

Instruction Sheet

IS-539-10/C
3/22/93

Model 4000 and 4050 With Auto/Manual Low Signal Follower (Internal Ratio Adjustment)

Dynamatic

Introduction

These instructions relate specifically to the following Model 4000 and 4050 controllers which are assembled for Speed Control with the Auto/Manual Low Signal Follower (Internal Ratio Adjustment) modification.

Model 4000, 4.3 Amp Controllers:
15-533-1010 Panel Mount
15-535-1010 Standard Enclosure
15-536-1010 Blank Cover

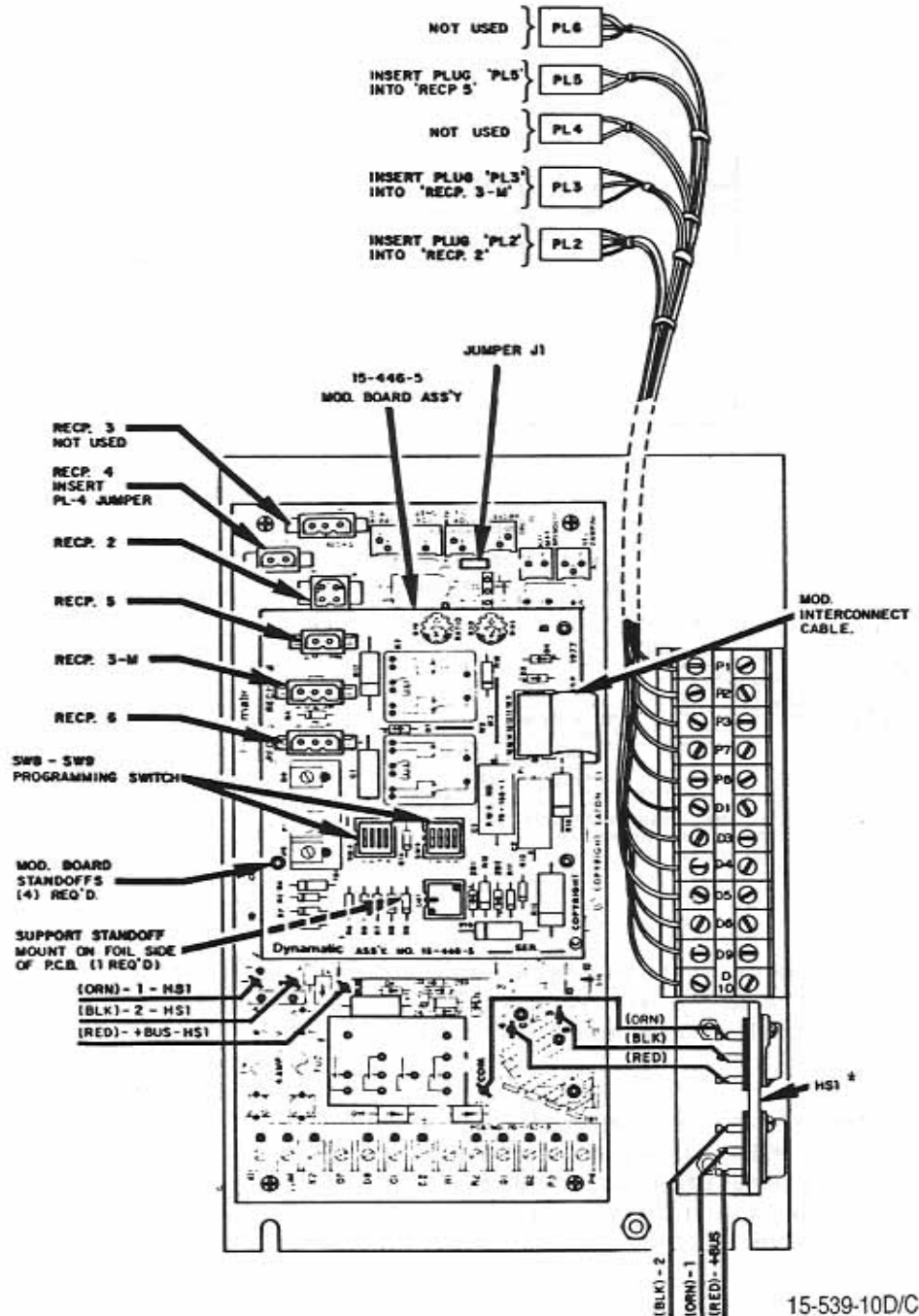
Model 4050, 8 Amp Controllers:
15-539-0010 Panel Mount
15-540-0010 Standard Enclosure

Connection diagram, schematic diagram, switch programming, plug wiring connection, adjustment procedure and recommended spare parts list for these specific assemblies are contained in this instruction sheet. Any differences between these two controllers are clearly noted.

Use instruction manual IM-130006-83XX with this instruction sheet for complete installation, operation and maintenance instructions.

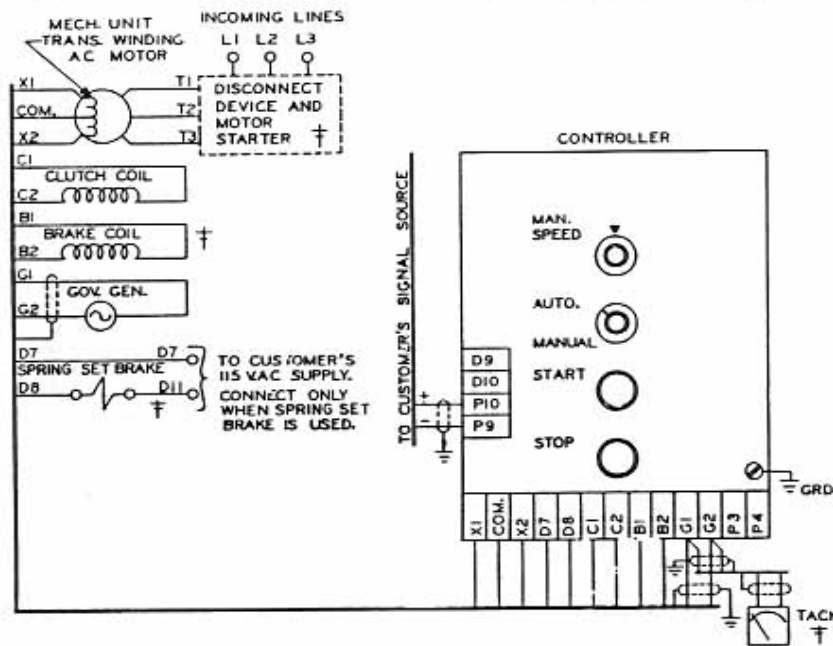
CAUTION: Above ground electrical potentials can be hazardous. Always disconnect electrical power before working on the controller.

* Heat sink assembly, HS1, and its wiring apply only to the Model 4050 controllers. These parts are not supplied on Model 4000 controllers. The parts are mounted on the 15-530-5 main 4000 board.



Model 4050 Controller Panel with Modification Board 15-446-5
Auto/Manual Low Signal Follower (Internal Ratio Adjustment)

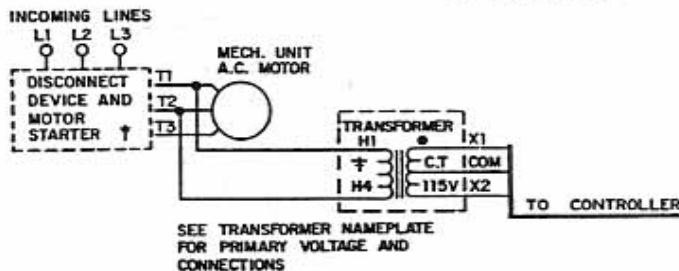
Connection Diagram for Standard Cast Enclosure 4000 Controller



CONTROL PROGRAMMING

15-530-5/6 P.C.B.
J1-POSITION-NORM

15-446-5 P.C.B.



SW8	
CONTACT	POSITION
1	CLOSED
2	OPEN
3	OPEN
4	OPEN

DC INPUT SIGNAL	INPUT IMPEDANCE	SW8			
		1	2	3	4
5.5-7.5V MAX	5.1K	0	0	0	0
1-5 MA	1.5K	0	0	0	X
2-10 MA	750Ω	0	0	X	0
4-20 MA	360Ω	0	X	0	0
10-50 MA	150Ω	X	0	0	0

X INDICATES CLOSED CONTACT.
O INDICATES OPEN CONTACT.

SW9	
CONTACT	POSITION
1	OPEN
2	CLOSED
3	CLOSED
4	CLOSED

(SW8 PROGRAMMING ABOVE FOR 10 TO 50 MA DC, 150 OHM INPUT SIGNAL)

ED-58210/B

Note 1:

This equipment must be installed in compliance with National Electrical code and all applicable state and local codes.

Note 2:

Transformer may be supplied as a winding in the ac motor or as a separate item. Standard connections to winding in mechanical unit and to separate transformer are both shown above.

Note 3:

To eliminate linear acceleration on manual speed, open contact 4 on SW9.

Note 4:

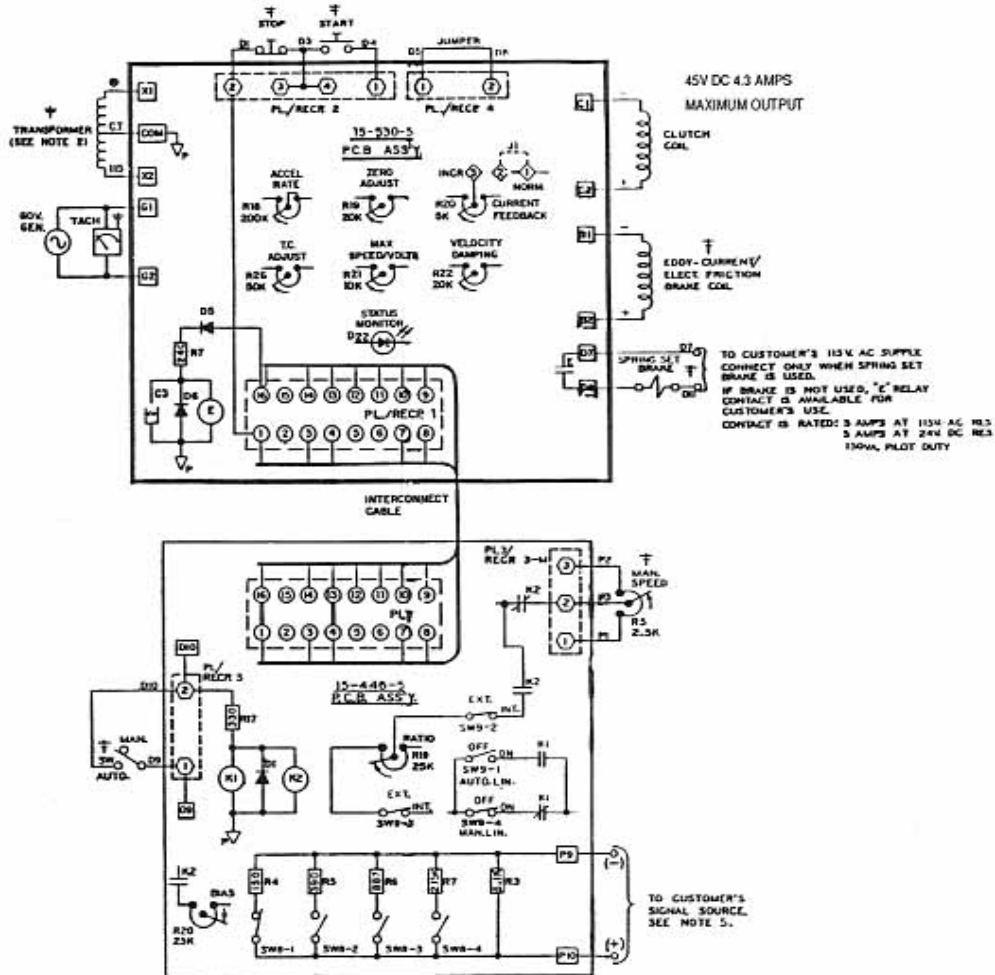
To add linear acceleration to Auto, close contact 1 on SW8.

Note 5:

For alternate input signals, program contacts SW8-1, 2, 3 & 4 as shown above.

- Programming & Mod. interconnect plug/recp.
- Operator's station & PCB interconnect plug/recp.
- Screw terminal
- ⊕ Signal common
- ⊕ Power common
- ⊕ Items furnished only when specified

Schematic Diagram for 4000 Controller

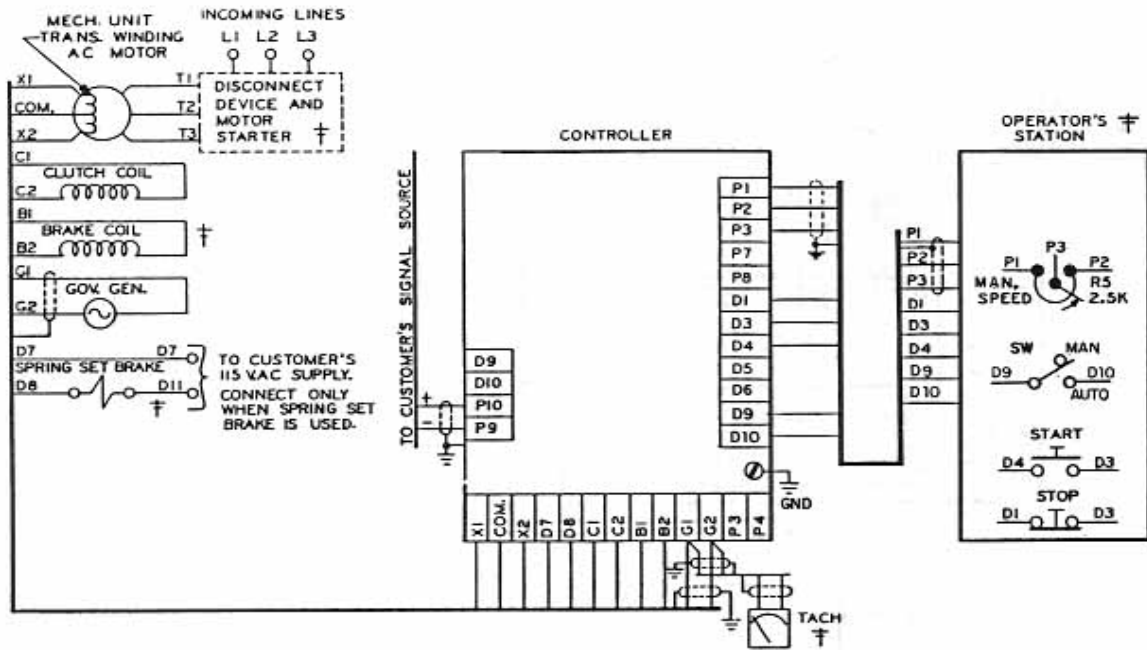


Modification PCB Mounting

If you have purchased a complete controller this section may be passed over and you may proceed to General Description.

- Place the Main PCB in front of you with the long dimension in a horizontal position and the terminal strip to the left.
- Remove the DIP switch by pulling it straight out of the receptacle, RECP 1. Then, peel the adhesive-backed label off the other half of RECP 1.
- Insert the arrow-type locking head of the four nylon stand-offs supplied into the four 0.188" diameter holes in the main PCB and press in. The tabs will snap out to lock the stand-offs permanently in position.
- Hold the modification PCB assembly over the stand-offs with the ribbon connector toward you and insert the ribbon connector plug into RECP 1. Be careful to see that all 16 pins are started properly into the receptacle before pressing the plug in.
- Align the holes in the modification PCB assembly over the stand-offs and press over the tapered posts until the locking flanges snap out to lock the board in position.

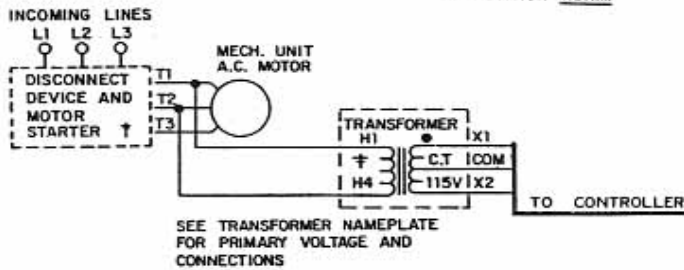
Connection Diagram for 4000 Panel Mount/Blank Cover and 4050 Controllers



CONTROL PROGRAMMING

15-530-5/6 P.C.B.

J1 POSITION - NORM.



15-446-5 P.C.B.

SW8	
CONTACT	POSITION
1	CLOSED
2	OPEN
3	OPEN
4	OPEN

DC INPUT SIGNAL	INPUT IMPEDANCE	SW8			
		1	2	3	4
5.5-7.5V MAX	5.1K	0	0	0	0
1-5 MA	1.5K	0	0	0	X
2-10 MA	750Ω	0	0	X	0
4-20 MA	350Ω	0	X	0	0
10-50MA	150Ω	X	0	0	0

SW9	
CONTACT	POSITION
1	OPEN
2	CLOSED
3	CLOSED
4	CLOSED

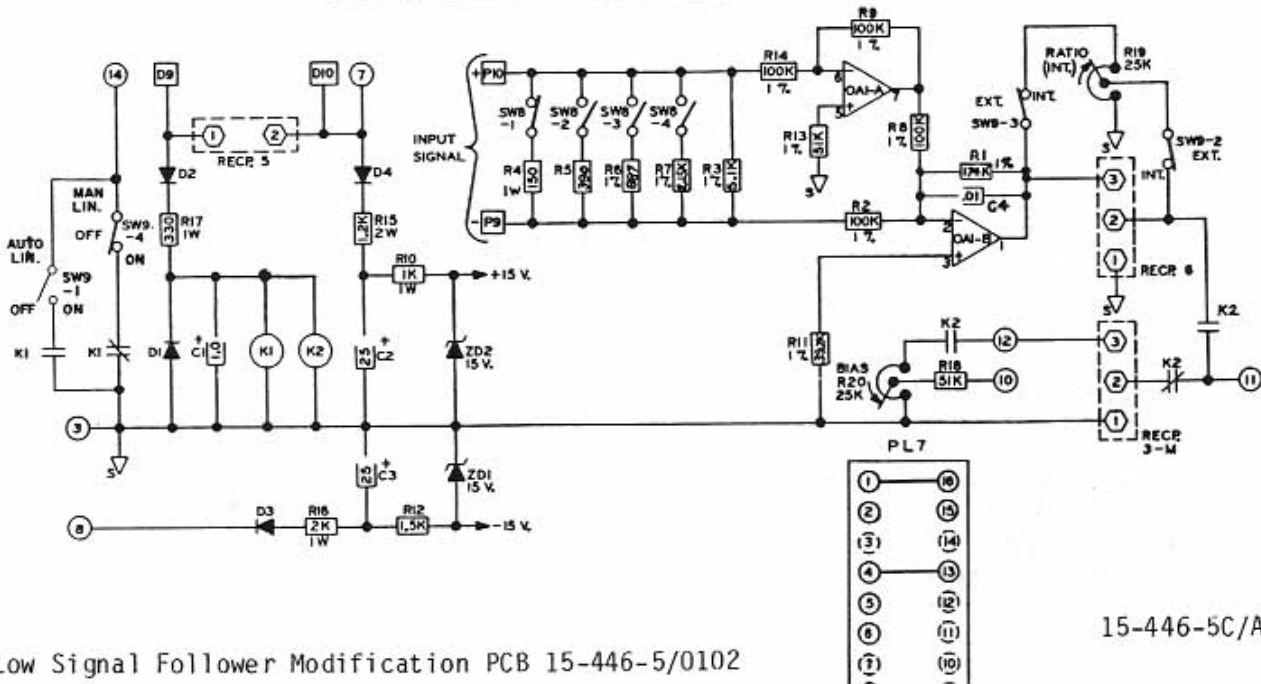
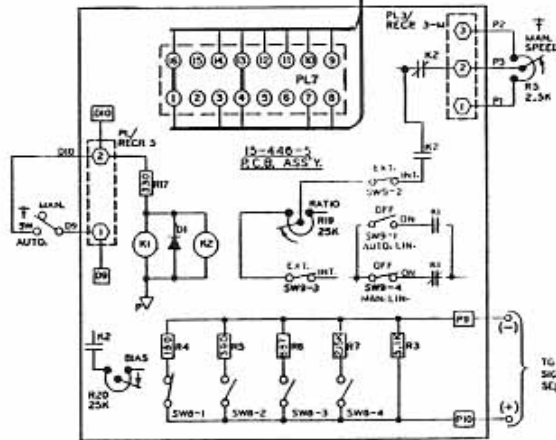
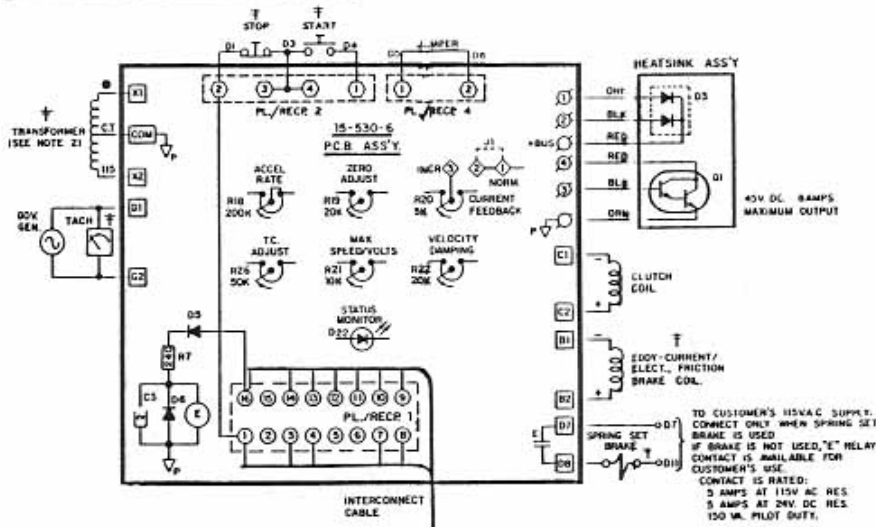
X INDICATES CLOSED CONTACT.
O INDICATES OPEN CONTACT.

(SW8 PROGRAMMING ABOVE FOR 10 TO 50 MA DC, 150 OHM INPUT SIGNAL)

See page 2 for notes and description of symbols.

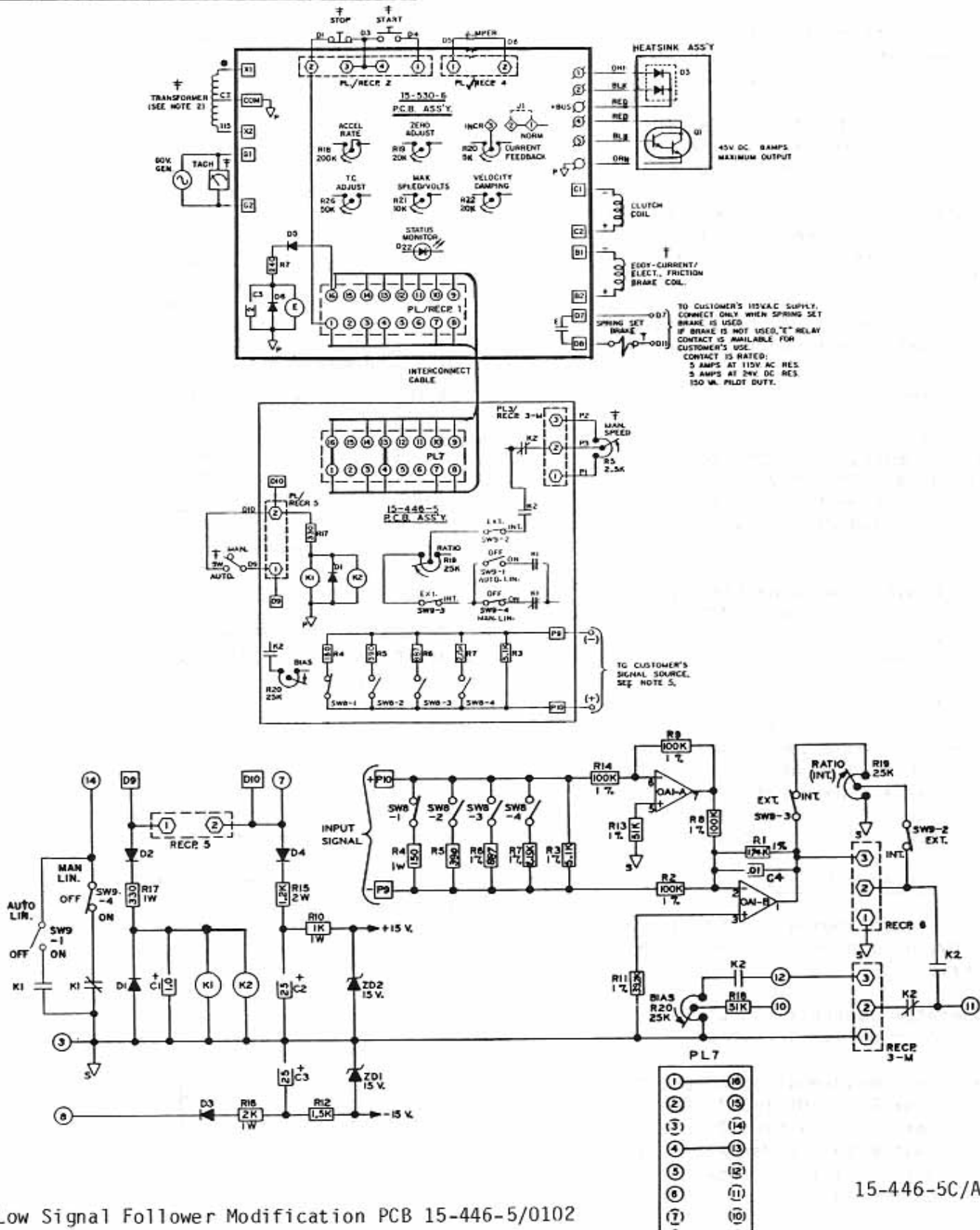
ED-56810/C

Schematic Diagram for 4050 Controller



Low Signal Follower Modification PCB 15-446-5/0102

Schematic Diagram for 4050 Controller



15-446-5C/A

Low Signal Follower Modification PCB 15-446-5/0102

General Description

This modification circuit accepts a transducer output signal (current or voltage) and conditions it to produce a dc reference voltage for the controller. The circuit is adjusted for a specific linear drive speed range to be obtained for a given transducer output range.

The modification can also be placed in the Manual Mode whereby the drive speed is controlled by an external Manual Speed potentiometer.

Linear acceleration may be selected for Auto, Manual or both modes of operation.

Visual Inspection

1. Before proceeding to the preliminary adjustments, check the controller for any damage that may have occurred during shipment, such as loose connections and damaged wire or components.
2. Check all interconnecting wires for conformance to connection diagram and schematic as supplied in this instruction sheet.
3. Check the Operator's controls (which are supplied by customer) to see if they are connected properly per the connection diagram. This includes the Manual Speed pot R5, the Manual/Auto selector switch and the Start and Stop pushbutton controls.

Preliminary Adjustments

Perform the following preliminary adjustments (with no power applied to the controller).

1. Operator Controls (supplied by customer unless specified)
 - a. Set the Manual Speed potentiometer R5 to 0% (Full CCW).
 - b. Set the Auto/Manual selector switch to the Manual position.
 - c. Note location of Start and Stop pushbuttons.

2. Main PCB 15-530-5 or 15-530-6

The pots used are screwdriver adjust single turn pots. Do not use a screwdriver with a blade width exceeding 1/8 inch.

- a. Set the Accel Rate potentiometer R18 to 100% (Full CW).
- b. Set the Zero Adjust potentiometer R19 to 0% (Full CCW).
- c. Set the Max Speed/Volts potentiometer R21 to 0% (Full CCW).
- d. Set the Velocity Damping potentiometer R22 as follows (see trimpot illustration):

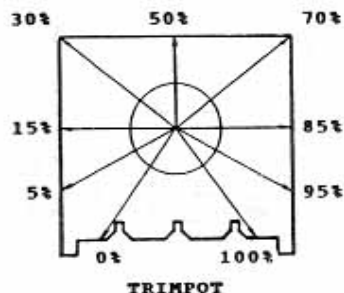
Mechanical Unit Model Numbers		Velocity Damping Setting
AC/ACM/ACS/PD/VT Fractional Hp (FHP)	AS/AT/AE/VT/EC	
Fractional Hp	14/112/140	0%
181/182/184/186	18/21/132/160/180/210	50%
214/216/254/256	25/27/180/225/250/280	75%
280/320/360/440	320/360/440	75%

- e. Set the Time Constant (TC) Adjust potentiometer R26 as follows (see trimpot illustration):

Mechanical Unit Model Numbers		TC Adjust Setting
AC/ACM/ACS/PD/VT Fractional Hp (FHP)	AS/AT/AE/VT/EC	
FHP/181/182	14/18/112/132/140/180	0%
184/186/214	21/160/210	15%
216/254/256/280	25/27/180/225/250/280	30%
320/360/440	320/360/440	100%
		100%

*Typical product number stamped on mechanical unit nameplate:

- 1) A1-100214-0053, specific mechanical model is AC-214.
- 2) B2-100210-0008, specific mechanical model is AS-21.



TRIMPOT ILLUSTRATION

speed point setting will vary with different mechanical units.

There are two other conditions for which the LED will be out besides the drive being set for zero speed, or running wide open above the regulating range. These are whenever the "E" relay is deenergized (the drive is stopped), or due to a wiring error, ground or some malfunction of the controller itself.

MAX SPEED/VOLTS R21, Alternate Methods

- a. To set maximum rated speed with a tach or stroboscope: turn the Manual Speed potentiometer R5 to 100% (Full CW). Allow the drive to accelerate to full speed, turn the Max Speed/Volts pot CW until the rated speed indicated is the same as the speed listed on the nameplate of the mechanical unit.
 - b. To set approximate maximum speed with a voltmeter, connect a voltmeter (60 Vac scale) across terminals G1 and G2. Turn the Manual Speed pot R5 to 100% (Full CW). Allow the drive to accelerate to full speed. With the drive at full speed, turn the Max Speed/Volts pot CW until the meter reading ceases to rise. Back off the adjustment (CCW) until the meter reading just begins to drop. This is the point of maximum speed.
 - c. To set a maximum speed that is less than rated maximum speed requires the use of a tachometer or stroboscope indicator. This cannot be accomplished with the LED status monitor. Turn the Manual Speed potentiometer to 100% (Full CW). Allow the drive to accelerate to full speed. With the drive at full speed, slowly increase Max Speed/Volts potentiometer setting CW until the desired speed is indicated.
5. Since there may be some interaction between the Zero Adjust and the Max Speed/Volts, particularly if the minimum speed is other than zero, repeat steps 3 and 4 until the desired speeds are obtained for both the zero and max positions of the Manual Speed pot.
 6. TIME CONSTANT (TC) ADJUST R26 - The TC Adjust is used to set current feedback by using coil voltage and a variable RC combination to simulate the different coil time constants of various size drives. A trimpot illustration is provided to facilitate the setting of this control. Sufficient range has been provided for drive sizes from fractional through 20 hp for the 4000 controller and up to 125 hp for the 4050 controller. Set your TC control appropriately for your individual drive size as shown in Preliminary Adjustments.

Settings are not critical and so may be "tuned" for each drive. High inertia applications can benefit from a higher than normal setting.
 7. CURRENT FEEDBACK R20* - Normal operation will not require use of this potentiometer. Certain applications are best met with a negative current feedback response which is slower in settling and less likely to overshoot at low rpm's. There are some low inertia, light load, linear acceleration applications that may also benefit from improved low end linearity with current feedback damping. If you have one of these applications, remove Jumper J1 from the Normal position and place it in the Increased position. Adjust Current Feedback R20 as required to obtain desired drive response.
- *See basic 4000/4050 manual for a more detailed description of this adjustment.
8. ACCEL RATE R18 - The purpose of Linear Acceleration is to slow down drive response to an increase in command. Without Linear Accel con-

trol, the drive will respond to operator speed adjustments very quickly, limited only by the torque capacity of the drive. With the Linear Accel circuit, the output of the controller is linear with respect to time. This circuit is adjustable from 3 to 90 seconds. Linear acceleration may be selected for Auto, Manual or both modes of operation. When set at the slowest acceleration rate, the drive will take 90 seconds to accelerate from zero to rated speed, following a linear ramp. When less than rated speed is set, the time required to reach top speed is proportionally less.

To set the Accel Rate: stop the controller with the Stop pushbutton. Turn the Manual Speed potentiometer to 100% (Full CW). With the drive at a complete stop, push the Start pushbutton and time the interval required for the drive to accelerate from zero to full speed. Adjust the Accel Rate potentiometer R18 CCW for a slower accel rate, or CW for a faster accel rate. This potentiometer sets the acceleration rate for both the Manual and Automatic modes.

NOTE: Only the Acceleration Rate is adjustable. The response of the controller to a reduced command is instantaneous. The response of the drive to a decrease in command is a function of drive system load and inertia.

9. VELOCITY DAMPING R22* - This potentiometer is used to match the controller response to the drive response (drive response is a function of the clutch coil time constant and system inertia). The proper setting for this adjustment depends on the drive size and total load inertia.

See Preliminary Adjustments. If instability (speed control becomes erratic) occurs at any setting increase (turn CW) slightly until the speed becomes stable. This completes the adjustment procedure.

*See basic 4000/4050 manual for a more detailed description of this adjustment.

Automatic Operation

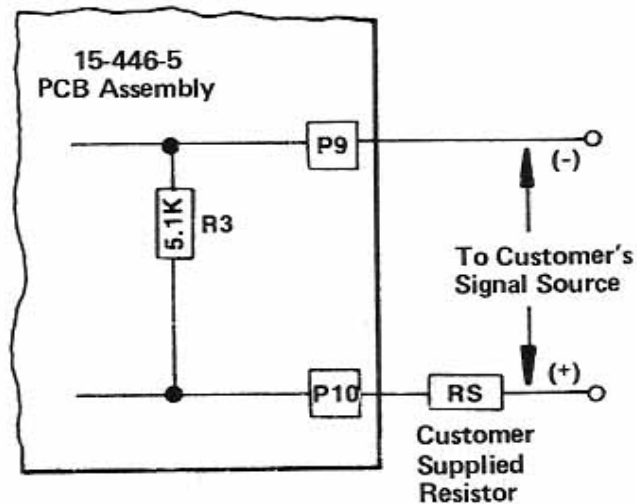
1. For standard dc current input signals to the 4000/4050 controller, program switch SW8-1 through -4 on 15-446-5 mod board per chart on page 2 or 4.
2. For other dc voltage input signals, program contacts SW8-1 through -4 on 15-446-5 mod board per chart on page 2 or 4 and connect an external series dropping resistance as follows:

- a. 0-7.5 Vdc input signal - no external series dropping resistor is required.

7.5 Vdc is the maximum signal voltage that should be applied to the controller. Lower voltages, down to 0-5.5 Vdc will also work satisfactorily.

- b. Input signals greater than 7.5 Vdc

Input voltages greater than 7.5V require the addition of a drop-



Circuit Diagram for Input Signals Greater than 7.5 Vdc

ping resistor to reduce the voltage applied to P9 & P10 to a maximum of 7.5 V. This resistor, RS, should be connected in series with terminal P10 on the 15-446-5 mod board. The input signal should then be applied to one side of resistor RS and terminal P9 as shown above. This will result in a nominal voltage of 7.5 V applied to P9 & P10.

The value of RS should be determined as follows:

V_{in} = Voltage input signal

RS = Value of customer supplied series resistor in ohms.

$$RS = 680 V_{in} - 5100$$

The value of RS is not critical, therefore it is not necessary to use the exact value calculated for it. The nearest standard resistor value to the calculated value may normally be used, as long as the maximum voltage applied to P9 & P10 is between the limits of 5.5/7.5 Vdc.

The minimum wattage of resistor, RS, should be determined as follows:

P_{RS} = minimum wattage rating of RS

$$P_{RS} = \frac{2 (V_{in} - 7.5Vdc)^2}{RS}$$

1. Set the Auto/Manual switch to Auto.
2. Set the Ratio pot R19, located on the modification board, to 50% CW. Turn the process control ON and set it for minimum signal output.
3. With minimum signal output, start the controller and adjust the Bias pot R20 CW until the drive just begins to run. Then adjust the potentiometer CCW until the drive just stops (R20 on the modification board).

4. Set the process control for maximum signal output. Adjust the Ratio pot R19 (on the modification board) for the maximum speed.
5. Repeat Steps 3 and 4 until desired tracking is obtained.
6. For speed control signals independent of process control signals, place the switch in Manual and adjust the Manual Speed pot for desired speed.
7. Check motor current to make sure the motor is operating within its rating. If motor current exceeds the nameplate rating, shut it down and correct the problem. This completes the adjustment procedure.

NOTE:

Some transducer installations may cause the Low Signal Follower circuit to operate incorrectly. Typically in these applications there will be no control of the output at C1 and C2 on the controller, resulting in either no drive output or full output speed. Another possible problem is erratic drive speed. These problems are caused by signal noise into the follower circuit.

These problems can normally be corrected by jumpering the P9 terminal on the follower mod board to the COM terminal on the main 15-530-* controller board.

*15-530-2, 15-530-5 or 15-530-6.

CAUTION:

A 1/4 amp, 115 volt fuse must be installed in series with the P9 line from the transducer into the follower board when P9 and COM are jumpered as described above. This will prevent a possible runaway if a ground fault occurs in the drive.

Please consult an authorized Cutler-Ham-
mer/Dynatomic representative or the Field
Service department at the factory if you

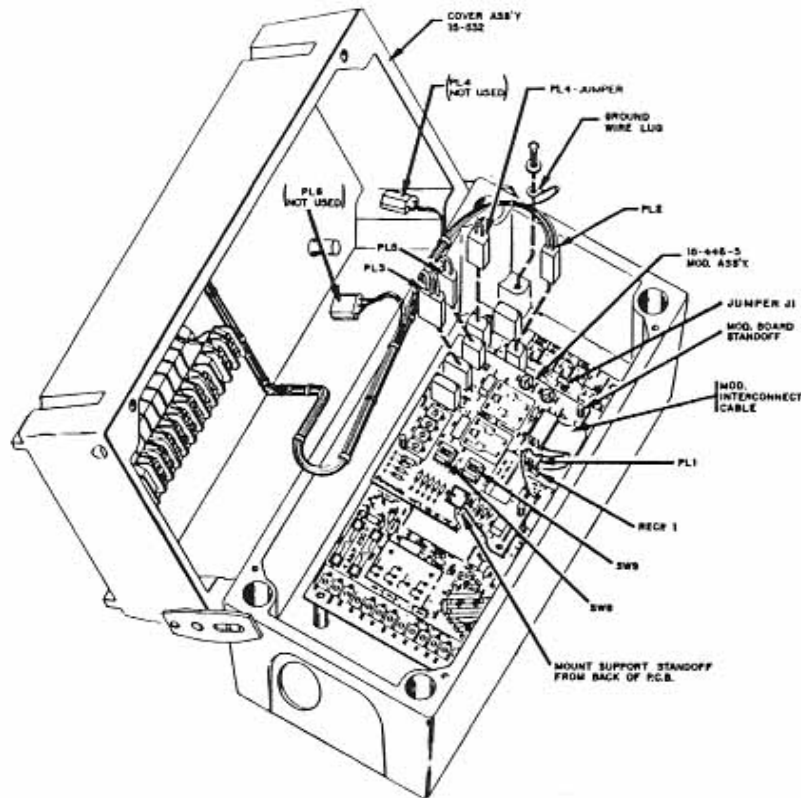
have any questions regarding these in-
stallations.

Renewal Parts List for Standard 4000 and 4050 Controllers
with Auto/Manual Low Signal Follower (Int. Ratio)

Qty	Part Number	Description	Legend
MODEL 4000 CONTROLLERS			
15-530-0005 MAIN PCB ASSEMBLY**			
1	27-123-0001	Mini-jumper	J1
* 2	32-018-4091	Fuse, 4 Amp, 250 V	FU1,2
* 1	53-398-0001	Relay, 4pdt, plug-in	E
15-533-1010 PANEL MOUNT			
* 1	15-530-0005	Main PCB (Refer to PCB parts list above.)	
* 1	15-446-0005	Low Signal Follower PCB assembly	
4	36-298-0010	Circuit board support	
15-535-1010 STANDARD ENCLOSURE			
* 1	15-530-0005	Main PCB (Refer to PCB parts list above.)	
* 1	15-446-0005	Low Signal Follower PCB assembly	
1	15-531-1001	Base assembly	
1	15-532-0007	Cover assembly	
* 1	15-529-0001	Pushbutton assembly	PB1,2
* 1	15-529-0003	Speed pot	R5
1	15-529-0008	Selector switch	SW
4	36-298-0010	Circuit board support	
15-536-1010 BLANK COVER			
* 1	15-530-0005	Main PCB (Refer to PCB parts list above.)	
* 1	15-446-0005	Low Signal Follower PCB assembly	
1	15-531-1001	Base assembly	
1	15-532-0000	Cover assembly (blank)	
4	36-298-0010	Circuit board support	
MODEL 4050 CONTROLLERS			
15-530-0006 MAIN PCB ASSEMBLY**			
1	27-123-0001	Mini-jumper	J1
* 2	32-028-0100	Fuse, 10 Amp, 250 V	FU1,2
* 1	53-398-0001	Relay, 4pdt, plug-in	E
15-539-0010 PANEL MOUNT			
* 1	15-530-0006	Main PCB (Refer to PCB parts list above.)	
* 1	15-446-0005	Low Signal Follower PCB assembly	
1	15-529-0019	Heat sink assembly, incl. Q1 & D3	
4	36-298-0010	Circuit board support	
15-540-0010 STANDARD ENCLOSURE			
1	15-539-0010	Basic Panel assembly (Refer to panel mount parts above.)	

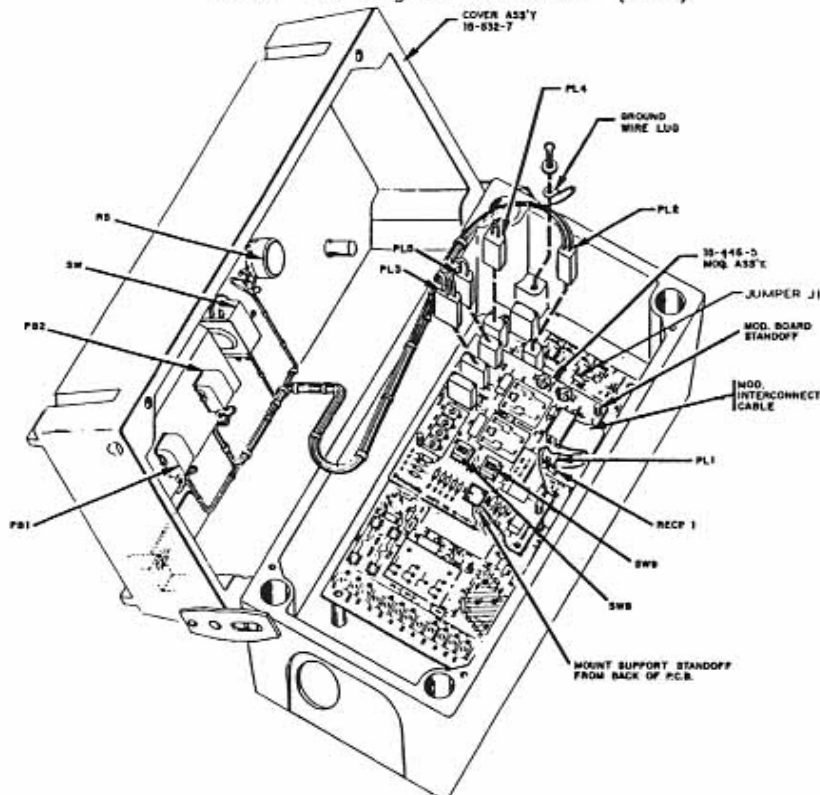
* denotes minimum spare parts.

** denotes suggested spares when downtime is critical.



15-536-1010C/-

Model 4000 Controller Blank Cover Version
With Low Signal Follower (Int)



15-535-1010C/A

Model 4000 Controller in Cast Enclosure with Auto/Manual
Low Signal Follower (Int) Modification Board 15-446-5 (shown)