BALDOR®

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BC203 Regenerative Drive Adjustable Speed DC Control

6/15 **Installation & Operating Manual** MN714

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Introduction

Thank you for purchasing the BC203 Chassis style DC drive. Baldor is committed to providing total customer satisfaction by providing quality products that are easy to install and operate. The BC203 is manufactured with Surface Mount components (SMT), incorporating advanced circuitry and technology.

The BC203 is a full-wave regenerative drive capable of operating DC PM (Permanent Magnet) or Shunt wound motors in a bidirectional mode. Its 4-quadrant operation provides forward and reverse torque in both directions. This allows the control to maintain constant speed with overhauling loads and provides rapid instant reversing and controlled braking. Because of its excellent controllability and response time, the BC203 can replace servos in many applications. The control is factory set for armature feedback, which can provide, 1% load regulation over a motor base speed of 50:1. However, tachometer feedback is also available if superior regulation is required. By resetting mode jumper J7 to the TRQ position, the BC203 can be changed from a speed control to a torque control.

The BC203 can be operated with either a two (2) or three (3) wire start/stop circuit, or can be started from the AC line. A set of dedicated relay contacts are provided which are activated via the start/stop circuit. They can be used to turn on or off corresponding equipment or to sound an alarm if the drive stops.

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 1-1 Electrical Ratings

Model Number	Input Voltage (VAC)	Max Input Current (Amps RMS)	Armature Voltage (Volts DC)	Max Armature Current (ADC)	Max Field Current (A) @ 200/100 VDC	Maximum Power HP (kW)
BC203	230	38	-180 to +180	25	3/1.5	5 (3.8)

Table 1-2 Performance Specifications

Parameter	Specification	"Factory Setting"
AC Line Input Voltage (VAC ±10%, Single Phase 50/60 Hz)	208/230	-
Arm Voltage Range (VDC)	-180 to +180	-
Field Voltage	200/100	-
Service Factor	1.0	-
Duty	Continuous	-
Max Load Capacity (% for 2 minutes)	150	-
Ambient Temperature Range (°C/ °F)*	0 - 40 / 32 - 104	-
Operating Humidity Range (% Relative, Non-Condensing)	0 - 95	-
Storage Temperature (°C/ °F)	-25 - +85 / -13 - +185	-
Speed Range (Ratio)	50:1	-
Arm Feedback Load Regulation (% Base Speed)	±1	-
Tach Feedback Load Regulation (% Set Speed)	±1	-
Line Regulation (% Base Speed)	±0.5	-
FWD and REV Accel Range (Secs.)	0.1-15	1
Dead Band Range (% Base Speed)	-3 to +3	0
Offset Range (% Base Speed)	-5 to +5	0
Max Speed Trimpot Range (% Base Speed)	70-110	100
IR Comp Range (VDC)	0-30	10
FWD and REV CL Range (% Range Setting)	0-150	150
Timed CL Range (Sec.)	1-15	5
Voltage Following Input Range (VDC)	-10 to +10	-
Voltage Following Linearity (% Base Speed)	±0.5	-
Tachometer Voltage Input (Volts)	7,20/30,50	50

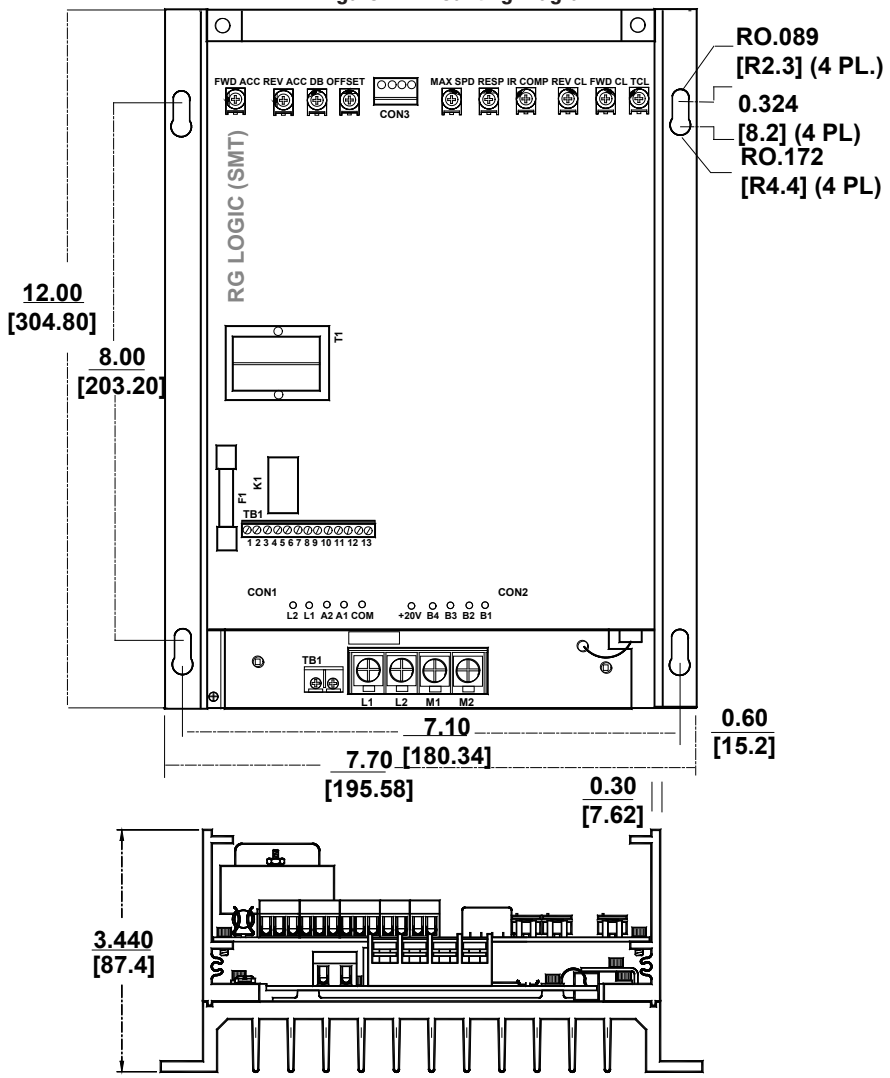
WARNING: Do not use this drive in an explosive environment. An explosion can cause serious or fatal injury. This drive is not explosion proof.

Mounting

Mount the BC203 in a vertical position (connection terminals in down or up position) on a flat surface free of moisture, metal chips, or corrosive atmosphere. Mount the control in such a manner that there is unrestricted air flow through the heat sink cooling fins.

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

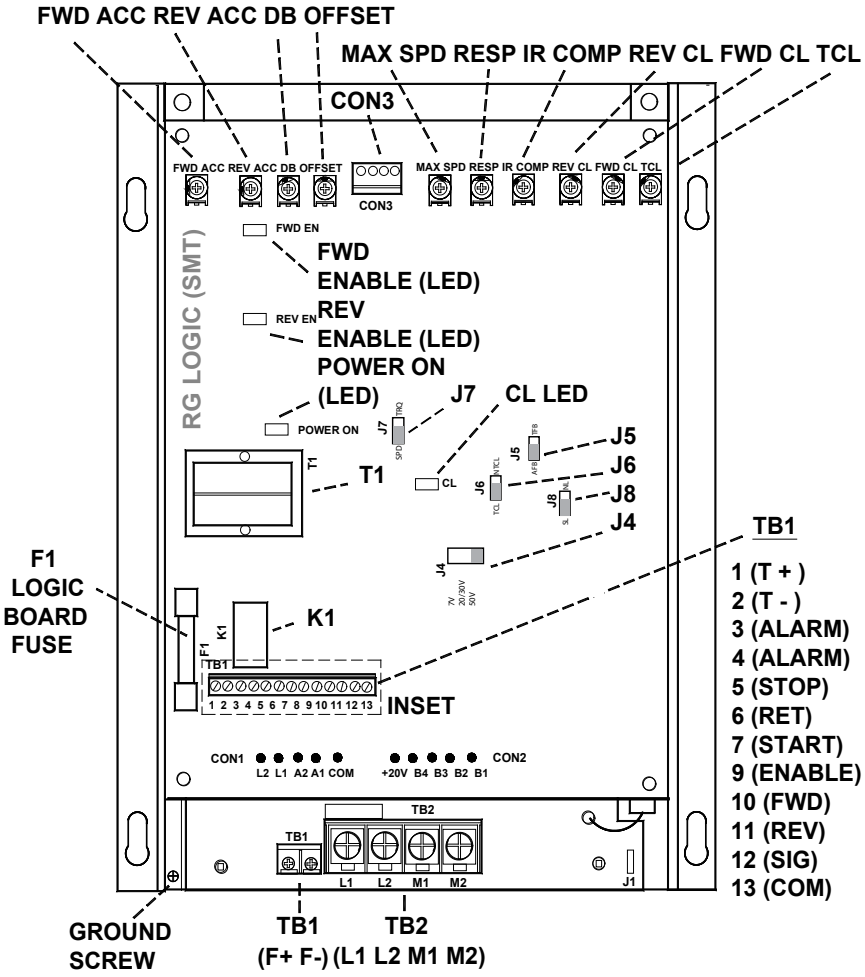
Figure 2-1 Mounting Diagram



A 5K ohm Remote Speed potentiometer is provided with each control. Install potentiometer using hardware provided. Be sure to install insulating disk between potentiometer and inside of panel.

Enclosure - When mounting the BC203 in an enclosure, it must be large enough to allow for proper heat dissipation. A 18x24x36 enclosure is suitable for the BC203 at full rating. Smaller enclosures may be used if full rating is not required, or if adequate ventilation, or auxiliary cooling methods are used.

Figure 2-2 Control Board Component Location



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.

AC LINE

Verify the AC line voltage matches the line voltage of the control. Connections are shown in Figure 2-2. A 40A fuse or circuit breaker must be used for AC line. A disconnect switch is recommended. Connect the AC Line to terminals L1 and L2 and tighten as specified in Table 2-1.

Table 2-1 Terminal Block Information

Terminal Block Designation	Connection Designation	Supply Wire Gauge (AWG - Copper)		Maximum Tightening Torque (lbs- in)
		Minimum	Maximum	
TB1 (Power Board)	F+, F-	22	14	7
TB2 (Power Board)	L1, L2, M1, M2	18	8	16
TB1 (Logic Board)	Logic Connections	22	14	3.5

Ground Connection

Connect all ground wires (earth) to the green ground screw terminal, Figure 2-2.

Motor Armature Connection

Connect the motor armature positive lead (+) to Terminal M1 and negative lead (-) to Terminal M2, Figure 2-2.

Motor Field Connection (Shunt Wound Motors Only)

Do not use F+ and F- terminals for any other motor type.

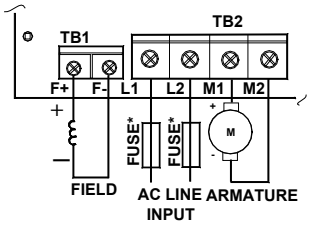
CAUTION! Do not connect motor armature leads to Terminals F+ and F-. Do not use Terminals F+ and F- for any purpose other than to power the field of a shunt wound motor. Shunt wound motors may be damaged if the field remains energized without armature rotation for an extended period of time.

Full Voltage Field Connection (Shunt Wound Motors Only)

Connect the motor field leads to F+ (+) and F- (-) terminals of TB1, Figures 2-2 and 2-3.

Figure 2-3 Full Voltage Field Connection

*Do not fuse neutral or grounded conductors.



Half Voltage Field Connection (Shunt Wound Motors Only)

Connect the motor field leads F+ (+), TB1 and L- (-) terminals of TB2, Figures 2-2 and 2-4.

Figure 2-4 Half Voltage Field Connection

*Do not fuse neutral or grounded conductors.

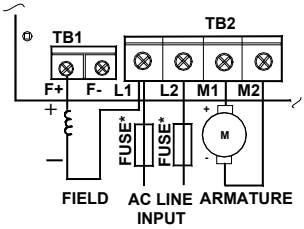


Table 2-2 Field Connection (Shunt Wound Motors Only)

AC Line Voltage (Volts AC)	Armature Voltage (Volts DC)	Field Voltage (Volts DC)	Field Connections
230	180	200	F+ and F-
230	180	100	F+ and L1

Main Speed Potentiometer Connection

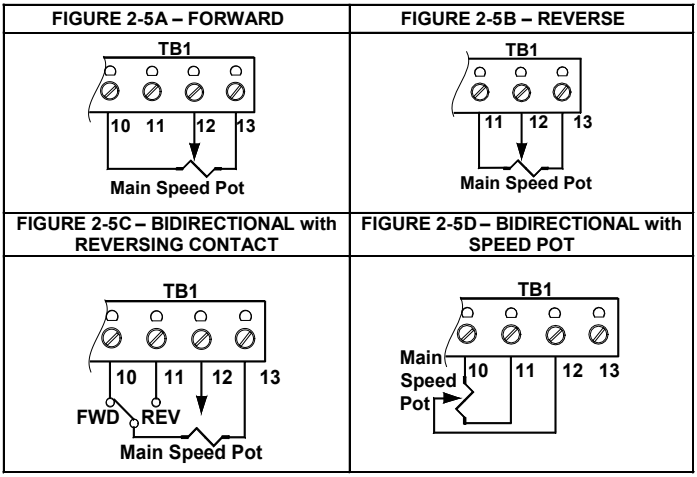
The main speed potentiometer can be connected in several ways using TB1, terminals 10, 11, 12, 13. A 5K ohm potentiometer is supplied with control. A 10K potentiometer can also be used.

A. Unidirectional operation only - Connect potentiometer to terminals 10, 12, 13 for forward direction. Connect to terminals 11, 12, 13. for reverse direction. See Figures 2-5A and 2-5B.

B. Bidirectional operation using user supplied, SPDT, FWD/REV Switch - Connect potentiometer and switch to terminals 10, 11, 12, 13. See Figure 2-5C.

C. Bidirectional operation with potentiometer - Connect potentiometer to terminals 10, 11, 12. See Figure 2-5D.

Figure 2-5 Main Speed Potentiometer Connections

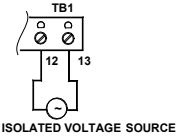


Caution: Terminals 10, 11, 12 and 13 are not isolated from AC line. Do not ground (earth).

Voltage Following

An isolated analog voltage can be used in lieu of main speed potentiometer. Connect signal to terminals 12 and 13. See Figure 2-6.

Figure 2-6 Voltage Following



Note: Terminal 13 is common. A positive signal with respect to terminal 13 will produce a positive output to motor. A negative signal with respect to terminal 13 will produce a negative output.

ENABLE

Control may be started and stopped with the Enable circuit. To use this feature, install a jumper across TB1, terminals 5 and 7, (Start/Stop circuit), and connect Enable contacts to TB1, terminals 8 and 9. When the contacts close the control is in the Enable state and the motor will start and run. When the Enable contacts open, the control is in the Inhibit state and the motor will coast to rest See Figure 2-7A.

Note: If ENABLE is not used, a jumper must be installed across terminals 8 and 9 of TB1.

START/STOP CIRCUIT

A standard 3-wire start/stop push button control station may be connected to TB1 terminals 5, 6, and 7, allowing remote start/stop control. If AC input power is cycled On/Off, or if the timed current limit mode has timed out, the start push button must be used to restart the motor. See Figure 2-7B.

Note: The Start/Stop function may be bypassed by connecting a jumper wire across the 5 and 7 terminals of TB1.

Note: The Timed CL function will operate only when the Start/Stop mode is used.

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.

Note: The Control will not start if AC line voltage is below 20% of nominal, (190 VAC on 230 VAC input).

OUTPUT RELAY

S.P.S.T. relay contacts (terminals 3 and 4) are used to signal a warning or to shut other equipment down if control goes to an Inhibit state. Rating of contacts are 1A-28VDC, 0.5A-115VAC. See Table 2-3, for relay control state vs. contact state. See Figure 2-7C.

Figure 2-7 Output Relay

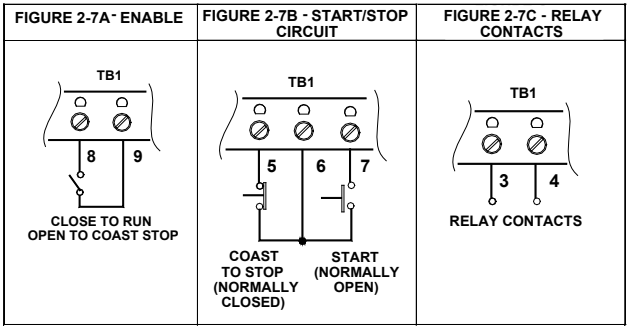


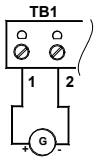
Table 2-3 Control State vs. Relay Contact State

Description of Control State	Relay Contact State	
	Using Start / Stop	Start / Stop Bypassed
Power Off	0	0
Power Applied	0	X
Control in Stop Mode	0	N/A
Control is started with Start button	X	N/A
Control has Timed Out in TCL	0	N/A
0 = Open, X = Closed, NA = Not Applicable		

DC Tachometer Input

If Tachometer Feedback is used, Jumper J5 must be in the TFB position and an analog tach signal must be connected to TB1, terminals 1 and 2. The IR COMP Trimpot must be set to minimum, fully CCW. Connect the tachometer so that when the motor rotates in the desired forward direction the positive tach voltage lead is connected to terminal 1 and the negative lead to terminal 2. See Figure 2-8. Set Jumper J4 to the corresponding tachometer voltage (7V, 20/20V, 50V).

Figure 2-8 Tachometer Connection



Note: If the Tachometer leads are connected backwards, the motor will run at full speed and will not respond to a speed reference signal. Verify position of Jumper J5 is in TFB and the tach signal polarity is correct.

Startup & Adjustments

Motor Type

The BC203 is a full wave regenerative, bi-directional control used to operate Permanent Magnet (PM), and Shunt Wound DC motors. Do not use the control in applications where specified ratings would be exceeded.

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.

Setting Jumpers

This control has selectable jumpers which can be changed to accommodate various applications. Jumpers must be set before the control can be used. See Figure 2-2 for jumper locations.

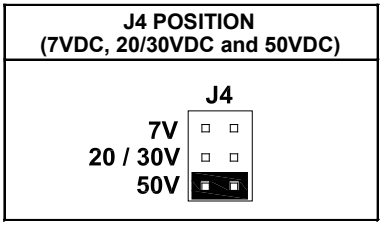
Note: Jumpers J1, J2 and J3 are not used.

J4 - Tachometer Voltage

Note: Selection of this jumper is not, required if tachometer feedback is not used.

If Tachometer feedback is used, select the J4 position, 7V, 20/30V, 50V which corresponds to the Tachometer voltage in Volts/1000 RPM. See Figure 2-9.

Figure 2-9 J4 Position (7VDC, 20/30VDC and 50VDC)



Note: The selection of J4 position is based on a maximum motor speed of 1800 RPM. If other than standard voltages and motor speeds are required, an external 1/2, watt resistor, (RT), may be used.

For example, if the tachometer is 25V/1000 RPM and the motor speed is 3,600 RPM (90 VDC), use the 50V J4 position. For other tachometer voltages and motor speeds, an external resistor (RT) may be used as follows:

1. Place J4 in 7V position.
2. Calculate the value of RT as follows:
   RT = [(5.4 x VT x S) - 68,000]
   VT = Tach voltage in volts/1000 RPM
   S = Base Speed of motor in RPM
3. Install resistor in series with either tachometer lead.

Note: Choose the closest standard 1/2 watt resistor value to the calculated value.

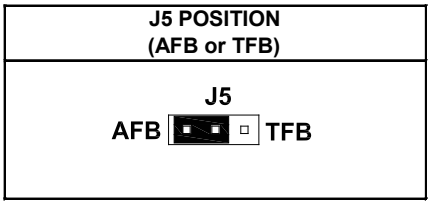
J5 - Feedback Type

The BC203 can be operated in either armature feedback AFB or tachometer feedback TFB. Armature feedback provides adequate load regulation for most applications.
For very precise performance, tachometer feedback TFB should be used. See Figure 2-10.

Notes:

1. If tachometer feedback is desired, an external DC tachometer must be used and connected.
2. The IR Comp trimpot must be set to the minimum setting [CCW] when using tachometer feedback.

Figure 2-10 J5 Position (AFB or TFB)



J6 - Current Limit Mode

(Factory set for TCL). The BC203 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:

Timed Current Limit, TCL

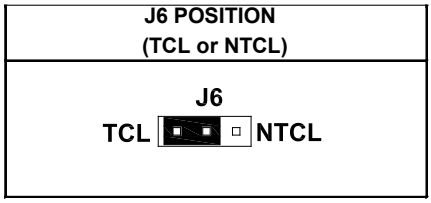
Note: For the Timed Current Limit feature to operate, the Start/Stop control circuit must be connected Figure 2-7B. Also, the Timed Current Limit feature cannot be used in either torque mode since nuisance tripping will occur.

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 – 15 seconds and is factory set for approximately 5 seconds. To restart the control after it has timed out, the start button must be pressed.

Non-Timed Current Limit, NTCL

In this mode, the drive will reach preset Current Limit during overload and stay at that motor current level until the drive is turned off or fuse blows. If Non-Timed CL is desired, move jumper J6 from the factory set TCL position to the NTCL position. The NTCL position must be used when operating in the torque mode.

Figure 2-11 J6 Position (TCL or NTCL)



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 and the Forward Enable, (FWD EN), indicator is on.
   If the direction of rotation is incorrect, stop the control and disconnect AC power.
   Switch the H1 and H2 motor leads.
   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, Figure 2-2.

Maximum Speed Trimpot (MAX)

The MAX trimpot is used to set the maximum voltage of the drive. This sets the maximum speed of the motor. Use the MAX trimpot to change the factory setting. Adjust the MAX trimpot as follows:

a. Rotate Main Potentiometer to maximum speed position (full clockwise).

b. Adjust MAX trimpot setting to desired maximum motor speed.

Note: Do not exceed maximum rated RPM of the motor.

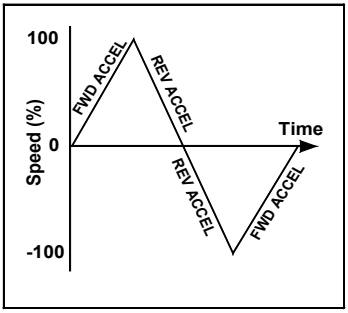
Acceleration (ACCEL)

The FWD ACC trimpot determines the amount of time it takes the control voltage to reach full output in the forward direction. It also determines the amount of time it takes for the control voltage, in the reverse direction, to reach zero output. (FWD ACCEL also sets the Reverse Decel.)

The REV ACC trimpot determines the amount of time it takes the control voltage to reach full output in the reverse direction and the time it takes for the control voltage, in the forward direction, to reach zero output. (REV ACC is the Forward Decel) The FWD and REV ACC trimpots are factory adjusted to 1 second. The acceleration times are adjustable to a maximum of 15 seconds.

Note: The FWD and REV CL trimpot settings may override the rapid accel and decel settings. See Figure 2-12.

Figure 2-12 Accel Trimpot Adjustment



Deadband (DB)
The DB trimpot sets the amount of main speed potentiometer rotation required to initiate control voltage output. It is factory adjusted to approximately 25% of rotation. Adjust Deadband to suit application requirements by rotating the DB trimpot CW, (increase), or CCW, (decrease).

The DB trimpot also determines the amount of delay that will occur before regeneration starts. (Regeneration occurs when the applied load torque is in the same direction as the motor rotation.) To readjust the DB to factory setting:

a. Set Main Speed pot to zero speed position.

b. Set DB trimpot to full CCW position.

c. Adjust DB trimpot CW until motor hum is eliminated.

Offset (OFFSET)
This trimpot determines the amount of bias in the forward or reverse direction. The trimpot is factory set to provide approximately zero offset, which means neither the forward nor the reverse speed is favored. Adjust offset to suit application requirements.

Note: If the deadband trimpot is set too low (CCW direction), the motor may oscillate between forward and reverse. Adjust deadband trimpot CW until the instability disappears. Oscillation may also occur due to response setting.

Response (RESP)

This trimpot determines the dynamic response of the control. The factory setting is approximately 50% of full rotation. The setting may be increased if a faster response is required.

Note: If response is made too fast, unstable operation may result.

IR Compensation (IR Comp)

The IR Comp is used to stabilize motor speed under varying loads.
If control is in Tach Feedback mode, the IR Comp should be set to minimum-CCW.

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

Adjust the IR Comp trimpot as follows

a. Run motor at approximately 30-50% of rated speed under no load and measure actual speed.

b. Load motor to rated current. Rotate IR Comp trimpot so that loaded speed is the same as the unloaded speed measured in the previous step.
Control is now compensated so that minimal speed change will occur over a wide range of motor load.

Forward Current Limit (FWD CL) and Reverse Current Limit (REV CL)

These trimpots are used to set the maximum amount of DC current that the motor can draw in both the forward and reverse directions. The amount of DC current determines the amount of maximum motor torque in both the Speed Control Mode and Torque Mode. These CL trimpots are factory set at 150% of the motor current. The value can be set to a lower value by adjustment of the CL trimpots. Some applications require a lower torque limiting value so as not to damage the process material or the drive train.

Readjust the CL trimpots as follows

a. Turn CL trimpot to MIN (CCW) position.

b. Connect a DC ammeter in series with armature lead. Load shaft of motor in accordance with application requirements.

c. Apply power; Rotate CL trimpot CW until desired CL setting is reached (factory setting is 5 times rated motor current). Be sure control is in Forward direction for FWD CL trimpot adjustment and likewise with REV CL.

Timed Current Limit (TCL) Trimpot

Trimpot is functional only when control is connected for 3-wire Start/Stop and J6 is in the TCL position. The TCL trimpot sets the delay time for the Timed Current Limit. The trimpot is adjustable over a time range of 1-15 seconds and is factory set for approximately 5 seconds. Calibrate the TCL trimpot by setting the trimpot to the approximate desired delay time as follows: See Table 2-4.

Table 2-4 Current Limit Timer Settings

Approximate Trip Time (Seconds)	Trimpot Position
1	Full CCW
8	Midway
15	Full CW

Operation

The Speed reference input voltage can be derived from the wiper of the main speed potentiometer or from an isolated analog input (voltage following mode). Since the BC203 is a 4-quadrant regenerative drive, the motor speed will follow both a positive and negative wiper voltage and drive the motor in both the forward direction and reverse direction. In addition, it will apply both forward and reverse torque to stabilize motor speed.

The BC203 can be operated as a speed control or torque control by setting the position of jumper J7. The main speed potentiometer controls the magnitude of the mode selected. Set jumper J7 to SPD for speed control or to TRQ for torque control.

Speed Or Torque Control - See Figure 2-13

Figure 2-13 J7 / J8 Positions

<table>
<tr><th colspan="2">J7 / J8 POSITIONS</th></tr>
<tr><td colspan="2">When jumper J7 is set to the "SPD" position, the BC203 will vary the motor speed as a function of the voltage on input terminals 12 (signal) and 13 (common).
<u>IMPORTANT NOTE:</u> When J7 is set for speed control ("SPD"), J8 must be set to "S/L" position (factory setting).</td></tr>
<tr><th>J7 POSITION
(TRQ or SPD)</th><th>J8 POSITION
(S/L or NL)</th></tr>
<tr><td>J7
SPD  TRQ</td><td>J8
S/L  NL</td></tr>
</table>

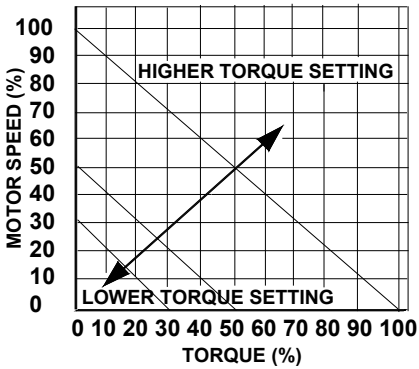
Table 2-5 Summary of Control (REGEN) Operation

Quadrant	Type of Operation	Motor Rotation Direction	Motor Torque Direction	Applied Load Direction
I	Motoring	CW	CW	CCW
II	Regeneration	CCW	CW	CCW
III	Motoring	CCW	CCW	CW
IV	Regeneration	CW	CCW	CW

Torque Control Mode

When Jumper J7 is set to TRQ position, the BC203 will control motor torque. The BC203 contains two (2) types of torque characteristics which are selectable with jumper J8. Speed Linear Torque (S/L) and Non Linear Torque (NL). In the S/L position (factory setting), both output torque and motor speed vary linearly as a function of the analog input signal. The S/L type of torque is most suitable for take up and payout winders where the speed and torque requirements vary as the winder roll diameter changes. The S/L torque characteristics are shown in Figure 2-14.

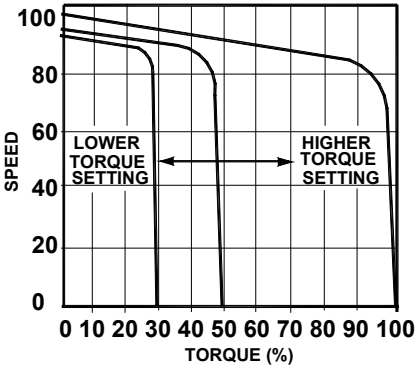
Figure 2-14 Linear Torque Curve



In the NL position, only torque (not speed) is varied by the input signal. The motor output torque remains constant over the motor's full speed range unless the load is less than the set torque. If the load torque decreases below the set torque, the motor will rapidly increase to full speed. This type of torque control is applicable to processes where the torque must remain constant over a wide motor speed range. The NL torque characteristics are shown in Figure 2-15.

Because the BC203 is a regenerative control, torque will be applied in both forward and reverse directions. The maximum torque can be set with the FWD CL and REV CL trimpots, and by using the FWD ACC and REV ACC trimpots, the rate of change of torque can be made more or less gradual. The maximum speed trimpot can be used to set the maximum motor speed under a no load condition.

Figure 2-15 Non-Linear Torque Curve



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.

B. **CURRENT LIMIT (CL)**
Indicates that the drive is in Current Limit. If set in the timed Current Limit mode (J6 set to TCL) and has timed out, the LED 2 will remain ON until the drive is restarted.

C. **Forward Enable** (FWD EN)
Indicates that the drive is engaged in the forward direction. [Enable circuit closed, (terminals 8 and 9), the start circuit asserted and a forward speed command.] The FWD EN lamp will also be lighted in the reverse direction if the control is in regeneration.

D. **Reverse Enable** (REV EN)
Indicates that the drive is engaged in the reverse direction.
[Enable circuit closed (terminals 8 and 9), the start circuit asserted and a reverse speed command.]
The REV EN lamp will also be lighted in the forward direction if the control is in regeneration.

Table 2-6 Troubleshooting Guide

Indication / Symptom	Possible Soloutions
Motor is not running and Power On LED indicator is illuminated.	Start-Stop switch is in the STOP position. If this mode is used, place the switch in 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.
Power ON LED indicator is not illuminated.	Check AC Line connections have been made. Verify correct wiring.
	Check AC Line fuse.
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 Table 1-4 for the correct line fuse or circuit breaker rating. Check for loose or damaged wiring.
Logic Control Board fuse, F1, blows.	Check to see if signal or control wiring is not shorted or grounded. Verify Start/Stop switch, Enable switch, and Speed Adjust pot are operating properly and are not shorted or grounded.
CL 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.
Motor runs at high speed and does not respond to main adjust speed pot or reference signal.	Check field wiring. If using tachometer feedback, check tachometer signal.
Note: For any other problems, consult your local Baldor District Office.	

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