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# WARNER

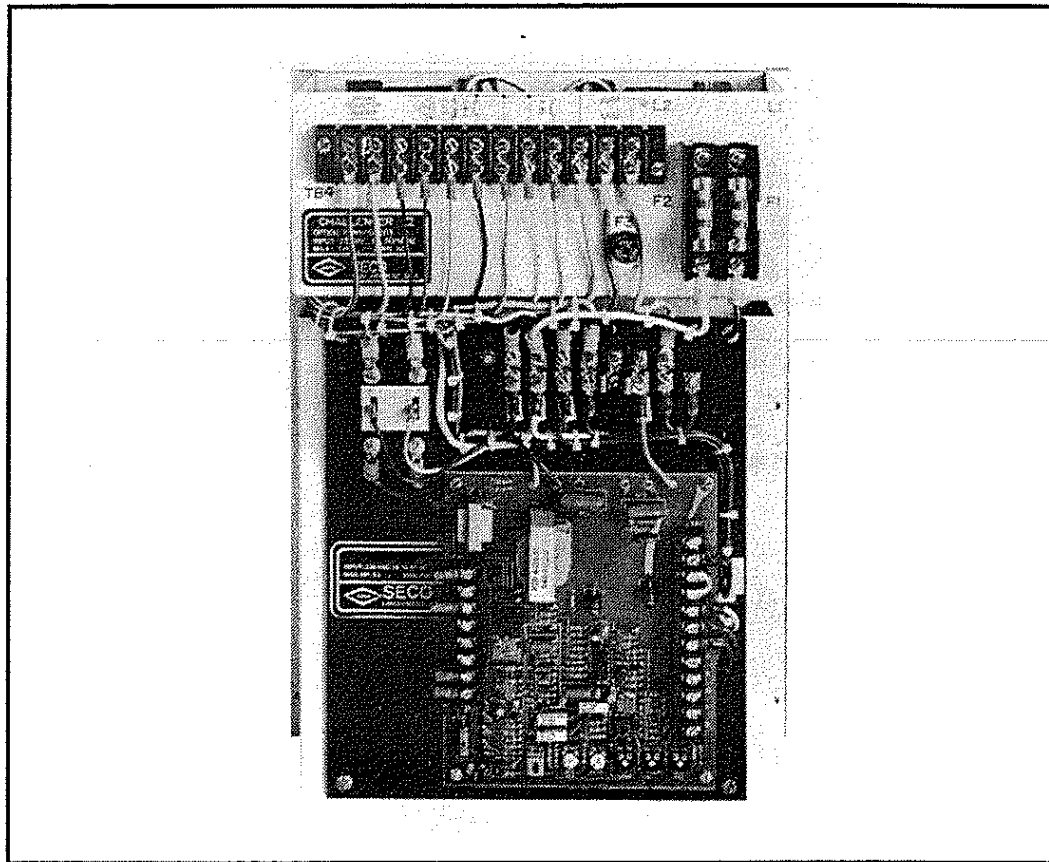
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## INSTALLATION & OPERATION MANUAL

### SECO® DC Drive

Challenger Series Models 8500, 8600, 8800

1/4 - 5 H.P.



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**Superior**  
Electric

383 Middle Street • Bristol, CT 06010

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# Limited Warranty

SECO Electronics Division warrants that it will repair or replace (whichever it deems advisable) any product manufactured and sold by it which proves to be defective in material or workmanship within a period of one (1) year from the date of installation or 18 months from the date of shipment to the buyer, whichever is shorter.

This warranty extends only to the initial purchaser and is not transferable or assignable without SECO's prior consent.

A purchase receipt or other proof of original purchase will be required before warranty service is rendered. If found defective under the terms of this warranty, repair or replacement will be made, without charge, together with a refund for transportation costs. If found not to be defective, you will be notified and, with your consent, the item will be repaired or replaced and returned to you at your expense.

This warranty covers normal use and does not cover damage or defect which results from alteration, accident, neglect, or improper installation, operation or maintenance.

Some states do not allow limitation on how long an implied warranty lasts, so the above limitation may not apply to you.

SECO's obligation under this warranty is limited to the repair or replacement of the defective product and in no event shall SECO be liable for consequential, indirect, or incidental damages of any kind incurred by reason of the manufacture, sale or use of any defective product. SECO neither assumes nor authorizes any other person to give any other warranty or to assume any other obligation or liability on its behalf.

Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

## 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 SECO Representative. Always refer to SECO order number, model number, and serial number when contacting SECO Electronics Corporation.

**NOTE:** *The information contained herein is accurate at the time of publication. SECO reserves the right to make design changes to motor controls described in this manual at anytime and without notice.*

# SECO ELECTRONICS CORPORATION

## STANDARD TERMS AND CONDITIONS OF SALE

### 1. PRICES:

All prices on standard catalog industrial products are F.O.B. shipping point. All prices and discount schedules are subject to change without notice. Price in effect at time of shipment will apply.

Quotations not accepted by the Buyer within 30 days are subject to review and revision. All excise, sales, use, and other similar taxes applicable to this order and required to be collected by the Seller shall be added to the invoice unless an appropriate exemption certificate is received.

The minimum charge on any order will be \$100.00. Products of different manufacturing locations may not be combined for minimum charge.

### 2. TRANSPORTATION:

Shipments from Seller's plants and warehouse are F.O.B. shipping point. Any transportation damages must be claimed by the buyer and the buyer must submit a claim to the carrier.

### 3. BOXING & CARTAGE:

No charge is made for boxing or crating required by transportation company for domestic shipments. Cost of special boxing, export boxing, cartage to steamer or transfer expenses will be added to the invoice unless such charges are shown to be included in the prices quoted.

### 4. ACCEPTANCE AND CANCELLATION OF ORDERS:

No contract between the Seller and Buyer shall be deemed in existence until Buyer's order has been accepted by Seller. Orders placed can be cancelled, and deliveries of goods made up or in process extended beyond the original delivery date only with the Seller's written consent and upon terms which will equitable indemnify the Seller.

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The standard terms of payment are thirty (30) days net.

### 6. TITLE:

Title to all products and parts ordered and risk of loss shall pass to Buyer upon their delivery to a Carrier for shipment. Any claims for shortages or damages suffered in transit shall be submitted by the Buyer directly to the Carrier.

### 7. DELAYS:

Seller shall not be liable for any defaults, damages, or delays in fulfilling any order caused by conditions beyond Seller's control, including, but not limited to Acts of God, strike, lockout, boycott, or other labor troubles, war, riot, flood, government regulations, or delays of Seller's subcontractors or

suppliers in furnishing materials or supplies due to one or more of the foregoing causes.

8. Seller warrants the products furnished hereunder to be free from defects in material and workmanship under normal use and service for the period of one (1) year from date of shipment from Seco. Seller's sole obligation under this warranty shall be to repair or replace any defective product or part thereof, which is returned to Seller's factory transportation charge prepaid within the period mentioned above, and which upon examination is proven to Seller's satisfaction to be so defective. The warranty shall not apply to any product or part which has been subject to misuse, negligence, or accident. Seller MAKES NO WARRANTY THAT ITS PRODUCTS ARE FIT FOR THE USE OR PURPOSE TO WHICH THEY MAY BE PUT BY BUYER whether or not such use or PURPOSE HAS BEEN DISCLOSED TO SELLER IN SPECIFICATIONS OR DRAWINGS PREVIOUSLY OR SUBSEQUENTLY PROVIDED SELLER, and whether or not Seller's products ARE SPECIFICALLY DESIGNED AND/OR MANUFACTURED BY SELLER FOR BUYER'S USE OR PURPOSE. SELLER SHALL NOT be responsible for any special or consequential damages, AND THE WARRANTY AS SET FORTH IS IN LIEU OF ALL OTHER WARRANTIES EITHER EXPRESSED OR IMPLIED.

### 9. REJECTIONS AND RETURNED MATERIAL:

Claims for incorrect material must be filed in writing within (30) days from delivery at Buyer's place of business. No material may be returned without first obtaining written approval from the Seller, and no claim will be allowed nor credit given for material returned without such written approval.

### 10. DESIGN, DIMENSIONS, AND WEIGHTS:

We reserve the right to change designs without notice. The weights listed are approximate and sufficiently accurate for most uses. The Buyer should use Certified Prints for construction where exact dimensions and weights are critical.

This sale is conditioned ON THE BUYER'S AGREEMENT THAT THE TERMS AND CONDITIONS SET FORTH ABOVE SHALL BE APPLICABLE TO ALL ORDERS ACCEPTED BY SELLER AND SHALL CANCEL AND SUPERSEDE ANY TERMS AND CONDITIONS WHETHER ORAL OR BY PURCHASE ORDER FORMS SUBMITTED BY BUYER. THESE TERMS AND CONDITIONS ARE SUBJECT TO MODIFICATION ONLY BY THE MUTUAL AGREEMENT OF THE BUYER AND SELLER EXPRESSED IN WRITING. IF THESE TERMS AND CONDITIONS ARE NOT ACCEPTABLE, BUYER MUST SO NOTIFY AT ONCE.

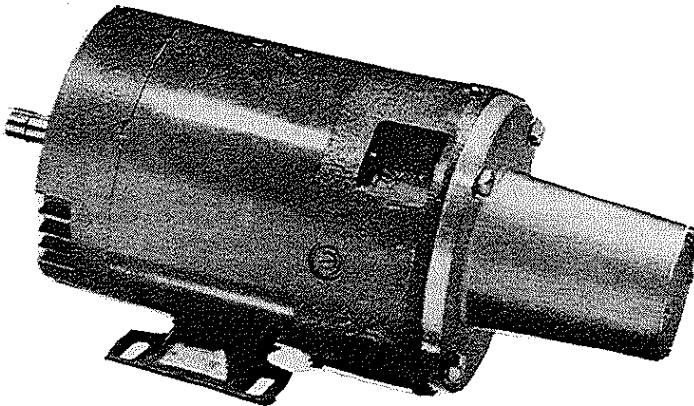
# INSTRUCTIONS AND WIRING DIAGRAMS

## 1. GENERAL DESCRIPTION

SECO Electronics Corporation Challenger motor controls provide speed control from zero RPM to normal motor speed for DC shunt wound motors between 1/8 and 5 horsepower. A typical Challenger drive system consists of a SECO Electronics motor control and the drive motor. Some controls require a remote operators station.

### 1.1 DRIVE MOTOR

SECO Electronics Corporation supplies DC motors built according to NEMA Standards for general applications and are designed for operation with single phase, full-wave rectification. The DC motors are available as open drip-proof or totally enclosed. The motors are normally supplied with NEMA C faces and removable bases. When a tachometer feedback system is required, most motors can be supplied with motor mounted tachometers.



### 1.2 MODEL IDENTIFICATION

Every SECO motor speed control contains a serial number and model number when it leaves the factory. Make reference to these numbers if it is ever necessary to consult the factory.

The table below lists the various models in the Challenger Series. The model number is a four digit number. The first two digits indicate the voltage and horsepower range of the motor control. Model 85XX designates 120VAC, 60Hz input with a horsepower range between 1/8 and 1 horsepower. Model 86XX designates 230 volts input with a range between 1/2 and 2 horsepower, Model 88XX designates 230 volts input with a range between 3 and 5 horsepower. The last two digits complete the definition of the control, and the dash number defines the type of enclosure.

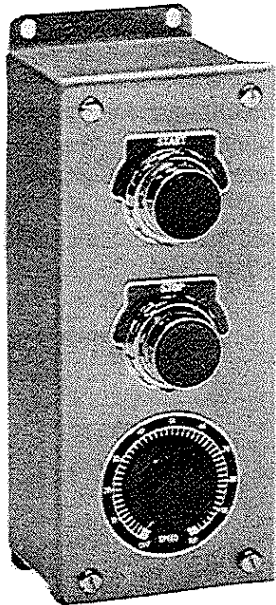
## STANDARD MODELS FOR CHALLENGER SERIES SCR MOTOR SPEED CONTROLS

XX	DESCRIPTION
00	Control module assembly supplied with external speed potentiometer. NOTE: This assembly is designed for OEM applications and is to be user mounted in control console or enclosure.
01	Basic control, manually operated, in NEMA 1 enclosure with front panel mounted Power Switch, Speed Potentiometer, and Pilot Light.
03	Basic control with Contactor (Automatic) Reversing Dynamic Braking. Power Switch and Pilot Light on front panel. Housed in NEMA 1 enclosure. 8006 Remote Station required.
04	Basic control with Run-Brake. In NEMA 1 enclosure. Front panel mounted Power Switch and Pilot Light. 8005 Remote Station required.
09	Basic control with External Signal Input with Run-Brake in NEMA 1 enclosure. Input Ranges: 1 - 5 ma 4 - 20 ma 10 - 50 ma Input can be isolated or non-isolated. Panel mounted Pilot Light and Power Switch. 8011 Remote Station required.

**OPTIONAL ENCLOSURE IDENTIFICATION**

- N27 NEMA 12 enclosure 20 x 16 x 7 for 8800 Series controls.
- N47 NEMA 4 enclosure 13 x 10 x 6¼ for 8500 and 8600 Series controls.
- N48 NEMA 4 enclosure 14 x 12 x 6¼ for 8500 and 8600 Series controls.
- N49 NEMA 4 enclosure 20 x 16 x 8 for 8800 Series controls.

**1.3 REMOTE STATIONS**



Four basic remote stations are used with the Challenger Series. Several optional features are available with each Remote Station and are identified by a dash number. The Remote Stations and optional features are identified below:

**1.3.1 BASIC REMOTE STATIONS**

<u>PART NO.</u>	<u>DESCRIPTION</u>
8005	Start-Stop push buttons, Speed Adjust.
8006	Forward-Stop-Reverse push buttons, Speed Adjust.
8011	Auto-Manual switch, Start-Stop push buttons and Speed Adjust.
8012	Start-Stop push buttons, Speed Adjust. Start button also resets Electronic Circuit Breaker.

**1.3.2 OPTIONAL FEATURES**

<u>DASH NO.</u>	<u>DESCRIPTION</u>
-RJ	Run-Jog option with Run-Jog selector switch, Jog Speed Adjust internally located and Jog Push button (part of Start button function).

- 710 Ten turn Speed Adjust in place of single turn.
- AE Adjustable Exponential Acceleration.
- AL Adjustable Linear Acceleration.
- F17 Tach follower for a full range input voltage of 5 to 100 VDC. A ratio adjust is internally located. The standard Speed Adjust functions as a Manual Speed Adjust and a Selector Switch is located on the front.

**1.4 TECHNICAL DATA AND PHYSICAL SPECIFICATIONS**

**1.4.1 85XX SERIES**

**A. Technical Data**

- Input voltage . . . . . 108-130VAC, 50/60Hz, 1 phase
- Horsepower range . . . . . 1/8 – 1 HP
- Speed range . . . . . 50:1
- Speed regulation (no load to full load)
  - 1) Armature feedback mode . . . . . ±1% of base speed
  - 2) Tachometer feedback mode . . . . . ±.5% of base speed
- Tachometer input volts . . . . . 12.25 VDC at motor base speed
- Temperature range . . . . . -10°C to 50°C
- Torque adjust (current limiting) . . . . . approximately 25% to 150% of full load current
- Acceleration rate . . . . . internal fixed
- Overload protection (control only) . . . . . line fuse
- Transient protection . . . . . AC thyrector (line) RC filter (line)
- Slope . . . . . adjustable
- Minimum speed . . . . . 0 to 30% of base
- Maximum speed . . . . . +10%, -30% of base
- IR compensation . . . . . adjustable

**B. Physical Specifications**

See enclosure dimensions Section 2 for enclosure sizes.

**1.4.2 86XX SERIES**

**A. Technical Data**

- Input voltage . . . . . 208-250VAC, 50/60Hz, 1 phase
- Horsepower range . . . . . 1/2 – 2 HP
- (all other data same as 85XX Series)

**B. Physical Specifications**

See enclosure dimensions Section 2 for enclosure sizes.

**1.4.3 88XX SERIES**

**A. Technical Data**

- Input voltage . . . . . 208-250VAC, 50/60Hz, 1 phase
- Horsepower range . . . . . 3 – 5 HP
- (all other data same as 85XX Series)

**B. Physical Specifications**

See enclosure dimensions Section 2 for enclosure sizes.

## 2. INSTALLATION

### 2.1 MOTOR INSTALLATION

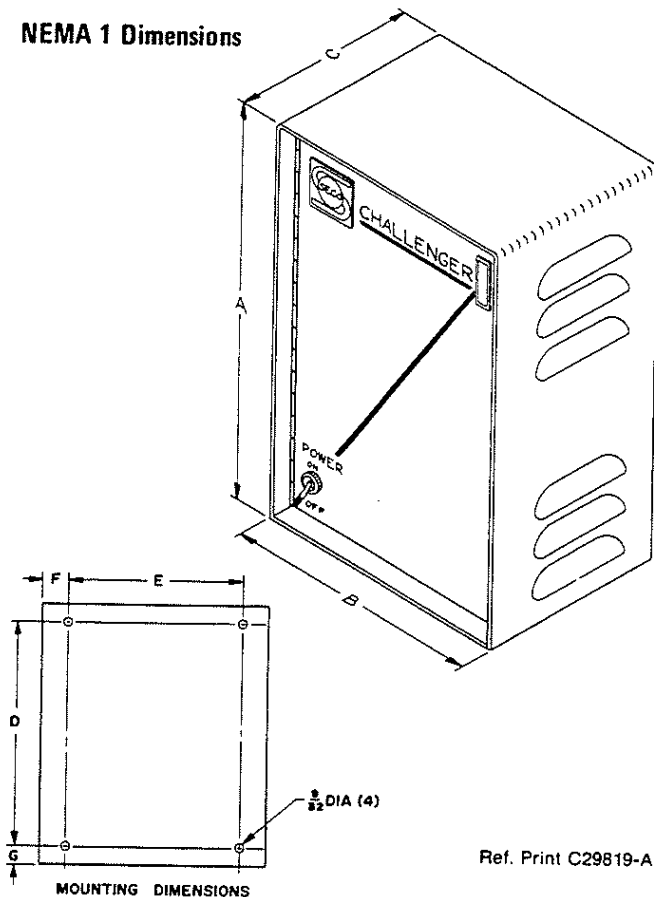
SECO supplied DC shunt motors are available for base mounting or with C face.

The drive motor may be connected to the load through a gear reducer, belt, or by direct coupling. When a motor is coupled through a gear reducer make certain that the C flanges are mated properly. Connect the gear reducer according to the manufacturer's instructions. If the motor is coupled to the load by belting it is important that the sheaves be in line. Check belt tightness. A belt that is too loose will result in excessive slippage.

**Direct coupling** is best accomplished by using a flexible coupling. A proper coupling will extend the motor and bearing life.

**NOTE:** A properly connected direct coupled load does not exert forces on the motor shaft in any direction.

#### NEMA 1 Dimensions



DIMENSION TABULATION								APPROX
MODEL NO.	A	B	C	D	E	F	G	WEIGHT (LBS)
8501 8601 8504 8604	13 $\frac{1}{4}$	9 $\frac{1}{4}$	6 $\frac{1}{4}$	12	5 $\frac{3}{4}$	1 $\frac{1}{2}$	$\frac{5}{8}$	18.0
8503 8603 8509 8609 8801 8804	14 $\frac{1}{4}$	12 $\frac{3}{4}$	7	11	11	$\frac{3}{4}$	1 $\frac{5}{8}$	25.0
8803 8809	20 $\frac{1}{4}$	16 $\frac{3}{4}$	7	18 $\frac{1}{4}$	13	$\frac{7}{8}$	$\frac{7}{8}$	30.0

Figure 2.1

### 2.2 DIRECTION OF MOTOR ROTATION

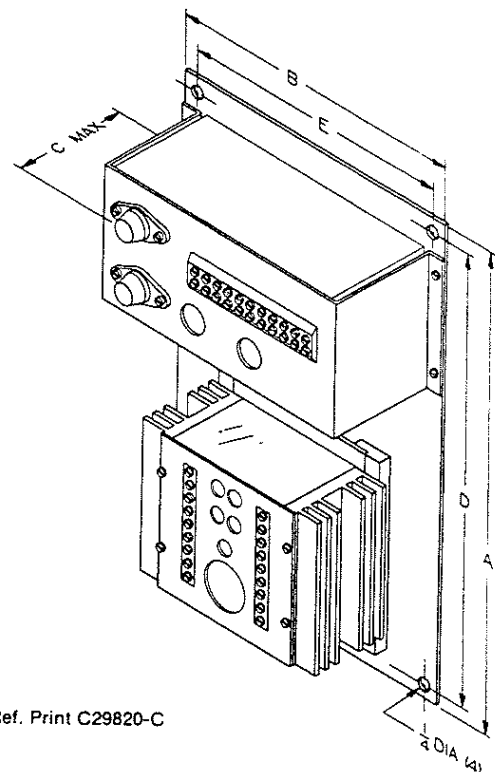
The standard direction of rotation is counterclockwise (CCW) looking at the end opposite the drive shaft (CW looking at the drive shaft end). SECO supplied motors with A1, A2, F1, and F2 connected as shown in the connection diagrams will rotate in the (CCW) direction.

**NOTE:** When installing motors having split field windings, determine the correct field connections by referring to section 15 of this manual.

### 2.3 MOTOR CONTROL MOUNTING

The Challenger Series controls are designed for wall mounting. Figure 2.1 gives the enclosure dimensions for the basic motor controls. The enclosure can be used as a template for mounting by opening the front panel to expose the 4-mounting holes in the rear of the panel. Figure 2.2 shows the chassis dimensions and Figure 2.4 shows the control module dimensions. Two 7/8 dia. conduit holes are provided at the bottom of each NEMA 1 enclosure. See Figure 2.3 for NEMA 4 JIC and NEMA 12 JIC dimensions.

#### Chassis Dimensions

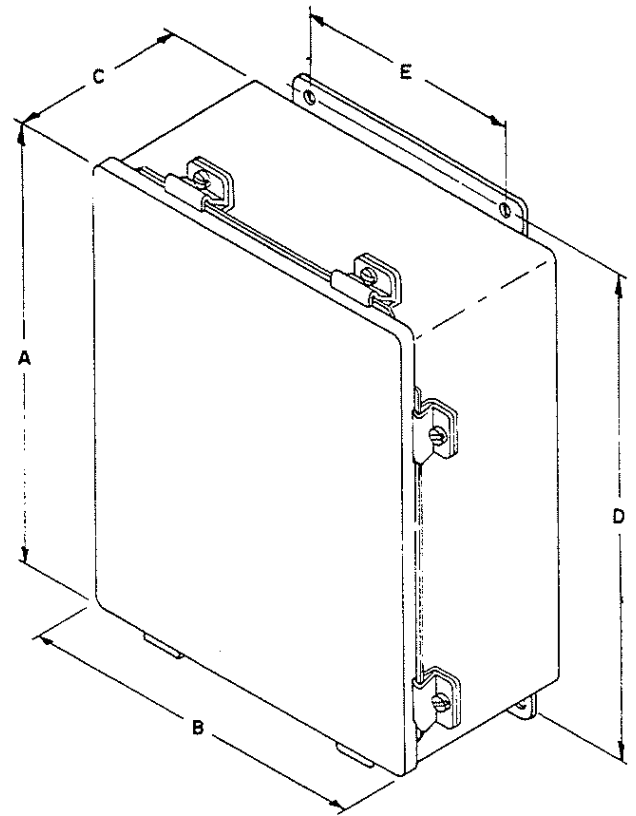


DIMENSION TABULATION							APPROX
MODEL NO.	A	B	C MAX	D	E	WEIGHT (LBS)	
8501 NO 8601 NO 8504 NO 8604 NO	11 $\frac{3}{8}$	7 $\frac{5}{8}$	3 $\frac{11}{16}$	10 $\frac{1}{8}$	5 $\frac{3}{4}$	7.0	
8503 NO 8603 NO 8509 NO 8609 NO 8801 NO 8804 NO	12 $\frac{1}{4}$	10 $\frac{1}{4}$	4 $\frac{7}{8}$	11 $\frac{5}{8}$	9 $\frac{5}{8}$	12.5	
8803 NO 8809 NO	17	13	5	15 $\frac{1}{4}$	11 $\frac{1}{4}$	13.0	

Figure 2.2

## NEMA 12 JIC and NEMA 4 JIC Dimensions

		ENCLOSURE DIMENSIONS					APPROX. WEIGHT	
MODEL		A	B	C	D	E		
NEMA 4	8501-N47 8504-N47	8601-N47 8604-N47	13	10	6 $\frac{1}{4}$	13 $\frac{3}{4}$	8	21 LBS
	8503-N48 8509-N48	8603-N48 8609-N48	14	12	6 $\frac{1}{4}$	14 $\frac{3}{4}$	10	27 LBS
	8801-N49 8803-N49	8804-N49 8809-N49	20	16	9 $\frac{3}{8}$	21 $\frac{1}{4}$	10	42 LBS
NEMA 12	8801-N27 8803-N27	8804-N27 8809-N27	20	16	7 $\frac{1}{4}$	21 $\frac{1}{4}$	10	42 LBS

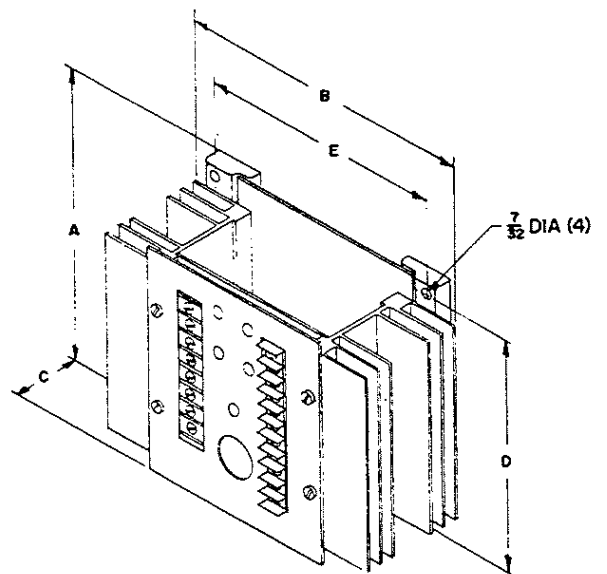


Ref. Print C29818-A

Figure 2.3

## Control Module Dimensions

CONTROL MODULE DIMENSIONS						APPROX. WEIGHT
MODEL	A	B	C	D	E	
8500	6 $\frac{1}{2}$	7 $\frac{5}{8}$	3 $\frac{3}{4}$	6	5 $\frac{15}{16}$	4 LBS
8600	6 $\frac{1}{2}$	7 $\frac{5}{8}$	3 $\frac{3}{4}$	6	5 $\frac{15}{16}$	4 LBS
8800	9	7 $\frac{5}{8}$	4 $\frac{1}{16}$	8 $\frac{1}{2}$	5 $\frac{15}{16}$	4 $\frac{1}{2}$ LBS



Ref. Print C29803

Figure 2.4

## 2.4 CIRCUIT PROTECTION

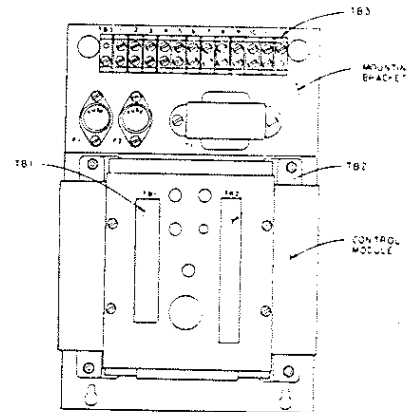
Local codes require adequate circuit protection upon installation. Model 8500/8600 motor controls normally are supplied from stock with a 15A fuse. The model 8800 motor controls are supplied with a KAX50 fuse.

The Challenger Series must be fused per local electrical code upon installation. Listed below is the input specifications and recommended fuse size for each horsepower range. Select wire size based upon local codes. All other wiring is based upon 1 Amp RMS.

HP	Input Voltage	AC Input Full Load Current	Recommended Fuse
1/8	120	2.5	3.5A FNM
1/6	120	3.4	4A FNM
1/4	120	4.3	5A FNM
1/3	120	5.3	6 1/2A FNM
1/2	120	7.9	8A FNM
3/4	120	11.7	15A FNM
1	120	16.0	15A FNM
1/2	230	4.3	5A FNM
3/4	230	5.6	7A FNM
1	230	7.9	8A FNM
1 1/2	230	12.2	KTK 15
2	230	14.0	KTK 15
3	230	19.0	KAX 40
5	230	29.0	KAX 50

**NOTE:** To determine transformer KVA rating a working rule of thumb is to multiply horsepower by 1.5.

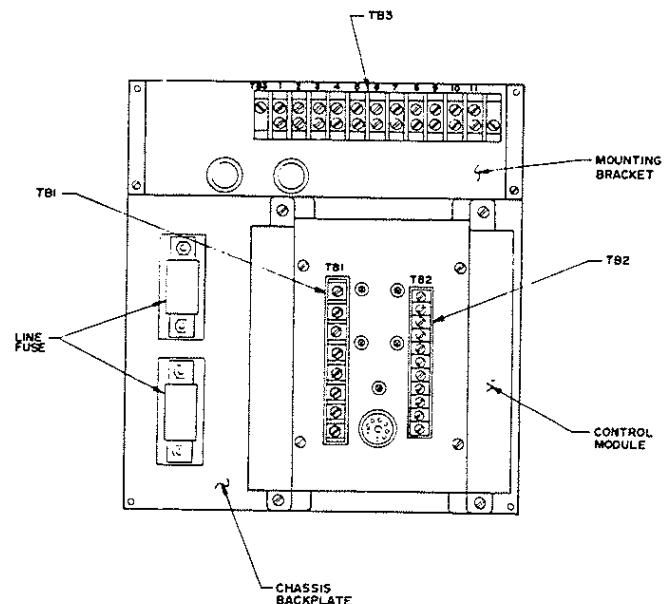
## Chassis Layout 8500 and 8600 Series



Ref. Print C28497

Figure 2.5

## Chassis Layout 8800 Series



Ref. Print C29734-A

Figure 2.6

## 2.5 CONNECTION INSTRUCTIONS

### 2.5.1 ARMATURE CONNECTION

Before installing the motor control verify the horsepower rating of the motor to be used with the control. Armature leads A1 and A2 are connected to terminal strip TB1 or TB3, depending on the particular model of motor control used. Refer to Figure 2.5 and 2.6 for the location of these terminal strips. The motor control can be used to operate motors over a wide range of horsepowers simply by the proper connection of armature lead A2 to the terminals on terminal strip TB1. The table below lists the horsepower range and corresponding screw terminal on TB1.

**NOTE:** Integral horsepower G.E. Motors may have C1, C2 Windings. These are not used and must be individually taped and insulated.



### MODEL 8500 SERIES

Horsepower Range	Connect Armature Lead (A2) to:
1/8 to 1/4	TB1-4
1/3 to 1/2	TB1-5
3/4 to 1	TB1-6

### MODEL 8600 SERIES

Horsepower Range	Connect Armature Lead (A2) to:
1/2	TB1-4
3/4 to 1	TB1-5
1-1/2 to 2	TB1-6

### MODEL 8800 SERIES

Horsepower Range	Connect Armature Lead (A2) to:
3	TB1-4
5	TB1-5

On models that require user connection of the armature leads to TB3 it will be necessary to move the wire connected to TB1. If a lower horsepower range is to be used, again refer to the above tables for the proper connections.

### 2.5.2 FIELD CONNECTIONS

Several manufacturers supply motors with dual voltage fields. SECO Challenger controls are set up to use the high connection in all cases. The two field winding should be connected in series. Refer to instructions supplied by motor manufacturer for proper connections.

### 2.5.3 ARMATURE FEEDBACK OR TACHOMETER FEEDBACK MODE

Either mode is selectable by moving the TACH/ARM slide switch located on the amplifier board assembly. A white dot on the switch identifies the tachometer position. Moving the slide away from the dot places the control in the armature position. Check this switch when installing the control. The control is designed for tachometers with an output of 12.25VDC at motor base speed. Consult the factory if a different output is to be used. On models 8502, 8602, 8510, 8610 and 8810 tachometer feedback should not be used.

### 2.5.4 WIRING

Miniaturization of the control module is made possible by locating the terminal strips on the top of the module. The control identification cover should not be removed for wiring. Figure 2.7 illustrates a typical wire bundling scheme to insure a neat efficient installation. Do not use over-sized terminal lugs on terminal strip TB2 as this will damage the insulating barrier between the terminals.

Shielded cable is recommended for external speed pot & tachometer wiring. These should be run in their own separate conduit and the shield should be connected to control common at the control and isolated from ground at the component end.

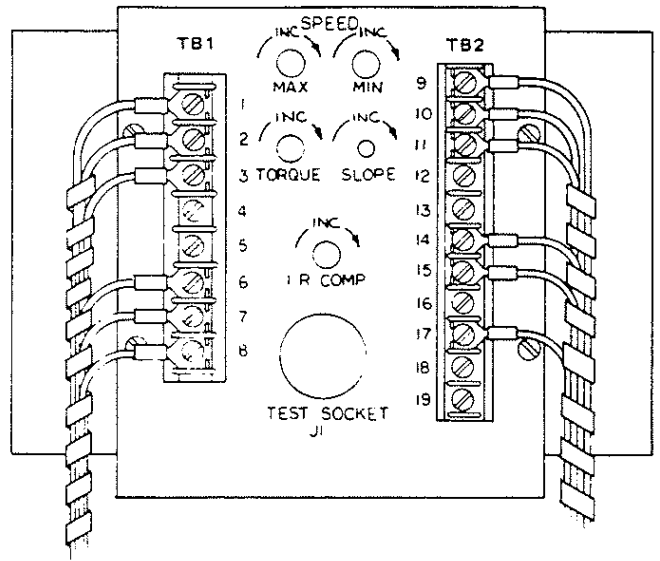


Figure 2.7

### 2.5.5 USER ENGINEERED SYSTEMS

For applications using Manual Reversing Remote Start-Stop, Run-Brake, and Contactor Reversing, screw terminals 12 and 13 to TB2 (see Figure 2.5) must be shorted through a normally closed contact. This causes the control to shut off during switching and reversing. It does not provide a braking function.

### 3. ADJUSTMENT PROCEDURE

#### 3.1 DESCRIPTION OF CONTROLS

##### 3.1.1 FRONT PANEL CONTROLS

- A. **POWER:** When this switch is placed in the position "ON", AC power is supplied to the motor control.
- B. **PILOT LIGHT:** The Light indicates AC power is supplied to the motor control and is off when the Power Switch is in the "OFF" position.
- C. **SPEED ADJUST:** This control is a potentiometer that varies the motor speed. At a setting of zero, within normal minimum speed setting, no armature voltage is generated. Increasing the potentiometer results in an increase of armature voltage which increases the speed of the motor.
- D. **MRDB Switch:** When this switch is placed in the Forward position the motor will run Forward and Reverse when in the Reverse position. In the Center position the motor will be dynamically braked to a stop. This is not available in a NEMA 12 or NEMA 4 because of the open nature of the switch.

##### 3.1.2 INTERNAL CONTROLS (SEE FIGURE 3.1)

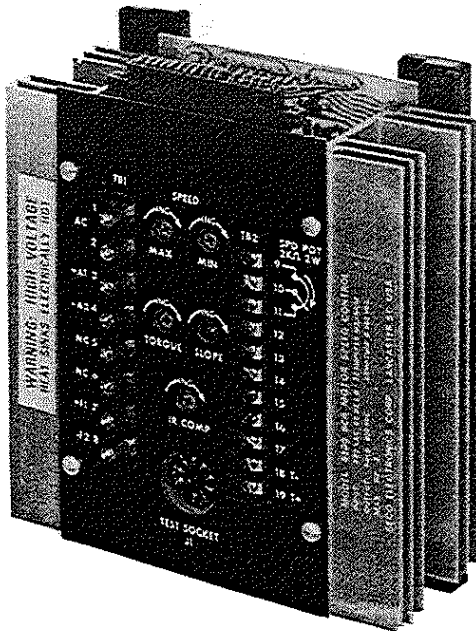


Figure 3.1

- A. **MIN SPEED:** The Minimum Speed adjustment is a means to adjust the lowest output motor shaft speed when the speed adjust potentiometer is set to zero. Clockwise rotation of this adjustment increases the output speed.

- B. **MAX SPEED:** The Maximum Speed adjustment is a means to adjust the highest motor shaft speed when the speed adjust potentiometer is set to 100. Clockwise rotation of this adjustment increases the output speed.
- C. **IR COMP:** The IR Drop Compensation adjustment provides a means to adjust the armature feedback. This feedback is used to compensate for motor losses and to obtain flat load regulation.

Clockwise rotation of this adjustment increases the feedback. If the feedback is too low, the motor speed decreases as the load increases. If the feedback is too high, the motor speed increases as the motor load increases. If feedback is excessive, the system becomes unstable and pulsations may result.

In Tachometer Feedback mode IR Drop Compensation is not required and the IR Drop Comp adjustment is disconnected from the control via the Tach/Arm switch.

- D. **TORQUE ADJUST:** This adjustment sets the maximum Torque (armature current) supplied to the motor. Setting this control to "MIN" will limit the armature current to approximately 25% of its rated value. Factory adjustment limits armature current at approximately 150% of rated value.

To decrease the minimum Torque beyond the lowest settings on the dial, move the armature connections to the next lowest horsepower. Further Torque reduction can be achieved by turning the IR compensation adjust to the minimum (CCW).

For take-up operation adjust torque for correct tension of minimum roll diameter. Adjust slope for correct roll tension at maximum roll diameter.

- E. **SLOPE:** Used in conjunction with Torque adjust to produce an increasing Torque-decreasing speed characteristic above a fixed Torque limit. See Figure 3.2. Increasing this control reduces the Slope. Normal setting is at "MIN"

Adjusting the Torque setting moves the entire curve. Adjusting the Slope setting changes the stall point only.

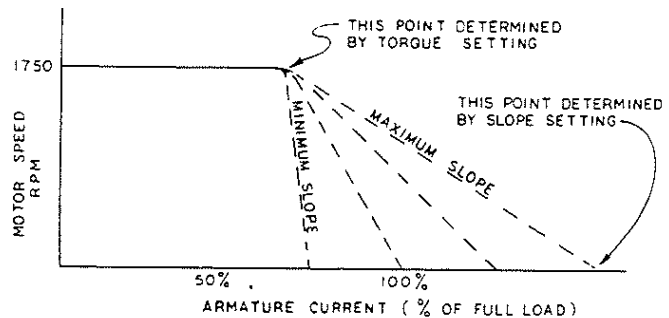


Figure 3.2

F. TEST SOCKET J1: For use with the Check Mate to measure the following functions:

- |                      |                       |
|----------------------|-----------------------|
| 1) AC input voltage. | 4) Armature current.  |
| 2) Armature voltage. | 5) Reference voltage. |
| 3) Field voltage.    |                       |

NOTE: On the model 8800 control the high current range is used to indicate percent of full motor load (240% = 24).

G. TACHOMETER/ARMATURE SWITCH: Located on the amplifier board assembly. Switch must be in Armature position unless Tachometer Feedback is used. Tachometer Feedback position is designated by a white mark on the Tach/Arm Switch. The Tachometer Feedback mode is used when precise ( $\pm 5\%$ ) load regulation is necessary.

## 3.2 ADJUSTMENTS

### 3.2.1 BASIC MODULE

Before Power is applied to the motor control, the following instructions should be observed:

Check all connections that have been made. Be certain that they agree with the connection diagram for the model that is being installed. Check to be sure that all connections are properly secured and tightened.

Check motor for proper alignment and for secure mounting. Also check for proper and tight connections at the motor terminals.

Measure resistance from all motor terminals to ground. Resistance should be greater than .5 megohms. Do not use megger or devices that use a generator.

Motor controls sold with matching SECO supplied motors are factory adjusted.

The initial control settings are as follows:

Control	Setting
Power	Off
Speed Pot	Zero
Torque Pot	(factory adjusted at 150%)
Min Speed	(factory adjusted for zero motor speed)
Max Speed	(factory adjusted for base motor speed)
IR Comp	(factory adjusted at 200 RPM)
Slope	Minimum (Full CCW)
Tach/Arm Switch	Armature Position (in Tach position with tach input)

#### STEP 1

With no load on the motor turn Power Switch "ON" and check Pilot Light to see that it is on.

#### STEP 2

With no load on the motor and the speed dial at "0" decrease the Min Speed adjust until the armature voltage reads zero. Use a metering device such as the SECO "Check Mate". Increase the speed dial to 15 (about 200RPM). The motor should be running smoothly. Measure the no load speed.

#### STEP 3

(May be omitted with tachometer operation). Without changing Speed dial, turn Power off and apply full load to the motor. Reapply Power and measure the resultant full load speed. Readjust the IR Comp potentiometer until the no load speed is reached. Too much IR Compensation results in instability, too little causes the motor speed to decrease as load increases.

#### STEP 4

Turn the Speed dial to 100 and decrease the Max Speed adjust to the base speed of the motor. Usually 1750 RPM. The Max and Min speed adjustments set the high and low speed limitations within which the motor can operate.

#### NOTE: Precautions -

1. Do not attempt to operate the motor with the field disconnected.
2. Do not connect to DC Power Lines.
3. The direction of motor rotation may be reversed by reversing the motor armature leads. If tachometer feedback is used the tachometer leads must also be reversed.

### 3.2.2 EXTERNAL SIGNAL PRINTED CIRCUIT BOARD ASSEMBLY. (MODELS 8509, 8609 AND 8809)

This assembly is designed to accept current signals of:

- 1 - 5 ma
- 4 - 20 ma
- 10 - 50 ma

Refer to sections 7.6, 9.6 or 10.5 for proper jumper arrangement on Terminal Board TB3.

#### STEP 1

With no load on the motor and the input signal at minimum adjust the minimum speed adjustment until the armature voltage reads zero. Use a metering device such as the SECO "Check Mate," or a Simpson 260.

#### STEP 2

With no load on the motor and the input signal at maximum adjust the maximum speed to the motor base speed, usually 1750 RPM.

## 4. DESCRIPTION OF OPERATION

The speed of a DC motor can be varied by varying the armature voltage while maintaining a fixed voltage on the motor field. This principle is used in SECO Challenger Series controls. AC line voltage is converted to variable DC voltage for the motor armature and converted to fixed DC voltage for the motor field. Armature or tachometer feedback circuitry makes speed essentially constant with varying loads. Torque control is achieved by sensing the armature current. Figure 4.1 is a functional block diagram of the motor control. The following paragraphs describe the function of each circuit block and how it accomplishes its function.

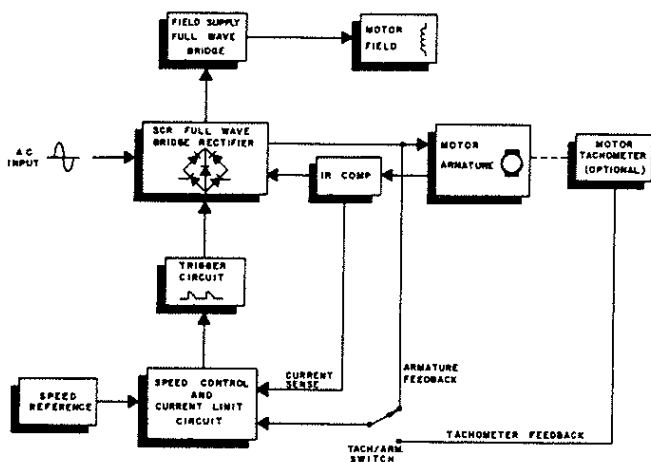


Figure 4.1

### 4.1 RECTIFIER CIRCUIT

Figure 4.2 shows the combined field rectifier and armature rectifier circuits. These circuits convert AC line voltage to DC voltage. The field rectifier is a full-wave bridge circuit made up of diodes D1, D2, D7, and D6. The armature rectifier is also a full-wave bridge circuit consisting of diodes D1, D2 and SCR's D4 and D5.

Variable DC voltage is produced for the armature by triggering the gates of the SCR's with a positive gate voltage. The SCR's will not conduct until a positive signal is applied to the gates.

The amplitude of the DC output voltage is determined by the point at which an SCR is fired with respect to line voltage input. By controlling the phase of the gate pulse with respect to the AC input voltage, the SCR can be fired at any point during 180° of the input voltage. The two SCR's in opposite legs of the bridge circuit allows the output to be controlled throughout the complete cycle (360°) of incoming AC line voltage.

Diode D3, connected across the output of the armature rectifier circuit, is commonly called a "flyback" or "free wheeling rectifier". It supplies a discharge path for the armature voltage in the "off" position of each cycle.

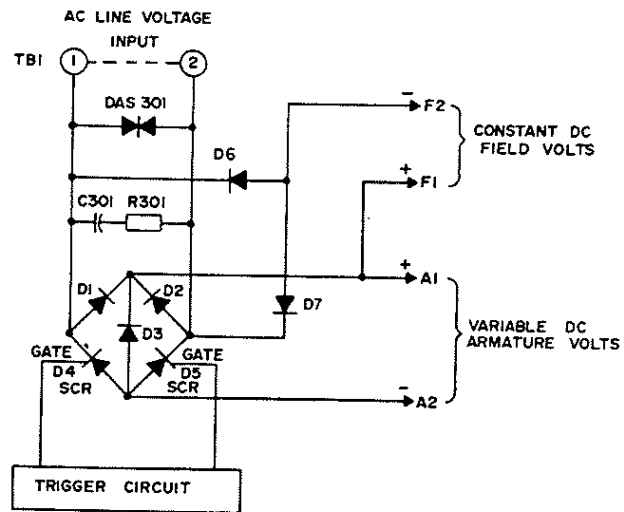


Figure 4.2

### 4.2 TRIGGER CIRCUIT

Fig. 4.3 shows the SCR Gate Pulse Triggering Circuit. SCR Gate Pulses are generated by turning the primary winding of Pulse Transformer T201 on and off to induce a Gate Pulse in the secondary. The primary is switched on and off by Transistor Q201. Q201 is driven on and off by the Programmable Unijunction Transistor (PUT) Q206.

The PUT is controlled by Transistors Q205 and Q204 as follows. Initially Q205 is turned on as the AC voltage goes positive. As Q205 turns on it lowers the base voltage of Q204 to turn Q204 off. Q204 acts as a switch across C204. With Q204 off, C204 is allowed to charge thru R226. As soon as C204 reaches the firing voltage of Anode "A" of Q206, the transistor fires. This firing point is determined by "programming" the Gate "G" of Q206 with the resistor divider network R225 and R224. Firing Q206 turns on Q201 to generate the Gate Pulse. The DC voltage placed on the Anode of Q206 from the driver thru R207 and D205 is added to the capacitor C204 to enable Q206 to fire sooner in relation to the positive AC line voltage. Lowering this DC voltage causes Q206 to fire later.

As soon as the AC voltage goes negative, Q205 turns off turning Q204 on. When Q204 turns on, C204 is shorted and prevented from charging until the next positive cycle of the AC line voltage.

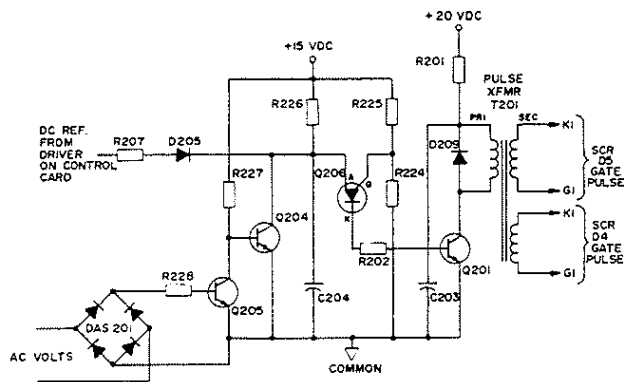


Figure 4.3

### 4.3 CONTROL CIRCUIT

The control circuit controls the motor speed, motor speed regulation, and motor torque. Figure 4.4 illustrates the primary components in the control circuit.

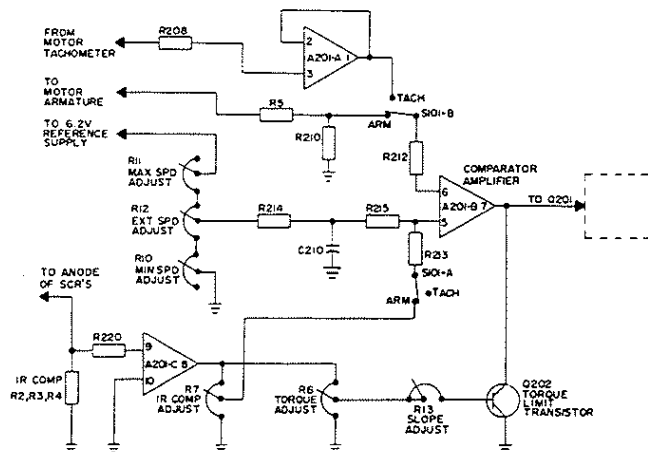


Figure 4.4

Voltage proportional to speed is generated by the motor armature (Back EMF) and appears across the divider network R5 and R210. Voltage at R210 is fed to the negative (pin 6) input of the comparator amplifier A201-B. This is called the armature feedback voltage. Reference voltage at R12 is added to IR compensation voltage from R7. This sum appears at the positive (pin 5) input of A201-B. The voltage difference that appears between pin 5 and pin 6 of A201-B is amplified at the output of A201-B to drive the trigger circuit.

R214 and C210 form a soft start acceleration network by providing a time constant for adjustments of speed potentiometer R12.

Armature current flows through the IR comp resistors R2, R3, and R4 to produce a voltage of a few millivolts. This voltage is amplified to a usable level of several volts by current amplifier A201-C. The output of the amplifier is then proportional to armature current and the amount of IR compensation needed is set by R7.

If tachometer feedback is used, switch S1 disables the IR comp and armature feedback signals and enables the tachometer feedback signal. The signal from the tachometer is buffered by A201-A to provide a high input impedance for the tachometer.

### 4.4 TORQUE AND SLOPE CONTROLS

By limiting the output of A201-B the armature voltage and armature current can be controlled. Armature current determines the motor torque. Increasing the current increases the torque. The torque limit transistor shown in Figure 4.4 is used to accomplish this.

Output from A201-C (which is proportional to armature current) appears at the torque potentiometer R6. R6 divides the voltage to establish a bias for the torque limit transistor Q202. When Q202 turns on (saturates), it limits the output of A201-B to a low voltage resulting in low armature current.

By adjusting the torque potentiometer the motor torque can be limited to high or low levels.

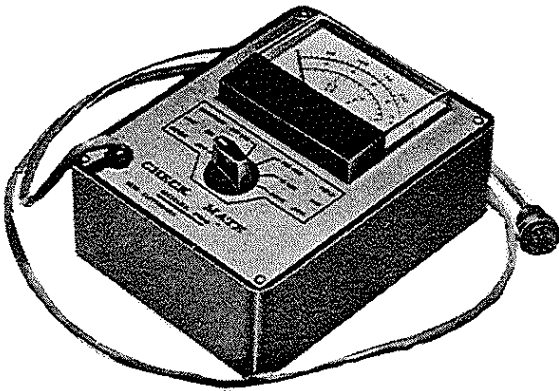
The slope adjust potentiometer R12 raises the bias point to further increase the maximum torque at any set speed. See Figure 3.2 for the effect of slope on the torque-speed characteristic curve.

## 5. TROUBLE SHOOTING PROCEDURE

Fast accurate and complete repair is always preceded by a complete analysis of the problem. Read the complete trouble shooting procedure before attempting to repair the control. Remember – you are looking for a system problem, the control may have failed but this failure is generally a result of something else being wrong in the system to cause the failure. The control is the heart of most systems. Isolate your problem quickly by going through the following steps:

**CAUTION:** Be sure Power is off before removing control module assembly. Heat sinks and identification cover screws are electrically hot (armature potential).

To take advantage of the built-in test socket J1, use the SECO Check Mate. It is designed to rapidly and easily monitor the significant parameters of your motor control.



**Meter requirements:** If the Check Mate is not available a Simpson 260 or equivalent can be used. For armature current use a DC ammeter (do not use clip-on type). For line current use AC ammeter (do not use clip-on type).

### 5.1 OPERATIONAL CHECK LIST

A. Motor will not come up to speed.

- 1) Motor overloaded.
- 2) MAX speed improperly set.
- 3) TORQUE adjust set too low.
- 4) Defective component in amplifier board.
- 5) Defective SCR.

B. Control will not return to zero.

- 1) Low speed improperly set (too high).
- 2) Defective component in amplifier board.

3) Tachometer/Armature switch in TACH position with no TACH input or TACH connected backwards.

4) Defective SCR.

C. Control is unstable (pulsates or increases in speed as load is placed on motor).

- 1) IR COMP is set too high (turn CCW to decrease).
- 2) Load requires negative horsepower on part of its operational cycle.
- 3) Defective motor (motor does not give the proper signal to the control-commutation problem).
- 4) Defective component on amplifier board.

D. Control drifts in speed or changes speed abruptly.

- 1) Defective SCR.
- 2) Defective component on amplifier board.
- 3) Defective motor.

E. Control blows fuses or breakers.

- 1) Shorted SCR.
- 2) Shorted power diode.
- 3) Defective motor.
- 4) Shorted AC thyrector.

F. No speed.

- 1) Defective SCR.
- 2) Defective power diode.
- 3) Defective field diode.
- 4) Defective amplifier board.

### 5.2 CONTROL CHECKOUT

**Voltage tests:** The voltage readings are the normal operating voltages measured at terminal strips TB1 and TB2 on the face of the control.

**NOTE:** Voltage measurements taken with Check Mate.

MODEL 85XX		
Terminal	Function	Measurement
1 & 2	120VAC input	108 to 130VAC
3 & 4	armature 1/8-1/4HP range	75 - 95 volts
3 & 5	armature 1/3-1/2HP range	75 - 95 volts
3 & 6	armature 3/4-1HP range	75 - 95 volts
7 & 8	field	95 - 105VDC
9 & 11	speed reference	4 - 6VDC

### MODEL 86XX

Terminal	Function	Measurement
1 & 2	230VAC	208 to 250VAC
3 & 4	armature 1/2HP range	160 to 200VDC
3 & 5	armature 3/4-1HP range	160 to 200VDC
3 & 6	armature 1-1/2-2HP range	160 to 200VDC
7 & 8	field	180 to 220VDC
9 & 11	speed reference	4 - 6 VDC

### MODEL 88XX

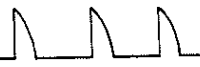
1 & 2	230VAC	208 to 250VAC
3 & 4	armature 3HP range	160 to 200VDC
3 & 5	armature 5HP range	160 to 200VDC
6	not used	
7 & 8	field	180 to 220VDC
9 & 11	speed reference	4 to 6VDC

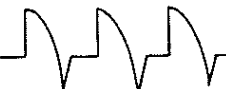
Wave shape checks: (use an oscilloscope that is isolated from ground).

Terminals 7 & 8  full-wave rectified DC

Terminals: Between A1 and A2

speed potentiometer at 0 \_\_\_\_\_ no output

speed potentiometer at 50 

speed potentiometer at 100 

### A. AC input

If the problem results in blowing fuses or circuit breakers, disconnect the motor from the control. With the motor disconnected turn the power on. If the circuit breaker or fuse blows again, the problem is a shorted diode, SCR or AC thyrector in the control module assembly.

### B. Armature Voltage

With the motor disconnected, install a dummy load (consisting of one 100 watt light bulb on the 8500 controls or two 100 watt bulbs in series on 8600 and 8800 controls) between A1 and A2 in place of the motor armature. (If light bulbs are not available, use a 20K 10 watt resistor.) Vary the speed potentiometer from 0 to 100. If the voltage increases from zero to maximum, the problem is not in the speed control but in the motor or connections to the motor.

**NOTE:** Failure to use a dummy load will result in low output voltage from the control and may be erratic.

### C. Field voltage

Absence of voltage at terminals 7 & 8 is the result of a faulty field diode.

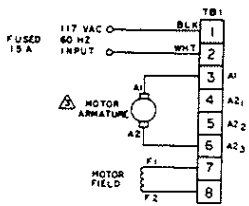
### D. Reference voltage

Loss of voltage at terminals 9 & 11 indicates a faulty component in the reference supply or an open High or Low Speed potentiometer.

# 8500 SERIES CONNECTION DIAGRAMS

(Refer to Section 15 for special connections.)

## 6.1 MODEL 8500 CONTROL MODULE



△ A2 CONNECTIONS

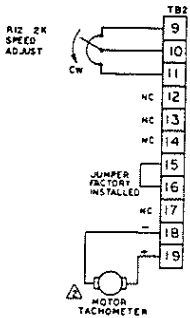
HP RANGE	TB1 CONN
1/8 - 1/4	4
1/2 - 1/2	5
3/4 - 1	6
3/4 TO 1 HP RANGE	

△ TACHOMETER OPTIONAL. FOR TACH FEEDBACK OPERATION TACH/ARM. SWITCH MUST BE IN "TACH" POSITION.

· NC (NO CONNECTION REQUIRED).

Ref. Print B28180-A

## 6.2 MODEL 8501 STANDARD



△ A2 CONNECTIONS

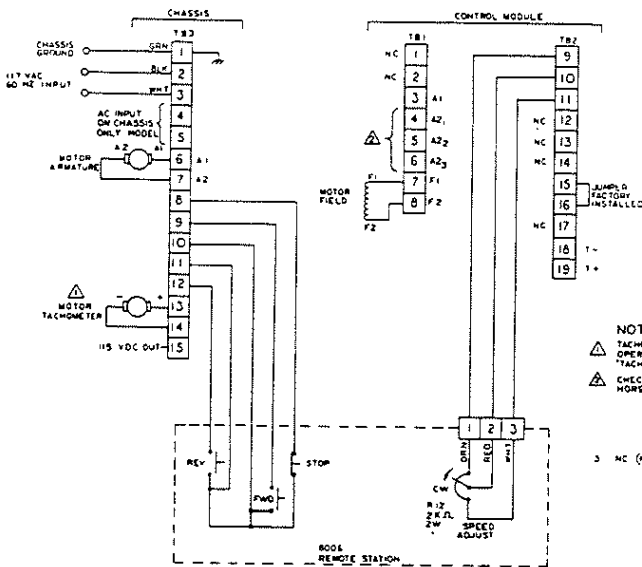
HP RANGE	TB1 CONN
1/8 - 1/4	4
1/2 - 1/2	5
3/4 - 1	6
3/4 TO 1 HP RANGE	

△ TACHOMETER OPTIONAL. FOR TACH FEEDBACK OPERATION TACH/ARM. SWITCH MUST BE IN "TACH" POSITION.

· NC (NO CONNECTION REQUIRED).

Ref. Print B28451-D

## 6.4 MODEL 8503 CONTACTOR REVERSING DYNAMIC BRAKING (CRDB)



### NOTES

- △ TACHOMETER OPTIONAL. FOR TACH FEEDBACK OPERATION TACH/ARM SWITCH MUST BE IN "TACH" POSITION.
- △ CHECK A2 CONNECTIONS FOR CORRECT HORSEPOWER RANGE.

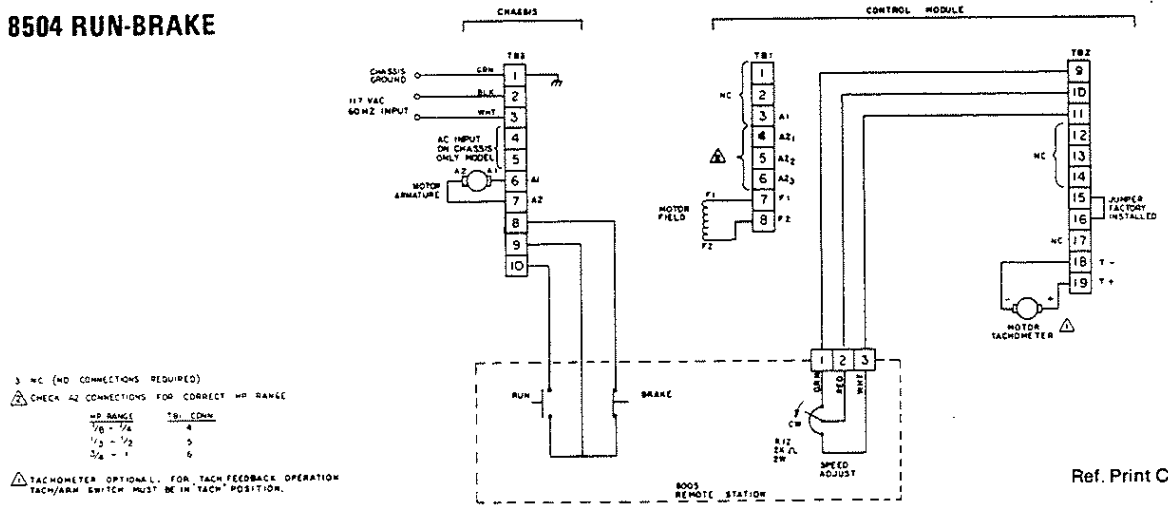
HP RANGE	TB1 CONN
1/8 - 1/4	4
1/2 - 1/2	5
3/4 - 1	6

· NC (NO CONNECTION REQUIRED)

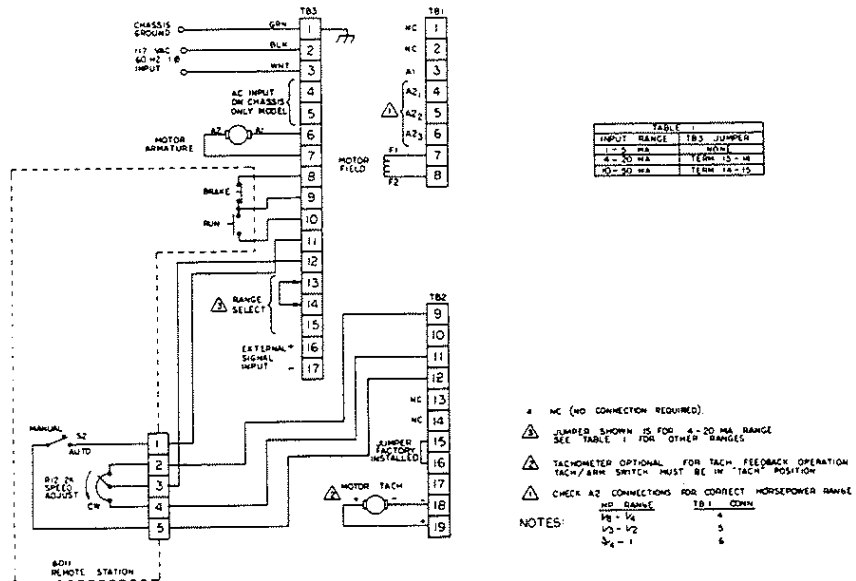
Ref. Print C28453-D



## 6.5 MODEL 8504 RUN-BRAKE



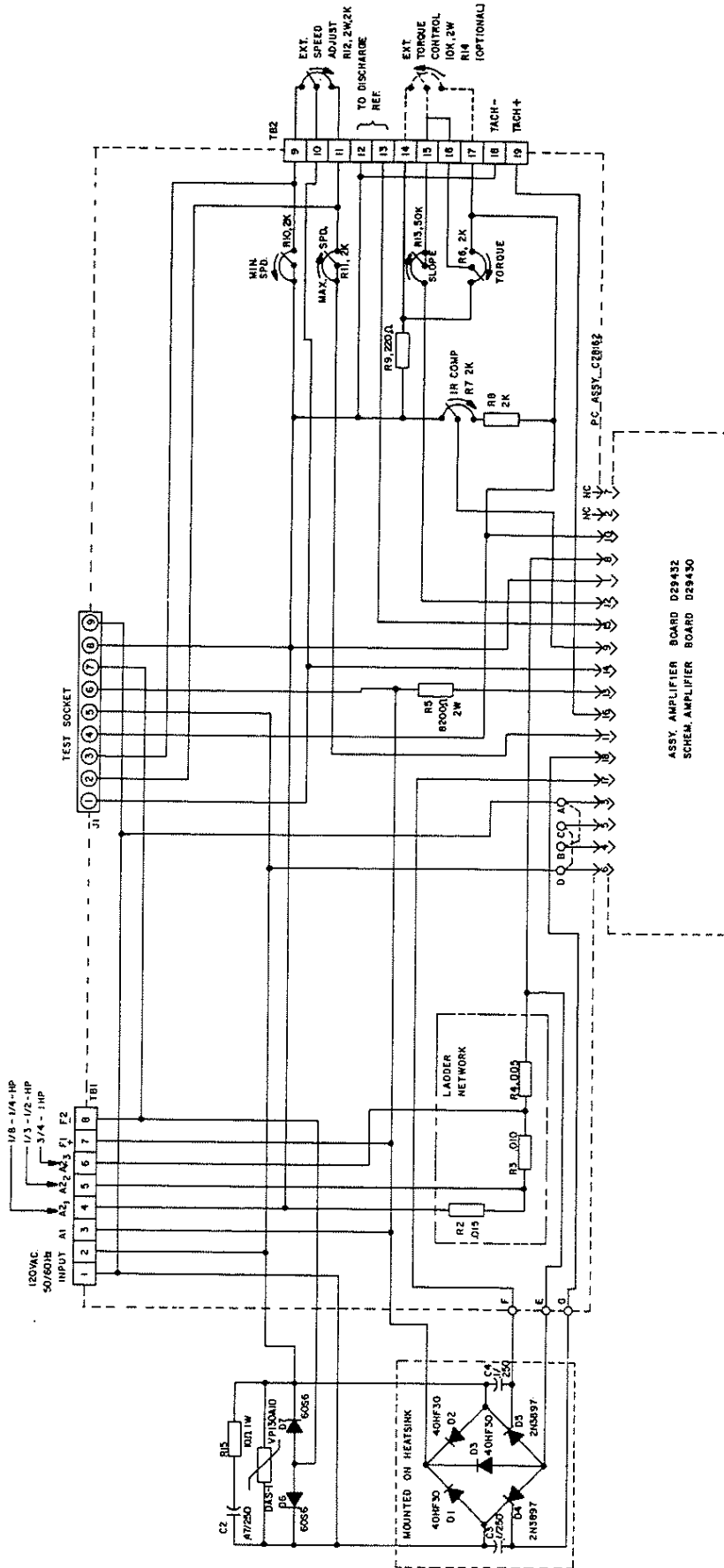
## 6.6 MODEL 8509 EXTERNAL SIGNAL WITH RUN-BRAKE



# 7. 8500 SERIES SCHEMATICS AND REPLACEMENT PARTS LISTS

4. ARROW ON POT. INDICATES CLOCKWISE ROTATION.
3. DISCONNECT JUMPER FOR EXTERNAL TORQUE CONTROL.
2. ALL CAPACITORS VALUES IN MFDS / WVDC.
1. ALL RESISTORS 0.5 WATT, 10%.

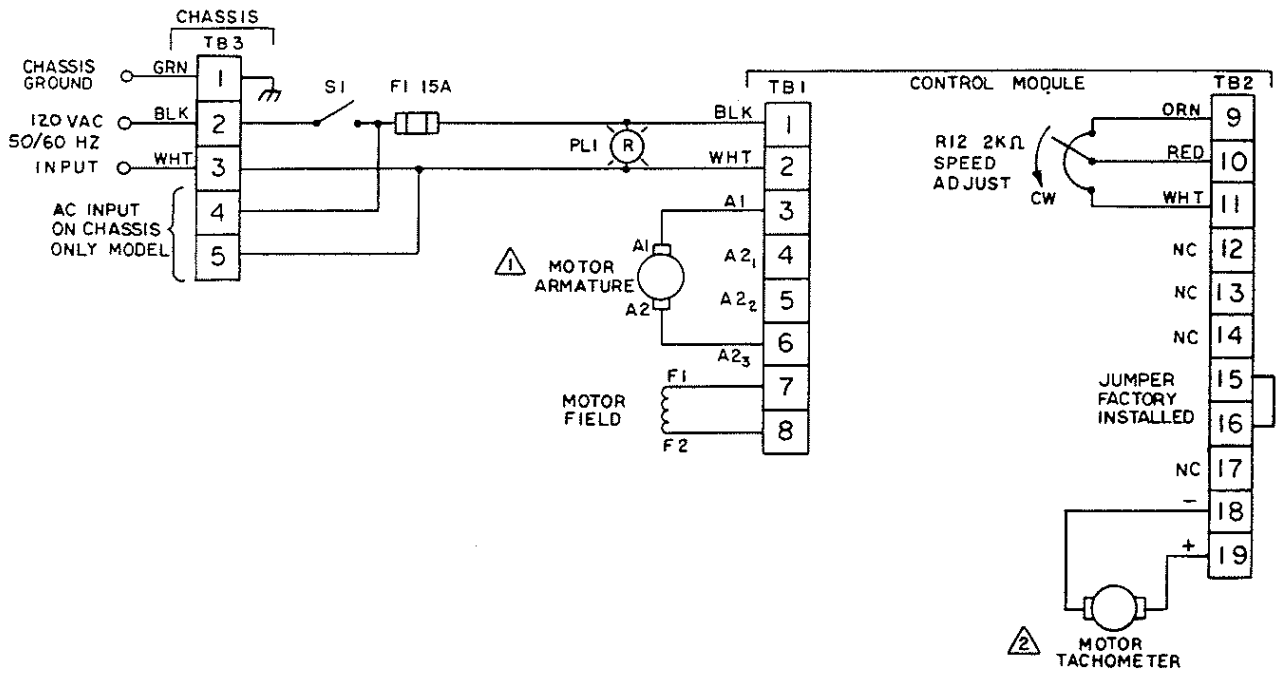
NOTES:



Assy. D29432A, Page 39  
 Schem. D29430, Page 40

Ref. Print D34568.

7.1 Model 8500 Control Module (see Section 12 for replacement parts)



3 NC (NO CONNECTION REQUIRED.)

② TACHOMETER OPTIONAL. FOR TACH FEED BACK OPERATION, TACH/ARM. SWITCH MUST BE IN "TACH" POSITION.

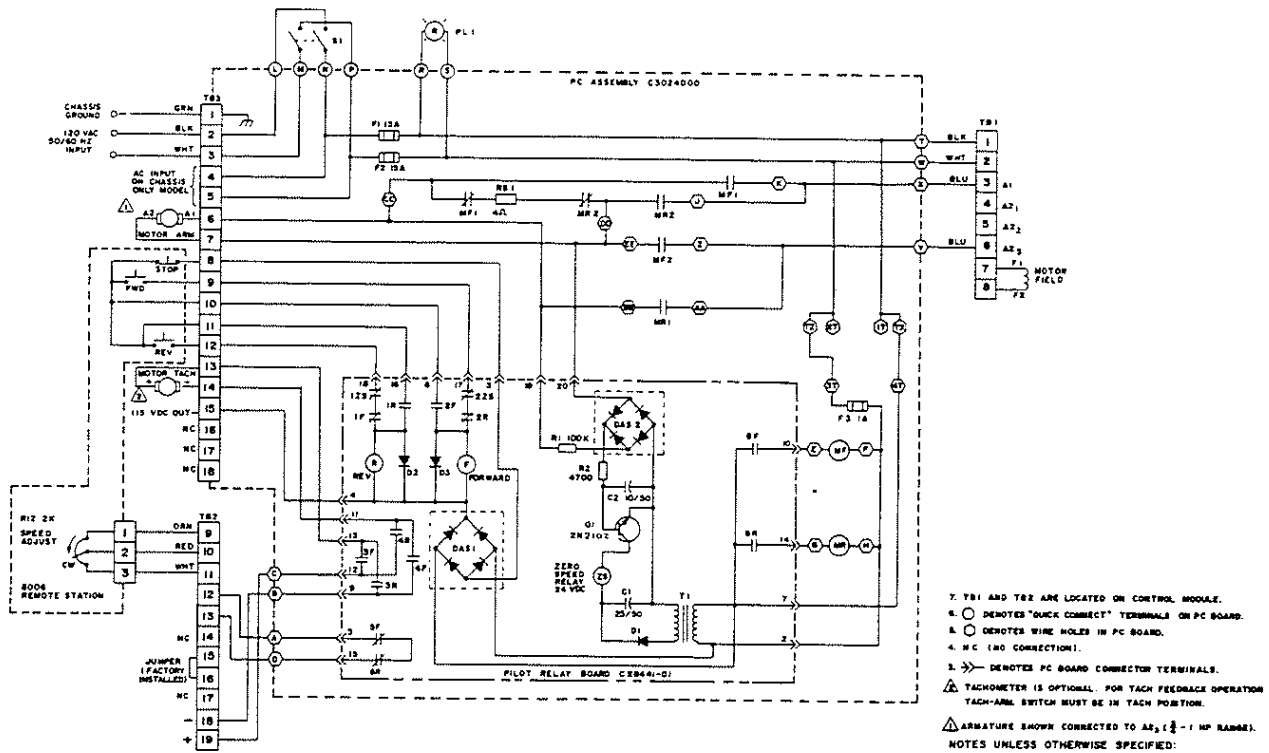
① ARMATURE SHOWN CONNECTED TO A2<sub>3</sub> (3/4 TO 1 HP RANGE),

Ref. Print B28181-D

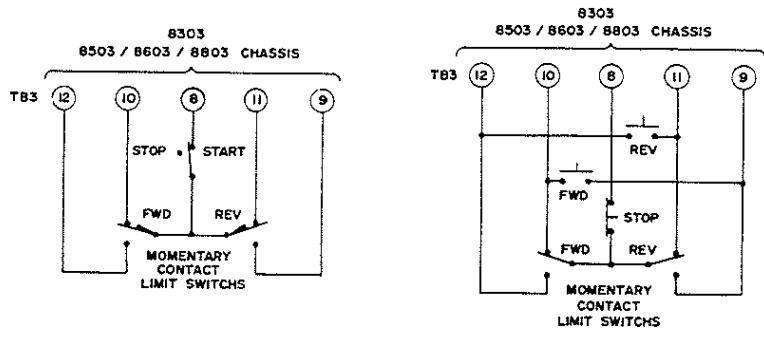
Circuit Symbol	Description	SECO Part #	Vendor Part #
PLI	Pilot Light 120VAC	AL11002-01	Leecraft 31-2111T
FHI	Fuseholder 15 Amp	PFU2012-00	Buss HPF
FI	Fuse 15A FNM	PFU1006-12	Buss FNM-15
R12	Speed Pot 2K, 2W	APT2001-00	CTS AW-18486-SJ-2K
TB3	Terminal Strip 11 pos	HWA2026-06	GE CR15120111
SI	Switch SPST	ASW1003-00	Cutler Hammer #7501-12
*	Water tight nut	HMI1012-00	APM Hexseal
*PLI	Oil tight light assy	AL11003-00	Dialco 123-1363-1231-41
*PL	Pilot lamp neon	AL11004-00	Dialco NE51H
*B	Switch Boot	HMI1026-00	1113/42

\*Used on NEMA 4 Enclosure only.

Model 8503A Contactor Reversing Dynamic Braking (CRDB)



Ref. Print D30572-A

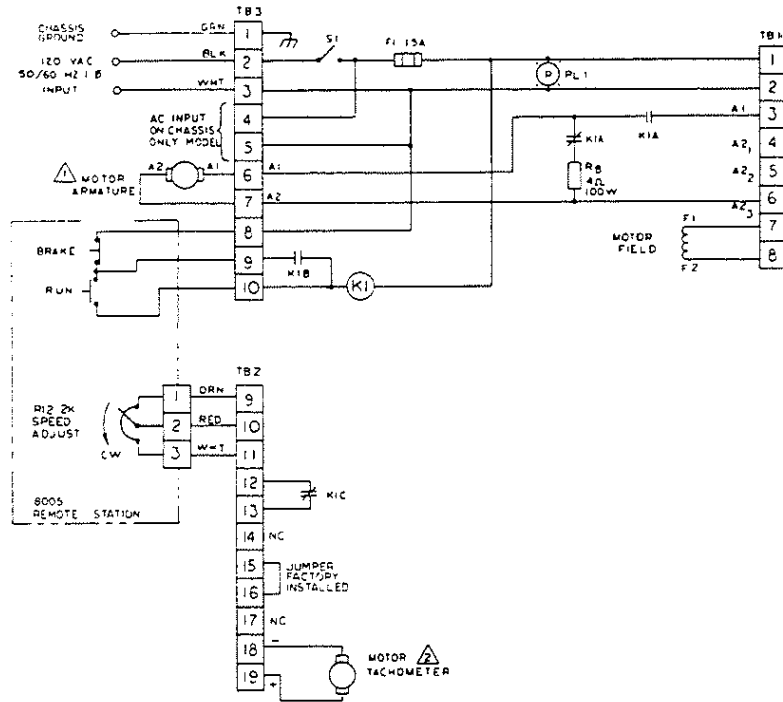


Ref. Print C29900-A

Circuit Symbol	Description	SECO Part #	Vendor Part #
PCB	Rev. Assy. Pilot Rly Card	C3024000	SECO
PCB	Rev. Assy. W/O Pilot Relay Card	C3058000	SECO
PRB	Pilot Relay Card	C2844101	SECO
PLI	Pilot Lgt. 120 VAC Neon	AL11002	Leecraft 31-2111T
FI	Fuse 15A FNM	PFU 1006-12	Bussman FNM-15
RB	Brk. Res. 4 OHM, 100W	PRE2002-05	Milwaukee Resistor Corp
SI	Switch DPDT	ASW1004	Cut. Hammer #7565K5
MF	Forward Contactor 115VAC	ARE3001	Potter & Bromfield PRIIAG
MR	Rev. Contactor 115VAC	ARE3001	Potter & Bromfield PRIIAG
F3	Fuse 1 Amp AGC	PFU1004-03	Bussman 1AAGC
*PLI	Oil tight Lgt. Assy.	AL11003-01	Dialco 123-1363-1231-431
*PL	Pilot lamp Neon	AL11004-00	NE51H
*B	Switch Boot	HMI1026-00	1113/42

\*Used on NEMA 4 enclosure only.

Model 8504 Run-Brake



3 NC (NO CONNECTION REQUIRED)

TACHOMETER OPTIONAL. FOR TACH FEEDBACK OPERATION TACH/ARM SWITCH MUST BE IN "TACH" POSITION.

ARMATURE SHOWN CONNECTED TO A2<sub>3</sub> (3/4 TO 1 HP RANGE).

Ref. Print C28184-C

**Circuit Symbol**

PLI	Pilot Light 120 VAC Neon
FHI	Fuse Holder 15 Amp
FI	Fuse 15A FNM
TB3	Terminal Strip 11 position
RB	Brake Res. 4 ohm 100W
SI	Switch SPST
KI	Contactor 115VAC
*PLI	Oiltight Light Assy.
*PL	Pilot Lamp Neon
*B	Switch Boot

**Description**

**SECO Part #**

ALT1002
PFU2012-00
PFU1006-12
HWA2026-06
PRE2002-05
ASW1003
ARE3001
ALI1003-01
ALI1004-00
HMI1026-00

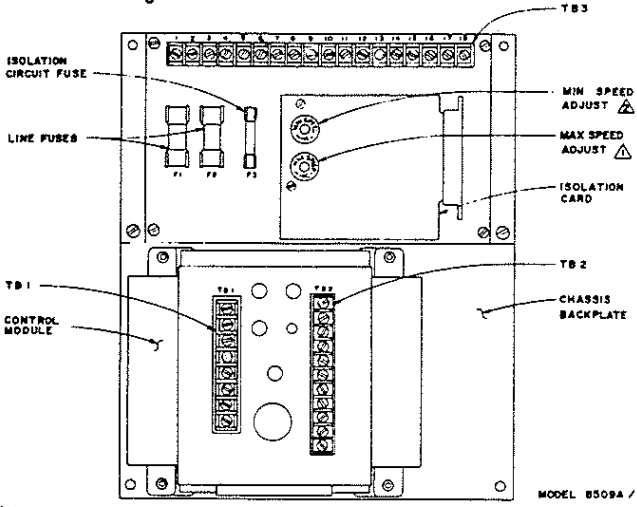
**Vendor Part #**

Leecraft 31-2111T
Bussman FNM-15
Milwaukee Res. Corp.
Cutler Hammer 7501-12
Potter Bromfield PRIIAG
Dialco 123-1363-1231-431
NE51H
1113/42

\*Used on NEMA 4 enclosure only.

Model 8509A External Signal with Run-Brake

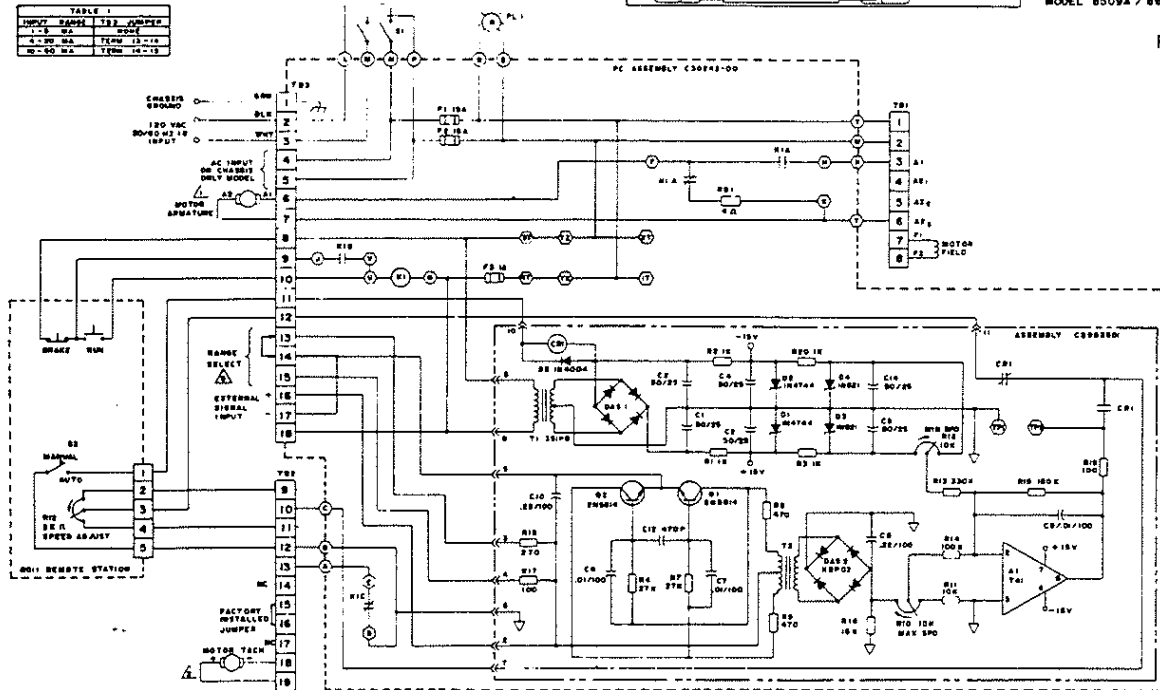
- ⚠ SET MAX SPEED ADJUST FOR MAXIMUM MOTOR SPEED NEEDED. MAX SPEED ADJUST ON ISOLATION CARD REPLACES MAX SPEED ADJUST ON CONTROL MODULE WITH CONTROL IN "AUTO" MODE.
  - ⚠ SET MIN SPEED ADJUST FOR MINIMUM MOTOR SPEED NEEDED. MIN SPEED ADJUST ON ISOLATION CARD REPLACES MIN SPEED ADJUST ON CONTROL MODULE WITH CONTROL IN "AUTO" MODE.
- NOTES:



- ⚠ AMPERES SHOWN IS FOR 4-800MA RANGE. SEE TABLE 1 FOR OTHER RANGES.
  - 1. TB1 AND TB2 ARE LOCATED ON THE CONTROL MODULE.
  - 2. ○ DENOTES "SNICK CONNECT" TERMINALS ON PC BOARD.
  - 3. ○ DENOTES WIRE HOLES IN PC BOARD.
  - 4. ○ DENOTES CONNECTIONS.
  - 5. → DENOTES PC BOARD CONNECTOR TERMINALS.
  - ⚠ TACHMETER IS OPTIONAL. FOR TACH FEEDBACK OPERATION TACH-ARM SWITCH MUST BE IN TACH POSITION.
  - ⚠ ARMATURE SHOWN CONNECTED TO A2, 1 (1-1 HP RANGE).
- NOTES UNLESS OTHERWISE SPECIFIED:

TABLE 1	
INPUT RANGE	TACH JUMPER
1-5 MA	1-2
4-20 MA	1-3
10-50 MA	1-4

Ref. Print D30577-A



Ref. Print D30574

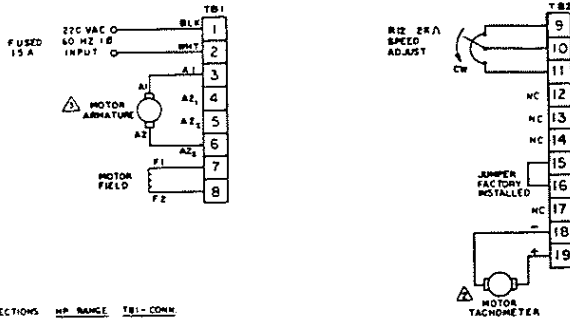
Circuit Symbol	Description	SECO Part #	Vendor Part #
PCB	Run-Brake Assembly with External Signal Card	C3024200	SECO
PCB	Run-Brake Assy. W/O External Signal Card	C3058100	SECO
ESB	External Signal Card	C2963502	SECO
PLI	Pilot Light 120VAC	ALI1002	Leecraft 31-2111T
FI	Fuse 15 Amp FNM	PFU1006-12	Bussman FNM-15
RB	Brake Res. 4 ohm, 100W	PRE2002-05	Milwaukee Res. Corp.
SI	Switch DPDT	ASW1004	Cutler Hammer 7565K5
KI	Contacter 115VAC	ARE3001	Potter & Bromfield PRIIAG
F3	Fuse 1 Amp AGC	PFU1004-03	Bussman 1A AGC
*PLI	Pilot Light Assembly	ALI1003-01	Dialco 123-1363-1231-H13
*PL	Pilot Light Neon	ALT1004-00	NE51H
*B	Switch Boot	HMI1026-00	1113/42

\*Used on NEMA 4 enclosure only.

# 8.0 8600 SERIES CONNECTION DIAGRAMS

(Refer to Section 15 for special connections.)

## 8.1 MODEL 8600 CONTROL MODULE

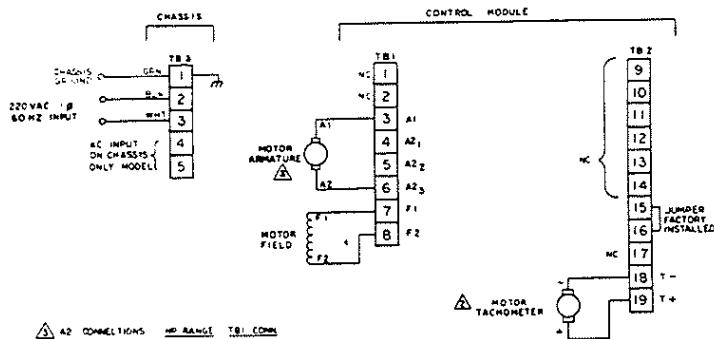


HP RANGE	TB1-CONN
1/2	4
3/4 - 1	5
1 1/2 - 2	6

(ARMATURE SHOWN CONNECTED TO 2 HP RANGE)  
 TACHOMETER OPTIONAL. FOR TACH FEEDBACK OPERATION TACH/ARM SWITCH MUST BE IN "TACH" POSITION.  
 NC (NO CONNECTION REQUIRED)

Ref. Print B28190-B

## 8.2 MODEL 8601 STANDARD

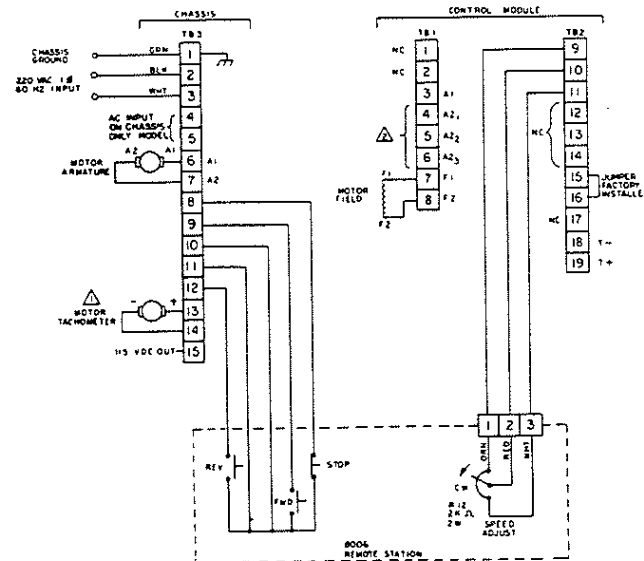


HP RANGE	TB1-CONN
1/2	4
3/4 - 1	5
1 1/2 - 2	6

(ARMATURE SHOWN CONNECTED TO 2 HP RANGE)  
 TACHOMETER OPTIONAL. FOR TACH FEEDBACK OPERATION TACH/ARM SWITCH MUST BE IN "TACH" POSITION.  
 NC (NO CONNECTION REQUIRED)

Ref. Print B28455-D

## 8.4 MODEL 8603 CONTACTOR REVERSING DYNAMIC BRAKING (CRDB)



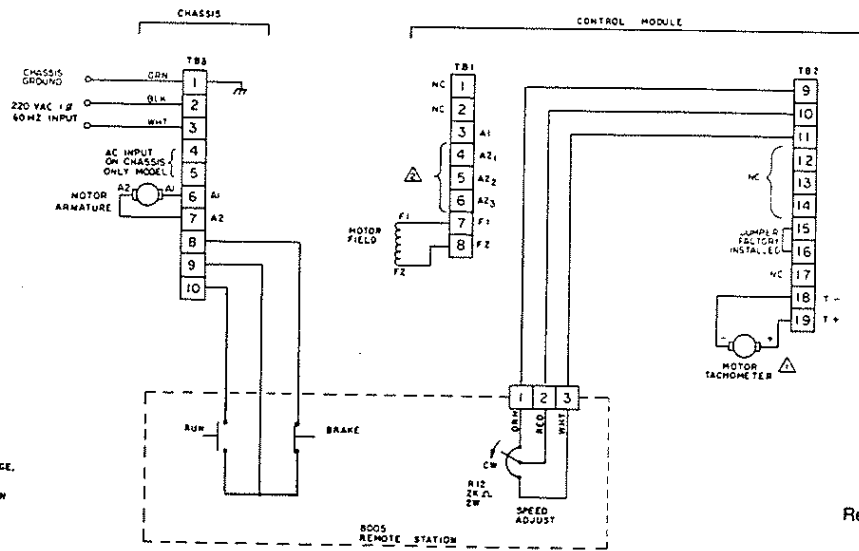
NOTES  
 TACHOMETER OPTIONAL. FOR TACH FEEDBACK OPERATION TACH/ARM SWITCH MUST BE IN "TACH" POSITION.  
 CHECK A2 CONNECTIONS FOR CORRECT MOTOR POWER RANGE.

HP RANGE	TB1-CONN
1/2	4
3/4 - 1	5
1 1/2 - 2	6

NC (NO CONNECTION REQUIRED)

Ref. Print C28457-1

## 8.5 MODEL 8604 RUN-BRAKE



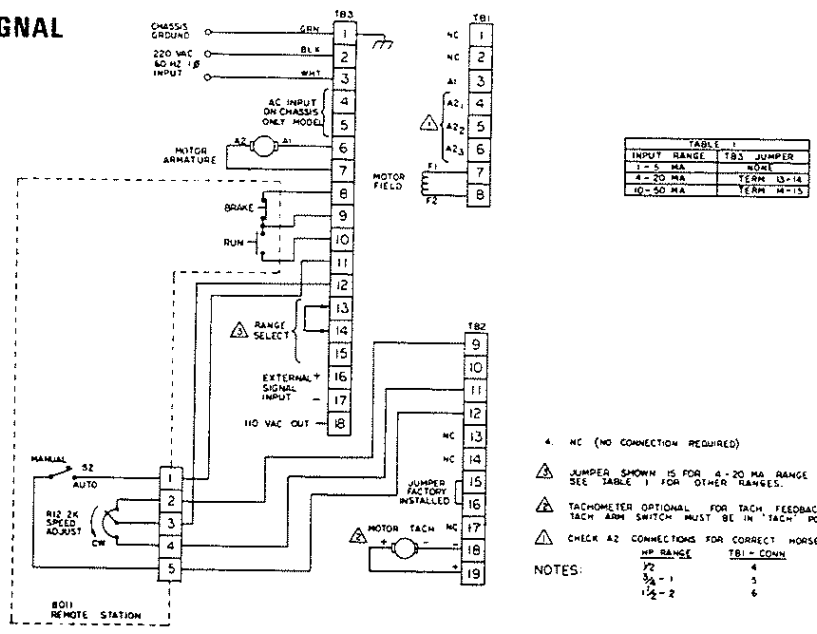
HP RANGE	TB1 CONN
1/2	4
3/4 - 1	5
1 1/2 - 2	6

CHECK A2 CONNECTIONS FOR CORRECT HORSEPOWER RANGE.

TACHOMETER OPTIONAL. FOR TACH FEEDBACK OPERATION TACH/ARM SWITCH MUST BE IN 'TACH' POSITION.

Ref. Print C28458-D

## 8.6 MODEL 8609 EXTERNAL SIGNAL WITH RUN-BRAKE



INPUT RANGE	TB1 JUMPER
1 - 5 MA	NO JUMPER
4 - 20 MA	TERM 13-14
10 - 50 MA	TERM 14-15

- 4. NC (NO CONNECTION REQUIRED)
- △ JUMPER SHOWN IS FOR 4-20 MA RANGE SEE TABLE 1 FOR OTHER RANGES.
- △ TACHOMETER OPTIONAL. FOR TACH FEEDBACK OPERATION TACH/ARM SWITCH MUST BE IN 'TACH' POSITION
- △ CHECK A2 CONNECTIONS FOR CORRECT HORSEPOWER RANGE

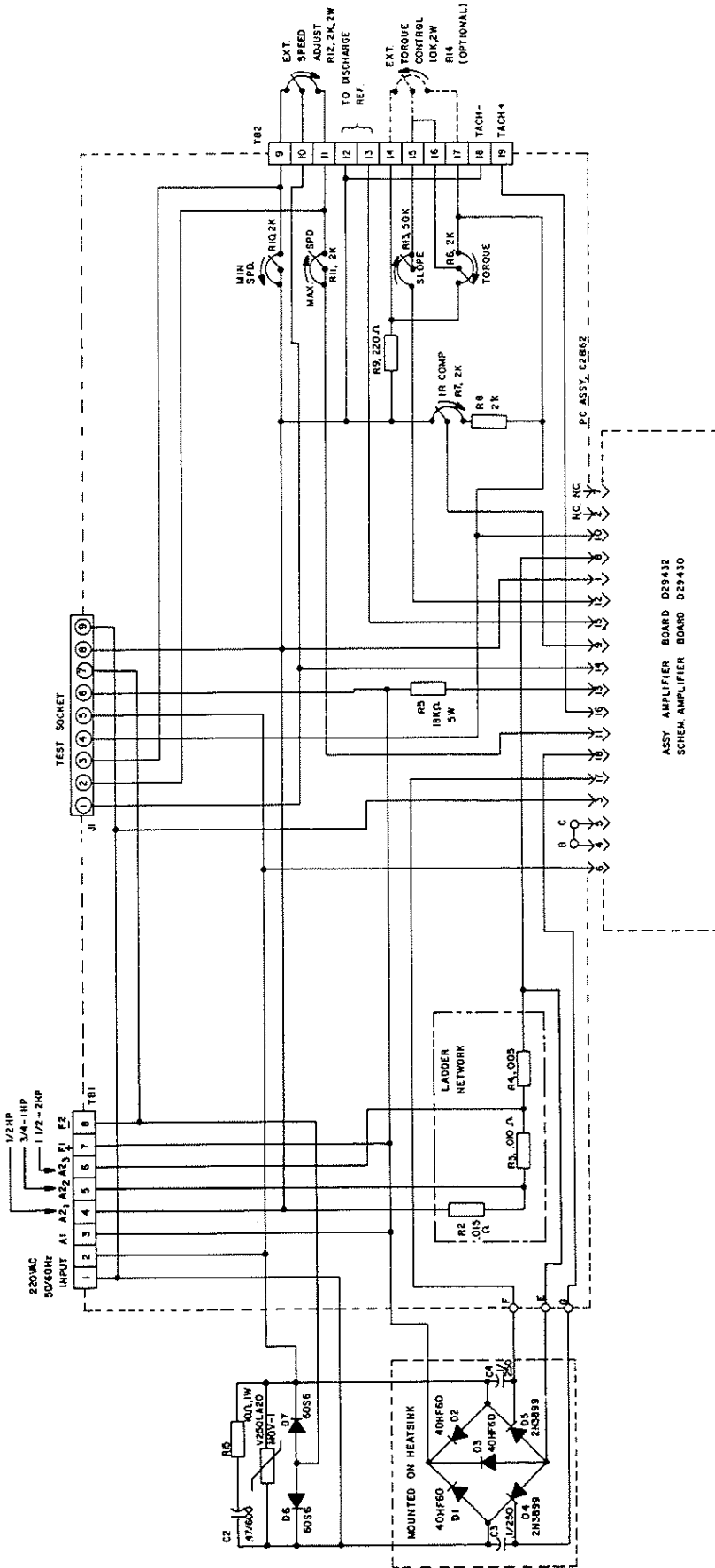
NOTES:

HP RANGE	TB1 - CONN
1/2	4
3/4 - 1	5
1 1/2 - 2	6

Ref. Print C28477-C



# 9. 8600 SERIES SCHEMATICS AND REPLACEMENT PARTS LISTS



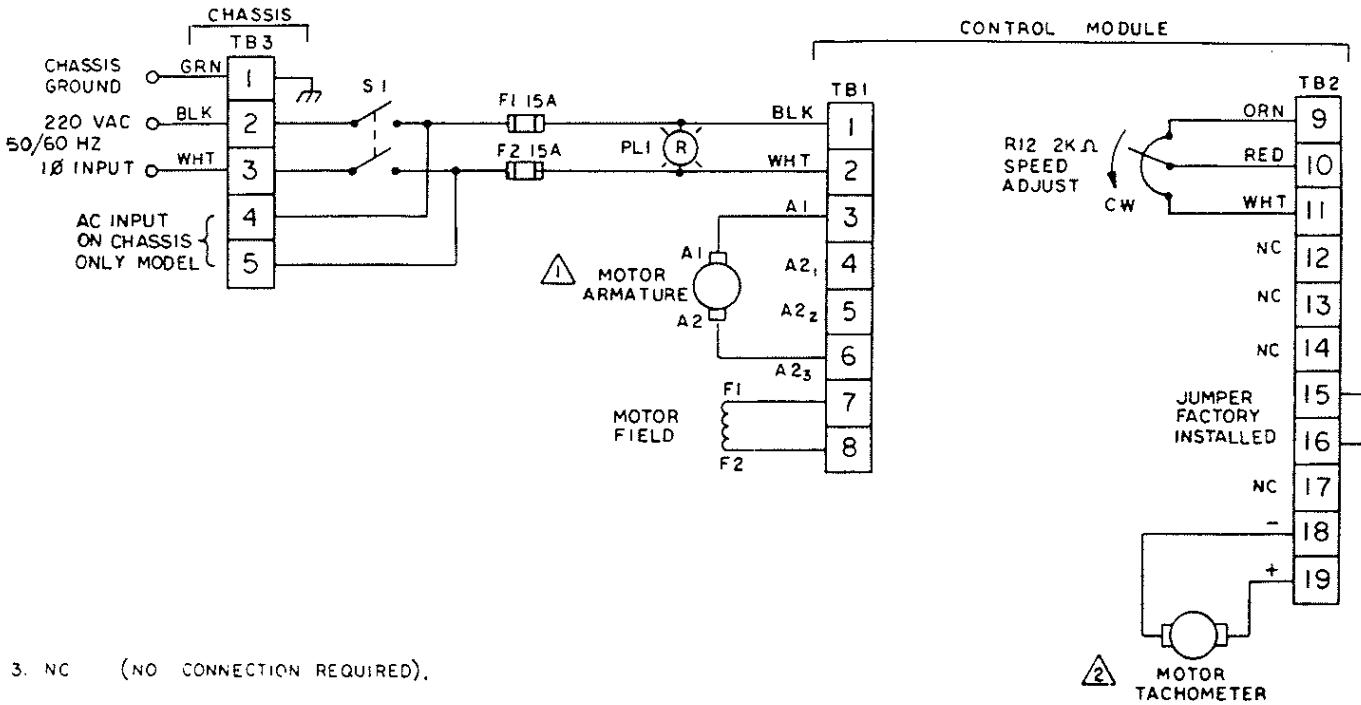
Assy. D29432A, Page 39  
 Schem. D29430, Page 40

- NOTES:
4. ARROW ON POT. INDICATES CLOCKWISE ROTATION
  3. DISCONNECT JUMPER FOR EXTERNAL TORQUE CONTROL
  2. ALL CAPACITOR VALUES IN MFBS/WVDC
  1. ALL RESISTORS 0.5 WATT, 10%

Ref. Print D34571

9.1 Model 8600 Control Module (see Section 12 for replacement parts)

Model 8601 Standard



3. NC (NO CONNECTION REQUIRED).

TACHOMETER OPTIONAL. FOR TACH FEEDBACK OPERATION, TACH/ARM SWITCH MUST BE IN "TACH" POSITION.

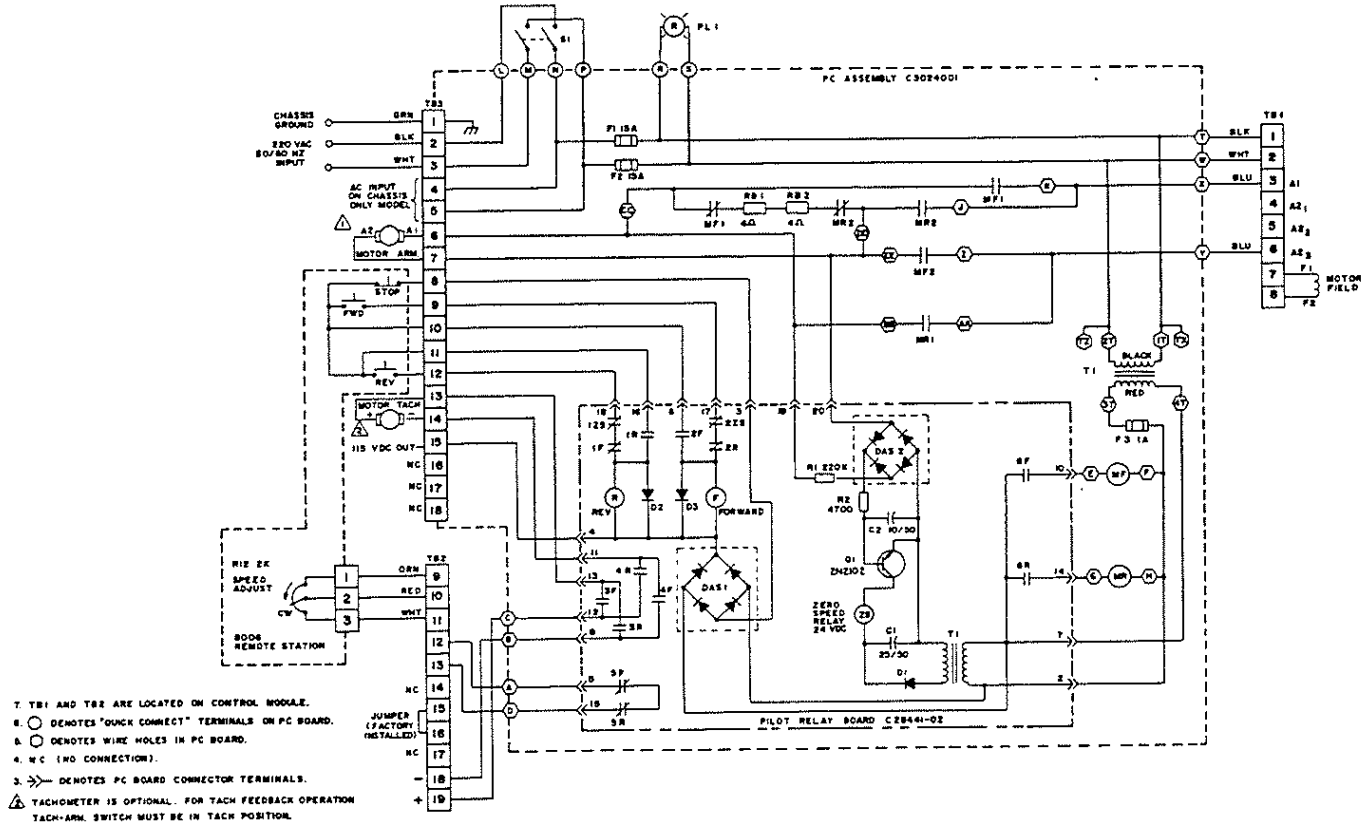
ARMATURE SHOWN CONNECTED TO A2<sub>3</sub> (1½-2HP RANGE).

Ref. Print B28191-E

Circuit Symbol	Description	SECO Part #	Vendor Part #
PL1	Pilot Light 220 VAC	ALI1002-02	Leecraft 31H-2111T
FH1, FH2	Fuse Holder 15 AMP	PFU2012-00	Bussman HPC
F1, F2	Fuse 15 AMP KTK	PFU1013-00	Bussman 15 AMP KTK
R12	Speed Pot 2K, 2W	APT2001-00	CTS-AW-18486-SJ-2K
TB3	Terminal 11 position	HWA2026-06	GE CR151D20111
S1	Switch DPDT	ASW1004-00	Cutler-Hammer 7565K5
*	Water-tight nut	HMI1012-00	APM Hexseal
*PL1	Oiltight Assy.	ALI1003-02	Dialco 123-9363-1231-463
*PL	Pilot Lamp Neon	ALI1004-00	Dialco NE51H
*B	Switch Boot	HMI1026-00	1113/42

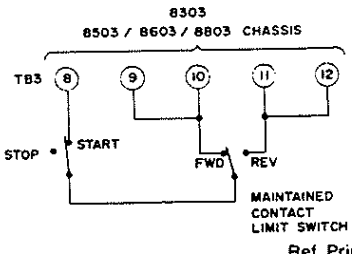
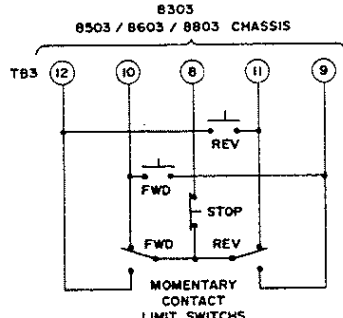
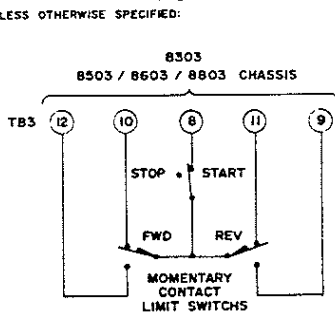
\*Used on NEMA 4 enclosure only.

Model 8603A Contactor Reversing Dynamic Braking (CRDB)



7. TB1 AND TB2 ARE LOCATED ON CONTROL MODULE.  
 8. ○ DENOTES "QUICK CONNECT" TERMINALS ON PC BOARD.  
 9. ○ DENOTES WIRE HOLES IN PC BOARD.  
 4. NC (NO CONNECTION).  
 3. >>> DENOTES PC BOARD CONNECTOR TERMINALS.  
 △ TACHOMETER IS OPTIONAL. FOR TACH FEEDBACK OPERATION TACH-ARM SWITCH MUST BE IN TACH POSITION.  
 △ ARMATURE SHOWN CONNECTED TO A2<sub>2</sub> (1 1/2 - 2 HP RANGE).  
 NOTES UNLESS OTHERWISE SPECIFIED:

Ref. Print D30573-A

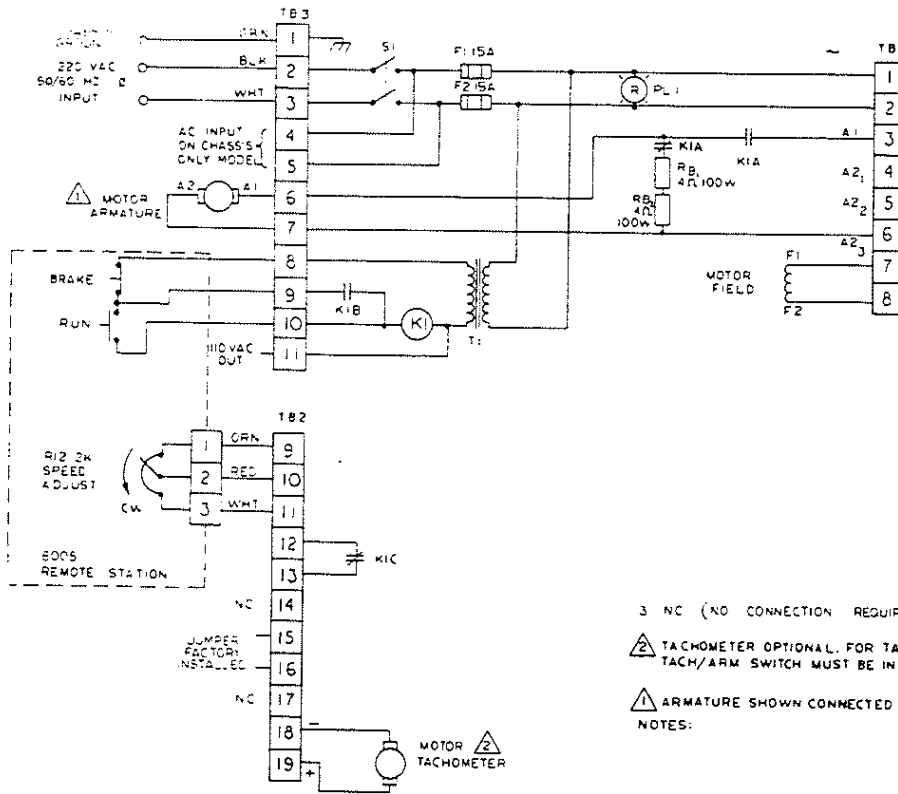


Ref. Print C29900-A

Circuit Symbol	Description	SECO Part #	Vendor Part #
PCB	Rev. Assy. W/Pilot Relay Card	C3024001	SECO
PCB	Rev. Assy. W/O Pilot Relay Card	C3058001	SECO
PRB	Pilot Relay Card	C2844102	SECO
PLI	Pilot Light 220VAC	ALI1002-02	Leecraft 31H-2111T
F1, F2	Fuse 15 AMP KTK	PFU1013-00	Bussman 15 AMP KTK
RB1, RB2	Brake Res. 4 ohm, 100w	PRE2002-05	Milwaukee Res. Corp.
SI	Switch DPDT	ASW1004-00	Cutler-Hammer 7565K5
MF	Forward Contactor 115VAC	ARE3001-01	Potter-Bromfield
MR	Reverse Contactor 115VAC	ARE3001-01	Potter-Bromfield
F3	Fuse 1A AGC	PFU1004-03	Bussman 1A AGC
TI	Isolation transformer	PTR1001	SECO
*PLI	Oiltight Light Assy.	ALI1003-02	Dialco 123-9363-1231-463
*PL	Pilot Lamp Neon	ALI1004-00	Dialco NE51H
*B	Switch Boot	HMI1026-00	1113/42

\*Used on NEMA 4 enclosure only.

Model 8604 Run-Brake



3 NC (NO CONNECTION REQUIRED).

TACHOMETER OPTIONAL. FOR TACH FEEDBACK OPERATION TACH/ARM SWITCH MUST BE IN "TACH" POSITION.

ARMATURE SHOWN CONNECTED TO A2<sub>3</sub> (1 1/2 - 2HP RANGE).

NOTES:

Ref. Print C28194-D

**Circuit Symbol**

- PL1
- FH1, FH2
- F1, F2
- TB<sub>3</sub>
- RB, RB<sub>2</sub>
- S1
- K1
- TI
- \*PL1
- \*PL
- \*B

**Description**

- Pilot Light 220VAC
- Fuse Holder 15 AMP
- Fuse 15 AMP KTK
- Terminal Strip 11 Position
- Brake Resistor 4 ohm 100W
- Switch DPDT
- Contactar 115VAC
- Isolation transformer
- Oiltight Light Assy.
- Pilot Lamp Neon
- Switch Boot

**SECO Part #**

- AL11002-02
- PFU2012-00
- PFU1013-00
- HWA2026-06
- PRE2002-05
- ASW1004-00
- ARE3001-01
- PTR1001
- AL11003-02
- AL11004-00
- HMI1026-00

**Vendor Part #**

- Leecraft 31H-2111T
- Bussman HPC
- Bussman 15 AMP KTK
- GE CR151D20111
- Milwaukee Res. Corp.
- Cutler-Hammer 7565 K5
- Potter-Bromfield
- SECO
- Dialco 123-9363-1231-463
- Dialco NE51H
- 1113/42

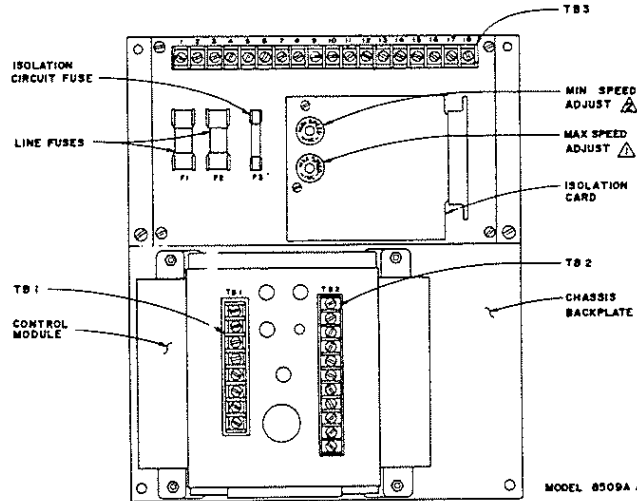
\*Used on NEMA 4 enclosure only.

Model 8609A External Signal with Run-Brake

- ⚠ SET MAX SPEED ADJUST FOR MAXIMUM MOTOR SPEED DESIRED. MAX SPEED ADJUST ON ISOLATION CARD REPLACES MAX SPEED ADJUST ON CONTROL MODULE WITH CONTROL IN "AUTO" MODE.
  - ⚠ SET MIN SPEED ADJUST FOR MINIMUM MOTOR SPEED DESIRED. MIN SPEED ADJUST ON ISOLATION CARD REPLACES MIN SPEED ADJUST ON CONTROL MODULE WITH CONTROL IN "AUTO" MODE.
- NOTES:

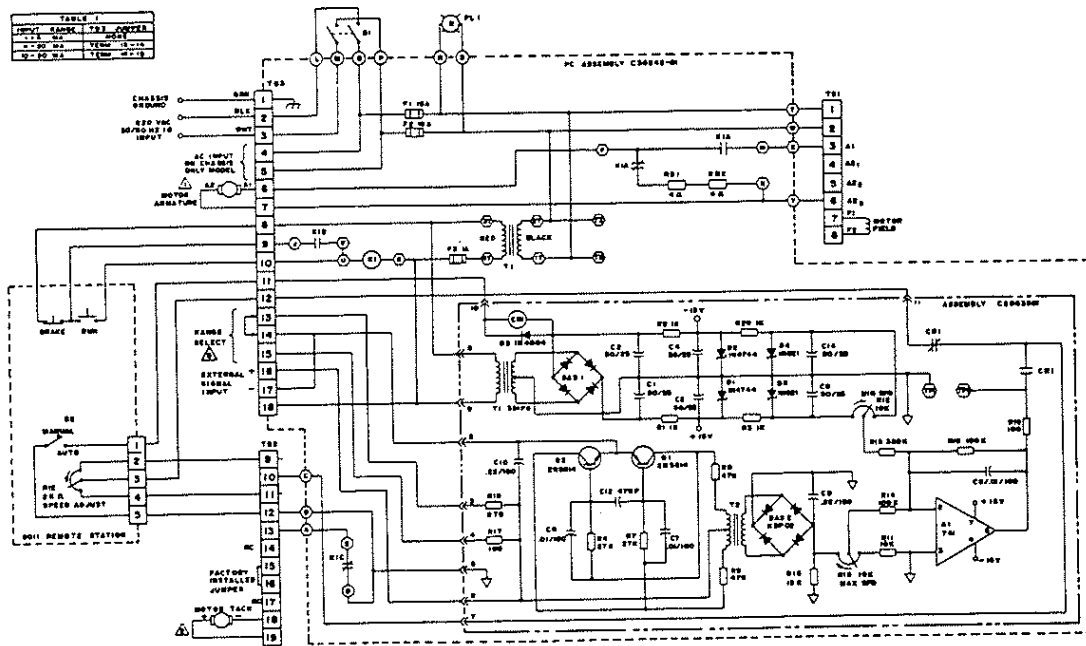
- ⚠ NUMBER SHOWN IS FOR 4-500MA RANGE. SEE TABLE 1 FOR OTHER RANGES.
  - 1, TB1 AND TB2 ARE LOCATED ON THE CONTROL MODULE.
  - ⊙ DENOTES "POCKET CONNECT" TERMINALS ON PC BOARD.
  - ⊙ DENOTES WIRE HOLES IN PC BOARD.
  - ⊙ DC (NO CONNECTION)
  - ⊙ DENOTES PC BOARD CONNECTOR TERMINALS.
  - ⚠ TACHMETER IS OPTIONAL FOR TACH FEEDBACK OPERATION. TACH LINE SWITCH MUST BE IN "TACH" POSITION.
  - ⚠ ARMATURE SHOWN CONNECTED TO ALL (1/2" & 3/4" RANGE).
- NOTES UNLESS OTHERWISE SPECIFIED:

INPUT RANGE	RES	WIRE GAUGE
0-250 MA	100	28
0-500 MA	100	28



MODEL 8509A / 8609A CHASSIS

Ref. Print D30577-A



Ref. Print C30575

**Circuit Symbol**

- PCB
- PCB
- ESB
- PLI
- F1, F2
- RB1, RB2
- S1
- K1
- FH3
- F3
- T1
- \*PL1
- \*PL
- \*B

**Description**

- Run Brake Assy. w/Ext. Sgl. Crd.
- Run Brake Assy. w/o Ext. Sgl. Crd.
- External Signal Card
- Pilot Light 220 VAC
- Fuse 15 AMP KTK
- Brake Res. 4 ohm 100W
- Switch DPDT
- Contactor 115 VAC
- Fuseholder 1 Amp
- Fuse 1 Amp A G C
- Isolation Transformer
- Oil tight light assy.
- Pilot lamp neon
- Switch Boot

**SECO Part #**

- C302301
- C3058101
- C2963502
- ALI 1002-02
- PFU1013-00
- PRE 2002-05
- ASW 1004-00
- ARE 3001-01
- PFU-2008-00
- PFU 1004-03
- PTR 1001
- ALI 1003-02
- ALI 1004-00
- HMI 1026-00

**Vendor Part #**

- SECO
- SECO
- SECO
- Leecraft 31H-2111T
- Bussman 15 AMP KTK
- Milwaukee Res. Corp.
- Cutler-Hammer 7565K5
- Potter-Bromfield
- Bussman H K P
- Bussman 1A AGC
- SECO
- Dialco 123-9363-1231-463
- Dialco NE51H
- 1113/42

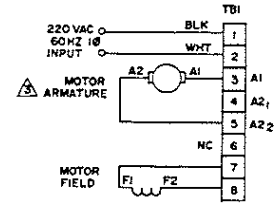
\*Used on NEMA 4 enclosure only.

# 10.0 8800A SERIES CONNECTION DIAGRAM

(Refer to Section 15 for special connections.)

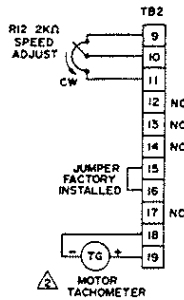
## 10.1 MODEL 8800A CONTROL MODULE

## 10.2 MODEL 8801A STANDARD

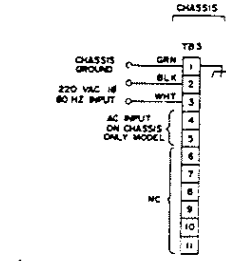


- A2 CONNECTIONS**
- | HP RANGE | TBI CONN. |
|----------|-----------|
| 3        | 4         |
| 5        | 5         |
- TACHOMETER OPTIONAL.** FOR TACH FEEDBACK OPERATION TACH/ARM. SWITCH MUST BE IN "TACH" POSITION.

1. NC (NO CONNECTION REQUIRED)  
NOTES:



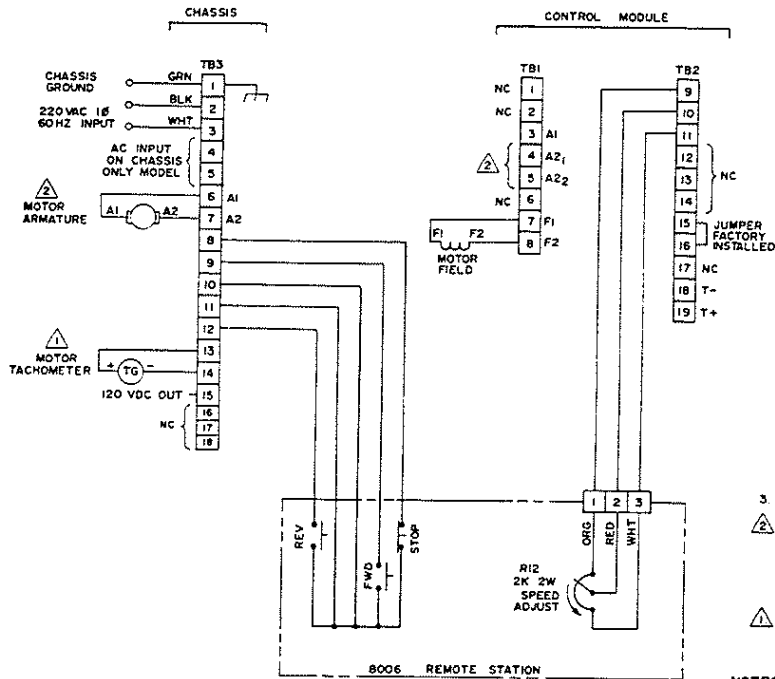
Ref. Print B29433



- A2 CONNECTIONS**
- | HP | TBI CONN. |
|----|-----------|
| 3  | 4         |
| 5  | 5         |
- (ARMATURE SHOWN CONNECTED TO SMP)
- TACHOMETER OPTIONAL.** FOR TACH FEEDBACK OPERATION TACH/ARM. SWITCH MUST BE IN "TACH" POSITION.
1. NC (NO CONNECTION REQUIRED)
- NOTES:

Ref. Print B29435

## 10.3 MODEL 8803A CONTACTOR REVERSING DYNAMIC BRAKING



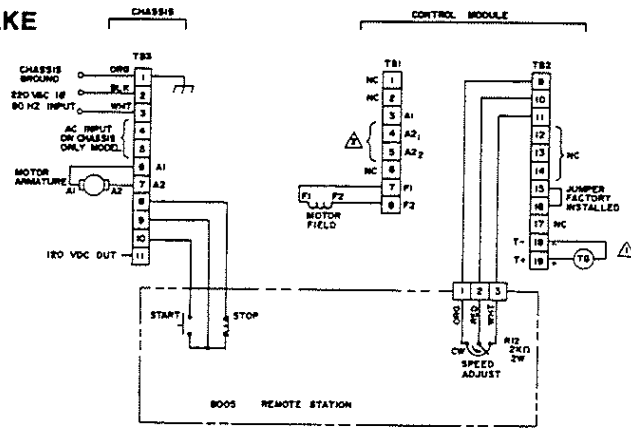
3. NC (NO CONNECTION REQUIRED)
- 2. CHECK A2 CONNECTIONS FOR CORRECT HORSEPOWER RANGE.**
- | HP RANGE | TBI-CONN. |
|----------|-----------|
| 3        | 4         |
| 5        | 5         |
- TACHOMETER OPTIONAL.** FOR TACH FEEDBACK OPERATION TACH/ARM. SWITCH MUST BE IN "TACH" POSITION.

NOTES

Ref. Print C29437

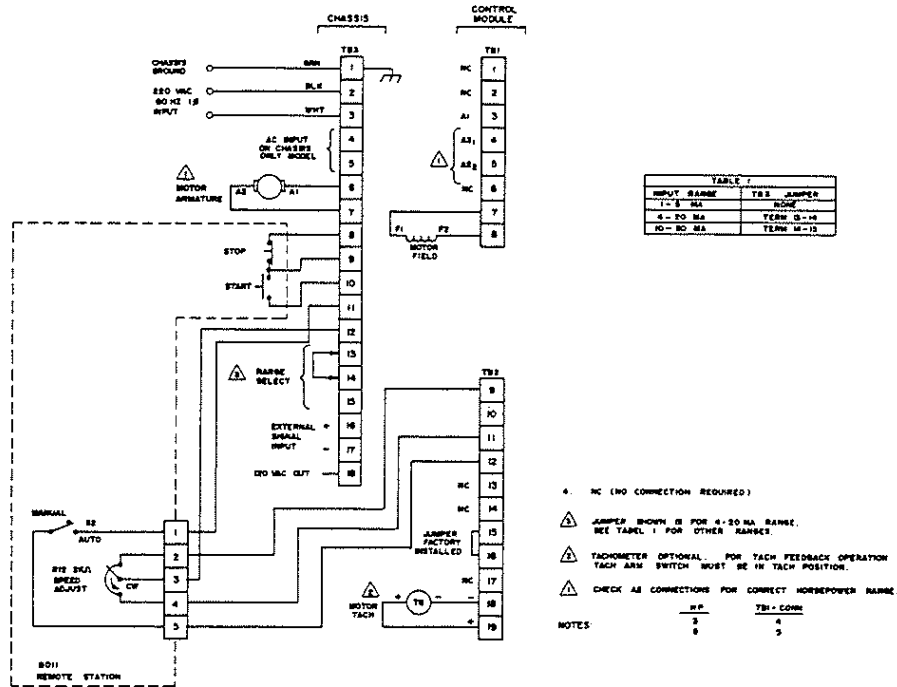
### 10.4 MODEL 8804A RUN-BRAKE

3. NC INDICATES NO CONNECTION.
- ⚠ CHECK AS CONNECTIONS FOR CORRECT HORSEPOWER RANGE.
- | HP RANGE | TB1 CONN |
|----------|----------|
| 3        | 4        |
| 5        | 5        |
- ⚠ TACHOMETER OPTIONAL. FOR TACH FEEDBACK OPERATION TACH/ARM SWITCH MUST BE IN 'TACH' POSITION.
- NOTES:



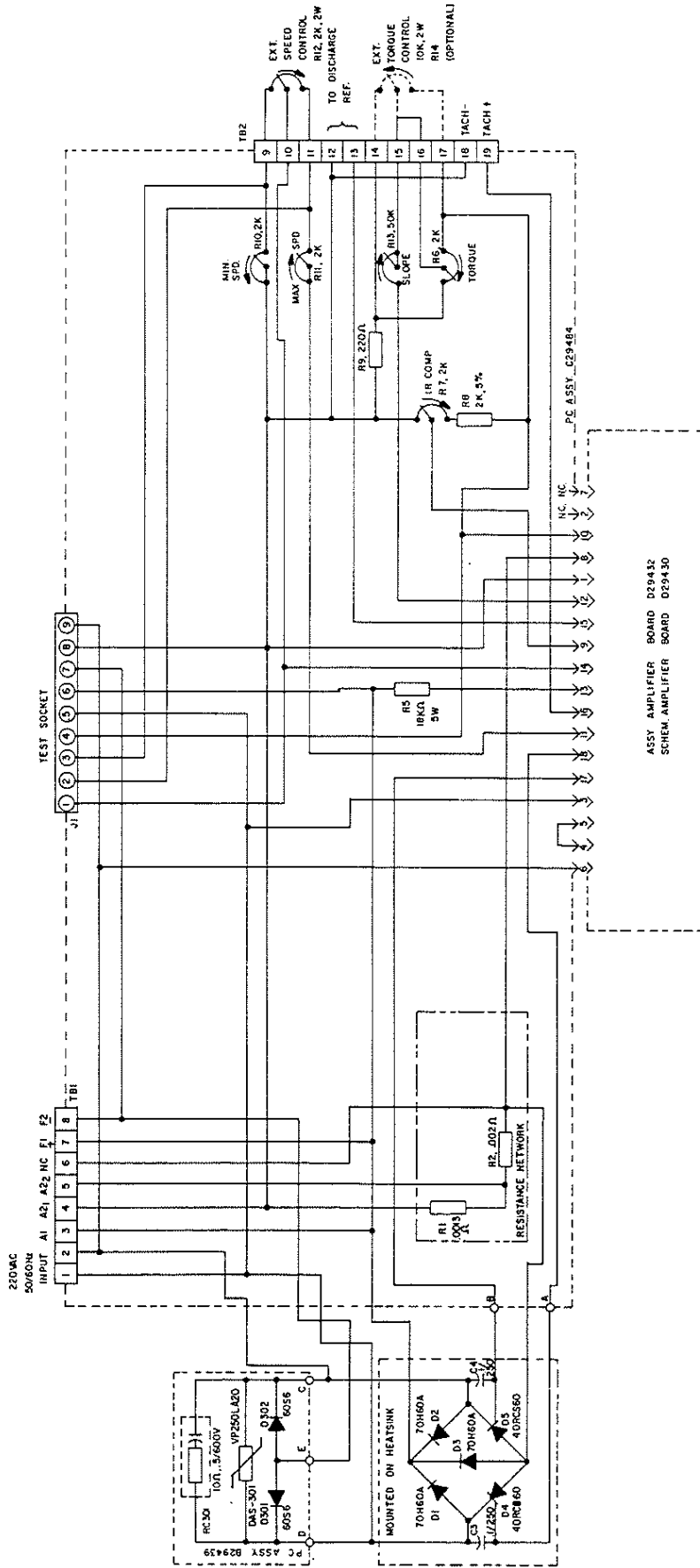
Ref. Print C29534

### 10.5 MODEL 8809A EXTERNAL SIGNAL WITH RUN-BRAKE



Ref. Print C29536

# 11. 8800 SERIES SCHEMATICS AND REPLACEMENT PARTS LIST



Ref. Print D34570

Assy. D29432A, Page 39  
 Schem. D29430, Page 40

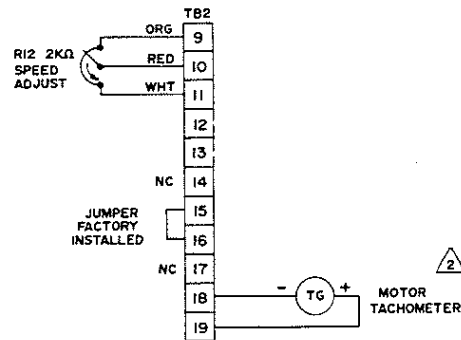
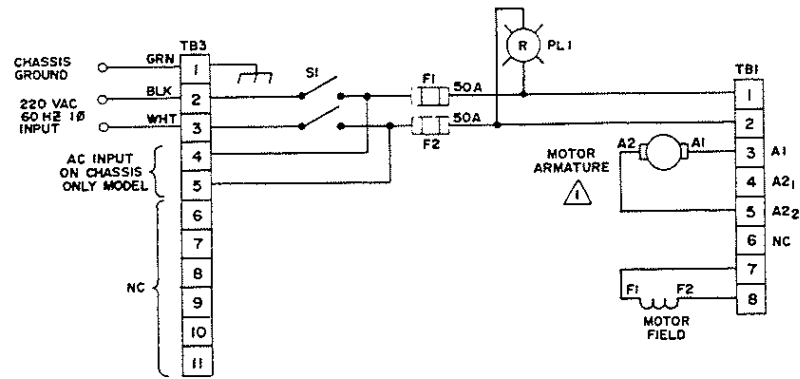
- 3. ASSY 029378
- 2. ALL CAPACITOR VALUES IN MFDS/WDC.
- 1. ALL RESISTORS GS WATT, 10%.

NOTES:

## 11.1 MODEL 8800 CONTROL MODULE (see Section 12 for replacement parts)



Model 8801A Standard



- 3. NC INDICATES NO CONNECTION.
- TACHOMETER OPTIONAL. FOR TACH FEEDBACK OPERATION TACH / ARM SWITCH MUST BE IN "TACK" POSITION.
- ARMATURE SHOWN CONNECTED TO A2, 5 HP RANGE.

NOTES:

Ref. Print C29434-A

**Circuit Symbol**

- PL1
- FH1, FH2
- F1, F2
- R12
- TB3
- SI
- \*
- \*PL1
- \*PL
- \*B

**Description**

- Pilot Light 220VAC
- Fuse Holder 50 Amp
- Fuse 50A
- Speed Pot 2K2W
- Terminal Strip 11pos.
- Switch DPDT
- Water Tight Nut
- Oil tight Light Assy.
- Pilot Lamp Neon
- Switch Boot

**SECO Part #**

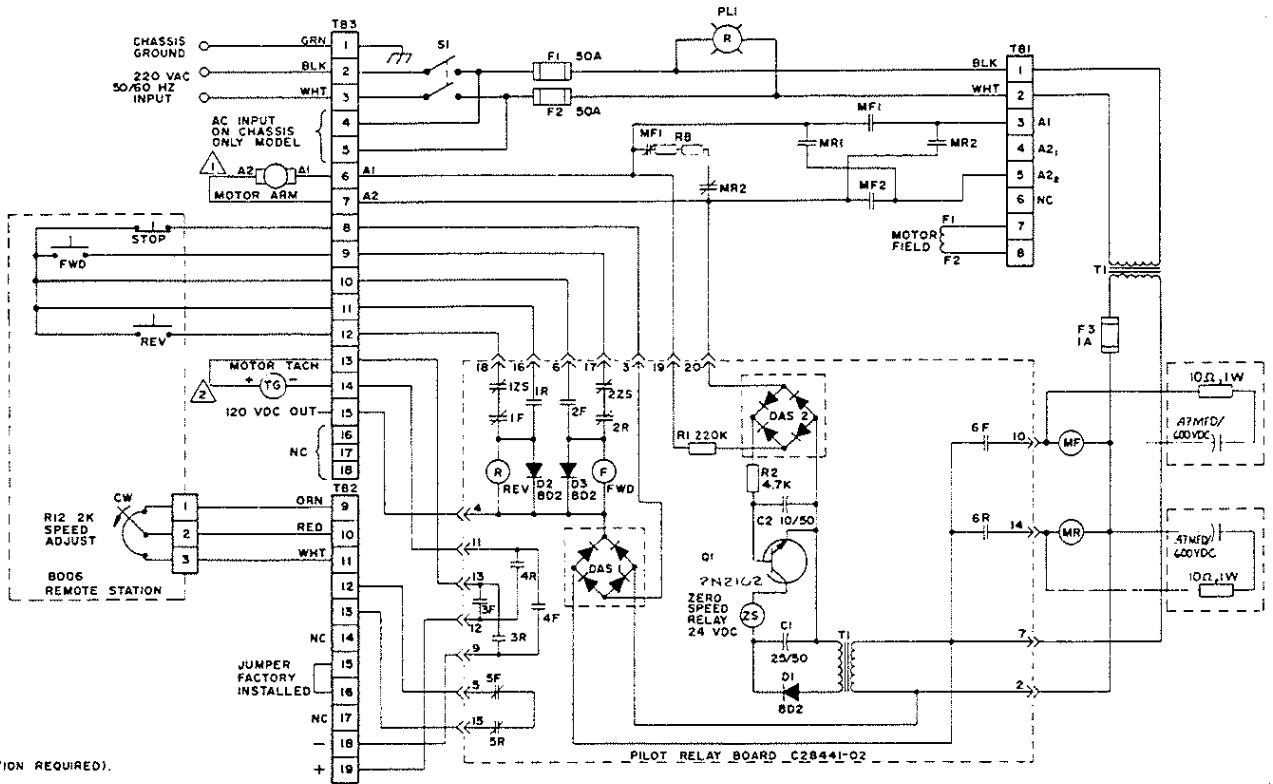
- ALI1002-02
- PFU2006-00
- PFU1002-05
- APT2001-00
- HWA2026-06
- ASW4009-00
- HMI1012-00
- ALI1003-02
- ALI1004-00
- HMI1025-01

**Vendor Part #**

- Leecraft 31H-2111T
- Bussman 3531
- Bussman KAX 50
- CTS-AW-18486-SJ-2K
- GE CR15D20111
- Heinaman SA30A
- Dialco 123-9363-1231-463
- Dialco NE 51H
- APM Hexseal

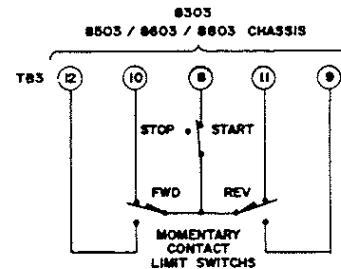
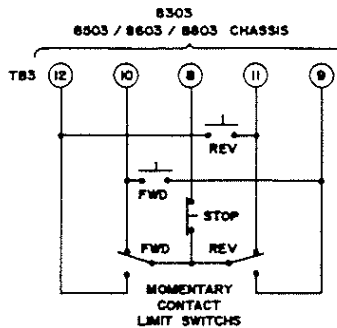
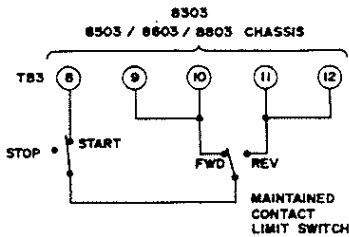
\*Used on NEMA 4 and NEMA 12 enclosure only.

Model 8803A Contactor Reversing Dynamic Braking (CRDB)



- 4. NC (NO CONNECTION REQUIRED).
- 3. → DENOTES CARD EDGE CONNECTOR TERMINALS (PI)
- ⚠ TACHOMETER OPTIONAL FOR TACH FEEDBACK OPERATION. TACH-ARM SWITCH MUST BE IN TACH POSITION.
- ⚠ ARMATURE SHOWN CONNECTED TO A2<sub>2</sub> (5 HP RANGE).

NOTES:



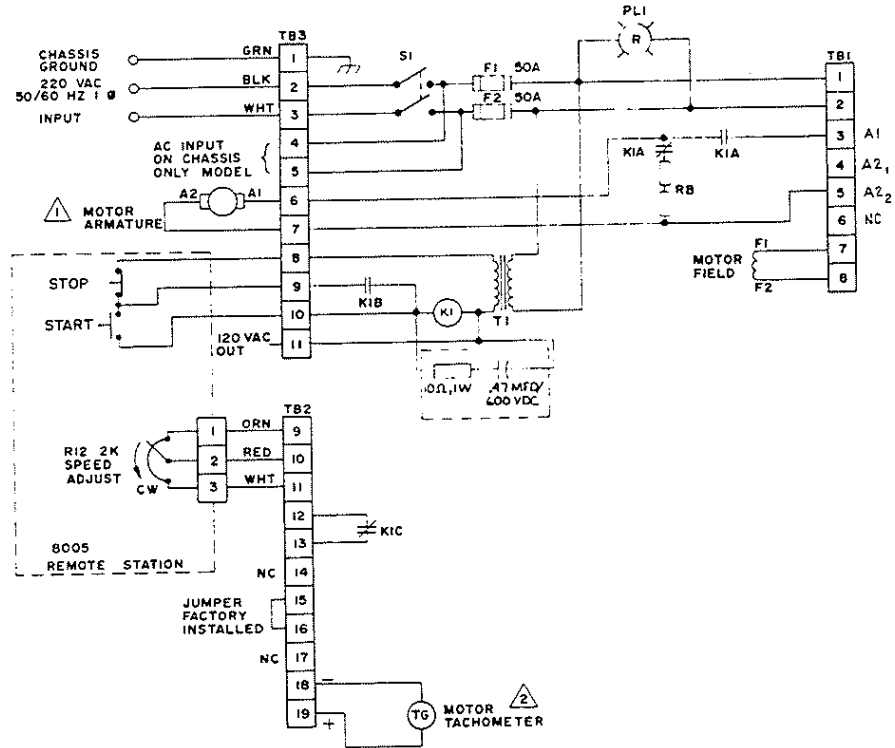
Ref. Print C29436-C

Ref. Print C29900-A

Circuit Symbol	Description	SECO Part #	Vendor Part #
PL1	Pilot Light 220 VAC	ALI 1002-02	Leecraft 31H-2111T
FH1, FH2	Fuseholder 50 Amp.	PFU-2006-00	Bussman 3531
F1, F2	Fuse 50A	PFU-1002-05	Bussman KAX 50
TB3	Terminal Strip 18 pos	HWA2021-04	6E CR 151D30118
RB	Brake Res. 9 ohm 300 W	PRE 2005-00	Milwaukee Res. 25870
T1	Isolation Transformer	PTR 1001	SECO
S1	Switch DPDT	ASW4009-00	Heinemann JA 30A
MF	Forward Relay 115 VAC	ARE 4008	Furnas Elec. 42BD65AF
MR	Reserve Relay 115 VAC	ARE 4008	Furnas Elec. 42BD65AF
P1	22 pin card edge connector	HPA1002-08	Amp. Inc. 582388
PRB	Pilot Relay Board	B2844102	SECO
FH3	Fuse holder 1 Amp	PFU 2008-00	Bussman HKP
F3	Fuse 1A AGC	PFU 1004-03	Bussman 1A AGC
*PL1	Oil tight light assy	ALI 1003-02	Dialco 123-9363-1231-463
*PL	Pilot Camp Neon	ALI 1004-00	Dialco NE51H
*B	Switch Boot	HMI 1025-01	APM Hexseal

\*Used on NEMA 4 and NEMA 12 enclosure only.

Model 8804A Run-Brake



Ref. Print C29533-B

- 3. NC (NO CONNECTION REQUIRED).
- TACHOMETER OPTIONAL. FOR TACH FEEDBACK OPERATION TACH/ARM SWITCH MUST BE IN "TACH" POSITION.
- ARMATURE SHOWN CONNECTED TO A2, 5 HP RANGE.

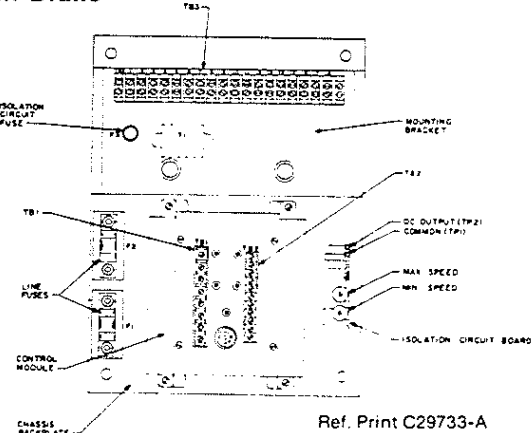
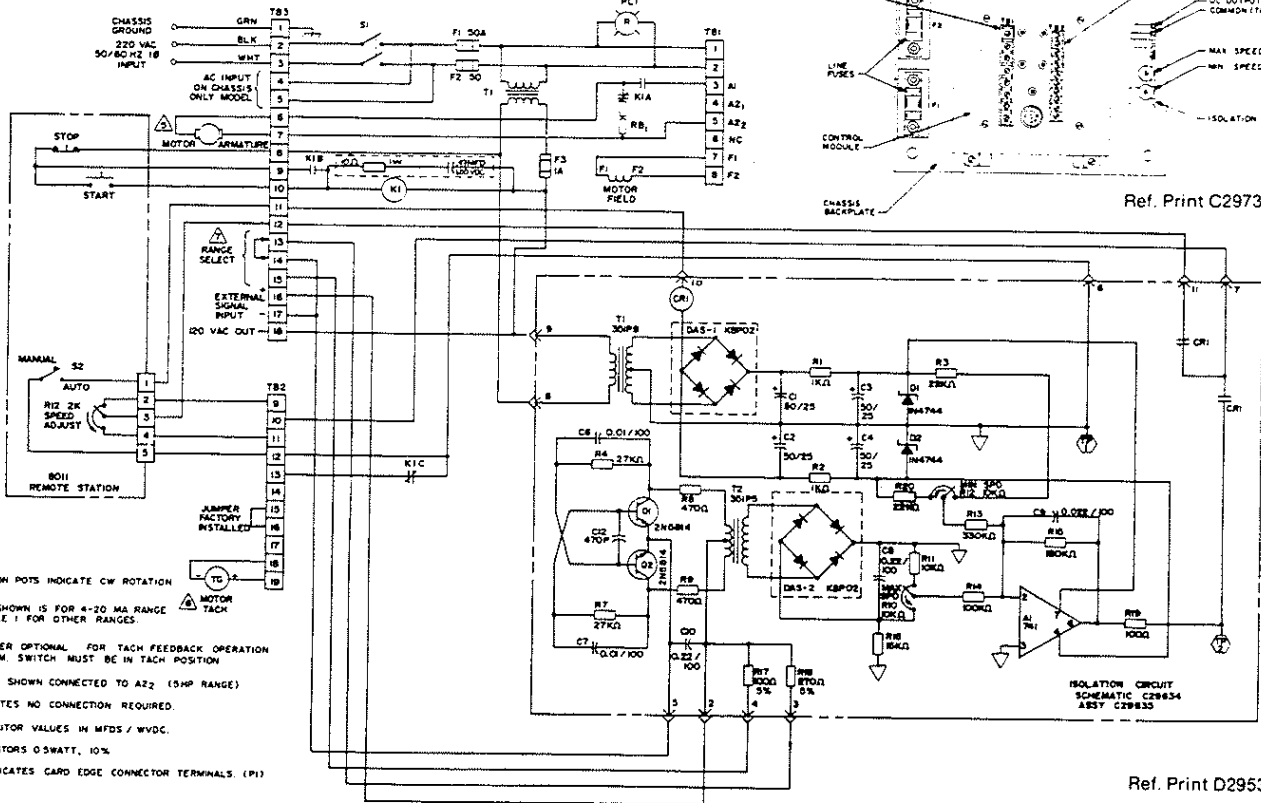
NOTES:

Circuit Symbol	Description	SECO Part #	Vendor Part #
PL1	Pilot Light 220 VAC	ALI 1002-02	Leecraft 31H-2111T
FH1, FH2	Fuse Holder 50 Amp	PFU 2006-00	Bussman 3531
F1, F2	Fuse 50A	PFU 1002-05	Bussman KAX 50
TB3	Terminal Strip II pos	HWA2026-06	GE CR151D20111
RB	Brake Resis. 9 ohm 300 W	PRE 2005-00	Milwaukee Res. 25870
T1	Isolation Transformer	PTR 1001	SECO
S1	Switch DPDT	ASW 4009-00	Heinemann J A 30A
K1	Contactora 115 VAC	ARE 4008-01	42BD65AFGB Furnas
*PL1	Oil tight light assy	ALI 1003-02	Dialco 123-9363-1231-463
*PL	Pilot lamp neon	ALI 1004-00	Dialco NE51H
*B	Switch Boot	HMI 1025-01	APM Hexseal

\*Used on NEMA 4 and NEMA 12 enclosure only.

Model 8809A External Signal with Run-Brake

INPUT RANGE	TB3 JUMPER
1-5 MA	None
4-20 MA	TERM 13-14
10-50 MA	TERM 16-15



Ref. Print C29733-A

Ref. Print D29535-C

- 8 ARROWS ON POTS INDICATE CW ROTATION
- 1 JUMPER SHOWN IS FOR 4-20 MA RANGE SEE TABLE 1 FOR OTHER RANGES
- 2 TACHOMETER OPTIONAL FOR TACH FEEDBACK OPERATION TACH / ARM. SWITCH MUST BE IN TACH POSITION
- 3 ARMATURE SHOWN CONNECTED TO AZ2 (5HP RANGE)
- 4 NC INDICATES NO CONNECTION REQUIRED.
- 5 ALL CAPACITOR VALUES IN MFDS / WVDC.
- 6 ALL RESISTORS 0.5WATT, 10%
- 7 -> INDICATES CARD EDGE CONNECTOR TERMINALS. (P1)

NOTES UNLESS OTHERWISE SPECIFIED

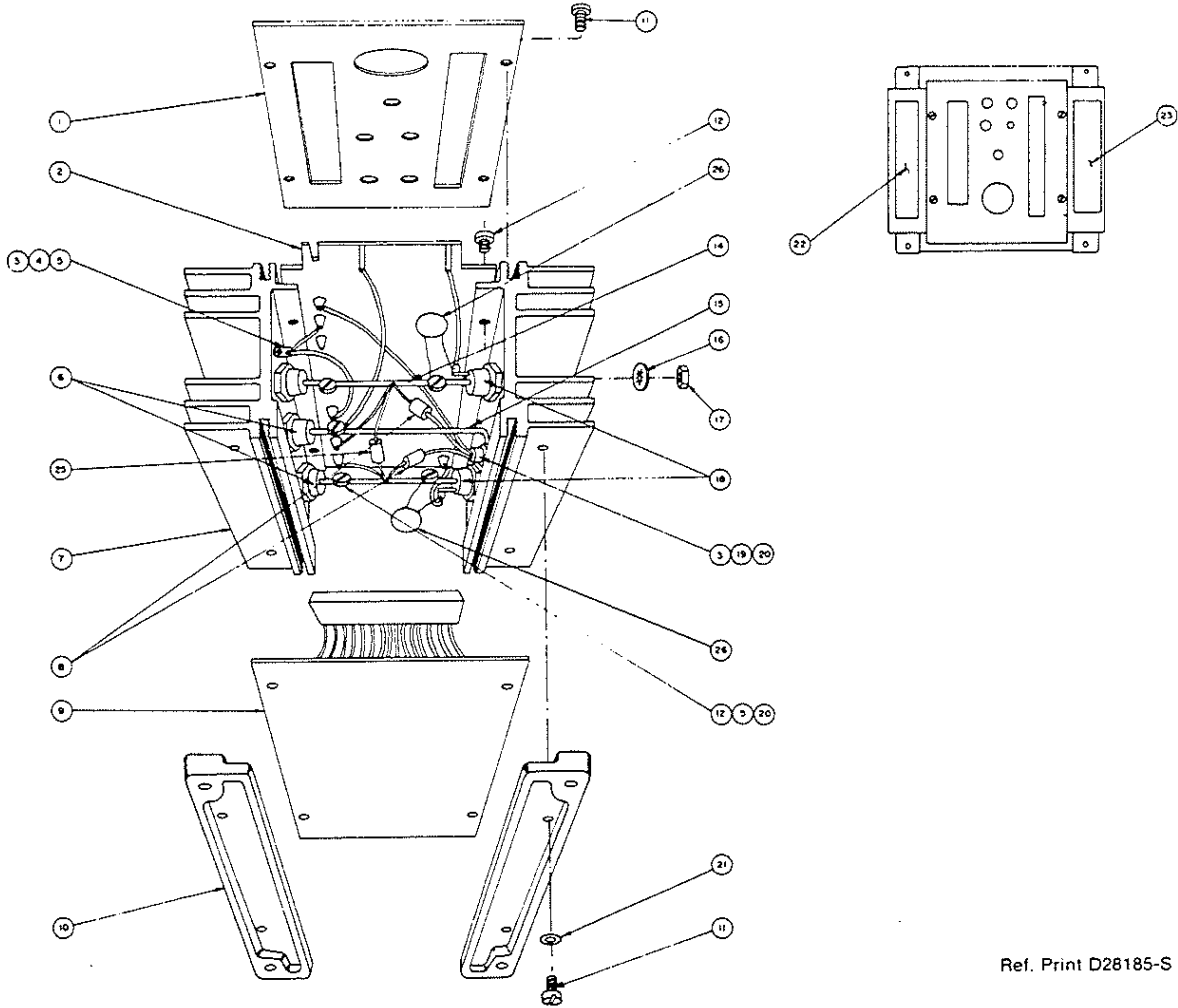
Circuit Symbol	Description	SECO Part #	Vendor Part #
PL1	Pilot Light 220 VAC	ALI 1002-02	Leecraft 31H-2111T
FH1, FH2	Fuse holder 50 Amp	PFU-2006-00	Bussman 3531
F1, F2	Fuse 50A	PFU-1002-05	Bussman KAX50
TB3	Terminal Strip 18 pos	HWA 2021-04	GE CR151D30118
RB	Brake Res. 9 ohm 300 W	PRE 2005-00	Milwaukee Res 25870
T1	Isolation Transformer	PTR 1001	SECO
S1	Switch DPDT	ASW 4009-00	Heinemann J A 30A
K1	Contacter 115 VAC	ARE 4008-01	Furnas 42BD65AFGB
ESB	External Signal Board	WC2963501	SECO
FH3	Fuseholder 1 Amp	PFU 2008-00	Bussman H K P
F3	Fuse 1A AGC	PFU 1004-03	Bussman 1A AGC
P1	18 Pin card edge con.	HPA 1002-07	Amp Inc. 582387
*PL1	Oil tight light assy.	ALI 1003-02	Dialco 123-9363-1231-463
*PL	Pilot lamp neon	ALI 1004-00	Dialco Ne51H
*B	Switch Boot	HMI 1025-01	APM Hexseal

\*Used on NEMA 4 and NEMA 12 enclosure only.

# 12. MODEL 8500/8600/8800 ASSEMBLY PARTS LISTS

12.1

## 8500/8600 Control Module Assembly Parts List

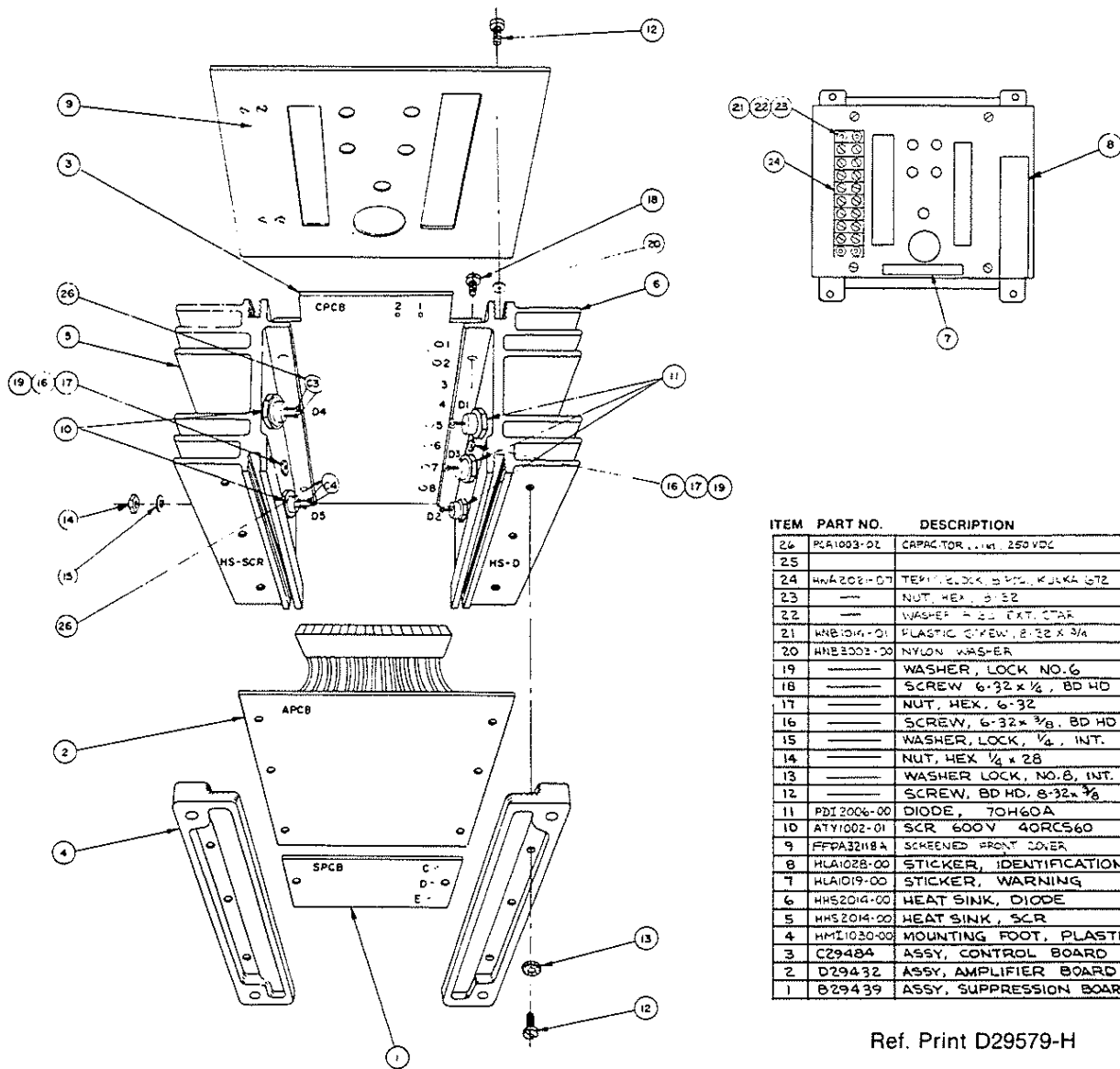


Ref. Print D28185-S

Circuit Symbol	Description	SECO Part #	Vendor Part #
	Cover Identification	FFPA32092	SECO
R15	Resistor 10 ohm, 1 W	PRE 1003-08	SECO
	Amplifier Board Assembly	D2943200 .	SECO
D6, D7	Diode 6 Amp 600 V	PDI 2010-00	IR60S6
	Mounting Foot, Plastic	C28157	SECO
C2	Capacitor .47 MFD, 250 V	PCA 1003-01	SECO
*C2	Capacitor .47 MFD, 600 V	PCA 1007-01	SECO
D1, D2, D3	Diode 40 Amp 300 V	PDI 2002-02	IR40HF30
*D1, D2, D3,	Diode 40 Amp 600 V	PDI 2002-00	IR40HF50
D4, D5	SCR 35 Amp 300 V	ATY 1017-01	2N3897
*D4, D5	SCR 35 Amp 600 V	ATY 1017-02	2N3899
.	Control Board Assembly	C2816200	SECO
.	Control Board Assembly	C2816201	SECO

\*Used on Model 8600

8800 CONTROL MODULE ASSEMBLY AND PARTS LIST



ITEM	PART NO.	DESCRIPTION
26	PCA1003-DL	CAPACITOR, .1uf, 250 VDC
25		
24	HW42021-07	TEP/TELOCK 5/16" x 1/2" x 1/2" STZ
23		NUT, HEX, 6-32
22		WASHER, 1/4" EXT. STAR
21	HMB104-01	PLASTIC SCREW, 2-32 x 3/4
20	HNB3002-00	NYLON WASHER
19		WASHER, LOCK NO. 6
18		SCREW, 6-32 x 1/2, BD HD
17		NUT, HEX, 6-32
16		SCREW, 6-32 x 3/8, BD HD
15		WASHER, LOCK, 1/4, INT.
14		NUT, HEX 1/4 x 28
13		WASHER LOCK, NO. 8, INT.
12		SCREW, BD HD, 8-32 x 3/8
11	PDI 2006-00	DIODE, 70H60A
10	ATY1002-01	SCR 600V 40RCS60
9	FFPA32118A	SCREENED FRONT COVER
8	HLA1028-00	STICKER, IDENTIFICATION
7	HLA1019-00	STICKER, WARNING
6	HHS2014-00	HEAT SINK, DIODE
5	HHS2014-00	HEAT SINK, SCR
4	HML1030-00	MOUNTING FOOT, PLASTIC
3	C29484	ASSY, CONTROL BOARD
2	D29432	ASSY, AMPLIFIER BOARD
1	B29439	ASSY, SUPPRESSION BOARD

Ref. Print D29579-H

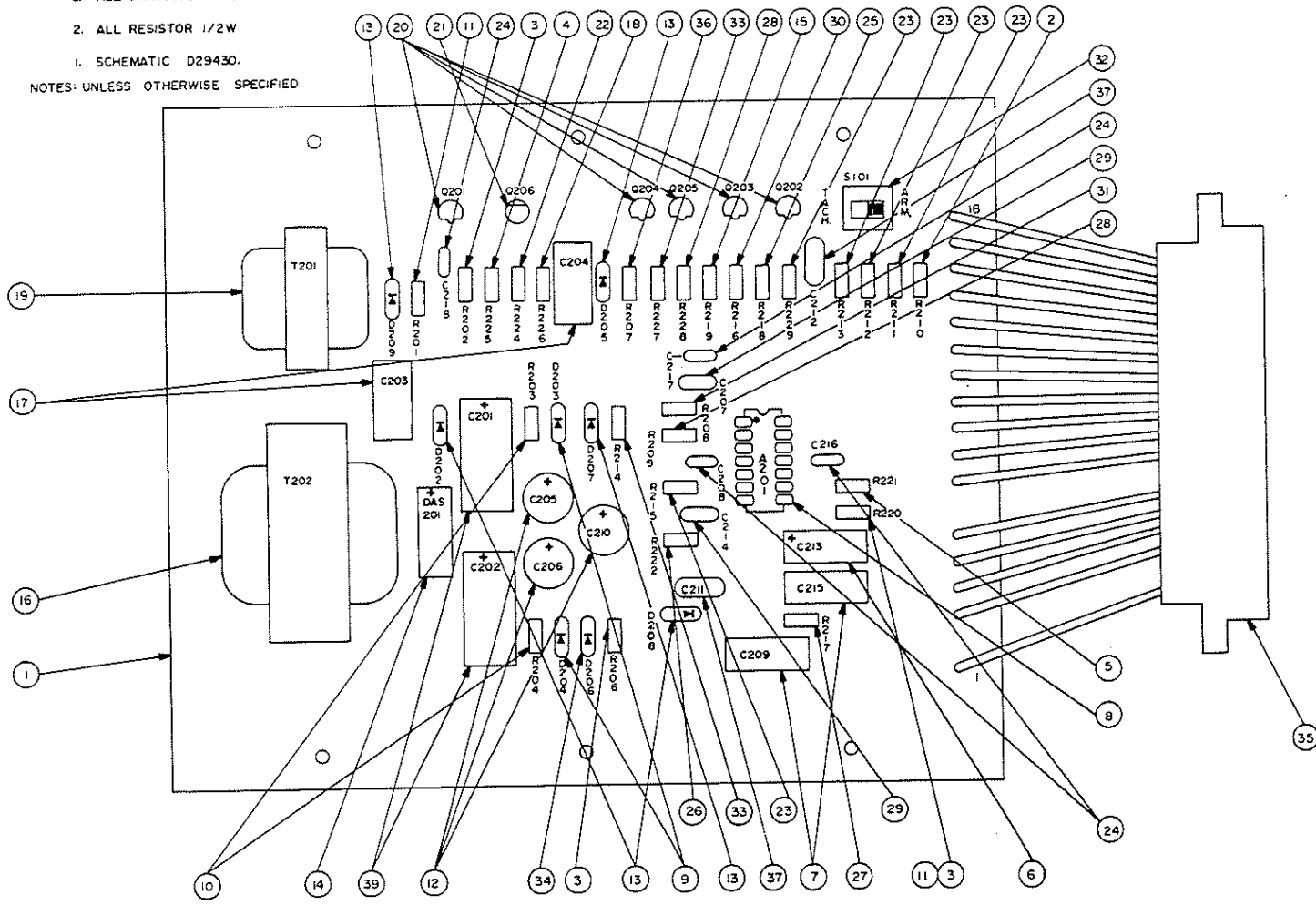
Circuit Symbol	Description	SECO Part #	Vendor Part #
	Cover Identification*	FFPA32118A	SECO
	Cover Identification	C29493	SECO
	Control Board Assembly	C29484	SECO
D1, D2, D3	Diode 600 V 70 A	PDI 1005	70H 60A
	Amplifier Board Assembly	D2943200	SECO
	Mounting Foot, Plastic	C29457	SECO
D4, D5	SCR 600 V 40A	ATY 1002-01	IR40RCS60
	Suppression Board Assy.	B29439	SECO

\*For the 8800-A Model

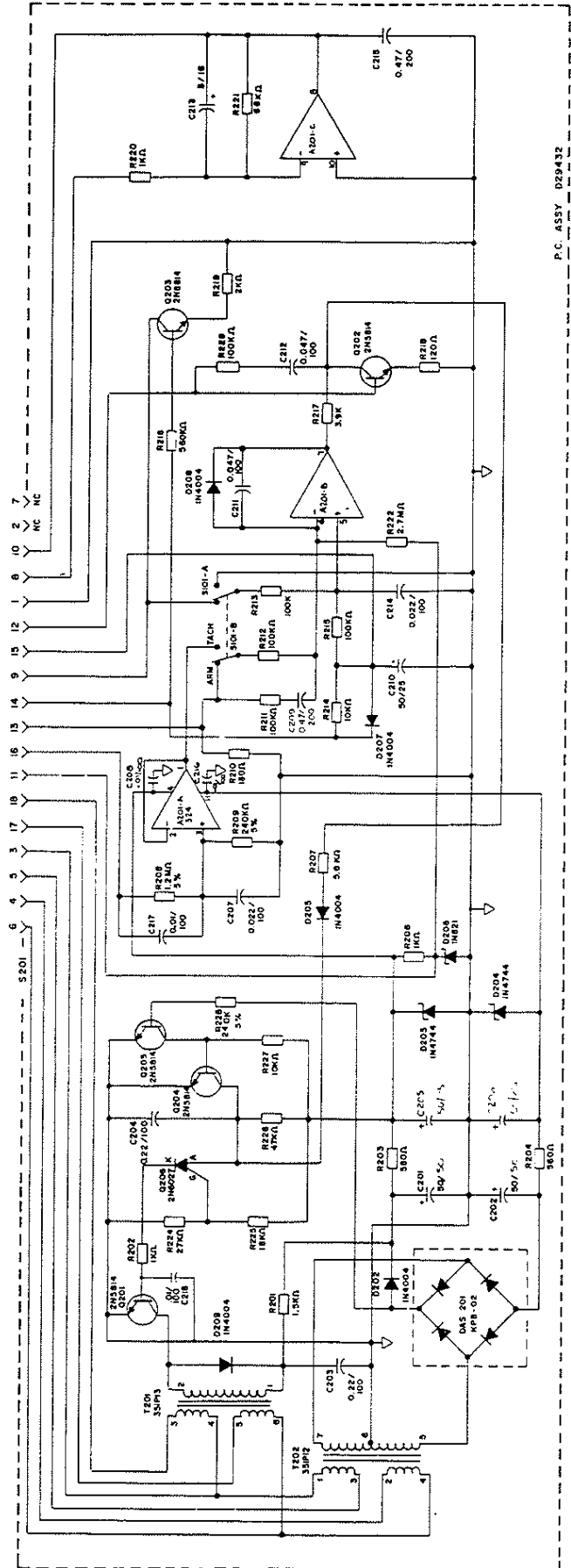
AMPLIFIER BOARD ASSEMBLY AND PARTS LIST

ITEM	PART NO.	DESCRIPTION
40	HW41116-01	I.C. SOCKET, 14 PIN
39	PCA2019-00	CAPACITOR, 47/50
38		
37	PCA1005-04	CAPACITOR, .047/100
36	PRE1001-81	RESISTOR, 5.6K 1/2W
35	WB28176-00	CONNECTOR ASSY
34	PD13002-00	DIODE, REF INB21
33	PRE1001-87	RESISTOR, 10K 1/2W
32	ASW1042-00	SWITCH, DPDT
31	PRE1033-38	RESISTOR, 1.2M 5% 1/2W
30	PRE1033-30	RESISTOR, 560K 1/2W
29	PCA1005-01	CAPACITOR, .022/100
28	PRE1033-21	RESISTOR, 240K, 5% 1/2W
27	PRE1001-77	RESISTOR, 3.9K 1/2W
26	PRE1033-46	RESISTOR, 2.7MEG. 1/2W
25	PRE1001-41	RESISTOR, 120Ω 1/2W
24	PCA1005-05	CAPACITOR, .01/100
23	PRE1033-12	RESISTOR, 100K 1/2W
22	PRE1001-97	RESISTOR, 27K 1/2W
21	ATR4001-00	TRANSISTOR, 2N6027
20	ATR1009-00	TRANSISTOR, 2N5814
19	PTR2001-00	TRANSFORMER, 351P13
18	PRE1033-04	RESISTOR, 47K 1/2W
17	PCA1033-00	CAPACITOR, .22/50
16	PTR4005-00	TRANSFORMER, 351P12
15	PRE1001-70	RESISTOR, 2.0K, 1/2W 5%
14	PD15001-00	BRIDGE, KBP-02
13	PD11006-00	DIODE, IN4004
12	PCA2032-01	CAPACITOR, 47/25
11	PRE1001-67	RESISTOR, 1.5K 1/2W
10	PRE1001-57	RESISTOR, 560Ω 1/2W
9	PD13001-00	DIODE, ZENER 15V 1W
8	AIC1010-00	AMPLIFIER 324, 14 PIN
7	PCA1010-02	CAPACITOR, .47/50
6	PCA2015-02	CAPACITOR, 3/16
5	PRE1033-08	RESISTOR, 68K, 1/2W
4	PRE1001-93	RESISTOR, 18K, 1/2W
3	PRE1001-63	RESISTOR, 1K, 1/2W
2	PRE1001-45	RESISTOR, 180Ω 1/2W
1	PCBD29431G	P.C. BOARD

- 4. SEE SHEET 2 FOR DIMENSIONS.
  - 3. ALL CAPACITOR VALUES IN MFDS / WVDC
  - 2. ALL RESISTOR 1/2W
  - 1. SCHEMATIC D29430.
- NOTES: UNLESS OTHERWISE SPECIFIED



Amplifier Board Parts List

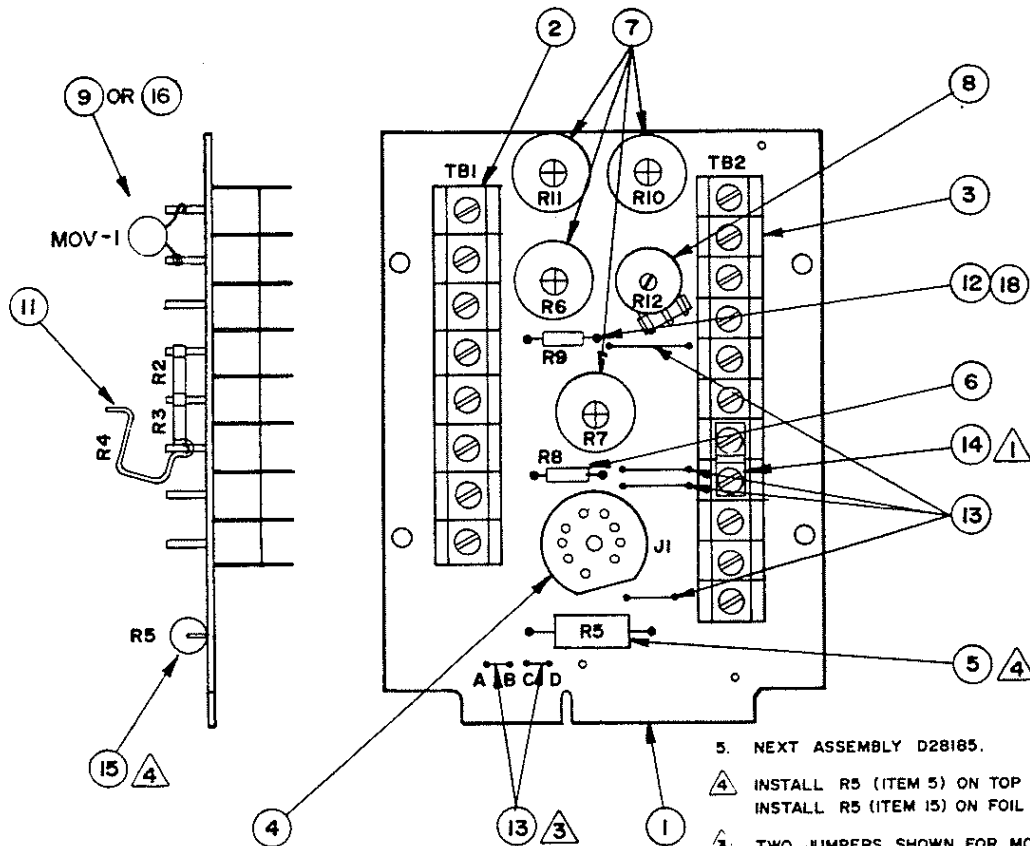


Ref. Print D29430

- 3. REF. ASSY D29432.
  - 2. ALL CAPACITOR VALUES IN MICRO/WOOD.
  - 1. ALL RESISTOR VALUES IN MICRO/WOOD.
- NOTES: UNLESS OTHERWISE SPECIFIED



8500/8600 Control Board Assembly Parts List



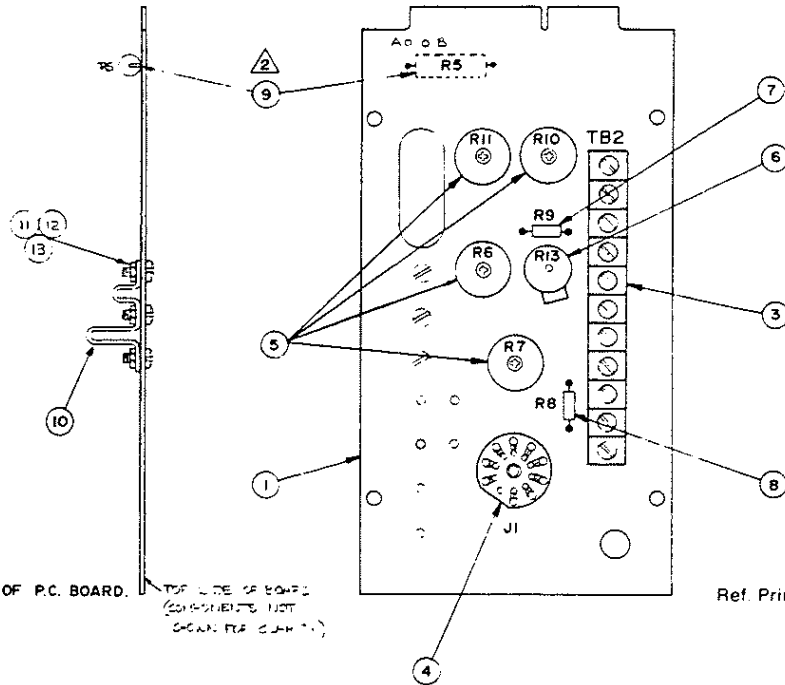
- 5. NEXT ASSEMBLY D28185.
- ⚠️ INSTALL R5 (ITEM 5) ON TOP OF BOARD FOR ASSY -00. INSTALL R5 (ITEM 15) ON FOIL SIDE FOR ASSY -01.
- ⚠️ TWO JUMPERS SHOWN FOR MODEL 8500. FOR MODEL 8600 USE ONE JUMPER BETWEEN B & C ONLY.
- 2. REF. SCHEMATIC D28156 & C28177.
- ⚠️ NOT USED WITH EXTERNAL TORQUE CONTROL.

NOTES:

Ref. Print C28162

Circuit Symbol	Description	SECO Part #	Vendor Part #
PC/B	Printed Circuit Board	D28155D	SECO
TB1	Terminal Strip 8 Position	HWA 2013-8	Magnum
TB2	Terminal Strip 11 Position	HWA 2007-11	Magnum 2420-PR-11
J1	Socket 9 Pin	HWA 1017	NPM 1600
R5	Resistor 8.2K 2W	PRE 1002-43	SECO
*R5	Resistor 18K 5W	PRE 1007	SECO
R8	Resistor 2K ½W 5%	PRE 1001-70	SECO
R6, R7, R10, R11	Potentiometer 2K, 2W	APT 1007	CTS 115
R12	Potentiometer 50K	APT 1002	CTS UY 1734
DAS 1	MOV	PSU 2003-00	VPI30A10
*DAS 1	MOV	PSU 2002-00	VP250A20
R2, R3, R4	IR Comp. Resistor Assem.	PRE 1028	SECO
R9	Resistor 220 ohm ½W	PRE 1001-47	SECO
	Jumper Two Position	HWA 2001	SECO

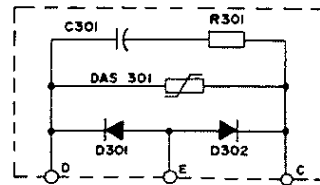
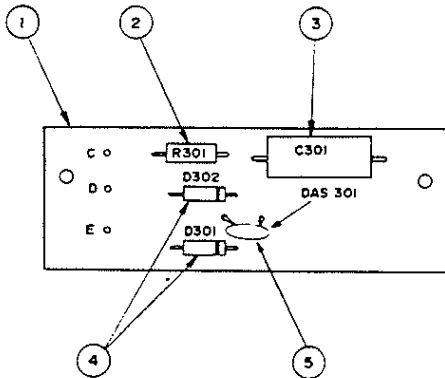
\*Used on Model 8600



1. REF. SCHEMATIC DIAG. D29537.

NOTES:

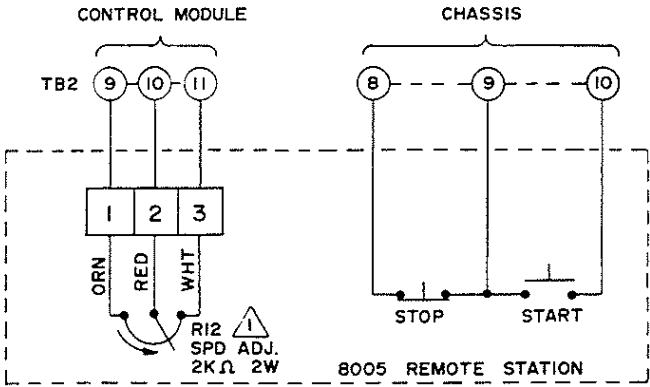
Circuit Symbol	Description	SECO Part #	Vendor Part #
PC/B	Printed Circuit Board	D29483B	SECO
TB1	Terminal Strip 8 position	HWA2010	KULKA 812-8-NH
TB2	Terminal Strip 11 position	HWA2007	Magnum 2420-PR-11
J1	Socket, Test 9 Pin	HWA1017	NPM 1600
R6, R7, R10	Pot, 2K	APT 1007	CTS 115
R11			
R13	Pot, 50K	APT 1002	CTS UY 1734
R9	Resistor 220 ohm, 1/2W	PRE 1001-47	SECO
R8	Resistor 2K, 1/2W	PRE 1001-70	SECO
R5	Resistor 18K, 5W	PRE 1007	SECO
R1, R2	IR Comp. Resistor	PRE 2006	SECO
	Jumper, 2 position	HWA 2001	Kulka 6003



Ref. Print B29439-F

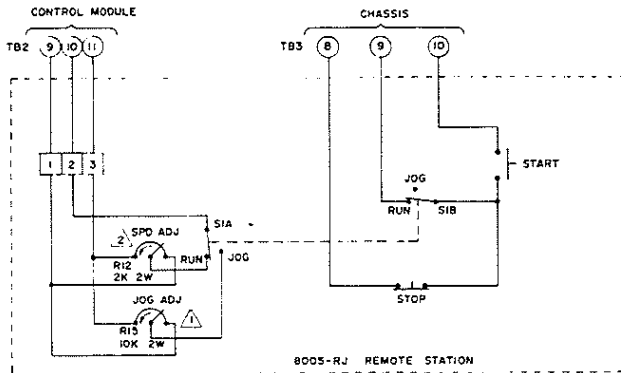
Circuit Symbol	Description	SECO Part #	Vendor Part #
PC/B	Printed Circuit Board	B29438	SECO
R301	Resistor 15 ohm, 2W	PRE1002-10	Speer
C301	Capacitor .47 mfd 600 VDC	PCA1007-01	CDE MPY6P47
D301, D302	Diode 60S6.	PDI 2010-00	60S6
DAS 301	MOV	PSU 2002-00	VP250A20

# 13. REMOTE STATIONS



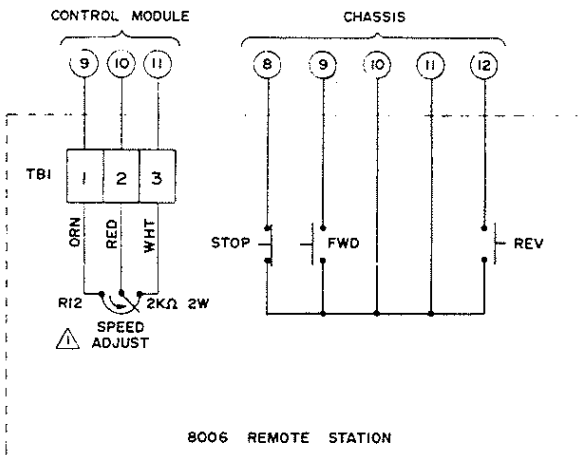
1. -710 OPTION IS TEN TURN POT. Ref. Print B28489-A

13.1 Model 8005 (Start-Stop) Schematic



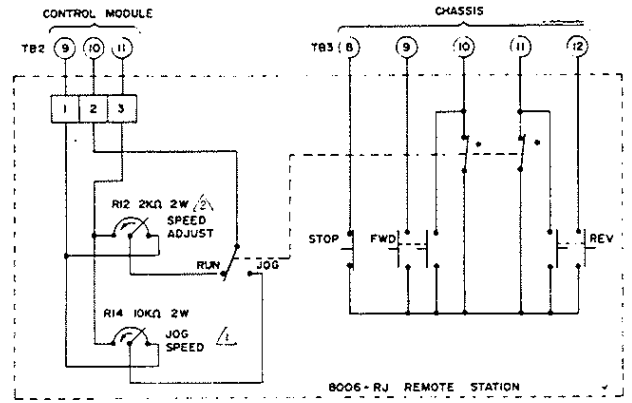
2. -710 OPTION IS TEN TURN POT  
 1. INTERNAL REMOTE STATION ADJUSTMENT.  
 NOTES: Ref. Print B29746-A

13.2 Model 8005-RJ (Start-Stop with Jogging) Schematic



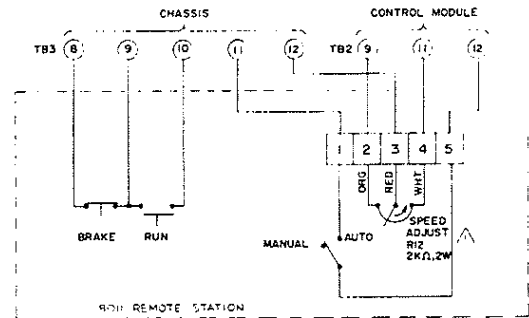
Ref. Print B28492-B

13.3 Model 8006 (Forward-Stop-Reverse) Schematic



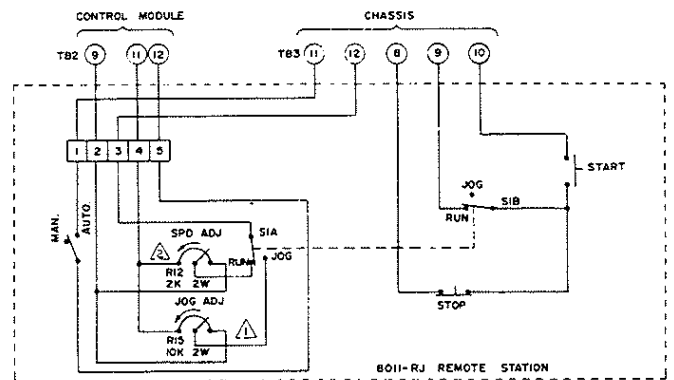
3. ASSEMBLY C30766.  
 2. -710 OPTION IS TEN TURN POT.  
 1. INTERNAL REMOTE STATION ADJUSTMENT.  
 NOTES: Ref. Print B29747-A

13.4 Model 8006-RJ (Forward-Stop-Reverse with Jogging) Schematic



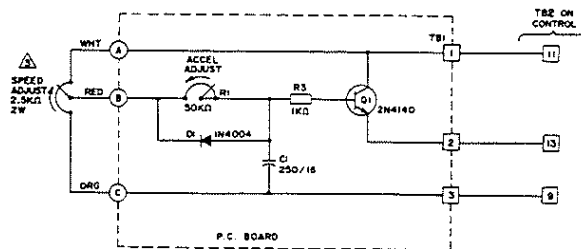
Ref. Print B28495

13.5 Model 8011 (Start-Stop-Auto/Manual) Schematic



3. ASSEMBLY C30979.  
 2. -710 OPTION HAS TEN TURN POT.  
 1. INTERNAL REMOTE STATION ADJUSTMENT.  
 NOTES: Ref. Print 29748-A

13.6 Model 8011-RJ (Start-Stop-Auto Manual with Jogging) Schematic



▲ MOUNTED ON FRONT COVER.  
 2. P.C. BOARD B28794.  
 1. ASSY DWG B28852.  
 NOTES:

Ref. Print B29754

13.9 Option - AE (Exponential Acceleration) Schematic

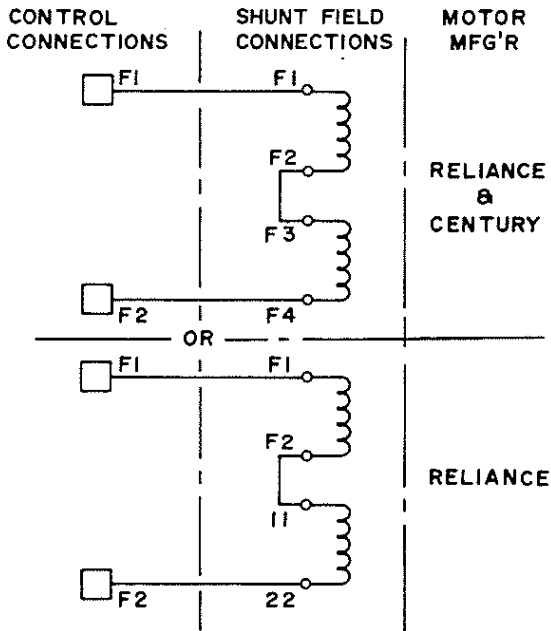
### 13.10 REPLACEMENT PARTS FOR REMOTE STATIONS

Circuit Symbol	Description	SECO Part #	Vendor Part #
Start	Black Push Button Assy.	ASW 2002-01	Furnas BJPI
	Contact Block N.O.	ASW 2003-01	Furnas BJK
Stop	Red Push Button Assy.	ASW 2002-02	Furnas BJPa
	Contact Block N.C.	ASW 2003-02	Furnas BJJ
Run-Jog	Red Selector Switch Assy.	ASW 1008-01	Furnas BJS2A
	Contact Block N.O.	ASW 2003-01	Furnas BJK
Speed Adjust	Potentiometer 2K, 2W	APT 2001-00	CTS 83-1837
Speed Adjust	Ten Turn Pot. 2K, 2W	APT 3001-00	Spectrol 534
	Ten Turn Dial	HMI 1009-00	Spectrol
Jog Speed	Potentiometer 10K, 2W	APT 2004-00	CTS 83-1848
TB1	Terminal Strip 3 Position	HWA 2026-02	Kulka 671-3
TB1	Terminal Strip 6 Position	HWA 2026-13	Kulka 671-6
AL	Linear Accel. Card	C29757	SECO
AE	Non-Linear Accel. Card	B28850	SECO
F17	Tach Follower Card	C29790	SECO

### 14. RECOMMENDED SPARES

Quantity	Description	SECO Part #	Vendor Part #
<b>14.1</b>			
<b>Model 8500</b>			
1	Amplifier Board Assy.	D29432	SECO
1	Control Board Assy.	C2816200	SECO
2	SCR's type 2N3897	ATY 1017-01	RCA
3	Diodes 40HF30	PDI 2002-02	IR
2	Diodes 60S6	PDI 2010-00	Motorola
1	MOV VP130A10	PSU 2003-00	G.E.
1	Fuse 15A Type FNM	PFU 1016-12	Bussman
<b>14.2</b>			
<b>Model 8600</b>			
1	Amplifier Board Assy.	D29432	SECO
1	Control Board Assy.	C28162-01	SECO
2	SCR's Type 2N3899	ATY 1017-02	RCA
3	Fuse 15A Type KTK	PFU 1013-00	
2	Diodes 60S6	PDI 2010-00	Int'l Rectifier
1	MOV VP 250A20	PSU 2002-00	G.E.
2	Fuse 15A type SC	PFU 1005-04	Bussman
<b>14.3</b>			
<b>Model 8800</b>			
1	Amplifier Board Assy.	D29432	SECO
1	Control Board Assy.	C29484	SECO
2	SCR's type 40RCS60	ATY 1002-01	IR
3	Diodes Type 70H60A	PDI 2006-00	IR
1	Suppression Board Assy.	B29439	SECO
2	Fuse KAX 50A	PFU 1002-05	Bussman KAX 50

# 15. SPECIAL CONNECTIONS

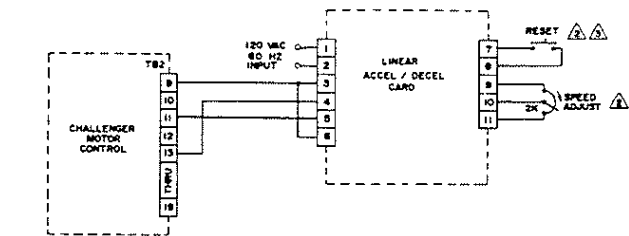


BEFORE USING A SECO CHALLENGER SERIES CONTROL WITH A DUAL WINDING SHUNT FIELD MOTOR, CONNECT THE FIELD WINDINGS FOR HIGH NAMEPLATE EXCITATION VOLTAGE.

HIGH FIELD CONNECTIONS ARE SHOWN HERE. USE FIELD LEAD MARKING AS A GUIDE TO THE APPROPRIATE DIAGRAM.

Ref. Print B30579

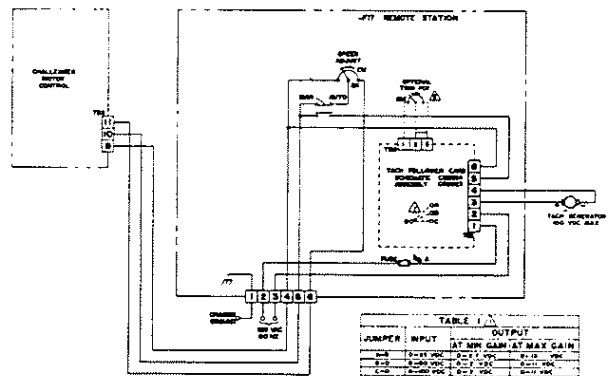
15.1 Dual Winding Shunt Field Connection Diagrams.



- ⚠ PART OF START PUSH BUTTON.
- ⚠ MOUNTED ON FRONT COVER OF REMOTE STATION.
- ↑ ARROWS ON POTS INDICATE CW ROTATION.

Ref. Print B29967-A

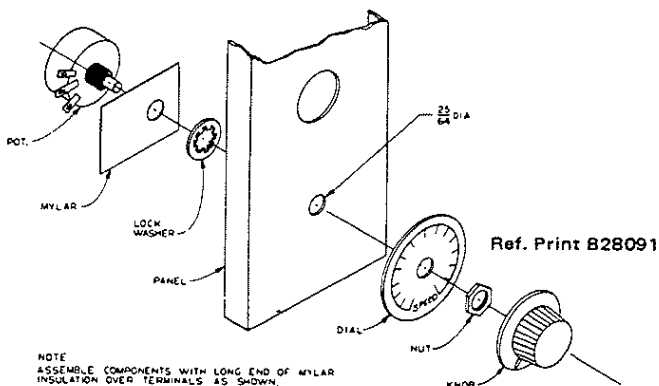
15.2 Option - AL (Linear Acceleration) Schematic



- ⚠ WHEN LEAD OPTION, THIS POT, REMOVE JUMPER FROM 2-3 & 3-4.
- ⚠ POSITION OF JUMPER ON TACH FOLLOWER CARD IS BASED ON INPUT RANGE. SEE TABLE FOR PROPER CONNECTIONS.

Ref. Print C29968-D

15.3 Option - F17 (5-100 VDC Tach. Follower)



Ref. Print B28091

15.4 Speed Potentiometer Assembly

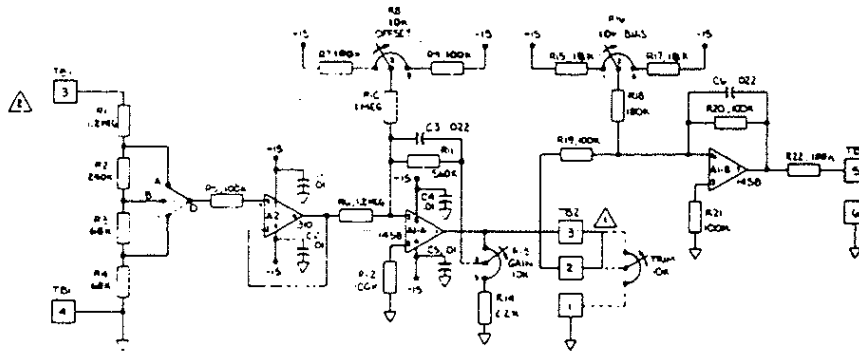
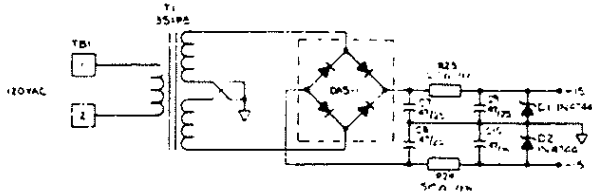


TABLE I			
JUMPER	INPUT	OUTPUT	
		AT 10% GAIN	AT 100% GAIN
A-D	0-25 VDC	2.0	10
B-D	0-50 VDC	2.0	11
C-D	0-100 VDC	2.0	11

**ADJUSTMENT PROCEDURE:**

1. APPLY 0 VOLTS BETWEEN TERMINALS TB1-5 & 4. MEASURE ACROSS TERMINALS TB1-1 & 2. ADJUST 'OFFSET' FOR 0 VOLTS.
2. WITH 0 VOLTS INPUT SIGNAL, ADJUST 'GAIN' FOR PREPARED MOTOR MAXIMUM SPEED.
3. WITH MAXIMUM TACHOMETER INPUT SIGNAL, ADJUST 'GAIN' FOR PREPARED MOTOR MAXIMUM SPEED.
4. REPEAT STEPS 1 THROUGH 3.

**NOTE:** OPTIONAL 'TRIM' POT ALLOWS RATINGS OF OUTPUT VOLTAGE. ADJUSTMENTS SHOULD BE MADE WITH 'TRIM' AT 100% (MAXIMUM).

1. REF C32625 FOR A 5MIN

⚠ SEE TABLE I FOR INPUT VOLTAGE RANGES

⚠ JUMPER 1 FACTORY INSTALLED TRIM POT IS OPTIONAL

NOTE...

Ref. Print C32624-C

## 15.5 - F17 Tach Follower Card

WARNER ELECTRIC MOTORS AND CONTROLS DIVISION  
BRISTOL PLANT  
383 MIDDLE STREET  
BRISTOL, CT 06010  
(860) 585-4500 FAX: (860) 589-2136  
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