

# Safety Warnings

Please read these instructions carefully before performing any of the procedures contained in this manual.

- 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.
- Reduce the chance of an electrical fire, shock, or explosion by proper grounding, over-current protection, thermal protection, and enclosure. Follow sound maintenance procedures.
- It is possible for a drive to run at full speed as a result of a component failure. We strongly recommend the installation of a master switch in the main power input to stop the drive in an emergency.
- Circuit potentials are at 115 VAC or 230 VAC above earth ground. 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 trimpot. Use approved personal protective equipment and insulated tools if working on this drive with power applied.

# Specification

Model: BC2000 series

Max. Current: 6 A

AC Line Voltage 115 VAC or 230 VAC  $\pm 10\%$ , 50/60 Hz, single phase

Armature Voltage (115 VAC Input) 0–90 VDC

Armature Voltage (230 VAC Input) 0–180 VDC

Field Voltage (115 VAC Input) 100 VDC

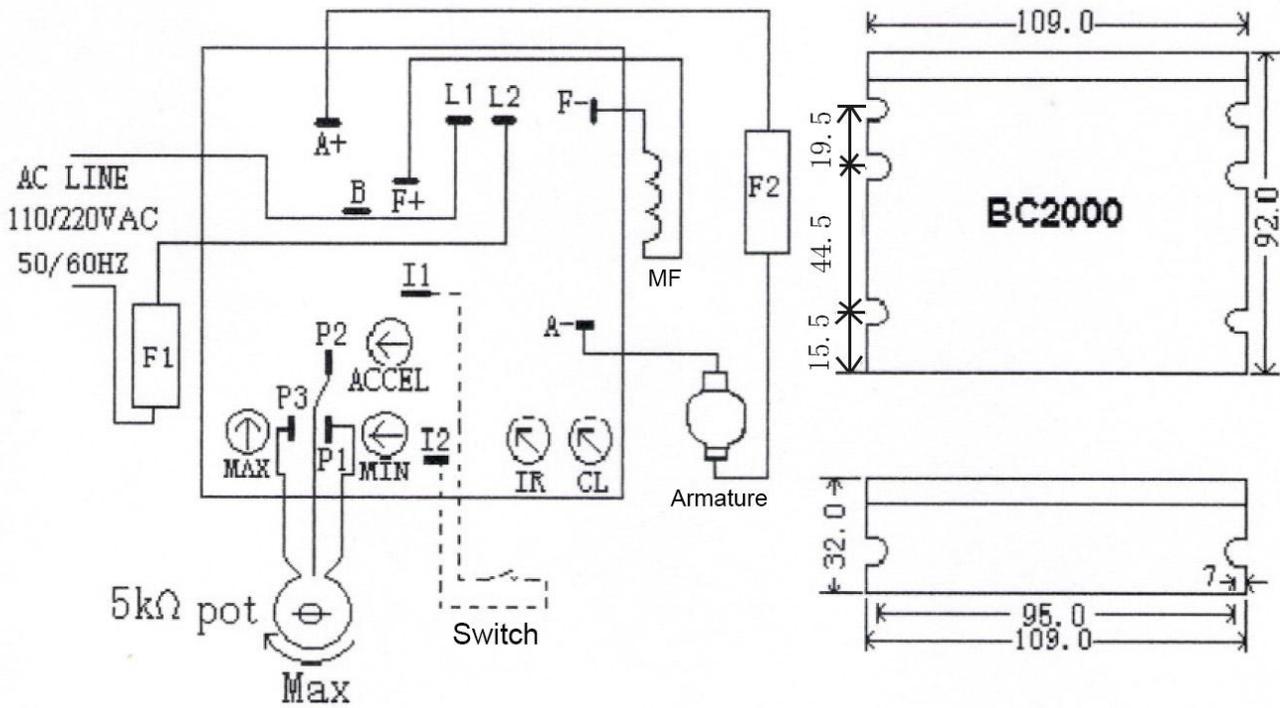
Field Voltage (230 VAC Input) 200 VDC

Max. Field Current 1 ADC

Safety Certification: CSA Certified CE Certificate of Compliance

Ambient Temp. Range (chassis drive) 10°C–55°C

# Drawing



Circuit Drawing

Dimensions

# Installation

Do not install, rewire, or remove this control with input power applied. Doing so may cause fire or serious injury. Make sure you have read and understood the Safety

## Mounting

Drive components are sensitive to electrostatic fields. Avoid contact with the circuit board directly. Hold drive by the chassis only.

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.

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

Do not install, remove, or rewire this equipment with power applied. Failure to heed this warning may result in fire, explosion, or serious injury.

Circuit potentials are at 115 or 230 VAC above ground. To prevent the risk of injury or fatality, avoid direct contact with the printed circuit board or with circuit elements.

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 (A+ and A-) wiring.

## Shielding guidelines

Under no circumstances should power and logic leads be bundled together. Induced voltage can cause unpredictable behavior in any electronic device, including motor controls.

As a general rule, we recommend shielding of all conductors. If it is not practical to shield power conductors, we recommend shielding all logic-level leads. If shielding of logic 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 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.

## Speed adjust potentiometer

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

Mount the speed adjust potentiometer through a 0.38 in. (10 mm) hole in the control panel in your own machine. Install the circular insulating disk between the panel and the 5K ohm speed-adjust potentiometer.

Twist the speed-adjust potentiometer wire to avoid picking up unwanted electrical noise. If speed adjust potentiometer wires are longer than 18 in. (457 mm), use shielded cable. Keep speed adjust potentiometer wires separate from power leads (L1, L2, A+,A-).

## Chassis drive connections

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

Strongly recommend the installation of a master power switch in the voltage input line. The switch contacts should be rated at a minimum of 200% of motor nameplate current and 250 volts.

## Power, fuse and motor connections

Connect the power input leads, an external line fuse and a DC motor to the drive.

## Motor

BC2000 drives supply motor armature voltage from A+ and A- terminals. It is assumed throughout this manual that, when A+ is positive with respect to A- , the motor will rotate clockwise (CW) while looking at the output shaft protruding from the front of the motor. If this is opposite of the desired rotation, simply reverse the wiring of A+ and A- with each other.

Connect a DC motor to PCB terminals A+ and A-. 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 single-throw, double-pole master power switch (recommended). The switch should be rated at a minimum of 250 volts and 200% of motor current.

## Line fuse

BC2000 drives require an external fuse for protection. Use fast acting fuses rated for 250 VAC or higher, and approximately 150% of the maximum armature current. Please select the right fuse according to Table 1.

Table 1 Recommended Line Fuse Sizes

90 VDC Motor (W)	180VDC (W)	F1 (Amp)	F2 (Amp)
50	100	1.5	0.8
100	200	3	1.5
150	300	5	3
250	500	8	4
375	750	12	6

## Field output connections

The field output is for shunt wound motors only. Do not make any connections to F+ and F- when using a permanent magnet motor.

See Table 2 for field output connections. Use 18 AWG wire to connect the field output to a shunt wound motor.

Table 2. Field Output Connections

Line Voltage (VAC)	Approximate Field Voltage (VDC)	Connect Motor Field To
115	100	F+ and F-
230	200	F+ and F-

## Trimpot

### Minimum Speed (MIN)

The MIN trimpot establishes the motor speed obtained in response to the minimum input signal. It is factory set for zero speed.

To calibrate the MIN pot, apply the minimum signal. Adjust the MIN trimpot until the motor runs at the desired speed or is just at the threshold of rotation.

### Maximum Speed (MAX)

The MAX SPD setting determines the maximum motor speed when the speed adjust potentiometer, or voltage input signal is set for maximum forward speed. It is factory set for maximum rated motor speed.

To calibrate MAX:

1. Set the MAX trimpot full CCW.
2. Set the speed adjust potentiometer or voltage input signal for maximum forward speed.
3. Adjust MAX until the desired maximum forward speed is reached.

Note: Check the MIN and MAX adjustments after recalibrating to verify that the motor runs at the desired minimum and maximum speed.

### IR COMPENSATION (IR)

The IR 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.

Use the following procedure to recalibrate the IR COMP setting:

1. Set the IR trimpot to minimum (full CCW).
2. Rotate the speed adjust potentiometer until the motor runs at mid-speed without load (for example, 900 RPM for an 1800 RPM motor). 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 trimpot until the motor runs at the speed measured in step 2. If the motor oscillates (overcompensation), the IR trimpot may be set too high (CW). Turn the IR trimpot CCW to stabilize the motor.

5. Unload the motor.

### TORQUE (CL Trimpot)

The TORQUE setting determines the maximum torque for accelerating and driving the motor. To calibrate TORQUE, refer to the recommended TORQUE settings as the following procedure:

1. With the power disconnected from the drive, connect a DC ammeter in series with the armature.

2. Set the CL trimpot to minimum (full CCW).
3. Set the speed adjust potentiometer or voltage reference signal to maximum speed (full CW).
4. Carefully lock the motor armature. Be sure that the motor is firmly mounted.
5. Apply line power. The motor should be stopped.
6. Slowly adjust the CL trimpot CW until the armature current is 150% of motor rated armature current.
7. Turn the speed adjust potentiometer CCW.
8. Remove line power.
9. Remove the stall from the motor.
10. Remove the ammeter in series with the motor armature if it is no longer needed.

### **Acceleration Time (ACCEL)**

The ACCEL is used to adjust the acceleration time of motor turning from 0 to full speed. 0.5 ~ 4s adjustable

## **Startup**

### **BC2000**

1. Turn the speed adjust potentiometer full counterclockwise (CCW) or set the voltage signal to minimum.
2. Apply AC line voltage.
3. Slowly advance the speed adjust potentiometer clockwise (CW) or increase the voltage signal. 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.