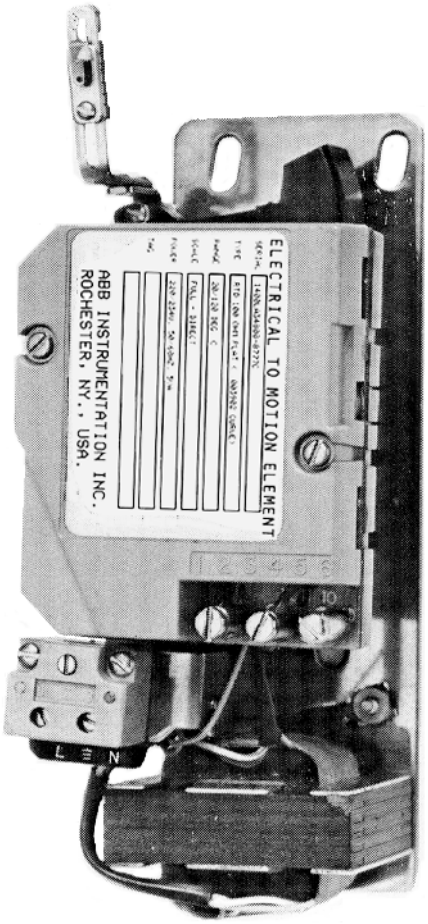
Electrical to Motion Elements for Indicators and Controllers

Instructions

Product Description, Installation, Wiring and Parts List for
1400L Model D EME



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2. Warning Labels on containers and packages must be observed.

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4. Normal safety procedures must be taken to avoid the possibility of an accident occurring when operating in conditions of high pressure and/or temperature.

5. Chemicals must be stored away from heat, protected from temperature extremes and powders kept dry. Normal safe handling procedures must be used.

6. When disposing of chemicals, ensure that no two chemicals are mixed.

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Warning. An instruction that draws attention to the risk of injury or death.

Caution. An instruction that draws attention to the risk of the product, process or surroundings.

Note. Clarification of an instruction or additional information.

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Although Warning hazards are related to personal injury, and **Caution** hazards are associated with equipment or property damage, it must be understood that operation of damaged equipment could, under certain operational conditions, result in degraded process system performance leading to personal injury or death. Therefore, comply fully with all **Warning** and **Caution** notices.

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DIAGRAMS

WD-L-1400-109 SCHEMATIC DIAGRAM, EME WITH VOLTAGE OR CURRENT INPUT
WD-L-1400-110 SCHEMATIC DIAGRAM, EME WITH RESISTANCE INPUT
WD-R-440-3 CONNECTION DIAGRAM, 440K, 440R SERIES PNEUMATIC INDICATING CONTROLLER

1 - PRODUCT DESCRIPTION

1.1 DESCRIPTION

The 1400L Series Electrical-to-Motion Elements (EME), Figure 1, are electromechanical devices that convert electrical input signals (for example, 4-20 mA) to an angular movement. This angular movement is compatible with the linkage systems of the FULSCOPE© pneumatic 440R Series. The 1400L EME features:

- **Sealed feedback potentiometer**
- **Computer-selected scaling resistors**
- **Modularized construction**

An optional fitting kit allows an instrument having another type of actuation, such as filled thermal system, to be converted to accommodate an EME.

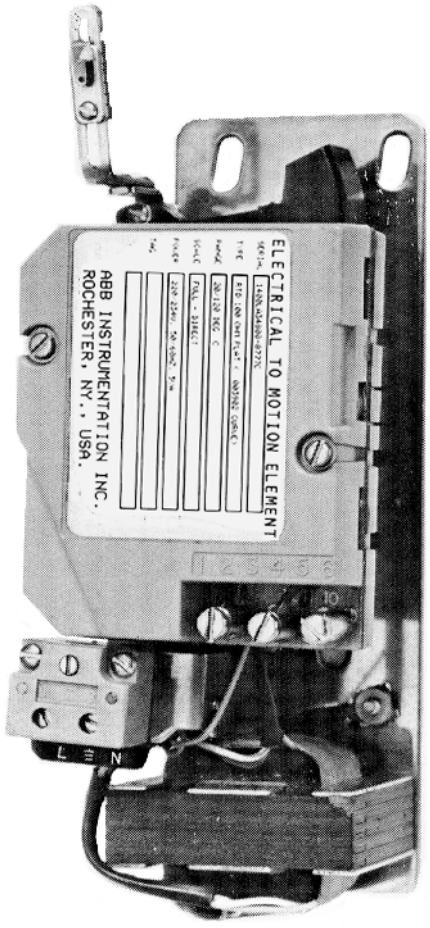


Figure 1. 1400L Series EME (Electrical to Motion Element)

1.2 EXPLANATION OF SERIAL AND CATALOG NUMBERS

The serial number stamped on the data plate consists of the catalog number and a sequential identification number. An X before the serial number indicates that the instrument was built to meet a customer's special requirements. The serial number, which is described below, contains a series of single and multiple-character codes. These codes provide specific information concerning various electrical and/or structural options. Each code is assigned a code identifier letter so that it may be easily referred to throughout these instructions.

BASE NUMBER - 1st thru 5th characters

1400L EME for 440R controller

ELECTRICAL CODE - 6th character

A General Purpose, ABB Standard

POWER - 7th character

1 110/117V, 50/60 Hz

3 220/234V, 50/60 Hz

INPUT - 8th and 9th characters

Analog

02 4 to 20 mA dc

04 0.25 to 1.25V dc

06 0 to 1.0V dc

08 1 to 5.0V dc

Resistance (RTD) Characteristics

48 100 Ohm platinum, curve (alpha coefficient) = .003902

52 100 Ohm platinum, curve (alpha coefficient) = .00385 (DIN 43760, BS 1904)

55 98.16 Ohm platinum, curve (alpha coefficient) = .003923 (SAMA RC21-14-1966)

56 100 Ohm platinum, curve (alpha coefficient) = .00392 (MIL-T-24388)

BASIC OPTIONS - 10th and 11th characters

00 None

03 Transmitter power supply (Not available with input code 48)

04 Combination of 03 and 06 (Not available with input code 48)

06 Fitting kit (required for first time conversions)

EME OUTPUT ACTION 12th character

D Direct - (0% input = minimum output angle)

R Reverse - (0% input = maximum output angle)

MODEL/DESIGN LEVEL 13th character

D Model D

1400LA10203DD Sample Catalog Number

1.3 SPECIFICATIONS

Power Requirements
110V, 117V, 50/60 Hz, 3W, 4VA
220V, 234V, 50/60 Hz, 3W, 4VA

Input
Voltage
0.25 to 1.25V dc
0 to 1.0V dc
1.0 to 5.0V dc
Current
4 to 20 mA dc

Resistance(RTD)
10 to 300 ohm span
RTD Zero Suppression
10 to 600 ohms

Impedance
4 to 20 mA dc, 250 ohms
All other inputs, greater than 100,000 ohms

Source Resistance
1000 ohms maximum

Output
Angular displacement equal to a chord of 0.481 in. (12.22 mm) [approximately 30°]

Accuracy
±0.55% of span

Repeatability
0.2%

Dead Band
0.2%

Speed of Response
6.1 ±0.5 seconds full scale - 60 Hz
7.3 ±0.5 seconds full scale - 50 Hz

Ambient Temperature (Operating)
-20 to 167°F (-29 to 75°C)

Storage Temperature
-20 to 180°F (-29 to 82°C)

Weight (approximate)
1.6 lb (0.7 kg)

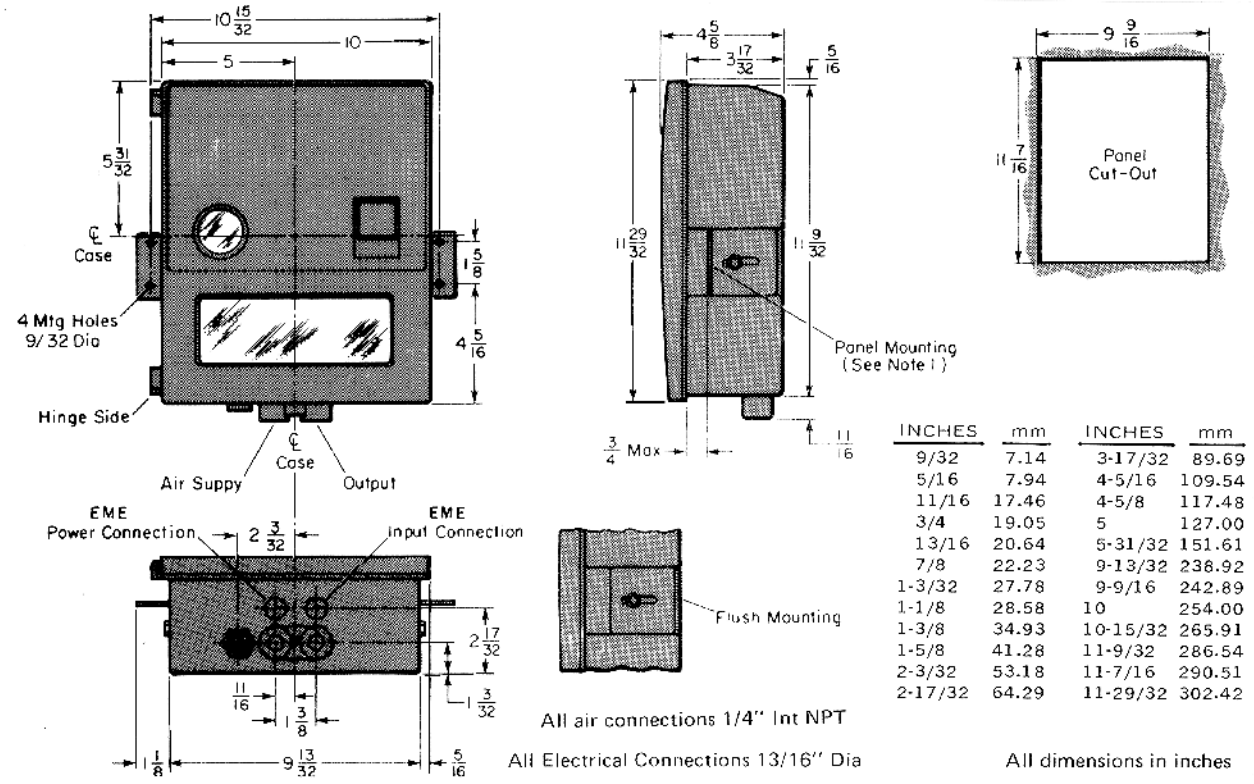
2 - MOUNTING

2.1 LOCATION

Select a location which is free from vibration and corrosive atmosphere. The ambient temperature of the instrument case should not exceed values listed under **Specifications.**

2.2 POSITIONING

By reversing the mounting brackets, Figure 2, the controller can be either panel or surface mounted. The optional pipe Mounting bracket, Accessory No. (82), permits mounting on 1-1/4, 1-1/2 or 2-inch diameter vertical pipe. Mount the controller so that it is vertical.



INCHES	mm	INCHES	mm
9/32	7.14	3-17/32	89.69
5/16	7.94	4-5/16	109.54
11/16	17.46	4-5/8	117.48
3/4	19.05	5	127.00
13/16	20.64	5-31/32	151.61
7/8	22.23	9-13/32	238.92
1-3/32	27.78	9-9/16	242.89
1-1/8	28.58	10	254.00
1-3/8	34.93	10-15/32	265.91
1-5/8	41.28	11-9/32	286.54
2-3/32	53.18	11-7/16	290.51
2-17/32	64.29	11-29/32	302.42

All dimensions in inches

For reference only; not for construction.

Note: 1. When panel mounting the controller, use the two 5/16" x 7/8" self tapping screws supplied with mounting bracket. Use of upper hole in each bracket is recommended.

Figure 2. Mounting Dimensions, 440K Series Indicator or 440R Series Controller Fitted with EME

3 - ELECTRICAL CONNECTIONS

3.1 PRELIMINARY CONSIDERATIONS

Before making any electrical connections **check** the voltage and frequency stamped on the EME data plate. All input signal connections are made to the terminal block or input terminal posts on the EME as shown in the connection diagram. Power connections are made to the terminal block on the EME. Refer to connection diagram.

When making signal connections keep the signal cable as far away from the power wiring as possible. Keep all wiring away from any mechanism inside the instrument. When conduit is connected to the instrument, run the signal cable in separate conduit from the power wiring. Use twisted pairs of wires for all signal wiring. Normally it is not necessary to use shielded cable for voltage, current or resistance element inputs. When the input signal cable is shielded, connect shield to terminal 6 for current, voltage or resistance element input. Do not connect shield at other end.

3.2 POWER DISCONNECT

A disconnect in the power line to an instrument is convenient in an installation. Install a single pole switch in the power wire connected to the AC instrument terminal. It is best to have a disconnect for each instrument but in the interest of economy, instruments may be selectively grouped together on the same disconnect. A three-wire power cord with a grounding plug connected to instrument power terminals may be plugged into an outlet strip located near the instruments. Removing the plug from the outlet in the strip serves as an instrument disconnect.

3.3 FUSING

Install a fuse to protect other instruments connected to the power source from an undervoltage condition in case of a short circuit in the instrument. Install the fuse in the power wire connected in series with the disconnect. This protects the power source and other instruments in case the power wire becomes grounded. The fusing method can be a fuse, circuit breaker, fused plug or a switch-fuse combination.

3.4 POWER CONNECTIONS

The power connections to the instrument are made as shown in the connection diagram.

3.5 INPUT CONNECTIONS

The input connections are made to the instrument as shown in the connection diagram. Do not use wire larger than 16 ga. Larger sizes of wire can damage input terminal block on EME.

3.5.1 Compensating Leads for Resistance Elements

The resistance of the connecting leads to the resistance bulb will change when the ambient temperature changes. This resistance change will affect the input signal. If the resistance change is significant, compensating leads should be connected as shown in the connection diagram. The wire used for the compensating leads must be the same as that used for the connection leads to the resistance bulb. The compensating leads must be run in the same conduit as the connecting leads.

3.5.2 Calculating Change in Lead Resistance

Calculate the change in lead resistance, due to ambient temperature change, as a percentage of the resistance change of the resistance bulb. The resistance change of copper wire for various lengths, wire gages and ambient temperature changes is shown in Table 1.

Example:
The installation has a wire run of 2500 ft (762.5m) of 20 gage wire from resistance bulb to transmitter and maximum ambient temperature change is 50'F (10'C). As shown in Table 1, the resistance change would be 6 ohms (0.60 ohms per 250 ft (76.25m) of wire x 10 = 6 ohms for 2500 ft (762.5m) of wire). If the transmitter's span is 100 ohms, this change in lead resistance due to ambient temperature change will cause an error of 6%.

Table 1. Resistance Change of Copper Wire Due to Ambient Temperature Change

Distance from Resistance Bulb to Instrument		*** Nominal Loop Resistance of 20 gage wire at 68°F (20°C) (ohms)**	**Change in resistance (Ω) for maximum change in ambient from value when calibrating**		
Feet	**Meters**		**20°F (70°C)**	**50°F (10°C)**	**100°F (38°C)**
100	30.5	2.03	0.105	0.24	0.49
250	76.25	5.08	0.24	0.60	1.21
400	122	8.12	0.402	0.96	1.93
700	213.5	14.21	0.68	1.69	3.38

*Multiplier for other wire gages: 16 ga. - 0.395; 18 ga. - 0.629

If compensating leads are not used, jumper terminal 3 to 4 with a short length of copper wire as shown in the connection diagram.

4 - DESCRIPTION OF OPERATION

4.1 GENERAL

The EME is an electromechanical unit which converts an electrical input signal to a proportional mechanical movement. The output arm of the EME provides the mechanical motion required for correct pen or pointer movement. The output arm and a feedback potentiometer are driven by a reversible motor which is controlled by the EME circuit. Simplified schematics of the EME circuits are shown in Figures 3 and 5.

4.2 VOLTAGE AND CURRENT INPUTS

When the input signal is a voltage or current, Figure 3, the input circuit converts the input signal to a 2 to 7V dc signal (referenced to + 9V dc) representing 0 to 100% of input range.

The direction control circuit compares the signal from the input amplifier to the signal from the feedback potentiometer. When the two signals are equal, the reversible motor is switched off and the pen or pointer will maintain its position until the input signal changes. The output of the input amplifier is connected to one input of direction control amplifier A1b and the signal from the feedback potentiometer is connected to the other. When the two signals are equal, the output of direction control amplifier A1b will be between 0 and +1.8V dc (referenced to +9V dc). This +1.8V dc provides a deadband which prevents oscillation or hunting when input and feedback are equal. The output of direction control amplifier A1b determines which direction the pen or pointer will move. When the input signal is greater than the feedback signal, the output of direction control amplifier A1b will go negative in relation to its output when input and feedback are equal. When the input signal is less than the feedback signal, the output of direction control amplifier A1b will go positive.

The comparator A1a, A1d converts the output of direction control amplifier A1b to the signals necessary to control triacs Q2 and Q3 in the motor drive control circuit. When the input signal equals the feedback signal, the outputs of both comparator amplifiers A1a and A1d are at 0V dc. When the signal from direction control amplifier A1b goes positive, the output of comparator amplifier A1a increases (to approx +16.5 dc) and turns on triac Q3. When triac Q3 turns on, it completes the motor circuit and the reversible motor starts driving downscale. During downscale drive, the output of comparator amplifier A1d remains at 0V dc and triac Q2 remains turned off. When the signal from direction control amplifier A1b goes negative, the output of amplifier A1d increases (output of amplifier A1a remains at 0V dc) turning on triac Q2 (triac Q3 remains off) and the reversible motor drives upscale. The reversible motor and the feedback potentiometer are connected into the circuit as required for correct pen or pointer movement.

The optional transmitter power supply is for use with a Two-Wire Transmitter. The power supply, EME and transmitter are connected in series as shown in Figure 4. A Two-Wire Transmitter has a 4 to 20 mA dc output signal. The 4 to 20 mA dc transmitter output signal and the 24V dc power to the transmitter are carried by the same pair of wires. The current flow through resistor R1, Figure 4, generates a dc voltage. This voltage is the input signal to the input amplifier in the EME circuit.

4.3 RESISTANCE ELEMENT INPUTS

When the input signal is from a resistance element, Figure 5, the EME circuit converts any change in resistance due to a change in process temperature into an electrical signal. This EME unit has an input bridge. The resistance element is connected into one side of the input bridge. This side of the bridge is connected to one input of input amplifier A2. The compensating lead(s) (or a jumper on the EME terminal block) is connected into the other side of the bridge and this side of the bridge is connected to the other input of input amplifier A2. When the resistance of the resistance element change due to a change in process temperature, the input amplifier A2 senses the change and changes its output accordingly. The output signal from input amplifier A2 is 2 to 7V dc representing 0 to 100% of temperature range at the resistance element.

The signal from the input amplifier and the feedback potentiometer are connected to direction control amplifier A1b and the operation of the remainder of the EME circuit is the same as for units with voltage or current input. The transmitter power supply is not available on EME units with resistance element inputs.

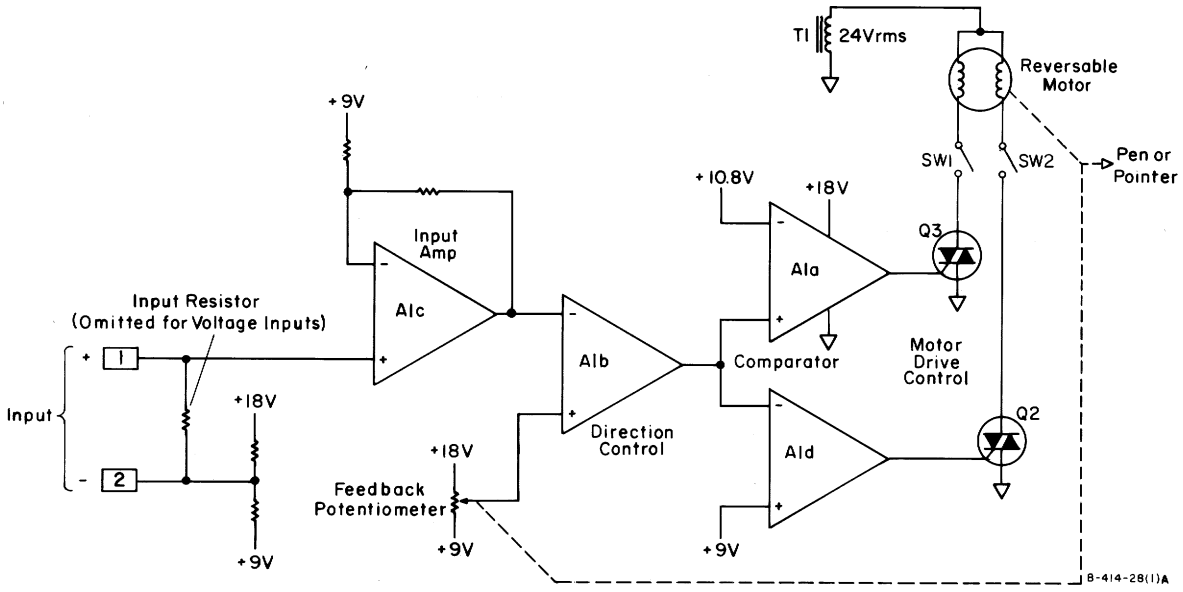


Figure 3. Simplified Schematic, EME with Voltage or Current Input

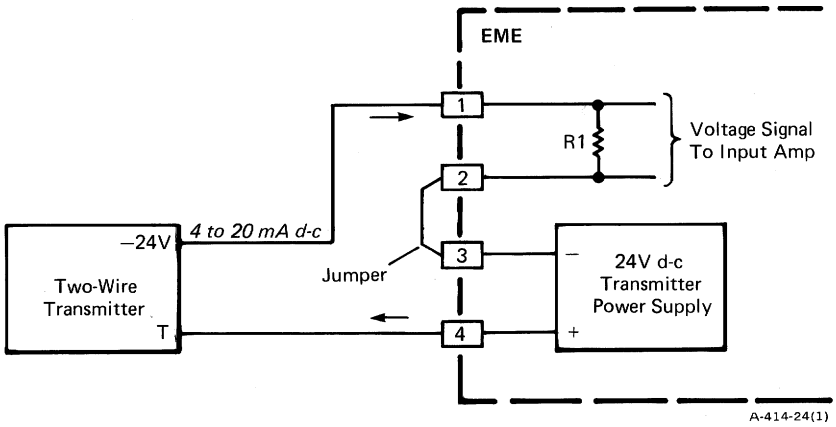


Figure 4. Two-Wire Transmitter Connected to EME

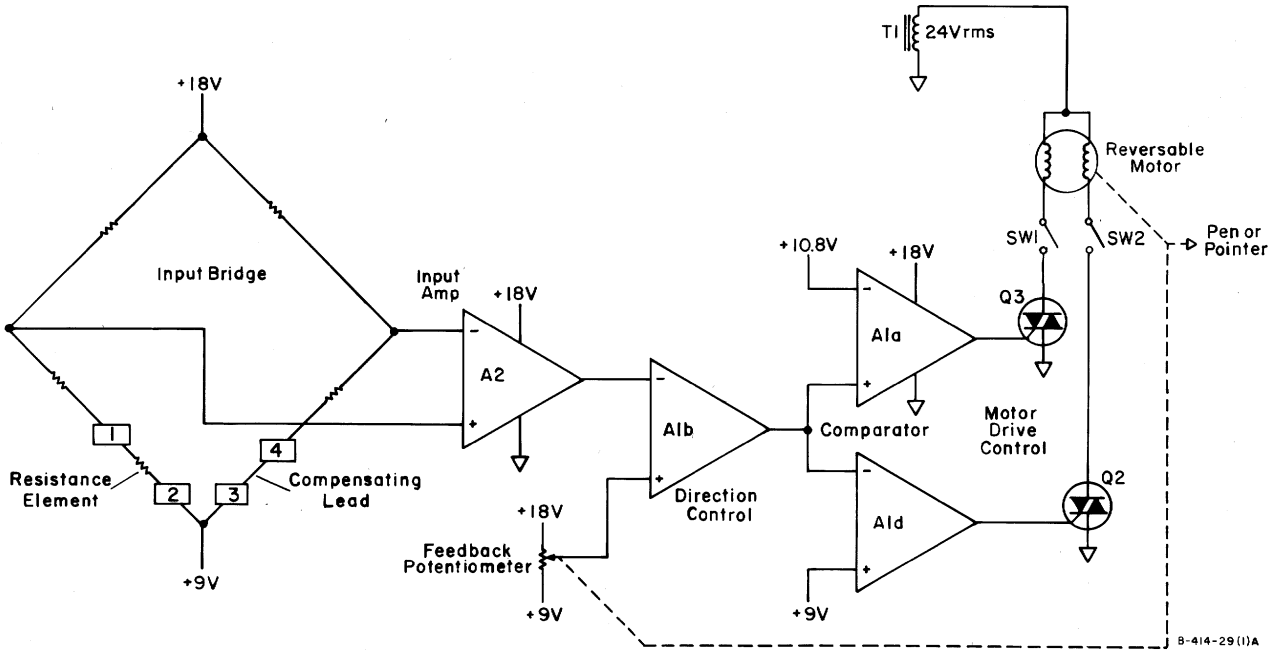


Figure 5. Simplified Schematic, EME with Resistance Element Input

CALIBRATION CIRCUITS

5 - CALIBRATION CIRCUITS

5.1 4 to 20 mA dc INPUTS (1400L--02--)

Connect the output of a Taylor Precision Calibrator or current source to EME input terminals 1 (+) and 2 as shown in Figure 6.

5.2 0 TO 1V or 0.25 to 1.25V dc INPUTS (1400L- -04, 06)

Connect the output of a Taylor Precision Calibrator or voltage source to EME input terminals 1 (+) and 2 as shown in Figure 6.

5.3 1 to 5V dc INPUTS (1400L- -08)

Connect the output of a voltage source to EME input terminals 1 (+) and 2 (-) as shown in Figure 6.

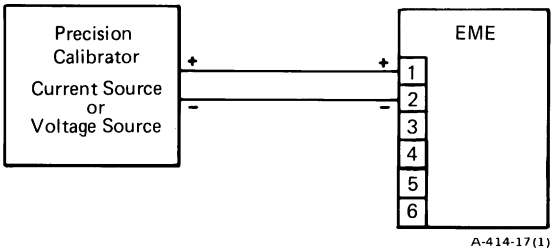


Figure 6. Calibration Circuit, Current or Voltage Input

5.4 RESISTANCE ELEMENT INPUTS (1400L - - 48, 52, 55, 56 - - - -)

Disconnect leads at resistance element and connect a precision resistance decade box in place of resistance element as shown in Figure 7. Connecting at resistance element end of lead wires compensates for resistance of lead wires during calibration. The resistance decade box is adjusted to equal resistance value of resistance element at 0, 50 and 100% of temperature range.

CALIBRATION CIRCUITS

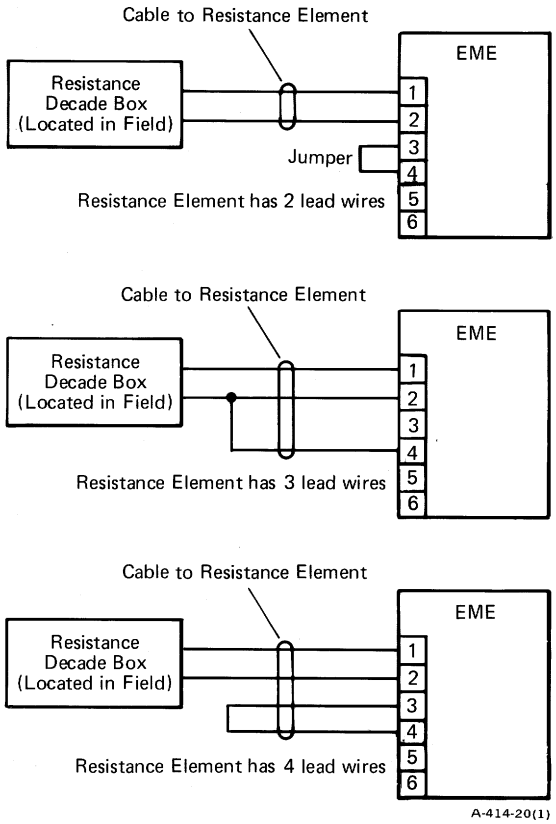


Figure 7. Calibration Circuit, Resistance Element Input

6 - PROCESS POINTER CALIBRATION

6.1 PROCEDURE

The following procedure is based on applying 0, 50 and 100% of input range to the EME in the instrument.

6.2 PRELIMINARY

1. Connect EME to a calibration circuit. Refer to **Calibration Circuits**.

2. Make sure that process link that was calibrated with EME is in place and proper ball pivots on process pointer yoke and process link are used.

   Ball pivots selected during factory calibration are identified as follows: a circle is scribed at the base of the ball pivot and/or unused ball pivots are coated with black lacquer. If ball pivots are unmarked or marking is questionable, connect process link to ball pivot B on process pointer yoke and EME take-off arm to ball pivot 3 on end of process link as shown in Figure 8. Open pivot assembly on process link and EME take-off arm as shown in Figure 9. If connecting to ball pivot which has been painted with black lacquer, remove lacquer before attempting to use the ball pivot.

3. Loosen EME mounting screws. Position EME to center mounting screws in alignment slots, Figure 10, of EME base plate. Tighten mounting screws.

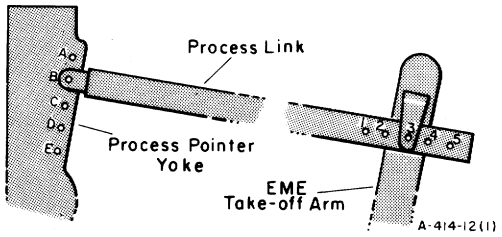


Figure 8. Ball Pivot Designations

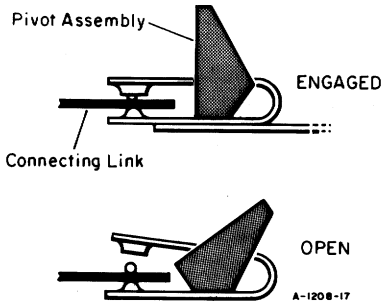


Figure 9. Pivot Assembly

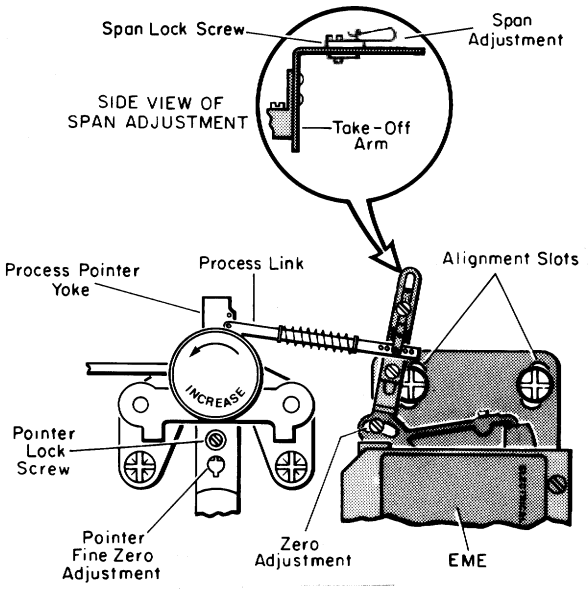


Figure 10. Calibration Adjustments

4. Loosen pointer lock screw. Adjust fine pointer zero adjustment to center of travel. Do not tighten pointer lock screw.

5. Loosen span lock screw. Turn span adjustment to center of travel. Do not tighten span lock screw.

6.3 SPAN AND ZERO ADJUSTMENTS

1. Apply 0% of input range.

2. Loosen zero adjustment screw, Figure 10, on EME. Adjust position take-off arm until pointer indicates approximately 0% on scale. Tighten zero adjustment screw.

3. Turn pointer fine zero adjustment until process pointer indicates 0% ±2 on scale.

   NOTE: Make sure pointer does not hit mechanical stops below 0% and above 100% of range.

4. Apply 100% of input range.

5. Turn span adjustment until pointer indicates 100% ±2 of scale.

6. Repeat Steps 1 through 5 for required accuracy.

6.4 LINEARITY ADJUSTMENT

1. Apply 50% of input range. If process pointer indicates 50% ± 2 of scale, calibration is complete. Proceed to Step 4.

2. To change linearity, use another ball pivot on right end of connecting link.

   If process pointer is below 50% of scale, use next ball pivot to left, i.e., shorten the process link.

   If process pointer is above 50% of scale, use next ball pivot to right, i.e., lengthen the process link.

   It may be necessary to change position of EME to compensate for linkage nonlinearities.

3. Repeat span, zero and linearity adjustment for required accuracy.

4. Tighten span and pointer lock screws, Figure 10.

PROCESS POINTER CALIBRATION

7 TROUBLESHOOTING

7.1 GENERAL

The following troubleshooting procedures are provided for experienced electronic technicians. If proper equipment or qualified personnel is not available, replace only an EME circuit board or the complete EME unit.

If the EME is operating incorrectly, use the troubleshooting chart shown in Figure 11 to isolate the problem to a section of circuitry. Test points on the EME circuit board are shown in Figures 12 and 13. Most failures will be diodes, transistors or integrated circuits.

If EME has transmitter power supply, check transmitter power supply voltages separately. Refer to Figures 14 and 15.

Incorrect power supply voltages can be caused by defective components in the power supply circuit or in the EME circuit. A component in the EME circuit can fail and overload the power supply circuit. This overload can cause an additional failure in the power supply circuit. Use the following method to supply power to the EME circuit without the use of the power supply circuit. Connect an external power supply (adjustable output with current limiting) to the appropriate test points on the circuit board. Do not apply power to the instrument terminals while the external power supply is connected to the EME. By using the external power supply, the defective component in the EME circuit can be located and replaced. Next, remove the external power supply and connect power to the instrument. Now, any defective component in the power supply circuit can be located and replaced.

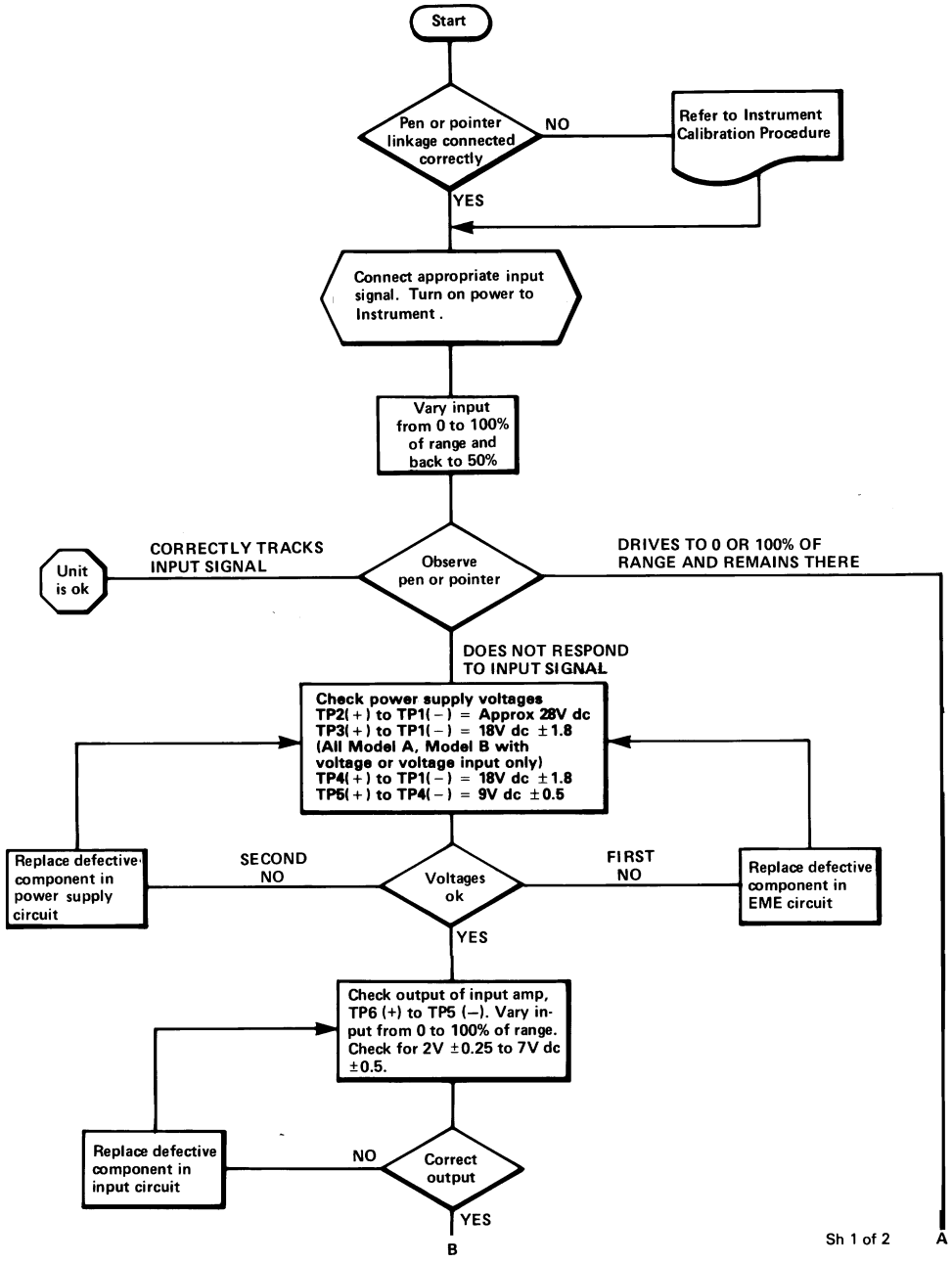


Figure 11a. Troubleshooting Chart, EME Circuit Board (Sheet 1 of 2)

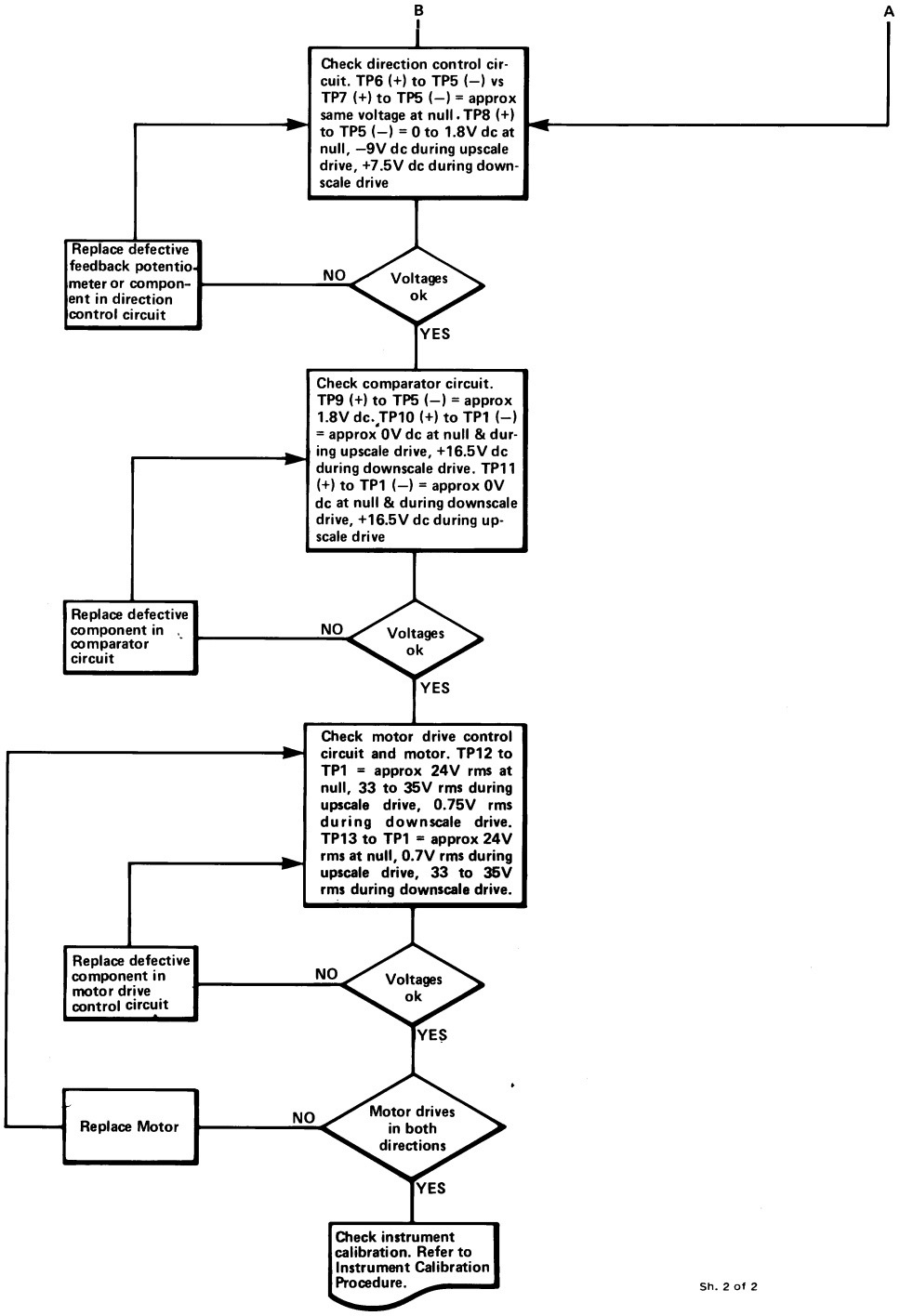


Figure 11b. Troubleshooting Chart, EME Circuit Board (Sheet 2 of 2)

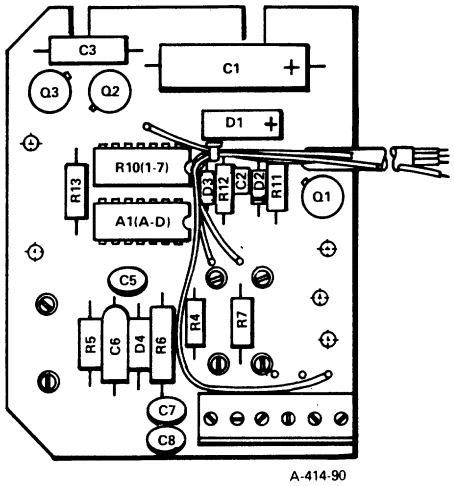


Figure 12. Test Point Locations, Model D EME Circuit Board with Voltage or Current Input

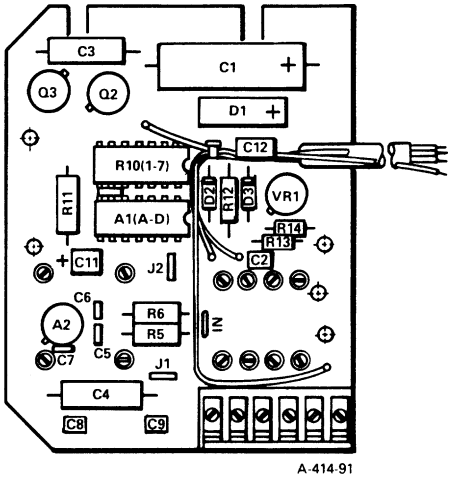


Figure 13. Test Point Locations, Model D EME Circuit Board with Resistance Element Input

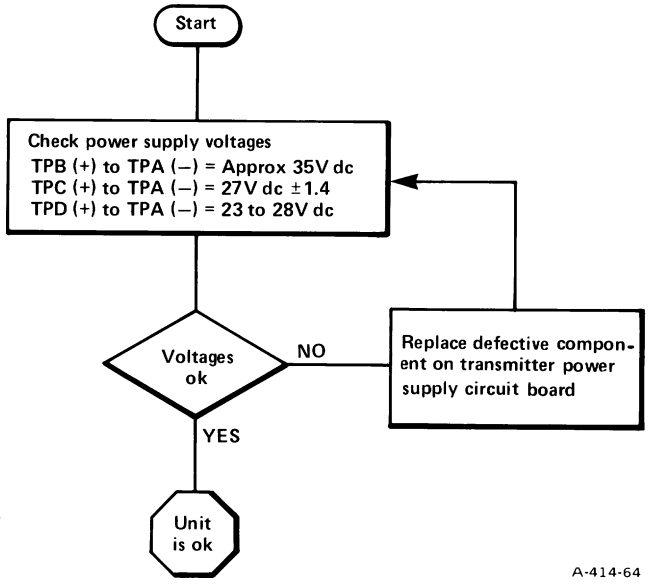


Figure 14. Troubleshooting Chart, Transmitter Power Supply Circuit Board

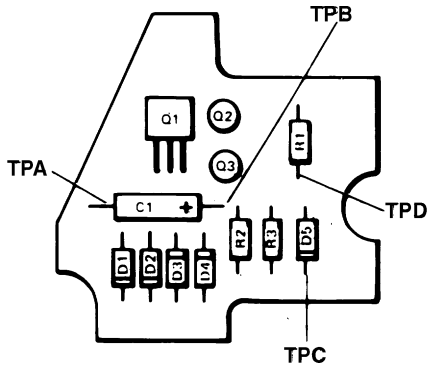


Figure 15. Test Point Locations, Transmitter Power Supply Circuit Board

8 PARTS LIST

8.1 ORDERING INFORMATION

When ordering parts always specify the complete serial number of the instrument.

8.2 RECOMMENDED SPARE PARTS

A plus (+) sign before the item number indicates that the item is a recommended spare part.

8.3 PARTS AVAILABILITY

This parts list may contain parts that are not saleable. These parts are identified with an asterisk (-) in the part number column. They are listed and shown as required to provide a comprehensive breakdown of the assembly.

8.4 PARTS AND COMPONENTS IDENTIFICATION

An assembly or subassembly (SA) in the parts description may be followed by part descriptions which have dots preceding them. These dots indicate the parts are components of that assembly or SA. The items bracketed in the figures also indicate the components of an assembly or SA.

8.5 UNIDENTIFIED ITEMS AND PARTS

A (-) dash in the item number column indicates that the part is not illustrated in the referenced figure.
A (-) dash in the part number column indicates there is not part identification available.

8.6 UNDERSCORE IDENTIFICATION

Underscores in place of characters in a catalog number (e.g. 1400L - - - - 6) indicate any character may apply. Refer to Explanation of Serial and Catalog Numbers. Underscores in place of characters in a part number (e.g. 127S932- - -) indicate that more than one character may apply. The part number may be referenced to another page or section for selection of required characters.

PARTS LIST

FINAL ASSEMBLY
Refer to Figure 16

Item	Part No.	Description	No. Req'd
1	1P495	Circuit Board Mtg Base	
3	3P1061	Cover	1
5	6P3349	Base Plate	1
6	6S1097	Pivot SA	1
7	32P316	Pivot Nut Plate	1
13	11P1341	Span Adj Take-off Arm	1
14	14P2380	Zero Adj Bracket	1
15	14P2389	Power Terminal Block Mtg Bracket	1
16	22P1106	Cover Mtg Screw Retaining Ring	2
17	29P820-1	Terminal Block Insulator	1
18		Serial Number Label	
19		Data Plate	
20	59P469	Circuit Board Mtg Pillar 1400L _ _ 02 thru 08 _ 3; _ _ 02 thru 08 _ 4	2
21	80S400	Servo SA	
+22	113SB25	Terminal Block	1
23	†	Main Circuit Board	1
30	125S1199-1	Transmitter Power Supply Circuit Board 1400L _ _ 02 thru 08 _ 3; _ _ 02 thru 08 _ 4	1
31	501M73	Servo, Transformer and Ground Mtg Screw, #6-32 x 5/16" Flat Hd	6
32	503M15	Circuit Board Base Mtg Screw, #6-32 x 3/8" Rd Hd	3
33	509M17	Process Link and Pivot Mtg Screw, #2-56 x 1/8" Binding Hd	3
34	542M169	Transformer Mtg Nut, 1/4"	2
35	542M174	Servo and Circuit Board Base Mtg Speed Nut, 5/16"	6
36	543M53	Ground Mtg Nut, 5/16"	1
37	546M4	Circuit Board Cover Mtg Washer, #4	2
38	546M7	Circuit Board Base and Ground Mtg Washer, #6S	4
39	546M22	Zero Adj Bracket Mtg Washer, #2	1
40	548M72	Ground Mtg Lockwasher, #6 Ext Tooth	1
42	562M3	Terminal Block Bracket Mtg Screw, #4-40 x 1/4" Pan Hd	1
43	562M13	Zero Adj Bracket Mtg Screw, #2-56 x 3/8" Pan Hd	1
44	562M16	Circuit Board Mtg Screw, #4-40 x 3/8" Pan Hd	3
45	562M23	Span Adj Mtg Screw, #2-56 x 3/8" Pan Hd	1
46	562M30	Terminal Block Mtg Screw, #4-40 x 5/8" Pan Hd	2
47	562M22	Circuit Board Cover Mtg Screw, #4-40 x 7/8" Pan Hd	2
T1	117S391-2	Transformer, 1400L _ _ _ 00, 06	1
T1	117S391-4	Transformer, 1400L _ _ _ 03, 04	1

†To order a Circuit Board SA specify "125S Circuit Board SA and (serial number of instrument)".

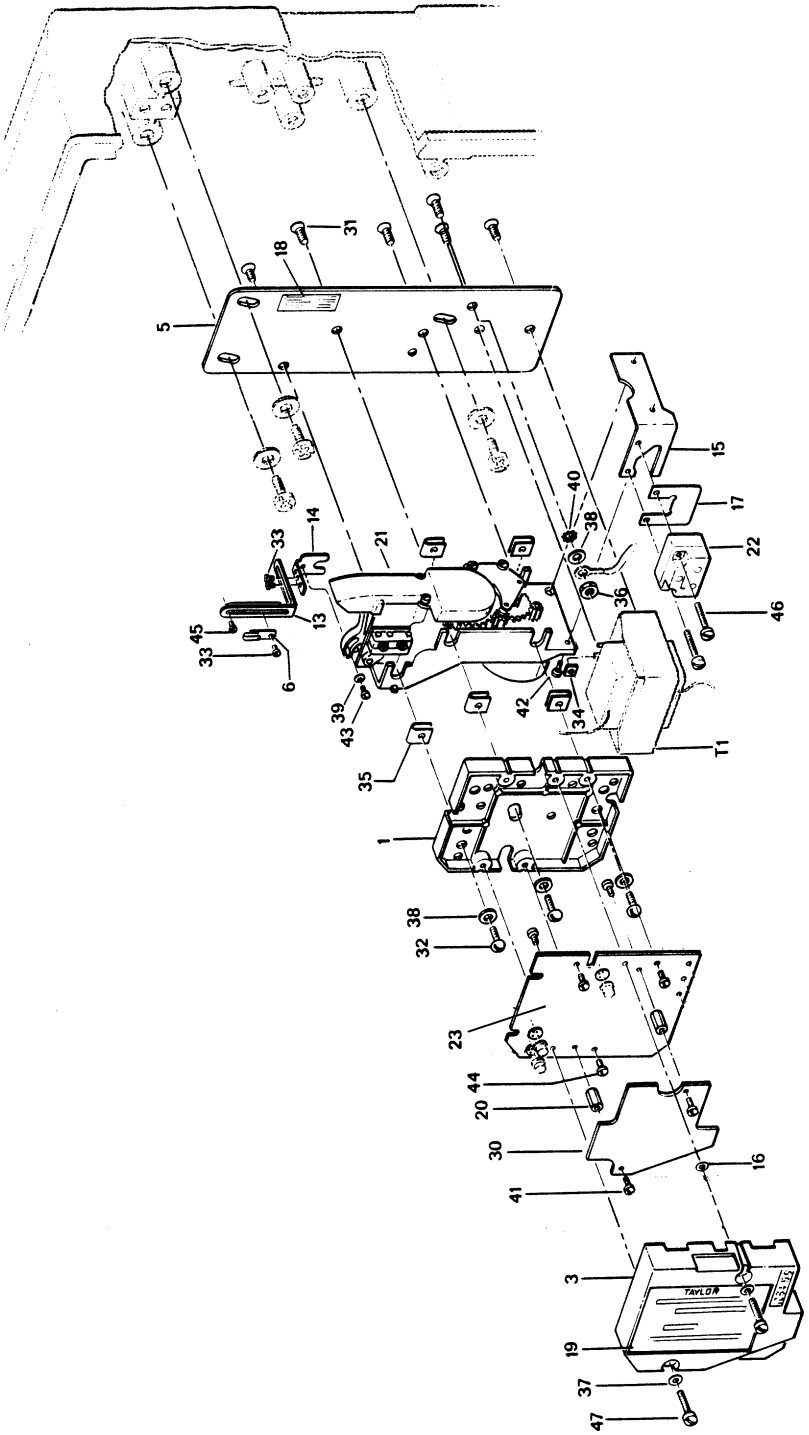


Figure 16. Final Assembly

PARTS LIST

SERVO SUBASSEMBLY, 80S400
Refer to Figure 17

Item	Part No.	Description	No. Req'd
1	*	Gear Retaining Plate	1
2	*	Switch Mtg Nut Plate	2
3	*	Servo Frame	1
4	*	Switch Cam	2
5	*	Sector Cover	1
6	*	Switch Insulator	2
7	*	Large Gear	1
8	*	Motor Idle Gear	1
9	*	Idle Gear	1
+10	*	Output Drive Tape	1
11	*	Motor and Pinion Kit	1
12	*	Output Drive Tape Mtg Screw, #2-56 x 1/8" Binding Hd	2
13	*	Large Gear Mtg Set Screw, #4-40 x 1/4" Allen Hd Cup Pt	1
14	*	Switch Cam Mtg Set Screw, #2-56 x 1/16"	2
15	*	Gear Retaining Plate Mtg Screw, #4-40 x 3/8" Pan Hd Type F	2
16	*	Sector Cover Mtg Screw, #4-40 x 3/8" Pan Hd Type F	2
17	*	Motor Mtg Nut, #4	2
18	*	Large Gear Mtg Locknut, 1/4"	1
19	*	Output Drive Tape Mtg Nut, 1/8"	1
20	*	Gear Retaining Plate Mtg Lockwasher, #4 Ext Tooth	2
21	*	Switch Mtg Lockwasher, #2	4
22	*	Switch Mtg Screw, #2-56 x 1/2" Pan Hd	4
23	*	Motor Mtg Screw, #4-40 x 1/4" Pan Hd	2
-	155S128	Gear Replacement Kit (includes items 1, 8, 9, 15, 20)	1
R13	119S454-001	Potentiometer	1

*Refer to Parts Availability.

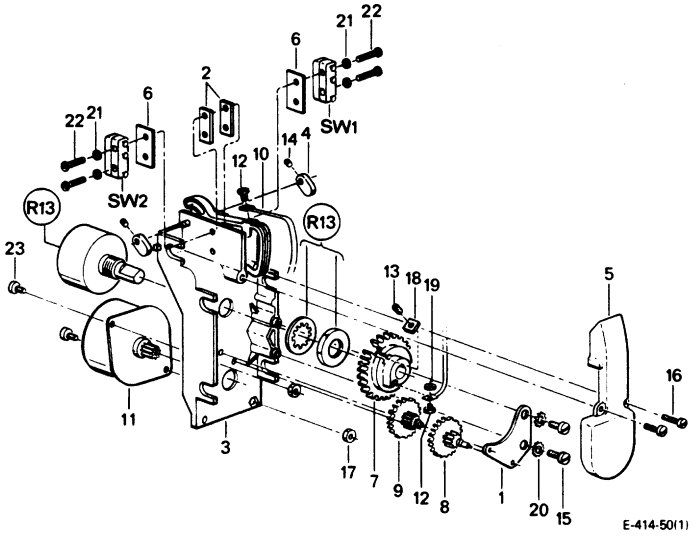


Figure 17. Servo Assembly

MOUNTING CONNECTIONS
Refer to Figure 18

Item	Part No.	Description	No. Req'd
1	6P2641	Case Fitting Plug	1
2	13S305-3	Ball Pivot Overthrow Connecting Link	1
3	37P623	. Pivot Operator	1
4	76P389-3	Plug	1
5	546M17	Element Mtg Washer, #10L	3
6	570M1	Element Mtg Screw, #10-32 x 1/2" Pan Hd	3

FITTING KIT, 13S368K - 1400L _ _ 4, 6
Refer to Figure 18

Item	Part No.	Description	No. Req'd
1	6P2641	Access Plate Blank	1
2	13S305-1	Process Link	1
5	546M17	Element Mtg Washer, #10	2
4	570M1	Element Mtg Screw, #10-32 x 1/2" Pan Hd	2

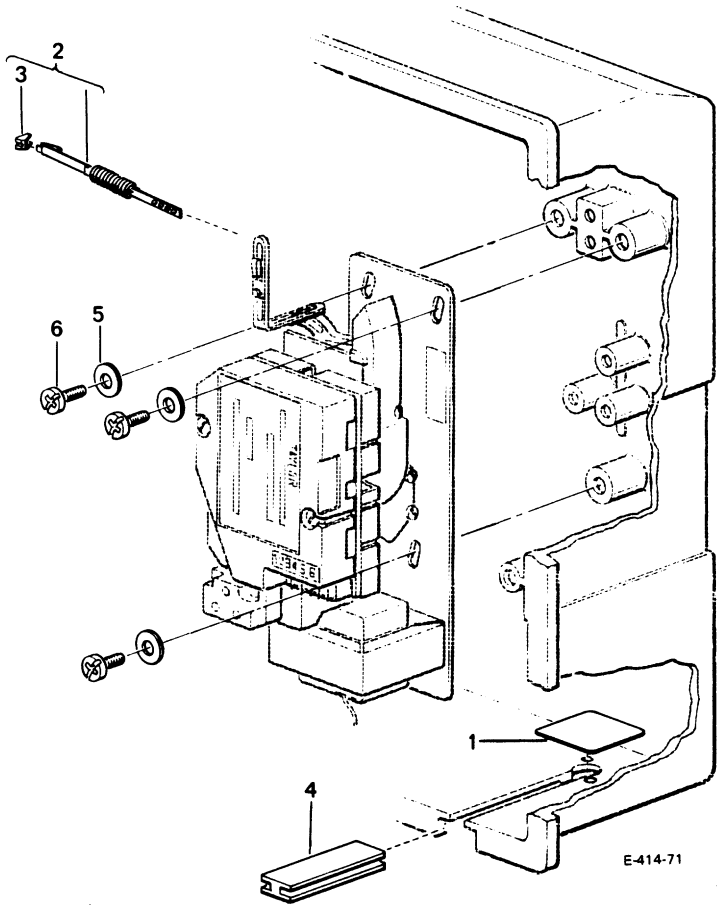


Figure 18. Mounting Connections and Fitting Kit

125S1192-30 MAIN BOARD, Voltage or Current - 1400L _ _ 02, 04, 06, 08
Refer to Figure 19.

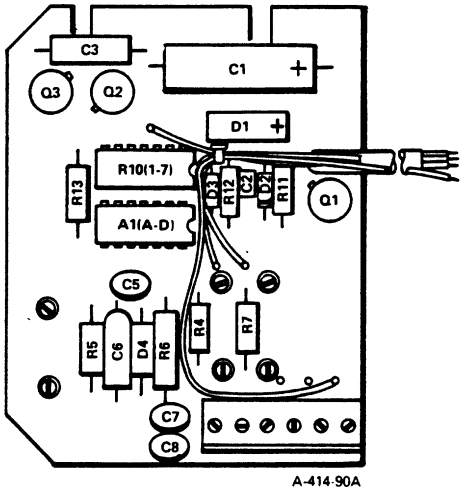


Figure 19. 125S1192-30 Main Board, Voltage or Current

125S1193-20 MAIN BOARD, Resistance - 1400L _ _ 48, 52, 55, 56
Refer to Figure 20.

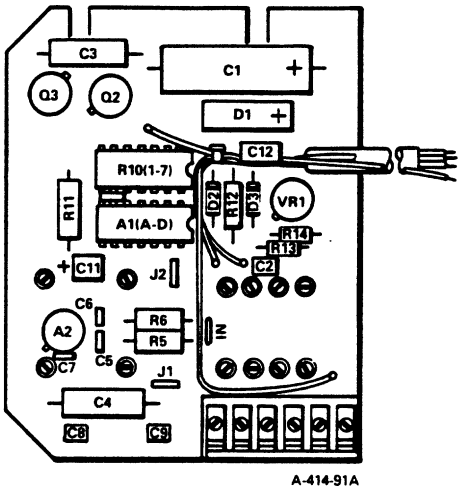


Figure 20. 125S1193-20 Main Board, Resistance

125S1199-1 TRANSMITTER POWER SUPPLY BOARD - 1400L _ _ _ 03, 04
Refer to Figure 21.

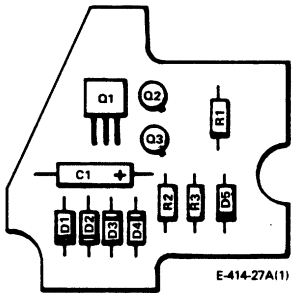


Figure 21. 125S1199-1 Transmitter Power Supply Board

PARTS LIST

Drawing applies only to following Cat. Nos.:

1400 L	A	*	02	00	D	D
1401			04	03	R	
1402			06	04		
1403			08	06		
1404						
1405						

***** Can be any digit

Continued on Sheet 2 of 2

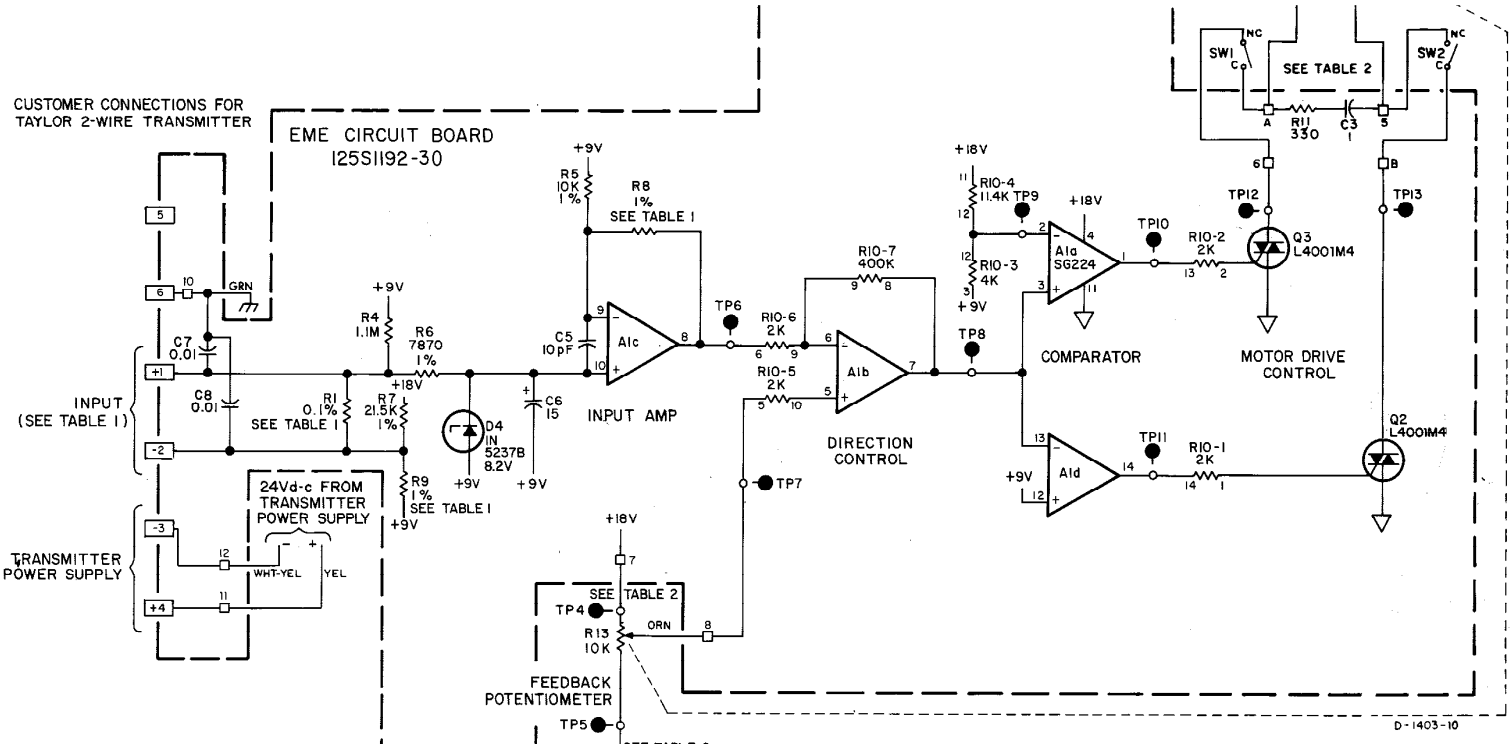


TABLE I
INPUT RESISTORS

INPUT SIGNAL	RESISTANCE VALUE (OHMS)		
	RI	R8	R9
0 to 1V dc	–	40.2K	IK
0.25 to 1.25V dc	–	40.2K	365
1 to 5V dc	–	2.49K	1.5K
4 to 20mA dc	250	2.49K	1.5K

TABLE 2
POTENTIOMETER, MOTOR & SWITCH CONNECTIONS

CATALOG NUMBER	R13 FEEDBACK POTENTIOMETER CONNECTIONS		MOTOR LEAD CONNECTIONS		EME OUTPUT ROTATION	SWI & SW2 CONNECTIONS			
						WHT/BRN & BRN		WHT/YEL & YEL	
	I OR CCW 3 OR CW		GRN	RED		SWI-COM	SWI-NC	SW2-COM	SW2-NC
1400L,1401L, 1404L	WHT	BLK	A	5	CCW	PAD A	PAD 6	PAD B	PAD 5
1402L,1403L, 1405L,	BLK	WHT	5	A	CW	PAD B	PAD 5	PAD A	PAD 6

Note:

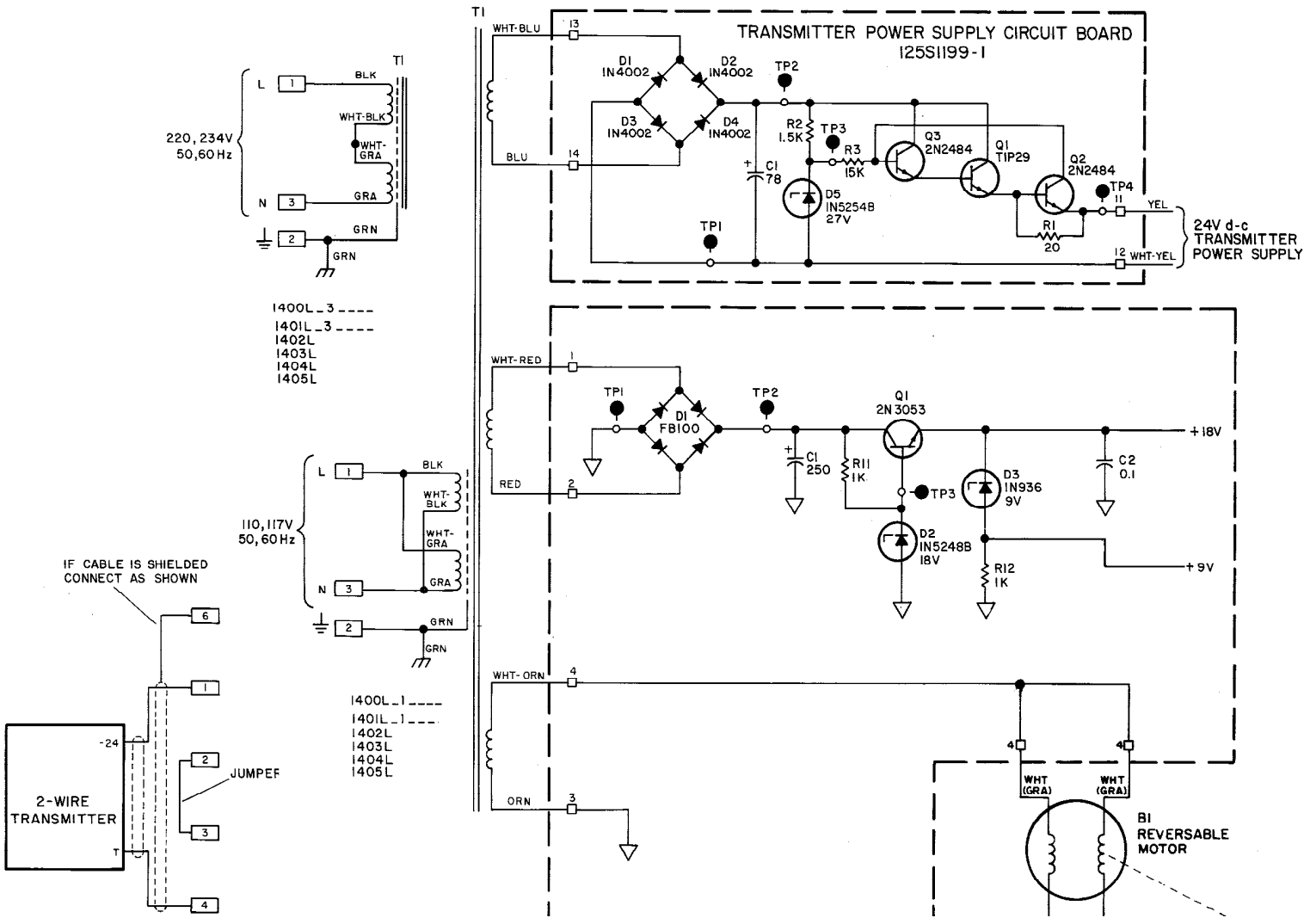
1. Unless otherwise specified, resistance values are given in ohms and capacitance values are given in microfarads.

ABB Instrumentation

SCHEMATIC DIAGRAM

Voltage or Current Input

WD-L-1400-109 Issue 1 Sheet 1 of 2



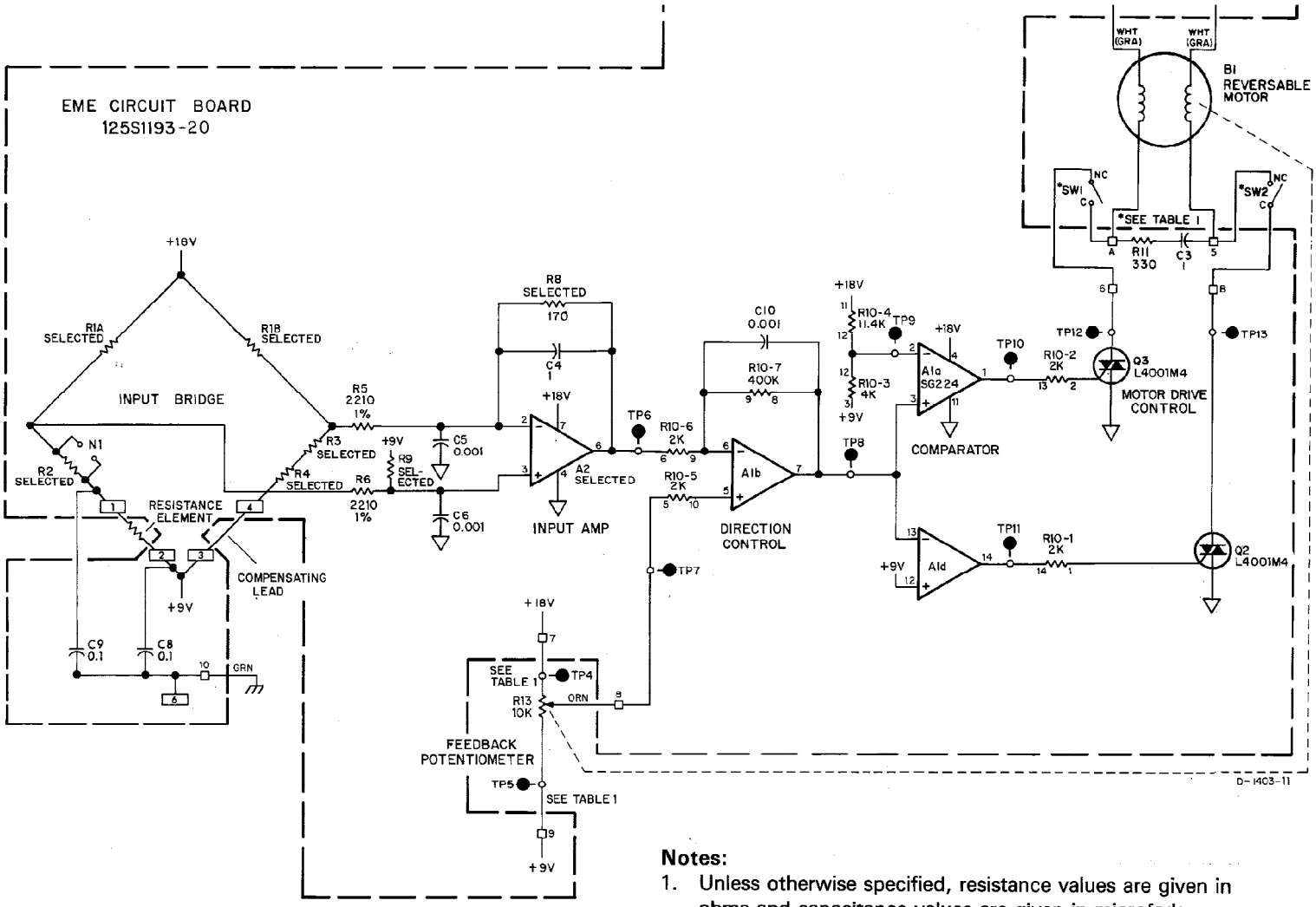
Continued on Sheet 1 of 2

Drawing applies only to following Cat. Nos.:

1400 L	A	*	48	00	D	D
1401			52	06	R	
1402			55			
1403			56			
1404						
1405						

* Can be any digit

Continued on Sheet 2 of 2



Notes:

1. Unless otherwise specified, resistance values are given in ohms and capacitance values are given in microfads.

TABLE 1

POTENTIOMETER, MOTOR & SWITCH CONNECTIONS

CATALOG NUMBER	R13 FEEDBACK POTENTIOMETER CONNECTIONS		MOTOR LEAD CONNECTIONS		EME OUTPUT ROTATION	SW1 & SW2 CONNECTIONS			
						WHT/BRN & BRN		WHT/YEL & YEL	
	1 OR CCW	3 OR CW	GRN	RED		SW1-COM	SW1-NC	SW2-COM	SW2-NC
1400L, 1401L, 1404L	WHT	BLK	A	5	CCW	PAD A	PAD 6	PAD B	PAD 5
1402L, 1403L, 1405L,	BLK	WHT	5	A	CW	PAD B	PAD 5	PAD A	PAD 6

Note:

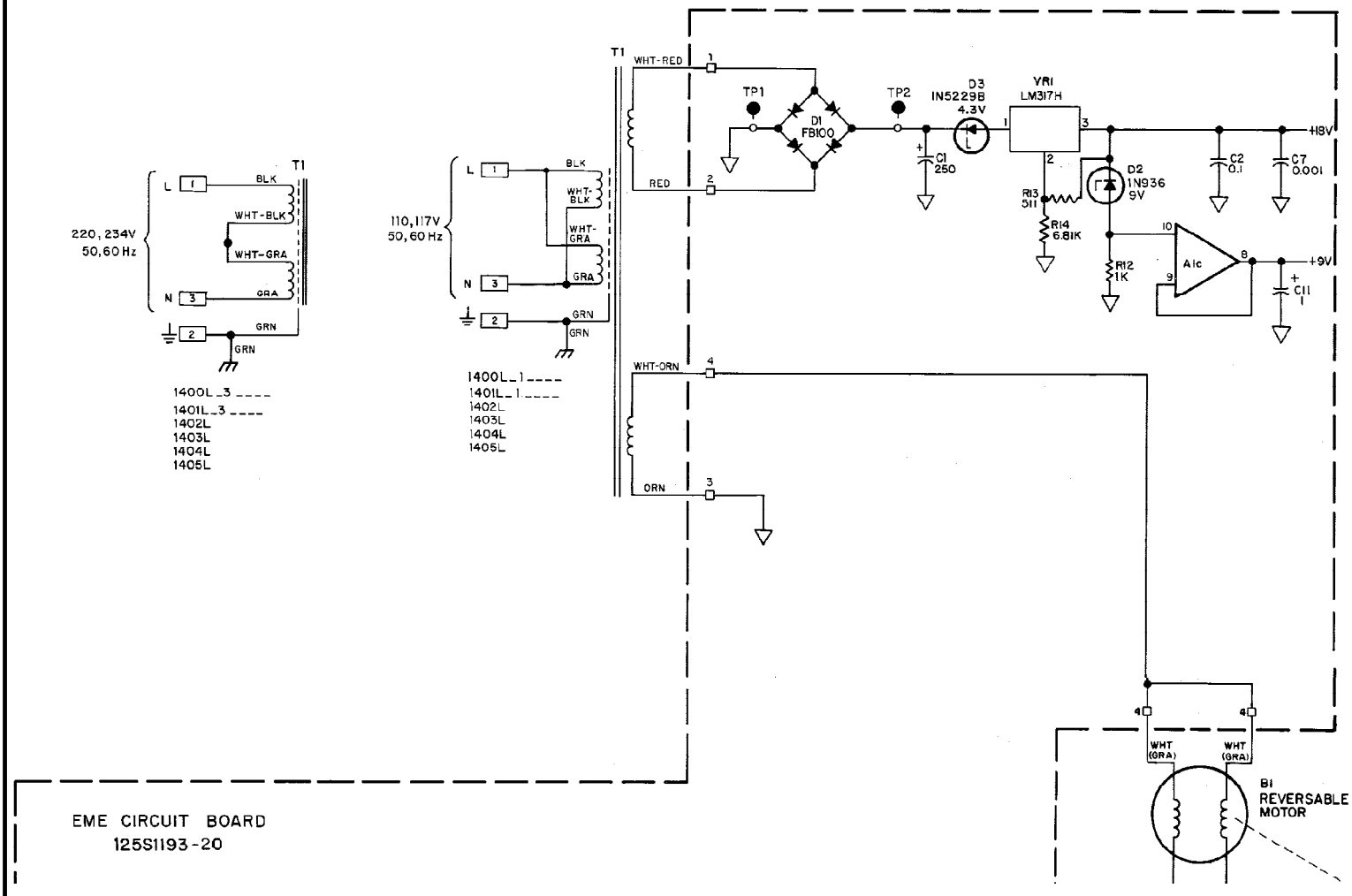
1. Unless otherwise specified, resistance values are given in ohms and capacitance values are given in microfarads.

ABB Instrumentation

SCHEMATIC DIAGRAM

Resistance Input

WD-L-1400-110 Issue 1 Sheet 1 of 2



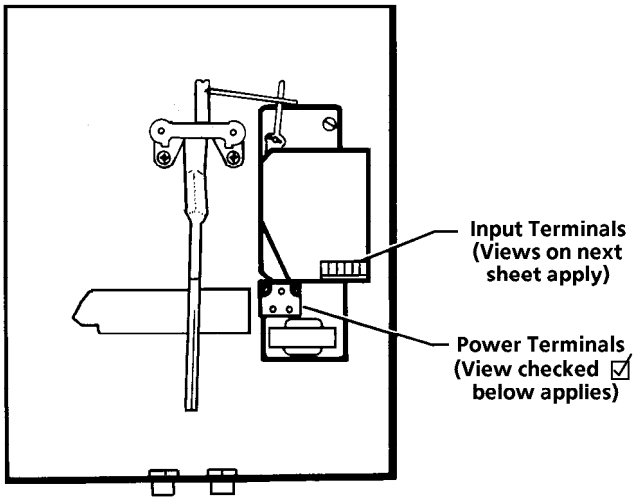
Continued on Sheet 1 of 2

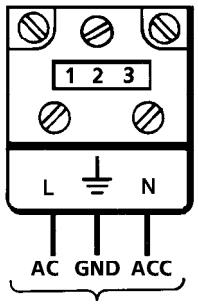
Drawing applies only to following Cat. Nos.:

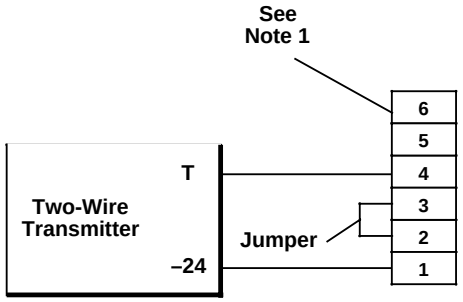
Element: 1400 L A * * * D D / R

Controller: 440 K T 1 * * * * * * * * D / R / 5
441
442
443
444

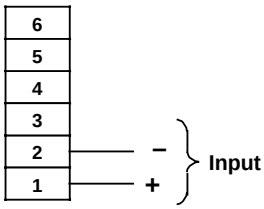
***** Can be any digit



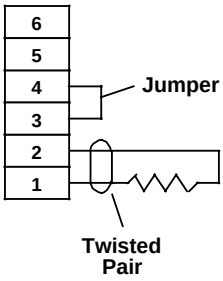




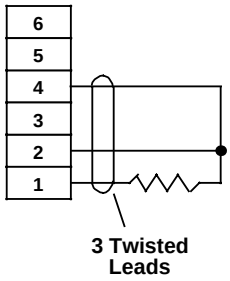
Typical Connections for Two-Wire Transmitter (4 to 20 mA dc Input)



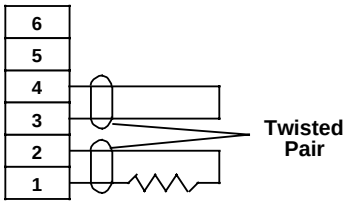
Voltage or Current Input
(See Note 1)



Resistance Element with 2 Lead Wires
(See Note 1)



Resistance Element with 3 Lead Wires
(See Notes 1 and 2)



Resistance Element with 4 Lead Wires
(See Notes 1 and 2)

Power:
110/117V, 50/60 Hz
220/234V, 50/60 Hz

Input:
Resistance Element
4 to 20 mA dc
0.25 to 1.25V dc
0 to 1V dc
1 to 5V dc

Alarms:
Refer to Alarm Connection Diagram

Notes:
1. Do not use wire larger than 16 ga for voltage, current or resistance element input connections. 24 ga or 0.5 mm wire is recommended for mV and thermocouple input connections and must be a twisted shielded pair or a twisted pair in conduit.
2. Run all signal wires in same conduit to minimize temperature effects.
3. L – Hot (Live) wire
   GND – Ground (Earth) wire
   N – Common (Neutral) wire

Only items checked apply

Cat. No. _____

Cust. No. _____ ABB Instrumentation No. _____

Also Refer to Dwgs. _____

Certified by _____ Date _____

ABB Instrumentation

ELECTRICAL CONNECTION DIAGRAM

440R Model D
Pneumatic Indicating Controller

WD-R-440-3 **Issue 1** **Sheet 1 of 1**

PRODUCTS AND SERVICING

A Comprehensive Instrumentation Range

Sensors, transmitters and related instruments for flow, temperature, pressure, level and other process variables

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Pressure transmitters

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Cable-length measuring systems

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