



An American Control Electronics Brand

# DC120-4Q

4Q PWM microprocessor based Chassis  
Adjustable Speed Drive  
for Low Voltage PMDC Brush Motors

## Specifications

Model	Source Voltage (VDC)	Armature Voltage Range (VDC)	Peak Armature Current (Amps)	Motor Horsepower Range
DC120-12/24-4Q	12 24 of Source Voltage	Up to 100%	120*	1/12 - 2/3 1/6 - 1 1/2

\* Peak current rating for 1 minute. Continuous current rating is 60 amps.

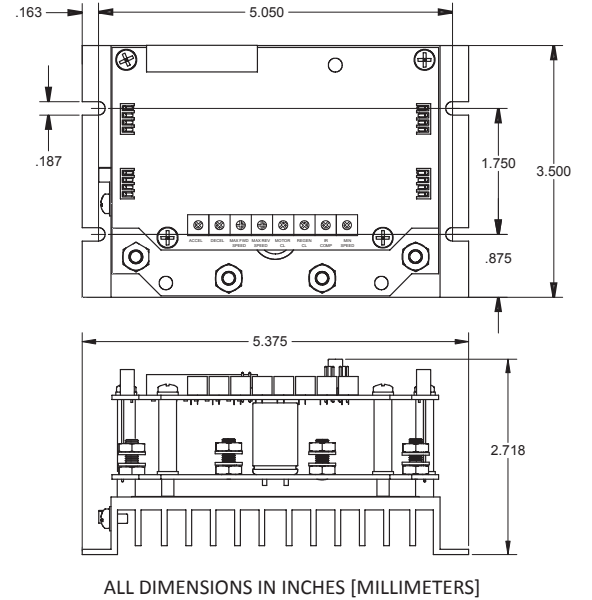
Source Voltage.....	10 - 32 VDC
Form Factor.....	1.01 at base speed
Acceleration Time Range.....	0.5 - 30 seconds
Deceleration Time Range.....	0.5 - 30 seconds
Analog Input Voltage Range.....	0 - 5 VDC
Input Impedance (S1 to S2).....	>100k ohms
Load Regulation.....	1% base speed
Speed Range.....	80:1
Vibration (0 - 50 Hz).....	0.5G maximum
(>50 Hz).....	0.1G maximum
Ambient Temperature Range.....	0°C - 40°C
Weight.....	0.98 lbs

## Safety Warnings

### READ ALL SAFETY WARNINGS BEFORE INSTALLING THIS EQUIPMENT

- **DO NOT INSTALL, REMOVE, OR REWIRE THIS EQUIPMENT WITH POWER APPLIED.** Have a qualified electrical technician install, adjust and service this equipment. Follow the National Electrical Code and all other applicable electrical and safety codes, including the provisions of the Occupational Safety and Health Act (OSHA), when installing equipment.
- Avoid direct contact with the printed circuit board or with circuit elements to prevent the risk of serious injury or fatality. Use a non-metallic screwdriver for adjusting the calibration trim pots. Use approved personal protection equipment and insulated tools if working on this drive with power applied.
- The drive is not diode-protected from reverse battery voltage. You must ensure that the positive terminal is wired to BAT+ and the negative terminal is wired to BAT-.
- Reduce the chance of an electrical fire, shock, or explosion by using proper grounding techniques, over-current protection, thermal protection, and enclosure. Follow sound maintenance procedures.
- **Removing DC power is the only acceptable method for emergency stopping.** Do not use regenerative braking, decelerating to minimum speed, or coasting to a stop for emergency stopping. They may not stop a drive that is malfunctioning. Removing DC power is the only acceptable method for emergency stopping.
- Applying and removing DC source voltage is recommended for infrequent starting and stopping of a drive only. Regenerative braking, decelerating to minimum speed, or coasting to a stop is recommended for frequent starts and stops. Frequent starting and stopping can produce high torque. This may cause damage to motors.
- **Do not disconnect any of the motor leads from the drive** unless power is removed or the drive is disabled. Opening any one lead while the drive is running may destroy the drive.
- Under no circumstances should power and logic level wires be bundled together.
- Be sure potentiometer tabs do not make contact with the potentiometer's body. Grounding the input will cause damage to the drive.
- Do not exceed 30 in-lbs tightening torque on terminals.

## Dimensions



## Installation

### Mounting

- Drive components are sensitive to electrostatic discharge. Avoid direct contact with the circuit board. Hold the drive by the heat sink only.
- Protect the drive from dirt, moisture, and accidental contact.
- Provide sufficient room for access to the terminal block and calibration trim pots.
- Mount the drive away from heat sources. Operate the drive within the specified ambient operating temperature range.
- Prevent loose connections by avoiding excessive vibration of the drive.
- Mount the drive with its board in either a horizontal or vertical plane. Four 0.19" (5 mm) wide slots in the heat sink accept #8 pan head screws.
- The heat sink should be earth grounded.

### Wiring

Use 18 - 24 AWG wire for logic wiring.  
For DC source (BAT+, BAT-) and motor (A1, A2) wiring, use 8 AWG when in open air and 6 AWG when in a tight enclosed area.

### Shielding Guidelines

As a general rule, it is recommended to shield all conductors. If it is not practical to shield power conductors, it is recommended to shield all logic-level leads. If shielding of logic-level leads is not practical, the user should twist all logic leads with themselves to minimize induced noise. 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 the drive, ground the shield at the end away from the drive. Do not ground both ends of the shield.

### Fusing

The drives require an external line fuse for protection. Use fast acting fuses rated for at least 150% of the maximum armature voltage and current. Fuse the positive terminal.

## Connections

### Pre-Charge

Connect the pre-charge switch between the positive battery terminal and the PRE-CHRG terminal on TB501 on the top board. If the pre-charge circuit is closed and the battery is being connected to the drive and allows the drive to pull less amperage when the pre-charge switch is disconnected, but the battery stays connected. The PRE-CHRG terminal must still be connected to the positive battery terminal if no pre-charge switch is desired.

### Main Contactor

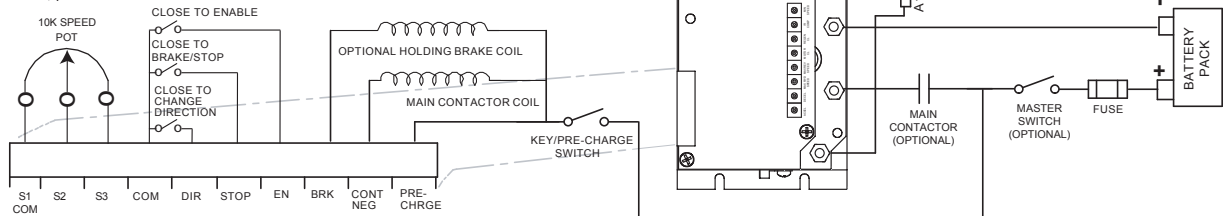
Connect a contactor into the positive battery wiring. Connect the contactor coil to the positive battery terminal and the CONT NEG terminal on TB501 on the top board. If the pre-charge circuit is closed and the drive is enabled, the CONT NEG terminal will output a voltage that engages the main contactor, which will then connect the positive battery terminal to the BAT+ terminal. The advantage of the main contactor is that it serves as an additional safety device to protect against a run away condition, some cases of reverse polarity battery connection, and excessive charging voltages. If no main contactor is desired, do not make any connection to the CONT NEG terminal.

### Input Power

Connect the DC input power leads to terminals BAT+ (positive) and BAT- (negative). **Connecting the DC input power backwards will cause damage to the drive.**

### Motor

Connect the DC armature leads to terminals A1 and A2. If the motor does not spin in the desired direction, power down the drive and reverse these connections.



### Speed Potentiometer

Use a 10k ohm, 1/4 W potentiometer for speed control. Connect the counter-clockwise end of the potentiometer to S1 COM, the wiper to S2, and the clockwise end to S3. If the potentiometer works inversely of desired functionality, (i.e. to increase motor speed, you must turn the potentiometer counterclockwise), power off the drive and swap the S1 COM and S3 connections.

### Stop

Short the COM and STOP terminals to regeneratively brake the motor to zero speed. The stop circuit follows the DECEL trim pot. Open the COM and STP terminals to accelerate the motor to set speed. **Do not use the stop for emergency stopping.**

### Enable

Connect an enable switch to the COM and EN terminals. Close the connection to run and open the connection to coast the motor to a stop. The enable comes into effect regardless of direction. If no switch is desired, jumper the COM and EN terminals.

### Direction

Connect a direction switch to the COM and DIR terminals. Close the connection to change direction.

### POWER

### LOGIC

# Startup

## STARTUP

- Verify that no foreign conductive material is present on the printed circuit board.

1. Turn the speed adjust potentiometer full counterclockwise (CCW).
2. Apply the source voltage.
3. Close the enable.
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. Remove the source voltage from the drive to coast the motor to a stop.

# LEDs

**Power (PWR):** Green LED is on whenever DC source voltage is applied to the drive.

**Status (FAULT):** Red LED

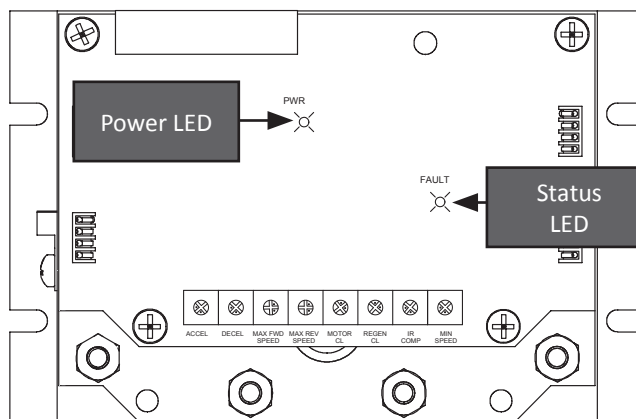
Solid: The drive is either in Torque Limit or Regenerative Torque Limit.

2 Blinks: The drive is in an under-voltage trip.

3 Blinks: The drive is in an over-voltage trip.

4 Blinks: The drive has detected a short circuit on the output.

5 Blinks: The drive is in an overheat trip.



# Calibration

**Minimum Speed (MIN SPD):** The MIN SPD setting determines the minimum motor speed when the speed adjust potentiometer is set for minimum speed. It is factory set for zero speed. To calibrate the MIN SPD:

1. Set the MIN SPD trim pot full CCW.
2. Set the speed adjust potentiometer for minimum speed.
3. Adjust MIN SPD until the desired minimum speed is reached or is just at the threshold of rotation.

**Forward Maximum Speed (MAX FWD SPD):** The MAX FWD SPD setting determines the maximum motor speed in the forward direction when the speed adjust potentiometer is set for maximum speed. It is factory set for maximum motor rated speed. To calibrate the MAX FWD SPD:

1. Set the MAX FWD SPD trim pot full CCW.
2. Set the speed adjust potentiometer for maximum speed.
3. Adjust MAX FWD SPD until the desired maximum speed is reached.

**Reverse Maximum Speed (MAX REV SPD):** The MAX REV SPD setting determines the maximum motor speed in the reverse direction when the speed adjust potentiometer is set for maximum speed. It is factory set for maximum motor rated speed. To calibrate the MAX REV SPD:

1. Set the MAX REV SPD trim pot full CCW.
2. Set the speed adjust potentiometer for maximum speed.
3. Adjust MAX REV SPD until the desired maximum speed is reached.

**Motoring Torque (MOTOR CL):** The MOTOR CL setting determines the maximum torque for accelerating and driving the motor in the forward or reverse directions. To calibrate the MOTOR CL:

1. With the power disconnected from the drive, connect a DC ammeter in series with the armature.
2. Set the MOTOR CL trim pot to minimum (full CCW).
3. Set the speed adjust potentiometer to maximum forward speed (full CW).
4. Carefully lock the motor armature. Be sure that the motor is firmly mounted.
5. Apply power source. The motor should be stopped.
6. Slowly adjust the MOTOR CL trim pot CW until the armature current is 150% of motor rated armature current.
7. Turn the speed adjust potentiometer to minimum speed (full CCW).
8. Remove power source.
9. Remove the stall from the motor.
10. Remove the ammeter in series with the motor armature if it is no longer needed.

**Regening Torque (REGEN CL):** The REGEN CL setting determines the maximum torque for decelerating the motor and resisting an overhauling load in the forward or reverse directions. Turn the REGEN CL trim pot CW to increase the regen current limit and CCW to decrease the regen current limit. See the approximate settings below.

**IR Compensation (IR COMP):** The IR COMP setting determines the degree to which motor speed is held constant as the motor load changes. It is factory set for minimum (full CCW). To calibrate the IR COMP:

1. Set the IR COMP trim pot full CCW.
2. Increase the speed adjust potentiometer until the motor runs at midspeed without load. A handheld 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 trim pot until the motor runs at the speed measured in step 2. If the motor oscillates (overcompensation), the IR COMP trim pot may be set too high (CW). Turn the IR COMP trim pot CCW to stabilize the motor.
5. Unload the motor.

**Acceleration (ACCEL):** The ACCEL setting determines the time the motor takes to ramp to a higher speed. To calibrate the ACCEL, turn the ACCEL trim pot CW for a longer acceleration time and CCW for a shorter acceleration time.

**Deceleration (DECEL):** The DECEL setting determines the time the motor takes to ramp to a lower speed. To calibrate the DECEL, turn the DECEL trim pot CW for a longer deceleration time and CCW for a shorter deceleration time.