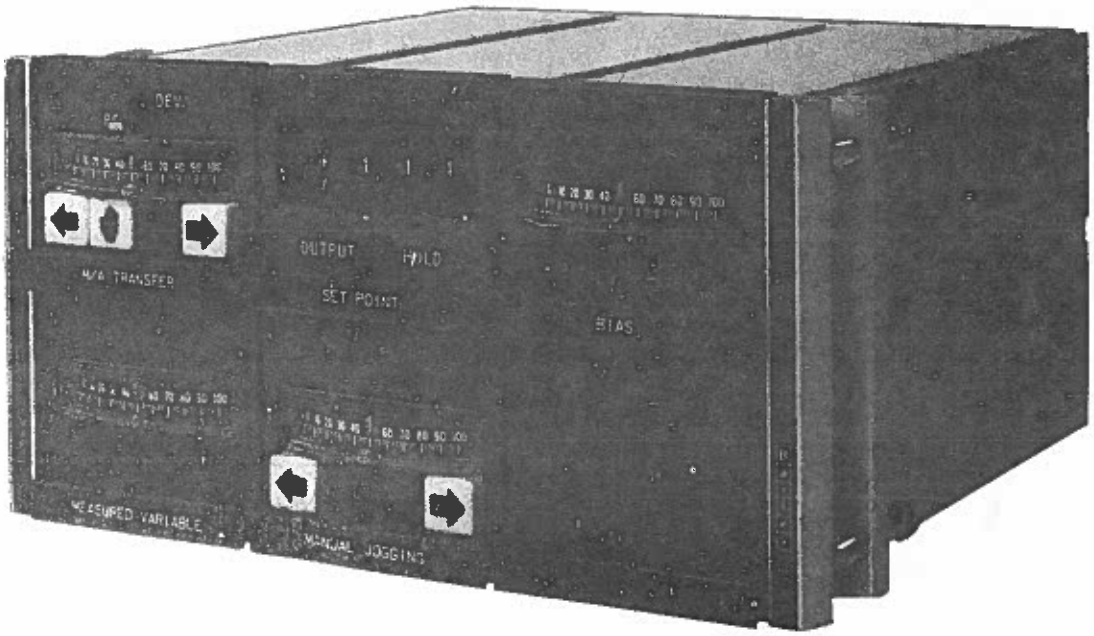
Bailey Control Systems	Product Instruction **E91-10**

Operator Interface Stations
Type T



A7412

Form E91-10A Litho in U.S.A. 681

Bailey Controls
Babcock & Wilcox, a McDermott company

WARNING

INSTRUCTION MANUALS

DO NOT INSTALL, MAINTAIN OR OPERATE THIS EQUIPMENT WITHOUT READING, UNDERSTANDING AND FOLLOWING PROPER **Babcock & Wilcox Bailey Controls** INSTRUCTIONS AND MANUALS, OTHERWISE INJURY OR DAMAGE MAY RESULT.

RADIO FREQUENCY INTERFERENCE

MOST ELECTRONIC EQUIPMENT IS INFLUENCED BY RADIO FREQUENCY INTERFERENCE (RFI). CAUTION SHOULD BE EXERCISED WITH REGARD TO THE USE OF PORTABLE COMMUNICATIONS EQUIPMENT IN THE AREA. PRUDENT PRACTICE DICTATES THAT CAUTIONING AGAINST THE USE OF PORTABLE COMMUNICATIONS EQUIPMENT BE TAKEN BY POSTING APPROPRIATE SIGNS IN YOUR PLANT.

AVERTISSEMENT

MANUELS D'OPERATION

NE PAS METTRE EN PLACE, RÉPARER OU FAIRE FONCTIONNER CE MATERIEL SANS AVOIR LU, COMPRIS ET SUIVI LES INSTRUCTIONS REGLEMENTAIRES DE **Babcock & Wilcox Bailey Controls** TOUTE NEGLIGENCE A CET EGARD POURRAIT ETRE UNE CAUSE D'ACCIDENT OU DE DEFAILLANCE DU MATERIEL.

PERTURBATIONS DE LA FREQUENCE RADIOPHONIQUE

LA PLUPART DES ÉQUIPEMENTS ÉLECTRONIQUES SONT SENSIBLES AUX PERTURBATIONS DE LA FRÉQUENCE RADIO. DES PRÉCAUTIONS DEVRONT ÊTRE PRISES LORS DE L'UTILISATION DE MATÉRIEL DE COMMUNICATION PORTATIF. LA PRUDENCE EXIGE QUE LES PRÉCAUTIONS À PRENDRE DANS CE CAS SOIENT SIGNALÉES AUX ENDROITS VOULUS DANS VOTRE USINE.

INDEX

	Page
INSTALLING THE OPERATOR INTERFACE STATIONS	4
PREPARING THE OPERATOR INTERFACE STATIONS FOR SERVICE	5
OPERATING PROCEDURES	6
ROUTINE SERVICING	8
TROUBLESHOOTING	8
CALIBRATING THE OPERATOR INTERFACE STATIONS	34
HOW THE OPERATOR INTERFACE STATIONS OPERATE	43
EXPLANATION OF NOMENCLATURE	47
SPECIFICATIONS	48
REPLACEMENT PARTS	50

LIST OF FIGURES

	Page
FIGURE 1 – Enclosure Trim and Mounting Hardware	4
FIGURE 2 – Removing Station from Enclosure	5
FIGURE 3 – Operating Controls and Indicators	7
FIGURE 4 – Bulb and Button Pullers	7
FIGURE 5 – Card Extender Station	9
FIGURE 6 – Transfer Station (TT20) Test Points	10
FIGURE 7 – Set Point Station (TG11) Test Points	12
FIGURE 8 – Signal Generator Stations (TG30, TG40) Test Points	13
FIGURE 9 – Measured Variable Stations (TY10, TY11) Test Points	14
FIGURE 10 – Manual Jogging Station (TJ20) Test Points	15
FIGURE 11 – Replacing Components of TY20 Measured Variable Station	16
FIGURE 12 – Replacing Components of TT20 Transfer and TJ20 Jogging Stations (TT20 shown)	16
FIGURE 13 – Replacing Components of TG11 Set Point Station	19
FIGURE 14 – Replacing Components of Signal Generator TG30, TG40 Stations (TG30 shown)	19
FIGURE 15 – Replacing Components of TY10, TY11 Measured Variable Stations (TY10 shown)	20
FIGURE 16 – Schematic Diagram for Type TT20 Transfer Station	16

LIST OF FIGURES (con't)

	Page
FIGURE 17 – Wiring Diagram for Type TT20 Transfer Station	22
FIGURE 18 – Schematic Diagram for Type TG11 Set Point Station	23/24
FIGURE 19 – Wiring Diagram for Type TG11 Set Point Station	25
FIGURE 20 – Schematic Diagram for Types TG30, TG40 Signal Generator Stations	26
FIGURE 21 – Wiring Diagram for Types TG30, TG40 Signal Generator Stations	27
FIGURE 22 – Schematic Diagram for Types TY10, TY11 Measured Variable Stations	28
FIGURE 23 – Wiring Diagram for Types TY10, TY11 Measured Variable Stations	29
FIGURE 24 – Schematic Diagram for Type TY20 Measured Variable Station	29
FIGURE 25 – Wiring Diagram for Type TY20 Measured Variable Station	30
FIGURE 26 – Schematic Diagram for Type TJ20 Manual Jogging Station	31
FIGURE 27 – Wiring Diagram for Type TJ20 Manual Jogging Station	32
FIGURE 28 – Printed Circuit Board Component Locations (all T Stations)	33
FIGURE 29 – Set Point Station (TG11) Adjustments	36
FIGURE 30 – TG11 Coarse Zero Switch Setting Examples	37
FIGURE 31 – TG11 Coarse Span Switch Setting Examples	37
FIGURE 32 – Signal Generator Stations (TG30, TG40) Adjustments (TG30 shown)	39
FIGURE 33 – Measured Variable Stations (TY10, TY11) Adjustments (TY10 shown)	39
FIGURE 34 – Meter Zero Adjustment (TJ20 shown)	40
FIGURE 35 – Calibration Circuit for TY20 Station	41
FIGURE 36 – Calibration Circuits for TG11, TG30 and TG40 Stations	41
FIGURE 37 – Calibration Circuits for TY10, TY11 Measured Variable Stations	42
FIGURE 38 – Simplified Schematic for Transfer Station (TT20)	42
FIGURE 39 – Simplified Schematic for Set Point Station (TG11)	44
FIGURE 40 – Simplified Schematic for Signal Generator Stations (TG30 and TG40)	44
FIGURE 41 – Simplified Schematic for Measured Variable Stations (TY10 and TY11)	46
FIGURE 42 – Simplified Schematic for Manual Jogging Station (TJ20)	46
FIGURE 43 – Parts Drawing E91-10-1, Type TT20 Transfer Station and Type TJ20 Manual Jogging Station	51
FIGURE 44 – Parts Drawing E91-10-2, Type TG11 Signal Generator Set Point Station	52
FIGURE 45 – Parts Drawing E91-10-3, Types TG30, TG40 Signal Generator Stations	53
FIGURE 46 – Parts Drawing E91-10-4, Types TY10, TY11 and TY20 Measured Variable Stations	54
FIGURE 47 – Parts Drawing E91-10-6, Type TO10 Blank Station	55
FIGURE 48 – Parts Drawing E91-10-7, Type TZ Enclosure	56
FIGURE 49 – Parts Drawing E91-10-8, Plug-In Connector Assemblies for Operator Interface Stations	57
FIGURE 50 – Type T Stations Front Plate Controls and Typical Assembly Dimensions	58
FIGURE 51 – Mounting Dimensions for Type TZ Enclosures and Arrays	59

INSTALLING THE OPERATOR INTERFACE STATIONS

Unpacking

Check for obvious damage to carton and contents.

Installing the Enclosure

Type T Operator Interface Stations mount in type TZ Enclosures.

The type TZ Enclosures may be panel mounted either individually or in high-density arrays of up to 100 units. Figures 50 and 51 at the rear of the manual give the Enclosure dimensions, panel cutout sizes and other information necessary for individual and array mounting. Figure 1 shows the use of trim and mounting hardware. Study these drawings carefully before beginning the installation procedures outlined below.

1. Determine number of Enclosures to be mounted (maximum number in a single array is 150 Enclosures, stacked 15 units high and ten units wide).

2. Measure and cut mounting hole in panel. Follow exact dimensions (including tolerances) given in Figure 51 at the rear of the manual.

3. Arrange first row of Enclosures on work bench. Place them side-by-side with fronts facing one direction.

4. Open trim package containing trim pieces and housing keys as specified per job requirements.

5. Key Enclosures together as illustrated in Figure 1. Drive keys into tracks with soft mallet (top and bottom, front and rear).

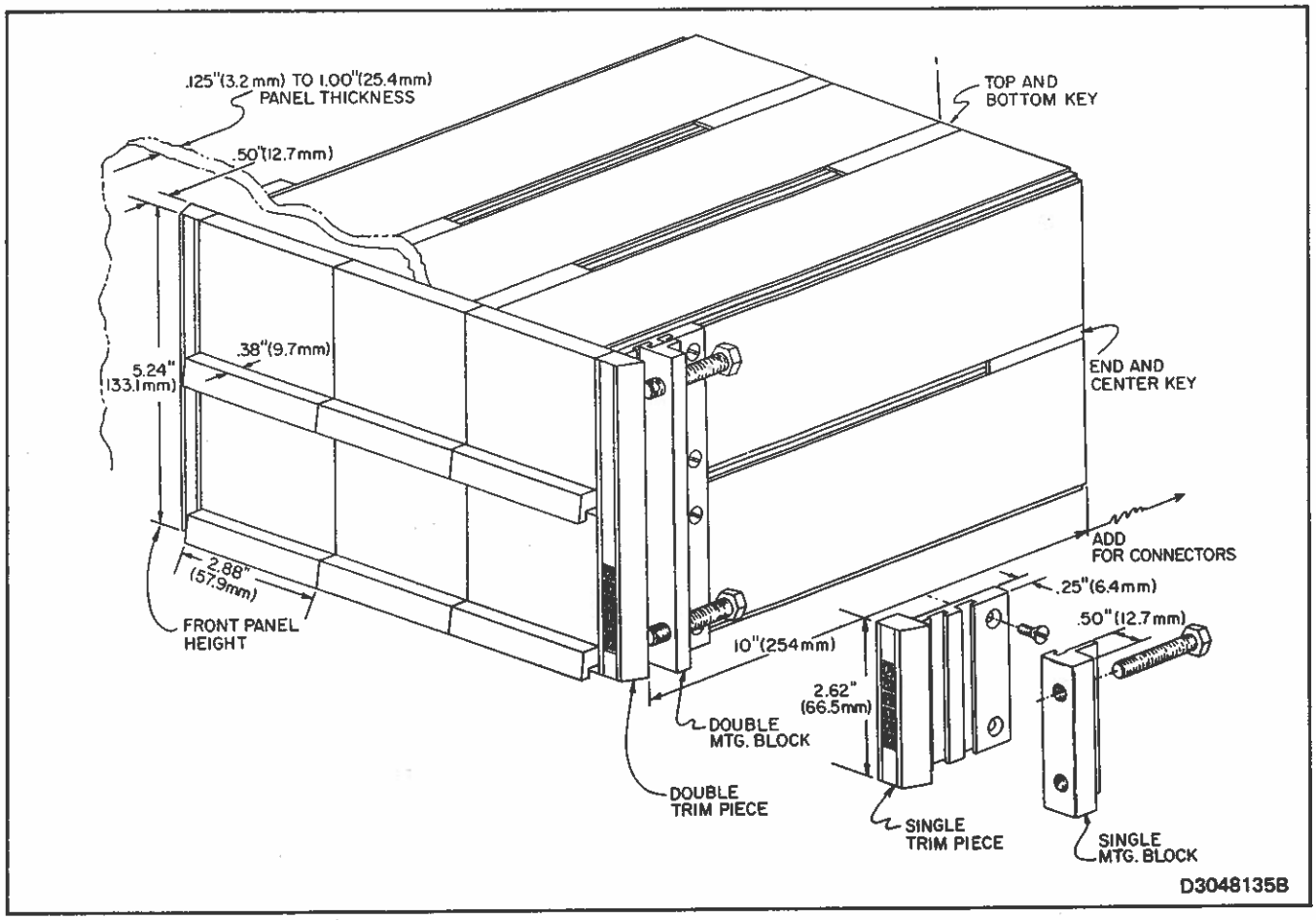


FIGURE 1 – Enclosure Trim and Mounting Hardware

6. Key succeeding rows of Enclosures to first row as described in step 5.

7. Mount trim pieces at both ends of Enclosure or Enclosure array (refer to Figure 1).

8. From front of panel, insert Enclosure or Enclosure array into panel cutout until trim is flush with panel. Center Enclosure(s) in cutout.

9. Insert mounting clips (Parts Drawing E91-10-7) with long screws installed into grooves of mounting flanges and tighten screws against back of panel (refer to Figure 51).

10. Install connector and cable assembly to rear plate (refer to Figure 1 and Parts Drawing E91-10-8).

Mounting The Stations

Each type T Operator Interface Station installs in a single type TZ Enclosure. Input, output and power supply connect thru a plug-in connector and cable assembly mounted to the Enclosure back plate. Typical station dimensions and front plate layouts are shown in Figure 50 at the rear of the manual.

Install the Operator Interface Station as follows:

1. Determine Station type corresponding to Enclosure position from System drawings.

2. Set Point Stations have normal-reverse jumpers which must be properly positioned before placing the system in service.

3. Pull-out handle on Station front plate to stop (Figure 2).

4. Insert Station into designated Enclosure until back of front plate mates with Enclosure; push handle to latch Station in Enclosure.

NOTE: Type T Operator Interface Stations may require calibration to system engineering units. Refer to "Calibrating the Operator Interface Stations" for calibrating instructions.

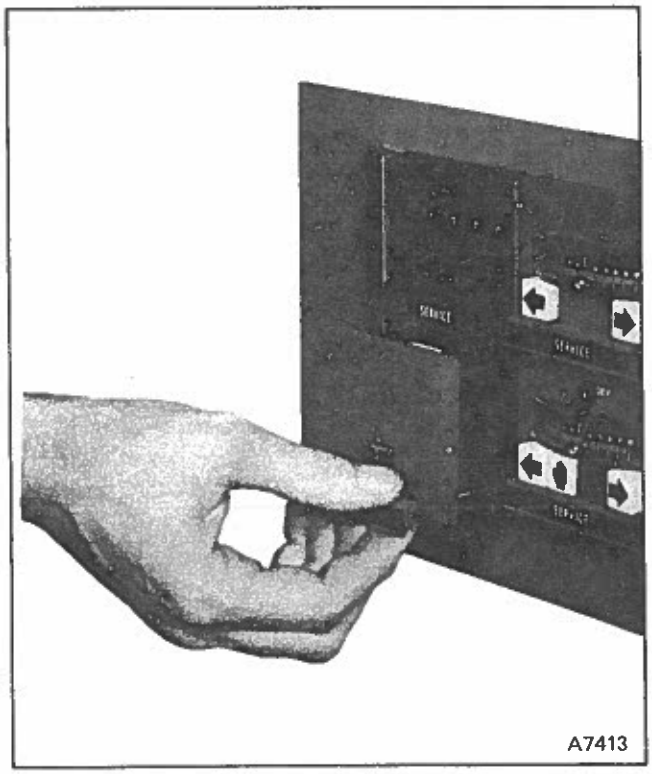


FIGURE 2 – Removing Station from Enclosure

PREPARING THE OPERATOR INTERFACE STATIONS FOR SERVICE

NOTE: Make certain all cable assemblies are connected in accordance with system design drawings.

Set Point, Signal Generator and Measured Variable Stations

1. Pull handle out and withdraw Station from Enclosure (Figure 2).

2. Set normal-reverse (NOR-REV) staple jumpers (where applicable) to desired position.

3. Re-install Station in Enclosure.

4. Energize station as outlined under "Operating Procedures".

OPERATING PROCEDURES

Transfer Station (refer to Figure 3)

1. Energize Transfer Station and associated Analog Control System instruments. Yellow pushbutton with black hand should be illuminated to indicate manual control.

2. Manual operation - select POS. position of toggle switch on Station front plate. In POS. position, meter indicates remote operator position or Memory module output from 0 to 100%. Depress increase and decrease pushbuttons as necessary to control remote operator or Static Analog Memory module output. Increase pushbutton has arrow pointing right. Decrease pushbutton has arrow pointing left.

3. Transferring from Manual to Automatic - depress automatic pushbutton (green pushbutton with black circular arrows representing closed loop control). If Transfer Station is used in conjunction with an electric power operator, hold automatic pushbutton in for at least 1/2 second before releasing to ensure completion of transfer. Green pushbutton is illuminated during automatic operation.

NOTE: To prevent controlling to undesired set point or demand signals, balancing before transfer may be required. To balance:

a. Select DEV position of toggle switch. (A– or +12.5% difference signal will cause meter deflection to end of scale.)

b. Change manual control or set point signals until front plate meter reads 50% (0 DEV).

c. Depress automatic pushbutton.

d. Move toggle switch to POS.

4. Transferring from Automatic to Manual - depress manual pushbutton and hold manual pushbutton in for about 1/2 second before releasing to ensure completion of transfer. Manual pushbutton is illuminated during manual control.

Set Point Station (refer to Figure 3)

1. Position four thumbwheels to desired set point. Thumbwheel switch is read left-to-right across Station front plate.

2. Energize Set Point Station and associated Analog Control System instruments.

NOTE: To change set point during operation, depress pushbutton under thumbwheel switch while making change. This holds set point constant as thumbwheels are repositioned. Releasing pushbutton when set point change is complete allows output integrator to change set point to new set value at a constant one percent per second rate.

Signal Generator Stations (refer to Figure 3)

1. Position thumbwheel dial on Station front plate to desired output as indicated by dial engraving opposite red arrow.

2. Energize Station and associated Analog Control System instruments.

Measured Variable Station (refer to Figure 3)

1. Energize Measured Variable Station and associated Analog Control System instruments.

2. Position front plate toggle switch down if measured variable signal is between 0 and 60% or up if measured variable signal is between 40 and 100%. Switch position can be up or down for measured variable signals between 40 and 60%.

Manual Jogging Station (refer to Figure 3)

1. Energize associated Analog Control System instruments.

2. Depress increase and decrease pushbuttons as necessary to control remote operator or Static Analog memory module output. Increase pushbutton has arrow pointing right. Decrease pushbutton has arrow pointing left. Front plate meter gives position or module output reading in percent.

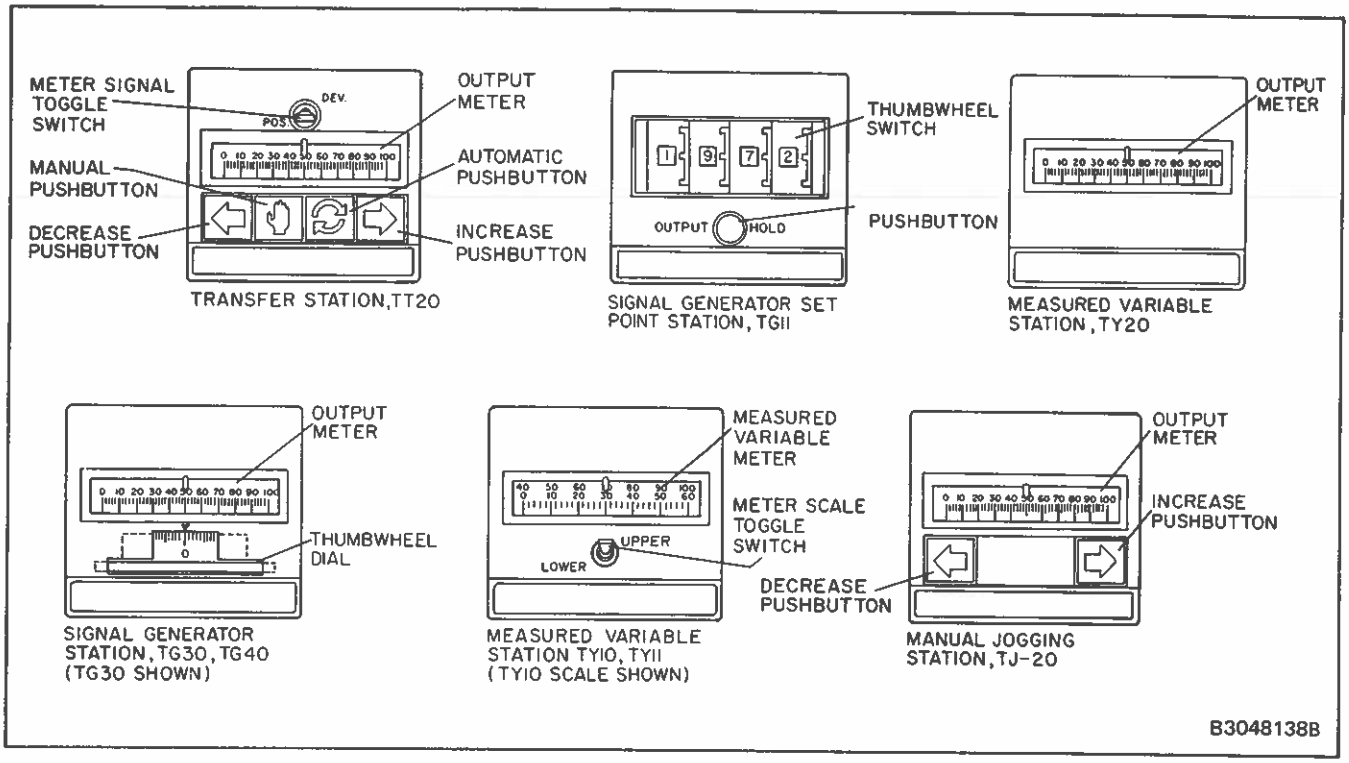


FIGURE 3 — Operating Controls and Indicators

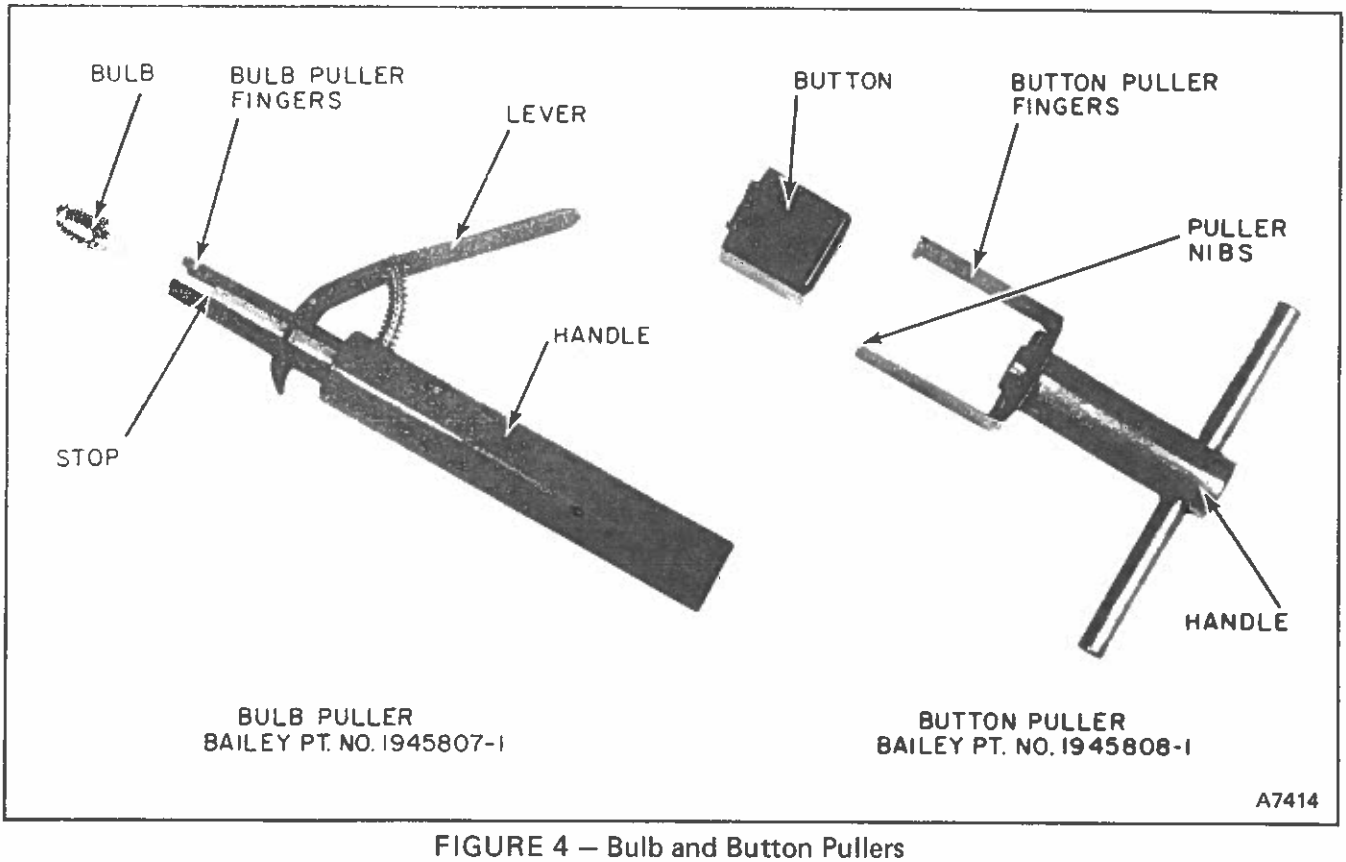


FIGURE 4 — Bulb and Button Pullers

ROUTINE SERVICING

The Operator Interface Stations require no routine servicing. If periodic cleaning of the front plate surfaces is desired, use a soft cloth which will not scratch the finish. If a solvent is needed, use one which will not react with plastic.

A procedure for replacing the bulbs behind the automatic/manual - increase/decrease pushbuttons in the Transfer and Jogging Stations follows.

Bulb Replacement In Automatic/Manual - Increase/Decrease Pushbutton

This procedure is accomplished using button puller (Pt. No. 1945808-1) and bulb puller (Pt. No. 1945807-1) (Figure 4).

NOTE: If desired, Station may be removed from Enclosure. When removed, the output signal remains as it was.

1. Remove pushbutton with button puller by inserting fingers of puller at sides of button until puller nibs engage with back of button. Pull handle of puller with one hand while bracing Station front plate with other hand.

2. Insert fingers of bulb puller over bulb to stop. Press lever on handle of puller to grip bulb base (do not grip glass). Pull handle of puller straight back (use slight twisting motion) while bracing other hand against front plate. Release lever and remove bulb from puller.

3. Insert new bulb to stop in bulb puller. Lightly grip base of bulb by pressing on lever. Push bulb in socket of pushbutton until bulb base latches with socket (use slight twisting motion while inserting bulb). Release lever and remove bulb puller.

4. Remove pushbutton from button puller. Install button on pushbutton by positioning slot in back of button on pushbutton lever.

NOTE: When Station is in automatic mode and manual button is being replaced, press and hold automatic button to prevent Station from switching to manual mode. When Station is in manual mode and automatic button is being replaced, press and hold manual button to prevent Station from switching to automatic mode.

Be sure to press button being replaced to the stop on pushbutton lever.

TROUBLESHOOTING

GENERAL

If an Operator Interface Station malfunctions, refer to the Fault Correction Charts to isolate the problem to a particular component or group of components. Use the Card Extender Station for access to test points. Component replacement procedures and schematic, wiring and component location diagrams (Figures 12 thru 28) follow the Fault Correction Charts.

If problem cannot be determined, contact a Bailey service representative.

CAUTION

Do not make wiring changes to the circuit board while this unit is connected to the process system. Disconnect this unit from the mounting unit or the cable connector or any other source of electrical power before making wiring changes.

ATTENTION

Ne pas modifier le câblage de la plaquette de circuit tant que l'appareil est raccordé au système de processus. Avant toute modification du câblage, il est essentiel de déconnecter cette unité de l'appareil sur lequel elle est montée ou de débrancher le connecteur de câbles ou toute autre alimentation électrique.

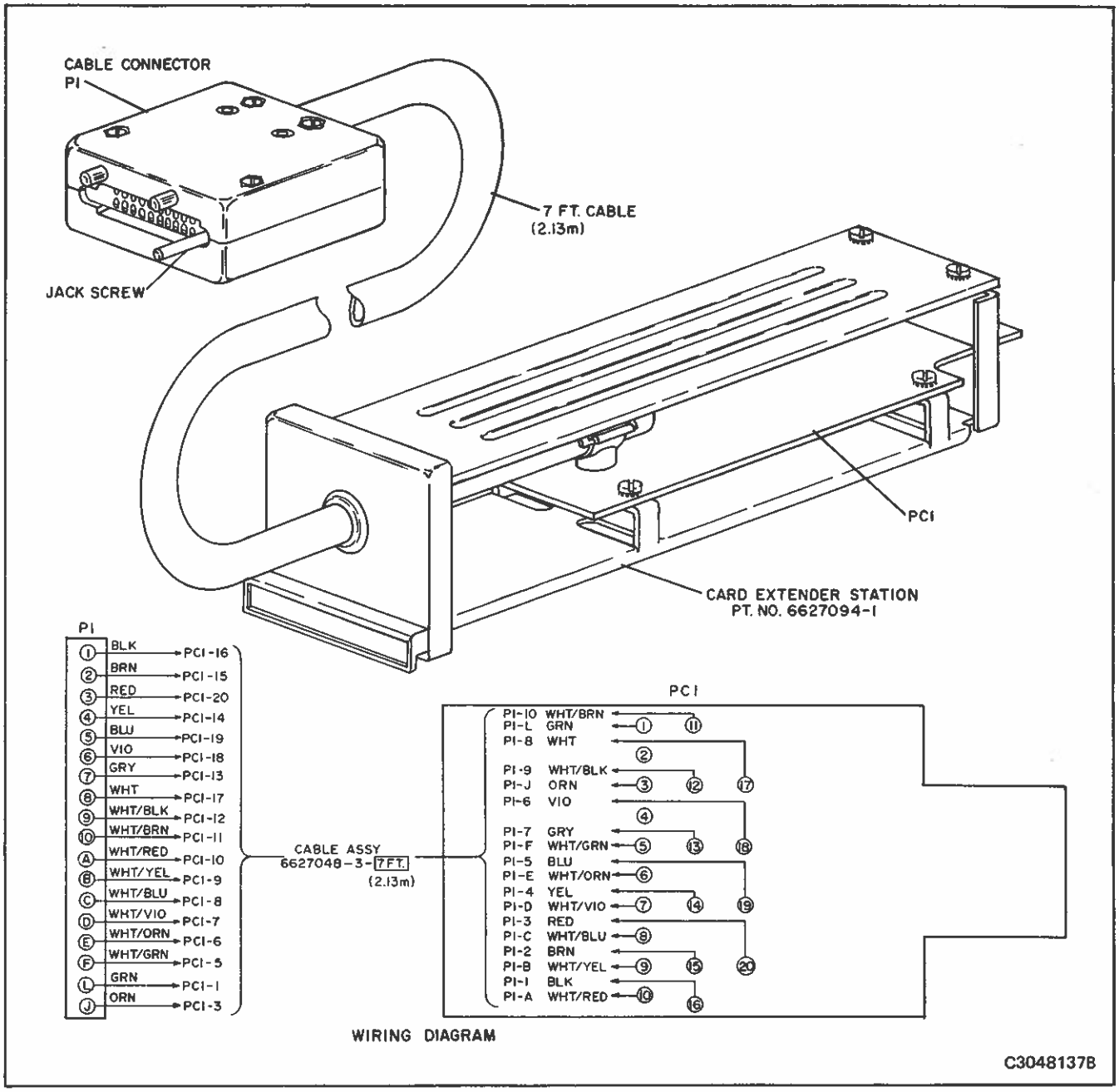


FIGURE 5 – Card Extender Station

Using the Card Extender Station

The Card Extender Station, Pt. No. 6627094-1 (Figure 5) is a troubleshooting aid. Its use allows other Stations to be tested under actual System conditions. Use the Card Extender Station as follows:

1. Remove Station to be tested from Enclosure and place on working surface located within seven feet of Enclosure mounting.

2. Plug Card Extender Station cable connector into Station being tested (looking at back of Station, connector jack screw fits in hole to left of printed circuit board connector).

3. Insert and latch Card Extender Station into Enclosure of test Station. This energizes Station being tested.

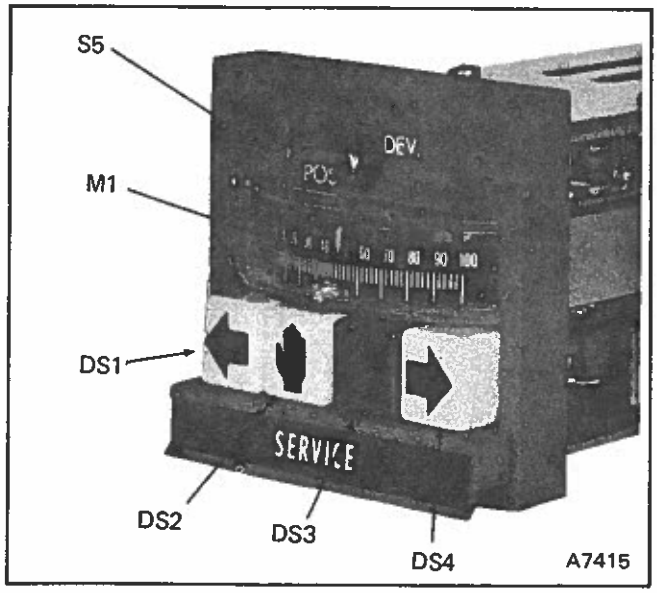


FIGURE 6 — Transfer Station (TT20) Test Points

FAULT ISOLATION CHARTS

NOTE: Follow the Fault Correction Charts in given step order. Connect voltage readings must be obtained before proceeding to the next step. If a trouble is found, correct trouble and repeat all steps of Fault Correction Chart, beginning at step 1. Refer to Figure 28 for printed circuit board component locations for all stations. Actual repair of an Operator Interface Station should be attempted only by qualified personnel.

Transfer Station TT20 (refer to Figure 6)

TROUBLE	PROBABLE CAUSE	CORRECTION
1. With ±2.5 V dc applied between P1-1 (+) and P1-2 (—) and toggle switch in DEV position, meter M1 does not deflect or deflection is erratic.	1. Resistor R2, toggle switch S5 or meter M1 defective.	1. Replace defective part.
2. With ±10 V dc applied between P1-3 (+) and P1-4 (—) and toggle switch in POS position, meter M1 does not deflect full scale or deflection is erratic.	1. Resistor R1, toggle switch S5 or meter M1 defective.	1. Replace defective part.
3. With 24 V dc applied between P1-D and P1-F, lamp DS1 does not light.	1. Lamp DS1 defective.	1. Replace defective lamp.
4. With 24 V dc applied between P1-J and P1-F lamp DS2 does not light.	1. Lamp DS2 defective	1. Replace defective lamp.
5. With —24 V dc applied between P1-E and P1-F, lamp DS3 does not light.	1. Lamp DS3 or diode CR1 defective.	1. Replace defective part.
6 With 24 V dc applied between P1-C and P1-F, lamp DS4 does not light.	1. Lamp DS4 defective.	1. Replace defective lamp.

Set Point Station TG11 (refer to Figure 7)

Before proceeding with this fault correction chart, double check station calibration.

TROUBLE	PROBABLE CAUSE	CORRECTION
1. Test point A does not equal −24 ±2.4 V dc.	1. Connector improperly connected to enclosure.	1. Secure connector
	2. Connector-cable assembly defective	2. Repair or replace defective part
	3. Faulty power supply	3. Repair or replace power supply
2. Test point B does not equal −12 ±1 V dc	1. Regulator U2 defective	1. Replace defective part
3. Test point C does not equal +15 ±1 V dc	1. Connector improperly connected to enclosure	1. Secure connector.
	2. Connector-cable assembly defective	2. Repair or replace defective part.
	3. Faulty power supply	3. Repair or replace power supply
	4. Regulator U1 defective	4. Replace defective part
4. Test point D does not equal −15 ±1 V dc	1. Resistor R15 or Zener diode CR2 defective.	1. Replace defective part.
5. Test point E does not equal −9.7 ±1 V dc.	1. Resistor R6 or Zener diode CR3 defective.	1. Replace defective part.
6. Test point F does not equal +9.7 ±1 V dc.	1. Resistors R5, R6, U17, Oper. Ampl., U3, or Transistor Q1 defective.	1. Replace defective part.
7. Test point G does not have a nominal 400 KHz square wave present.	1. Oscillator U4 defective.	1. Replace defective part.
8. With coarse zero set at 10^2 = "9", 10^3 = "15" and coarse span set at 10^2 = "0", 10^3 = "10", test point H does not have a nominal 40 Hz square wave present.	1. IC's U5 thru U15 may be defective.	1. Replace defective part.
9. Duty cycle (On time vs. Off time) of square wave at test point H does not vary with thumbwheel setting.	1. Thumbwheel defective	1. Replace defective part.
	2. Resistors R1, R2, R3, or or R4 defective.	2. Replace defective part.
	3. IC's U9, U10, U11, or U12 defective.	3. Replace defective part.

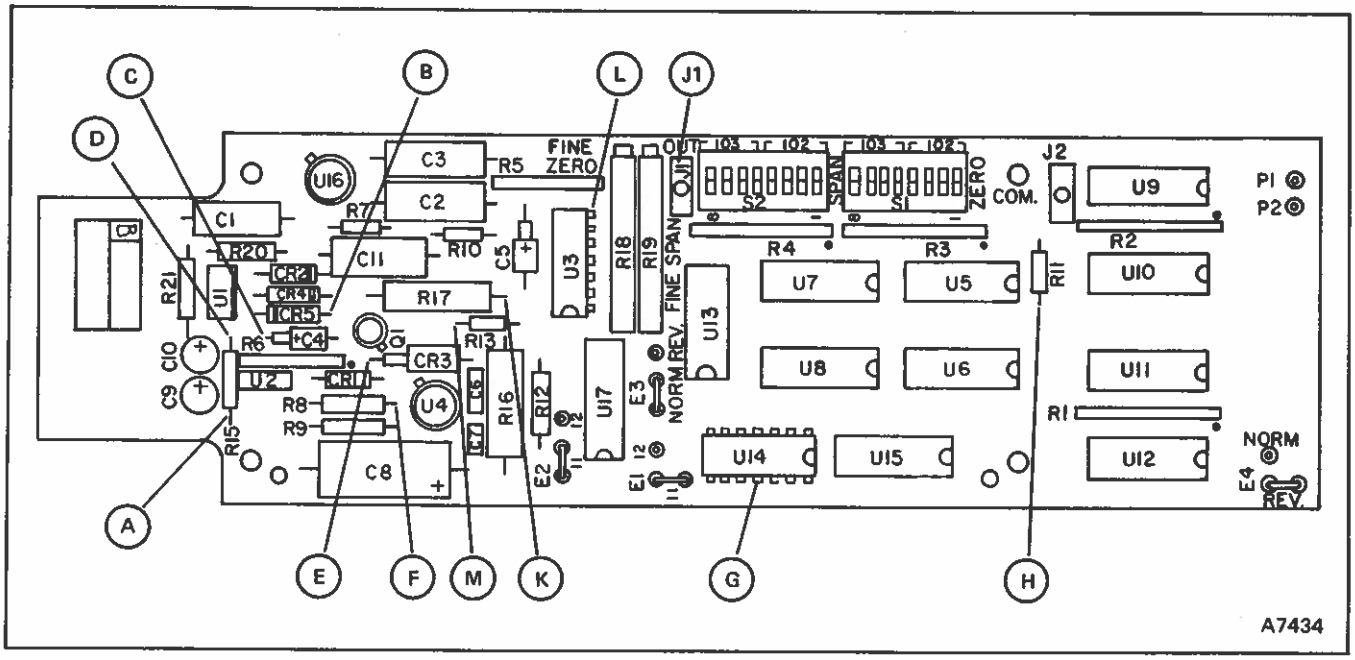


FIGURE 7 – Set Point Station (TG11) Test Points

(TG11 Continued)

10. Test point M does not vary over an approximate 16 V dc range with thumbwheel setting.	1. IC U3 defective.	1. Replace defective part.
11. Test point K does not vary over an approximate 16 V dc range with thumbwheel setting.	1. IC U3 defective	1. Replace defective part.
12. Test point L does not change to either approximately +14 V dc or –12 V dc when large thumbwheel changes are made.	1. IC U3 defective	1. Replace defective part.
13. Test point J1 does not integrate at 0.1 ±0.05 V dc per second when thumbwheel setting is changed.	1. IC U16, capacitor C1, R7, R14, R5, R6, or S3 defective.	1. Replace defective part.

Signal Generator Stations TG3, TG40 (refer to Figure 8)

TROUBLE	PROBABLE CAUSE	CORRECTION
All voltage readings are in reference to common, test jack J3.		
1. Test point A does not equal +24 (±2.4) V dc and/or test point B does not equal –24 ±2.4 V dc.	1. Connector improperly connected to Enclosure.	1. Secure connector.
	2. Connector-cable assembly defective	2. Repair or replace defective part.
	3. Faulty power supply.	3. Repair or replace power supply.

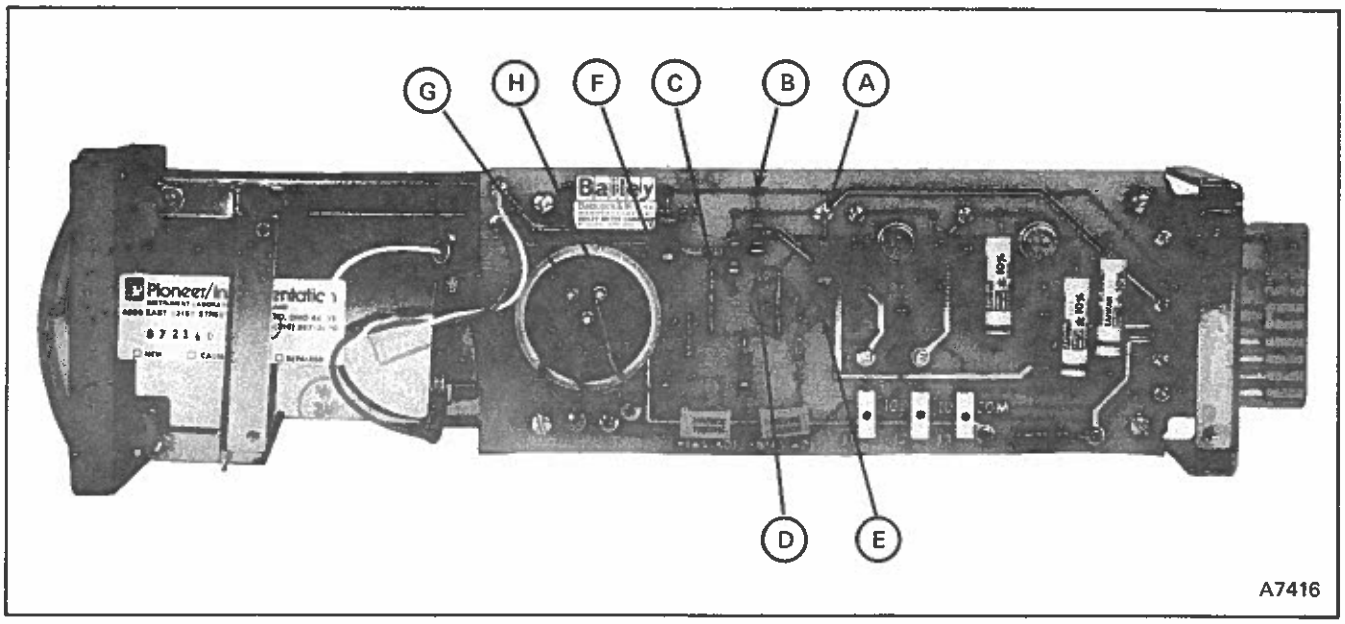


FIGURE 8 – Signal Generator Stations (TG30, TG40) Test Points

(TG30, TG40 Continued)

2. Test point C does not equal +15 ±1 V dc.	1. Resistor R3 or Zener Diode CR3 defective.	1. Replace defective part.
3. Test point D does not equal –15 ±1 V dc.	1. Resistor R2 or Zener Diode CR2 defective.	1. Replace defective part.
4. Test point E does not equal +11.7 ±0.75 V dc.	1. Resistor R4 or Zener Diode CR4 defective.	1. Replace defective part.
5. Test point F does not equal –11.7 ±0.75 V dc.	1. Resistor R1 or Zener Diode CR1 defective.	1. Replace defective part.
6. Test point G does not have –8.6 to –11.7 V dc range when R6 is adjusted.	1. Resistor R6 or R8 defective.	1. Replace defective part.
7. Test point H does not have +8.6 to +11.7 volt dc range when R7 is adjusted.	1. Resistor R7 or R9 defective.	1. Replace defective part.
8. Test jack J1 has no output or is saturated at approx. 15 volts dc.	1. Resistor R5, R10, R11 or oper. ampl. U1 defective.	1. Replace defective part.
9. Output at J1 is ±10 volts dc but test jack J2 has no output or is saturated at approx. 15 volts dc	1. Resistor R12, R13, R14 capacitor C1 or oper. ampl. U2 defective.	1. Replace defective part.
10. With ±10 volts dc applied between P1-3 (+) and P1-4 (–), meter M1 does not deflect or defection is erratic.	1. Resistor R15 or meter M1 defective.	1. Replace defective part.

Measured Variable Station TY10, TY11 (refer to Figure 9)

TROUBLE	PROBABLE CAUSE	CORRECTION
All voltage readings are in reference to common, test jack J8.		
1. Test point A does not equal +24 ±2.4 V dc and/or test point B does not equal −24 ±2.4 V dc.	1. Connector improperly connected to Enclosure.	1. Secure connector.
	2. Connector-cable assembly defective	2. Repair or replace defective part.
	3. Faulty power supply.	3. Repair or replace power supply.
2. Test point C does not equal +15 ±1 V dc.	1. Resistor R2 or Zener Diode CR3 defective.	1. Replace defective part.
3. Test point D does not equal −15 ±1 V dc.	1. Resistor R1 or Zener Diode CR1 defective.	1. Replace defective part.
4 Test point E does not equal +9 ±0.5 V dc.	1. Resistor R3 or Zener Diode CR4 defective.	1. Replace defective part
5. Test point F does not equal −9 ±0.5 V dc.	1. Resistor R15 or Zener Diode CR3 defective.	1. Replace defective part.
6. Test point G does not have +3.5 to +4.5 V dc range when R5 is adjusted.	1. Resistor R4, R5, or R6 defective.	1. Replace defective part.
7. Test point H does not have −3.5 to −4.5 V dc range when R8 is adjusted.	1. Resistor R7, R8 or R9 defective.	1. Replace defective part.
8. Voltage at test jack J2 does not vary between ±6 V dc as input signal at test jack J1 varies between ±10 V dc.	1. Staple Jumpers improperly positioned.	1. Position staple jumpers as specified by Station calibration.

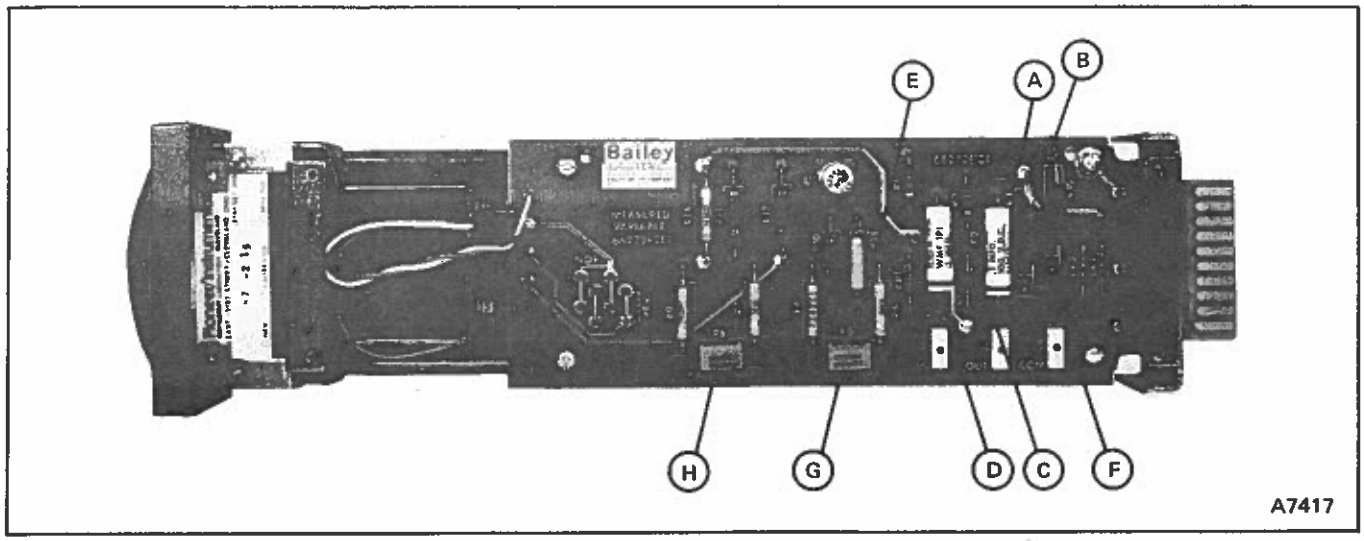


FIGURE 9 – Measured Variable Stations (TY10, TY11) Test Points

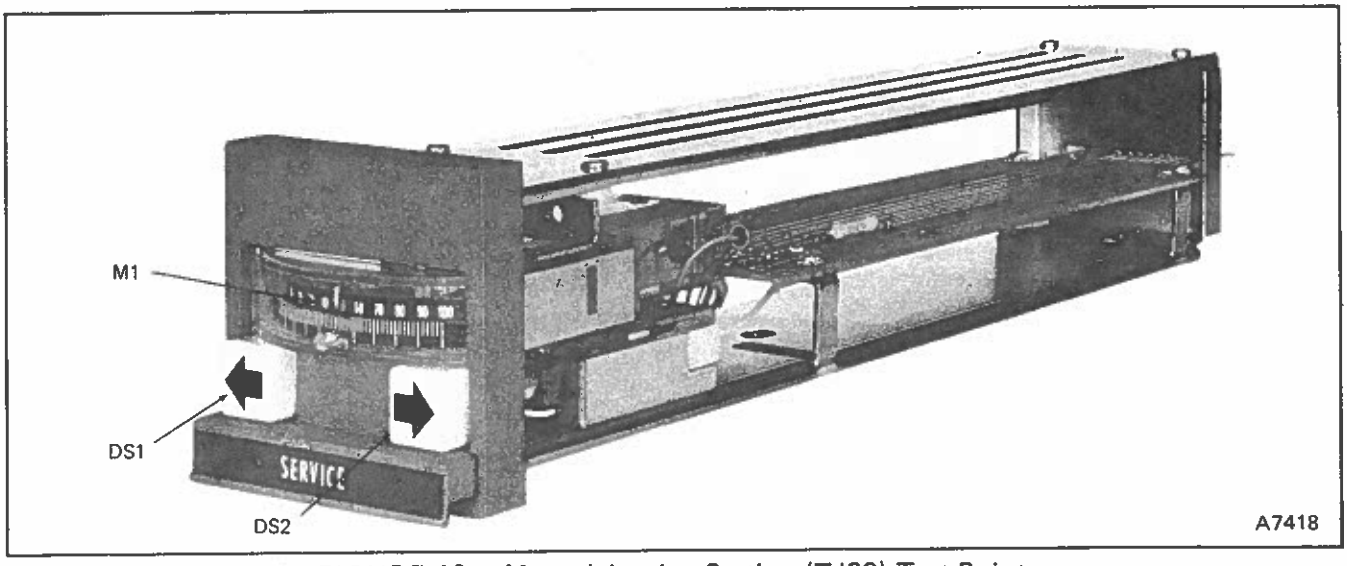


FIGURE 10 – Manual Jogging Station (TJ20) Test Points

(TY10, TY11 Continued)

	2. Resistor R10, R11, R12, R13, oper. ampl. U1 or toggle switch S2 defective.	2. Replace defective part.
9. With 6 V dc signal at test jack J2 meter M1 does not deflect or deflection is erratic.	1. Resistor R14 or meter M1 defective; staple jumper positioned wrong.	1. Replace defective part.

Manual Jogging Station TJ20 (refer to Figure 10)

TROUBLE	PROBABLE CAUSE	CORRECTION
1. With 10 V dc applied between P1-3 (+) and P1-4 (–), meter M1 does not deflect or deflection is erratic.	1. Resistor R1 or meter M1 defective.	1. Replace defective part.
2. With 24 V dc applied between P1-D and P1-F, lamp DS1 does not light.	1. Lamp DS1 deflective	1. Replace defective lamp.
3. With 24 V dc applied between P1-C and P1-F, lamp DS2 does not light.	1. Lamp DS2 defective.	1. Replace defective lamp.

Measured Variable Station TY20 (refer to Figures 11 & 24)

TROUBLE	PROBABLE CAUSE	CORRECTION
1. With ±10 volts dc applied between P1-1 (+) and P1-F (–), meter M1 does not deflect full scale or deflection is erratic.	1. Resistor R1 or meter M1 defective.	1. Replace defective part.

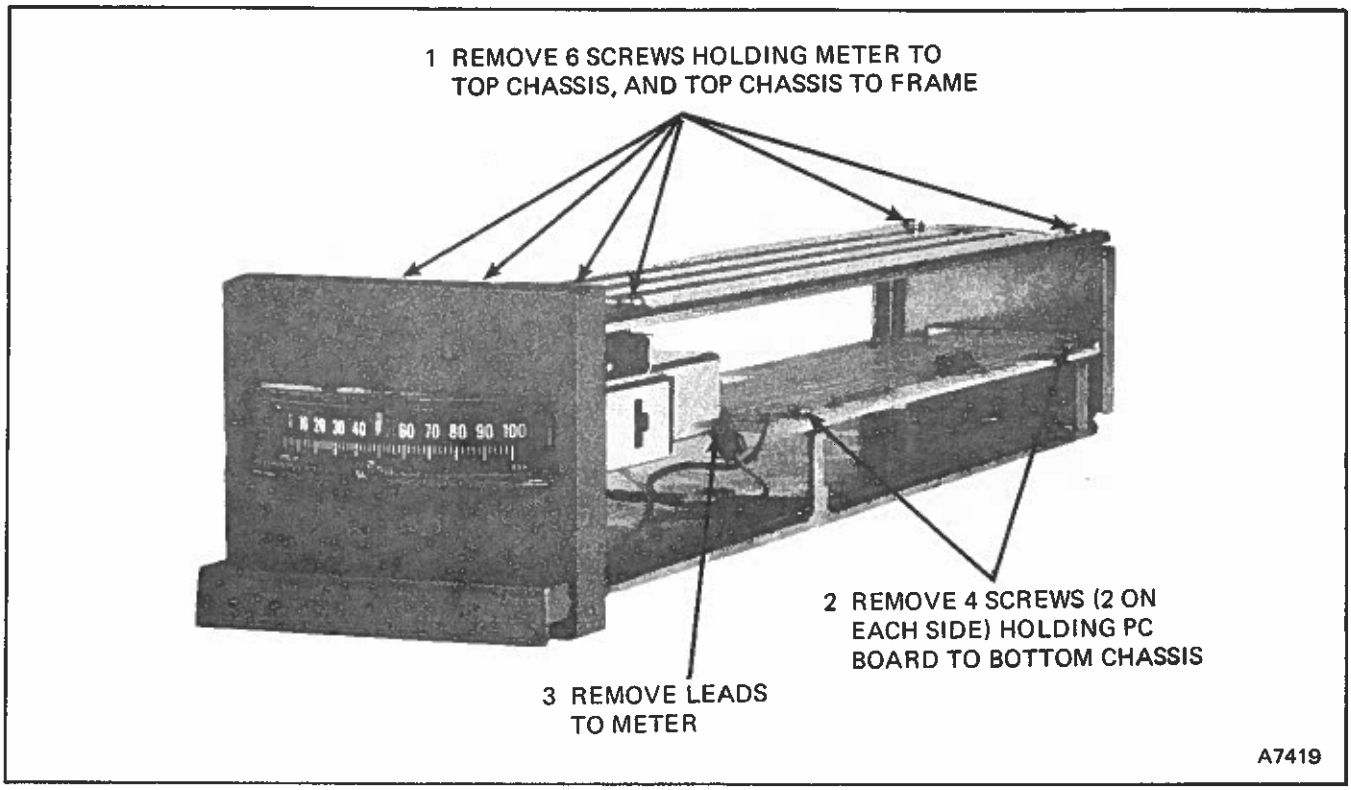


FIGURE 11 – Replacing Components of TY20 Measured Variable Station

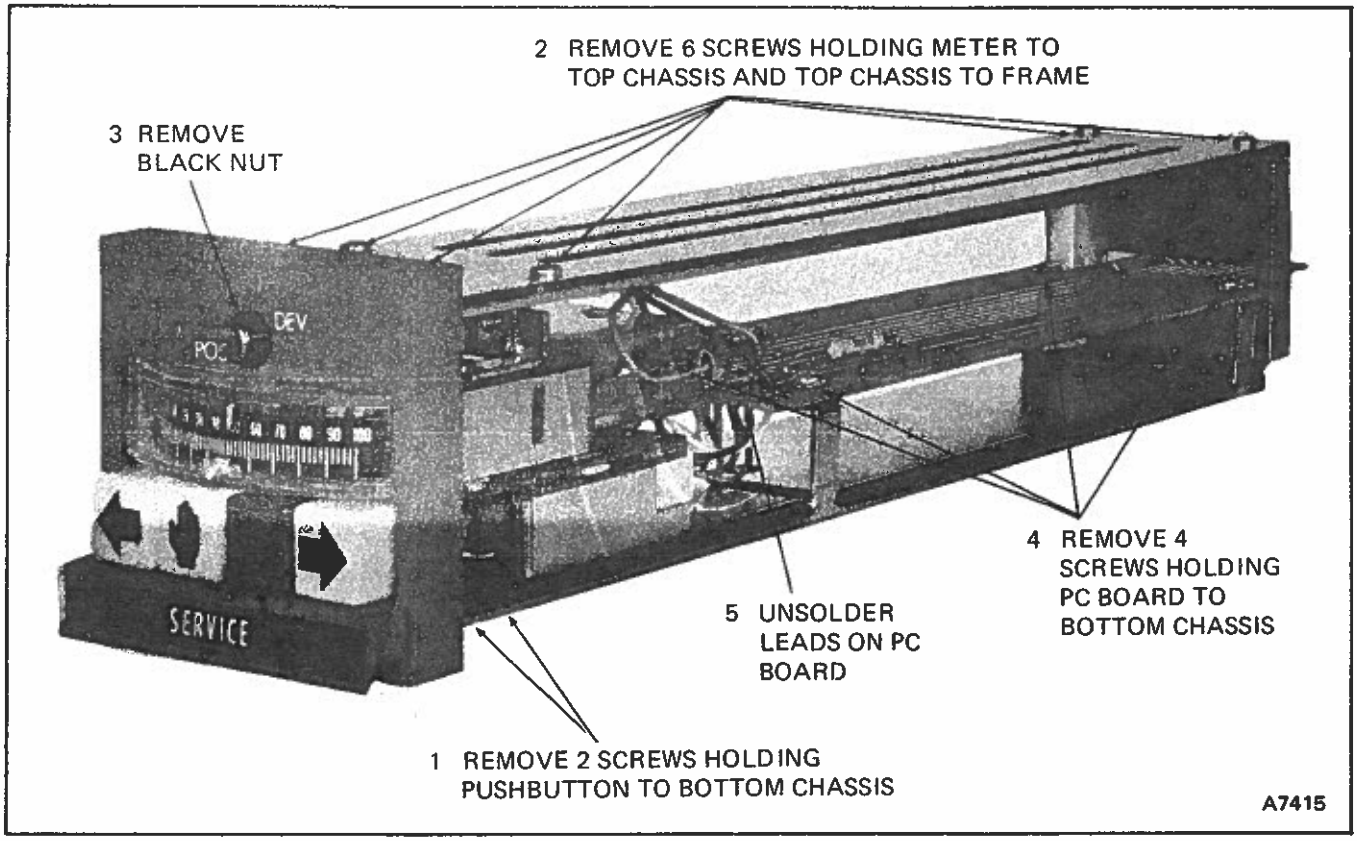


FIGURE 12 – Replacing Components of TT20 Transfer and TJ20 Jogging Stations (TT20 shown)

REPLACEMENT PROCEDURES

Transfer and Jogging Stations TT20, TJ20

Replacing Pushbutton Switch and/or Printed Circuit Board (refer to Figure 12):

1. Remove Station from Enclosure.

2. Remove screws holding pushbutton switch to bottom chassis.

3. Remove screws holding top chassis to frame assembly and screws holding meter mounting bracket to top chassis.

4. Remove top chassis.

5. Transfer Station only, remove black nut holding toggle switch to front plate.

6. Tilt back of meter up to clear printed circuit board and slide meter toward rear of station. When front of meter (toggle switch on Transfer Station) clears front plate, rotate meter so meter lies on top of printed circuit board.

7. Remove screws holding printed circuit board to bottom chassis.

8. Grasp pushbutton and printed circuit board at sides and slowly slide entire assembly forward. When rear of printed circuit board clears back plate, tilt rear of printed circuit board up until it is above back plate. Slowly slide pushbutton switch - printed circuit board assembly out of frame assembly.

9. Unsolder leadwires at part being replaced (at pushbutton switch or at printed circuit board).

10. Reverse above procedure (steps 1 thru 9) to install new part. When resoldering leadwire connections refer to appropriate wiring diagram. (Figure 17 for TT Station or Figure 27 for TJ Station).

11. Calibrate Station before placing in operation. Refer to "Calibrating the Operator Interface Stations".

Replacing Output Meter (refer to Figure 12):

1. Remove Station from Enclosure.

2. Remove screws holding meter mounting bracket to top chassis and top chassis to frame assembly.

3. Remove top chassis.

4. Transfer Station only, remove black nut holding toggle switch to front plate.

5. Remove hex nuts securing meter leads to meter terminals and remove leads.

6. Slide meter toward rear of station. When front of meter (toggle switch on Transfer Station) clears front plate, rotate meter so meter lies on top of printed circuit board.

7. Remove screws holding meter to mounting bracket and remove meter.

8. Reverse above procedure (steps 1 thru 7) to install new output meter.

9. Calibrate Station before placing in operation. Refer to "Calibrating the Operator Interface Stations".

Set Point Station TG11

Replacing Thumbwheel Switch and/or Printed Circuit Board (refer to Figure 13):

1. Remove Station from Enclosure.

2. Remove screws holding top chassis to frame assembly.

3. Remove top chassis.

4. Remove screws holding switch mounting bracket to bottom chassis.

5. Position station upright and rotate thumbwheel switch - mounting bracket assembly so assembly lies on top of printed circuit board.

6. Remove screws holding printed circuit board to bottom chassis.

7. Grasp printed circuit board at front and slowly slide toward front plate. When rear of printed circuit board clears black plate, lift printed circuit board clear of frame assembly.

8. Unsolder leadwires at part being replaced (at thumbwheel switch or at printed circuit board).

9. Reverse above procedure (steps 1 thru 8) to install new part. When resoldering leadwire connections refer to wiring diagram (Figure 19).

10. Calibrate Station before placing in operation. Refer to "Calibrating the Operator Interface Stations".

Signal Generator Stations TG30, TG40

Replacing Component Board (refer to Figure 14):

1. Remove Station from Enclosure.

2. Remove screws holding dial-idler gear-mounting bracket (dial assembly) to bottom chassis.

3. Remove dial assembly by rotating rear of assembly to side of Station and sliding out. Place dial assembly aside.

4. Remove screws holding top chassis to frame assembly. Remove screws holding output meter mounting bracket to top chassis.

5. Remove top chassis.

6. Tilt back of output meter up to clear potentiometer, then slide meter toward rear of Station. When front of meter clears front plate, rotate meter so meter lies on top of printed circuit board.

7. Remove screws holding printed circuit board to bottom chassis.

8. Grasp printed circuit board at front and lift until shaft of potentiometer clears hole in bottom plate.

9. Slowly slide printed circuit board toward front plate. When rear of printed circuit board clears back plate, lift printed circuit board clear of frame assembly.

10. Remove hex nuts securing meter leads to meter terminals and detach meter.

11. Reverse above procedure (steps 1 thru 10) to install new printed circuit board.

NOTE: When installing dial assembly but before engaging idler-gear and drive-gear teeth, position dial (thumbwheel) so that last left major scale graduation is opposite red pointer on front plate and set screws of drive gear are positioned for easy access.

12. Calibrate Station before placing in operation. Refer to "Calibrating the Operator Interface Stations".

Replacing Output Meter (refer to Figure 14):

1. Remove Station from Enclosure.

2. Remove screws holding meter mounting bracket to top chassis and top chassis to frame assembly.

3. Remove top chassis.

4. Remove hex nuts securing meter leads to meter terminals and remove leads.

5. Tilt back of meter up to clear potentiometer and remove meter by sliding toward rear of Station.

6. Reverse above procedure (steps 1 thru 5) to install new output meter.

7. Calibrate Station before placing in operation. Refer to "Calibrating the Operator Interface Stations".

Measured Variable Station TY10, TY11, TY20

Replacing Component Board (refer to Figure 15):

1. Remove Station from Enclosure.

2. Remove screws holding top chassis to frame assembly and screws holding meter mounting bracket to top chassis.

3. Remove top chassis.

4. Tilt back of meter up to clear printed circuit board. Slide meter toward rear of Station. When front of meter clears front plate, rotate meter so it lies on top of printed circuit board.

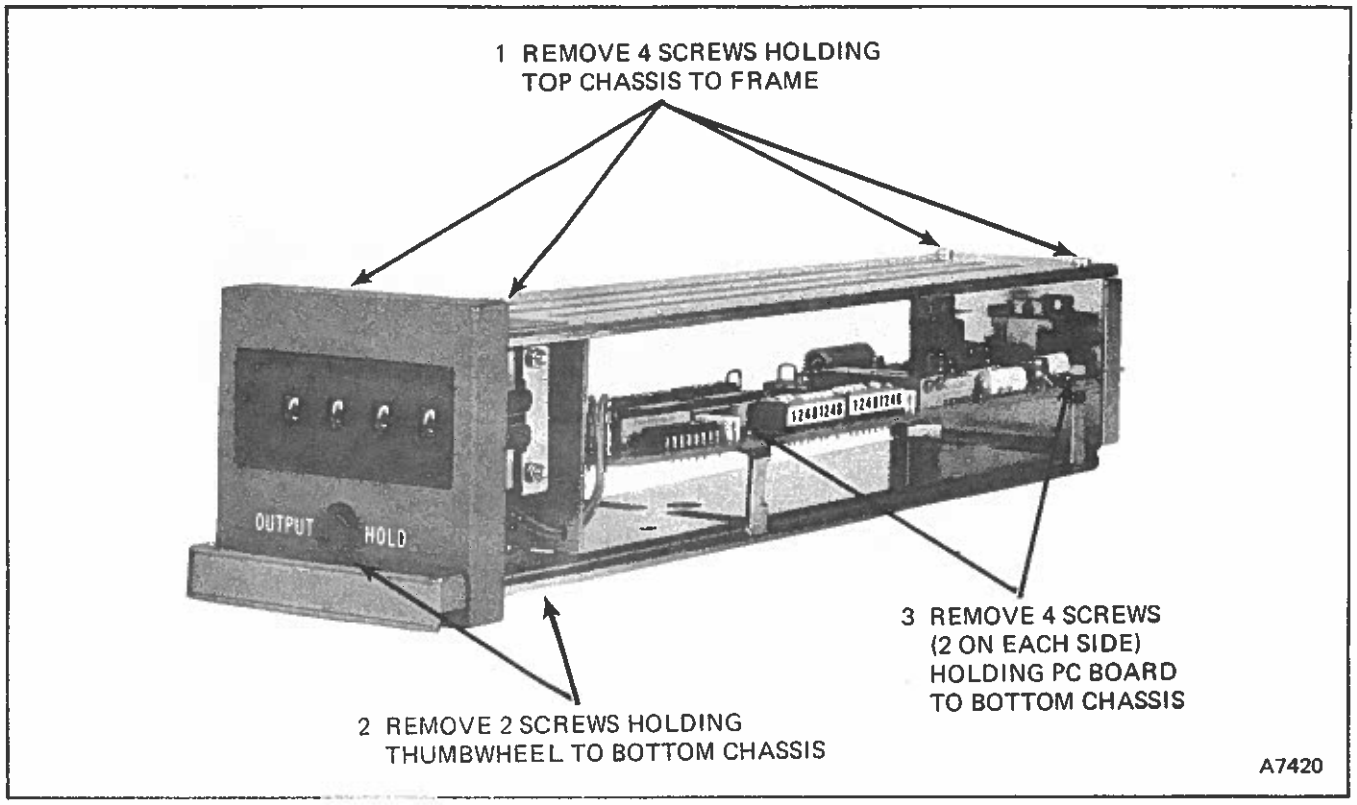


FIGURE [illegible] Replacing Components of TG11 Set Point Station

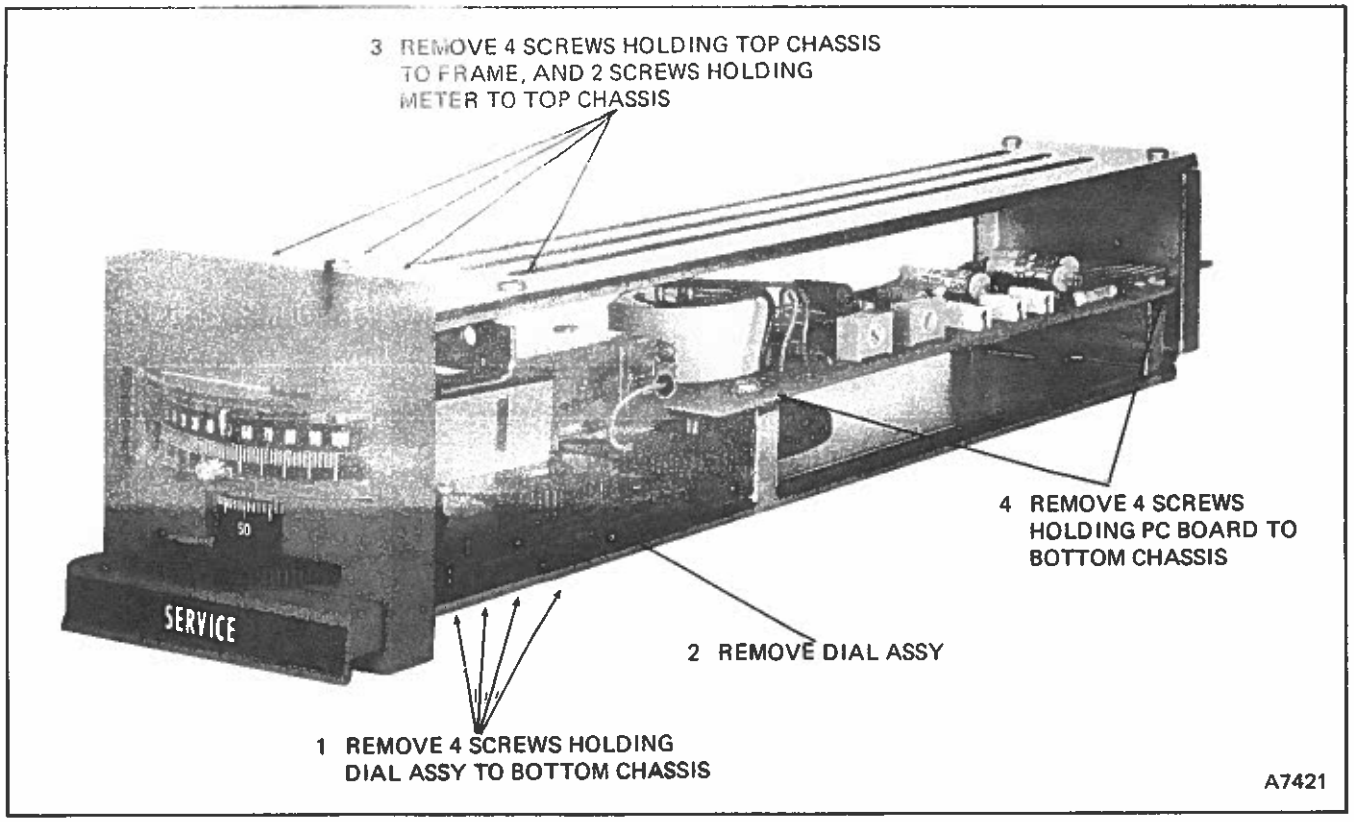


FIGURE 14 – Replacing Components of Signal Generator TG30, TG40 Stations (TG30 shown)

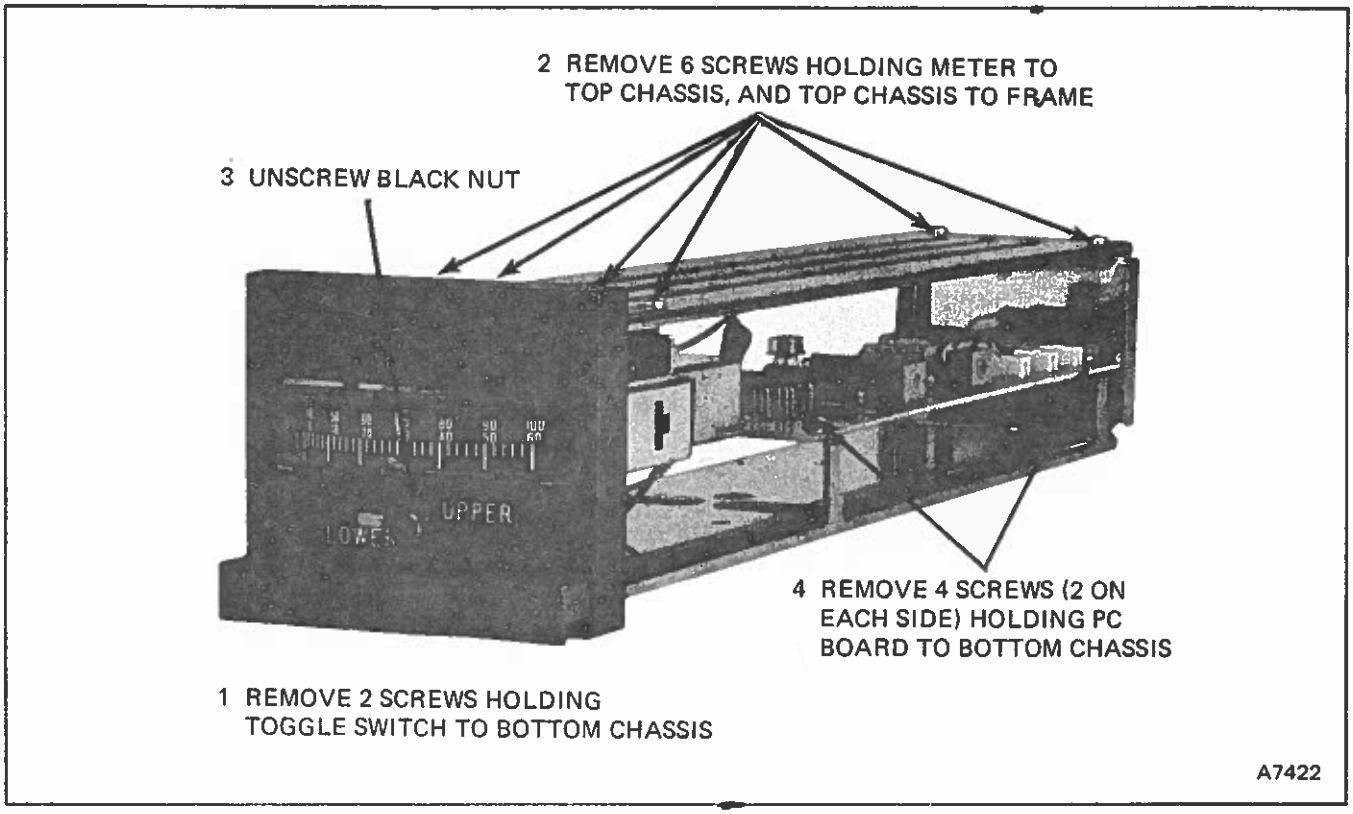


FIGURE 15 – Replacing Components of TY10, TY11 Measured Variable Stations (TY10 shown)

5. Remove screws holding printed circuit board to bottom chassis.

6. Grasp printed circuit board at sides and slowly slide toward front plate. When rear of printed circuit board clears back plate, lift printed circuit board clear of frame assembly.

7. Remove hex nuts securing meter leads to meter terminals and detach meter.

8. Reverse above procedure (steps 1 thru 9) to install new printed circuit board.

9. Calibrate Station before placing in operation. Refer to "Calibrating the Operator Interface Stations".

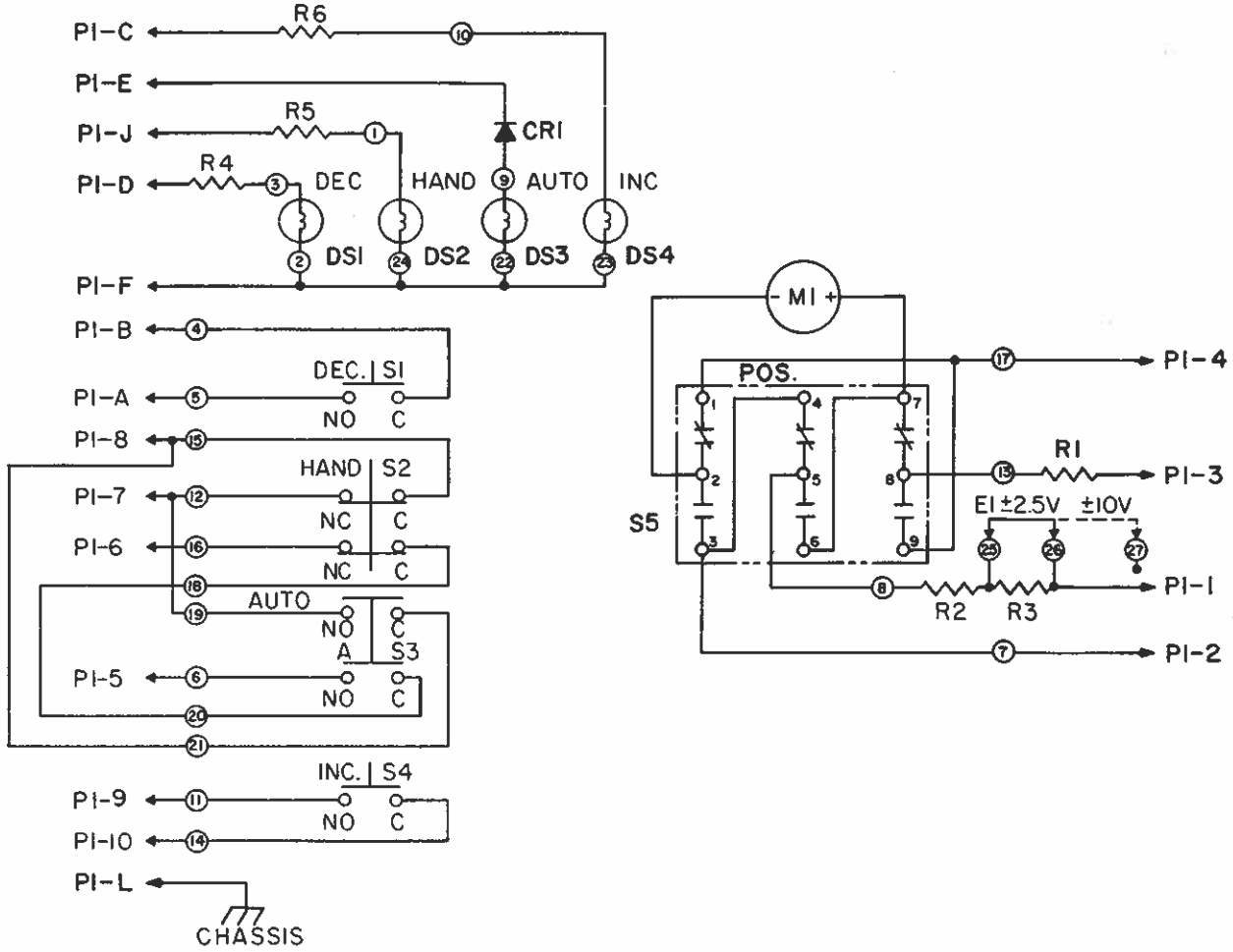
Replacing Measured Variable Meter (refer to Figures 15 or 11):

1. Remove Station from Enclosure.

2. Remove screws holding meter mounting bracket to top chassis and top chassis to frame assembly.

3. Remove top chassis.

4. Remove hex nuts securing meter leads to meter terminals and remove leads.



COMPONENT	DESCRIPTION
R1	RES 99.4K 1/2W 0.1%
R2	RES 24.9K 1/4W 0.1%
R3	RES 75K, 1/4W, 0.1%
R4, R5 & R6	RES 47Ω, 1/2W ±5%
CR1	DIODE 1N4383
DS1 THRU DS4	INCANDESCENT LAMP
J25, J26 & J27	SPRING SOCKET
M1	DC MILLIAMETER (SPDT)
S1 & S4	PUSHBUTTON SWITCH (DPDT)
S2 & S3	PUSHBUTTON SWITCH
S5	TOGGLE SWITCH 3 PDT
E1	STAPLE JUMPER

B30481488

FIGURE 16 – Schematic Diagram for Type TT20 Transfer Station

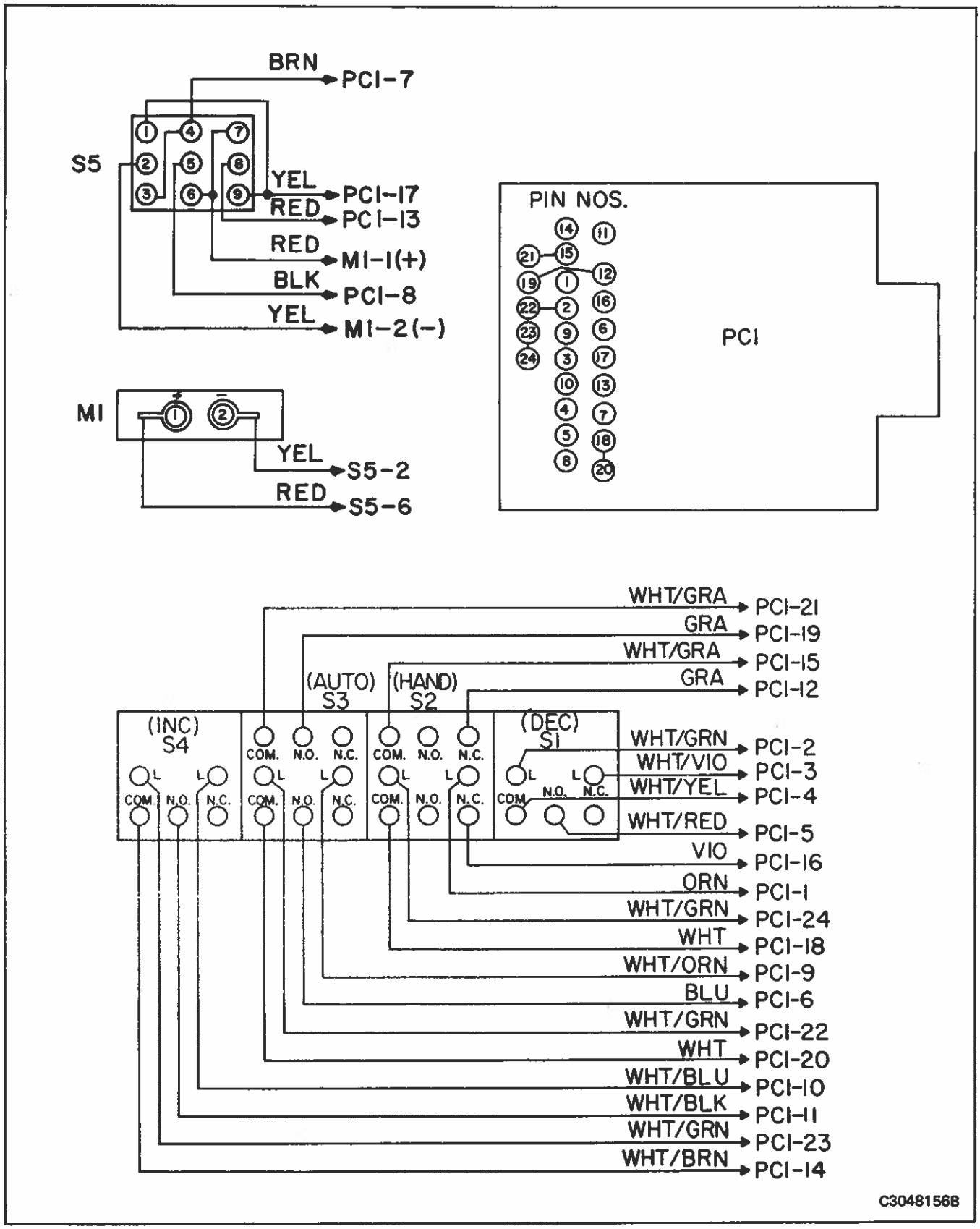
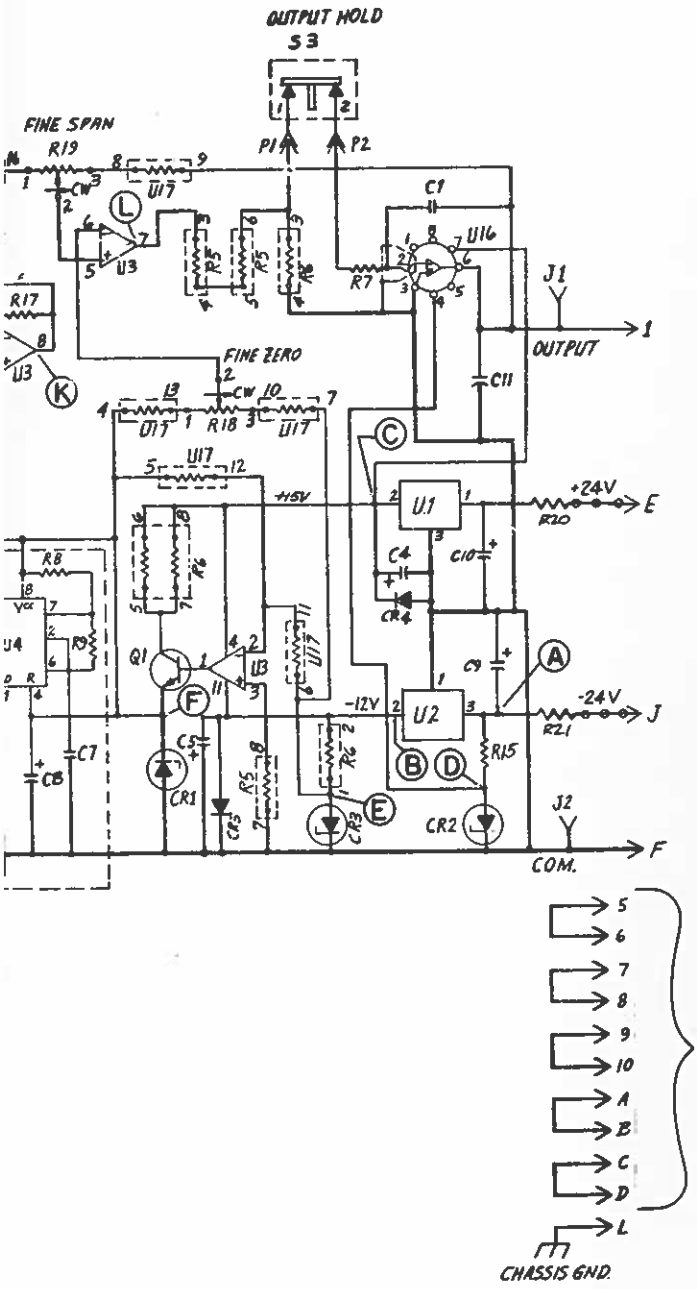


FIGURE 17 — Wiring Diagram for Type TT20 Transfer Station



POWER APPLIED ACROSS JUMPERS SHOULD NOT EXCEED ±24 V dc, 3A

COMPONENT	DESCRIPTION
C1, C2, C3	CAP, 1uF, 50 V
C4, C5	CAP, 1uF, 50 V
C6	CAP, .01uF, 200 V
C7	CAP, 330 pf, 200 V
C8	CAP, 25uF, 25 V
C9, C10	CAP, 4.7uF, 35 V
E1, E2, E3, C4	STAPLE JUMPER
J1, J2	JACK, P.C.
W1-26	CABLE, FLAT, JUMPER
P1, P2	PIN, CONNECTOR
Q1	TRANSISTOR, SIG, NPN, SI, 2N2222A
R1 THRU R4	RES, 47K
R5	RES, 22K
R6	TES, 270Ω
R7	RES, 499K, 1/4W, 1%
R8	RES, 7.21K, 1/4W, 1%
R9	RES, 3.16K, 1/4W, 1%
R10, R11	RES, 100K, 1/4W, 1%
R12, R13	RES, 402K, 1/4W, 1%
R14	RES, 100Ω, 1/2W, 5%
R15	RES, 820Ω, 1/2W, 5%
R16, R17	RES, 10K, 1/2W, 0.1%
R18, R19	RES, 20K, 3/4W
R20, R21	RES, 5.11Ω, 1/4W, 1%
CR1, CR2	ZENER DIODE, 15 V, IN965B
CR3	DIODE, 9.3 V, IN2621
CR4, CR5	DIODE, 200 V, RG1181/IN5393
S1, S2	SWITCH, DIP PACK, 8 ROCKER
S3	SWITCH, PUSHBUTTON
S4A, B, C, D	SWITCH, FOUR DECADE THUMBWHEEL
U1	REGULATOR, 1C, LINEAR, UA7815UC, LM340T-15
U2	REGULATOR, 1C, LINEAR, 7912 UC
U3	OPER AMPL LM324D, CA324G
U4	TIMER, IC, LINEAR, LM555CH
U5 THRU U8	4 BIT MAGNITUDE COMPARATOR, F340085PC, DM74C85N
U9 THRU U12	SYNCHRONOUS U/DN COUNTER, 4029
U13	HEX INVERTING BUFFER, 4049
U14	DUAL D FLIP FLOP, 4013
U15	IC, DIGITAL GATE, 4001
U16	OPER AMPL LH740AC, ICL8007C
U17	RES, 47K, DIP 16

S4A, B, C, D

BCD W/COMPLEMENT 2 POLE 10-POSITION								
DIAL	COMMONS (C) & ($\overline{C}$) CONN. TO TERMINALS INDICATED							
	C				$\overline{C}$			
	1	2	4	8	$\overline{1}$	$\overline{2}$	$\overline{4}$	$\overline{8}$
0					X	X	X	X
1	X					X	X	X
2		X			X		X	X
3	X	X					X	X
4			X		X	X		X
5	X		X			X		X
6		X	X		X			X
7	X	X	X					X
8				X	X	X	X	
9	X			X		X	X	

E8052222E

FIGURE 18 – Schematic Diagram for Type TG11 Set Point Station

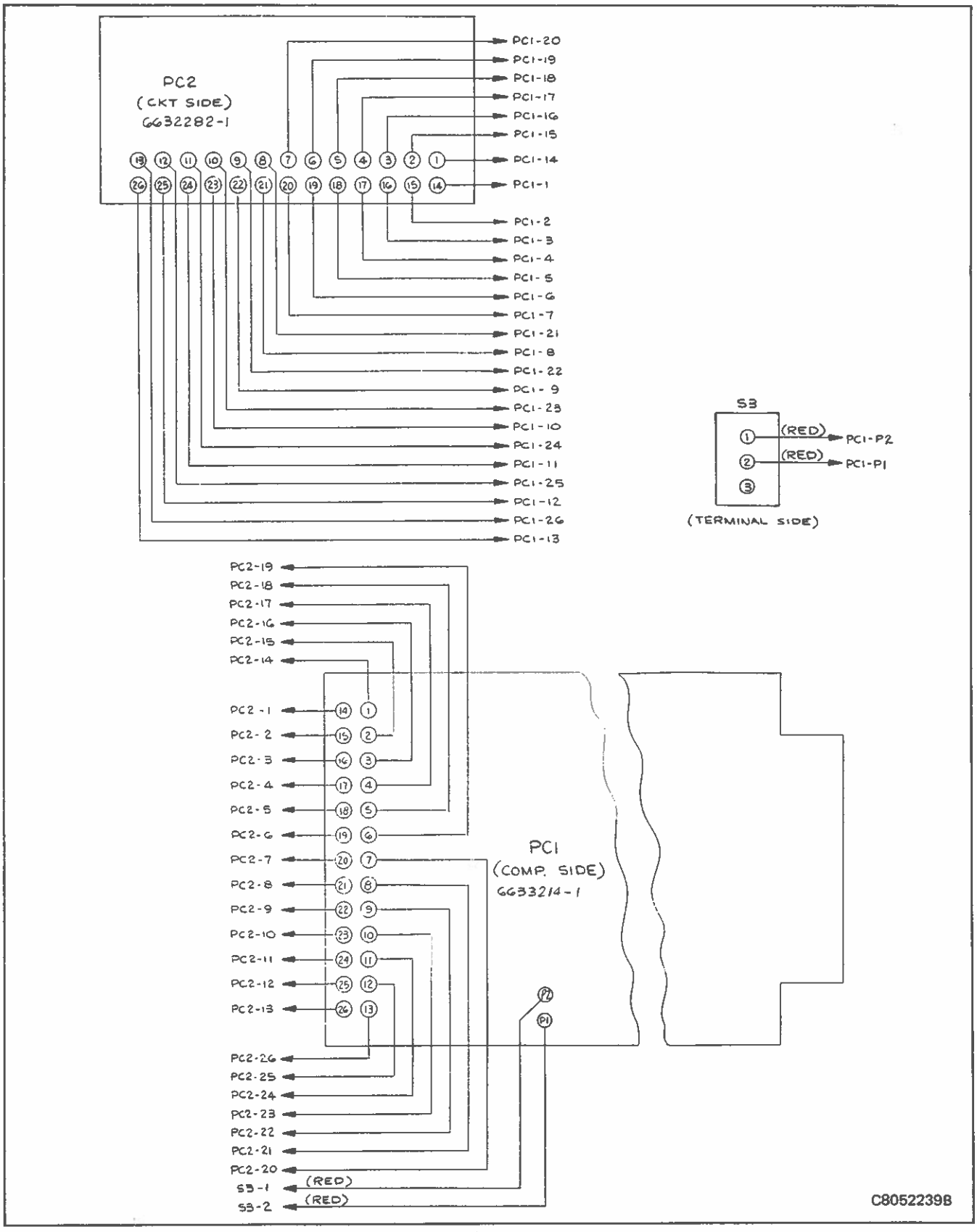
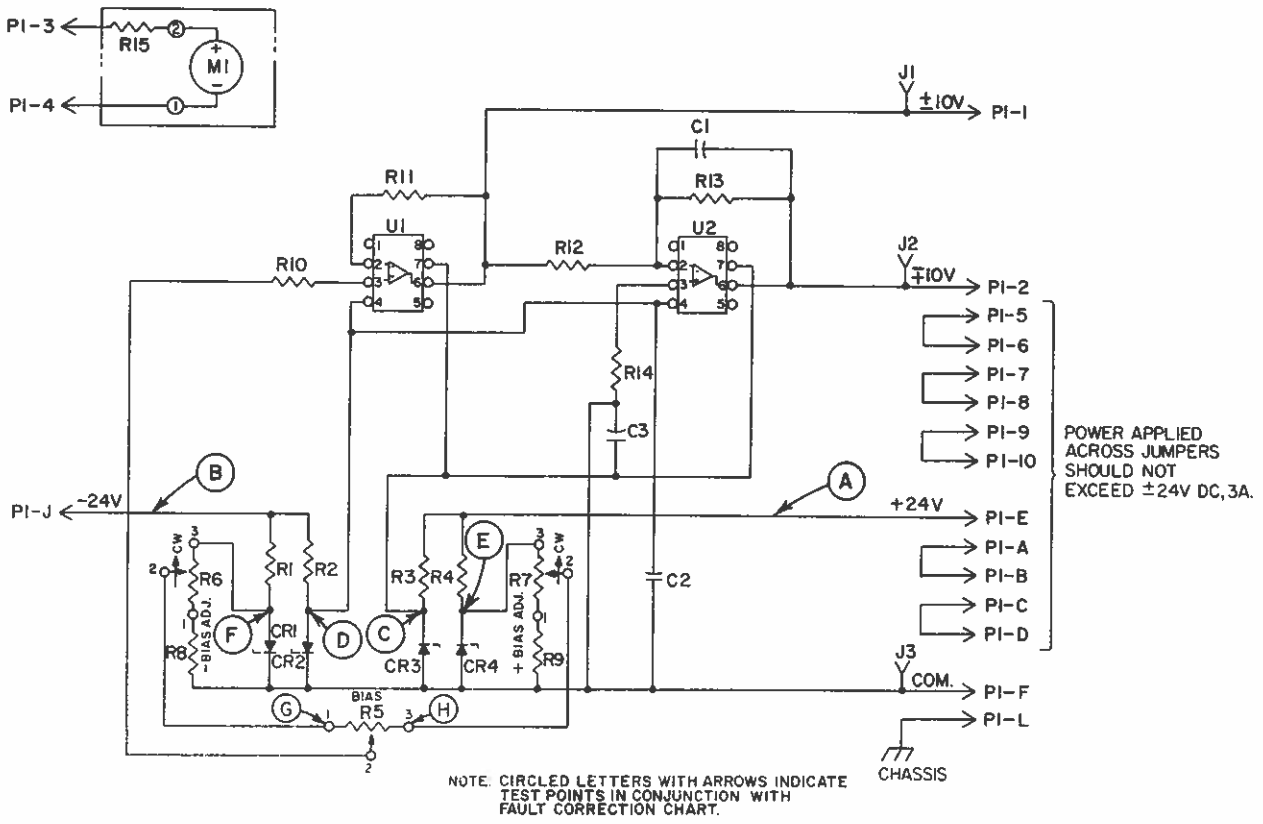


FIGURE 19 – Wiring Diagram for Type TG11 Set Point Station



COMPONENT	DESCRIPTION
R1, R4	RES 360 OHM 1W 5%
R2, R3	RES 680 OHM 1/2W 5%
R5	POT 2K
R6, R7	TRIMMER 200 OHM
R8, R9	RES 560 OHM 1/2W 5%
R10, R11	RES 10K 1/2W 1%
R12, R13	RES 10K 1/2W 0.1%
R14	RES 4.99K 1/2W 1%
R15	RES 99.4K 1/2W 0.1%
C1, C2, C3	CAP 0.1 MFD 100 V
CR1, CR4	ZENER DIODE 11.7 V 1N942
CR2, CR3	ZENER DIODE 15 V 1N965B
U1, U2	OPER AMPL LM307H
J1, J2, J3	TEST JACK
M1	DC MILLIAMETER

C3048152B

FIGURE 20 – Schematic Diagram for Types TG30, TG40 Signal Generator Stations

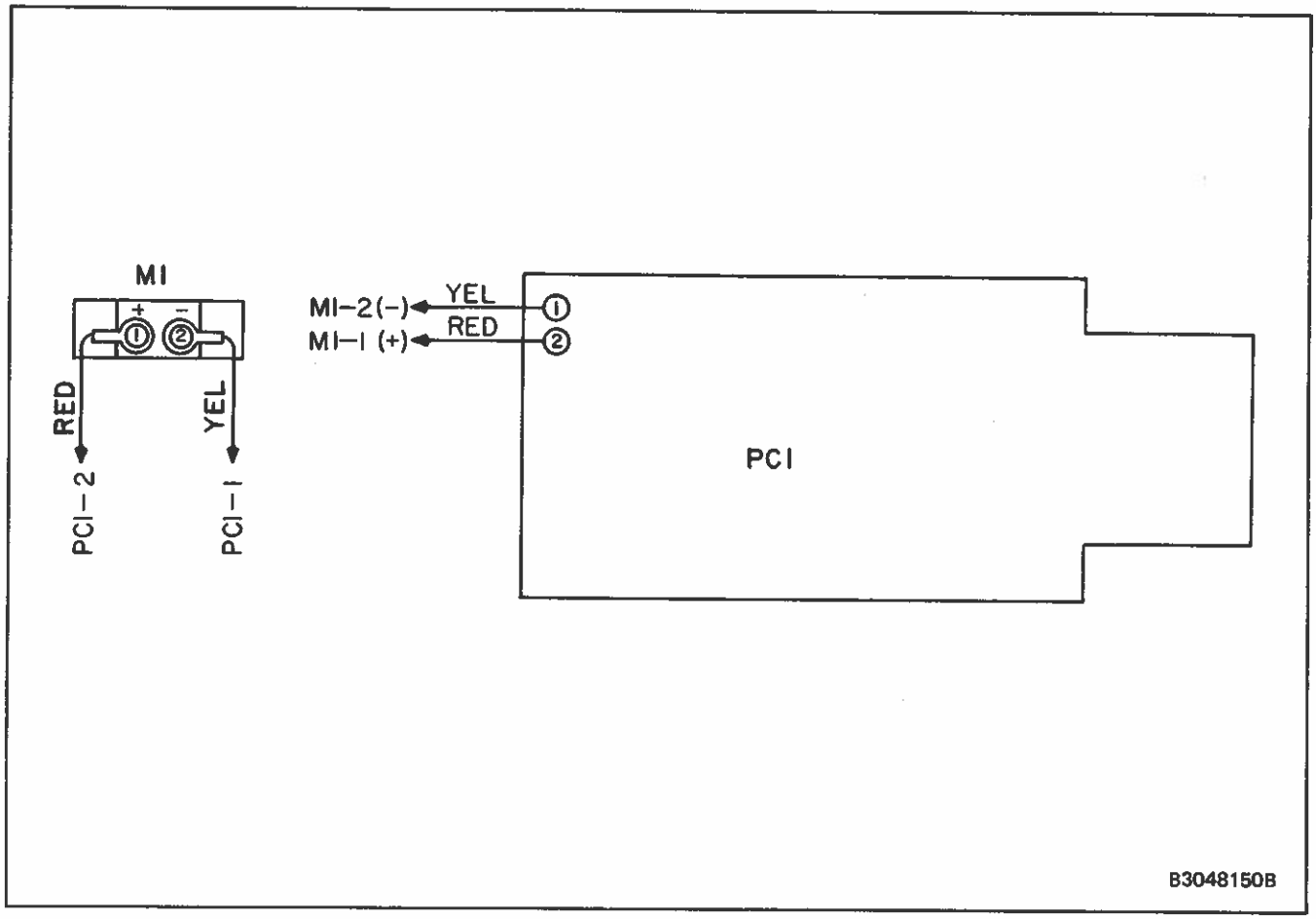
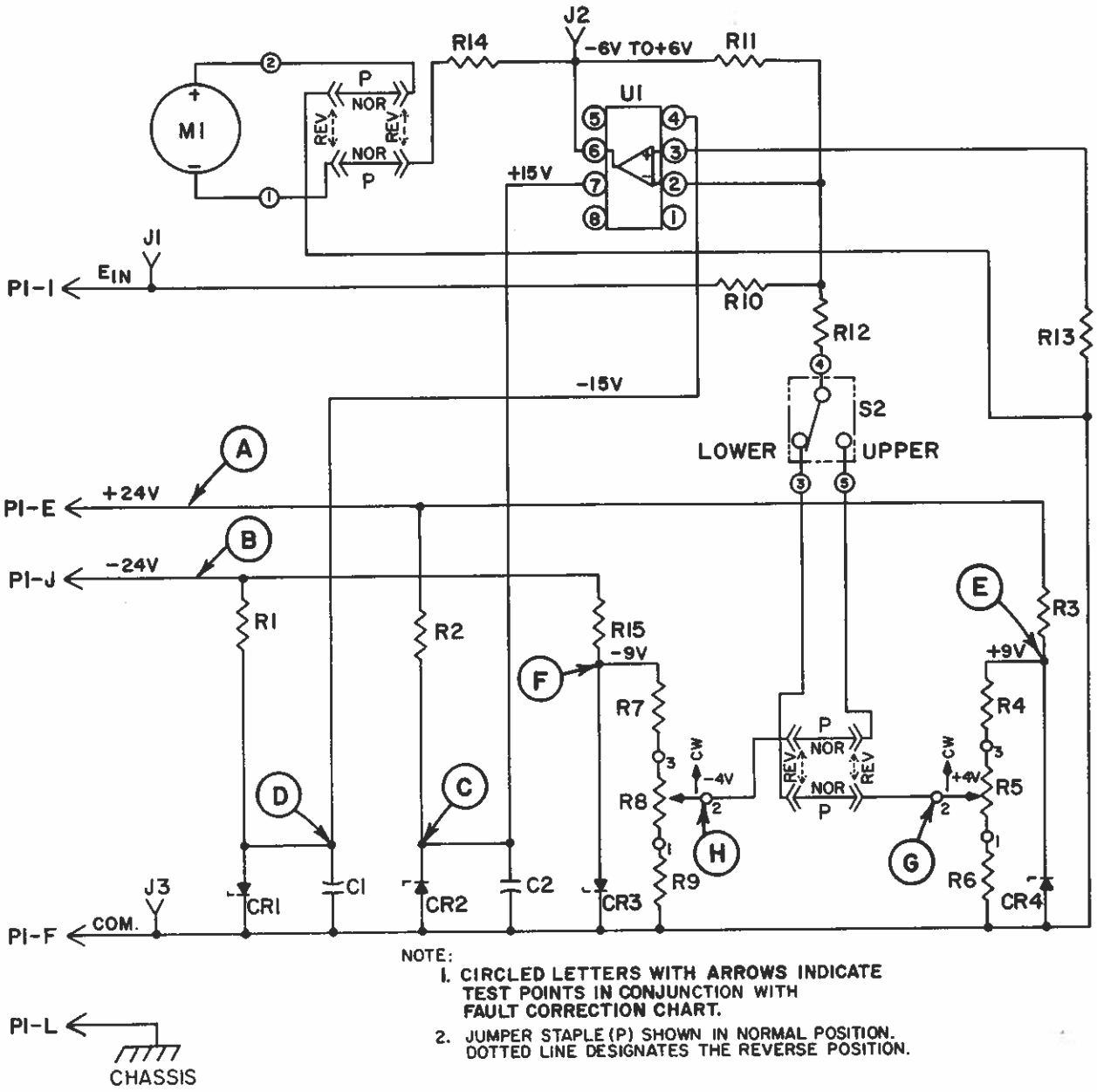


FIGURE 21 – Wiring Diagram for Types TG30, TG40 Signal Generator Stations



NOTE:
1. CIRCLED LETTERS WITH ARROWS INDICATE TEST POINTS IN CONJUNCTION WITH FAULT CORRECTION CHART.
2. JUMPER STAPLE (P) SHOWN IN NORMAL POSITION. DOTTED LINE DESIGNATES THE REVERSE POSITION.

COMPONENT	DESCRIPTION
C1, C2	MYLAR CAPACITOR 0.1 MFD, 100 V
CR1, CR2	ZENER DIODE 15 V, 1N965B
CR3, CR4	ZENER DIODE 9 V, 1N936
J1, J2, J3	PRINTED CIRCUIT JACK
R1, R2	RESISTOR 510 OHM 1/2W 5%
R3, R15	RESISTOR 750 OHM 3W 1%
R4, R7	RESISTOR 511 OHM 1/2W 1%
R5, R8	CERMET TRIMMER POT. 200 OHM

COMPONENT	DESCRIPTION
R6, R9	RESISTOR 402 OHM 1/2W 1%
R10, R11	RESISTOR 100K 1/2W 0.1%
R12	RESISTOR 100K 1/2W 1%
R13	RESISTOR 33.2K 1/2W 1%
R14	RESISTOR 59.4K 1/2W 0.1%
M1	DC MILLIAMETER
P	STAPLE, JUMPER
S2	SUB-MINIATURE TOGGLE SWITCH SPDT
U1	OPERATIONAL AMPLIFIER LM307H

C3048157B

FIGURE 22 – Schematic Diagram for Types TY10, TY11 Measured Variable Stations

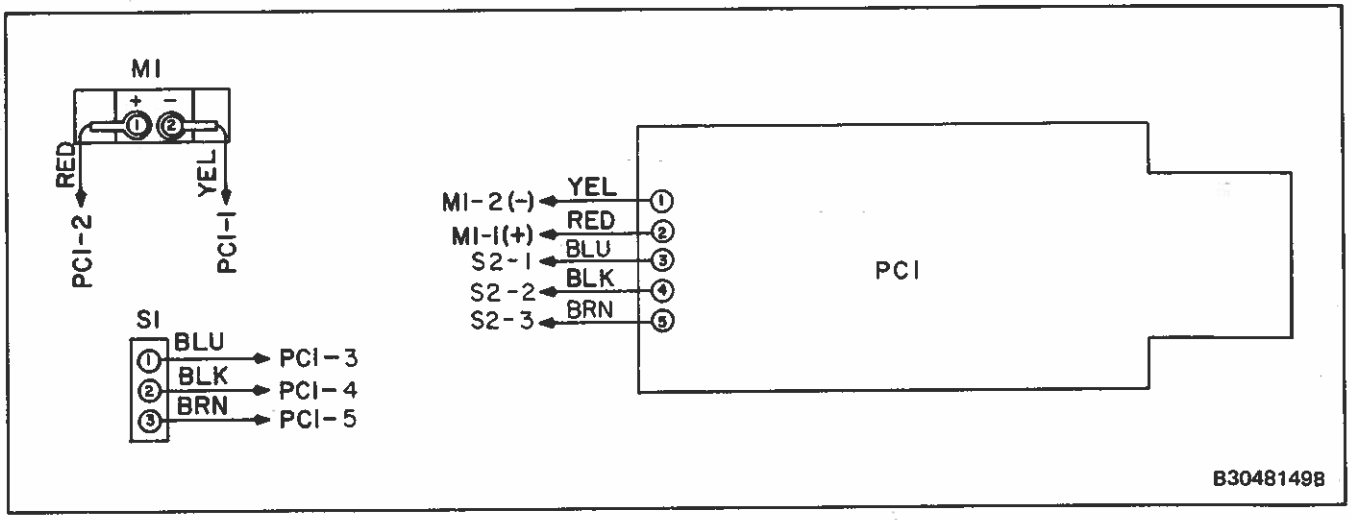
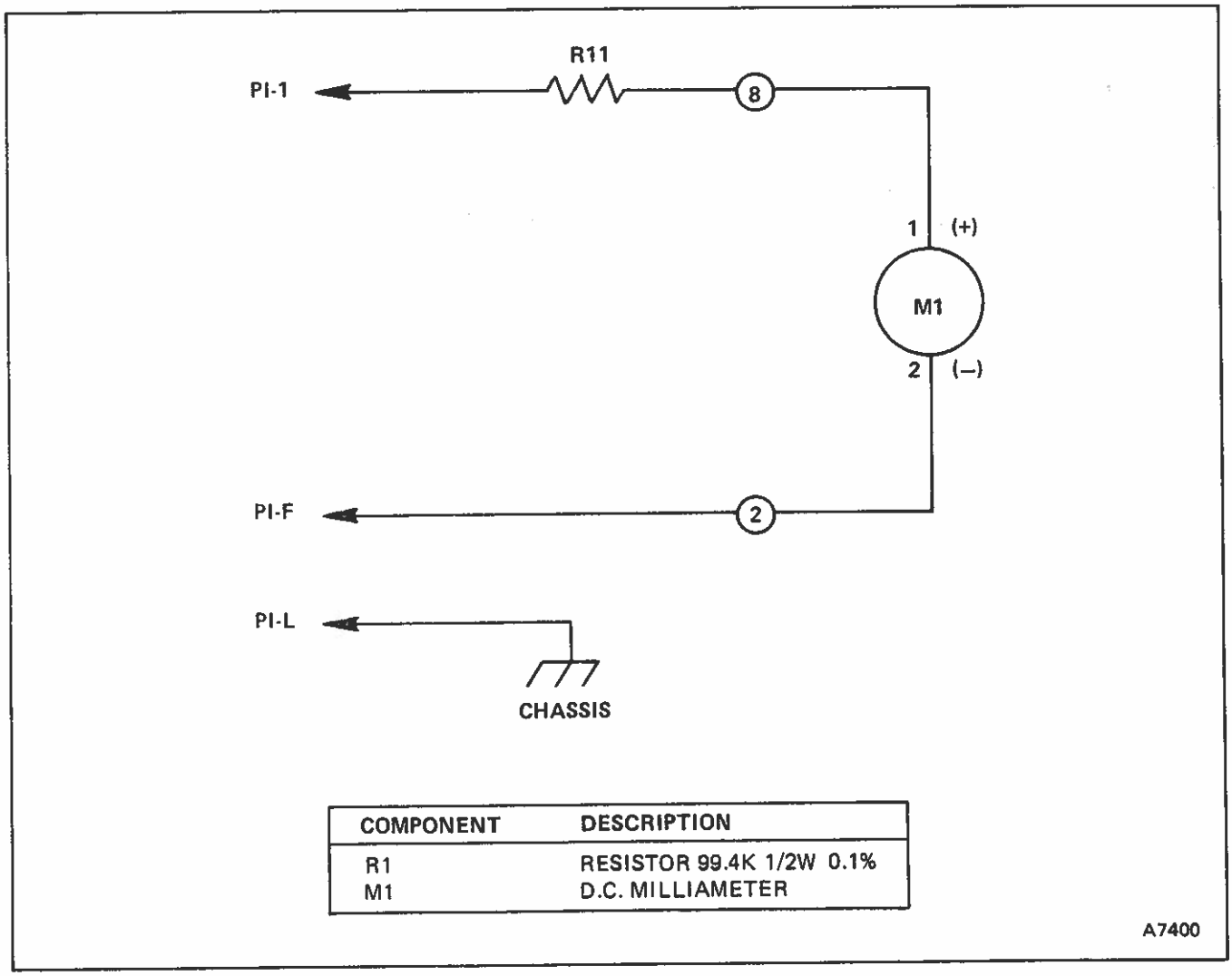


FIGURE 23 – Wiring Diagram for Types TY10, TY11 Measured Variable Stations



COMPONENT	DESCRIPTION
R1	RESISTOR 99.4K 1/2W 0.1%
M1	D.C. MILLIAMETER

FIGURE 24 – Schematic Diagram for Type TY20 Measured Variable Station

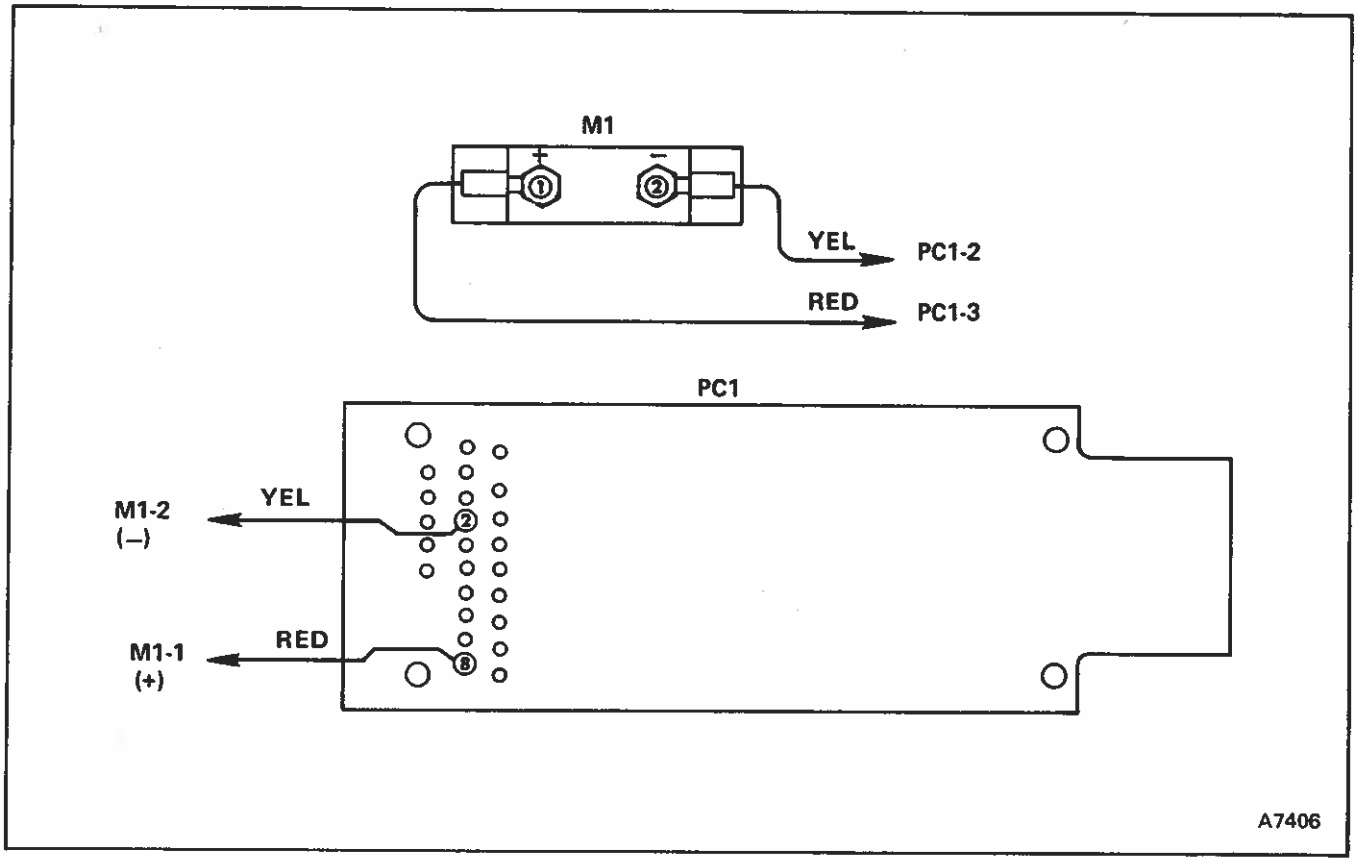
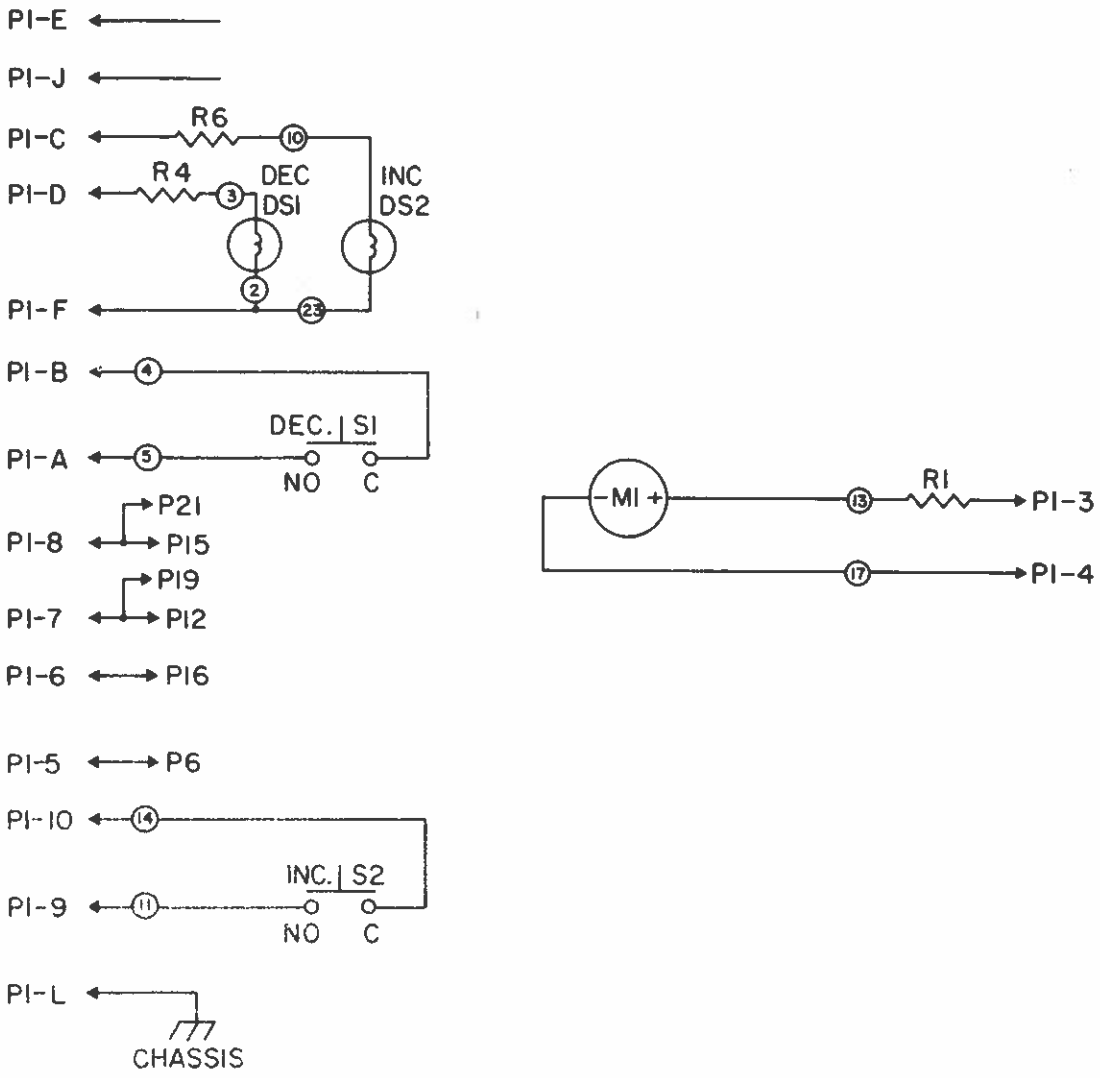


FIGURE 25 – Wiring Diagram for Type TY20 Measured Variable Station



COMPONENT	DESCRIPTION
R1	RES 99.4K 1/2W 0.1%
R4, R6	RESISTOR, 47Ω, 1/2W, 5%
DS1, DS2	INCANDESCENT LAMP
M1	DC MILLIAMETER
S1, 2	PUSHBUTTON SWITCH (SPDT)
PC2 THRU PC5, PC10, PC11 P13, P14, P17 & P23	CONNECTOR PIN
J2 THRU J5, J10, J11, J13, J14, J17 & J23	PIN RECEPTACLE

B30481688

FIGURE 26 – Schematic Diagram for Type TJ20 Manual Jogging Station

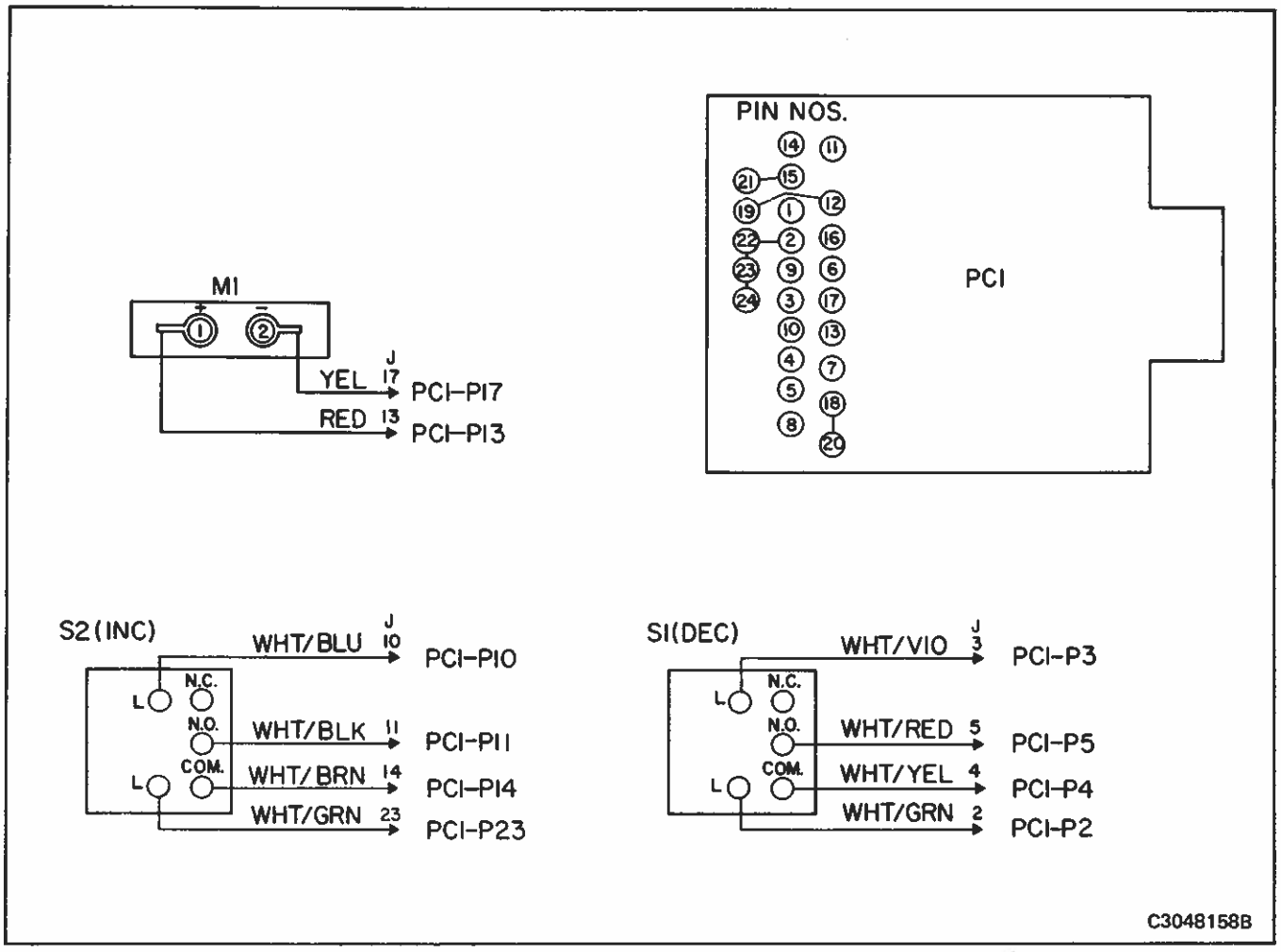


FIGURE 27 – Wiring Diagram for Type TJ20 Manual Jogging Station

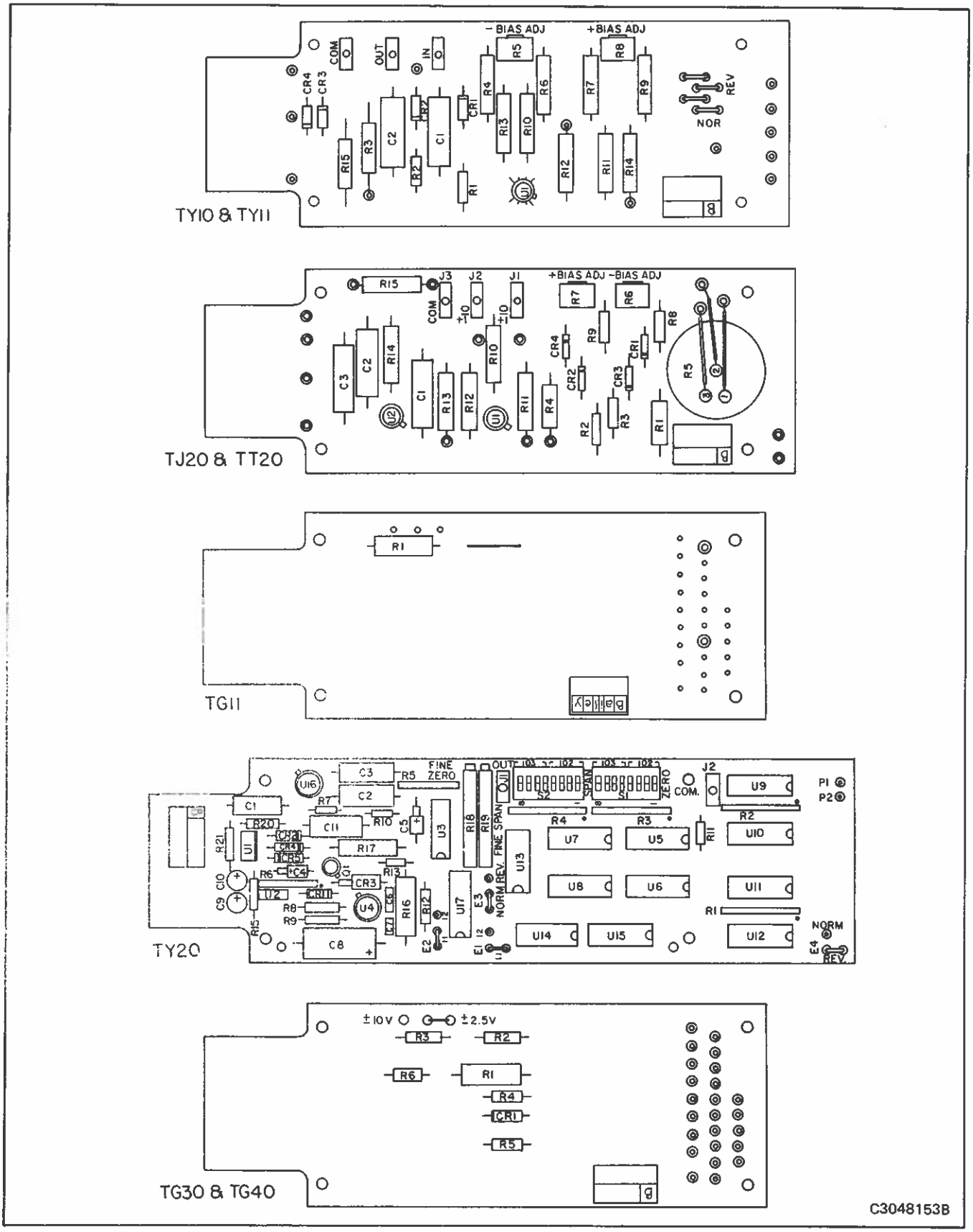


FIGURE 28 – Printed Circuit Board Component Locations (all T Stations)

CALIBRATING THE OPERATOR INTERFACE STATIONS

TG11 Set Point Station Calibration (refer to Figure 29 for adjustment locations).

1. Set the staple jumpers in the proper positions. (Refer to Table 1).

2. Determine the coarse zero adjustment from the engineering data of the application. Note that for full range, a zero of "0000" is desired.

3. Coarse zero switches are provided only for the hundreds and thousands digits of the zero setting. The units and tens digits are both preset to "9" Select the number closest to the desired zero which can be entered.

Example:

Desired zero "1000" - Setting "0999"
Desired zero "2400" - Setting "2399"

4. When a zero of "0000" is desired, a setting of "15999" should be used. Due to the peculiarities of the counting scheme used, this setting gives a result only one unit different than the desired "0000".

Example:

Desired zero "0000" - Setting "15999"

5. Refer to Table 2. Convert the desired setting into switch positions, and enter those positions on the coarse zero switch. See Figure 30 for examples.

6. Determine the coarse span adjustment from the engineering data of the application. Note that for full range, a span of "9999" is desired.

7. Coarse span switches are provided only for the hundreds and thousands digits of the span setting. The units and tens digits are both preset to "0". Select the number closest to the desired span which can be entered.

Example.

7.1 Desired span "7000" Setting "7000"
7.2 Desired span "6625" Setting "6600"

8. When a span of "9999" is desired, a setting of "10000" should be used. Due to the pecularities of the counting scheme used, this setting gives a result only one unit different than the desired "9999".

Example:

8.1 Desired span "9999" Setting "10000"

9. Referring to Table 3, convert the desired setting into switch positions, and enter those positions on the coarse span switch. See Figure 31 for example.

10. Connect the station to the calibration circuit and turn the power supplies on (Figure 36).

11. Switch input thumbwheel setting to midpoint and adjust output for 0 volts ±.010 volts using fine zero pot.

Example:

With a coarse zero of "1000" and a coarse span of "9000", midpoint is "5000".

12. Switch input setting to the coarse zero value or lower, and adjust the output for −10 volts ±.010 volts using the fine span adjustment.

13. Switch input setting to the coarse span value or greater. Divide the resulting output by 2 and add 5. Using the fine zero adjustment, adjust the output to this value ±.010 V. Then adjust the fine span until the output is +10 ±.010 V.

14. Switch input setting to the coarse zero value or lower. Divide the resulting output by 2 and add (−5). Using the fine zero adjustment, adjust the output to the calculated value ±.010 volts. Adjust the fine span until the output is −10 ±.010 volts.

15. Repeat 13. and 14. until the output at both points is within .010 volts of ±10 volts.

TABLE 1 – TG11 STAPLE POSITIONING FOR NORMAL OUTPUT AND REVERSE OUTPUT

Staple Ref. Des.	Staple Positions	
	Normal Output	Reverse Output
E1	11	11
E2	11	11
E3	Norm	Rev
E4	NA	NA

TABLE 2 – TG11 COARSE ZERO SWITCH POSITIONS CORRESPONDING TO DIGITS OF ZERO SETTING NUMBER

Thousands Digit	Setting on DIP Package Switches*				Hundreds Digit	Setting on DIP Package Switches*				Tens Digit	Units Digit
10^3	SW 5	SW 6	SW 7	SW 8	10^2	SW 1	SW 2	SW 3	SW 4	10^1	10^0
15	C	C	C	C	—	—	—	—	—	Preset at 9	Preset at 9
0	O	O	O	O	0	O	O	O	O		
1	C	O	O	O	1	C	O	O	O		
2	O	C	O	O	2	O	C	O	O		
3	C	C	O	O	3	C	C	O	O		
4	O	O	C	O	4	O	O	C	O		
5	C	O	C	O	5	C	O	C	O		
6	O	C	C	O	6	O	C	C	O		
7	C	C	C	O	7	C	C	C	O		
8	O	O	O	C	8	O	O	O	C		
9	C	O	O	C	9	C	O	O	C		

*O = Open
C = Closed

Example: Setting "0999" / Setting "2399"

Equivalent Switch Positions							
1	2	3	4	5	6	7	8
C	O	O	C	O	O	O	O
C	C	O	O	O	C	O	O

TABLE 3 – TG11 COARSE SPAN SWITCH POSITIONS CORRESPONDING TO DIGITS OF SPAN SETTING NUMBER.

Thousands Digit	Settings on DIP Package Switches *				Hundreds Digit	Setting on DIP Package Switches*				Tens Digit	Units Digit
10^3	SW 5	SW 6	SW 7	SW 8	10^2	SW 1	SW 2	SW 3	SW 4	10^1	10^0
0	O	O	O	O	0	O	O	O	O	O	O
1	C	O	O	O	1	C	O	O	O		
2	O	C	O	O	2	O	C	O	O		
3	C	C	O	O	3	C	C	O	O		
4	O	O	C	O	4	O	O	C	O		
5	C	O	C	O	5	C	O	C	O		
6	O	C	C	O	6	O	C	C	O		
7	C	C	C	O	7	C	C	C	O		
8	O	O	O	C	8	O	O	O	C		
9	C	O	O	C	9	C	O	O	C		
10	O	C	O	C	—	—	—	—	—		

*O = Open
C = Closed

Example: Setting "7000"
Setting "6600"

Equivalent Switch Positions							
1	2	3	4	5	6	7	8
O	O	O	O	C	C	C	O
O	C	C	O	O	C	C	O

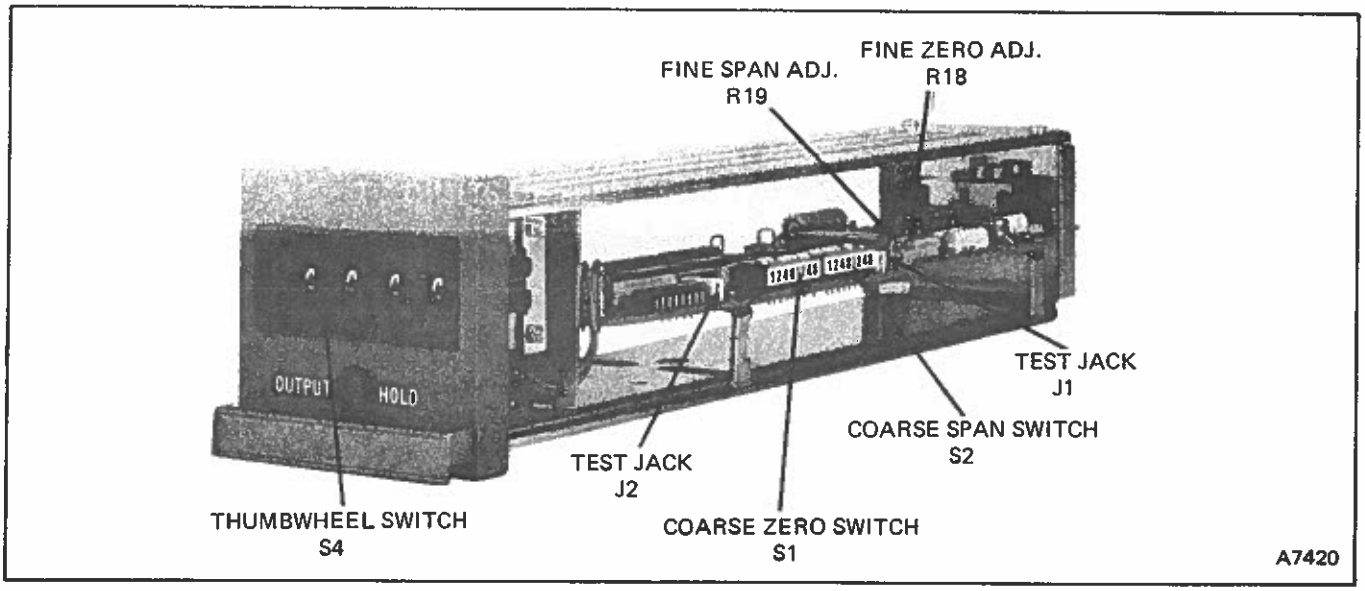


FIGURE 29 – Set Point Station (TG11) Adjustments

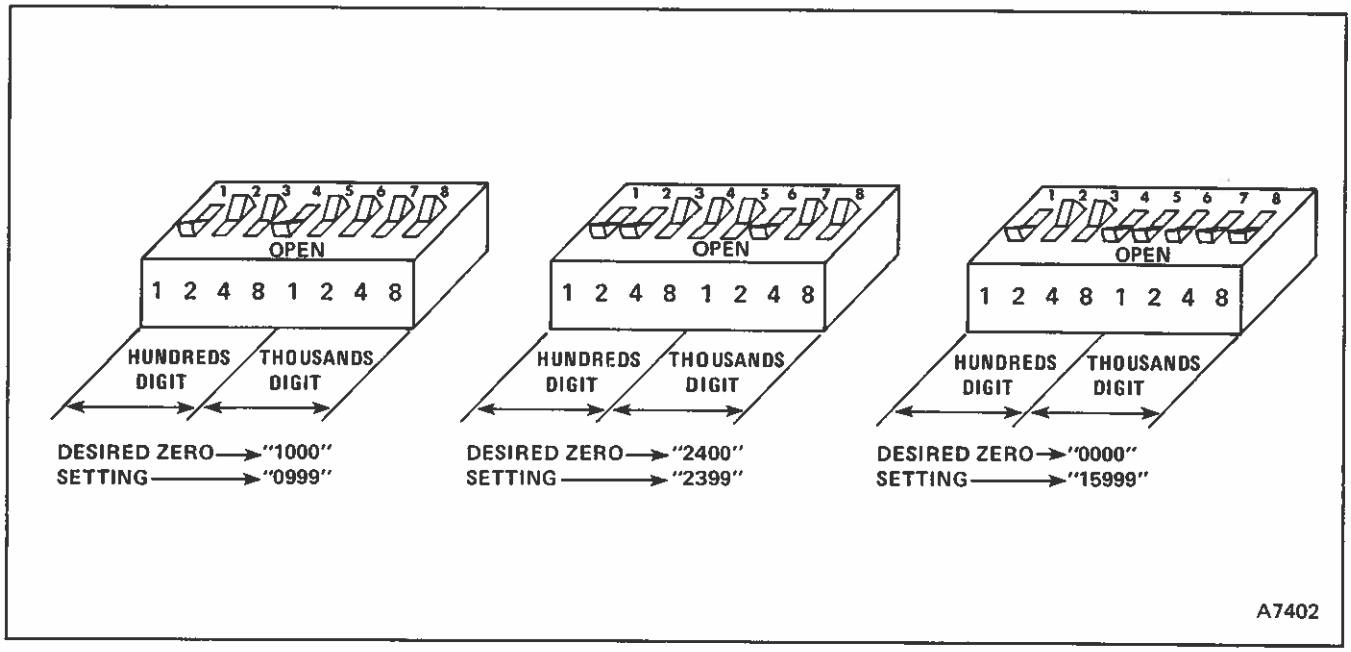


FIGURE 30 – TG11 Coarse Zero Switch Setting Examples

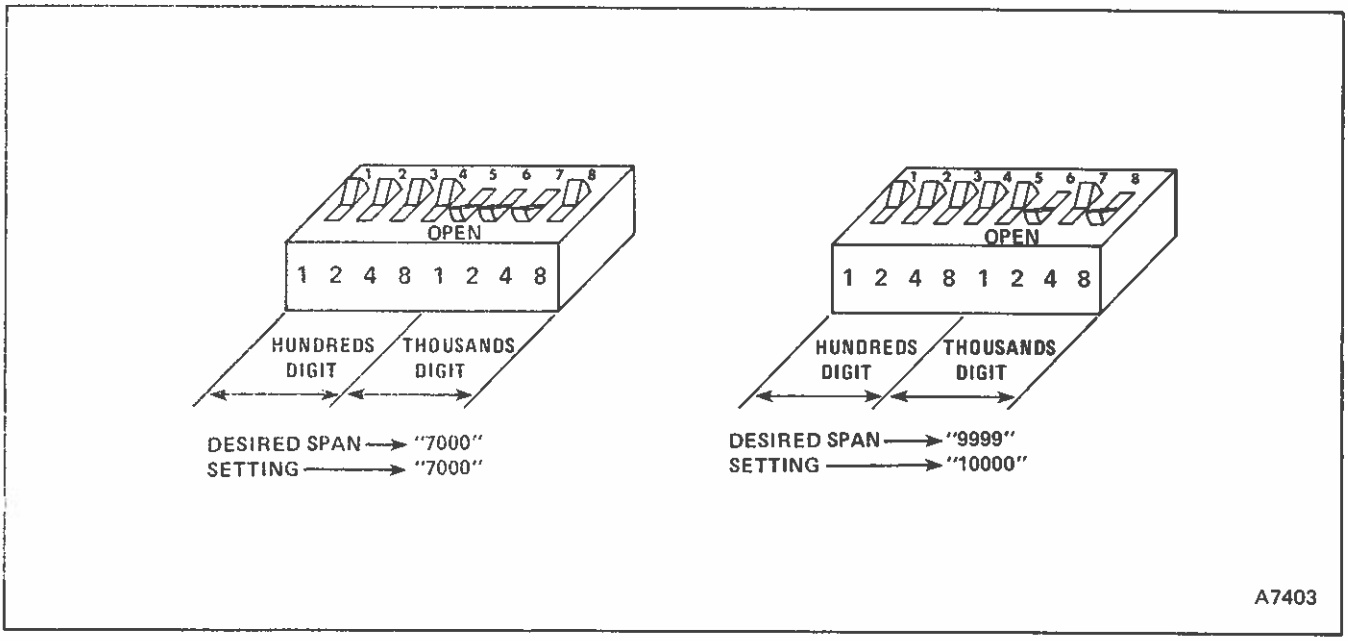


FIGURE 31 – TG11 Coarse Span Switch Setting Examples

TG30, TG40 Signal Generator Station Calibration

Electrical Calibration (refer to Figures 32 & 36):

1. Remove Station from Enclosure. Adjust meter zero until meter pointer is at mid-scale. (Figure 33).

2. Check thumbwheel-scale alignment to red front-plate pointer by turning thumbwheel to left stop and then to the right stop. Check that dial can be set to maximum and minimum graduations. If scale is misaligned, perform Thumbwheel Calibration (below).

3. Connect Station to calibration circuit (Figure 36) and turn on power supply.

4. Connect DVM between test jacks J1 and J3 (common) and turn thumbwheel left to minimum graduation.

5. Adjust trimmer potentiometer R6 until DVM reads −10.000 (±0.010) V dc.

6. Connect DVM between test jacks J2 and J3. Reading should be 10.000 (±0.030) V dc.

7. Connect DVM between test jacks J1 and J3 and turn thumbwheel right to maximum graduation.

8. Adjust trimmer potentiometer R7 until DVM reads +10.000 (±0.010) V dc.

9. Connect DVM between test jacks J2 and J3. Reading should be −10.000 (±0.030) V dc.

10. Repeat steps 3 thru 9 until no further adjustments are necessary. Disconnect DVM and calibration circuit. This completes Bias Manual and Manual Control Station Calibration.

Thumbwheel Calibration (refer to Figure 32):

1. Loosen two set screws holding drive gear to feedback potentiometer shaft.

2. Insert screwdriver thru hole provided in bottom plate of Station and turn potentiometer shaft to counterclockwise stop. Mark position of the slot. Turn the shaft to clockwise stop and mark. Measure to find the midpoint between the marks, and set slot to this point.

3. Set the thumbwheel dial to its midscale point. Hold it and recheck the potentiometer setting.

4. Tighten drive gear set screws being careful not to move drive gear or potentiometer shaft.

5. Perform Electrical Calibration for Signal Generator Station.

TY10, TY11 Measured Variable Stations Calibration (refer to Figures 33, 41)

NOTE: The following calibration procedure assumes an input signal range of −10 to +10 V dc. If it is desired to calibrate the Measured Variable Station using an input signal range of +10 to −10 V dc, the following changes in the calibration procedure are necessary.

a. Change step 4 to read - Position reverse input polarity staple jumpers to REV position.

b. Change step 7 to read - Adjust trimmer potentiometer R8 until meter M1 is at mid-scale.

c. Change step 10 to read - Adjust trimmer potentiometer R5 until meter M1 is at mid-scale.

d. Change step 11 to read - Apply −10.00 V at the input.

e. Change step 12 to read - Apply E_{IN} to +10.00 V.

TY10 and TY11 Basic Calibration Steps:

1. Remove Measured Variable Station from Enclosure.

2. Adjust meter zero adjustment until meter pointer is at mid-scale (Figure 34).

3. Connect Station to calibration circuit (Figure 37) and turn ON power supplies.

4. Position reverse input polarity staple jumpers to NOR position. (In NOR, input signal range is −10 to +10 V dc. In REV, input signal range is +10 to −10 V dc, see NOTE on Figure 41).

5. Position scale select switch S2 on front plate to LOWER position.

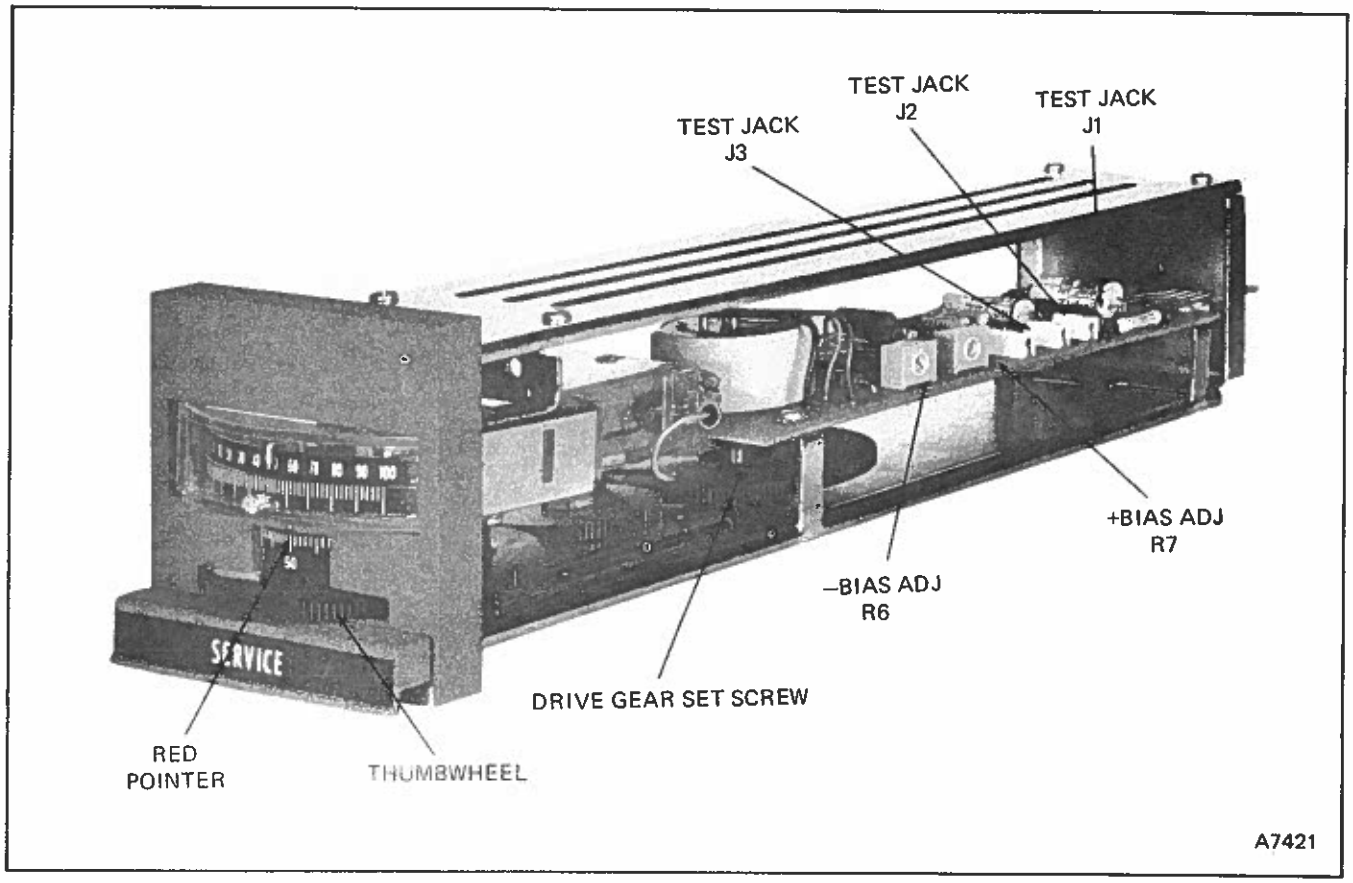


FIGURE 32 – Signal Generator Stations (TG30, TG40) Adjustments (TG30 shown)

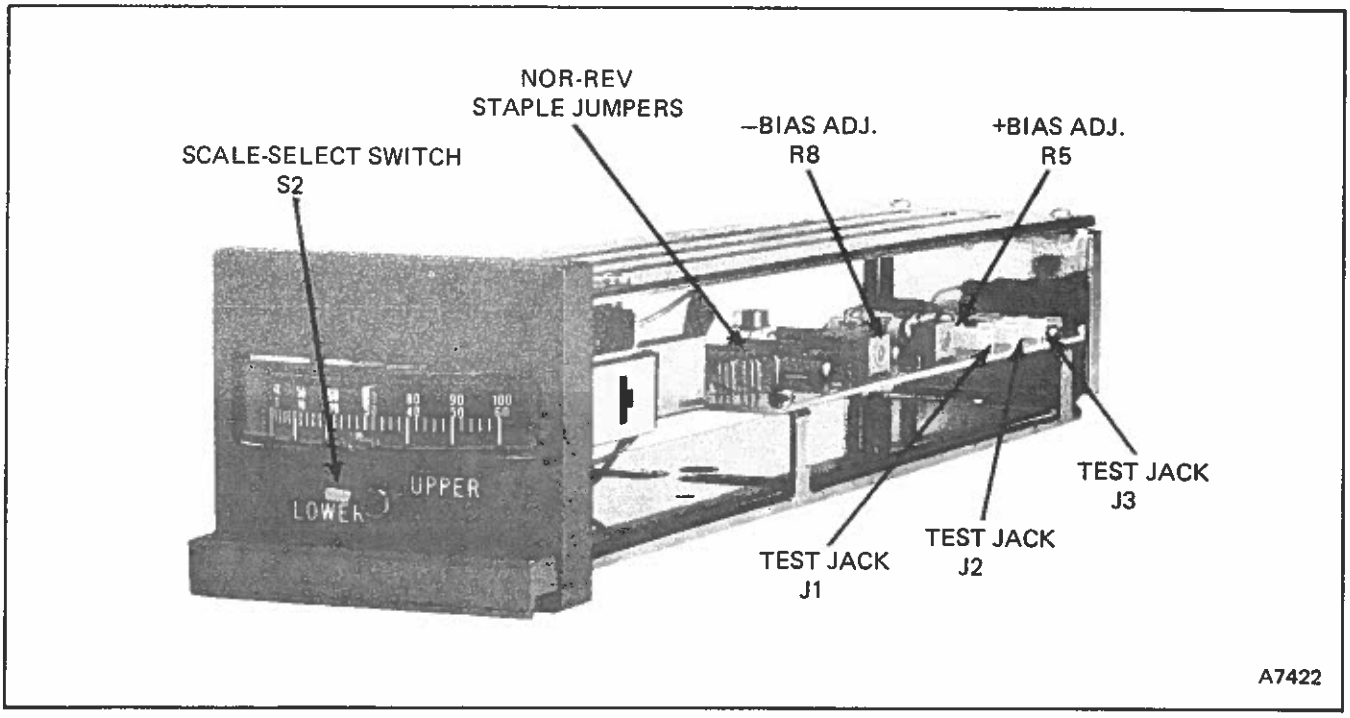


FIGURE 33 – Measured Variable Stations (TY10, TY11) Adjustments (TY10 shown)

6. Connect DVM between test jacks J1 (E_{IN}) and J3 (common) and adjust E_{IN} voltage to −4.00 ±0.005 V dc.

7. Adjust trimmer potentiometer R5 until meter M1 is at mid-scale.

8. Position scale select switch S2 to UPPER position.

9. Adjust E_{IN} to +4.00 ±0.005 V dc.

10. Adjust trimmer potentiometer R8 until meter M1 is at mid-scale.

11. Apply +10.00 ±0.005 V on input. Meter should read full scale right.

12. With S2 in lower position, adjust E_{IN} to −10.00 ±0.005 V. Meter should read full scale left.

13. Disconnect DVM and calibration circuit. This completes calibration.

TY20 Measured Variable Station Calibration

1. Remove Measured Variable Station from Enclosure and connect to calibration circuit (Figure 35).

2. Adjust meter zero adjustment until meter pointer is at mid-scale (Figure 34).

3. Apply +10 ±0.005 V input and verify meter swings full scale right.

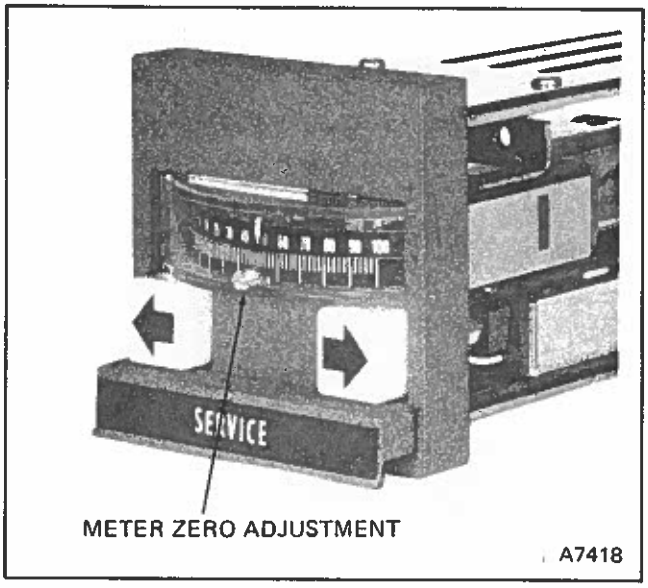


FIGURE 34 – Meter Zero Adjustment (TJ20 shown)

4. Apply −10 ±0.005 V to input and verify neter swings full scale left.

5. Disconnect input. This completes calibration.

6. To check calibration of Measured Variable Station:

Apply +10 V signal. Meter should swing full scale.

Apply −10 V signal. Meter should swing full scale in opposite direction.

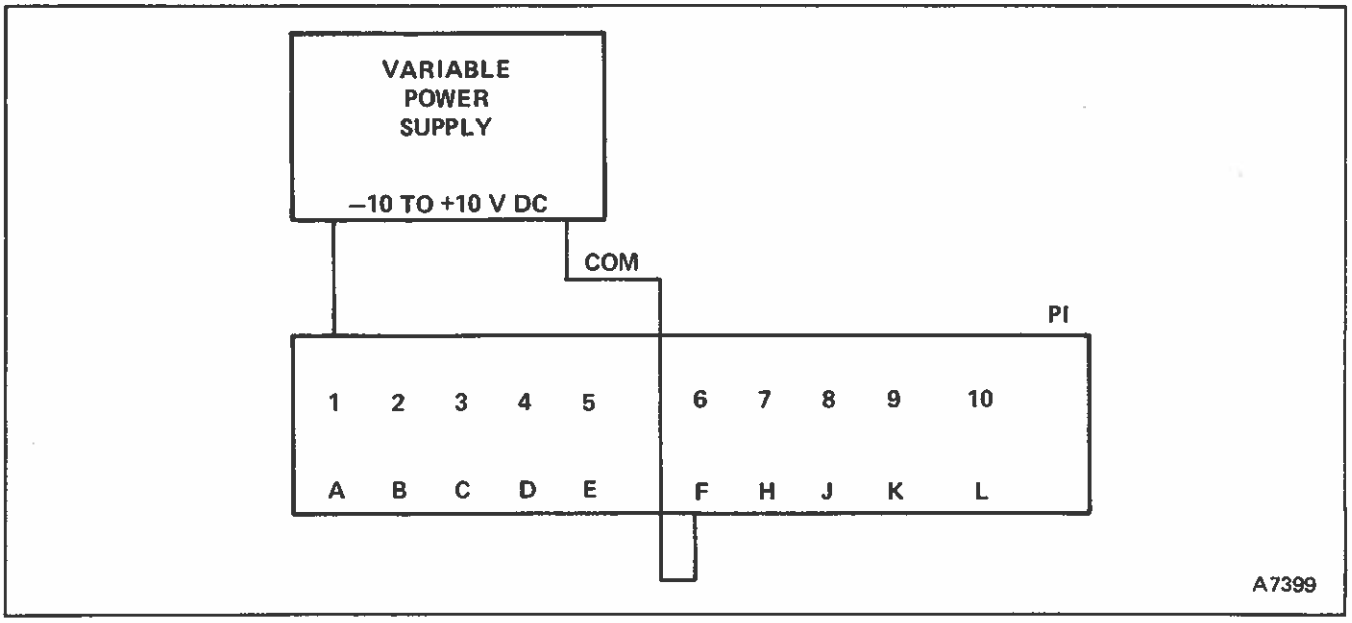


FIGURE 35 – Calibration Circuit for TY20 Station

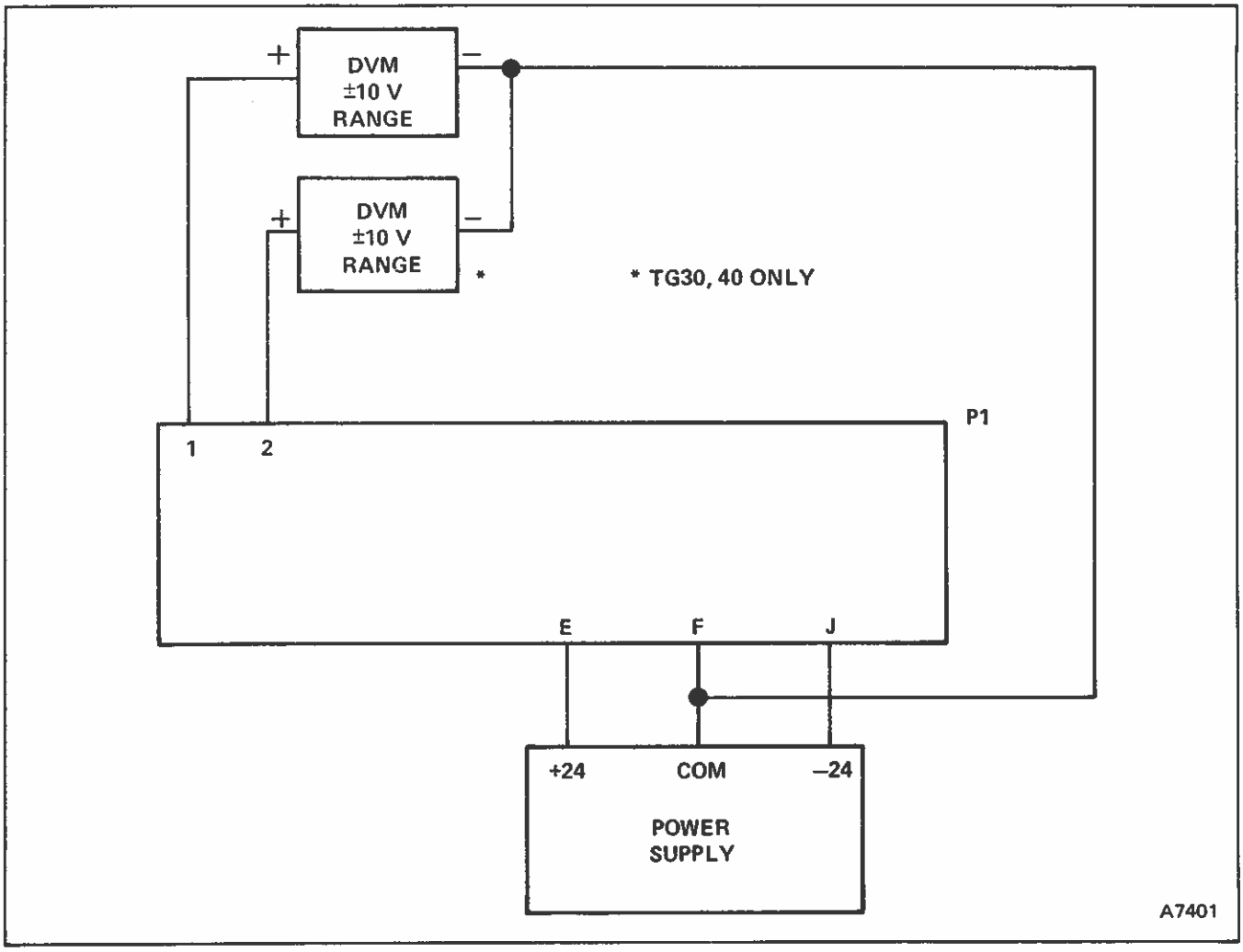


FIGURE 36 – Calibration Circuits for TG11, TG30 and TG40 Stations

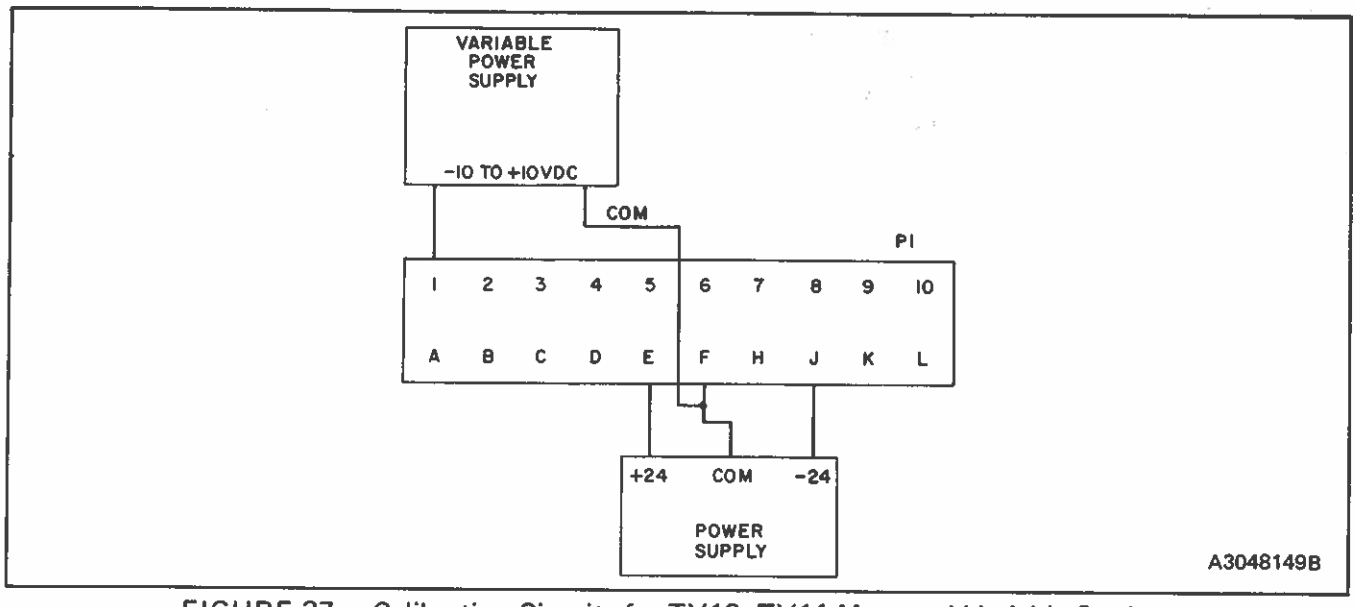


FIGURE 37 – Calibration Circuits for TY10, TY11 Measured Variable Stations

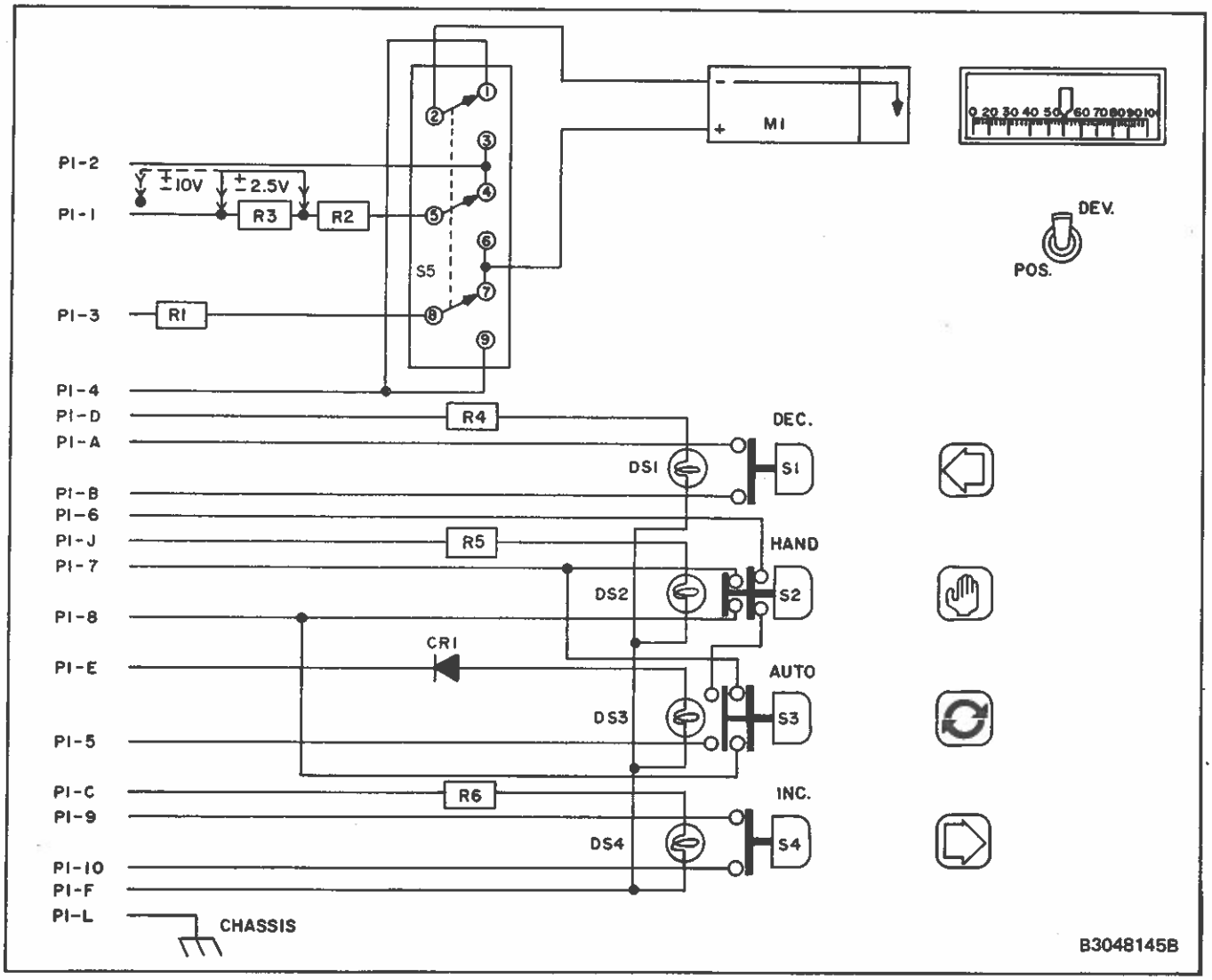


FIGURE 38 – Simplified Schematic for Transfer Station (TT20)

HOW THE OPERATOR INTERFACE STATIONS OPERATE

The Operator Interface Stations include the Transfer Station, Set Point Station, Signal Generator Stations, Measured Variable Station and Manual Jogging Station. These Stations operate in conjunction with separately mounted components of an Analog Control System. Interconnection is made by cable.

The Transfer Station, TT20

This Station provides interface functions between the Analog Control System and a remote operator or Static Analog Memory module (see Product Instruction E92-78 for a description of the Static Analog Memory Module). These interface functions include automatic/manual mode selection, increase/decrease control during manual mode operation and meter indications of percent position - percent signal level or percent deviation between controlling signal and system set point or demand signal.

Refer to Figure 38. Automatic/manual transfer consists of two illuminated, momentary pushbutton switches. The pushbuttons initiate transfer of control of the Analog Control System from manual control. When the automatic pushbutton is depressed, two relays, in the Transfer Relay module of the Analog Control System, are energized. (See Product Instruction E92-77 for a description of the Transfer Relay.) A normally open contact from one of the relays holds the two relays energized after the pushbutton is released. The Transfer Relay module also provides voltage to illuminate the green automatic pushbutton. This operation transfers the control of the remote operator or Static Analog Memory module to the appropriate Analog Control System components. When the manual pushbutton is depressed, the holding circuit is opened, de-energizing the relays. This transfers the System to manual, lights the lamp behind the yellow manual pushbutton and turns off the lamp behind the automatic pushbutton. Since the pushbuttons are momentary, transfer to manual can also be accomplished by interlock circuitry external to the Transfer Station.

Two normally open, momentary pushbutton switches provide the increase/decrease function during manual mode operation. A depressed pushbutton provides a closed contact signal to the Analog Control System. When a pneumatic device is used as a final actuator, the pushbutton contacts connect to the up-down terminals of a Static Analog Memory module. Output of the memory module is applied to the next control element, such as an electric-pneumatic converter producing a proportional pneumatic signal to position the actuator.

The meter provides indication of the final actuator position, or signal to the final actuator. Associated with the meter is a toggle switch selecting percent position (POS) or percent position deviation from set point (DEV). Meter scale engraving is from 0 to 100%, full scale. Deviation from set point is monitored around the 50% mark on the scale. The position input signal can be +10 to −10 V dc or −10 to +10 V dc. The deviation reading has increased sensitivity. The input can be +2.5 to −2.5 V dc or −2.5 to +2.5 V dc for a full-scale reading.

The Set Point Station TG11 (refer to Figure 39)

The purpose of the Analog Control System is to maintain the process at desired level. The Set Point Station generates these desired set point voltage signals as set by a four decade thumbwheel switch mounted on the front plate. Switch numbers are in engineering units, not % of span.

Type TG11 has a thumbwheel switch with a 0 to 9999 unit range. The range can be adjusted for a minimum span of 400 units and a maximum suppression ratio of 24. As an example: with a range of 9600 to 9999 units, the suppression ratio is 9600/400, equaling 24 (see SAMA Standard PMC20.1).

During alignment of the thumbwheel switch, large output step changes are prevented by integrating the set point voltage output at a rate of 1% per second (0.2 volts per second). Also, a pushbutton, located under the thumbwheel switch on the front plate, gives the operator the ability to prevent the set point voltage from changing until he has completed the thumbwheel switch setting. During initial calibration, the Set Point Station is adjusted for range and span to give the thumbwheel switch a direct engineering unit readout.

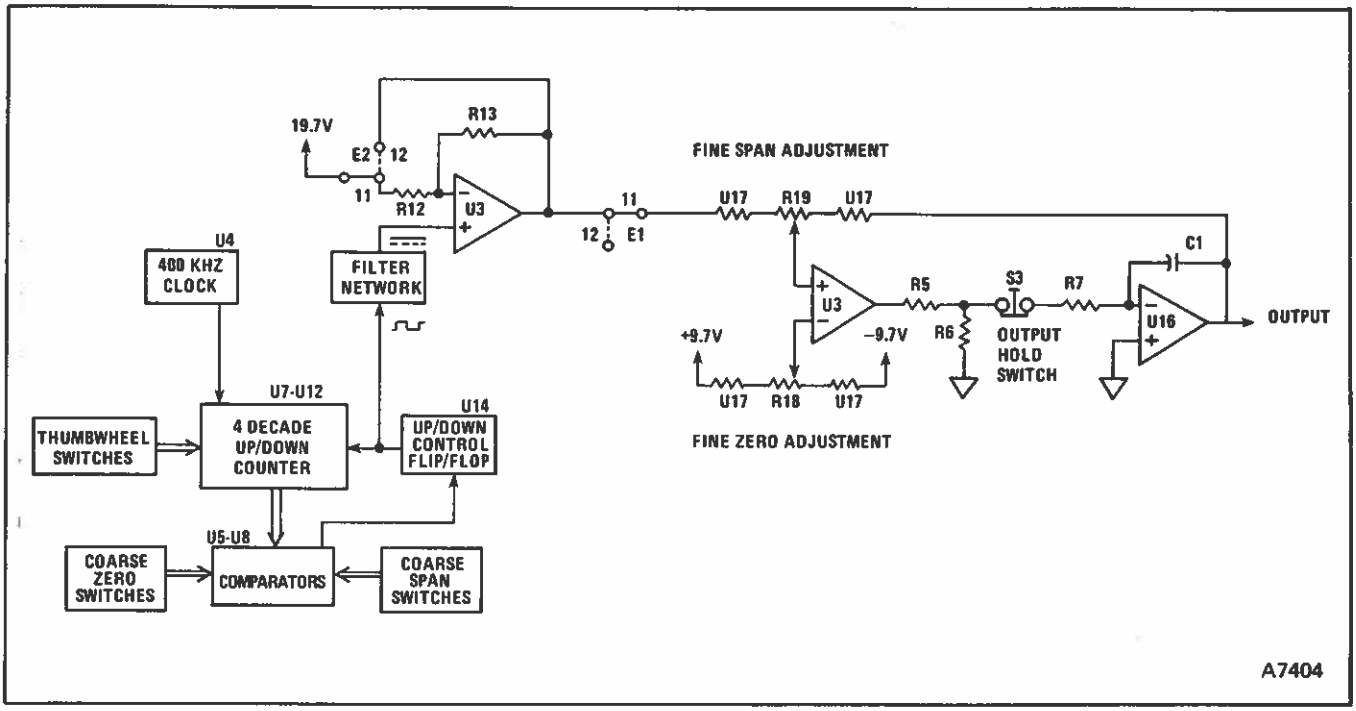


FIGURE 39 – Simplified Schematic for Set Point Station (TG11)

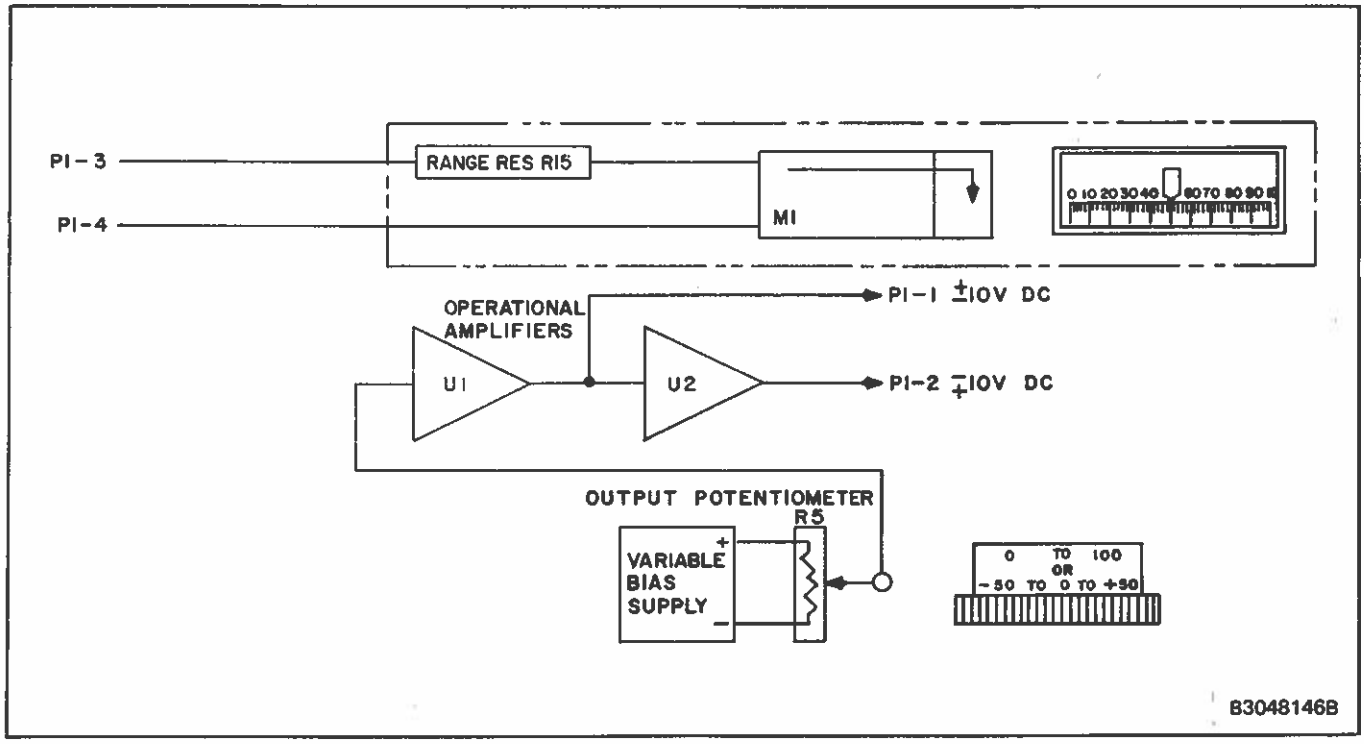


FIGURE 40 – Simplified Schematic for Signal Generator Stations (TG30 and TG40)

The TG11 uses pulse width modulation to convert the thumbwheel switch setting to an analog signal. The method used to create the pulse width modulation is to control the ratio of "up" count time and "down" count time of 4 up/down counters over some constant count period, which can be selected for various input spans. The input switch span and zero suppression are selected by using the binary coded decimal (BCD) coarse zero and BCD coarse span select switch the difference between the two switch settings determines the humber of counts in one period. The thumbwheel switch setting determines the point in the period, when referenced to the coarse zero and span switch settings, where the counters change counter direction. Thus, if the coarse zero switch is at 1,799 and the coarse span select is at 3,600, the period is 1,801 counts. If the thumbwheel switch is set at 2,516, 1,084 counts will be made with the counter in the "up" mode and 717 counts will be made in the down mode. The result is a duty cycle of 60.19%.

The duty cycle created from the digital system is referenced to a stable voltage source, filtered and converted into a ±10 V output signal.

Signal Generator Stations TG30, TG40 (Bias Manual and Manual Control)

The Bias Manual Station supplies two dc bias voltage signals for use by the Integrated Analog Control System. One signal is −10 to +10 V dc while the other signal is +10 to −10 V dc. Both signals are simultaneously adjusted with one thumbwheel-driven potentiometer. This permits simultaneous biasing up and down of two power operators. The thumbwheel is accessible from the front plate and has engravings of −50 to 0 to +50. Normally, this station is used in conjunction with an Operator Interface Transfer Station. In this application, the Bias Manual Station provides an adjustable bias signal used in operating the final actuator.

Refer to Figure 40. Circuitry for the Bias Manual Station consists of a bias supply, output adjusting potentiometer and two integrated-circuit operational amplifiers. The variable bias supply provides a dual polarity, ±10 V dc signal to the potentiometer. This allows the potentiometer to select any voltage between +10 and −10 V dc. The potentiometer wiper connects to the input of unity gain, non-inverting amplifier U1. The output of U1 provides one of the Station outputs and is used as the input of unity-gain inverting amplifier U2. The output of U2 is identical to the output of U1 but of opposite polarity.

The Bias Manual Station has a horizontal meter on the front plate for monitoring the final output device position. The meter allows operation with position indication. Meter connections P1-3 and P1-4 accept input voltage signals of −10 to +10 V dc or +10 to −10 V dc. Meter scale engravings are 0 to 100%.

The Manual Control Station is identical to the Bias Manual Station except the thumbwheel has engravings of 0 to 100. This station provides direct manual control of an output device not being automatically controlled by the Integrated Analog Control System.

Measured Variable Stations TY10, TY11

The Measured Variable Station accepts −10 to +10 V dc or +10 to −10 V dc measured variable signal from the Analog Control System for display. A split scale horizontal meter on the front plate can be marked for a particular application to give a readout in actual engineering units. The split scale feature of the meter expands a 0 to 100 percent full scale reading over two scales to increase the effective scale length. The upper scale covers 0 to 60 percent of full scale range while the lower scale covers 40 to 100 percent of full scale. This gives a 20 percent overrange centered around 50 percent of full scale. A front plate toggle switch selects the upper and lower scales.

Refer to Figure 41. The Measured Variable Station consists of a variable bias supply, integrated circuit operational amplifier, horizontal meter, meter range resistor, reversed input polarity switch and meter scale select switch. In the circuit, the variable bias supply converts the measured variable input signal to 6 V dc range signal. Amplifier U1 buffers the converted signal providing circuit isolation. The output of U1 drives the horizontal meter thru a range resistor R14. Staple jumpers change the bias polarity and reverses the meter connections allowing the Station to accept reversed polarity input signals. Switch S2 selects the upper or lower meter scale.

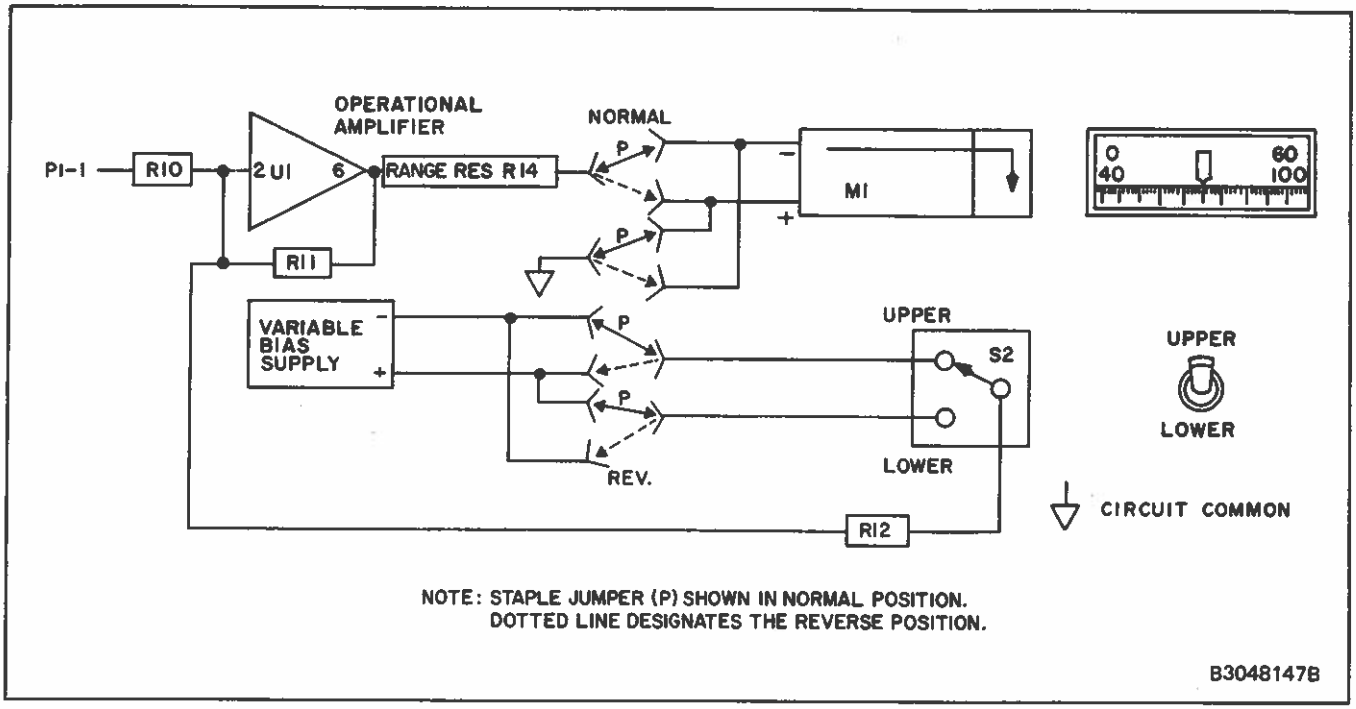


FIGURE 41 – Simplified Schematic for Measured Variable Stations (TY10 and TY11)

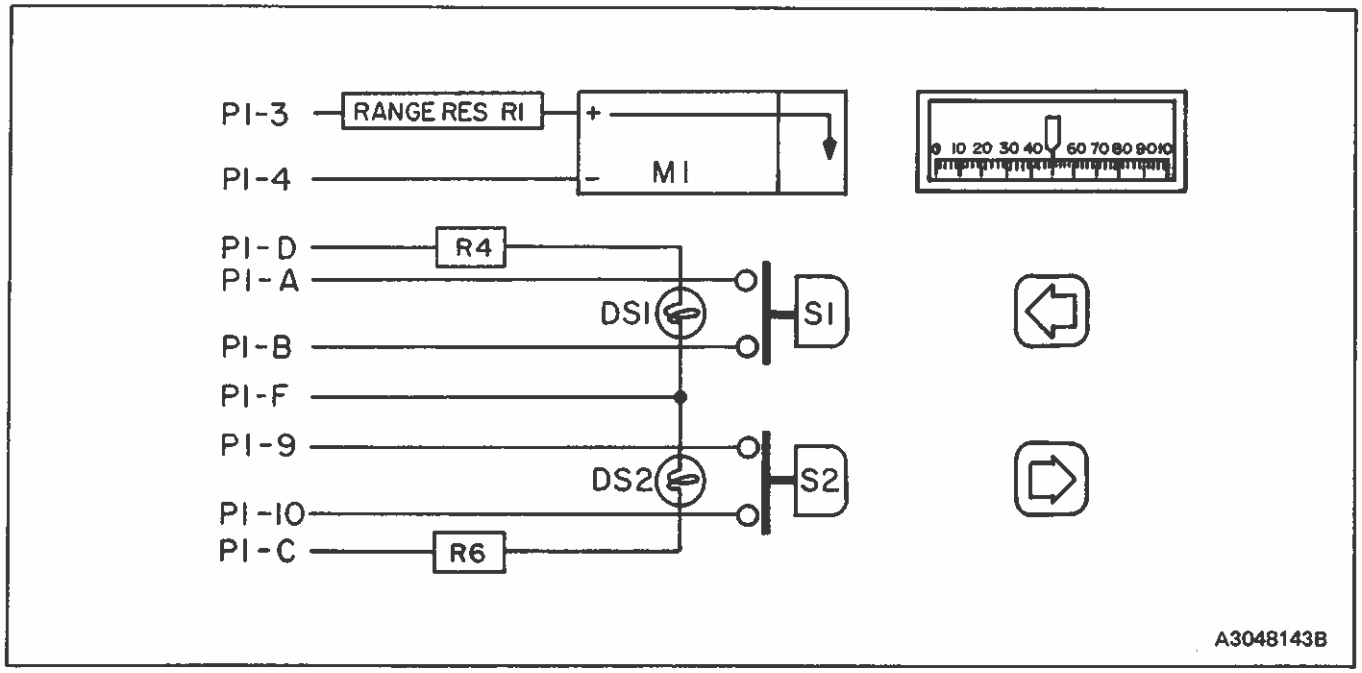


FIGURE 42 – Simplified Schematic for Manual Jogging Station (TJ20)

The Manual Jogging Station TJ20

The station provides direct manual jogging control of a final output device or remote output adjustment of a State Analog Memory module (see Product Instruction E92-78 for a description of the Static Analog Memory module).

Refer to Figure 42. In the circuit, two momentary pushbutton switches give direct increase/decrease control. A depressed pushbutton provides a closed contact signal. Also included in the Station is a meter to indicate the output device position or other signals. Meter scale engraving is from 0 to 100% full scale.

EXPLANATION OF NOMENCLATURE

STANDARD TYPES

TRANSFER STATION - TYPE TT20

TT20	Illuminated manual/automatic and increase/decrease pushbuttons.

MANUAL JOGGING STATION - TYPE TJ20

TJ20	Illuminated increase/decrease pushbuttons.

SET POINT STATION - TYPE TG11

TG11	For zero based or suppressed range requirements.

SIGNAL GENERATOR STATIONS - TYPE TG30, TG40

TG30, Bias/Manual	0 to 100 percent output meter; thumbwheel engraved for –50 to 0 to +50 percent setting.
TG40, Manual	0 to 100 percent output meter; thumbwheel engraved for 0 to 100 percent setting.

MEASURED VARIABLE STATION - TYPE TY□□

TY10	Horizontal edgewise meter 0 to 100 percent engraving.
TY11	Horizontal edgewise meter engraved in engineering units as specified by customer.
TY20	Horizontal edgewise meter, 0 to 100 percent engraving, single range.

BLANK STATIONS TYPE - TO

TO10	Blank filler station.

STATION ENCLOSURE TYPE - TZ

TZ10	Enclosure for single Type T operator interface station.

SPECIFICATIONS

TRANSFER STATION - TYPE TT20

Accuracy*	Horizontal meter scale: 2.0% of output span.
Normal Operating	Temperature*: 40° to 120°F (4°C to 49°C).
Indicator Signal	−10 to +10 V dc or +10 V to −10 V dc (Position) −2.5 to +2.5 V dc or +2.5 V to −2.5 V dc (Deviation) ±2.5 V dc or ±10 V dc internally set
Transfer Operation	In transferring system from manual to automatic operation or from automatic to manual operation it is only necessary to push the "Auto" or "Hand" pushbutton. 820 System automatically transfers without "bumping" control system or power devices. Switch rating 28 V dc, 3 amps resistive.
Remote Manual Operation	Pushbutton switches provide manual control of power device. Power device remains stationary unless switch calls for increase or decrease. Switch rating: 28 V dc, 3 amps resistive.

*As defined by SAMA standard PMC20.1.

Indicating Scales	Horizontal Meter: Indicates power device position, deviation, demand or set point signal, depending on position of meter switch; scale graduated 0 to 100%.
Indicating Lights	Lamps: 0.2 candlepower at 28 V dc. Green: Indicates when system is under automatic operation. Yellow: Indicates when system is under remote manual operation.
Service Legend	Maximum number of letters and spaces: 23 per line if 0.156" (4mm) high; 28 per line if 0.0939" (2.4mm) high; 2 lines.
Mounting	Designed for plug-in mounting in Type TZ10 Enclosures.
Size	2.9" x 2.6" x 10.5" behind faceplate (74mm x 67mm x 267mm); Faceplate 0.9" (23mm)
Weight	1.3 lbs (0.6 kg)
Certification	CSA certified for general purpose (non-hazardous) locations.

SET POINT STATION - TYPE TG11

Accuracy*	0.25% of span, full scale, minimum
Normal Operating	Temperature: 40° to 140°F (4° to 60°C)
Power Requirements	+24 V dc @ 30 mA and −24 V dc @ 30 mA.
Output Signal	−10 to +10 V dc or +10 to −10 V dc.
Output Integration Rate	1% per sec. of full scale output, typical.
Output Impedance	< 1 ohm.
Output Ripple	<0.1% (peak-to-peak).
Output Loading	2K ohms, minimum.

*As defined by SAMA standard PMC20.1.

Setpoint Adjust	Four decade thumbwheel switch, readout in engineering units after internal calibration.
Setpoint Range	Zero or suppressed ranges.
Service Legend	Maximum numbers of letters and spaces: 23 per line if 0.156" (4mm) high; 28 per line if .0939" (2.4mm) high; 21 lines possible.
Mounting	Designed for plug-in mounting in Type TZ10 Enclosure.
Size	2.9" x 2.6 x 10.5" (74mm x 66mm x 267mm) behind faceplate. Faceplate 0.9" (23mm).
Weight	1.3 lbs (0.6 kg).
Certification	CSA certified for general purpose (non-hazardous) locations.

SIGNAL GENERATOR STATIONS - TYPE TG30 AND TG40

Accuracy*	Dial indicator scale: ±1.0% of output span. Horizontal meter scale: ±2% of full scale output.
Normal Operating	Temperature*: 40° to 120°F (4°C to 49°C)
Power Requirements	±24 V dc @ 70 mA.
Output Signal	–10 to +10 V dc and +10 to –10 V dc.
Output Impedance	< 1 ohm.
Output Ripple	< 0.1% (peak-to-peak)
Indicating Scales	TG30 and TG40: horizontal meter indicates 0 to 100% from a –10 to +10 V dc or +10 to –10 V dc signal. Monitors power device position. TG30: dial indicates bias signal of –50 to 0 to +50%. TG40 only: dial indicates bias signal of 0 to 100%.

Service Legend	Maximum number of letters and spaces: 23 per line if 0.156" (4mm) high; 28 per line if .0939" (2.4mm) high; 2 lines.
Mounting	Designed for plug-in mounting in Type TZ10 Enclosures.
Size	2.9" x 2.6" x 10.5" behind faceplate. (74mm x 66mm x 267mm); Faceplate 0.9" (23mm)
Weight	1.3 lbs (0.6 kg).
Certification	CSA certified for general purpose (non-hazardous) locations.

*As defined by SAMA standard PMC20.1.

MEASURED VARIABLE STATION - TYPES TY10, TY11 AND TY20

Accuracy*	Horizontal meter scale: ±2% of output span.
Normal Operating	Ambient Temperature*: 40° to 120°F (4° to 49°C)
Power Requirements	±24 V dc @ 45 mA (TY10 and TY11 only)
Input Signal	–10 to +10 V dc or +10 to –10 V dc.
Input Impedance	100K ohms, minimum.
Indication Scales	TY10: horizontal meter has dual scale, indicating 0 to 60% and 40 to 100%, switch selectable. TY11 horizontal meter has dual scale, indication in engineering units as specified by customer, switch selectable. TY20: horizontal meter has single scale, indicating 0 to 100%.

Service Legend	Maximum number of letters and spaces: 23 per line if 0.156" (4mm) high; 28 per line if .0939" (2.4mm) high; 2 lines.
Mounting	Designed for plug-in mounting in Type TZ10 Enclosures.
Size	2.9" x 2.6" x 10.5" behind faceplate (74mm x 67mm x 280mm); Faceplate 0.9" (23mm).
Weight	1.3 lbs (0.6 kg)
Certification	CSA certified for general purpose (non-hazardous) locations.

*As defined by SAMA standard PMC20.1.

MANUAL JOGGING STATION - TYPE TJ20

Accuracy*	Horizontal meter scale: 2.0% of output span.
Normal Operating	Temperature*: 40° to 120°F (4° to 49°C)
Input Signal	–10 to +10 V dc or +10 to –10 V dc.
Remote Manual Operation	Pushbutton switches provide manual control of power device. Power device remains stationary unless switch calls for increase or decrease. Switch rating: 28 V dc, 3 amps resistive.
Indicating Lights	Lamps 0.3 candlepower @ 28 V dc. Pushbutton color specified by customer.

*As defined by SAMA standard PMC20.1.

Service Legend	Maximum number of letters and spaces: 23 per line if 0.156" (4mm) high; 28 per line if .0939" (2.4mm) high; 2 lines
Mounting	Designed for Plug-in mounting in Type TZ10 Enclosures.
Size	2.9" x 2.6" x 10.50" behind faceplate (74mm x 66mm x 267mm); Faceplate 0.9" (23mm)
Weight	1.3 lbs (0.6 kg)
Certification	CSA certified for general purpose (non-hazardous) locations.

OPERATOR INTERFACE STATION ENCLOSURE - TYPE TZ

Enclosure Capacity	One Type T Operator Interface Station per Enclosure
External Wiring Connections	Separate cable with 20 pin rectangular connector
Material	Enclosure, trim and mounting hardware: 6063-6 extruded aluminum

Finish	All major parts are anodized or simulated anodized aluminum.
Size	2.9" x 2.5" x 10" (74mm x 64mm x 254mm)
Weight	.75 lbs (0.34 kg)
Certification	CSA certified for general purpose (non-hazardous) locations.

BLANK STATION - TYPE TO

Size	2.9" x 2.6" x 10.50" behind faceplate (74mm x 66mm x 267mm); Faceplate 0.9" (23mm).

Weight	0.625 lbs. (0.284 kg)

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

REPLACEMENT PARTS

Figures 43 thru 49 (parts drawings) and Figures 50 and 51 (dimensional drawings) which follow, will normally apply to furnished Operator Interface Stations; however, there may be individual differences in specific assemblies due to:

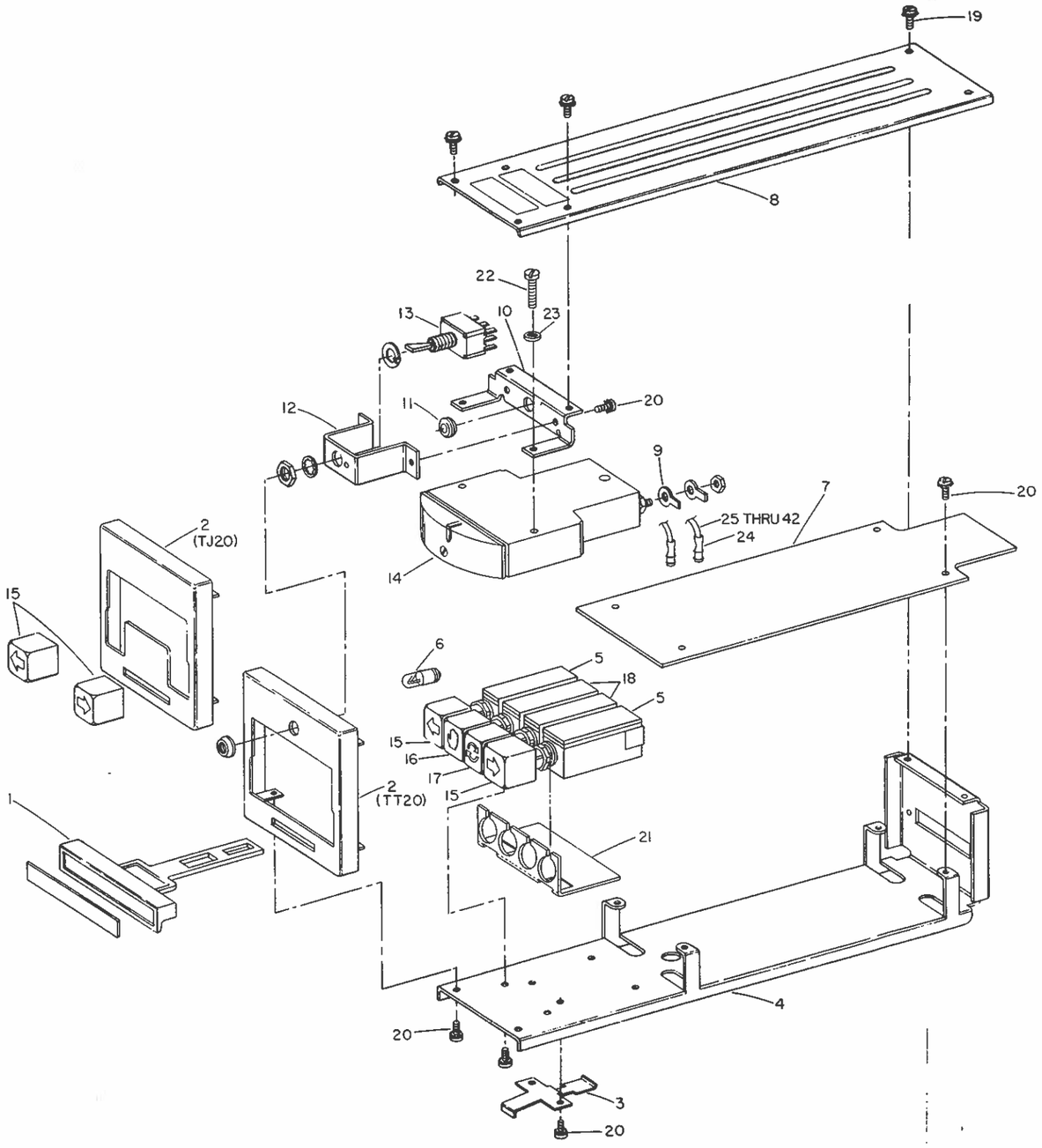
a. Design changes made since the printing of this Product Instruction.

b. Special design of equipment furnished to make it suitable for special applications.

Therefore, when ordering individual parts, assure the receipt of correct replacements by specifying on the order:

1. Complete nomenclature, code number, part number, series label number and S.O. number of equipment for which parts are desired.

2. Parts Drawing Number on which each part is illustrated.



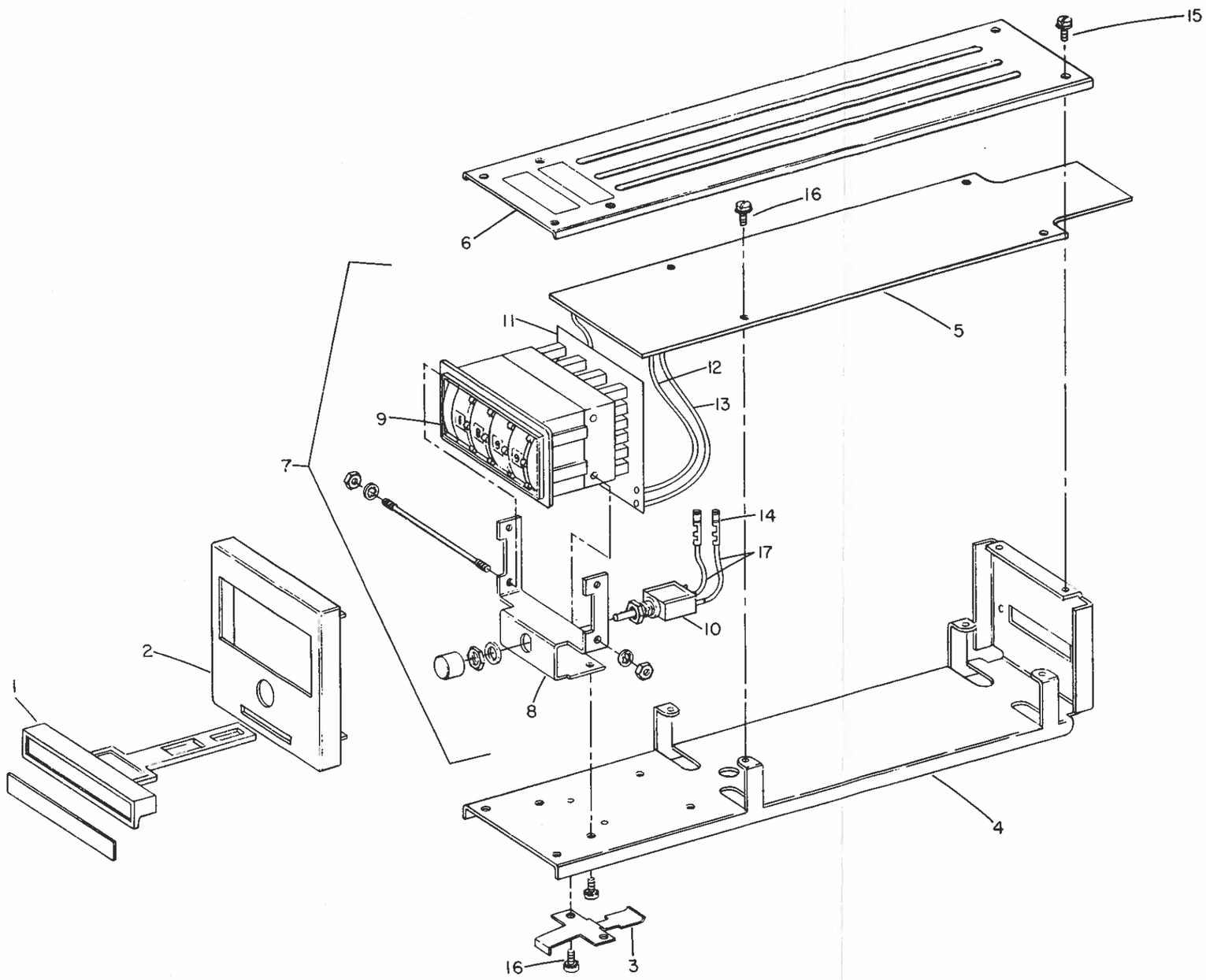
ITEM	PART NO.	NAME
1	6627052-1	LATCH HANDLE
2	(SEE TABLE)	FRONT PLATE
3	6627053-1	LATCH SPRING
4	6627047-1	BOTTOM CHASSIS
5	1947023-1	PUSHBUTTON SWITCH 2 REQD
6	1943272-1	INCANDESCENT LAMP, (SEE TABLE)
7	(SEE TABLE)	TRANSFER/MANUAL JOGGING COMPONENT ASSEMBLY
8	6627049-1	TOP CHASSIS
9	1941399-3	SOLDERLESS TERMINAL, 2 REQD
10	6627054-2	METER MTG. BRACKET
11	67125-1	RUBBER GROMMET, (SEE TABLE)
12	6627055-1	SWITCH MTG. BRKT. (SEE TABLE)
13	1945849-1	SUB-MINIATURE TOGGLE SWITCH, (SEE TABLE)
14	1945848-1	D.C. MILLIAMETER
15	1947024-7	SWITCH BUTTON, 2 REQD
16	1947024-2	SWITCH BUTTON, (SEE TABLE)
17	1947024-3	SWITCH BUTTON, (SEE TABLE)
18	1947023-2	PUSHBUTTON SWITCH, (SEE TABLE)
19	.112-40x.188LG	PAN HD CD PL STL MACH SCR, 6 REQD
20	.112-40x.188LG	PAN HD CD PL STL SEMS EXT, 12 REQD
21	6632688-1	BRACKET, SW. MTG.
22	.138x625 LG	PAN HD CD PL STL THRD FRMG SCREW TYPE B, 2 REQD
23	1206-00	CD PL STL SHAKE-PROOF LOCKWASHER, 2 REQD
24	1946162-1	RECEPTACLE, PIN SEE TABLE
25	R2041-1661 22 AWG	WHT/RED LEADWIRE, 4.5 IN
26	R2041-1663 22 AWG	WHT/YEL LEADIWRE, 4.5 IN
27	R2041-1664 22 AWG	WHT/GRN LEADWIRE (SEE TABLE)
28	R2041-1659 22 AWG	WHT LEADWIRE (SEE TABLE)
29	R2041-1658 22 AWG	GRA LEADWIRE (SEE TABLE)
30	R2041-1653 22 AWG	ORN LEADWIRE (SEE TABLE)
31	R2041-1667 22 AWG	WHT/GRA LEADWIRE, (SEE TABLE)
32	R2041-1657 22 AWG	VIO LEADIWRE (SEE TABLE)
33	R2041-1656 22 AWG	BLU LEADWIRE (SEE TABLE)
34	R2041-1666 22 AWG	WHT/VIO LEADWIRE 4.5 IN
35	R2041-1662 22 AWG	WHT/ORN LEADWIRE (SEE TABLE)
36	R2041-1660 22 AWG	WHT/BLK LEADWIRE 4.5 IN
37	R2041-1715 22 AWG	WHT/BRN LEADWIRE 4.5 IN
38	R2041-1665 22 AWG	WHT/BLU LEADWIRE 4.5 IN
39	R2041-1652 22 AWG	RED LEADWIRE (SEE TABLE)
40	R2041-1654 22 AWG	YEL LEADWIRE (SEE TABLE)
41	R2041-1650 22 AWG	BLK LEADWIRE (SEE TABLE)
42	R2041-1651 22 AWG	BRN LEADWIRE (SEE TABLE)

TYPE	ITEM 2	ITEM 6	ITEM 7	ITEMS: 11, 12 13, 16 & 17	ITEM 18
TT20	6627050-11	4 REQD	6633171-1	1 REQD	2 REQD
TJ20	6627050-12	2 REQD	6633171-2	OMIT	OMIT

	ITEM 24	ITEM 27	ITEMS: 28 29 & 31	ITEMS: 30 32, 33, 35 41 & 42	ITEMS: 39 & 40
TT20	24 REQD	18 IN	9 IN	45 IN	9 IN
TJ20	10 REQD	9 IN	OMIT	OMIT	4.5 IN

D6627097M

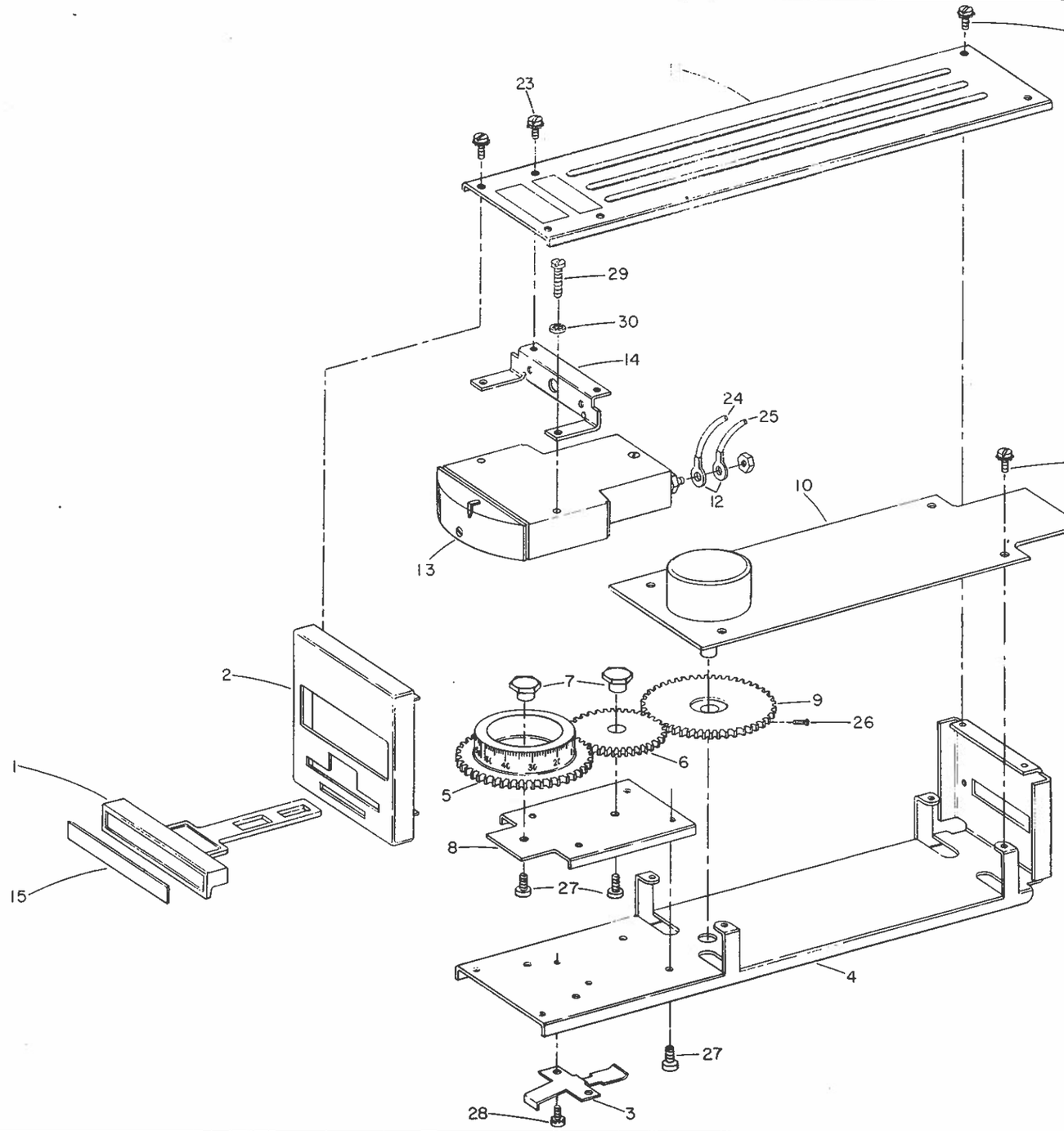
FIGURE 43 – Parts Drawing E91-10-1, Type TT20 Transfer Station and Type TJ20 Manual Jogging Station.



ITEM	PART NO.	NAME
1	6627052-1	LATCH HANDLE
2	6627050-6	FRONT PLATE
3	6627053-1	LATCH SPRING
4	6627047-1	BOTTOM CHASSIS
5	6633214-1	COMPONENT BOARD ASSY
6	6627049-1	TOP CHASSIS
7	6632282-1	SWITCH ASSEMBLY (INCLUDES ITEMS 8 THRU 13)
8	6627439-1	SWITCH MOUNTING BRACKET (P/O ITEM 7)
9	6632261-1	FOUR DECADE THUMBWHEEL SW (P/O ITEM 7)
10	1945859-1	PUSHBUTTON SWITCH (P/O ITEM 7)
11	6632261-1	BD SWITCH PRCKT (P/O ITEM 7)
12	1946412-2	CABLE, FLAT, JUMPER
13	1946412-3	CABLE, FLAT, JUMPER
14	1946162-1	PIN RECEPTACLE, 2 REQD
15	.112-40x.125	PAN HD CD PL STL MACH SCR 4 REQD
16	.112-40x.188	PAN HD CD PL STL SEMS EXT. 10 REQD
17	R2041-1652	22 AWG LEADWIRE (RED) 3 IN, 2 REQD

D30048160B

FIGURE 44 — Parts Drawing E91-10-2, Type TG11
Signal Generator Set Point Station

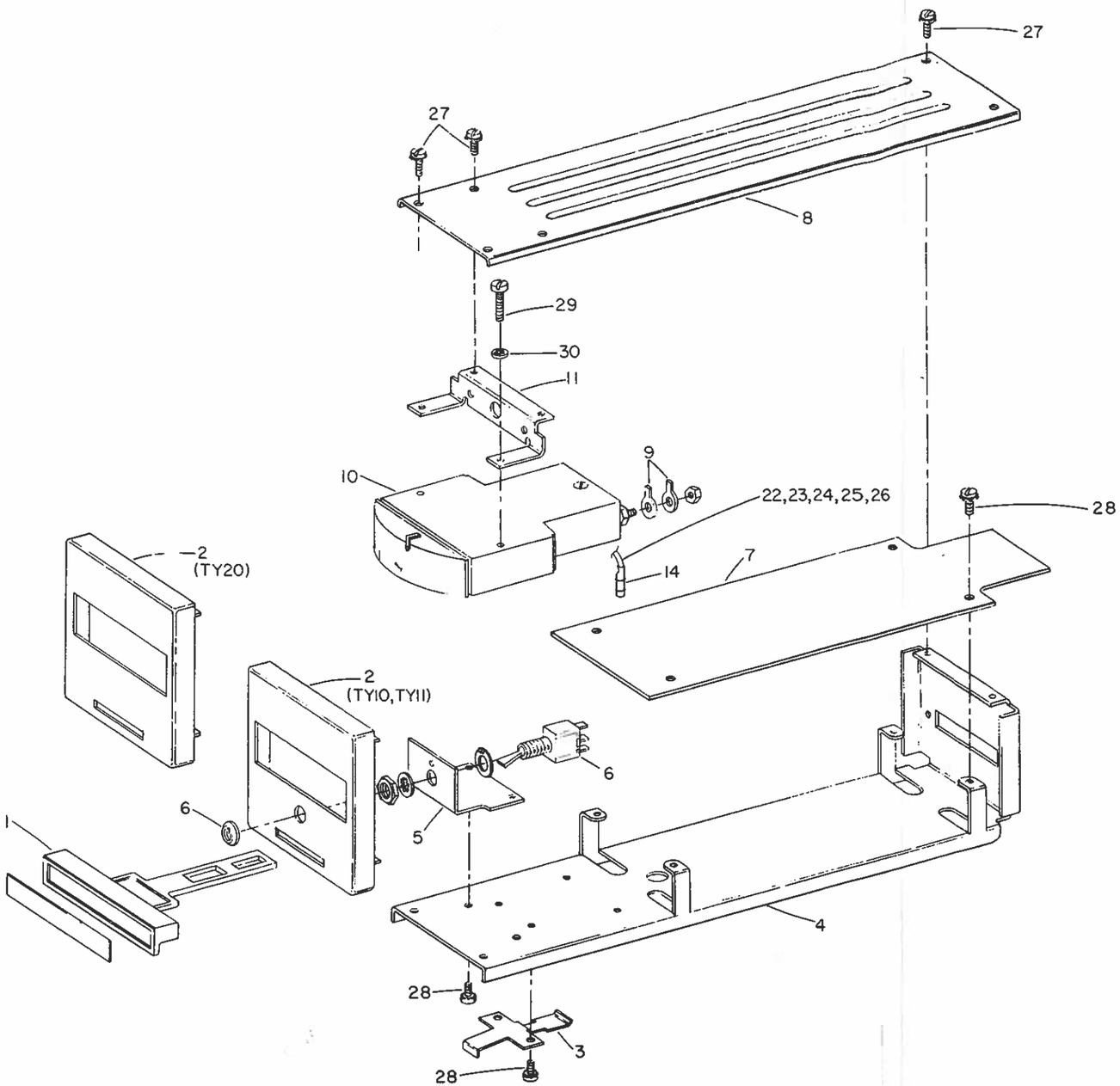


ITEM	PART NO.	NAME
1	6627052-1	LATCH HANDLE
2	6627050-3	FRONT PLATE
3	6627053-1	LATCH SPRING
4	6627047-1	BOTTOM CHASSIS
5	SEE TABLE	DIAL
6	193195-1	IDLER GEAR
7	6627238-1	SPACER, 2 REQD
8	6627237-1	MTG BRKT
9	193196-1	DRIVE GEAR
10	6627236-1	COMPONENT BOARD ASSY, SIGNAL GENERATOR
11	6627049-1	TOP CHASSIS
12	1941399-3	SOLDERLESS TERM. 2 REQD
13	19458-1	DC MILLIAMETER
14	6627054-2	METER MTG. BRKT
15	1962855-1	LEGEND PLATE
23	.112-40x188	PAN HD CD PL STL MACH SCR 6 REQD
24	R2041-1654	22 AWG RED LEAD-WIRE, 4 IN
25	R2041-1652	22 AWG YELLOW LEADWIRE, 4 IN
26	.112-40x.250	HEX SOCKET HEADLESS STN STL CUP PT SET SCREW, 2 REQD
27	.112-40x.312	PAN HD MACH SCREW CD PL STL, SEMS EXT.
28	.112-40x.188	PAN HD SEMS EXT, CD PL STL SEMS EXT, 8 REQD
29	.138x.625	THREAD FORMING SCREW, TYPE B 2 REQD
30	1206-00	SHAKEPROOF LKWASH, CD PL STL 2 REQD

TYPE	ITEM 5
TG30	1962845-1 (-50 TO +50)
TG40	1962845-2 (0 TO 100)

D3048163B

FIGURE 45 – Parts Drawing E91-10-3, Types TG30, TG40 Signal Generator Stations



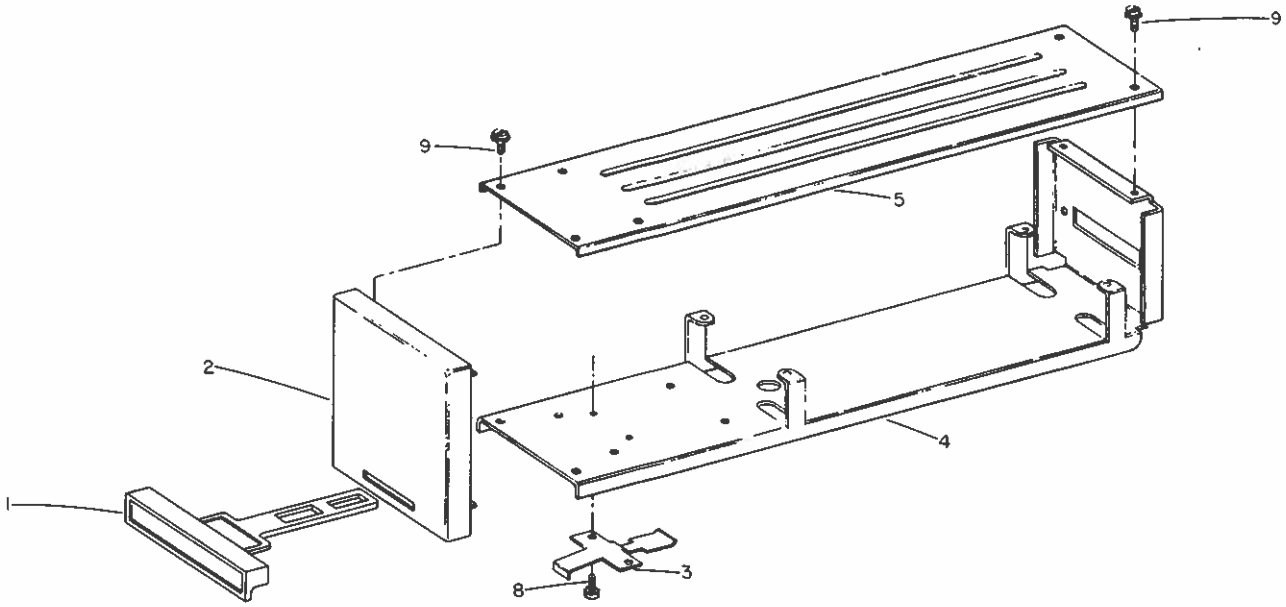
ITEM	PART NO.	NAME
1	6627052-1	LATCH HANDLE
2	SEE TABLE	FRONT PLATE
3	6627053-1	LATCH SPRING
4	6627047-1	BOTTOM CHASSIS
5	6627279-1	SWITCH MTG BRKT
6	1945849-2	TOGGLE SWITCH (SEE TABLE)
7	SEE TABLE	COMPONENT BOARD
8	6627049-1	TOP CHASSIS
9	1941399-3	SOLDERLESS TERM, 2 REQD
10	SEE TABLE	DC MILLIAMETER
11	6627054-2	METER MTG BRKT
14	1946162-1	RECEPTACLE PIN
22	R2041-1652	22 AWG LEADWIRE (RED) 4.5 IN
23	R2041-1654	22 AWG LEADWIRE (YEL) 4.5 IN
24	R2041-165	22 AWG LEADWIRE (BLU) (SEE TABLE)
25	R2041-165	22 AWG LEADWIRE (BLK) (SEE TABLE)
26	R2041-165	22 AWG LEADWIRE (BRN) (SEE TABLE)
27	.112-40x.188	PAN HD CD PL STL MACH SCR 6 REQD
28	.112-40x.188	PAN HD CD PL STL SEMS EXT. (SEE TABLE)
29	.138x625	PAN HD CD PL STL THD FRMG SCR TYPE B, 2 REQD
30	1206-00	CD PL STL SHAKEPROOF LOCKWASHER 2 REQD

TYPE	ITEM 2	ITEMS 5 & 6	ITEM 7	ITEM 10
TY10	6627050-5	1 REQD	6627282E1	1945848-2
TY11	6627050-5	1 REQD	6627882E1	1945848-□ (Range & Scale per Engrg Data)
TY20	6627050-9	OMIT	6633190-1	194548-1

	ITEM 28	ITEM 14	ITEMS 24, 25, 26
TY10	10 REQD	OMIT	4.5 IN EACH
TY11	10 REQD	OMIT	4.5 IN EACH
TY20	8 REQD	2 REQD	OMIT

D3048159B

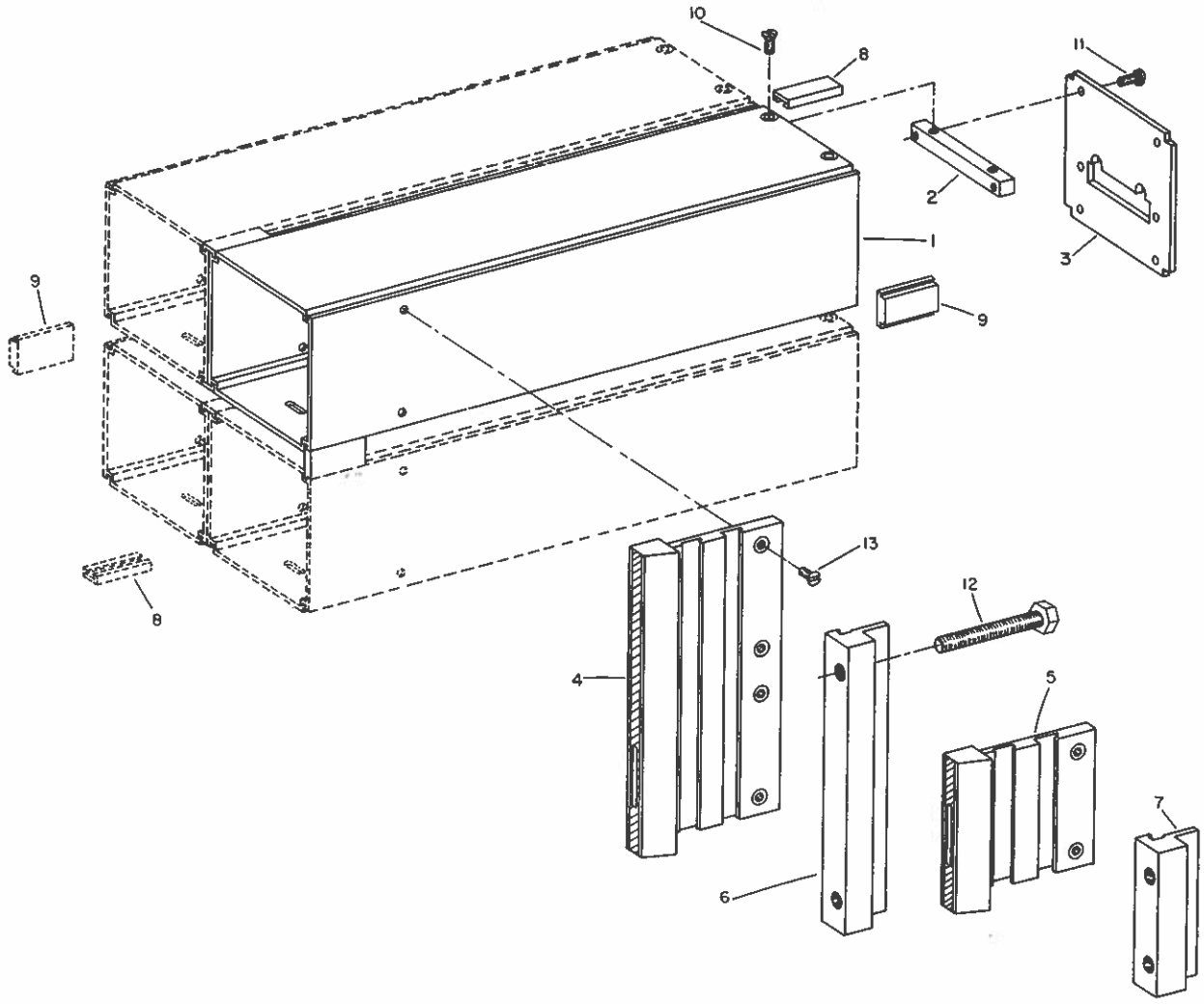
FIGURE 46 – Parts Drawing E91-10-4, Types TY10, TY11 and TY20 Measured Variable Stations



ITEM	PART NO.	NAME
1	6627052-1	LATCH HANDLE
2	6627050-1	FRONT PLATE
3	6627053-1	LATCH SPRING
4	6627047-1	BOTTOM CHASSIS
5	6627049-1	TOP CHASSIS
8	.112-40x.188	PAN HD SEMS EXT
9	.112-40x.188	PAN HD MACH SCR

C3048151B

FIGURE 47 – Parts Drawing E91-10-6, Type TO10 Blank Station

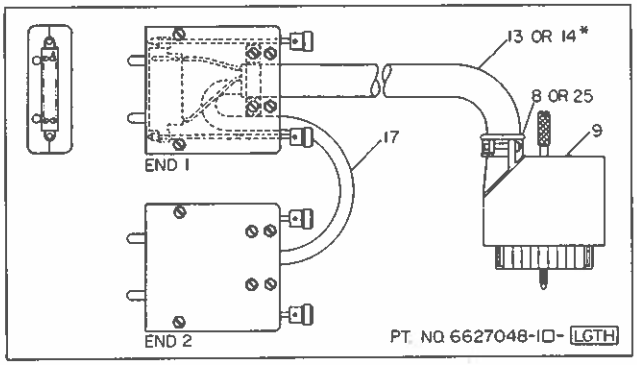


ITEM	PART NO.	NAME	667935-1 PKG* [SINGLE HORIZONTAL ROW 2.62"/ 66.5mm HIGH]	667935-2 PKG* [DOUBLE HORIZONTAL ROW 5.24"/ 133mm HIGH]
1	6626951-1	MACHINING HOUSING	1 REQD	1 REQD
2	6627045-1	MOUNTING BLOCK	2 REQD	2 REQD
3	6627046-2	BACK PLATE	1 REQD	1 REQD
4	6627043-2	TRIM PIECE (ARRAY MOUNTING) 5.24" (133mm) WITH LOGO		1 REQD
	6627043-4 (NOT SHOWN)	TRIM PIECE (ARRAY MOUNTING) 5.24" (133mm) W/O LOGO	1 REQD	
5	6627043-1	TRIM PIECE 2.62" (66.5mm) WITH LOGO	1 REQD	
	6627043-2	TRIM PIECE 2.62"	2 REQD	
	(NOT SHOWN)	(66.5mm) W/O LOGO	1 REQD	
6	6626017-2	MOUNTING CLIP 2.5" (63.5mm)		
7	6627017-1	MOUNTING CLIP (ARRAY MOUNTING) 5.0" (127mm)	2 REQD	
8	6627044-1	HOUSING KEY, TOP & BOTTOM (FRONT & REAR)	AS REQD*	AS REQD*
9	6627044-2	HOUSING KEY, END AND/OR CENTER (REAR ONLY)	AS REQD*	AS REQD*
10	.112-40x.3125	FLAT HD CD PL STN STL MACH SCR	4 REQD	8 REQD
11	.112-40x.375	PAN HD CD PL THRD CUTTING SCR, TYPE 1	4 REQD	4 REQD
12	.250-28x1.750	HEX HD INDENTED SLOT MACH SCR	4 REQD	4 REQD
13	.112-40x375	FLAT HD MACH SCR	4 REQD	8 REQD

*NOTE: 1. Even number of vertical rows use double row hardware
2. Odd number of vertical rows use single row hardware
3. Each enclosure is shipped in separate carton with four horizontal keys (Pt. No. 6627044-1) and two vertical keys (Pt. No. 6627044-2)

D3048162B

FIGURE 48 — Parts Drawing E91-10-7, Type TZ Enclosure



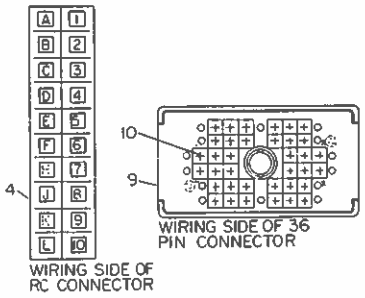
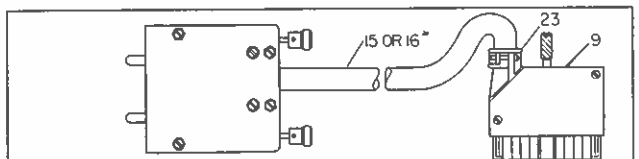
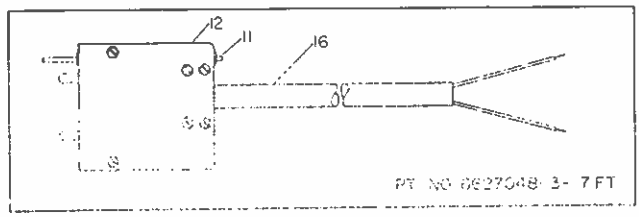
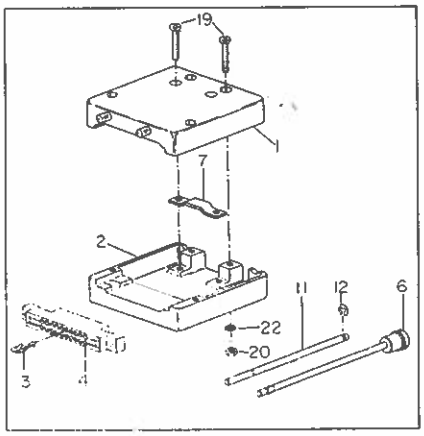


TABLE I CONNECTOR WIRING		
SECTION 1		
COLOR CODE	END 1 ITEM 4 TERM	ITEM 9 TERM
BLK	1	1
BRN	2	2
RED	3	3
YEL	4	4
BLU	5	5
VIO	6	6
GRY	7	7
WHT	8	8
WHT/BLK	9	9
WHT/BRN	10	10
WHT/RED	A	11
WHT/YEL	B	12
WHT/BLU	C	13
WHT/VIO	D	14
WHT/ORN	E	15
WHT/GRN	F	16
GRN	L	17
ORN	J	18
SECTION 2		
COLOR CODE	END 2 ITEM 4 TERM	ITEM 9 TERM
YEL/BLK	1	35
ORN/BRN	2	36
YEL/RED	3	23
YEL/BRN	4	24
YEL/BLU	5	25
ORN/VIO	6	26
YEL/GRY	7	27
WHT/GRY	8	28
GRN/BLK	9	29
GRN/BRN	10	30
GRN/RED	A	31
YEL/VIO	B	32
GRN/BLU	C	33
GRN/VIO	D	34
GRN/ORN	E	19
GRN/GRY	F	20
YEL/GRN	L	21
ORN/GRA	J	22







*LENGTH OF CABLE TO BE SPECIFIED PER ENGINEERING DATA AS PART OF PT. NO 6627048-□□-[illegible]

ITEM	PART NO.	NAME	PT/QTY BREAKDOWNS FOR CABLE ASSYS				
			6627048-1-LGTH	6627048-IN-LGTH	6627048-2-LGTH	6627048-2N-LGTH	6627048-3-LGTH
1	6627042-2	CONNECTOR HOOD	2	2	1	1	1
2	6627042-1	CONNECTOR HOOD	2	2	1	1	1
3	1945423-1	CONTACT	36	36	18	18	18
4	1945424-2	CONNECTOR BLOCK	2	2	1	1	1
6	6633215-1	JACKSCREW ASSY	4	4	2	2	—
7	197569-1	CABLE CLAMP	2	2	1	1	1
8	488907-19	GROMMET	1	—	—	—	—
9	1945869-2	CABLE CONNECTOR 36 PIN	1	1	1	1	—
10	1945501-1	CONTACT	36	36	18	18	—
11	197570-1	JACKSCREW	—	—	—	—	1
12	197146-2	RETAINING RING	—	—	—	—	2
13	R2041-1563	LEADWIRE 36 COND FLAME RET	—	REQD	—	—	—
14	R2041-1565	LEADWIRE 36 COND PVC	REQD	—	—	—	—
15	R2041-1562	LEADWIRE 18 COND FLAME RET	—	—	—	REQD	—
16	R2041-1564	LEADWIRE 18 COND PVC	—	—	REQD	—	7' (2.13m)
17	R9023-0123	INSULATION TUBING NO. 33	12" (31cm)	12" (31cm)	—	—	—
19	.112-40x.75	PAN HD STN STL SEMS EXT	12	12	6	6	6
20	.112-40	HEX NUT, CD PL STL	8	8	4	4	4
23	48890765	GROMMET	—	—	1	1	—
25	488907-17	GROMMET	—	1	—	—	—

NOTE: "N" in Pt. No. denotes flame retardant cable

D30481368

FIGURE 49 — Parts Drawing E91-10-8, Plug-In Connector Assemblies for Operator Interface Stations

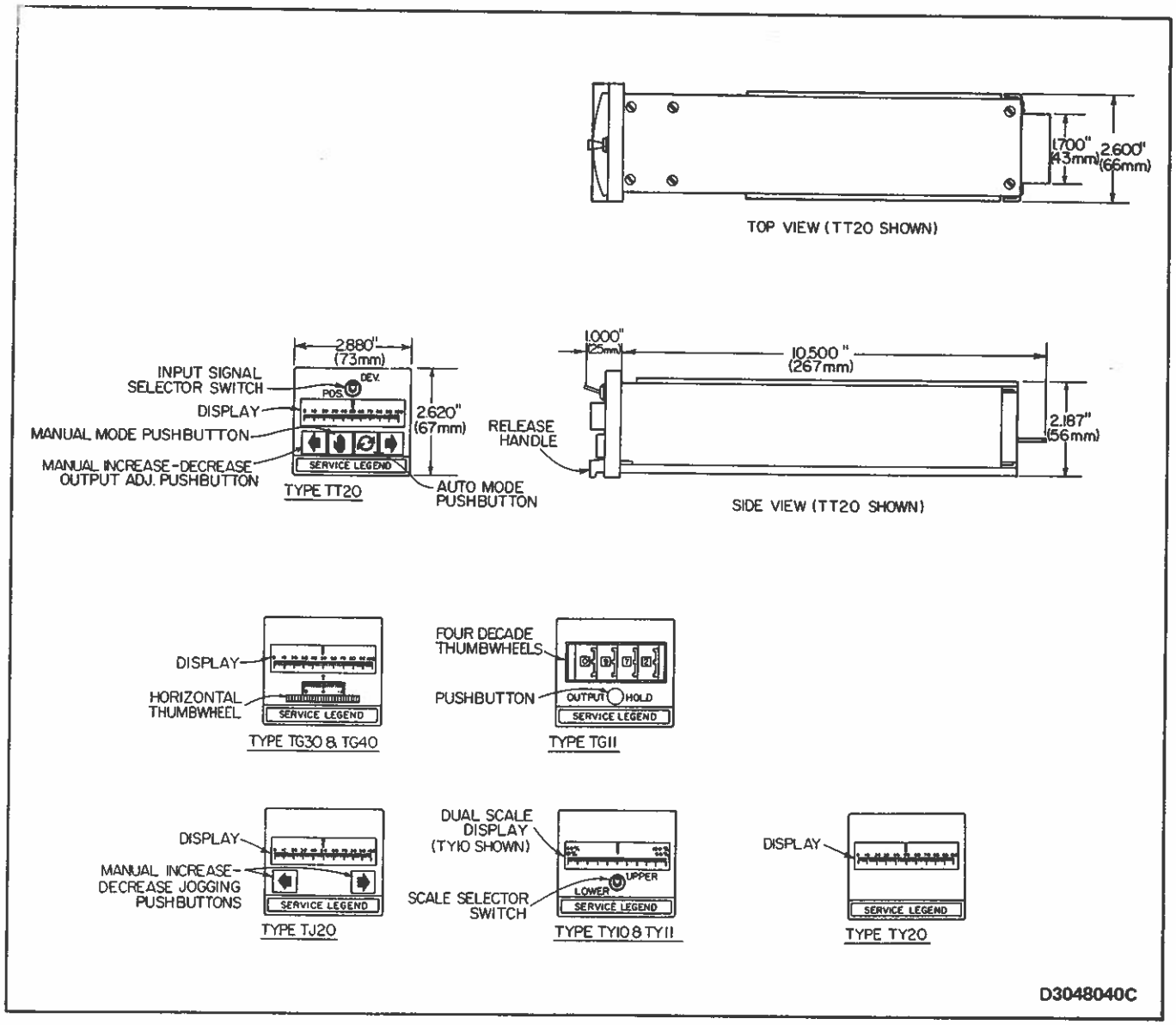
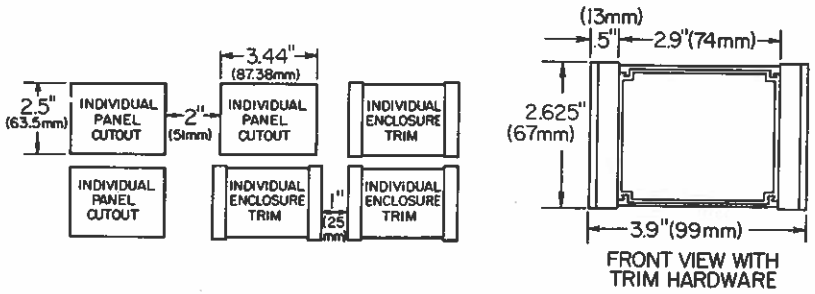


FIGURE 50 – Type T Station Front Plate Controls and Typical Assembly Dimensions

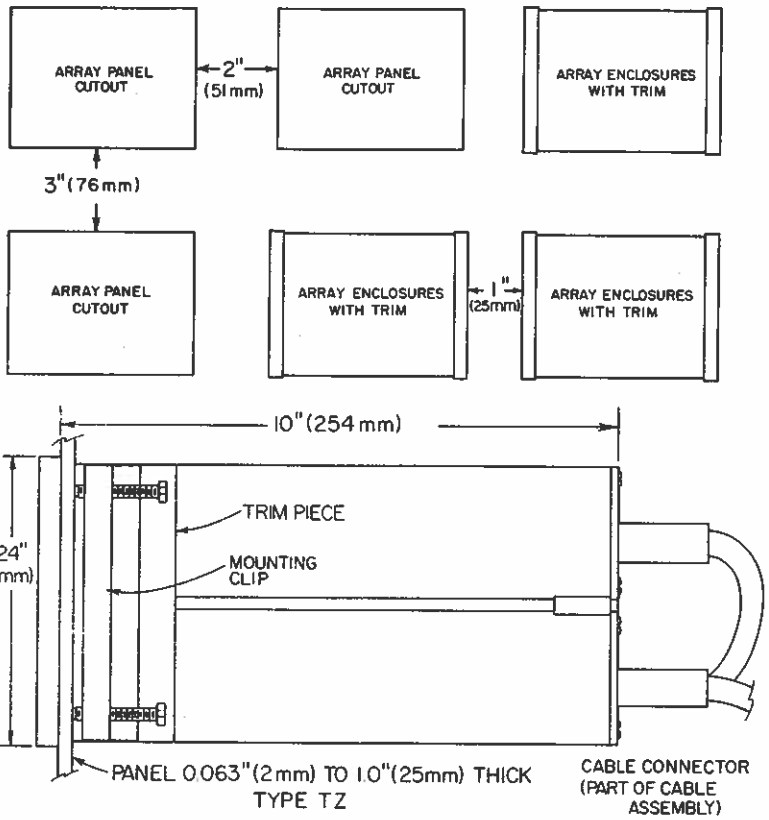
INDIVIDUAL ENCLOSURE MOUNTING(S)



NOTES:

1. REFER TO LINE 1 OF TABLE FOR INDIVIDUAL ENCLOSURE CUTOUT SIZE.
2. MINIMUM SPACING BETWEEN INDIVIDUAL CUTOUTS IS 2" (51mm) HORIZONTALLY AND 0" VERTICALLY.
3. MINIMUM SPACING BETWEEN ENCLOSURE FRONT TRIM EDGES IS 1" (25mm)
4. MINIMUM CLEARANCE BEHIND PANEL IS 18" (457mm)

TYPICAL ARRAY MOUNTING(S):



NOTES:

1. REFER TO TABLE FOR ARRAY ENCLOSURE CUTOUT SIZES.
2. MINIMUM SPACING BETWEEN ARRAY PANEL CUTOUT IS 2" (51mm) HORIZONTALLY, RECOMMENDED VERTICAL DISTANCE BETWEEN ARRAY PANEL CUTOUTS IS 3" (76mm).
3. PANEL STRENGTH REQUIRES THAT MINIMUM HORIZONTAL DISTANCE BETWEEN ARRAY TRIM EDGES IS 1" (25mm); VERTICAL SPACE BETWEEN TRIM EDGES CAN BE REDUCED TO ZERO.
4. MOUNT ENCLOSURES FACING ONE DIRECTION.
5. MAXIMUM MOUNTING ANGLE OF FRONT PLATE IS 0° TO 75°% FROM VERTICAL.
6. MAXIMUM NUMBER OF ENCLOSURES IN ARRAY MOUNTING IS 15 HIGH AND 10 WIDE.
7. A TAIL BRACE IS SUGGESTED FOR AN ARRAY 4 HIGH OR MORE THAN 6 WIDE.
8. SUFFICIENT AREA SHOULD BE LEFT BETWEEN ARRAYS FOR PANEL BRACING.
9. MINIMUM CLEARANCE BEHIND PANEL IS 18" (457mm).

TABLE OF DIMENSIONS FOR PANEL INDIVIDUAL ENCLOSURE CUTOUT (LINE 1) and ARRAY ENCLOSURE CUTOUTS

PANEL CUTOUT WIDTH			PANEL CUTOUT HEIGHT	
NO. OF ENCLOSURES WIDE	CUTOUT WIDTH INCHES (MM)	FRONT TRIM WIDTH INCHES (MM)	NUMBER OF ROWS HIGH	CUTOUT HEIGHT INCHES (MM)
1	3.44 (87.38)	3.90 (99.06)	1	2.5 (63.50)
2	6.35 (161.29)	6.81 (172.97)	2	5.12 (130.05)
3	9.26 (235.20)	9.72 (246.89)	3	7.74 (196.60)
4	12.17 (309.12)	12.63 (320.80)	4	10.36 (263.14)
5	15.08 (383.03)	15.54 (394.72)	5	12.98 (329.69)
6	17.99 (456.95)	18.45 (468.63)	6	15.60 (396.24)
7	20.90 (530.86)	21.36 (542.54)	7	18.22 (462.79)
8	23.81 (604.77)	24.27 (616.46)	8	20.84 (529.34)
9	26.72 (678.69)	27.18 (690.37)	9	23.46 (595.88)
10	29.63 (752.60)	30.09 (764.29)	10	26.08 (662.43)

*ALL CUTOUT DIMENSIONS ARE +0.06 INCHES (1.5MM) AND –0.00 INCHES.

D30480418

FIGURE 51 – Mounting Dimensions for Type TZ Enclosures and Arrays

Bailey Controls, Wickliffe, Ohio 44092, a division of Babcock & Wilcox, U.S.A.

Bailey Meter Australia Pty. Ltd., Regents Park, N.S.W., Australia
Bailey do Brasil, Sao Paulo, Brazil
Bailey Meter GMBH, Mannheim, West Germany

Bailey Controls, Division of B&W Industries Ltd. (Canada)
Bailey Japan Company, Ltd., Nirayama-cho, Japan
Representatives in Other Principal Cities