



BC140 / BC140-FBR DC CONTROL

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Important:

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Introduction

Thank you for purchasing the BC140™ / BC140-FBR, full-wave variable speed DC motor controls. Baldor is committed to providing total customer satisfaction by producing quality products that are easy to install and operate. The BC140 and BC140-FBR offer the user the ultimate in reliability and performance at an affordable price.

The BC140 and BC140-FBR are able to handle both 115 and 208/230 Volt AC line inputs. In addition, one model can be used on a wide range of motors by selecting and inserting the appropriate Plug-in Horsepower Resistor®.

The standard model, BC140, controls all motors through 3/4 HP at 115 Volt AC line input and 1-1/2 HP at 230 Volt AC line input. By installing the Auxiliary Heat Sink (see Table 1-2), the horsepower range is increased to 1 HP at 115 Volt AC line input and 2 HP at 230 Volt AC line input. The versatility of the control is enhanced with the optional Forward-Brake-Reverse Switch Kit (Catalog No. BC144)*.

*Note: Forward-Brake-Reverse Switch Kit, BC144, is factory installed on the BC140-FBR model.

The electronics for the BC140 and BC140-FBR consist of a patented speed control module. Its field-proven reliability is confirmed by over 100,000 controls presently in operation. The module is housed in a rugged metal enclosure not plastic. Keyhole slots facilitate mounting and an easily accessible terminal block simplifies connections.

SAFETY NOTICE

A Warning statement indicates a potentially hazardous situation which, if not avoided, could result in injury or death.

A Caution statement indicates a potentially hazardous situation which, if not avoided, could result in damage to property.

A Note indicates additional information that is not critical to the installation or operation.

- WARNING:** This equipment may contain voltages as high as 1000 volts! Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the start-up procedure or troubleshoot this equipment.
- WARNING:** Be sure the system is properly grounded before applying power. Do not apply AC power before you ensure that all grounding instructions have been followed. Electrical shock can cause serious or fatal injury.
- WARNING:** Electrical shock can cause serious or fatal injury. Be sure that all power is disconnected and there is no voltage present from this equipment or equipment to which it is or will be connected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the installation and start-up procedures.
- WARNING:** Electrical shock can cause serious or fatal injury. Verify there is no voltage phase-to-phase or phase-to-neutral at the motor leads before connecting motor to this control. Motor may have high voltage present even when disconnected from this control.
- WARNING:** Do not use motor overload relays with an automatic reset feature. These are dangerous since the process may injure someone if a sudden or unexpected automatic restart occurs. If manual reset relays are not available, disable the automatic restart feature using external control wiring.
- WARNING:** This unit has an automatic restart feature that will start the motor whenever input power is applied and a RUN (FWD or REV) command is issued. If an automatic restart of the motor could cause injury to personnel, the automatic restart feature should be disabled.
- WARNING:** Using a jumper to eliminate the start/stop function will cause the motor to run at the Main Speed Potentiometer setting when the AC line is applied.
- WARNING:** If possible, do not adjust trim pots with the main power applied. Electrical shock can cause serious or fatal injury. If adjustments are made with the main power applied, an insulated adjustment tool must be used to prevent shock hazard and safety glasses must be worn.
- WARNING:** Do not use this drive in an explosive environment. An explosion can cause serious or fatal injury. This drive is not explosion proof.
- WARNING:** When the Enable jumper is installed, the drive and motor will start and run when AC power is applied, when power is restored after a momentary power loss, or after an overload or TCL fault is reset. The user must ensure that automatic start up of the driven equipment will not cause injury to operating personnel or damage to the driven equipment. The user is responsible for providing suitable audible or visual alarms or other devices to indicate that the drive may start at any moment. Failure to observe this warning could result in severe bodily injury or loss of life.

SAFETY NOTICE Continued

- WARNING:** Do not use start/stop, inhibit or enable functions as a safety disconnect. Use only an AC line disconnect for that purpose. Failure to observe this warning could result in severe bodily injury or loss of life.
- Caution:** Disconnect motor leads (A1 and A2) from control before you perform a Dielectric Withstand test on the motor. Failure to disconnect motor from the control will result in extensive damage to the control. The control is tested at the factory for high voltage / leakage resistance as part of Underwriter Laboratory requirements.
- Caution:** Do not connect AC power to the Motor terminals A1 and A2. Connecting AC power to these terminals may damage the control.
- Caution:** Baldor recommends not to use Grounded Leg Delta transformer power leads that may create ground loops. Instead, we recommend using a four wire Wye.
- Caution:** Suitable for use on a circuit capable of delivering not more than 5,000 RMS symmetrical short circuit amperes listed here at rated voltage.
- Caution:** Adjusting the current limit above 150% of the motor nameplate rating can cause overheating and demagnetization of the PM motor.
- Caution:** Do not leave the motor in a locked rotor condition for more than a few seconds since motor damage may occur.
- Caution:** Shunt wound motors may be damaged if field windings remain energized for an extended period of time without armature rotation.

Receiving

Each control is thoroughly tested at the factory and carefully packaged for shipment. When you receive your control, there are several things you should do immediately.

1. Observe the condition of the shipping container and report any damage immediately to the commercial carrier that delivered your control.
2. Verify that the part number you received is the same as the part number listed on your purchase order.
3. Do not unpack until ready for use.

Table Electrical Ratings

AC Voltage (± 15%, 50/60 Hz) (VAC)	Motor Voltage (VDC)	Maximum Rating without Auxiliary Heat Sink			Maximum Rating with Auxiliary Heat Sink		
		AC Current (RMS Amps)	DC Load Current (Avg. Amps)	Power (HP, (kW))	AC Current (RMS Amps)	DC Load Current (Avg. Amps)	Power HP (kW)
115	90 – 130	12.0	6.0	0.75, (0.6)	16.0	12.0	1 (.75)
230	180	12.0	6.0	1.5, (1.1)	16.0	12.0	2 (1.5)

Table 1-2 General Performance Specifications¹

Description	Specification	Factory Setting
Speed Range (Ratio)	50:1	—
Armature Feedback Load Regulation (0 - Full Load, 50:1 Speed Range) (% Base Speed)	1 ²	—
Line Voltage Regulation (at Full Load, ± 10% Line Variation) (% Base Speed)	0.5 ²	—
Control Linearity (% Speed vs. Dial Rotation)	2	—
Acceleration (ACCEL) Trimpot Range (Seconds)	0.2 - 10	2
Deceleration (DECEL) Trimpot Range (Seconds)	0.2 - 10	2
Maximum Speed (MAX) Trimpot Range (% Base Speed)	50 - 110 ²	100
Minimum Speed (MIN) Trimpot Range (% Base Speed)	0 - 30 ²	0
CL/Torque Range (% Full Load)	0 - 200	150
IR Compensation (IR) Trimpot Range (at Specified Full Load at 90/180 Volts Output) (Volts DC)	0 - 24 / 0 - 48	3 / 6
Operating Temperature Range without Optional Auxiliary Heat Sink (Catalog No. BC143) (°C / °F)	0 - 40 / 32 - 104	—
Operating Temperature Range with Optional Auxiliary Heat Sink (Catalog No. BC143) (°C / °F)	0 - 50 / 32 - 122	—

1. CE Compliance requires BC24-LF RFI Filter. (See Optional Accessories, Table 1-2).
2. Performance is for 90 Volt PM motors with 115 VAC line input and 180 Volt DC PM motors with 230 VAC line input.

Chapter 2

Installation

WARNING: Do not use this drive in an explosive environment. An explosion can cause serious or fatal injury. This drive is not explosion proof.

Introduction

The control is designed with a NEMA-1 / IP-40 enclosure for indoor use. It is recommended that the control be mounted vertically on a flat surface with adequate ventilation. Leave enough room below the control to allow for AC line and motor connections and any other connections that are required. A mounting template is included to facilitate mounting of the control.

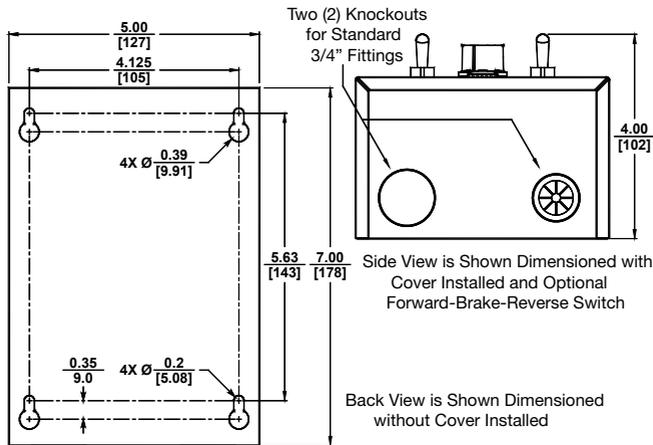
Control installation must ensure unrestricted air flow through the heatsink cooling fins.

Note: If drive is mounted in other than a vertical position, decrease maximum allowable ambient temperature by 10°C.

Front Cover - The control is designed with a removable cover. To remove the cover, the two screws must be removed.

After mounting the control and all connections are completed, install the cover and secure it with the two screws. Tighten the screws to 5 lbs-in (6 kg-cm). Do not overtighten.

Figure 2-1 Mounting Hole Locations



Mounting

The control is designed with a NEMA-1 / IP-40 enclosure for indoor use. It is recommended that the control be mounted vertically on a flat surface with adequate ventilation. Leave enough room below the control to allow for AC line and motor connections and any other connections that are required. A mounting template is included to facilitate mounting of the control. See Figure 2-1.

Care should be taken to avoid extreme hazardous locations where physical damage can occur. The control should be located in an area where it will not be exposed to contaminants such as water, metal chips, solvents or excessive vibration.

Without the Auxiliary Heat Sink, the temperature around the control must not exceed 50°C (122°F). With the Auxiliary Heat Sink, the temperature around the control must not exceed 40°C (104 °F).

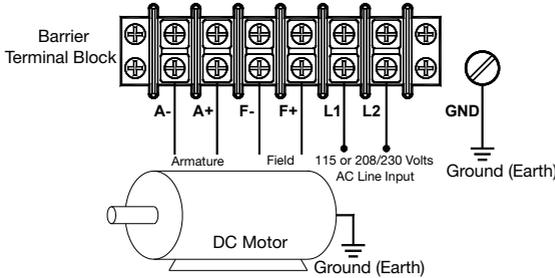
The control is designed with a removable cover. To remove the cover, the two screws must be removed.

After mounting the control and all connections are completed, install the cover and secure it with the two screws. Tighten the screws to 5 lbs-in (6 kg-cm). Do not overtighten.

Electrical Connections

Connection terminals are shown in Figure 2-2.

Figure 2-2 AC Line, Armature, Field*, and Ground Connections



AC Power

Verify AC Line voltage matches to control voltage rating, (115/208/230VAC - 50/60 Hz, 1phase).

Connect AC Line to L1 and L2 terminals and tighten to correct torque (Table 2-1). The installer should provide fuse protection for each ungrounded supply conductor. See Table 2-2.

The AC Line fuse is factory installed. The Armature fuse (supplied separately) must be installed in the armature fuse holder, as shown in Figure 2-3.

Fuses are available from your distributor. All fuses should be normal blow ceramic 3AG, MDA, or equivalent. On domestic 230 Volt AC lines, separate branch circuit protection for each line must be used.

Table 2-1 Terminal Block Wire and Tightening Torque Specifications

Maximum Motor Current (ADC)	90 – 130 VDC Motors (Max HP)	180 VDC Motors (Max HP)	Maximum Wire Size (Cu)				Recommended Tightening Torque	
			Maximum 50 Ft.		Maximum 100 Ft.			
			AWG	mm ²	AWG	mm ²	lb-in	kg-cm
6	1/2	1	16	1.3	14	2.1	12	13.8
12	1	2	14	2.1	12	3.3	12	13.8

The AC Line Fuse acts as a disconnect in case of a catastrophic failure. If the AC Line Fuse blows, the control is miswired, the motor is shorted or grounded, or the control is defective.

Ground Connection

Connect all ground wires (earth), of connections to the control, to the green ground screw on the chassis, tighten to correct torque (Table 2-2).

Permanent Magnet (PM) Motor Armature Connection

Connect the motor armature positive lead (+) to Terminal A+ and negative lead (-) to Terminal A-, as shown in Figure 2-1.

Motor Field Connection (Shunt Wound Motors Only)

CAUTION! Do not connect motor armature leads to Terminals F+ and F-. Do not use Terminals F+ and F- for any purpose other than to power the field of a shunt wound motor. Shunt wound motors may be damaged if the field remains energized without armature rotation for an extended period of time.

Full Voltage Field

Connect the field positive (+) lead to Terminal F+ and the negative lead (-) to Terminal F-, on the Barrier Terminal Block (Table2-2).

Half Voltage Field

For 50 Volt DC with 100 Volt rated armature, use Terminal L1 and F+, on the terminal board (Table2-2).

Table 2-2 Armature and AC Line Fuse Chart

Motor Horsepower		Approximate Motor Current (Amps DC)	Fuse Selection (AC Amps)	
90VDC	180VDC		Armature	Line
1/100	1/50	0.2	0.5	12
1/50	1/25	0.3	0.5	12
1/30	1/15	0.33	0.5	12
1/20	1/10	0.5	0.75	12
1/15	1/8	0.8	1	12
1/12	1/6	0.85	1.25	12
1/8	1/4	1.3	2	12
1/6	1/3	2	2.5	12
1/4	1/2	2.5	4	12
1/3	3/4	3.3	5	12
1/2	1	5.0	8	12
3/4	1½	7.5	12	12
1*	2*	10	15	25

*With optional Auxiliary Heat Sink (Catalog No. BC143).

Table 2-3 Field Connection (Shunt Wound Motors Only)

AC Input Voltage (Volts AC)	Voltage Selector Switch (Position)	Armature Voltage (Volts DC)	Field Voltage (Volts DC)	Terminal Connections
115	115	0 – 90	100	F+, F-
			50	F+, L1
208/230	230	0 – 180	200	F+, F-
		0 – 90*	100	F+, L1

Plug-In Horsepower Resistor®

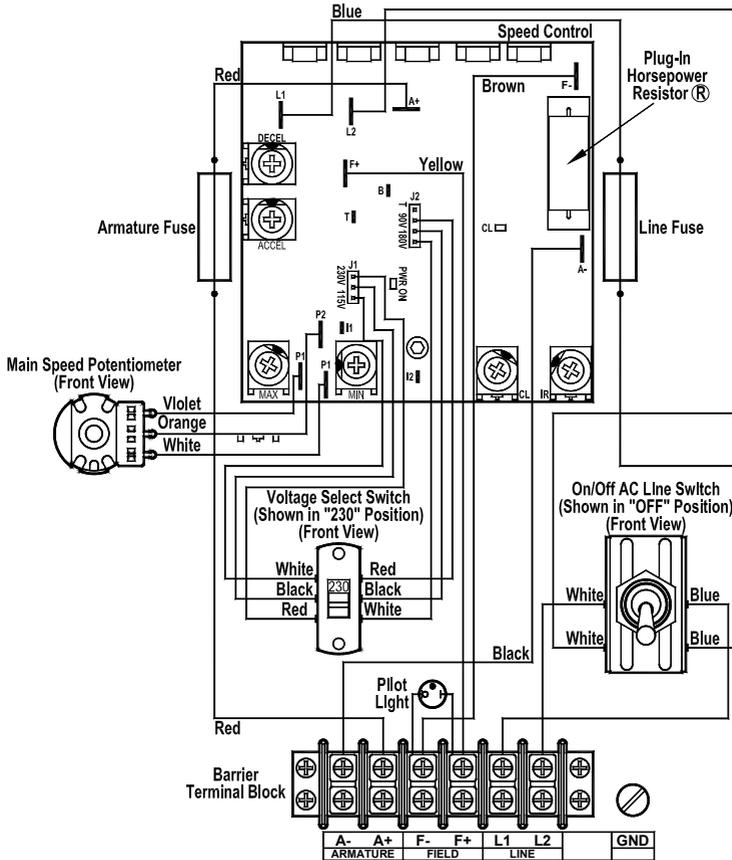
A Plug-In Horsepower Resistor® (supplied separately) must be installed to match the control to the motor so the IR Compensation and Current Limit settings to be correct. Select the proper Plug-In Horsepower Resistor® according to Table 2-3. Plug-In Horsepower Resistors® are available from your distributor. Install the Plug-In Horsepower Resistor®, as shown in Figure 2-3.

Note: Be sure the Plug-In Horsepower Resistor® is inserted completely into the mating sockets.

Table 2-4 Plug-In Horsepower Resistor® and Armature Fuse Kit Information

Motor Horsepower		Approximate Motor Current (ADC)	Plug-In HP Resistor® and Armature Fuse Kit		
Armature VDC 90 – 130	Armature VDC 180		Plug-In HP Resistor Value (Ohms)	Armature Fuse Rating (Amps)	Catalog No.
1/100	1/50	0.2	1.0	0.5	BR1000
1/50	1/25	0.3	0.51	0.5	BR0510
1/30	1/15	0.33	0.35	0.5	BR0350
1/20	1/10	0.5	0.25	0.75	BR0250
1/15	1/8	0.8	0.25	1	BR0251
1/12	1/6	0.85	0.18	1.25	BR0180
1/8	1/4	1.3	0.1	2	BR0100
1/6	1/3	2	0.1	2.5	BR0101
1/4	1/2	2.5	0.05	4	BR0050
1/3	3/4	3.3	0.035	5	BR0035
1/2	1	5	0.025	8	BR0025
3/4	1½	7.5	0.015	12	BR0015SP
1*	2*	10	0.01	15	BR0010SP

Figure 2-3 Control Layout and Internal Connection Diagram



Important Considerations

Motor Type

The BC140 / BC140-FBR is designed for permanent magnet (PM) and Shunt Wound DC motors. Controls operated on 115 Volt AC line input are designed for 90 Volt SCR rated motors. Controls operated on 230 Volt AC line input are designed for 180 and 90 Volt (step-down) SCR rated motors. Use of higher voltage motors will result in a reduction of the available maximum speed. Also, if motor is not an SCR rated type, the actual AC line amperage of the control, at full load, should not exceed the motor's DC nameplate rating.

Torque Requirements

The motor selected for the application must be capable of supplying the necessary torque. To ensure the motor is not overloaded, a DC ammeter should be connected in series with the armature. Be sure the current under full load does not exceed the motor nameplate rating.

Acceleration Start

The BC140 / BC140-FBR contains an adjustable acceleration start feature which allows the motor to smoothly accelerate from zero speed to full speed over a time period of 0.2-10 seconds. The acceleration trimpot (ACCEL) is factory set for 2 seconds.

Limitation In Use

The BC140 / BC140-FBR control is designed for use on machine applications.

Startup & Adjustments

The Voltage Select Switch is located under the cover and must be set before applying power to the control. Figure 2-4.

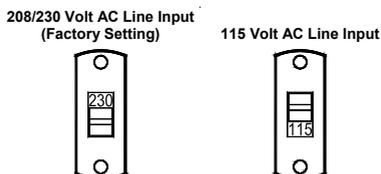
For 208/230 Volt AC Line Input

Set the Voltage Select Switch to the 230 position (factory setting). The switch toggle should be in the lower position with 230 displayed at the top.

For 115 Volt AC Line Input

Set the Voltage Select Switch to the 115 position. The switch toggle should be in the upper position with 115 displayed at the bottom.

Figure 2-4 Voltage Select Switch Setting



After the control has been mounted properly and electrical connections have been completed,

1. Verify the speed adjust potentiometer is set fully counterclockwise.
2. Apply AC power.
3. Observe the Power ON LED indicator is illuminated. If not on, refer to troubleshooting.
4. Verify correct direction of motor rotation.

Start the control. The motor shaft should begin to rotate as the potentiometer knob is turned clockwise, or the analog speed reference signal is increased.

Verify the motor shaft is rotating in the desired 'forward' direction.

If the direction of rotation is incorrect, stop the control and disconnect AC power.

Switch the motor lead connections at the A+ and A- terminals.

If a tachometer is connected, the leads may also need to be switched for correct signal polarity.

If the CL LED is on, refer to troubleshooting.

WARNING: If possible, do not adjust trim pots with the main power applied. Electrical shock can cause serious or fatal injury. If adjustments are made with the main power applied, an insulated adjustment tool must be used to prevent shock hazard and safety glasses must be worn.

TRIMPOT ADJUSTMENTS

The control contains trimpots which have been factory set for most applications. Some applications may require readjustment to tailor the control for a specific performance requirement.

Minimum Speed Trimpot (MIN)

The MIN Trimpot sets the minimum speed of the motor when the Main Speed Potentiometer is set fully counterclockwise. The MIN Trimpot is factory set to 0% of base motor speed. To increase the minimum speed, rotate the MIN Trimpot clockwise. To decrease the minimum speed, rotate the MIN Trimpot counterclockwise. The MIN Trimpot range is 0% – 30% of base motor speed.

Note: Readjusting the MIN Trimpot will affect the maximum speed setting. Therefore, it is necessary to readjust the MAX Trimpot if readjusting the MIN Trimpot. It may be necessary to repeat these adjustments until both the minimum and maximum speeds are set to the desired levels.

Maximum Speed Trimpot (MAX)

The MAX Trimpot sets the maximum speed of the motor when the Main Speed Potentiometer is set fully clockwise. The MAX Trimpot is factory set to 100% of base motor speed. To increase the maximum speed, rotate the MAX Trimpot clockwise. To decrease the maximum speed, rotate the MAX Trimpot counterclockwise. The MAX Trimpot range is 50% – 110% of base motor speed.

Note: The MAX trimpot is inoperative in the voltage following mode.

Caution: Do not set the maximum speed above the rated motor RPM since unstable motor operation may occur.

Note: Do not adjust the maximum speed above the rated motor RPM or unstable operation may occur.

For moderate changes in the maximum speed, there will be a slight effect on the minimum speed setting when the minimum is set to zero. There may be significant variation in the minimum speed setting if the minimum speed is at a higher than zero setting.

Acceleration Trimpot (ACCEL)

The ACCEL Trimpot is provided to allow for a smooth start over an adjustable time period each time the AC power is applied or the Main Speed Potentiometer is adjusted to a higher speed. The ACCEL Trimpot is factory set to 2 seconds, which is the amount of time it will take for the motor to accelerate from zero speed to full speed. To increase the acceleration time, rotate the ACCEL Trimpot clockwise. To decrease the acceleration time, rotate the ACCEL Trimpot counterclockwise. The ACCEL Trimpot range is 0.2 – 10 seconds.

Deceleration Trimpot (DECEL)

The DECEL Trimpot controls the amount of rampdown time when the Main Speed Potentiometer is adjusted to a lower speed. The DECEL Trimpot is factory set to 2 seconds, which is the amount of time it will take for the motor to decelerate from full speed to zero speed. To increase the deceleration time, rotate the DECEL Trimpot clockwise. To decrease the deceleration time, rotate the DECEL Trimpot counterclockwise. The DECEL Trimpot range is 0.2 – 10 seconds.

Current Limit Trimpot (CL)

The CL Trimpot is used to limit the maximum current (torque) to the motor. The CL also protects the control from excessive current during startup. The CL Trimpot is factory set to 150% of the full load current rating of the motor. To increase the current limit, rotate the CL Trimpot clockwise (do not exceed 200% of the full load current rating of the motor (maximum clockwise position)). To decrease the current limit, rotate the CL Trimpot counterclockwise. On cyclical loads, it may be normal for the CL LED to momentarily flash.

(Visible only if the cover is removed.) The CL Trimpot range is 0% – 200% of the full load current rating of the motor. Some application may require a lower value so as not to damage process material or drive train components.

Note: For the Current Limit to operate properly, the correct Plug-In Horsepower Resistor® must be installed for the particular motor and input voltage being used. Calibration of the CL Trimpot is normally not required when the proper Plug-In Horsepower Resistor® is installed.

Caution: do not leave motor shaft locked for more than 2 – 3 seconds or motor damage may result.

To Recalibrate the CL Trimpot:

1. Disconnect the AC power and connect a DC ammeter in series with either motor armature lead. If only an AC ammeter is available, connect it in series with either AC line input lead.
2. Set the Main Speed Potentiometer to approximately 30% – 50% clockwise position.
3. Set the CL Trimpot fully counterclockwise. The CL LED will illuminate red.
4. Load the motor shaft in accordance with application requirements.

Apply power and rotate the CL Trimpot clockwise until the desired current reading is observed on the DC ammeter. Factory Current Limit setting is 150% of the full load current rating of the motor. If using an AC ammeter connected in the AC line input, the factory Current Limit setting will read 75% of the full load current rating of the motor. Do not exceed 200% of the full load current rating of the motor (maximum clockwise position).

IR Compensation Trimpot (IR)

The IR Trimpot sets the amount of compensating voltage required to keep the motor speed constant under varying loads. If the load does not vary substantially, the IR Trimpot may be set to a minimum level (approximately 1/4 of full clockwise rotation). The IR Trimpot is factory set to provide 3 Volts of compensation for controls with 90 Volt DC output and 6 Volts of compensation for controls with 180 Volt DC Output. To increase the amount of compensating voltage, rotate the IR Trimpot clockwise. To decrease the amount of compensating voltage, rotate the IR Trimpot counterclockwise.

To Recalibrate the IR Trimpot:

1. Set the IR Trimpot to approximately 25% rotation.
2. Run the motor unloaded at approximately 1/3 speed and record the RPMs.

3. Run the motor with the maximum load and adjust the IR Trimpot so that the motor speed under load equals the unloaded speed recorded in step 2.
4. Remove the load and recheck the RPMs.

If the unloaded RPM has changed, repeat steps 2 and 4 for better regulation. The control is now compensated to provide minimal speed change due to changing loads.

Operation

Set the AC Line Switch to the ON position. Observe that the Pilot Light illuminates. Gradually increase the Main Speed Potentiometer. The motor should smoothly come up to the desired speed and remain stable.

Troubleshooting

The BC140 / BC140-FBR has LEDs to display the control's operational status.

Power On (PWR ON) LED and Pilot Light

When the AC power is applied to the control and the On/Off AC Line Switch is set ON, the PWR ON LED, on the PC board, will illuminate green and the Pilot Light, on the front cover, will illuminate orange.

Current Limit (CL) LED

The CL LED will illuminate red when the motor is overloaded, indicating that the current limit set point has been reached (set by the CL Trimpot).

Table 2-4 provides information on symptoms, possible causes, and the suggested corrective action for controls without optional forward-brake-reverse switch installed.

Table 2-4 Troubleshooting Guide (without Optional Forward-Brake-Reverse Switch)

Symptom	Possible Cause	Suggested Corrective Action
Motor is not running and Pilot Light not illuminated.	On/Off AC Line Switch in Off Position.	Set On/Off Switch to On Position.
	Blown Line fuse.	Replace Line Fuse.
	Defective On/Off AC Line Switch,	Replace On/Off AC Line Switch.
Motor does not run and Pilot Light is illuminated.	Main Speed Potentiometer set fully counterclockwise.	Rotate Main Speed potentiometer clockwise.
	Defective motor.	Check for defective motor, worn brushes, etc. Replace motor, if necessary.
	Plug-In Horsepower Resistor® not installed.	Install the correct Plug-In Horsepower Resistor®.
	Blown Armature Fuse.	Replace Armature Fuse.
	CL Trimpot set fully counterclockwise.	Set CL Trimpot
Motor hums, runs at very low speed, or slows down substantially when loaded.	Low AC line input voltage.	Check AC line input voltage.
Motor continues to run with Main Speed Potentiometer set fully counterclockwise.	MIN speed trimpot set higher than 0% of base speed.	Readjust the MIN Trimpot.
	IR Comp trimpot set too high.	Readjust the IR Trimpot.
Motor runs in wrong direction.	Motor armature leads are reversed.	Reconnect motor armature leads.
Motor will not run in Forward or Reverse direction.	Faulty wiring or loose connections to the reversing switch.	Check and correct connections.
	Forward-Brake-Reverse Switch is defective.	Replace Forward-Brake-Reverse Switch assembly.

Table 2-4 Troubleshooting Guide (without Optional Forward-Brake-Reverse Switch)

Symptom	Possible Cause	Suggested Corrective Action
No braking action in brake mode.	Faulty connections or loose connections.	Check and correct connections.
	Defective Brake Resistor.	Replace Forward-Brake-Reverse Switch assembly.
Erratic motor performance.	Overload condition.	Remove overload.
	Incorrect Plug-In Horsepower Resistor®.	Install the correct Plug-In Horsepower Resistor®.
	CL and/or IR Trimpots may be set incorrectly.	Readjust the CL and/or IR Trimpots
	Defective speed control module.	Replace speed control.
	Voltage Select Switch set to wrong position.	Recheck line voltage and the correct setting of the Voltage Select Switch.
	Defective motor, worn brushes, etc.	Repair or replace motor.

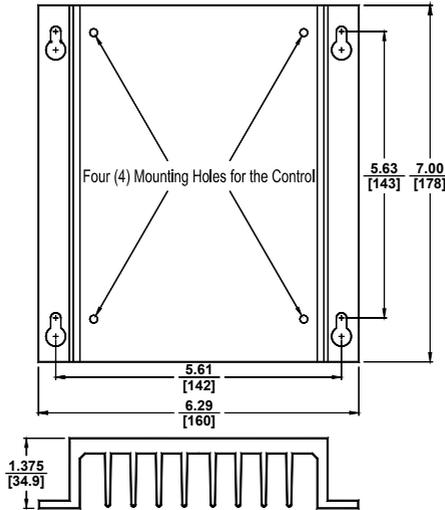
Table 2-5 Electrical Ratings

Line Voltage (± 15%, 50/60 Hz) (VAC)	Motor Voltage (VDC)	"Maximum Rating without Auxiliary Heat Sink"			Maximum Rating with Auxiliary Heat Sink		
		Line Current (RMS Amps)	Load Current (ADC)	Power HP (kW)	Line Current (RMS Amps)	Load Current (ADC)	Power HP (kW)
115	90 – 130	12.0	6.0	0.75, (0.6)	16.0	12.0	1, (.75)
230	180	12.0	6.0	1.5, (1.1)	16.0	12.0	2, (1.5)

OPTIONAL AUXILIARY HEAT SINK (CATALOG NO. BC143)

The optional Auxiliary Heat Sink (Catalog No. BC143) is used to increase the rating of the control. The control is mounted on the four (4) holes with four (4) mounting screws (supplied), Figure A-1.

Figure A-1 Optional Auxiliary Heat Sink Mechanical Specifications



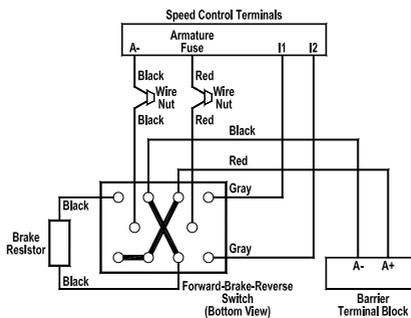
OPTIONAL Forward-brake-reverse switch (CATALOG NO. BC144)*

The optional Forward-Brake-Reverse Switch (Catalog No. BC144)* is used to dynamically brake the motor and reverse motor direction. The switch assembly is to be installed in the mounting hole provided on the control.

See the installation instructions MN1372, provided with the Forward-Brake-Reverse Switch kit for detailed information on mounting and connections.

Figure A-2 shows the connections of the Forward-Brake-Reverse Switch to the speed control and the Barrier Terminal Block. * BC144 is factory installed on BC140-FBR model.

Figure A-2 Optional Forward-Brake- Reverse Switch Connections



Optional RFI Filter (BC24-LF)

Panel mount. Rated 24 Amps at 115 and 208/230 Volts AC, single phase. Complies with CE Directive 89/336/EEC (EN55022 and/or EN55011) relating to the EMC Class A Industrial Standard.

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