BALDOR®

A MEMBER OF THE ABB GROUP

NEMA-4X—IP65

for Catalog BC354

6/15 **Installation & Operating Manual** MN731

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Be sure to check www.baldor.com to download the latest version of this manual in Adobe Acrobat PDF format.

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Introduction

Introduction

Baldor Electric Company. is committed to providing total customer satisfaction by producing quality products that are easy to install and operate. The BC354 is manufactured with surface mount components incorporating advanced circuitry and technology.

The BC354 is a PWM (Pulse Width Modulated) control in a NEMA-4X/IP65 washdown and watertight enclosure designed to operate Permanent Magnet and Shunt Wound motors through 7.5 Amps DC. The efficient PWM waveform, operating at a switching frequency greater than 16kHz, provides almost pure DC to the motor (form factor <1.05). This provides high motor efficiency, whisper quiet operation along with less motor heating. This allows for a smaller, less costly motor to be used in most applications. Another advantage of PWM is higher output voltage (up to 130VDC for 115VAC lines and 260VDC for 230VAC lines) which provides increased motor speed.

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.

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 1-1 Electrical Ratings

AC Voltage (+/- 10%, 50/60 Hz) (Volts AC)	Motor Voltage (VDC)	Max AC Current (Amps RMS)	Fuse or Circuit Breaker Rating (Amps DC)	Max Load Current (Amps DC)	Maximum Power HP (kW)		Rated Field Current	Field Voltage (Volts DC)
					SCR Rated Motors	PWM Rated Motors		
115	0 – 90,130	11.5	15	7.5	3/4, (0.5)	1, (0.75)	1.0	100
208 - 230	0 – 180, 260	11.5	15	7.5	1-1/2, (1)	2, (1.5)	1.0	200
	0 – 90*, 130	11.5	15	7.5	3/4, (0.5)	1, (0.75)	1.0	100

Table 1-2 Performance Specifications

Parameter	Specification	Factory Setting
Operating Frequency (kHz)	>16	–
Operating Temperature Range at Full Rating (°C/°F)	0 - 40 / 32 - 104	–
Operating Humidity Range % Relative, Non-Condensing)	0 - 95	–
Storage Temperature (°C/°F)	-25 – +85 / -13 – +185	–
Current Range (High Scale) (Amps DC)	1.7, 2.5, 3.5, 5.0, 7.5	7.5
Current Range (Low Scale) (Amps DC)[1]	0.2, 0.3, 0.4, 0.5, 0.8	–
ACCEL and DECEL Range (Seconds)	0.5 - 10	1
Jog Speed (% Base Speed)	0 - 50	15
MIN SPEED Range (% Base Speed (90 and 180 Volt DC Motors))	0 - 30	0
MAX SPEED Range (% Base Speed (90 and 180 Volt DC Motors))	50 - 140	100
IR COMP Range at 90 Volts DC Output (ΔVolts DC at Full Load)	0 - 15	4
IR COMP Range at 180 Volts DC Output (ΔVolts DC at Full Load)	0 - 30	8
CL Range (% Range Setting)	0 - 200	150
Timed Current Limit (TCL) Range (Seconds)	0.5 - 10	5
AC Line Input Voltage (Volts AC, ±10%, 50/60Hz)	115 -208/230	–
AC Line Regulation (% Base Speed)	0.5	–
Armature Voltage Range at 115 Volts AC Line Input (Volts DC)	0 - 130	90
Armature Voltage Range at 208/230 Volts AC Line Input (Volts DC)	0 - 130[2], 0 - 260	90
Armature Feedback Load Regulation (% Base Speed)	1	–
Tachometer Feedback Load Regulation (% Set Speed)	1	–
Field Voltage at 115 Volts AC Line Input (Volts DC)	100/50	–
Field Voltage at 208/230 Volts AC Line Input (Volts DC)	200/100	–
Speed Range (Ratio)	50:1	–
Voltage Following Linearity (% Base Speed)	±0.5	–

1. For low current operation, remove resistor R35, see Appendix A.
2. Step-down operation. Motor may have reduced brush life. Consult motor manufacturer.

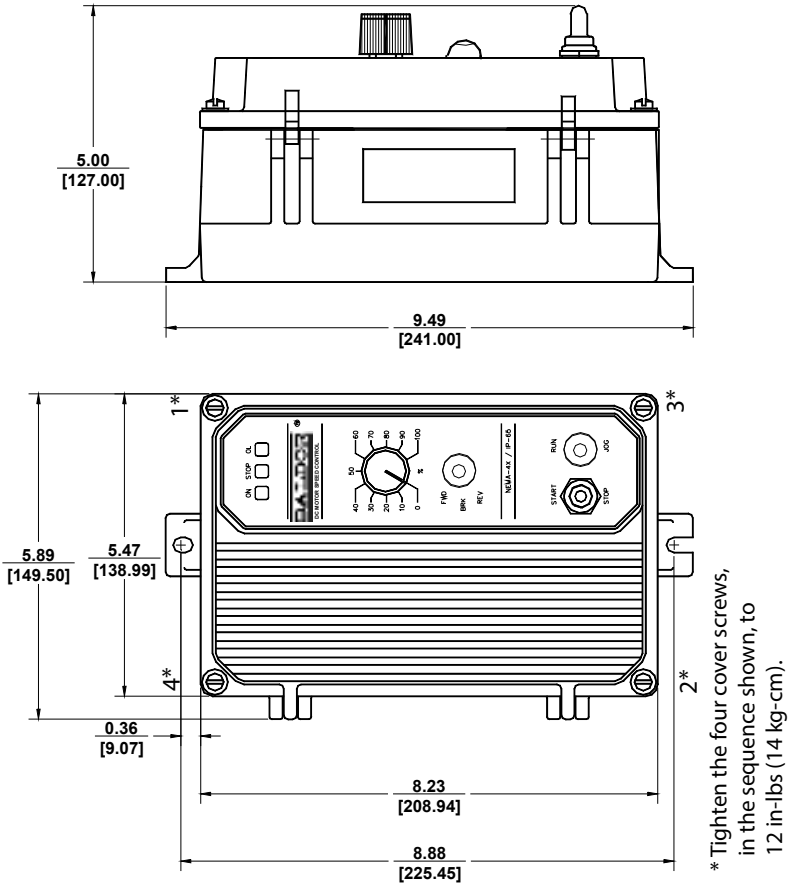
WARNING: Do not use this drive in an explosive environment. An explosion can cause serious or fatal injury. This drive is not explosion proof.

Mounting

The control should be mounted vertically on a flat surface with adequate ventilation. Allow enough room below the control to allow for AC line, motor connections, and any other wiring. Although the control is designed for outdoor and wash down use, care should be taken to avoid extreme hazardous locations where physical damage can occur. Mount the control in such a manner that there is unrestricted air flow through the heat sink cooling fins. If the control is mounted in a closed, unventilated location, allow enough room for proper heat dissipation so that the ambient temperature does not exceed 40°C (104°F).

Mount the control as shown in Figure 2-1.

Figure 2-1 Mounting Hole Locations



The BC354 is designed with a hinged case so that when the front cover is open, all wiring stays intact. To open the cover, the four screws must be loosened so they are no longer engaged in the case bottom. After mounting and wiring, close the cover and make sure that wires will not get caught or crimped as the cover is closed. Tighten all four cover screws, in the diagonal sequence so the gasket is slightly compressed (12 in-lbs (14 kg-cm)). Do not over tighten.

Electrical Connections

To avoid erratic operation, do not bundle the AC line and motor wires with signal or control wiring. Do not bundle motor wires from multiple controls in the same conduit. Use shielded cables on all signal wiring over 12 (30 cm). The shield should be earth grounded on the control side only. Wire the control in accordance with the National Electrical Code requirements and other local codes that may apply.

The control does not contain AC line fuses. Most electrical codes require that each ungrounded conductor contain circuit protection. Install a 20 Amp fuse (Littelfuse 326, BUSS ABC or equivalent) or a circuit breaker in series with each ungrounded conductor. Check all electrical codes that apply to the application.

A separate AC line switch or contactor must be connected as a disconnect switch so that contacts open each ungrounded conductor. See Table 2-1.

AC LINE

Connect the AC input to L1 & L2 of TB1, Figure 2-2.

Table 2-1 Terminal Block Wiring Information

Terminal Block	Designation	Connections	Max Wire Size (Copper) AWG(mm^2)	Tightening Torque lb-in (Nm)
TB1	AC Input	L1 and L2	14	9 (10.4)
TB1	Motor Armature	A1 and A2	14	9 (10.4)
TB2	Motor Field (Shunt Wound Motors Only)	F1 and F2	14	3.5 (4)
TB3	Tachometer	T+ and T-	14	3.5 (4)
TB3	Run Relay	Relay	14	3.5 (4)

Ground Connection

Earth ground the control chassis using the green ground screw that is provided on the inside of the control to the right side of Terminal Block TB1, as shown in Figure 2-2.

Motor Armature Connection

Connect the motor armature positive lead (+) to Terminal A1 and negative lead (-) to Terminal A2, Figure 2-2. For step-down operation (230 Volt AC line input with 90 Volt DC SCR rated motor or 130 VDC PWM rated motor) set jumper J1 to 90V position. However, in step-down operation the motor may have reduced brush life - consult motor manufacturer.

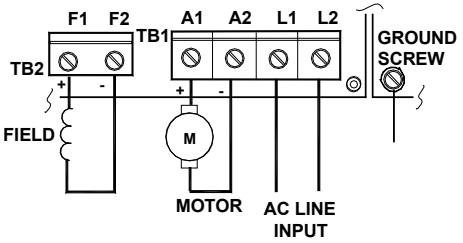
Note: Do not connect motor armature leads to F+ and F- terminals of Terminal Block TB2 or to F1 and F2 quick-connect terminals. Do not use F1 and F2 quick-connect terminals for any purpose other than to power the optional Signal Isolator BC245.

Full Voltage Field Connection (Shunt Wound Motors Only)

Wire the motor field leads to F+ and F- terminals of Terminal Block TB2, as shown in Figure 2-2 and as described in Table 2-2.

Note: Do not connect motor armature leads to F1 and F2 quickconnect terminals. Do not use F+ and F- terminals of Terminal Block TB2 for any purpose other than to power the field of a shunt wound motor.

Figure 2-2 Full Voltage Field Connection (Shunt Wound MotorsOnly)



Half Voltage Field Connection (Shunt Wound Motors Only)

Connect the motor field leads to F+ terminal of Terminal Block TB2 and L1 terminal of Terminal Block TB1, as shown in Figure 2-3 and as described in Table 2-2.

Figure 2-3 Half Voltage Field Connection (Shunt Wound Motors Only)

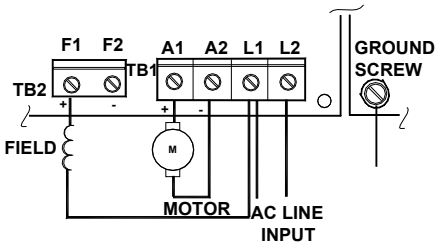


Table 2-2 Field Connection (Shunt Wound Motors Only)

AC Line (VAC)	Armature Voltage (VDC)	Field Voltage (VDC)	Field Connections
115	90 - 130	100	F1 and F2
115	90 - 130	50	F1 and L1
230	180 - 260	200	F1 and F2
230	180 - 260	100	F1 and L1
230	90 - 130	100	F1 and L1

Remote Main Speed Potentiometer

A Main Speed Potentiometer is mounted on the front cover for unidirectional forward operation of the motor as shown in Figure 2-5.

The Speed Potentiometer can be disconnected and a remote potentiometer (5k) can be used. Remove the white, orange, and violet potentiometer leads from P1, P2, and P3 terminals. The leads may be taped and left inside the control. The potentiometer assembly may be removed if a watertight seal is used to cover the hole in the front cover. Connect the remote main speed potentiometer wires to terminals P1 (low side), P2 (wiper), and P3 (high side), as shown in Figure2-4.

Figure 2-4 Remote Main Speed Potentiometer Connection

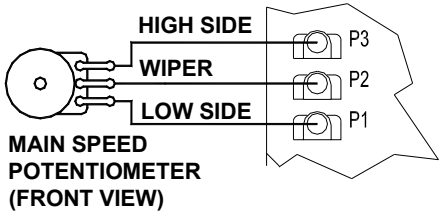
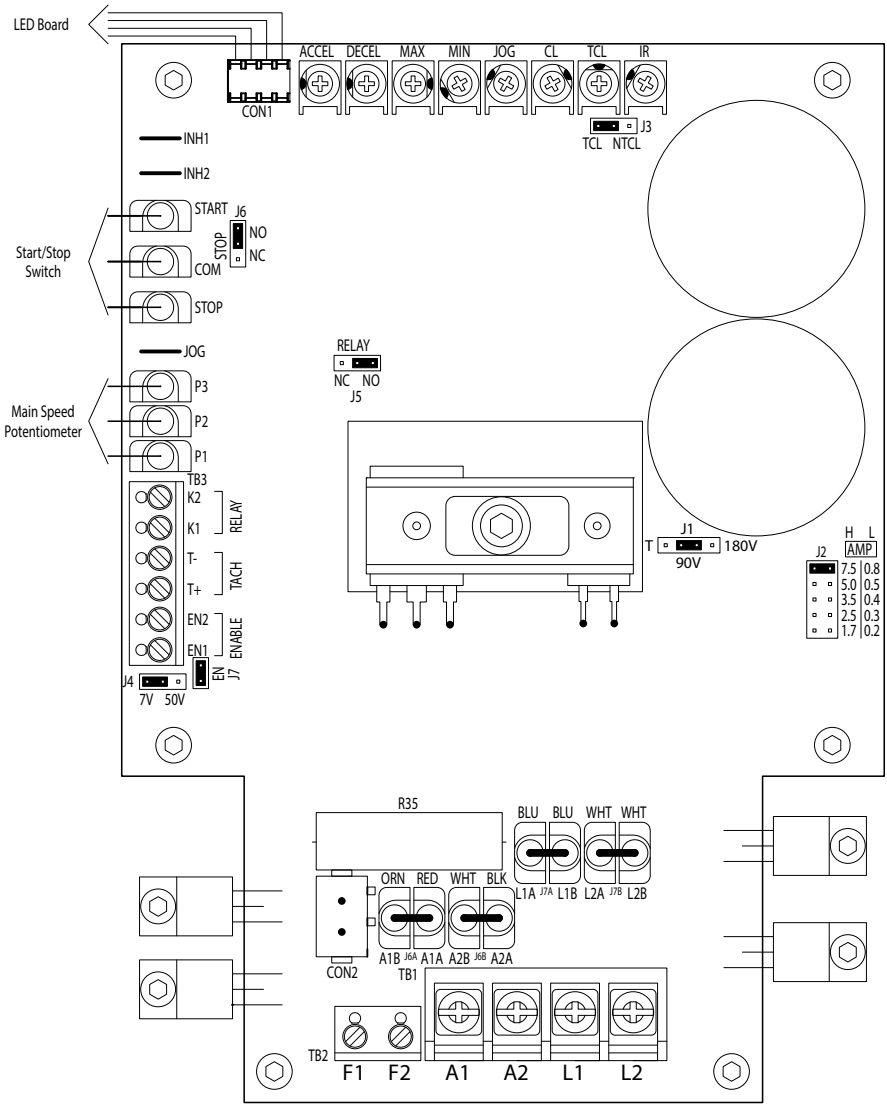


Figure 2-5 Control Board Layout



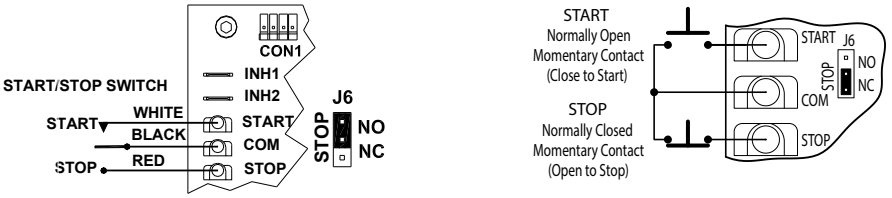
Remote Start/Stop Switch Connection

Warning! Eliminating the start/stop function when a 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 startup of the driven equipment will not cause injury to the operating personnel or damage to driven equipment. The user is responsible for providing suitable audible or visual 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.

The control is supplied with a prewired Start/Stop switch, with normally open stop contacts mounted on the front cover. Jumper J6 is factory set to the NO position. To operate the control from a remote Start/Stop switch (type: (ON)-OFF-ON, SPDT), remove the white, black, and red wires from START, COM, and STOP terminals. The leads may be taped and left in the control. The switch assembly may be removed if a watertight seal is used to cover the hole in the front cover. Connect the remote Start/Stop switch wires to START (momentary), COM (common), and STOP (maintained) terminals as shown in Figure 2-6. After applying power, momentarily set the Start/Stop switch to START position. The motor will operate at the set speed of the main speed potentiometer. To stop the motor, set the Start/Stop switch to STOP position.

Note: To eliminate the Start/Stop function, connect the START and COM terminals with the jumper that is provided.

Figure 2-6 Remote Start/Stop Switch Connection



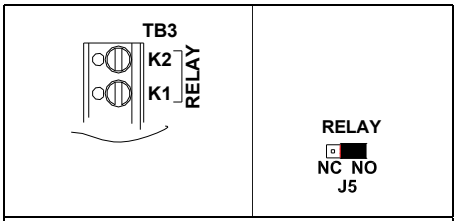
with Normally Open Stop Contacts **with Normally Closed Stop Contacts**

Run Relay Connection

Run Relay, K1, Normally open (N.O.) or normally closed (N.C.) relay output contacts are available at TB3. These contacts will change state when the Start/Stop switch is set to START position or if the control shuts down and goes into STOP mode from TCL. The run relay is used to indicate the state of the control (run or stop).

Normally open or normally closed run relay contact outputs can be selected depending on the position of jumper J5. If normally open is selected (J5 in N.O. position), the run relay output contacts will close when the Start/Stop switch is set to START position. If normally closed is selected (J5 set to N.C. position), the run relay output contacts will open when the Start/Stop switch is set to START position. When the control shuts down and goes into STOP mode from TCL, or the Start/Stop switch is set to STOP position, the Run Relay output contacts will be what the J5 position indicates. See Figure 2-7.

Figure 2-7 Run Relay Connections



See Table 4-1, for TB3 Tightening Torque Requirements.

The Run Relay Contact status for various drive operating conditions is shown in Table 2-3. Relay Contacts Ratings: 1 Amp at 30 Volts DC, 0.5 Amps at 125 Volts AC, and 0.25 Amps at 250 Volts AC.

Table 2-3 Drive Operating Condition and Run Relay Contact Status

Drive Operating Condition	Description	J3 in NTCL Position		J3 in TCL Position	
		J5 Position		J5 Position	
		NO	NC	NO	NC
Power Off	Main Power Disconnected	Open	Closed	Open	Closed
Run Mode[1]	Normal Drive Operation	Closed	Open	Closed	Open
Stop Mode[2]	Selected by Operator	Open	Closed	Open	Closed
Fault[3]	Drive Tripped	-	-	Open	Closed

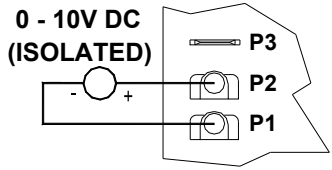
1. Run Mode is selected with the optional FWD–BRK-REV Switch.
2. Stop Mode is selected using the optional FWD-BRK-REV Switch.
3. TCL Fault.
4. If relay output contacts are not required for your application, J5 may be in any position.

Voltage Following Connection

An isolated 0 - 10 Volt DC analog signal can also be used to control motor speed. See Figure 2-8.

Note: If an isolated signal voltage is not available, an optional signal isolator can be installed (P/N BC145). Connect the isolated signal voltage to P2 (+) and P1 (-) terminals. Adjustment of the MIN trimpot may be necessary to achieve a 0 Volt DC output.

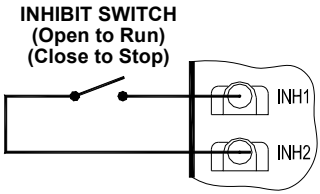
Figure 2-8 Voltage Following Connection



Inhibit Circuit Connection

The control is supplied with inhibit terminals (INH1 and INH2) to connect an Inhibit switch. See Figure 2-9. These terminals are used to electronically stop the control. When the Inhibit switch is closed, the control will coast to stop. When the Inhibit switch is opened, the control will accelerate to the main speed potentiometer setting.

Figure 2-9 Inhibit Circuit Connection



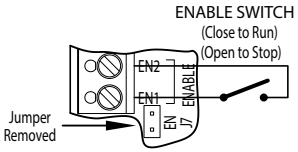
Enable Circuit Connection

There are two methods to incorporate an ENABLE function In the BC354. Either method of connection may be used to START and STOP the control.

Note: When using Enable, the Start/Stop function should be eliminated. Remove the white, black, and red wires from Terminals START, COM, and STOP. The leads may be taped and left in the control. The switch assembly may be removed if a watertight seal is used to cover the hole on the front cover. Connect Terminals START and COM with the jumper that is provided.

Method 1: Connect a switch to the dedicated Enable Terminals EN1 and EN2 on TB3. Remove Jumper J7. See Figure 4-10. When the Enable Switch is closed, the motor will accelerate to the Main Speed Potentiometer setting. When the Enable Switch is opened, the motor will coast to stop.

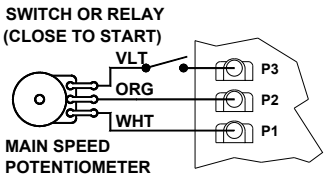
Figure 2-10 Enable Switch Wired into TB3



Method 2: Connect a switch in series with the violet main speed potentiometer lead which connects to the P3 terminal. When the Enable switch is closed, the motor will accelerate to the main speed potentiometer setting. When the Enable switch is opened, the motor will decelerate to a stop. See Figure 2-11.

Note: Jumper J7 must be installed when using the ENABLE circuit.

Figure 2-11 Enable Switch Wire into the Main Speed Potentiometer Circuit

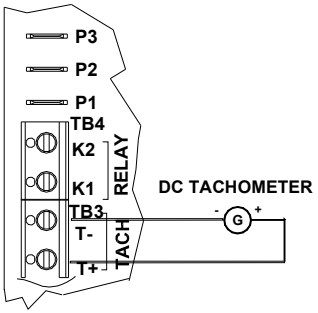


DC Tachometer Connection

Connect the tachometer to T+ (+) and T- (-) terminals of TB4 as shown in Figure 4-12. Jumper J1 must be in 'T ' position. Jumper J4 must be in '7V ' position for 7 Volt per 1000 RPM tachometer or '50V ' position for 50 Volt per 1000 RPM tachometers. See Startup for tachometers other than 7V or 50V per 1000 RPM.

Note: When using a tachometer, the IR trimpot should be set fully counterclockwise.

Figure 2-12 DC Tachometer Connection



Signal Isolator Connection

If an isolated signal voltage is not available, an optional signal isolator may be installed. Refer to BC145 Instruction Manual, MN1373.

Startup and Adjustments

Motor Type

The BC354 is designed for PWM rated motors. Use of higher voltage motors will result in reduction of available maximum (MAX) speed (Trimpot Adjustment). Also, if motor is not PWM rated type, the actual AC line amperage at full load should not exceed the motor's DC nameplate rating.

Torque Requirements

When replacing an AC induction motor with a DC motor and speed control, consideration must be given to the maximum torque requirements. The full load torque rating of the DC motor must be equal to, or greater than, that of the AC motor being replaced.

Set Jumpers

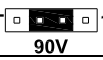
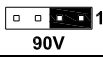
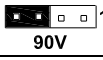
The BC354 has selectable jumpers which must be set before the control can be used. See Figure 2-5 for jumper locations.

J1 - Motor Voltage Selection

Jumper J1 is factory set to 90V position for 90 Volt SCR rated motors (or 130 Volt PWM rated motors). For 180 Volt SCR rated motors (or 260 Volt PWM rated motors), set jumper J1 to 180V position. See Figure 2-13.

Note: If jumper J1 is set to T position, a tachometer must be connected to TB3. If a tachometer is not used, jumper J1 must be in either 90V or 180V position. If jumper J1 is in T position, and a tachometer is not used, the motor will accelerate to full speed and the main speed potentiometer will not control speed.

Figure 2-13 Motor Voltage Selection

J1 Set for 90 Volt Motors (Factory Setting)	J1 Set for 180 Volt Motors	J1 Set for Tachometer Feedback
		

J2 - Motor Current Selection

Jumper J2 is factory set to 7.5A position for 7.5 Amp motors. For motors of lower amperage, set jumper J2 to the corresponding position for the motor being used. See Tables 6-1 and Table A-1.

Table 2-4 Motor Current Selection

J2 Set for 7.5 Amp Motor (Factory Setting)	High Scale Current Range (Amps DC)	Low Scale Current Range* (Amps DC)
	7.5	0.8
	5.0	0.5
	3.5	0.4
	2.5	0.3
	1.7	0.2

Note: For low motor current range settings (0.8A, 0.5A, 0.4A, 0.3A, and 0.2A), it is necessary to modify the Motor Current Selection circuit by removing resistor R35. See Appendix A.

J3 - Current Limit Mode Selection

The BC354 contains electronic current limiting which limits the maximum DC current to the motor, (the current limit set point is established with the setting of the CL trimpot). Two modes of current limit operation are provided.

TCL (Timed Current Limit)

In this mode the drive will turn off after being in current limit for a preset time. This time period is adjustable with the TCL trimpot from 0.5 - 10 seconds and is factory set for approximately 5 seconds.

Note: The Overload LED will remain lighted until the control is reset.

Resetting the Control after TCL

To reset the control after it has gone into TCL, momentarily set the Start/Stop switch to START position or disconnect and reconnect the AC line. If an On/Off AC Line Switch is installed, set it to OFF position and then back to ON position. If the Start switch is jumpered (START and COM terminals connected) the control must be restarted by disconnecting and reconnecting the AC line.

NTCL (Non-Timed Current Limit)

In this mode the drive will reach the preset current limit during overload and stay at that level until a fuse blows or the drive is manually turned off. If non-timed CL operation is desired, move jumper J3 from the factory set TCL position to the NTCL position. The NTCL position must be used when operating in the Torque Mode. When jumper J3 is set to NTCL position, the control will not go into STOP after it is in overload.

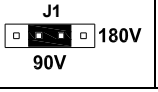
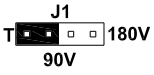
Note: The TCL trimpot will have no effect when Jumper J3 is in the NTCL position.

J1, J4 - Tachometer Feedback and DC Tachometer Voltage Selection

If a DC Tachometer is used, set J1, (Armature Voltage or Tachometer Feedback), to the 'T' position, and set J4 to the tachometer Volts/1000 RPM position in accordance with the tachometer nameplate value. (7V or 50V). See Figure 2-14.

Note: When using a tach-generator, the IR trimpot should be set fully counterclockwise.

Figure 2-14 DC Tachometer Voltage Selection

Jumper J1 Settings		Jumper J4 Settings	
J1 Set for 90 Volt Motors (Factory Setting)	J1 Set for Tachometer Input	J4 Set for 7V per 1000RPM Tachometer Input (Factory Setting)	J4 Set for 50V per 1000RPM Tachometer Input
			

The tachometer input is designed for 7 Volts/1000 RPM or 50 Volts/1000 RPM used with 1800 RPM motors. If other than standard tachometer voltages or motor speeds are used, an external resistor, (RT), must be installed in one leg of the tachometer.

1. Place J4 in the 7V position.
2. Calculate the value of RT as follows:

The value of RT (in Ω) can be calculated using the following formula:

RT = (1.46 X VT X S) - 19,000

VT is the tachometer voltage (in Volts per 1000 RPM)

S is the base speed of the motor (in RPM)

Example: Suppose you have a 20 Volt per 1000RPM tachometer with a 3600 RPM motor:

- RT = (1.46 X 20 X 3600) - 19000 = 86120Ω 1/2 Watt.
- Choose the closest 1/2W resistor value, which is 82000Ω (82kΩ) or 91000kΩ (91kΩ) 1/2 Watt.
- Readjustment of the MAX trimpot may be necessary to achieve the desired maximum output voltage.

J5 - Run Relay Output Mode Selection
Jumper J5 is factory set to N.O. position for normally open relay output at TB3.
For normally closed relay output, set jumper J5 to N.C. position.

J6 - Stop Mode Selection
A switch with N.O. (Normally Open) or N.C. (Normally Closed) stop contacts can be selected for Stop Mode. Jumper J6 is factory set to the N.O. position.

J7 - ENABLE (J7)
When connecting a switch to the dedicated Enable circuit Terminals EN1 and EN2 on TB3, Jumper 7 must be removed.

Startup

After the control has been mounted properly and electrical connections have been completed and jumpers are correctly set, start the control as follows:

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 BC254/BC254-FSR contains trimpots, which are factory set for most applications. Figure 2-2 illustrates the location of the trimpots and their approximate calibrated positions. Some applications may require readjustment of the trimpots to tailor the control for a specific requirement. Readjust trimpots as needed.

Acceleration (ACCEL)
The ACCEL trimpot sets the amount of time for the motor to accelerate from minimum to maximum speed. The acceleration circuit operates when starting the control with the main speed potentiometer rotated clockwise or when rapidly rotating the main speed potentiometer in the clockwise direction. The trimpot is factory set to one (1) second. To increase acceleration time, rotate the trimpot clockwise. If more rapid acceleration is desired, rotate the trimpot counterclockwise.

Note: Rapid ACCEL setting may cause the current limit circuit to activate which will extend the acceleration time.

Deceleration (DECEL)
The DECEL trimpot sets the amount of time for the motor to decelerate from maximum speed to minimum speed. The trimpot is factory set to one (1) second. To decrease deceleration time, rotate the trimpot counterclockwise. To increase deceleration time, rotate the trimpot clockwise.

Notes:

1. On high inertial loads, a rapid DECEL setting may cause the motor to coast to a stop slower than the DECEL setting. To increase deceleration time, rotate DECEL trimpot clockwise. 50% rotation represents approximately five (5) seconds and full rotation is approximately ten (10) seconds.
2. The Deceleration circuit works when rotating the Main Speed Potentiometer in the CCW direction or when opening the P3 lead of the Main Speed Potentiometer (with an Enable Switch). It does not operate when power is removed.

Maximum Speed (MAX)

The MAX trimpot is used to set the maximum voltage of the drive. This sets the maximum speed of the motor. The MAX trimpot is factory set to 100% of base speed.

Adjust the MAX trimpot as follows:

1. Rotate Main Potentiometer to maximum speed position (full clockwise).
2. Adjust MAX trimpot setting to desired setting of motor speed.

Minimum Speed (MIN)

The MIN trimpot is used to set the minimum voltage of the drive. This sets the minimum speed of the motor. The MIN Trimpot is factory set to 0% of base speed.

Adjust the MIN trimpot as follows:

1. Rotate Main Potentiometer to minimum speed position (full counterclockwise).
2. Increase setting of MIN trimpot so that motor runs at desired minimum speed.

Jog Speed (JOG)

This trimpot is operational only when the optional RUN-STOP-JOG Switch (BC157) is installed. The JOG trimpot is factory set for 15% of base speed. With the RUN-STOP-JOG switch in the JOG position the JOG trimpot can be adjusted to the desired JOG speed. To increase JOG speed, rotate the trimpot clockwise. To decrease JOG speed, rotate the trimpot counterclockwise.

Current Limit (CL)

This trimpot is used to set the maximum amount of DC current that the motor can draw. The CL trimpot is factory set to 150% of the J2 range setting. The current limit set point is determined by the setting of jumper J2 and the setting of the CL trimpot. To increase the current limit value, rotate the trimpot clockwise. To decrease the current limit value, rotate the trimpot counterclockwise. Some applications require a lower torque limiting value so as not to damage the process material or the drive train.

Caution: Adjusting the CL above 150% of motor rating can cause overheating and demagnetization of some PM motors. Consult motor manufacturer.

Timed Current Limit (TCL)

This function provides motor overload protection. Jumper J3 must be in the TCL position, in order for Timed Current Limit to be operational. This trimpot determines the approximate amount of time the drive will stay in Current Limit before trip out. The trimpot has an adjustment range of .5 - 10 seconds and is factory set for five (5) seconds. The trimpot can be reset according to the desired trip time. Rotating the trimpot clockwise, increases the trip time.

To reset the control after a current limit time out, momentarily set the START/STOP switch to the START position or cycle AC supply power OFF - ON.

Note: Non-Timed Current Limit - When jumper J3 is set to NTCL position and an overload condition exists, the control will remain in current limit.

IR Compensation (IR)

The IR comp circuit is used to stabilize motor speed under varying loads. The IR trimpot is factory set to 4 Volts for 90 Volt DC motors and 8 Volts for 108 Volt DC motors.

Note: If control is in Tach Feedback mode, the IR trimpot should be set to minimum - ccw.

Readjust the IR trimpot as follows:

1. Run the motor at approximately 30-50% of rated speed under no load and measure actual speed.
2. Load the motor in accordance with the application requirements. Rotate IR trimpot so that the loaded speed is the same as the unloaded speed measured in step 1.

Control is now compensated so that minimal speed change will occur over a wide range of motor load.

Note: Too much IR Camp will cause unstable (oscillatory) operation.

Troubleshooting

The control has LEDs to display the control's operational status.

A. **Power On**

This lamp indicates AC power is applied to the control.

Note: When removing power to the control, the ON LED will remain illuminated for a few seconds until the bus voltage discharges.

B. **STOP (STOP)**

The STOP LED will illuminate yellow when the Start/Stop switch is set to the STOP position. When the AC line is applied, this LED will also be illuminated until the Start/Stop switch is momentarily set to the START/STOP position.

C. **OVERLOAD (OL)**

The OL LED will illuminate red when the control goes into current limit, indicating that the current limit set point has been reached (set by the CL trimpot and the position of jumper J4). This LED will remain illuminated if the control times out in TCL (Jumper J8 set to the TCL position).

The control can be reset by either setting the Start/Stop Switch to the STOP position and then momentarily to the START position or by disconnecting and reconnecting the AC line. If the overload condition still exists when the control is restarted or AC line reapplied, the OL LED will illuminate again. If the OL LED remains illuminated during normal control operation, a fault condition may exist. See Table 2-5

Table 2-5 Troubleshooting Guide

Indication / Symptom	Possible Soloutions
Motor is not running or, STOP LED indicator is illuminated.	START-STOP Switch is in the STOP position. If so, move the START-STOP Switch to the START position.
	The Main Speed Potentiometer is set to zero speed. Set the Main Speed Potentiometer for the desired speed.
	The Main Speed Potentiometer, signal input, or motor connections are open. Verify Main Speed Potentiometer, signal input, or motor connections.
Motor runs then stops after a short time or, the Drive Trips due to overload (TCL Fault).	The drive must be manually restarted by disconnecting and reconnecting the AC power. Reduce load.
Line fuse blows or circuit breaker trips.	The line fuse or circuit breaker installed is the incorrect rating. See Appendix A for the correct line fuse or circuit breaker rating.
OL LED indicator is illuminated.	Motor is overloaded. Check motor amps with DC ammeter in series with armature. (If motor is shunt type, field may be open or not receiving proper voltage.)
	Check motor for shorts or grounds. Motor may be defective.
	Check position of CL trimpot. The CL may be set too low.
	Rapid Acceleration change will cause the LED to illuminate. Verify potentiometer setting.
Power ON LED indicator is not illuminated.	Check to see if the AC Line connections have been made.
	Check AC Line fuse.

Notes:

1. For any other problems, consult the factory representative.
2. In some applications, especially those requiring the motor to cycle on and off or from one speed to another or from stop to high speeds, the OL LED may blink, indicating a transient overload. This may be a normal condition for the application.

For low motor current range settings, (0.8A, 0.5A, OAA, 0.3A, and 0.2A), it is necessary to modify the motor current selection circuit by removing resistor R35.
Turn off all power.

Carefully cut the leads of R35 as shown below in Figure A-1.

After removing R35, set J2, to the motor nameplate current rating. Table See Table A-1.

Figure A-1 Removing Resistor R35

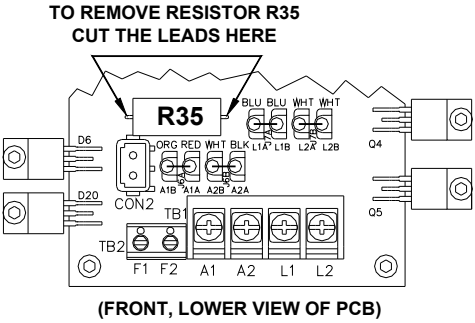


Table A-1 Current Limit Settings with .05 ohm Plug-in Horsepower Resistor Installed

J2 Setting Amps DC)	SCR Rated Motor Power HP, (kW)		PWM Rated Motor Power HP, (kW)	
	90 VDC	180 VDC	130 VDC	220 VDC
7.5	3/4, (0.5)	1-1/2, (1)	1, (0.75)	2, (1.5)
5.0	1/2, (0.37)	1, (0.75)	3/4, (0.5)	1-1/2, (1)
3.5	1/3, (0.25)	3/4, (0.5)	1/2, (0.37)	1, (0.75)
2.5	1/4, (0.18)	1/2, (0.37)	1/3, 0.25)	3/4, (0.5)
1.7	1/6, (0.1)	1/3, (0.25)	1/4, (0.18)	1/2, (0.37)
0.8*	1/12, (0.06)	1/6, (0.1)	1/8, (0.09)	1/4, (0.18)
0.5*	1/20, (0.04)	1/10, (0.08)	1/15, (0.05)	1/6, (0.1)
0.4*	1/25, (0.03)	1/12, (0.06)	1/20, (0.04)	1/8, (0.09)
0.3*	1/30, (0.02)	1/15, (0.05)	1/25, (0.03)	1/10, (0.08)
0.2*	1/50, (0.01)	1/25, (0.03)	1/30, (0.02)	1/20, (0.04)

* Current values with R35 removed. See Application Note and Figure A-1.

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