2002B

MAIN ASSEMBLY WITH SIGNAL CONDITIONERS

- -P PROCESS RECEIVER
- -E EXCITATION SUPPLY
- -S STRAIN / MICROVOLT

Operator's Manual

MADE IN THE U.S.A.

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It is the policy of NEWPORT to comply with all worldwide safety and EMC/EMI regulations that apply. NEWPORT is constantly pursuing certification of its products to the European New Approach Directives. NEWPORT will add the CE mark to every appropriate device upon certification.

The information contained in this document is believed to be correct but NEWPORT Electronics, Inc. accepts no liability for any errors it contains, and reserves the right to alter specifications without notice.

WARNING: These products are not designed for use in, and should not be used for, patient connected applications.

This device is marked with the international caution symbol. It is important to read the Setup Guide before installing or commissioning this device as it contains important information relating to safety and EMC.

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ILUSTRATIONS

1.0 GENERAL INFORMATION

The 2002B series provides several versions of a low-cost, four and one-half digit panel meter for a wide range of applications that require accurate DC measurement with zero and span adjustments.

1.1 MODEL **2002B-P**

The 2002B-P consists of a main assembly and a plug-in process receiver board.

Model 2002B-P is a process receiver with adjustments of 40,000 counts of zero and 20,000 counts of span for transmitter signals such as 4-20 mA, 1-5 V, and 0-10 V. The meter can be scaled to display readings directly in engineering units.

Model 2002B-P can also be used in ratiometric pot-follower applications, to determine such things as liquid level or valve setting from the position of a potentiometer wiper. The required external reference voltage can be derived from the meter's 4.7 V dc supply.

1.2 MODEL **2002B-E**

The 2002B-E consists of a main assembly and a process receiver with excitation board.

In addition to all Model 2002B-P features, Model 2002B-E offers an electrically-floating supply for powering transmitters, active transducers, and bridges. Supply voltage is adjustable from 10 to 24 V dc up to a maximum output current of 50 mA. (See Section 9.1)

1.3 MODEL **2002B-S**

The 2002B-S consists of a main assembly and a preamplifier with excitation board.

In addition to most 2002B-E features (with the exception that excitation maximum output current decreases from 30 mA at 10 V dc to 20 mA at 24 V dc), Model 2002B-S offers a high-impedance, precision preamplifier with programmable gains of 1, 3, 10, 30, and 100. Gains provide resolutions of 100, 30, 10, 3, and 1μV/count, respectively. Typical offset drift is only 0.3 μV/°C. The preamplifier is ideal for metal-foil, strain-gauge applications that require microvolt resolution.

2.0 SPECIFICATIONS

2.1 ANALOG INPUT

Models **2002B-P** and **2002B-E**

Range	4-20 mA	1-5 V	0-10 V
Resolution	0.8 μA	0.2 mV	0.5 mV
Input resistance	130 Ω	1 MΩ	1 MΩ
Bias current	50 pA	10 pA	5 pA
Maximum input	55 mA	250 V	250 V
Configuration	Differential with respect to AC earth ground, bipolar		
Zero range	-20,000 to +20,000 counts with multiturn pots		
Span range	0 to 20,000 counts with multiturn pots		
NMR	70 dB at 50/60 Hz		
Reference:			
Internal (standard)	1.0 V dc ±5% with 12 kΩ source resistance		
External (ratiometric)	0.5 - 2.0 V, 680 kΩ input resistance		

Model **2002B-S**

Range	
Most-sensitive scaling	±19.999 mV, 10 μV resolution
Least-sensitive scaling	±2.5 V, 1 mV resolution (limited by CMV)
Input resistance	1 GΩ min without bridge balance
Bias current	1 nA typ, 5 nA max
Maximum input	50 V
Configuration	Differential with respect to AC earth ground, bipolar
Coarse preamplifier gains	1, 3, 10, 30, 100
Bridge balance adj.	±1.5 mV with 350 Ω bridge
Zero range	-20,000 to +20,000 counts with multiturn pots
Span range	0 - 20,000 counts with multiturn pots
NMR	80 dB at 50/60 Hz for 20 mV range; 66 dB at 50/60 Hz for 0.2 and 2.0 V ranges
Reference:	
Internal (from excitation supply)	1.0 V dc with 9.5 kΩ source resistance at 10 V dc excitation
External (opt)	1.0 V dc -50%/+100% with 680 kΩ input resistance

2.2 ACCURACY AT 25°C

Models **2002B-P**, **2002B-E**, and **2002B-S**

Step response	1 second
Warmup to rated accuracy	10 minutes

Models **2002B-P** and **2002B-E**

Maximum error	±0.01% of span ±2 counts
Span tempco	±0.01% of span/°C
Zero tempco	±0.5 counts/°C

Model **2002B-S**

Reference	Internal	External
Maximum error	±0.01% S	±2 counts
Span tempco	±0.005% S/°C	±0.01% S/°C
Zero tempco	±0.5 μV/°C	±1.0 counts/°C
Bridge balance tempco	±0.5 μV/°C	±0.2 μV/°C

2.3 NOISE REJECTION

CMR, SIG GND to PWR GND	120 dB from DC to 60 Hz
CMV, SIG GND to PWR GND	1500 Vp per HV test; 354 Vp per IEC spacing

2.4 EXCITATION SUPPLY

Models **2002B-E** and **2002B-S**

Output voltage	Adjustable from 10 to 24 V dc with multiturn pot
Output current	50 mA max for -E; 30 mA max at 10 V decreasing to 12 mA max at 24 V for -S
Load regulation*	0.15% typ, 0.5% max from zero to max load
Line regulation*	0.01% typ, 0.04% max for 10% change of AC power voltage
Tempco*	0.02%/°C max
Ripple at 50/60 Hz	0.01%

* In Model 2002B-S, the meter's internal reference (e.g., 1 V at 10 V excitation) is derived from the excitation voltage for ratiometric operation which eliminates load and line regulation errors and reduces other errors.

2.5 ANALOG-TO-DIGITAL CONVERSION

Technique	Dual-slope, average-value
Input integration period	100 milliseconds
Read rate	2.5/seconds

2.6 DIGITAL INPUTS
(Positive true referenced to DIG GND)

DESCRIPTION	"0" LEVEL VOLTS	"1" LEVEL VOLTS	SINK mA	SOURCE μA
$\overline{\text{METER HOLD}}$	0 to 1.0	2.5 to 5.0	0.1	10
$\overline{\text{LAMP TEST}}$	0 to 0.6	2.0 to 5.0	1.3	20
$\overline{\text{DISPLAY BLANKING}}$	0 to 0.6	2.0 to 5.0	1.3	20

2.7 DISPLAY

Type	7 segment, red LED
Digit height	14.2 mm (0.56 in)
Symbols	-1.8.8.8.8
Decimal Points	4 positions programmed internally or at connector, source 0.3 mA from digit drive
Overrange indication	4 least-significant digits flash

2.8 POWER

Standard AC input voltage	115 V ac ±15%
Optional AC input voltage	230 V ac ±15%
AC frequency range	47 to 400 Hz
Optional DC input voltage	9-32 V dc, isolated to 300 V dc 26-56 V dc, isolated to 300 V dc
Power consumption, 2002B-P	2.4 watts
Power consumption, 2002B-E or 2002B-S	3.7 watts
Output voltages	+4.7 V dc ±5% at 10 mA max -4.7 V dc ±5% at 10 mA max

2.9 ENVIRONMENTAL

Operating temperature	0 to 60°C
Storage temperature	-40 to +85°C
Humidity	95% RH to 40°C (non-condensing)

2.10 MECHANICAL

Bezel	96 x 48 x 8.0 mm (3.78 x 1.89 x 0.31 inches)
Depth behind bezel with connector	104,2 mm (4.10 inches)
Panel cutout	92 x 45 mm (3.62 x 1.77 inches)
Weight	425 g (15 ounces)
Case material	94V-0 UL-rated polycarbonate
D1 connector (Optional)	PCB edge connector with double row of 18 pins; 3.96 mm (0.156 inches) between pins
Screw Terminals	Barrier strip with #6 screw terminals for power and signal inputs

3.0 MECHANICAL ASSEMBLY AND INSTALLATION

3.1 SAFETY CONSIDERATIONS

This device is marked with the international Caution symbol. It is important to read this manual before installing or commissioning this device as it contains important information relating to Safety and EMC (Electromagnetic Compatibility).

Unpacking & Inspection

Unpack the instrument and inspect for obvious shipping damage. Do not attempt to operate the unit if damage is found.

This instrument is a panel mount device protected in accordance with Class I of EN 61010 (115/230 AC power connections). Installation of this instrument should be done by Qualified personnel. In order to ensure safe operation, the following instructions should be followed.

This instrument has no power-on switch. An external switch or circuit-breaker shall be included in the building installation as a disconnecting device. It shall be marked to indicate this function, and it shall be in close proximity to the equipment within easy reach of the operator. The switch or circuit-breaker shall not interrupt the Protective Conductor (Earth wire), and it shall meet the relevant requirements of IEC 947–1 and IEC 947-3 (International Electrotechnical Commission). The switch shall not be incorporated in the mains supply cord.

Furthermore, to provide protection against excessive energy being drawn from the mains supply in case of a fault in the equipment, an overcurrent protection device shall be installed.

- The **Protective Conductor** must be connected for safety reasons. Check that the power cable has the proper Earth wire, and it is properly connected. It is not safe to operate this unit without the Protective Conductor Terminal connected.

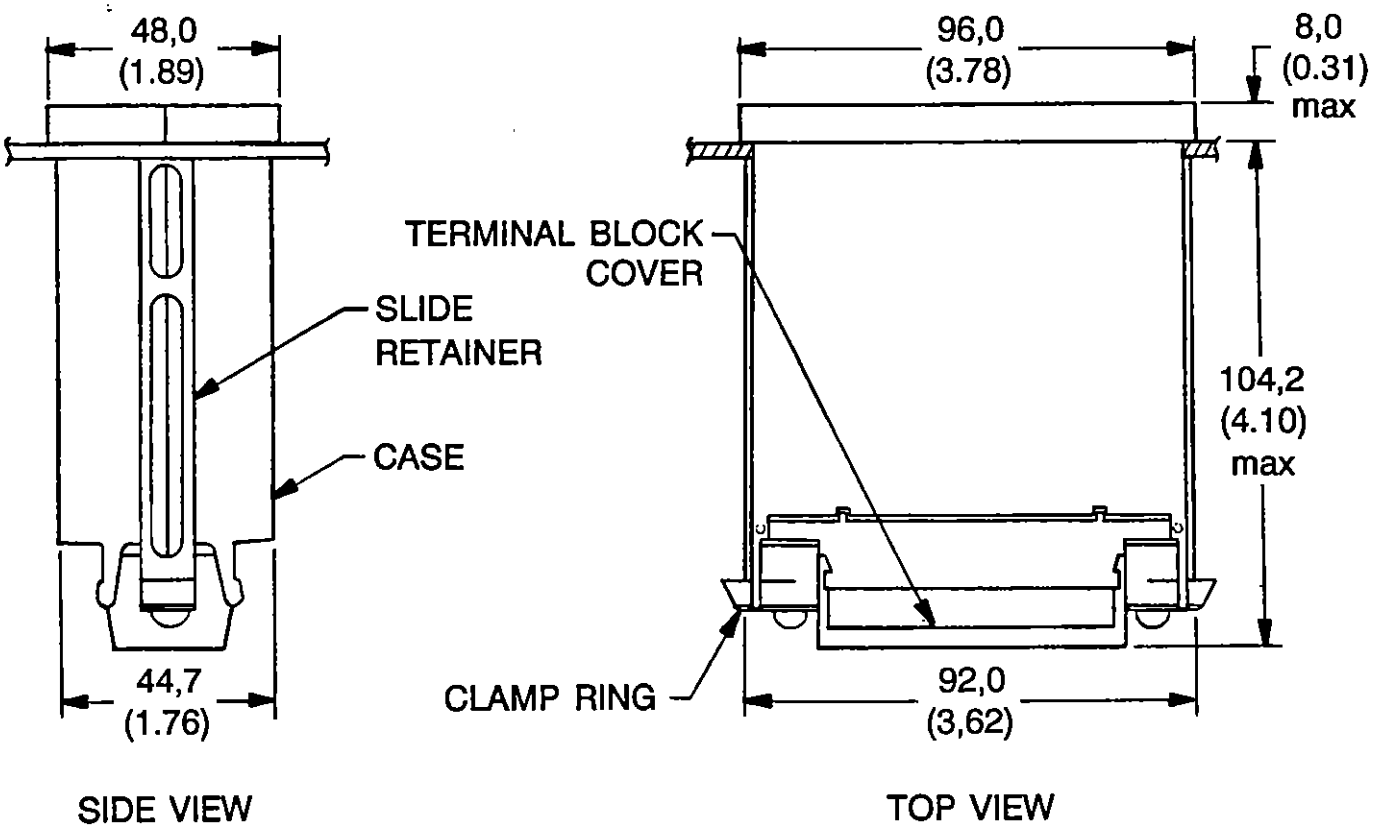
- Do not exceed voltage rating on the label located on the top of the instrument housing.
- Always disconnect power before changing signal and power connections.
- Do not use this instrument on a work bench without its case for safety reasons.
- Do not operate this instrument in flammable or explosive atmospheres.
- Do not expose this instrument to rain or moisture.

EMC Considerations

- Whenever EMC is an issue, always use shielded cables.
- Never run signal and power wires in the same conduit.
- Use signal wire connections with twisted-pair cables.
- Install Ferrite Bead(s) on signal wires close to the instrument if EMC problems persist.

3.2 PANEL MOUNTING

NOTE: Dimensions are in millimeters ±0,25 mm and inches are in ( ) ±0.01 in.



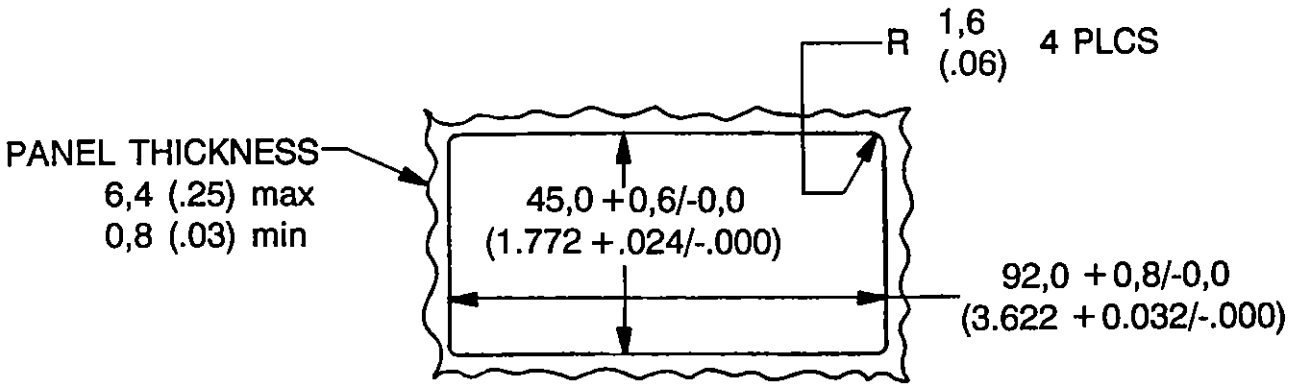


Figure 3-1 DIN Case Dimensions

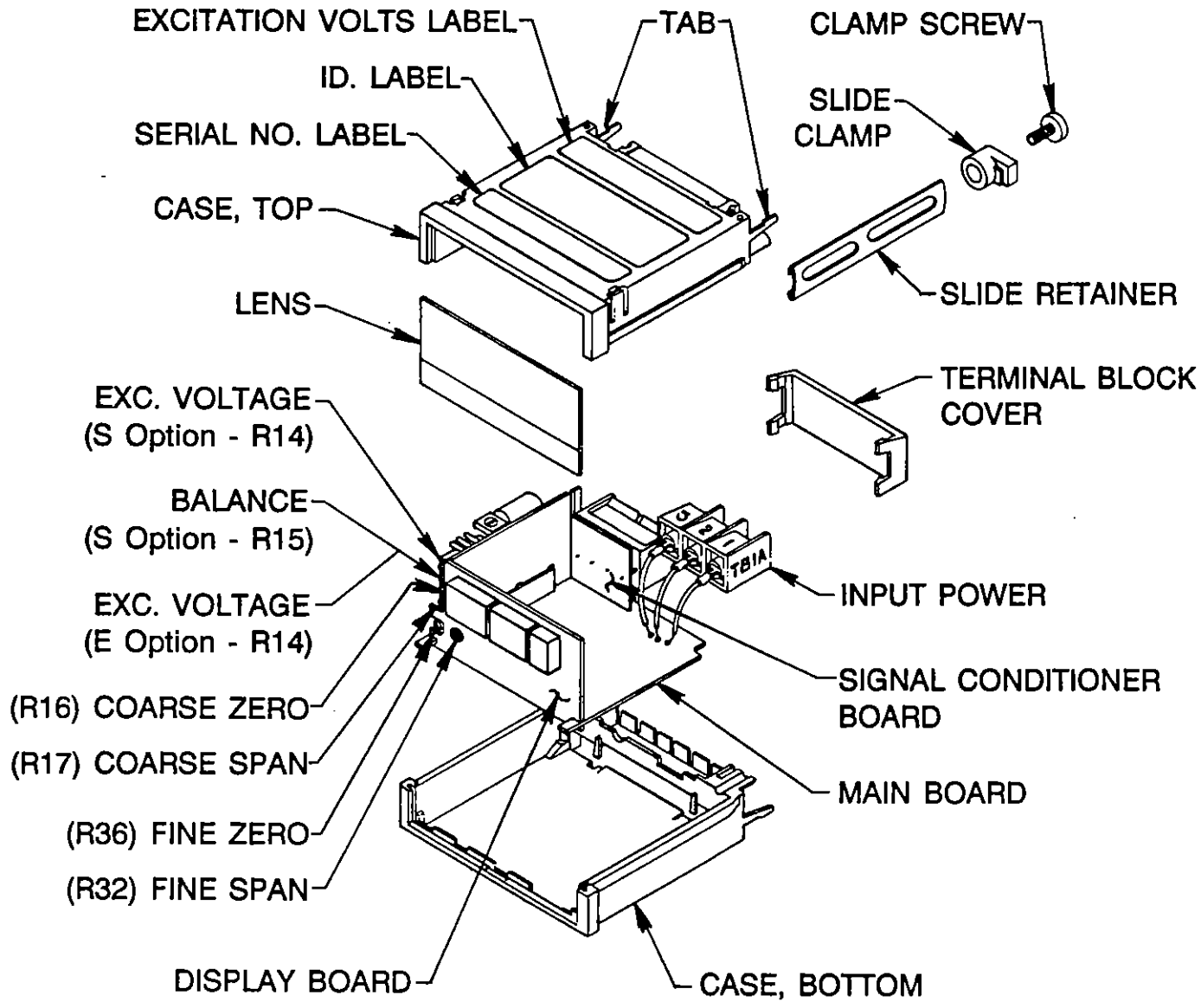


Figure 3-2 Exploded View

1. Remove main board edge connector J1, if installed.
2. Loosen the two clamp screws on rear of case until slide clamps can be rotated. Push the two slide retainers toward the rear of the case, and remove them.
3. Working from the front of the panel, insert the meter into the panel cutout.
4. Insert slide retainers back onto the case, and push them up tightly against the rear of the panel.
5. Rotate slide clamps back into original position and tighten clamp screws just enough to hold the case in place. NEVER OVERTIGHTEN CLAMP SCREWS.
6. Install any connectors that have been removed.

4.0 POWER AND SIGNAL INPUT CONNECTIONS (TB1)

CAUTION: Incorrect power input can damage your panel meter.

4.1 INSTALLING OPTION C1 (230 V ac)

If this option is to be used, it must be installed prior to any power and signal connections. Option C1 is 230 V ac ±15%, 47-400 Hz operation. To change the meter in the field from 115 V ac operation, follow this procedure:

1. Refer to Figures 4-1 and 4-2. Remove power lines from the meter, then remove the meter from the case.
2. Remove jumpers W5 and W6 on the transformer.
3. Add jumper W4 on the printed circuit board. The meter is now wired for 230 V ac operation.

NOTE: To change the meter from 230 V ac to 115 V ac operation, reverse the above procedure.

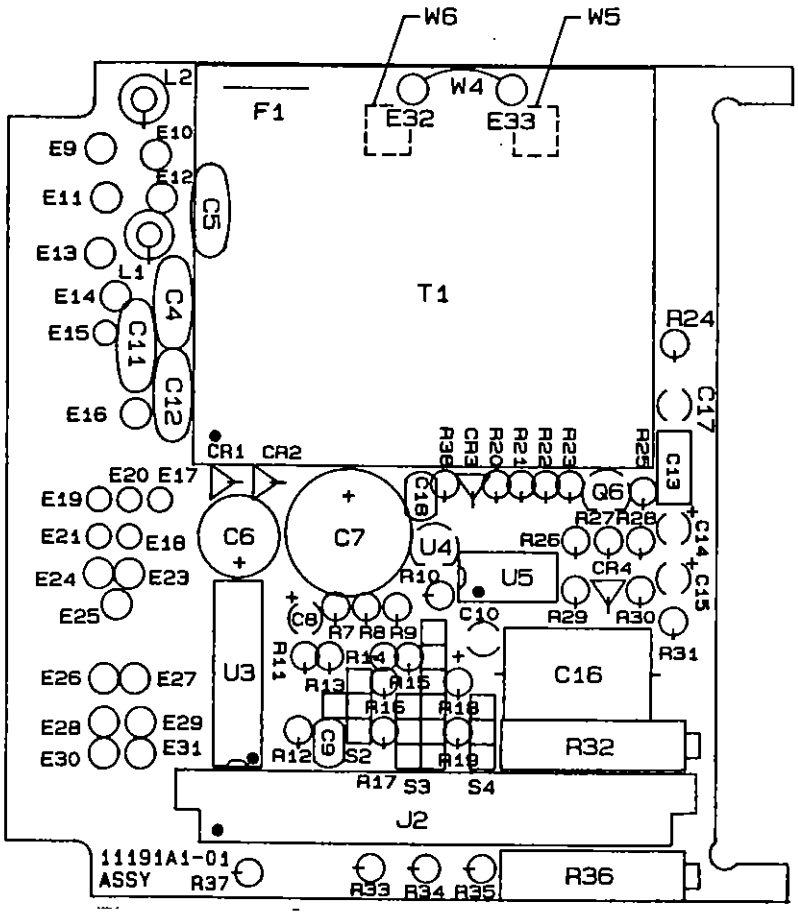


Figure 4-1 Changing Operating Voltage

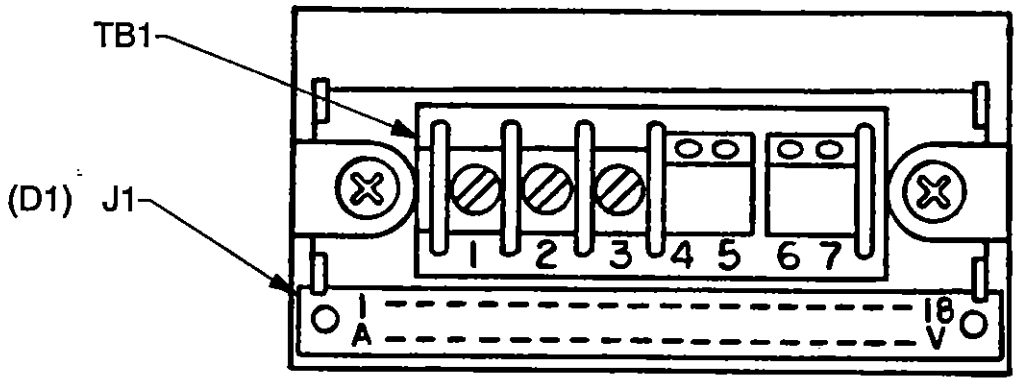


Figure 4-2 Rear View of Case with Connectors

4.2 POWER CONNECTIONS

TB1 Connection 2002B-P	2002B-E	2002B-S	AC Power Operation	Wire Color USA	Other	DC Power Operation
1	1	1	AC HI	Black	Brown	No Connection
2	2	2	AC LO	White	Blue	+ DC Power
3	3	3	AC GND	Green	Green/Yellow	DC Power RET

4.3 SIGNAL INPUT CONNECTIONS

TB1 Connection 2002B-P	2002B-E	2002B-S	Signal Input
N/C	4	4	- EXC
5	5	5	SIG LO
6	6	6	SIG HI
N/C	7	7	+ EXC

4.4 MAIN BOARD CONNECTOR PIN ASSIGNMENTS (J1)

(Left to right, looking at rear of case)

CONNECTION	FUNCTION	EXPLANATION
A	Spare (E9)	
1	No connection	
B	No connection	
2	Spare (E11)	
C	Spare (E13)	
3	No connection	
D	No connection	
4	No connection	
E	Spare (E15)	
5	No connection	
F	1999.9 DP	
6	Spare (E16)	
H	199.99 DP	
7	Spare (E17)	
J	19.999 DP	
8	Spare (E20)	
K	1.9999 DP	
9	Spare (E19)	
L	DP Return	
10	Spare (E18)	
M	Spare (E21)	
11	-4.7 V dc	Analog and Digital Power
N	Spare (E25)	
12	+4.7 V dc	Analog and Digital Power
P	-EXC	Excitation Voltage
13	+REF	Reference Voltage
R	$\overline{\text{LAMP TEST}}$	Lights All Display Segments
14	+EXC	Excitation Voltage
S	DIG GND	Digital Ground
15	$\overline{\text{HOLD}}$	Hold Last Display Reading
T	ANA GND	Analog Ground
16	SIG LO	Signal Input
U	$\overline{\text{BLANKING}}$	Blanks Four LSDs
17	SIG HI	Signal Input
V	OSC	100 kHz Out
18	ANA OUT	

5.0 MAIN BOARD CONFIGURATION

The following procedures are used to select the various configurations of the main board for use as a 2002B-P, 2002B-E, or 2002B-S in conjunction with a plug-in signal conditioning card.

5.1 DECIMAL POINT SELECTION

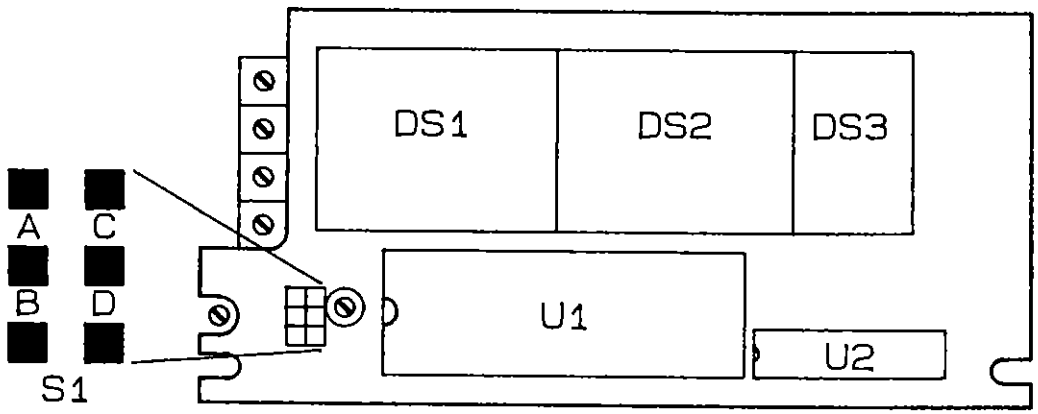


Figure 5-1 Display Board Jumper Locations

The 2002B has four decimal point locations which can be displayed. They may be programmed by installing push-on jumpers on S1 of the display board or by connecting pins on the optional rear connector, J1.

Remove all push-on jumpers not used in the desired configuration. Install appropriate jumpers as indicated in the chart below.

Decimal point	S1	Alternate decimal point selection using main board connector J1.
1.9999 DP	A	Connect K to L
19.999 DP	B	Connect J to L
199.99 DP	C	Connect H to L
1999.9 DP	D	Connect F to L

5.2 MODEL **2002B-P**

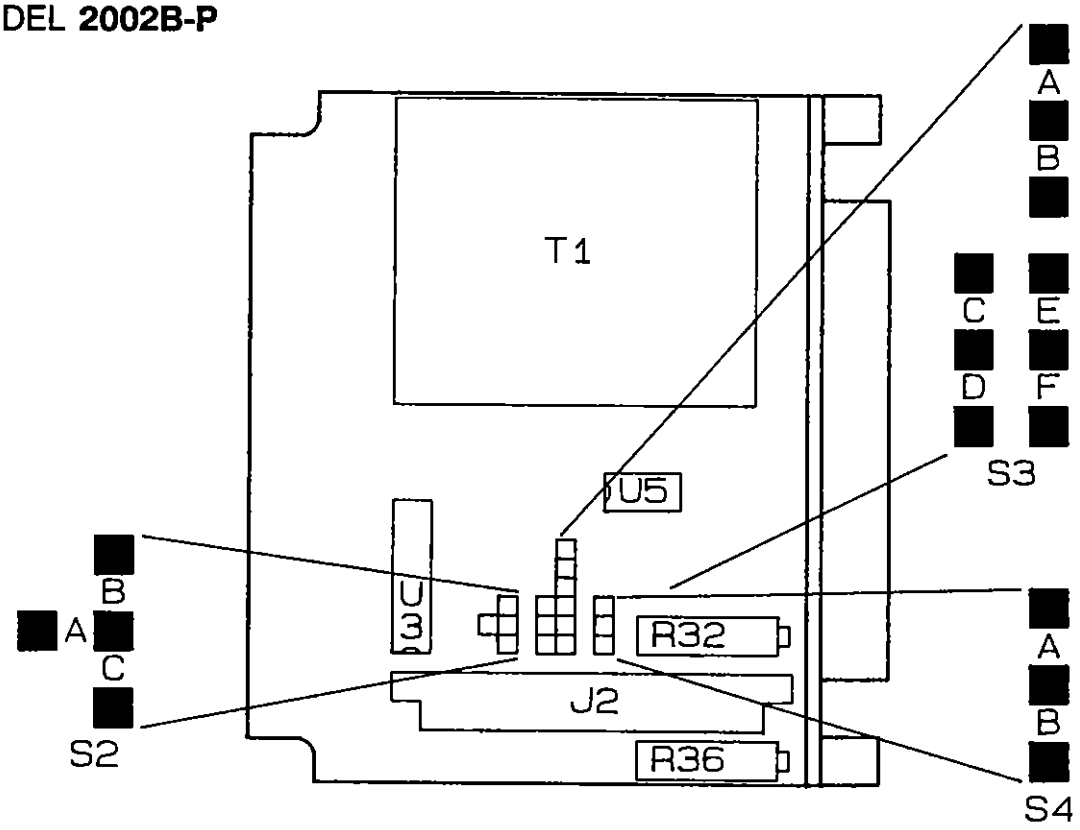


Figure 5-2 Main Board Jumper Locations

The 2002B-P main board is generally configured to use the internal absolute reference rather than an external ratiometric one. The three input ranges for this are listed in the chart below.

Input Ranges	S2	S3	S4
4-20 mA	A	A,F,C	B
1-5 V dc	B	A,F,D	B
0-10 V dc	C	A,F,D	B

5.3 MODELS **2002B-E** AND **2002B-S**

The 2002B-E main board may be configured to use one of three input ranges.

Input Ranges	S2	S3
4-20 mA	A	C
1-5 V dc	B	D
0-10 V dc	C	D

The 2002B-E and 2002B-S may also be configured to use one of three reference sources:

Internal Absolute Reference

This reference mode uses the meter's own internal reference to perform the analog-to-digital conversion. Use this mode when measuring an absolute voltage or current where you do not require measurement of the input signal to be relative to (ratiometric with) another signal such as an external transducer excitation supply.

Internal Ratiometric Reference

This reference mode will use the meter's own excitation supply voltage as a reference in performing the analog-to-digital conversion. Use this reference with a load cell or applications where it is desired to have the measurement of the input signal relative to (ratiometric with) the meter's internal excitation supply.

External Ratiometric Reference

This reference mode will use a signal which you will provide on the rear connector (J1-13) as a reference in performing the analog-to-digital conversion. Use this reference with a load cell or applications where it is desired to have the measurement of the input signal relative to (ratiometric with) some external signal.

Reference Voltage Source	S3	S4
Internal Absolute (as shipped)	A,F	B
Internal Ratiometric	B,E	A
External Ratiometric	-	-

NOTE: If your application requires the use of an external ratiometric reference, remove all push-on jumpers from S4. This reference signal must then be provided at the rear connector on J1-13.

6.0 PLUG-IN CARD CONFIGURATION

6.1 Model **2002B-P**

Remove all push-on jumpers not used in the desired configuration. Install appropriate jumpers as indicated.

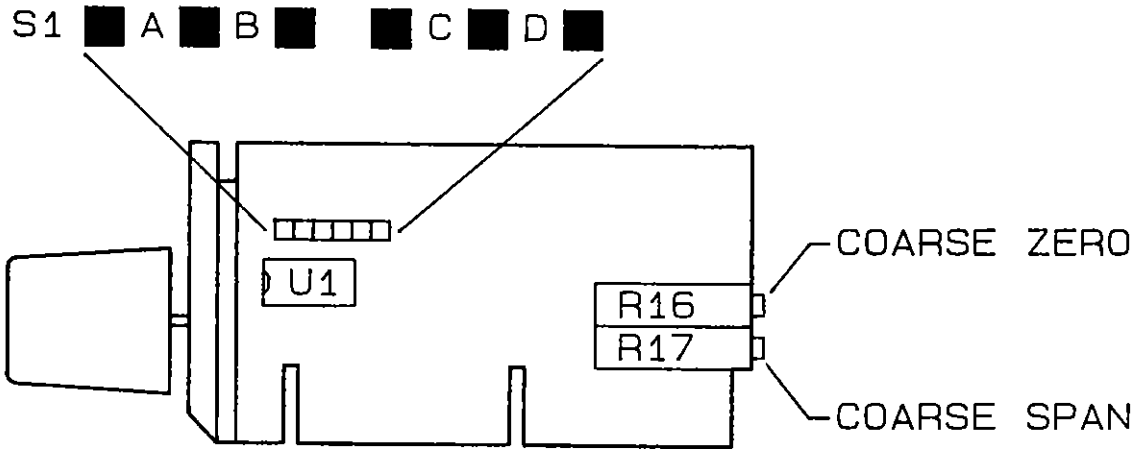


Figure 6-1 -P Card Jumper Locations

The 2002B-P plug-in card should have push-on jumpers installed on positions S1-A and S1-C.

6.2 Model **2002B-E**

Remove all push-on jumpers not used in the desired configuration. Install appropriate jumpers as indicated.

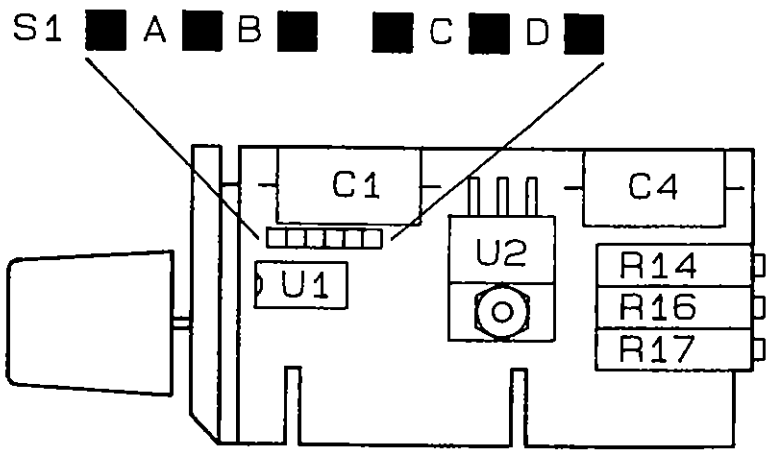


Figure 6-2 -E Card Jumper Locations

The 2002B-E plug-in card should be configured according to the type of reference for which the main board was configured.

* Reference Voltage Source	S1
Internal Absolute	A,C
Internal Ratiometric	B,D
External Ratiometric	A,C

* Zero Offset is derived from this reference.

6.3 Model **2002B-S**

Remove all push-on jumpers not used in the desired configuration. Install appropriate jumpers as indicated.

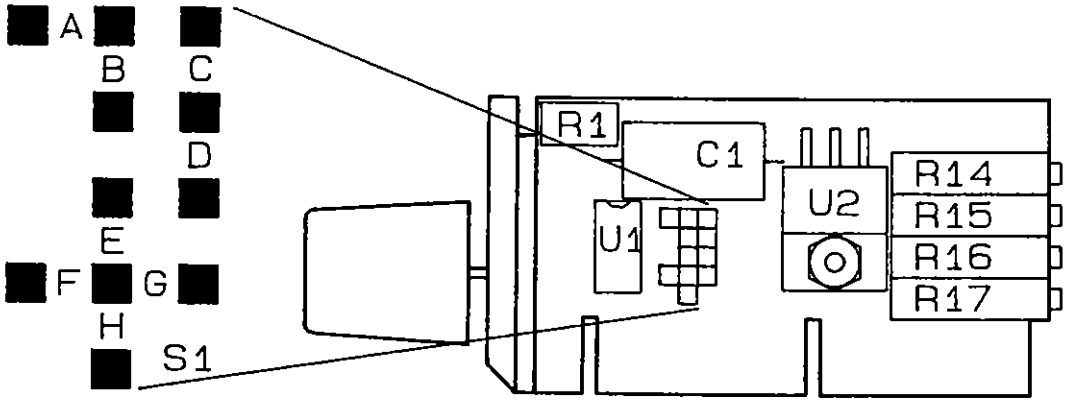


Figure 6-3 -S Card Jumper Locations

The 2002B-S plug-in card should be configured according to the type of reference for which the main board was configured.

* Reference Voltage Source	S1
Internal Absolute (as shipped)	A,C
Internal Ratiometric	B,D
External Ratiometric	A,C

Gain Ranges	μV/Count	S1
X1	0 to 100	G
X3	0 to 30	F
X10	0 to 10	E
X30	0 to 3	H
X100	0 to 1	-

* Zero Offset is derived from this reference.

7.0 CALIBRATION

Using the upper and lower signals as well as the upper and lower display readings required by your application, calculate the slope factor (S):

Upper Input (UI) _____ Upper Display (UD) _____

Lower Input (LI) _____ Lower Display (LD) _____

$$S = \frac{UD - LD}{UI - LI}$$

Then calculate the Top Calibration Point (TCP):

$$TCP = S \times UI$$

Example: If you wanted an input of 4 to 20 mA to produce display readings of 1000 to 10000:

UI = 20 UD = 10000
LI = 4 LD = 1000

$$S = \frac{10000 - 1000}{20 - 4} = 562.5$$

$$TCP = 562.5 \times 20 = 11250$$

After determining LI, UI, LD, UD, S, and TCP for your application, you will be ready to commence with the following procedure. Refer to Figure 3-1 to locate the calibration potentiometers.

1. If you are using a 2002B-E or a 2002B-S, adjust Excitation Voltage (R14) as required for your application.

2. Center the position of the Fine Span (R32) and Fine Zero (R36) by turning them 20 turns clockwise and then about 8 to 10 turns counter-clockwise.

3. Apply an input of zero volts or milliamperes (depending on your configuration). Adjust Coarse Zero (R16) until the meter displays 0000.

4. Apply the Upper Input signal and adjust the Coarse Span (R17) until the meter displays the TCP reading.

5. Apply the Lower Input signal and adjust the Coarse Zero (R16) until the meter displays the Lower Display reading.

6. Apply the Upper Input signal and adjust Fine Span (R32) until the meter displays the Upper Display reading.

7. Apply the Lower Input signal and adjust Fine Zero (R36) until the meter displays the Lower Display reading.

NOTE: If you are using a 2002B-S, a bridge balance adjustment (R15) is available to null any errors which may exist in your load cell bridge. A resistor may be installed at R5 on the plug-in board if R15 does not provide enough adjustment.

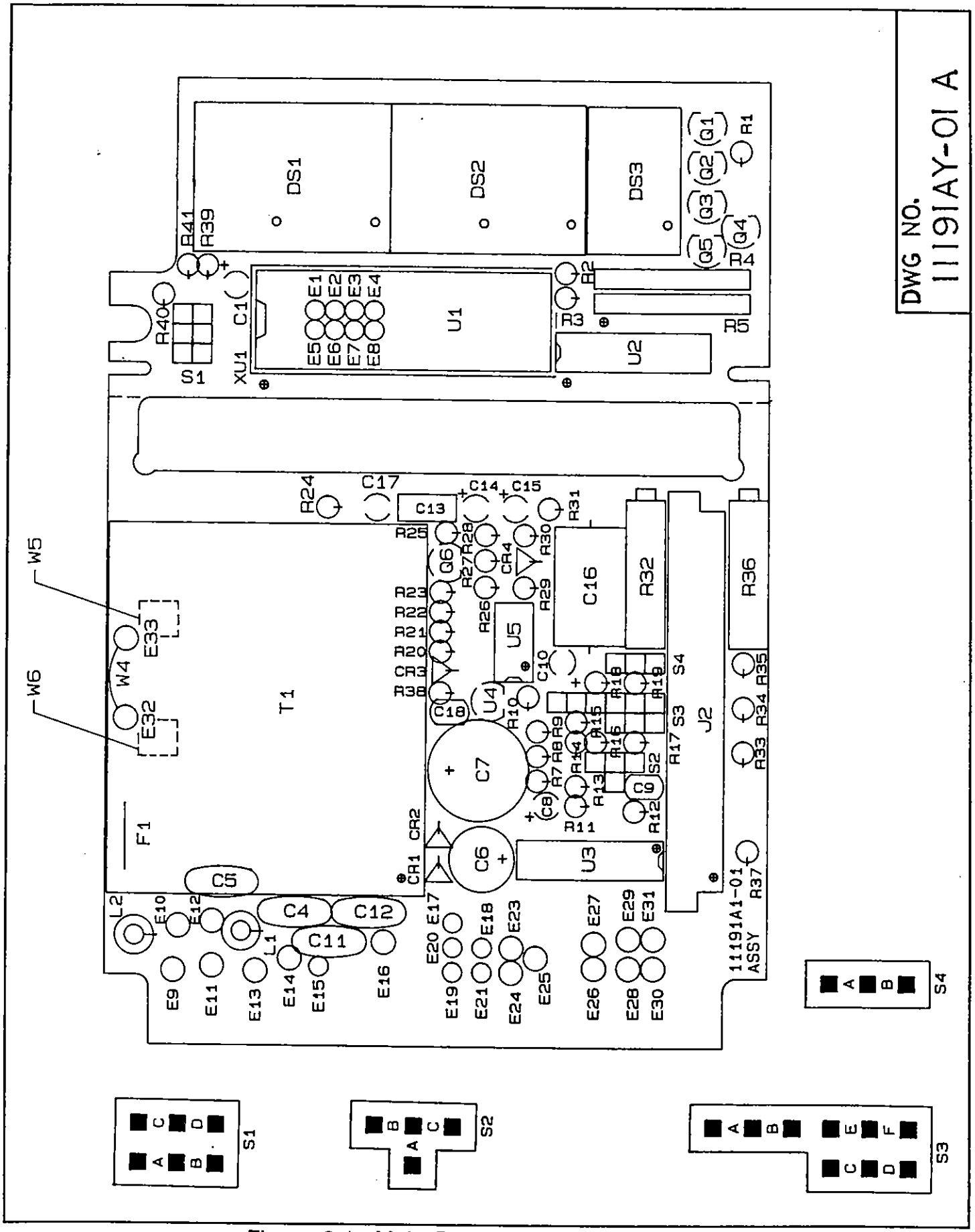


Figure 8-1 Main Board Assembly Diagram

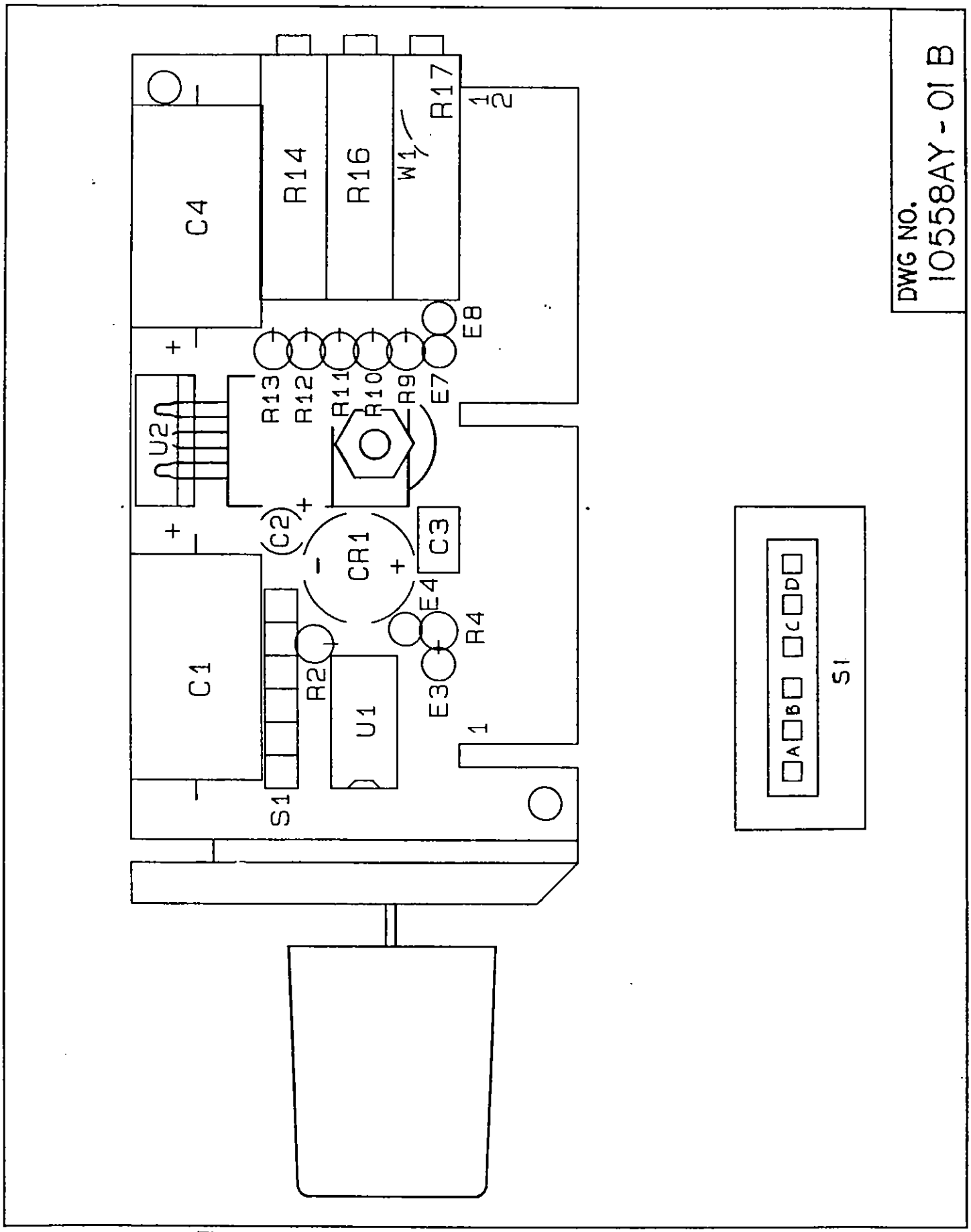


Figure 8-2 Plug-in Card Assembly -E or -P Diagram

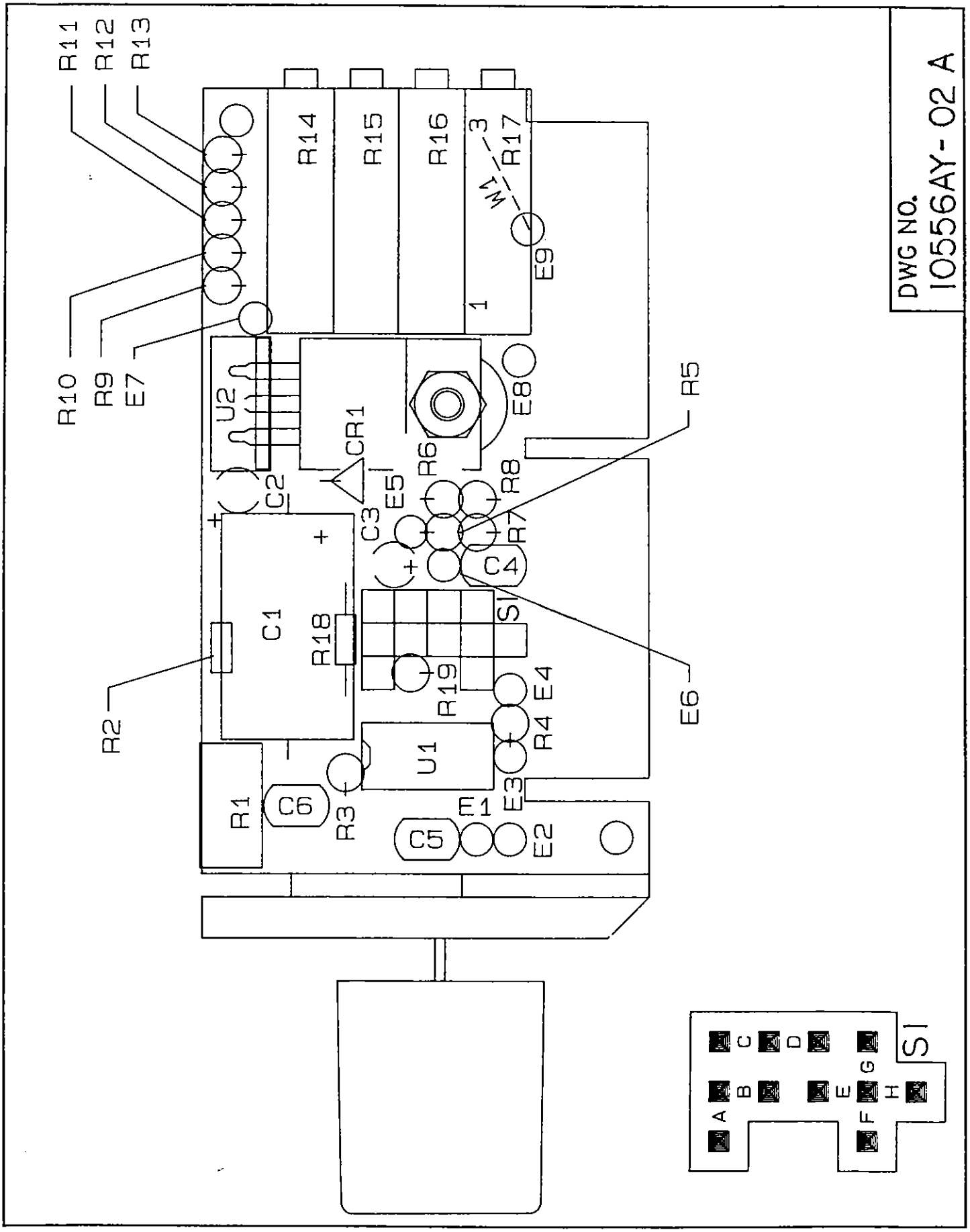


Figure 8-3 Plug-in Card Assembly -S Diagram

9.0 APPLICATION NOTES

9.1 Excitation Supply/Current Transmitter Interface

The following block diagrams show the proper hookup for interfacing an electrically-floating excitation supply with either a 2-wire or a 4-wire current transmitter (4-20 mA loop-powered).

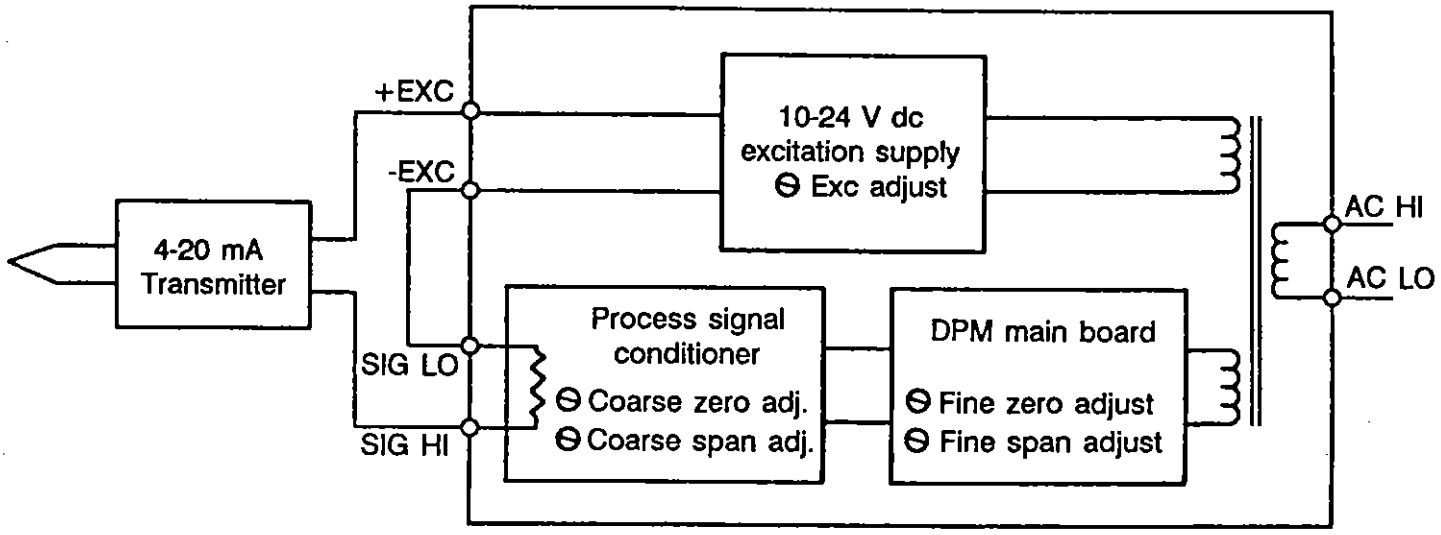


Figure 9-1 Two-wire Connection

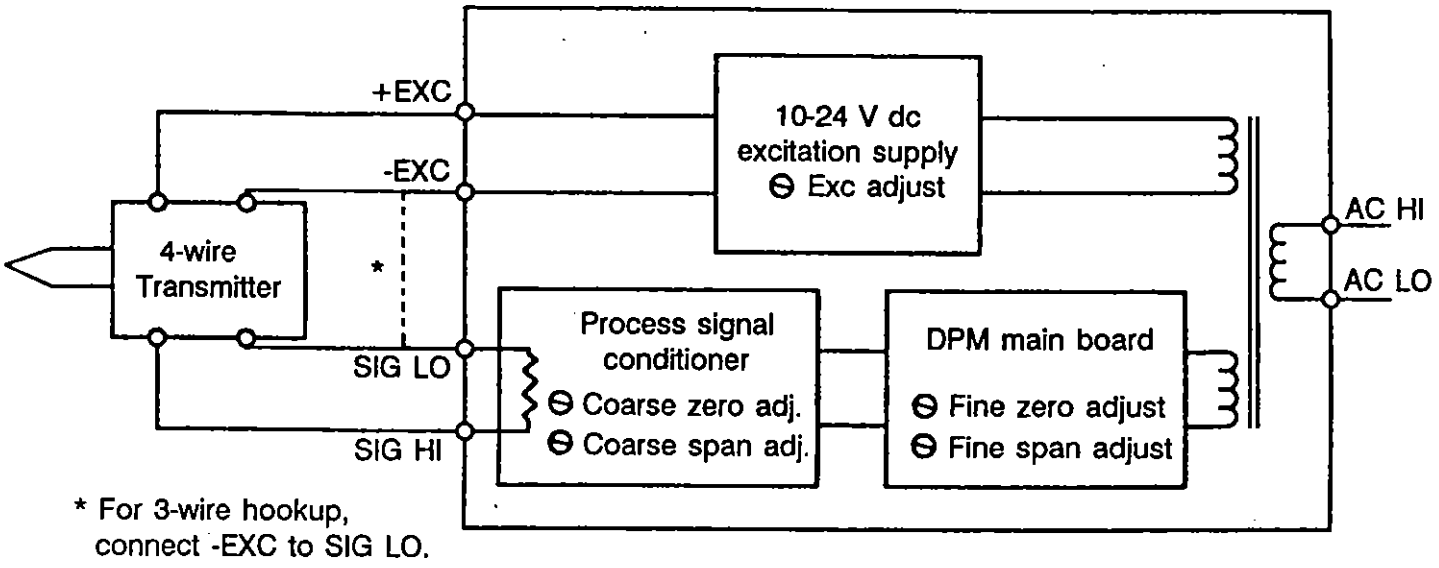


Figure 9-2 Four-wire Connection

NOTE:	For proper operation the unit must be configured for an internal absolute reference. (See Section 5.3)

Warranty/Disclaimer

NEWPORT ELECTRONICS, INC. warrants this unit to be free of defects in materials and workmanship for a period of one (1) year from date of purchase. In addition to NEWPORT's standard warranty period, NEWPORT ELECTRONICS will extend the warranty period for one (1) additional year if the warranty card enclosed with each instrument is returned to NEWPORT.

If the unit should malfunction, it must be returned to the factory for evaluation. NEWPORT's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by NEWPORT, if the unit is found to be defective it will be repaired or replaced at no charge. NEWPORT's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of being damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of NEWPORT's control. Components which wear are not warranted, including but not limited to contact points, fuses, and triacs.

NEWPORT is pleased to offer suggestions on the use of its various products. However, NEWPORT neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by NEWPORT, either verbal or written. NEWPORT warrants only that the parts manufactured by it will be as specified and free of defects. NEWPORT MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive and the total liability of NEWPORT with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall NEWPORT be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by NEWPORT is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, NEWPORT assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and additionally, purchaser will indemnify NEWPORT and hold NEWPORT harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

Return Requests/Inquiries

Direct all warranty and repair requests/inquiries to the NEWPORT Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO NEWPORT, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM NEWPORT'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting NEWPORT:

1. P.O. number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult NEWPORT for current repair charges. Have the following information available BEFORE contacting NEWPORT:

1. P.O. number to cover the COST of the repair,
2. Model and serial number of product, and
3. Repair instructions and/or specific problems relative to the product.

NEWPORT's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

NEWPORT is a registered trademark of NEWPORT ELECTRONICS, INC.

For immediate technical or application assistance please call:

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