Using CE-approved wiring practices (such as proper shielding) and the filters listed in this section help the drive meet EN55011 (1991 emissions standard) and EN50082-1 (1992 immunity standard).

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Rockwell Automation

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