

Seco

AC/DC Drives

INSTALLATION & OPERATION MANUAL

SECO® DC Drives (UL)

Bronco DC Series, 1/4 - 2 H.P. DC Drive
115/230 VAC 1 Phase, 50/60 Hz Input



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Receipt of Shipment

All equipment is tested before shipment, and is shipped in good condition. Any damages or shortages evident when the equipment is received must be immediately reported to the commercial carrier who transported the equipment. If required, assistance is available from the nearest Danaher Motion Representative. Always refer to the Danaher Motion Engineered Systems Center order number, model number, and serial number when contacting Danaher Motion Engineered Systems Center.

NOTE: *The information contained here is accurate at the time of publication. Danaher Motion Engineered Systems Center reserves the right to make design changes to motor controls described in this manual at anytime and without notice.*



Figure 1-1

1.0 GENERAL INFORMATION

This manual outlines installation and troubleshooting practices for the Bronco DC Series of DC controllers. (See Figure1-1). It also contains a brief description of the product and includes specifications and replacement parts lists.

Before installing or operating the equipment, read and understand this manual. Always observe the following dangers and cautions when operating or working on the equipment.

DANGER
The National Electrical Code (Publication NFPA No. 70) requires that a fused main disconnect switch be installed between the incoming AC line and the drive system or, if used, the power transformer. (Specifically, this includes the controller.) Serious injury or death may result if a disconnect switch is not provided.

DANGER
The Bronco DC controller is at line voltage when AC power is connected to the unit. The main power feed must be disconnected by a switch before it is safe to touch the internal parts. Serious personal injury or death may result if the procedure is not observed.

DANGER
The Bronco DC unit is combined with user chosen components to form a drive package. The user is responsible for proper selection of parts and subsequent operation. When a Bronco DC controller is being used, it should be installed, adjusted and serviced only by qualified personnel who are familiar with the operation of all major components in the system. Serious personal injury or death, and/or equipment damage, may result if this procedure is not followed.

1.1 CONTROLLER

The Bronco DC motor speed controller converts incoming AC line voltage into adjustable DC voltage in order to control a conventional shunt wound or permanent magnet DC motor. The controller may be used in applications within the following range:

1/4 - 1 HP 115 VAC, Single Phase Input

1/2 - 2 HP 230 VAC, Single Phase Input

The controller is designed to be integrated into a drive package selected and wired by the user. As such, it may be necessary to provide either a number of required operator's controls or equivalent relay contacts. The control functions are:

- Speed adjust or torque control potentiometer
- Start pushbutton switch, or relay contact
- Stop pushbutton switch, or relay contact
- Forward/Reverse switch

The Bronco DC controller is available in a NEMA 4/12 enclosure or as an open chassis unit designed for panel mounting. The controller consists of a power converter section containing the SCR power block and other high voltage circuits and a control card mounted above the power converter.

1.2 FEATURES AND SPECIFICATIONS

The Bronco DC controller standard features are summarized in Table 1.

TABLE 1
BRONCO DC FEATURES AND SPECIFICATIONS

MODEL	FEATURES
160	NEMA 4/12 enclosure with Start/Stop and Run/Jog Switches and Speed Potentiometer mounted on enclosure front cover.
161S	Chassis mount for mounting in user supplied enclosure.
162	NEMA 4/12 enclosure without operator's controls mounted on front cover. Requires remote operator's station.
163	NEMA 4/12 enclosure with Start/Stop, Run/Jog, Forward/Reverse Switches and Speed Potentiometer mounted on enclosure front cover.
165	Torque control with Start/Stop and Forward/Reverse Switches and Torque Potentiometer mounted on enclosure front cover.
169	External signal follower in NEMA 4/12 enclosure with Start/Stop and Auto/Manual Switches and Speed Potentiometer mounted on enclosure front cover.
168	Same as Model 169, except in Auto mode the speed potentiometer trims the motor speed from zero to the speed set by the auto signal.

Table 1. Continued on page 3

SPECIFICATIONS	All models- Bronco DC Series
Ratings	Horsepower Range 115 V 1/4-1 HP 230 V 1/2-2 HP
AC line input Voltage	115 or 230 VAC $\pm 10\%$
AC line frequency	50/60 Hz ± 2 Hz
115 VAC Supply Armature Voltage Field Voltage	0-90 VDC 50/100 VDC
230 VAC Supply Armature Voltage Field Voltage	0-180 VDC 100/200 VDC
Service Factor	1.0
Duty	Continuous
Max Load Capacity	150% for 1 min.
Line Protection	Fuse
Operating Conditions	
Ambient Temperature Chassis Model Enclosed Model	0-55° C 0-40° C
Relative Humidity	5-95% non condensing
Altitude	to 3300 ft. (1000m)
Performance Characteristics	
Speed Range	30:1 with Armature voltage Feedback 50:1 with optional Tach-generator Feedback
Speed Regulation (% of motor base speed) - For 95% load change. Armature Voltage Feedback Tachometer Feedback (non-reversing models only)	$\pm 2\%$ 1/2 - 1%
Adjustments	
Current Range	2.5, 5, 7.5, 10 Amps DC Nominal (Adjustable to 150% each range)
Max Speed	75 - 110% of motor base speed
Min Speed	0 - 30% of Motor Base Speed
IR Compensation	Adjustable
Acceleration	1 - 5 Seconds (Linear, 0 to Top Speed)

2.0 INSTALLATION

These procedures describe the installation of the Bronco DC controller.

CAUTION

In cases where the motor speed controller is integrated into a customer-designed drive system, the buyer is responsible for the correct choice of required associated equipment. In correctly specified components may cause improper operation and/or damage to the motor speed controller.

WARNING

Only qualified maintenance personnel should install the controller. They should be familiar with drive systems including operation - and with the possible hazards resulting from improper installation practices. Serious personal injury and/or equipment damage could result if this warning is not observed.

DANGER

The user is responsible for installation of the entire drive system, in accordance with the National Electrical Code, Publication NFPA No. 70; with Electrical Standards for Metalworking Machine Tools, NFPA No. 79; and with all local and national codes which apply. Serious personal injury, death and/or equipment damage could result if this procedure is not followed.

2.1 CONTROLLER MOUNTING

The Bronco DC controller must be mounted in a vertical position with terminals at the bottom. This orientation permits the required cooling of the heat sinks.

Drill patterns and dimensions for the Bronco DC controller are shown in Figure 2-1.

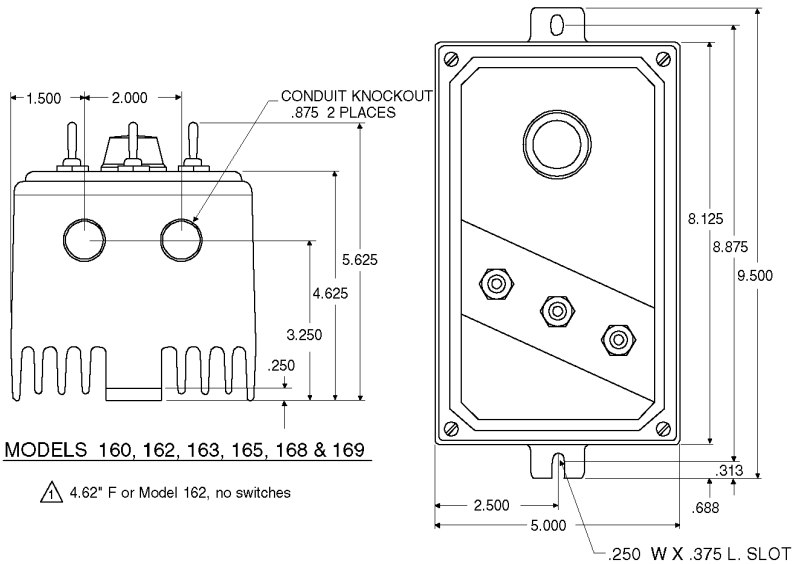
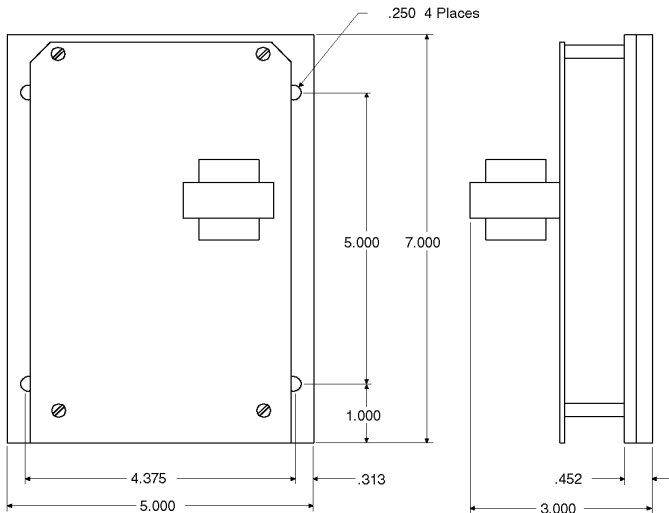


Figure 2-1



Model 161S
Figure 2-1 Continued

Be certain that the mounting area provides the environmental conditions noted in the following paragraphs.

2.1.1 AMBIENT TEMPERATURE

Ambient temperature should not exceed 40°C for enclosed models or 55°C for chassis mount unit.

2.1.2 ALTITUDE

Altitude should not exceed 1000 meters (3300 feet) unless the Bronco II has been specially rated for high altitudes. Consult factory for de-rating factor for high altitude operation.

2.1.3 AIR CONTAMINANTS

Ambient air should not be contaminated with caustic chemical vapors, excessive dust, dirt, or moisture. If such conditions exist, the proper enclosure and cooling methods recommended for such conditions should be used.

2.1.4 MOUNTING CLEARANCES

Adequate clearance should be allowed for easy access to terminals and adjustments and to facilitate inspection and maintenance.

2.1.5 MOUNTING AREA

Mounting area should be free of vibration and have sufficient clear air circulation.

2.1.6 GROUND CONDUCTOR

An equipment ground conductor (that is, ground wire) must be connected to the controller mounting panel. This conductor must run unbroken to a drive system wire connection point - or ground bus or grounding terminal block, as local usage determines. (See Figure 2-2). Separate equipment grounding conductors from other major component in the system must also be run unbroken to a central connection point. These components include:

- Motor
- Drive Enclosure
- Isolation transformer case, if used
- Operator control panel, if not on drive enclosure.

2.1.7 ELECTRICAL CONNECTIONS

When connecting the equipment grounding conductor to the Bronco II controller's mounting panel, permanently connect it to the grounding terminal provided.

2.2 INSTALLATION WIRING

Be sure that the AC power supplied is the voltage and frequency called for on the controller's name plate. Also be sure that the power line is capable of supplying at least the number of AC amperes indicated on the chart provided without voltage reduction. Improper voltage may damage the equipment, and insufficient current will cause erratic operation of the drive. Typical connection diagrams are shown in Figure 2-2 a, b, and c.

On enclosed units, install conduit fittings that maintain the NEMA 4 integrity of the enclosure.

2.2.1 WIRING CODES

All interconnection wiring should be installed in conformance with the National Electrical Code published by the National Fire Protection Association as well as any other applicable local codes.

2.2.2 SHIELDED CABLE

Shielded cable is recommended for the tachometer generator, speed potentiometer, and all low-level signal circuits to eliminate the possibility of electrical interference. Connect the shield to chassis ground at the controller end of the cable only.

CAUTION

Follow the installation wiring diagram provided in Figure 2-2. When connecting the motor, pay particular attention to the marking on the motor leads. It is possible to damage the Controller and motor if incorrect connections are made.

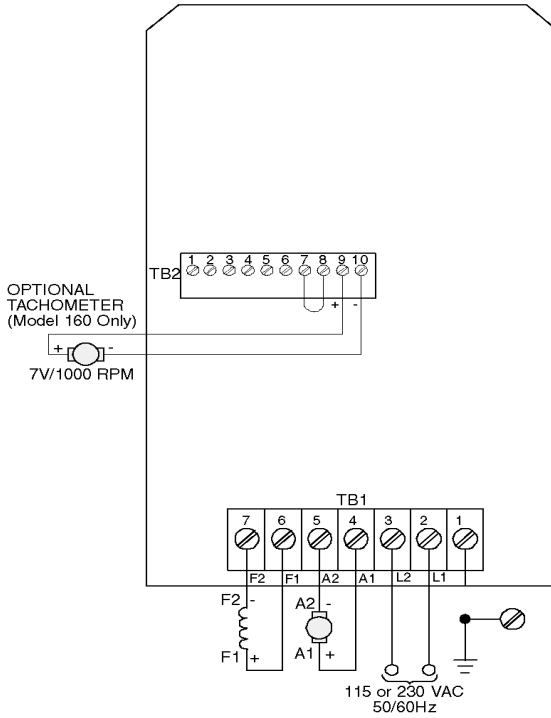


Figure 2-2a Models 160, 163 and 165

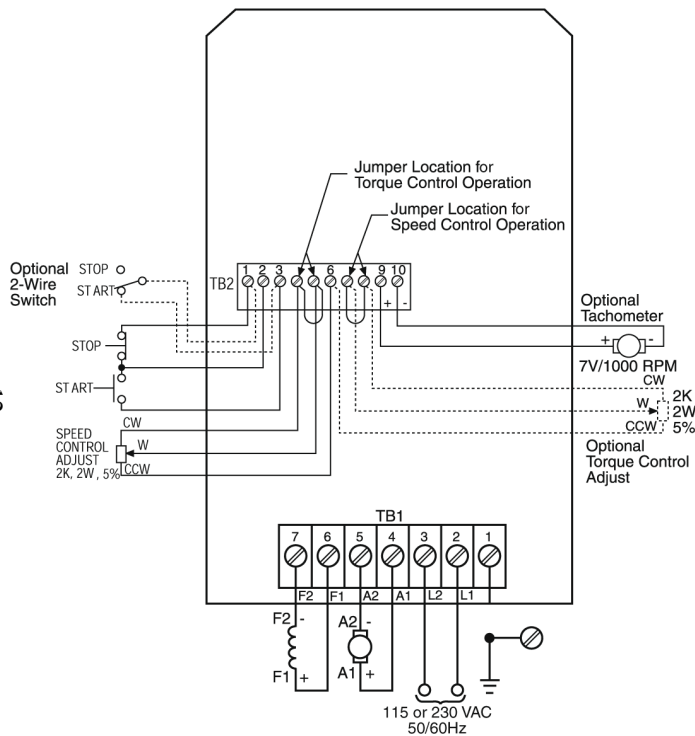
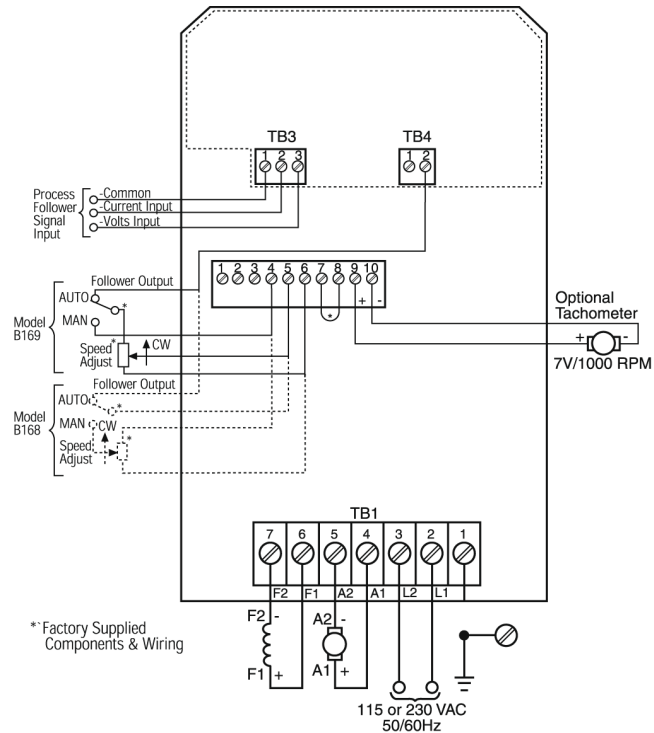


Figure 2-2b Model 161S and 162



*Factory Supplied
Components & Wiring

Figure 2-2c Models 168 & 169

2.2.3 MOTOR SHUNT FIELD

Bronco DC controllers have a standard field voltage supply as follows:

-115 VAC Controllers 50/100 VDC shunt field supply.

-230 VAC Controllers 100/200 VDC shunt field supply.

Refer to Figure 2-3 for motor field and armature wiring diagrams.

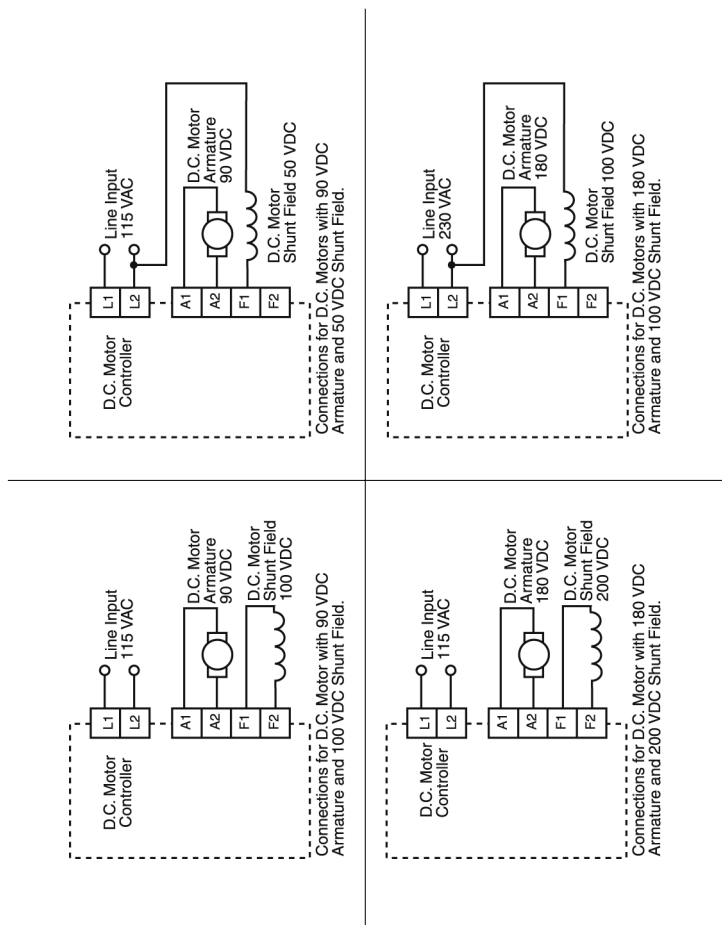


Figure 2-3

Some motors are furnished with dual voltage fields. If so, they will have 4 field leads marked F1, F2, F3 (or F11), and F4 (or F22). In such instances, check the motor nameplate for the field voltages and connect the motor leads for the field voltage supplied by the drive.

2.2.4 PERMANENT MAGNET MOTORS

If the Bronco DC is to be used with a permanent magnet motor, no connection is required to the field terminals.

2.2.5 MOTOR SERIES FIELD

If the motor has other leads marked S1 and S2 (series stabilizing field), ensure these are connected as recommended by the motor manufacturer.

2.2.6 MOTOR THERMOSTAT

If the motor has additional leads labeled P1 and P2 (motor thermal switch) , connect these wires in series with the STOP pushbutton.

3.0 OPERATION

3.1 FRONT PANEL (OPERATOR) CONTROLS (Models 160,163,165,168,169)

3.1.1 SPEED ADJUST POTENTIOMETER

A Speed Adjust Potentiometer on Model 160,163,168, and 169 varies motor speed by controlling applied armature voltage after the controller has been started. Clockwise rotation of the Speed Adjust Potentiometer increases motor speed.

3.1.2 TORQUE ADJUST POTENTIOMETER

A Torque Adjust Potentiometer is used in place of the speed adjust potentiometer on the Model 165 controller. The Torque Adjust Potentiometer controls motor torque by controlling the DC current in the motor armature. Clockwise rotation of the Torque Adjust Potentiometer increases motor torque.

3.1.3 START/RUN/STOP SWITCH

The START/RUN/STOP SWITCH, as provided on Models 160,163,165,168, and 169, is a three position toggle switch. The RUN and STOP positions are maintained switch positions, while START is a momentary position. With the switch in the STOP position the motor is stopped, however, AC Line voltage remains connected to the controller and full field voltage is present. Armature voltage is reduced to zero. When the switch is placed in the momentary START position, the motor will accelerate to the speed set by the Speed Adjust Potentiometer.

- For Model 165, the percentage of DC current as set by the Torque Adjust Potentiometer will be applied to the motor armature.
- Models 160 and 163 include a RUN/JOG SWITCH; see section 3.1.4.
- Models 168 and 169 will start, as described, when the AUTO/MAN SWITCH is in the MAN position. See section 3.1.5 for AUTO/MAN SWITCH position procedures.

If AC Line voltage is removed, the START switch must be operated to re-start the BRONCO DC unless the controller is being used with a 2 wire START/STOP switch. If in the START position, the controller will re-start when AC Power is applied.

WARNING
Line voltage is connected to the control when the START/RUN/ STOP SWITCH is in the maintained STOP position. Disconnect line voltage from the control before attempting to wire or service the control.

3.1.4 JOG/RUN SWITCH

A JOG/RUN SWITCH is supplied with Model 160 and Model 163 controllers. When the JOG position is selected, the controller will operate as long as the START/RUN/ STOP SWITCH is held in the START position.

The control will stop when the START/RUN/STOP SWITCH is in either the Run or Stop position, the controller will operate as described in section 3.1.3.

3.1.5 AUTO/MANUAL SWITCH

The AUTO/MANUAL SWITCH is used on Models 168 and 169 controllers. When the switch is in the MAN position, the motor speed is controlled by the Speed Adjust Potentiometer. On Model 169, when the switch is in the AUTO position, the motor speed is controlled by an external DC voltage or current signal. On Model 168, when the switch is in the AUTO position, the motor speed is controlled by the external DC current signal but may be trimmed between zero and the set speed by the Speed Adjust Potentiometer. The external signal is supplied to terminal TB3 on the FOLLOWER board that is mounted on the main PC Board. See Figure 3-1 for location.

3.1.6 FORWARD/REVERSE SWITCH

A FORWARD/REVERSE SWITCH is included on Model 163 and 165 controllers. The switch controls the direction of motor rotation by changing polarity at the motor armature connections. Move the switch to either position and momentarily press the START/RUN/ STOP SWITCH to the START position and the control will operate. To change motor rotation, first stop the controller with the START/RUN/ STOP SWITCH. After the motor has stopped then move the FORWARD/REVERSE switch to the opposite position.

NOTE: The FORWARD/REVERSE switch has a “hesitation” feature that will not allow a direct transfer from one direction to another. Stop the motor then move the switch from either direction to the center position and release pressure on the toggle. Then move the switch to the opposite position.

NOTE: TACHOMETER FEEDBACK must not be used on reversing models.

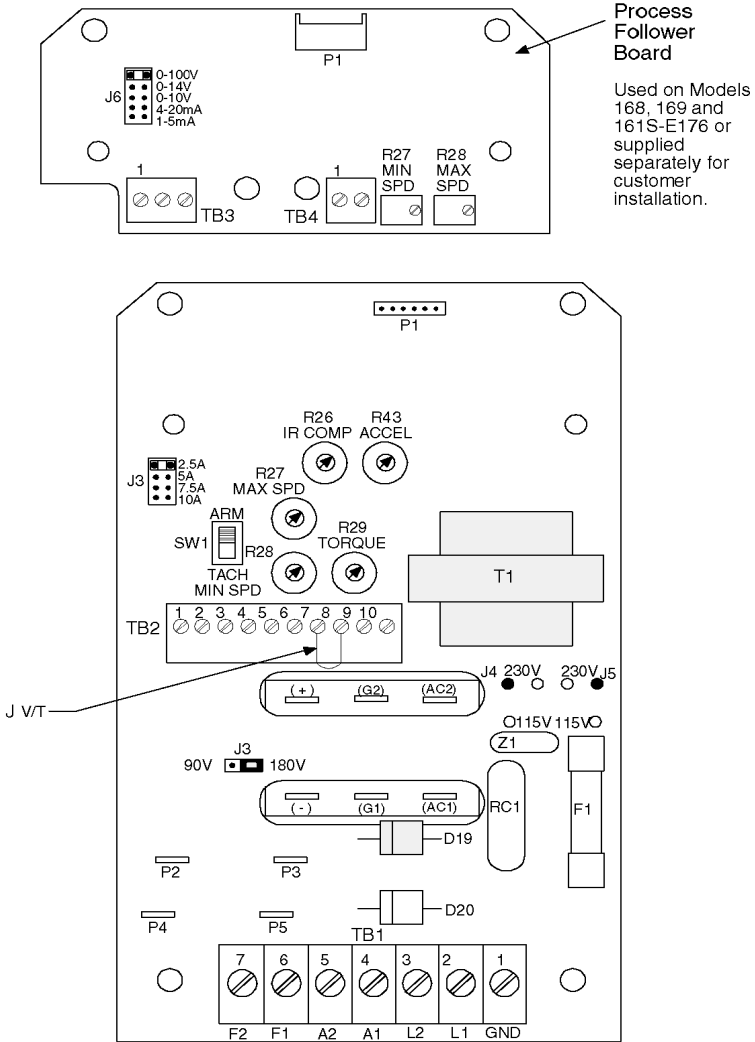


Figure 3-1

CAUTION
It is important that the motor is stopped before the FORWARD/ REVERSE switch is operated. Damage to the controller may result if the switch is operated while the motor is rotating.

3.2 REMOTE OPERATOR CONTROLS (Model 161S and 162)

3.2.1 SPEED ADJUST POTENTIOMETER

The user supplied Speed Adjust Potentiometer (see Figure 2-2b) varies speed by controlling applied armature voltage after the controller has been started.

3.2.2 START/STOP PUSHBUTTON

The controller can be wired for push button (3 wire) START/STOP as shown in Figure 2 -2b INSTALLATION. The controller will operate when the user supplied START button is momentarily pushed. The controller will stop when the user supplied STOP button is momentarily pushed. The START PUSHBUTTON is a normally open contact, and the STOP PUSHBUTTON is a normally closed contact. If AC Line voltage is removed, the START button must be momentarily pushed to re-start the controller.

It is possible to use a 2-wire (maintained contact, TB2 1 to TB2-3) START/STOP circuit, in which case the unit will start when AC power is applied if SWITCH is closed.

WARNING
LINE VOLTAGE is connected to the controller when the START/STOP SWITCH is in the STOP position. Disconnect the AC line voltage from the controller before attempting to wire or service the controller.

3.3 INITIAL SETTINGS (All Models)

The following procedure should be followed to check if jumper connections have been made correctly and that potentiometers are adjusted correctly.

All controllers have been tested at the factory under actual motor load. Factory settings for potentiometers are indicated in the procedure.

See Figure 3-1 for location of jumpers and potentiometers.

3.3.1 LINE VOLTAGE SELECTION

Bronco DC 160 Series controllers are suitable for operation on either 115 or 230 VAC single phase, 50/60 Hz supply

3.3.2 AC SUPPLY

Jumpers J4 and J5 should be in the 230V position for 230 VAC operation or in the 115V position for 115 VAC operation.

3.3.3 FEEDBACK

Jumper J3 should be in the 180V position for 230 VAC operation or in the 90V position for 115 VAC operation.

3.3.4 CURRENT SCALING

The factory setting for the controller has been made for the maximum current and horsepower rating shown on the name plate. Connections may be made for a lower maximum current rating by connecting Jumper J1 to match the current rating of the motor to be used as follows:

Current Rating (Amp Rating at 100% Current Rating)	HP (90VDC Armature)	HP (180 VDC Armature)
2.5	1/4	1/2
5.0	1/2	1
7.5	3/4	1-1/2
10.0	1	2

Table 2. Current Scaling

3.3.5 SPEED FEEDBACK SELECTION

The factory setting is for armature voltage feedback. Switch SW1 selects either armature voltage or tachometer generator voltage feedback- Bronco DC Series controllers are designed to accept a tachometer voltage of 12.25 VDC corresponding to the voltage generated by a 7 VDC tach generator mounted on a 1750 RPM motor.

NOTE: TACHOMETER FEEDBACK cannot be used on reversing models.

3.3.6 TORQUE OR SPEED CONTROL (Except for Model 168 and 169)

The factory setting for Model 160, 161S, 162, 163, and 164 controllers is for speed control. If torque control is required, Jumper V/T must be repositioned and the potentiometer connections changed as shown in Figure 3-2.

Model 165 controllers are factory connected for Torque control.

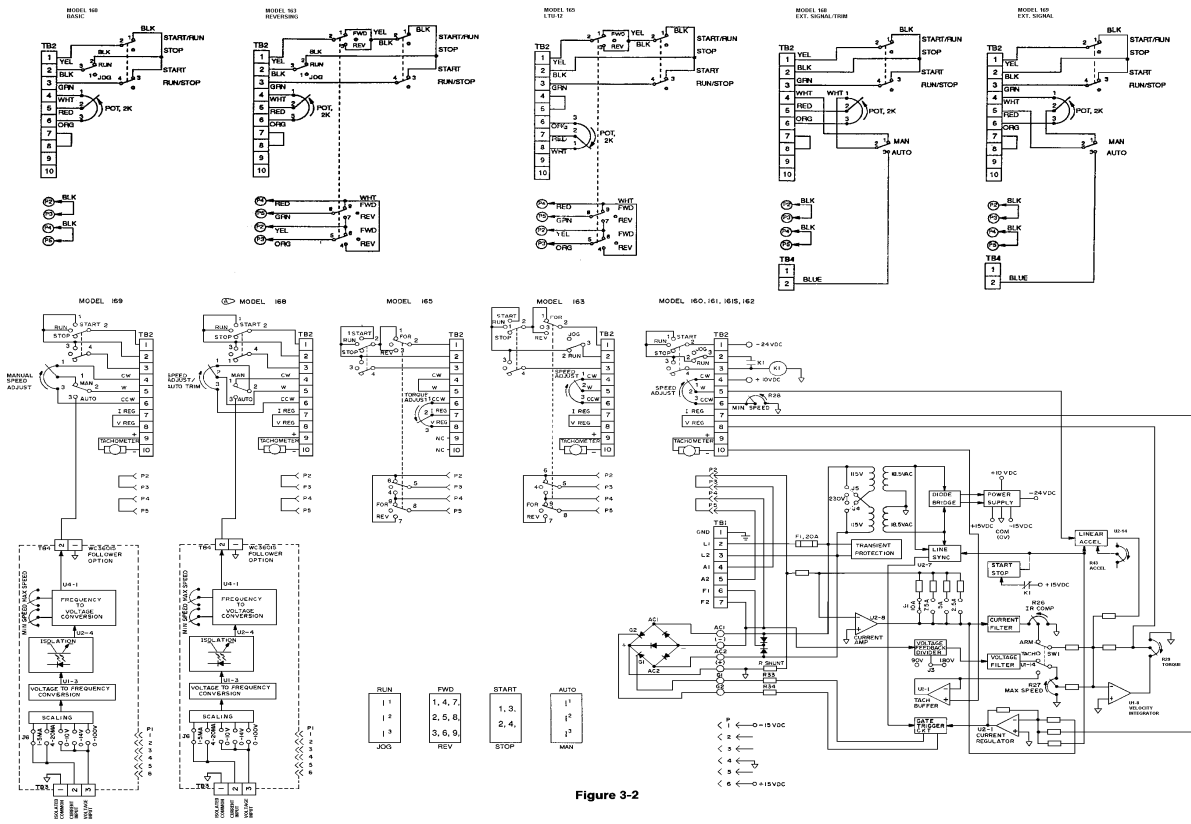


Figure 3-2

3.3.7 POTENTIOMETER SETTINGS

The following potentiometer settings should be checked before AC power is applied. The factory settings indicated are set when the controller is tested with a motor load. During start-up it may be necessary to modify them for a specific drive application. Generally clockwise (CW) rotation of a potentiometer increases a setting and counterclockwise (CCW) rotation decreases the setting.

3.3.7.1 MAXIMUM SPEED

The factory setting is at 100% of rated speed. Motor speed can be adjusted to between 75% and 110% of rated speed by adjusting R27 potentiometer, MAX SPEED.

3.3.7.2 MINIMUM SPEED

This potentiometer sets the minimum motor speed available when the operator's SPEED ADJUST potentiometer is at zero. The factory setting at full CCW allows the operator to control motor speed down to zero speed. The minimum speed may be increased to 30% of BASE SPEED by turning potentiometer, R28, MIN Speed, clockwise.

3.3.7.3 ACCELERATION TIME

The factory setting of fully clockwise represents a 1 second time to accelerate the motor to top speed. Turning the potentiometer R43, ACCEL TIME, counter clockwise will increase the time required to accelerate the motor to top speed.

3.3.7.4 IR COMPENSATION

This control provides a means of improving motor speed regulation in the armature feedback mode. The factory setting of full CCW provides no compensation. To compensate for motor IR losses, run the motor at the required speed with no motor load, then increase the load to maximum and adjust R26, IR COMP, to obtain the same motor speed as with no load.

CAUTION
Excessive IR compensation can cause instability.

NOTE: When Tach-Feedback mode is selected using Switch SW1, the IR Compensation circuit is disabled.

3.3.7.5 TORQUE CONTROL (Current Limit)

The factory setting of 3/4 full CW represents a current limit setting of approximately 100% of the selected current range, J1. It is possible to adjust the Torque Limit of the controller from 25% to 150% of the selected current range by adjusting R29, TORQUE, potentiometer.

3.3.8 MODELS 168 AND 169 AND ISOLATED PROCESS FOLLOWER BOARD INSTALLED BY THE USER

MODEL 169 controllers have an additional circuit board that allows the BRONCO DC to follow external signals. This FOLLOWER board is connected to the male connector on the BRONCO DC printed circuit board and contains the following controls and jumpers:

3.3.8.1 PROGRAMMING JUMPER

PROGRAMMING JUMPER, J6, selects the voltage or current range to match the external signal as shown in Table 3.

INPUT SIGNAL	
1-5	mA
4-20	mA
0-10	VDC
0-14	VDC
0-100	VDC

Table 3. External Signal

3.3.8.2 MIN SPEED ADJUSTMENT

MIN SPEED ADJUSTMENT, R27, determines the motor speed when the front panel AUTO/ MANUAL SWITCH is in the AUTO position and the external signal is at minimum value. Clockwise rotation of R27 increases the minimum speed.

NOTE: MIN SPEED ADJUSTMENT, R27, located on the isolator board, is connected when the AUTO/MANUAL is in the AUTO position. When the AUTO/MANUAL SWITCH is in the MANUAL position, MIN SPEED ADJUSTMENT, R28, situated on the main circuit board is connected. See section 3.3.7.2 for adjustment of R28.

3.3.8.3 MAX SPEED ADJUSTMENT

MAX SPEED ADJUSTMENT, R28, determines the motor speed when the AUTO/ MANUAL SWITCH is in the AUTO position and the external signal is at maximum. Clockwise rotation of R28 increases motor speed. Max speed should be adjusted after adjusting R27 Min speed as described in section 3.3.8.2.

NOTE: MAX SPEED ADJUSTMENT, R27, located on the main circuit board determines the motor speed when the AUTO/MAN SWITCH is in the MAN position and the SPEED ADJUST POT is at Maximum. R27 limits the range of adjustment of the Max SPEED Adjustment pot, R28, on the isolator Board. Adjust R27 per section 3.3.7.1 before adjusting R28.

4.0 TROUBLESHOOTING

4.1 VOLTAGE READINGS

The following voltage readings are typical for Bronco II controls under normal operating conditions. These readings should be made with a Simpson Model 260 V.O.M. or equivalent.

TERMINAL	FUNCTION	115 VAC LINE MEASUREMENT	230 VAC LINE MEASUREMENT
LI & L2	AC Voltage Input	100 - 125 VAC	200 - 250 VAC
AI & A2	Armature Connection (with Drive Started)	90 - VDC	0 - 180 VDC
FI & F2	Field Connection	95 - 105 VDC	180 - 220 VDC-1
TB2-5 & TB2-6	Speed Pot Reference Voltage	0 - 10 VDC	0- 10 VDC
TB2-7 & TB2-6	Torque Pot Reference Voltage (Model 165 Only)	0 - 10 VDC	0 - 10 VDC

Table 4. Voltage Readings

4.2 TROUBLESHOOTING GUIDE

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
Control Blows Line Fuse F1	<ul style="list-style-type: none"> • Shorted Power Module, Field Supply Diode (D19 or D20), or Suppressor (Z) • Controller or Motor Shorted to Ground 	<ul style="list-style-type: none"> • Replace Faulty Component • Check for Short and Repair as Required
Control will not START	<ul style="list-style-type: none"> • Blown Fuse (F1) • Defective Power Module • Defective Component on Control Board • Jumper missing from TB2-7 to TB2-8 (speed control) or TB2-4 to TB2-5 (Torque Control) 	<ul style="list-style-type: none"> • Replace Fuse • Replace Faulty Component • Replace Faulty Component • Replace Jumper on Terminal Strip

<p>Motor will not come up to speed</p>	<ul style="list-style-type: none"> • Max Speed Adjust R27 is set too low • Motor overloaded • Torque adjust, R29 is set too low • Current Programming Jumper J1 in wrong position • Defective Power Module • Defective Component on Control Board 	<ul style="list-style-type: none"> • Readjust Max Speed R27 for correct Top Speed • Check load and adjust as required • Re-adjust R29 for increased motor current • Re-locate Jumper position for correct current range • Replace Faulty Component • Replace Faulty Component
<p>Motor will not stop with Speed Adjust pot at zero speed</p>	<ul style="list-style-type: none"> • Min. Speed, R28, is set too high • Defective Speed Adjust pot • SW1 in Tach. Position • Tach generator polarity is incorrect • Defective Power Module • Defective Component on Control Board 	<ul style="list-style-type: none"> • Re-adjust R28 for correct min. speed when reference is at the minimum value • Replace Faulty Component • Select Arm Position • Reverse tach generator leads • Replace Faulty Component • Replace Faulty Component
<p>Motor speed is unstable or Pulsates</p>	<ul style="list-style-type: none"> • IR Comp. Adjust Pot. R26, is set too high (Armature Feedback only) • Motor is being Overhauled • Defective Motor • Defective Component on Control Board • Defective or Intermittent Tach Generator 	<ul style="list-style-type: none"> • Re-adjust R26 per Section 3.3.8 • Check Load for Correct Operation • Repair or Replace Motor • Replace Faulty Component • Replace Tach Generator
<p>Motor will not Maintain Speed</p>	<ul style="list-style-type: none"> • IR Comp. Adjust Pot R26 is set too low Under Load (Armature Feedback only) • Torque set too low • Motor Over Loaded • Defective Component on Control Board • Defective Power Module 	<ul style="list-style-type: none"> • Re-adjust R26 per Section 3.3.8 • Adjust Torque Pot • Check Load for Correct Operation • Replace Faulty Component • Replace Faulty Component

5.0 REPLACEMENT PARTS LIST

Description	Previous Part Number	New Replacement Part Number
Speed/Torque Adjust Pot. 2K	APT2026-00	224552-000
Start/Run/Stop Switch	ASW3010-00	224554-000
Forward/Reverse Switch	ASW1051-01	224579-000
Auto/Manual or Jog/Run Switch	ASW1079-00	224551-000
Water Tight Boot (For all Switches)	HMI1103-00	224639-000
Water Tight Nut (For all Switches)	HMI1012-00	224638-000
Fuse, 20 Amp	PFU1010-07	104364-025
Isolation Follower Card	BWC36015	BWC36015
Power Module	ATY4001-03	224544-001
PC Board Assembly	SPD36006-00	SPD36006-00

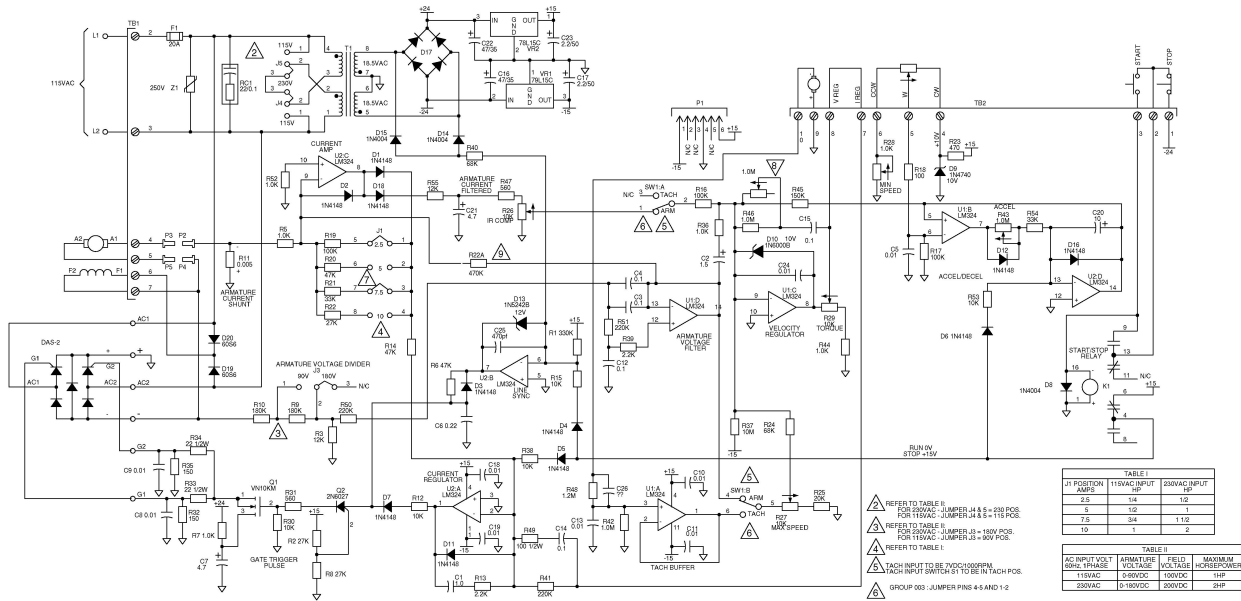


FIGURE 3-3

- ⚠ REFER TO TABLE I FOR 115VAC. JUMPER J4 & S = 1/4 POS.
- ⚠ REFER TO TABLE I FOR 115VAC. JUMPER J4 & S = 1/2 POS.
- ⚠ REFER TO TABLE I FOR 115VAC. JUMPER J4 = 1/2 POS.
- ⚠ REFER TO TABLE I FOR 115VAC. JUMPER J4 = 1/2 POS.
- ⚠ TACH INPUT TO BE 2VDC/100RPM.
- ⚠ TACH INPUT SWITCH S1 TO BE IN TACH POS.
- ⚠ GROUP 003 - JUMPER PINS 4-4 AND 1-2
- ⚠ GROUP 003 POSITION
- ⚠ GROUP 003 R48 REPLACED BY A 1.0M 1% PCT
- ⚠ GROUP 003 ONLY

6.0 CE COMPLIANT INSTALLATION REQUIREMENTS AND INFORMATION

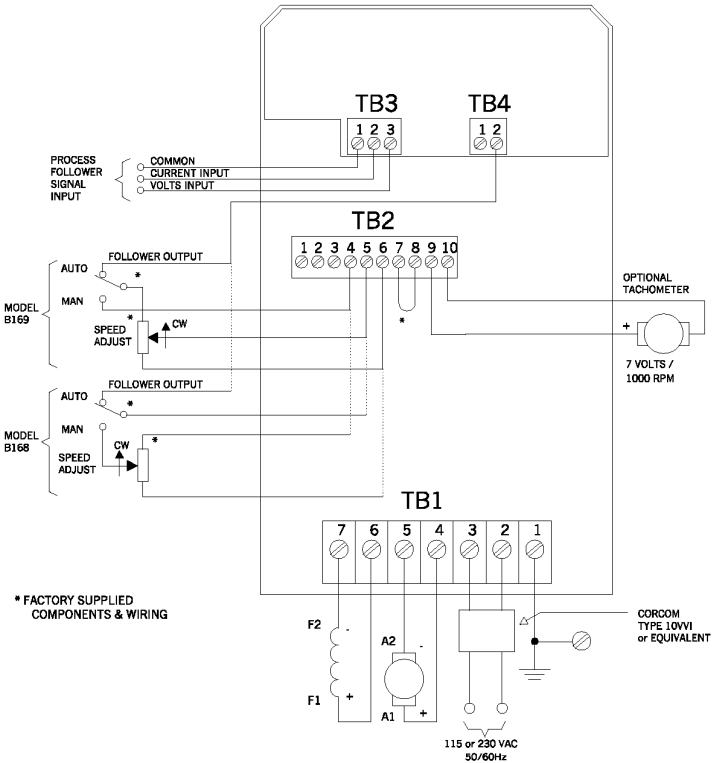
In order to reduce the amount of radiated Electro-Magnetic Interference and to reduce the susceptibility of the drive to interference from other devices the drive should be installed in accordance with the following instructions:

- 1) All Power and control wiring entering or leaving the enclosure must be enclosed in flexible metal conduits terminated with metal grounding hoods at each end.

- 2) A power line input filter Corcom Type 10VVI or equivalent must be installed at the power input of the drive with good electrical bonding to the wall of the enclosure.

The drive was installed by following the above instruction and was tested in an independent laboratory. The drive was found to be in conformance with the CE EMC directive but there is no guarantee that these findings can be transferred to a particular drive in a specific installation.

BRONCO DC 160 SERIES DRIVES, TYPICAL



NOTES:

Distribution Coast-To-Coast

Seco AC/DC drive products are available nationally through an extensive authorized distributor network. These distributors offer literature, technical assistance and a wide range of models off the shelf for the fastest possible delivery and service.

In addition, Seco AC/DC drive sales and application engineers are conveniently located to provide prompt attention to customers' needs. Call Seco AC/DC drives customer service for ordering and application information or for the address of the closest authorized distributor for Seco AC/DC drive products.

In U.S.A. and Canada

DANAHER MOTION ENGINEERED SYSTEMS CENTER

- **Customer Service, Product Application, Product Support: 704-588-5693**
- **Fax: 704-588-5695**

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Charlotte, NC 28273

Seco AC/DC Drives	BRONCO® AC and DC Drives SE2000 DC Drives with options Q7000 Regenerative DC Drives with options	M4000 DC Adjustable Speed Drives SV3000 Flux Vector AC Drives SL3000 V/Hz AC Drives
Danaher Motion - Engineered Systems Center	Rapidtrak Rod-less linear actuators E2000 Linear actuators Servo Motion Control Systems CUSTOM ENGINEERED SYSTEMS - Linear and Rotary Motion Control	EMP Engineered Motion Products Stepper Motion control systems Fusion® Vector/Servo/Motion Controller

Web Site: www.danahermotionesc.com

