QUANTA®

QXXXXE PROCESS SIGNAL WITH EXCITATION DIGITAL PANEL METER

Operator's Manual

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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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ILLUSTRATIONS

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.
- Unit mounting should allow for adequate ventilation to ensure instrument does not exceed operating temperature rating.
- Use electrical wires with adequate size to handle mechanical strain and power requirements. Install without exposing bare wire outside the connector to minimize electrical shock hazards.

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.

QUANTA CROSS REFERENCE

CONFIGURED MODEL

Q □ □ □ □ □

							MODULE NO.
						DISPLAY RESOLUTION	
	2					±1999 counts (3 1/2 digits)	BQ2X
	9					±9999 counts (4 digits)	BQ9X
						DISPLAY TYPE & METER POWER	
						(LCD is only available on Q2000 models)	
		0				LED, 120 V ac (50/60 Hz)	BQ20 or BQ90
		1				LCD, 120 V ac (50/60 Hz)	BQ21
		2				LED, 240 V ac (50/60 Hz)	BQ22 or BQ92
		3				LCD, 240 V ac (50/60 Hz)	BQ23
		4				LED, 9-32 V dc (isolated)	BQ24 or BQ94
		5				LCD, 9-32 V dc (isolated)	BQ25
		6				LED, 5 V dc	BQ26 or BQ96
		7				LCD, 5 V dc	BQ27
		8				LED, 24 V ac	BQ28 or BQ98
		9				LCD, 24 V ac	BQ29
		A				LED, 26-56 V dc (isolated)	BQ2A or BQ9A
		B				LCD, 26-56 V dc (isolated)	BQ2B
						ANALOG OUTPUTS	
			0			±1 or ±2 V (standard, all models)	None
			1			0-5 V dc	BA01
			2			0-10 V dc	BA01
			3			0-1 mA, source or sink	BA01
			4			4-20 mA, source or sink	BA01
			5			4-20 mA, sink (high-compliance)	BA02
						CONTROL OUTPUTS	
				0		None	None
				1		Dual-setpoint 10 A relays	BDT1
				2		Proportional 4-20 mA control, source or sink, plus drive for time-proportional solid-state relay	BDP1
				3		Proportional 4-20 mA control, source or sink, plus time-proportional solid-state 2 A relay	BDP2
				4		Parallel BCD (isolated)	BDD2
				5		Single-setpoint 10 A relay	BDS1
						SIGNAL-CONDITIONER INPUTS	
					A	DC voltage	BSCA
					B	DC current	BSCA
					C	AC voltage	BSCC
					D	AC current	BSCC
					F	True RMS voltage	BSCF
					G	True RMS current	BSCF
					H	Frequency/rate	BSCH1
					J	Type J thermocouple (°C or °F)	BSCJ
					K	Type K thermocouple (°C or °F)	BSCK
					T	Type T thermocouple (°C or °F)	BSCT
					M	RTD, normal resolution (°C or °F)	BSCM
					R	RTD, high resolution (°C or °F)	BSCR
					N	3-wire ratio (potentiometer)	BSCA
					O	2- or 4-wire resistance	BSCR
					P	Process signal (e.g., 4-20 mA, 1-5 V)	BSCP
					E	Process signal plus excitation	BSCE
					S	Strain gauge/low-level input	BSCS
					Z	Prototyping	BSCZ

1.0 MAIN ASSEMBLY - Q2000E SPECIFICATIONS

1.1 GENERAL

The Q2000 main assemblies are identified by an initial designator (BQ2) plus a power/display option numeral, zero thru nine (0-9).

The following table identifies the main assembly types:

Display Type	120 V ac	240 V ac	9-32 V dc	5 V ac	24 V ac
LED	BQ20	BQ22	BQ24	BQ26	BQ28
LCD	BQ21	BQ23	BQ25	BQ27	BQ29

The QUANTA Digital Panel Meter/Controller consists of a main assembly, signal conditioner and interface options (if ordered) all housed in a 1/8 DIN case.

The main assembly consists of a main board and a display board which is permanently attached to it at a 90 degree angle.

The main board provides mounting for the power supply, circuit components, and connectors for plugging in the signal conditioner, optional analog card, and optional controller/communications interface card (requires removal of a bypass push-on jumper).

The display board includes the analog-to-digital converter, the LED or LCD display and the push-on jumper for programming the decimal points. Decimal point programming may also be done from the main board connector (J1).

1.2 POWER

AC Models:	24/120/240 V +10/-15% 47-63 Hz
Common Mode Voltage:	1500 Vp test (354 Vp per IEC spacing)
DC Models:	5 V ±5% (5 V return common to signal LO) 9-32 V (300 V isolation from 9-32 V return to signal LO)
Source Impedance:	3 ohms
Ripple:	250 mV maximum
Power Consumption:	5 watts maximum

1.3 DISPLAY

LED:	14.2 mm (0.56 in), 7-segment light emitting diode
Lens color:	Red
LCD:	12.7 mm (0.50 in), 7-segment liquid crystal
Lens color:	Clear
Range:	0 to ±1999
Overload Indication:	Three least-significant digits blanked, "1" or "-1" displayed

1.4 CONVERSION

Technique:	Auto-zero, dual slope, average value
Signal Integration Period:	100 ms, nominal
Reading Rate:	2.5/s, nominal

1.5 ENVIRONMENTAL

Operating Temperature (Ambient):	0-60°C
Storage Temperature:	-40 to 85°C
Humidity:	To 95% RH, non-condensing, 0-40°C

1.6 MECHANICAL

Case Material:	UL-rated 94V-0, polycarbonate
Weight:	0.57 kg (with interface board)

2.0 MAIN ASSEMBLY - Q9000E SPECIFICATIONS

2.1 GENERAL

QUANTA Q9000 main assemblies are identified by an initial designator (BQ9) plus a power/display option numeral: 0, 2, 4, 6 or 8.

The following table identifies the main assembly types:

Display Type	120 V ac	240 V ac	9-32 V dc	5 V ac	24 V ac
LED	BQ90	BQ92	BQ94	BQ96	BQ98

The QUANTA Digital Panel Meter/Controller consists of a main assembly, signal conditioner and interface options (if ordered) all housed in a 1/8 DIN case.

The main assembly consists of a main board and a display board which is permanently attached to it at a 90 degree angle.

The main board provides mounting for the power supply, circuit components, and connectors for plugging in the signal conditioner, optional analog card, and optional controller/communications interface card (requires removal of a bypass push-on jumper).

The display board includes the analog-to-digital converter, the LED display and the push-on jumper for programming the decimal points. Decimal point programming may also be done from the main board connector (J1).

2.2 POWER

AC Models:	24/120/240 V +10/-15% 47-63 Hz
Common Mode Voltage:	1500 Vp test (354 Vp per IEC spacing)
DC Models:	5 V ±5% (5 V return common to signal LO) 9-32 V (300 V isolation from 9-32 V return to signal LO)
Source Impedance:	3 ohms
Ripple:	250 mV maximum
Power Consumption:	5 watts maximum

2.3 DISPLAY

LED:	14.2 mm (0.56 in), 7-segment light emitting diode
Lens color:	Red
Range:	0 to ±9999, digits flash from 10K-20K counts
Overload Indication:	Four digits flash zeros at 20K and above

2.4 CONVERSION

Technique:	Auto-zero, dual slope, average value
Signal Integration Period:	100 ms, nominal
Reading Rate:	2.5/s, nominal

2.5 ENVIRONMENTAL

Operating Temperature (Ambient):	0 to 60°C
Storage Temp.:	-40 to 85°C
Humidity:	To 95% RH, non-condensing, 0-40°C

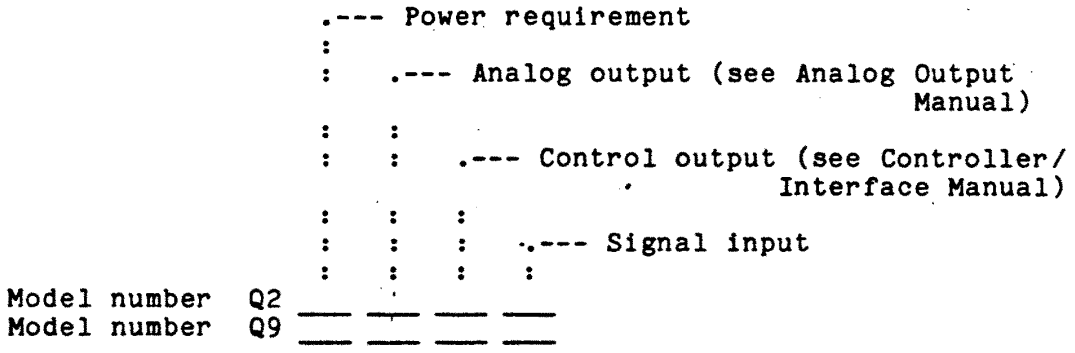
2.6 MECHANICAL

Case Material:	UL-rated 94V-0, polycarbonate
Weight:	0.57 kg (with interface board)

3.0 DIGITAL PANEL METER INSTALLATION

IMPORTANT:

For proper installation, electrical connections must be made according to the model number on the meter label. Write the model number in the following space and use the appropriate instructions for your model number.



3.1 UNPACKING & INSPECTION

Your QUANTA digital panel meter was systematically inspected and tested, then carefully packed before shipment.

Unpack the instrument and inspect for obvious shipping damage. Notify the freight carrier immediately upon discovery of any shipping damage.

3.2 SAFETY INSTRUCTIONS

As delivered from the factory/distributor, this instrument complies with required safety regulations. In order to maintain this condition and to ensure safe operation, the following instructions should be followed.

1. Unpacking - After visual inspection, do not attempt to operate the unit if damage is found.

2. Power Voltage - This instrument is delivered with mains (AC power) connection for 120 V in the U.S.A., and for 240 V in Europe (unless the instrument is fitted with DC drive capability). Check that the instrument is connected for the power voltage rating that will be used. If not, make the required changes as called out in the technical manual.

3. Mounting - This instrument is designed for mounting in a metal panel, as specified in the technical data. Check the dimensions of the panel cutout and observe the mounting instructions in the manual.

4. Power Wiring - This instrument has no mains switch; it will be in operation as soon as the power is connected.

   The meter must be grounded (earthed) in accordance with the latest local safety regulations. Check that the power cable has the proper ground (earth) wire and that this wire is properly connected to an adequate ground (earth) point.

   This instrument is protected according to Class I (Protective Earth) of the IEC (International Electrotechnical Commission) 348 and the VDE 0411 regulations. The power cable must contain a protective ground (earth) conductor which is not disconnected (open) either inside or outside the instrument. No extension cables without grounding (earthing) wires shall be used.

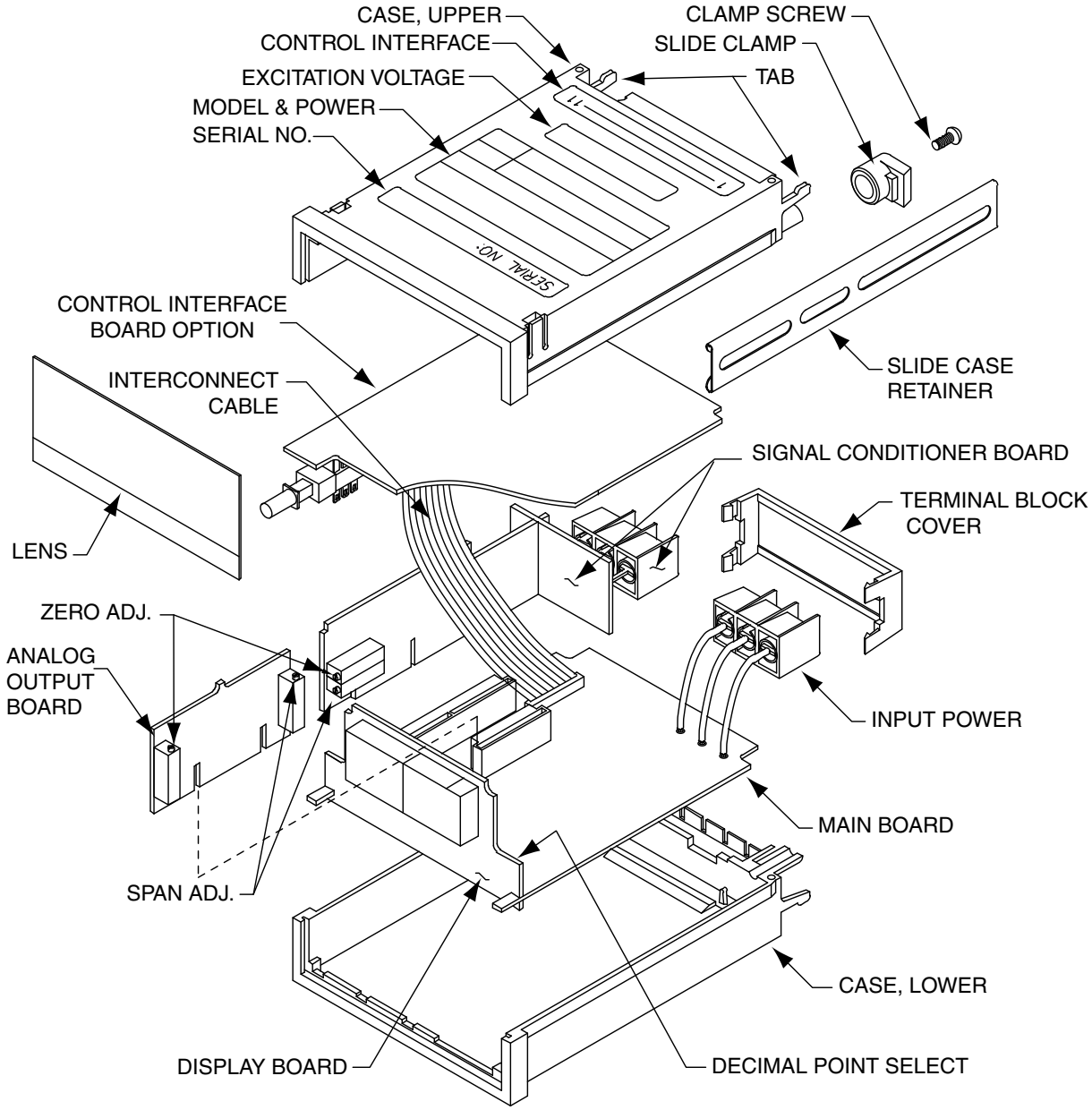
5. Signal Wiring - Do not make signal wiring connections or changes when power is applied to the instrument; make signal connections before power is applied and, if reconnection is required, disconnect the AC (mains) power before such rewiring is attempted.

3.3 MECHANICAL ASSEMBLY AND INSTALLATION

1. Insure that the panel cutout dimensions are as shown on Figure 3-2.

2. Refer to Figure 3-1. Remove the lower printed circuit board edge connector, (if installed) J1, by pushing two molded plastic tabs away from the connector body and pulling the connector off the printed circuit board. Remove the printed circuit board edge connector, J2, if upper-board output option was ordered.

3. Loosen two clamp screws on the rear of the case, enough to rotate the two slide clamps.
4. Slide the two slide retainers toward the rear of the case and remove them.
5. From the front of the panel, insert the meter into the panel cutout.
6. Slide the slide retainers back onto the case and push up tightly against the rear of the panel.
7. Rotate the slide clamps back into their original position and tighten enough to hold the case in place. Overtightening can break the clamps.
8. Install the lower printed circuit board edge connector, if supplied, by pushing it on to the printed circuit board connector. Install the upper printed circuit board edge connector, if used.



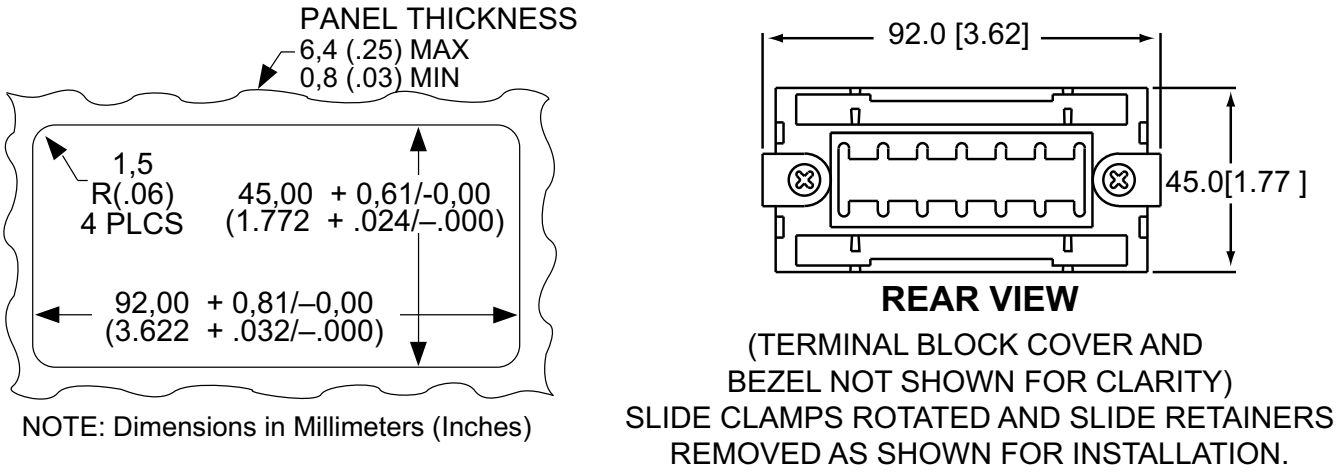
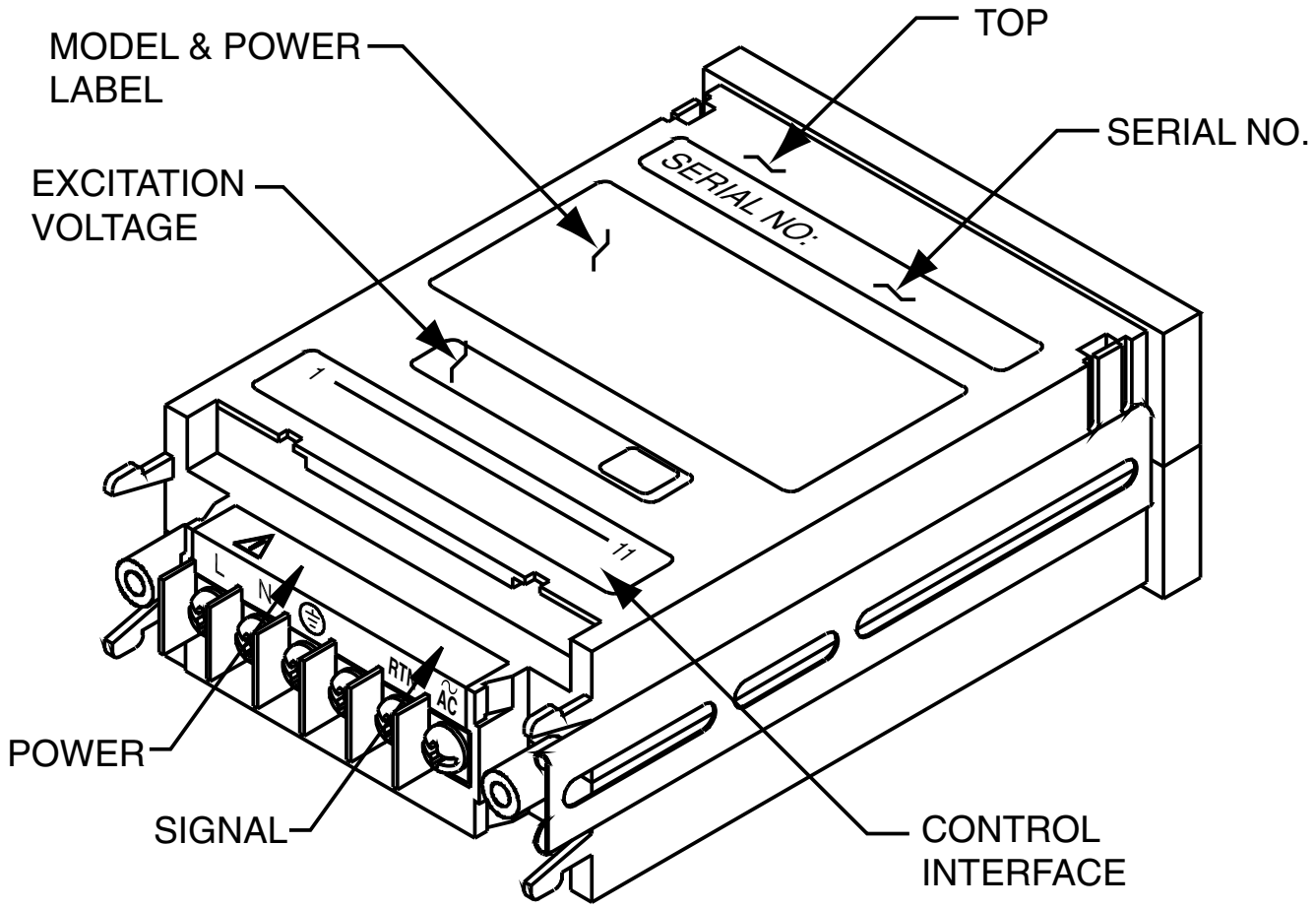


Figure 3-2 Panel Cutout Dimension



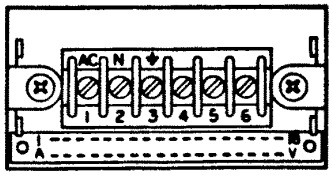
Note: Read labels from the Rear

Figure 3-3 Label Placement

4.0 POWER AND SIGNAL INPUT CONNECTIONS

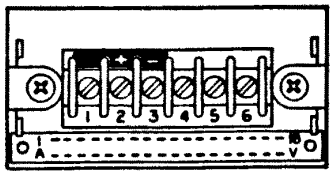
WARNING: Incorrect power input can damage your QUANTA PANEL METER

4.1 POWER CONNECTIONS



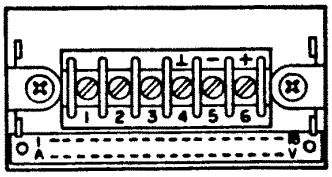
Terminal Connection	AC Versions	Wire Color
1	AC power HI	Black
2	AC power LO (neutral)	White
3	AC power GND	Green

REAR TERMINAL VIEW



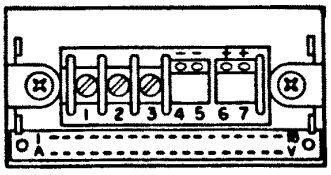
Terminal Connection	DC Versions
1	No connection
2	DC power +
3	DC power - (return)

4.2 SIGNAL INPUT CONNECTIONS



Terminal Connection	6 Terminal Versions Signal
4	Analog GND
5	Signal LO
6	Signal HI

REAR TERMINAL VIEW



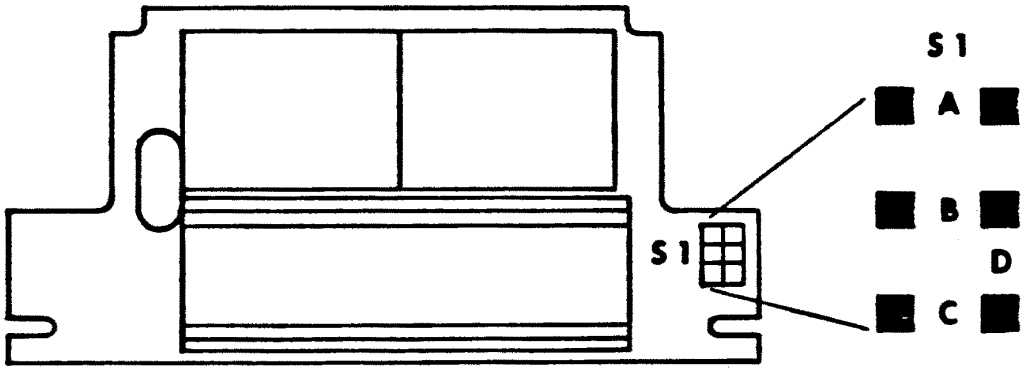
Terminal Connection	7 Terminal Versions Signal
4	-E (Excitation return)
5	-S (Signal LO input)
6	+S (Signal HI input)
7	+E (Excitation output)

5.0 CONFIGURATION PROCEDURE

This procedure is used to set the decimal point of the display and interface board signal bypass selections. For the configuration of the QUANTA Q2XXXX, use power options BQ20 through BQ29; use power options BQ90 through BQ98 for configurations of the QUANTA Q9XXXX.

The main assembly's configuration can be changed by using the push-on jumpers provided. (They may already be positioned on the pin-forests.) Pin-forest designations are shown below.

5.1 DECIMAL POINT SELECTION



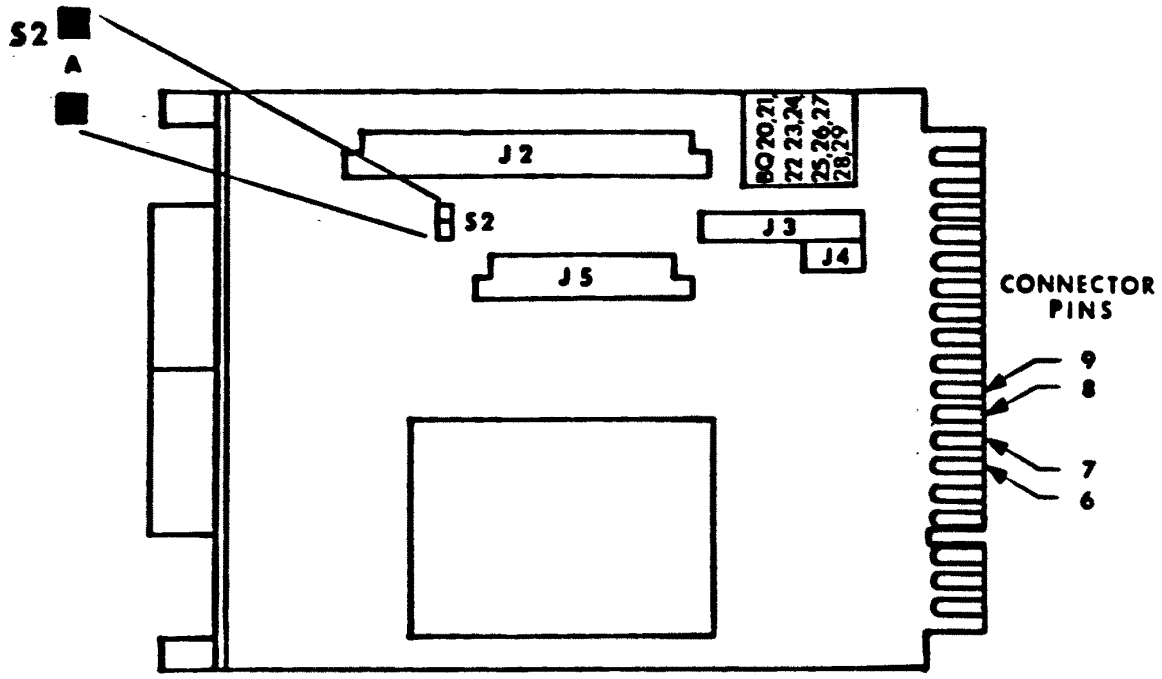
5.1.1 **Q2XXXE** Decimal Point Selection Chart

Step 1: Remove all push-on jumpers not used in the desired configuration(s).		
Step 2: Select the desired configuration from the chart below, the push-on jumpers indicated.		
Decimal Point Selection	S1	Alternate Decimal Point Selection Using Main Assembly Board (J1) Connector
Decimal Point (1.999)	A	Connect J1-K/9 to J1-6
Decimal Point (19.99)	B	Connect J1-J/8 to J1-6
Decimal Point (199.9)	C	Connect J1-H/7 to J1-6
No Decimal Point (1999)	D	No Connection

5.1.2 **Q9XXXE** Decimal Point Selection Chart

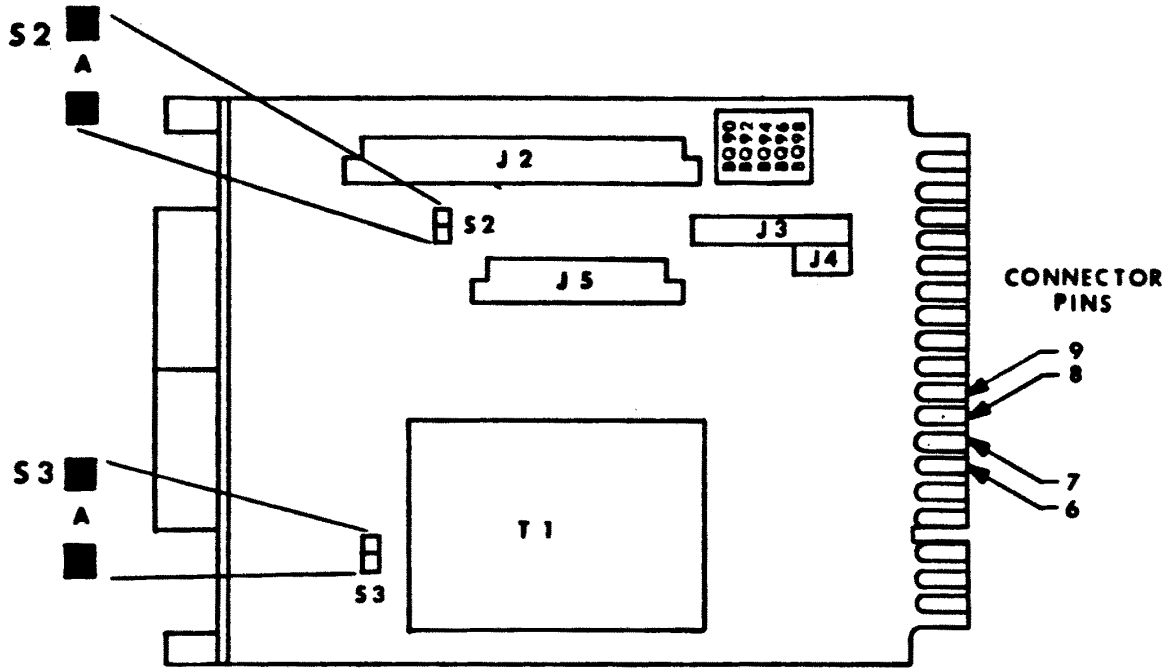
Step 1: Remove all push-on jumpers not used in the desired configuration(s).		
Step 2: Select the desired configuration from the chart below, then install the push-on jumpers indicated.		
Decimal Point Selection	S1	Alternate Decimal Point Selection Using Main Assembly Board (J1) Connector
Decimal Point (9.999)	A	Connect J1-K/9 to J1-6
Decimal Point (99.99)	B	Connect J1-J/8 to J1-6
Decimal Point (999.9)	C	Connect J1-H/7 to J1-6
No Decimal Point (9999)	D	No connection

5.2 INTERFACE BOARD SIGNAL BYPASS SELECTION Q2XXXE and Q9XXXE



Step 1: Check your QUANTA part number for a zero (0) in the following position; Q2XX0X or Q9XX0X. If there is a zero (0) in that position, interface board signal bypass is required.	
Step 2: Remove all push-on jumpers not used in the desired configuration(s).	
Step 3: Select the desired configuration from the chart below, then install the push-on jumpers indicated.	
Interface Board Signal Configuration	S2
Interface Board Signal Bypass	A

5.3 REFERENCE VOLTAGE (RV1, RV2) Q9000E ONLY



Step 1:	Remove all push-on jumpers not used in the desired configuration(s).
Step 2:	Select the desired configuration from the chart below, then install the push-on jumpers indicated.

Reference Voltage Configuration		S3
RV1	1 Volt	A
RV2	2 Volts	-

6.0 MAIN BOARD CONNECTOR PINOUTS (J1)

(Left to right, looking at rear of case)

Connection	Function
A - 1	Spare
B	Oscillator
2	-8.2 V dc Analog power
C - 3	Spare
D	+ Pol (sign)
4	$\overline{\text{HOLD}}$ (LED version only)
E - 5	Spare
F	Buffer Integrator output
6	Digital Ground
H - 7	99.9 (Decimal point)
J - 8	9.99 (Decimal point)
K - 9	.999 (Decimal point)
L - 10	Test (LED version only)
M - 11	+5 V dc Analog & digital power
N - 12	Analog output
P - 13	Spare
R - 14	Spare (- Excitation sense)
S - 15	Analog Ground
T - 16	Analog Option - Return
U	Analog Option - Out
17	+30 V dc Unregulated power
V - 18	Spare (+ Excitation sense)
-	Indicates common pin
	50 mA maximum power available from all internal sources.

7.0 TESTS & DIAGNOSTICS

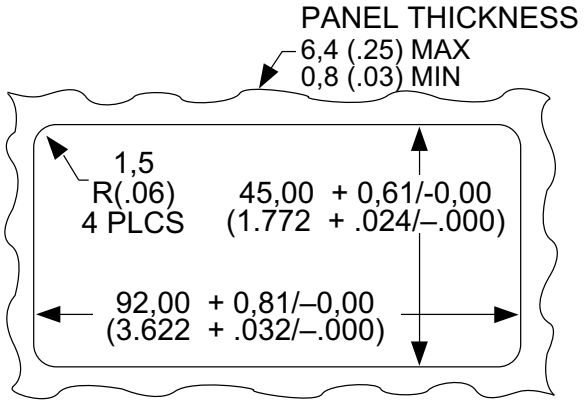
7.1 TEST CONFIGURATION REQUIREMENTS

The QUANTA main assembly is designed to function with a signal conditioner board as a minimum configuration. There is no provision for testing a main assembly alone.

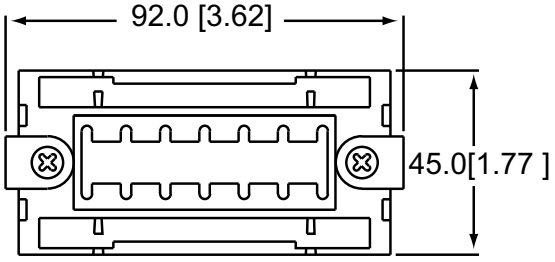
7.2 SIGNAL INPUT REQUIREMENTS

Signal input requirements for your configuration are identified in the signal conditioner section of this manual.

8.0 Panel Meter Dimensions for Q2000E / Q9000E

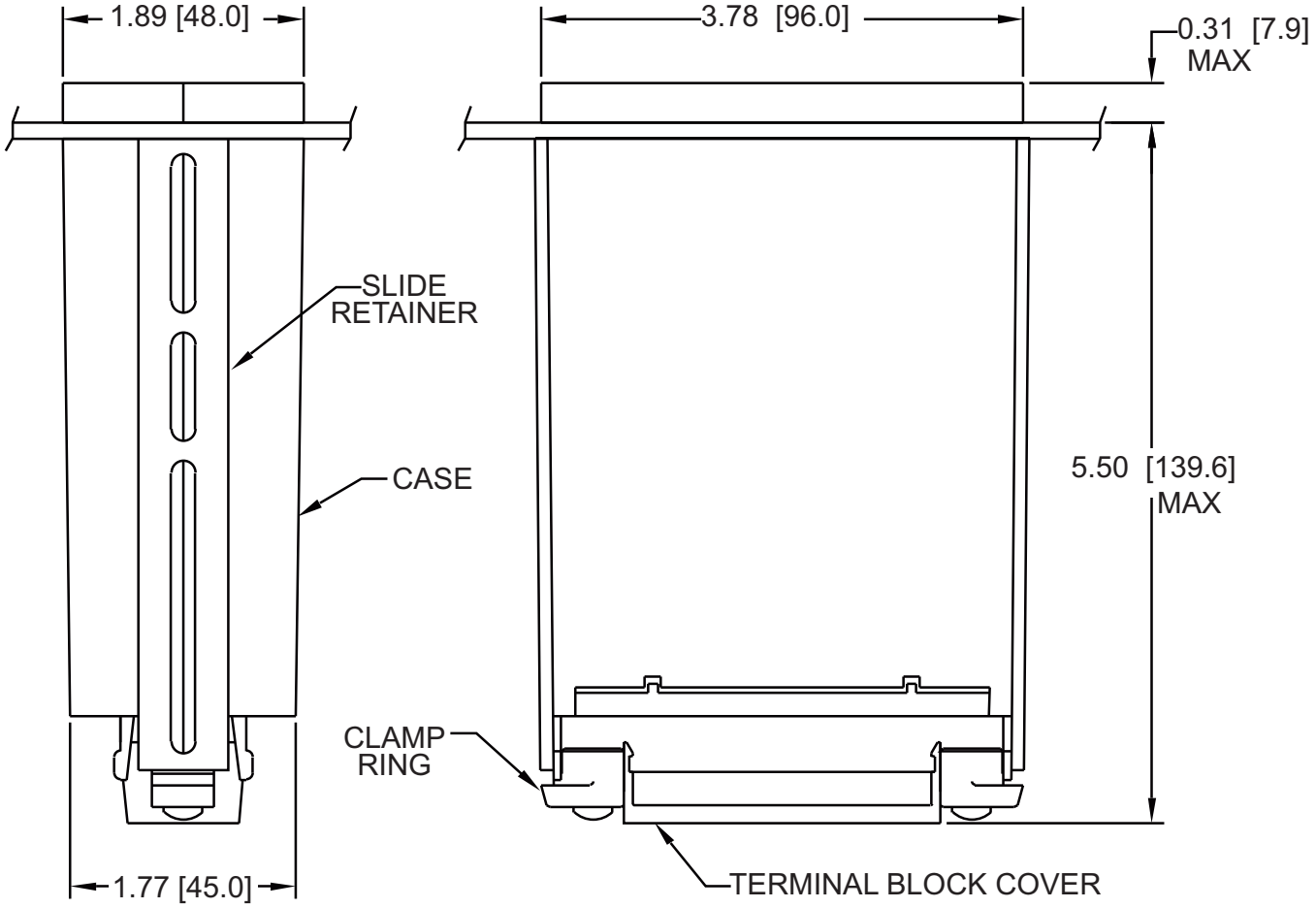


NOTE: Dimensions in Millimeters (Inches)



REAR VIEW

(TERMINAL BLOCK COVER AND
BEZEL NOT SHOWN FOR CLARITY)
SLIDE CLAMPS ROTATED AND SLIDE RETAINERS
REMOVED AS SHOWN FOR INSTALLATION.



Notes: Dimensions are in inches ±0.01"
with millimeters in [ ] ±0.25 mm.

Figure 8-1 Panel Meter Dimensions

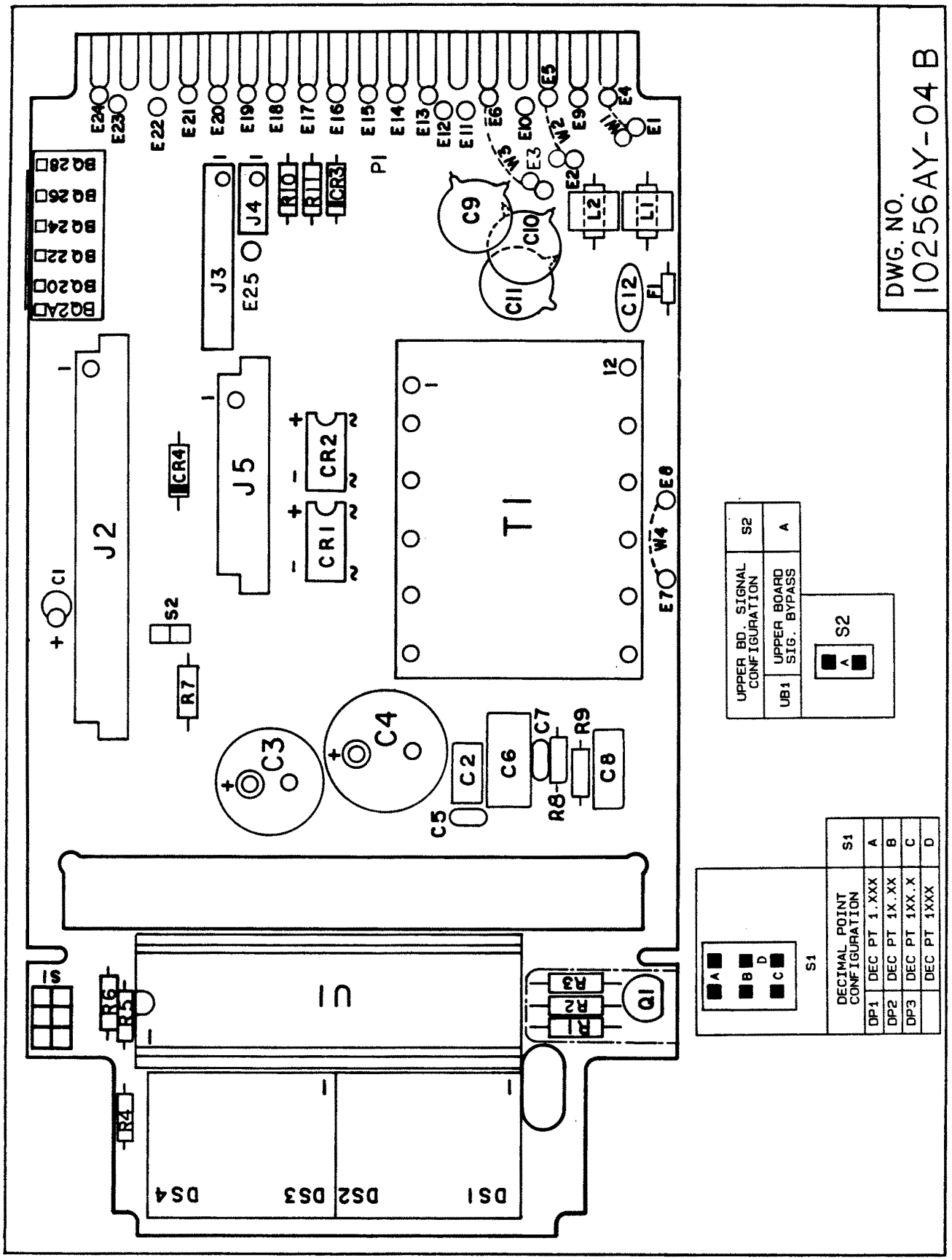


Figure 8-1 Q2000 LED Main Assembly

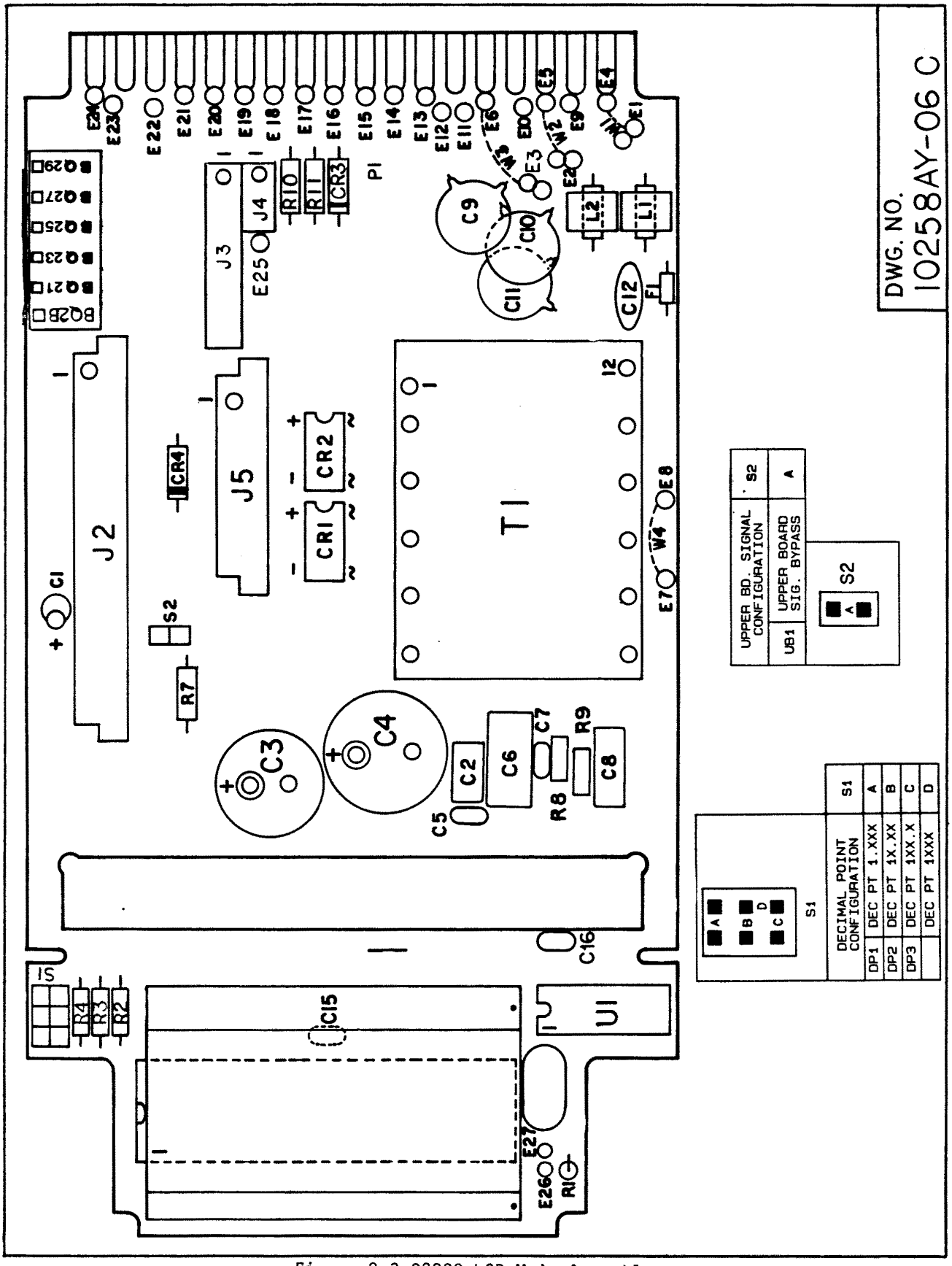


Figure 8-3 Q2000 LCD Main Assembly

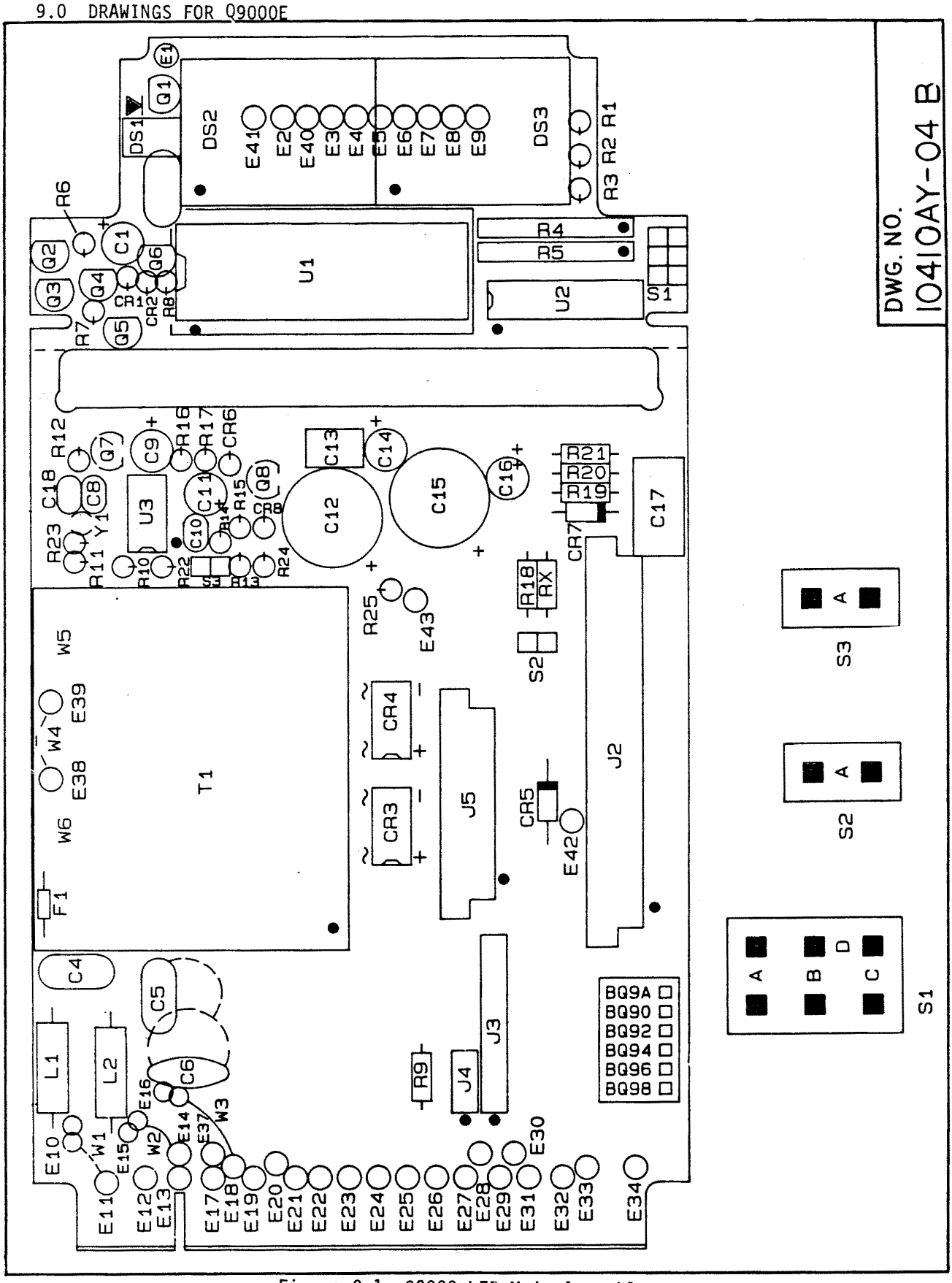


Figure 9-1 Q9000 LED Main Assembly

10.0 SPECIFICATIONS: BSCE PROCESS SIGNAL CONDITIONER WITH EXCITATION

10.1 GENERAL

This option board, identified as BSCE (Q2000E or Q9000E), provides extensive offset and scaling capability, permitting a wide selection of readout span for input current spans of 1 to 50 mA FS or for input voltage spans of 0.5 to 20 V FS. The Q2000 or Q9000 prefix is determined by the main assembly board used with the BSCE input board.

In addition to the above input capabilities, two excitation supply voltages are available for powering transducers. Supply voltages of 10 V with up to 50 mA or 15 V with up to 25 mA can be selected with push-on jumpers.

Selection of gain and offset ranges is made by push-on jumpers between 0.025" square pins on 0.1" centers. Six current ranges and six voltage ranges are provided, as well as push-on jumpers for offset and polarity to preserve the resolution and adjustability of the offset and gain potentiometers.

Formulas and computation procedures are supplied for calculating the proper model number based on the desired HI and LO input values and the top and bottom readout values chosen.

The BSCE has a restricted common-mode range: the BSCS strain gauge signal conditioner is recommended for signals with sizeable common-mode levels.

10.2 Q2000E & Q9000E: PROCESS SIGNAL INPUT SPECIFICATIONS

Configuration	Single-ended, meter ground common to input LO
Polarity	Bipolar
Span Ranges	Internally selectable by push-on jumpers 0 to 25% 25 to 50% 50 to 75% 75 to 100%
Zero Offset Ranges	Internally selectable by push-on jumpers -215 to -77 mV -77 to +54 mV +54 to +190 mV +165 to +295 mV
Fine Zero Offset	50% of full scale minimum (front panel adjustment by potentiometer)

VOLTAGE RECEIVER

Readout Range	-1999 to +1999 (Q2000E)						
Readout Range	-9999 to +9999 (Q9000E)						
Input Range	0.5	1.0	2.0	5.0	10.0	20.0	V FS
Input Impedance	0.10	0.25	0.50	1.09	1.04	1.02	M ohms
Bias Current	100	50	25	13	13	13	pA
NMR at 50/60 Hz	60	56	54	50	50	50	dB

Maximum Voltage: 250 Vp

DC CURRENT RECEIVER

Readout Range	-1999 to +1999 (Q2000E)						
Readout Range	-9999 to +9999 (Q9000E)						
Input Range	1.0	2.0	5.0	10.0	20.0	50.0	mA FS
Maximum Current	16	22	35	50	70	112	mA
Shunt Resistance	499	249	100	49.9	24.9	10.0	ohms
Full Scale Voltage Drop	0.5	0.5	0.5	0.5	0.5	0.5	V FS
NMR at 50/60 Hz	60	60	60	60	60	60	dB

Common Mode
Analog ground to AC power ground

CMR at DC to 60 Hz	120 dB
CMV at DC to 60 Hz	±1500 Vp per HV test ±354 Vp per IEC spacing

Accuracy at 25°C
Maximum Errors

Q2000E	±0.05 R ±1 count
Q9000E	±0.01 R ±2 counts
Reading Tempco	±0.005 R/°C
Zero Tempco	±0.2 counts °C
Warmup to rated accuracy	Less than 10 minutes

10.3 EXCITATION SUPPLY SPECIFICATIONS

Output Voltage	10 or 15 V ±5% internally selectable by push-on jumper
Output Current	50 mA max at 10 V and 25 mA at 15 V without any current output from other options
Load Regulation	0.5% max from zero to max load
Line Regulation	0.2% max for 10% change of AC line power voltage
Ripple at 50/60 Hz	0.01%

11.0 SIGNAL INPUT CONNECTIONS (TB1)

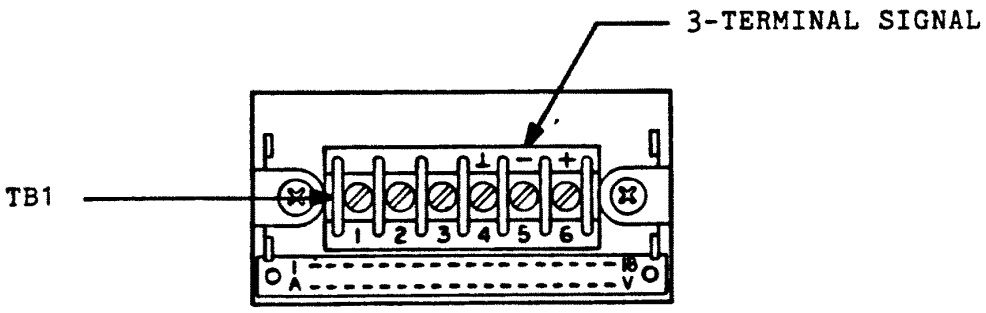
The signal input connections for the BSCE process signal conditioner are made at the standard 3-terminal barrier strip:

Signal input connections and excitation supply output connection for an amplified voltage output transducer:

Terminal Connection	Signal	Input	TRANSDUCER
4	+ Excitation	●	+Supply Voltage
5	- Signal LO/-Exc	●	Common
6	+ Signal HI	●	Signal Output

Signal input connections for an amplified current output transducer:

Terminal Connection	Signal	Input	TRANSDUCER
4	+ Excitation	●	+Supply Voltage
5	- Signal LO/-Exc	●	
6	+ Signal HI	●	Return



REAR TERMINAL VIEW

12.0 BSCE CONFIGURATION PROCEDURES

Use this procedure to determine the configuration of the BSCE Process Signal Option.

Configure the unit using push-on jumpers provided separately or already positioned on the pin forests. Pin-forest designations are shown with the configuration charts.

12.1 DEFINITION OF TERMS

S01-2	Signal Output Polarity
EV1-2	There are two excitation voltage ranges, EV1 has an output of 10 V and EV2 has an output of 15 V.
ZON	Zero Offset Number
LI	Lower Input Number
UI	Upper Input Number
LD	Lower Display Number
UD	Upper Display Number
G	Gain in Counts/Input
AM1-18	Ammeter. Range selection is 1 to 18.
VM1-15	Voltmeter. Range selection is 1 to 15.
VR1-24	Voltage Receiver. Range selection is 1 to 24.
CR1-24	Current Receiver. Range selection is 1 to 24.

12.2 VOLTMETER RANGE SELECTION

1. Specify the magnitude of the largest + or - input voltage:

   Q2000E: VM = _____ Volts (For a 2000 count reading)

   Q9000E: VM = _____ Volts (For a 10000 count reading)

2. Select the lowest range where VM (from step 1) is equal to or less than the limit of that range.

VM1 = 0.235 V	VM6 = 1.030 V	VM11 = 4.500 V
VM2 = 0.350 V	VM7 = 1.500 V	VM12 = 5.100 V
VM3 = 0.450 V	VM8 = 1.800 V	VM13 = 6.500 V
VM4 = 0.580 V	VM9 = 2.500 V	VM14 = 9.600 V
VM5 = 0.850 V	VM10 = 3.100 V	VM15 = 11.00 V

   VM = _____ This selection will be used in configuring the meter.

3. Proceed to Installation.

* Range Selection assumes that the meter has an offset range (Z03) selected which allows a shorted input to read 000 on the Q2000E display and 0000 on the Q9000E display.

12.3 AMMETER RANGE SELECTION

1. Specify the magnitude of the largest + or - input current.

   Q2000E = AM = _____ mA (For a 2000 count reading)

   Q9000E = AM = _____ mA (For a 10000 count reading)

2. Select the highest current range where AM is equal to or less than the limit of that range.

AM1 = 0.470 mA	AM7 = 2.350 mA	AM13 = 9.400 mA
AM2 = 0.700 mA	AM8 = 3.500 mA	AM14 = 14.00 mA
AM3 = 0.800 mA	AM9 = 4.000 mA	AM15 = 19.10 mA
AM4 = 0.940 mA	AM10 = 4.700 mA	AM16 = 23.50 mA
AM5 = 1.400 mA	AM11 = 7.000 mA	AM17 = 35.00 mA
AM6 = 1.910 mA	AM12 = 7.800 mA	AM18 = 51.00 mA

   AM = _____ This selection will be used in configuring the meter.

3. Proceed to Installation.

12.4 VOLTAGE RECEIVER SELECTION

1. Using the Input Span Range and the required display readings, calculate the zero offset required (with polarity).

   (LI) Lower Input = _____
   (UI) Upper Input = _____
   (LD) Lower Display = _____
   (UD) Upper Display = _____

2. When specifying the lower input (LI) and upper input (UI), the maximum display reading for a Q2000E is ±1999. The maximum display for a Q9000E is ±9999.

$$ZON = \frac{(LD \times UI) - (UD \times LI).}{(UI - LI)} = \_\_\_\_\_$$

3. Select a Zero Offset Range (ZO) from the appropriate QUANTA series where the Zero Offset Number (ZON) falls between the minimum and maximum numbers of that range.

Q2000E	Q9000E
ZO1 = -3000/-1895	ZO1 = -15000/-9475
ZO2 = -1900/-600	ZO2 = -9500/-3000
ZO3 = -605/+870	ZO3 = -3025/+4350
ZO4 = +865/+2100	ZO4 = +4325/+10500

   ZO = _____ This selection will be used in configuring the meter.

4. Using the same LI, UI, LD, and UD numbers, calculate the Gain (G) in Counts/Input.

$$\text{Gain (G)} = \frac{(UD - LD)}{(UI - LI)} = \underline{\qquad\qquad}$$

5. Select the group of four VR ranges under the Input Span Range required from the following chart.

6. Select one from this group which contains the Gain (G) number calculated in Step 4.

Voltage Receiver Selection	Input Span	Count Output Range Q2000E	Q9000E
VR1	0/0.5 V	80/2850	400/14250
VR2	0/0.5 V	2840/5500	14200/27500
VR3	0/0.5 V	5490/8170	27450/40850
VR4	0/0.5 V	8160/10600	40800/53000
VR5	0/1.0 V	40/1260	200/6300
VR6	0/1.0 V	1255/2440	6275/12200
VR7	0/1.0 V	2430/3605	12150/18025
VR8	0/1.0 V	3595/4700	17975/23500
VR9	0/2.0 V	20/750	100/3750
VR10	0/2.0 V	745/1452	3725/7260
VR11	0/2.0 V	1450/2157	7250/10785
VR12	0/2.0 V	2155/2750	10775/13750
VR13	0/5.0 V	8/231	40/1155
VR14	0/5.0 V	230/449	1150/2245
VR15	0/5.0 V	448/667	2240/3335
VR16	0/5.0 V	666/860	3330/4300
VR17	0/10.0 V	4/114.5	20/572
VR18	0/10.0 V	114/223	570/1115
VR19	0/10.0 V	222.5/331	1117/1655
VR20	0/10.0 V	330.5/428	1652/2140
VR21	0/20.0 V	2/56.8	10/284
VR22	0/20.0 V	56.5/110.3	282/551
VR23	0/20.0 V	110/164.4	550/822
VR24	0/20.0 V	164.2/220	821/1100

VR = _____ (Counts/Volts) This selection will be used in configuration.

Proceed to Installation.

12.5 CURRENT RECEIVER SELECTION

1. Using the Input Span Range and the required Display Reading, calculate the zero offset required (with polarity).

   (LI) Lower Input = _____
   (UI) Upper Input = _____
   (LD) Lower Display = _____
   (UD) Upper Display = _____

2. When specifying the Lower Input (LI) and Upper Input (UI), the maximum display reading for a Q2000E is ±1999. The maximum reading for a Q9000E is ±9999.

$$ZON = \frac{(LD \times UI) - (UD \times LI)}{(UI - LI)}$$

3. Select a Zero Offset Range (ZO) from the appropriate QUANTA series where the calculated Zero Offset Number (ZON) falls between the minimum and maximum numbers of that range.

Q2000E	Q9000E
Z01 = -3000/-1895	Z01 = -15000/-9475
Z02 = -1900/-600	Z02 = -9500/-3000
Z03 = -605/+870	Z03 = -3025/+4350
Z04 = +865/+2100	Z04 = +4325/+10500

   ZO = _____ This selection will be used in configuring the meter.

4. Using the same LI, UI, LD and UD numbers used, calculate the Gain (G) in Counts/Input.

$$\text{Gain (G)} = \frac{(UD - LD)}{(UI - LI)} = \_\_\_\_\_$$

5. Select the group of four CR ranges under the Input Span Range required from the following chart.

6. Select one of the four ranges which contains the Gain (G) number calculated in Step 4.

Current Receiver Selection	Input Span	Count Output Range Q2000E	Q9000E
CR1	0.2/1.0 mA	50/1405	250/7025
CR2	0.2/1.0 mA	1400/2730	7000/13650
CR3	0.2/1.0 mA	2725/4055	13625/20275
CR4	0.2/1.0 mA	4050/5264	20250/26320
CR5	0.4/2.0 mA	25/702	125/3510
CR6	0.4/2.0 mA	700/1365	3500/6825
CR7	0.4/2.0 mA	1363/2027	6815/10135
CR8	0.4/2.0 mA	2025/2632	10125/13160
CR9	1.0/5.0 mA	10/282.5	50/1413
CR10	1.0/5.0 mA	281.5/550	1408/2750
CR11	1.0/5.0 mA	548/816	2740/4080
CR12	1.0/5.0 mA	815/1059	4075/5295
CR13	2.0/10.0 mA	5/141	25/705
CR14	2.0/10.0 mA	140.5/274.5	702/1372
CR15	2.0/10.0 mA	274/407.5	1370/2037
CR16	2.0/10.0 mA	407/529	2036/2645
CR17	4.0/20.0 mA	2.5/70.4	13/352
CR18	4.0/20.0 mA	70.2/137	351/685
CR19	4.0/20.0 mA	136.6/203.4	683/1017
CR20	4.0/20.0 mA	203/264	1015/1320
CR21	10.0/50.0 mA	1/28.2	5/141
CR22	10.0/50.0 mA	28.1/55	141/275
CR23	10.0/50.0 mA	54.8/81.6	274/408
CR24	10.0/50.0 mA	81.5/106	408/530

CR = _____ (counts/mA) This selection will be used in configuration.

7. Proceed to Installation.

12.6 BSCE INSTALLATION

If unit is to be configured as a voltmeter (VM1-15) or an ammeter (AM1-18), then zero offset (Z03) is required.

Select the Voltmeter (VM1-15), Ammeter (AM1-18), Voltage Receiver (VR1-24), Current Receiver (CR1-24), Zero Offset (Z01-4), Signal Output Polarity (S01-2) and/or the excitation supply (EV1-2) required.

Install the push-on jumpers, as per the configuration section, depending upon which range is required.

12.6.1 Reference Voltage (Q9000E only)

Select reference RV2 by removing any jumpers on position S3 as per Section 5.3 in Main Assembly.

12.6.2 Decimal Point

If a decimal point is required, refer to the appropriate Main Assembly Section for location and configuration procedure.

13.0 CONFIGURATION CHARTS

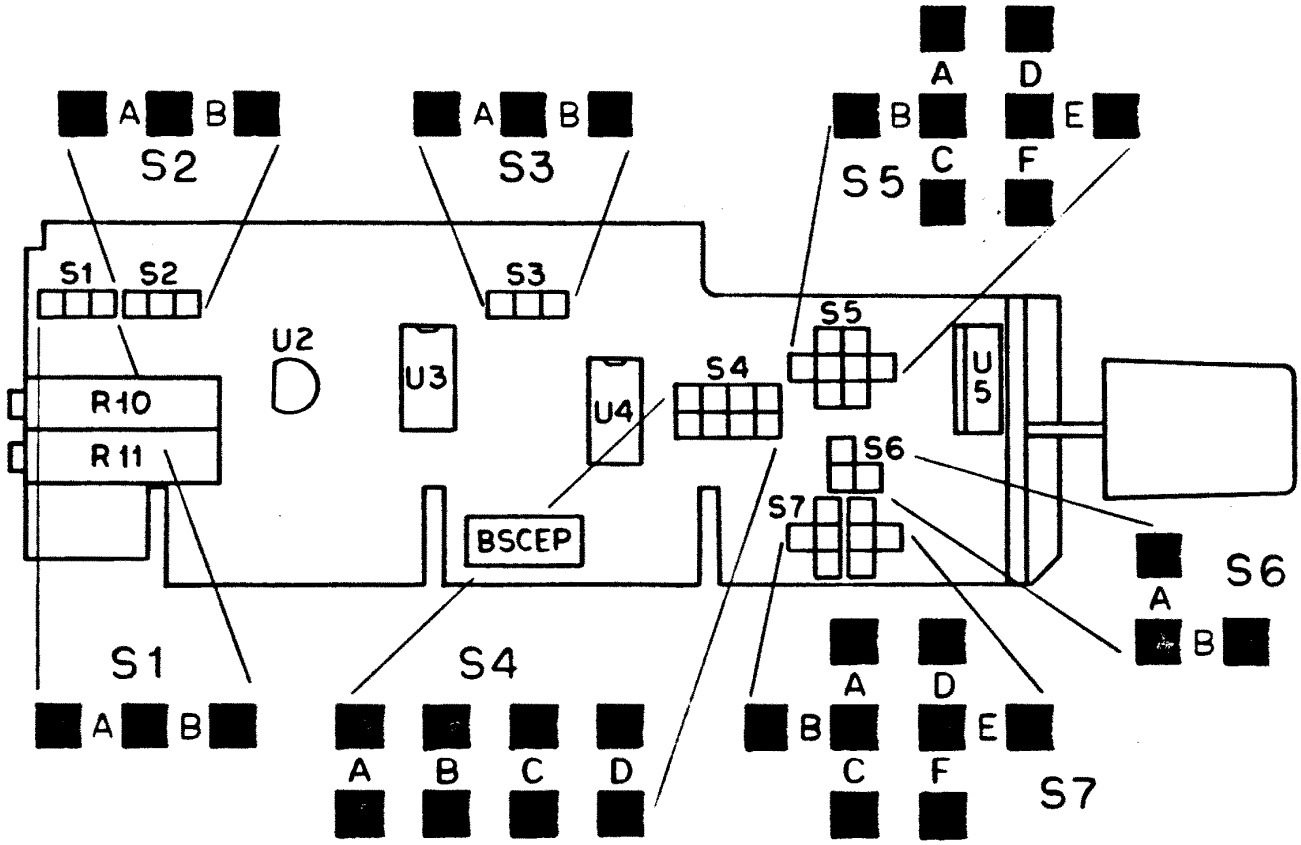


Figure 13-1 Push-On Jumper Locations

13.1 VOLTMETER (VM1-15)

Step 1: Remove all push-on jumpers not used in the desired configuration(s).							
Step 2: Select the desired configuration from the chart below, then install the push-on jumpers indicated.							
Voltmeter Configuration *		S2	S4		S5		Input Resistance
VM1	±190/235 mV	A	C	D	C	-	100 k ohms
VM2	±233/350 mV	A	A	D	C	-	100 k ohms
VM3	±348/450 mV	A	B	C	C	-	100 k ohms
VM4	±440/580 mV	A	C	D	B	-	230 k ohms
VM5	±575/850 mV	A	A	D	B	-	230 k ohms
VM6	±800/1030 mV	A	C	D	E	-	385 k ohms
VM7	±1.0/1.5 V	A	A	D	E	-	385 k ohms
VM8	±1.4/1.8 V	A	C	D	A	E	325 k ohms
VM9	±1.7/2.5 V	A	A	D	A	E	325 k ohms
VM10	±2.4/3.1 V	A	C	D	F	-	1 M ohm
VM11	±3.0/4.5 V	A	A	D	F	-	1 M ohm
VM12	±4.4/5.1 V	A	B	C	F	-	1 M ohm
VM13	±5.0/6.5 V	A	C	D	A	-	1 M ohm
VM14	±6.4/9.6 V	A	A	D	A	-	1 M ohm
VM15	±9.5/11.0 V	A	B	C	A	-	1 M ohm

* Used on the Q2000E or Q9000E

13.2 AMMETER (AM1-18)

Step 1: Remove all push-on jumpers not used in the desired configuration(s).							
Step 2: Select the desired configuration from the chart below, then install the push-on jumpers indicated.							
Ammeter Configuration *		S2	S4		S5	S7	Input Resistance
AM1	±370/470 uA	A	C	D	C	F	490 ohms
AM2	±460/700 uA	A	A	D	C	F	490 ohms
AM3	±690/800 uA	A	B	C	C	F	490 ohms
AM4	±790/940 uA	A	C	D	C	E	240 ohms
AM5	±935/1400 uA	A	A	D	C	E	240 ohms
AM6	±1.39/1.91 mA	A	B	C	C	E	240 ohms
AM7	±1.90/2.35 mA	A	C	D	C	D	100 ohms
AM8	±2.33/3.50 mA	A	A	D	C	D	100 ohms
AM9	±3.48/4.00 mA	A	B	C	C	D	100 ohms
AM10	±3.90/4.70 mA	A	C	D	C	A	50 ohms
AM11	±4.65/7.00 mA	A	A	D	C	A	50 ohms
AM12	±6.90/7.80 mA	A	B	C	C	A	50 ohms
AM13	±7.70/9.40 mA	A	C	D	C	B	25 ohms
AM14	±9.35/14.0 mA	A	A	D	C	B	25 ohms
AM15	±13.9/19.1 mA	A	B	C	C	B	25 ohms
AM16	±19.0/23.5 mA	A	C	D	C	C	10 ohms
AM17	±23.3/35.0 mA	A	A	D	C	C	10 ohms
AM18	±34.0/51.0 mA	A	B	C	C	C	10 ohms

* Used on the Q2000E or Q9000E

13.3 VOLTAGE RECEIVER (VR1-24)

Step 1: Remove all push-on jumpers not used in the desired configuration(s).						
Step 2: Select the desired configuration from the chart below, then install the push-on jumpers indicated.						
Voltage Receiver Configuration		S4		S5	Counts/Volt Q2000E	Counts/Volt Q9000E
VR1	0.5 V Input	A	B	C	80/2850	400/14250
VR2	0.5 V Input	B	C	C	2840/5500	14200/27500
VR3	0.5 V Input	A	D	C	5490/8170	27450/40850
VR4	0.5 V Input	C	D	B	8160/10600	40800/53000
VR5	1.0 V Input	A	B	B	40/1260	200/6300
VR6	1.0 V Input	B	C	B	1255/2440	6275/12200
VR7	1.0 V Input	A	D	B	2430/3605	12150/18025
VR8	1.0 V Input	C	D	B	3595/4700	17975/23500
VR9	2.0 V Input	A	B	E	20/750	100/3750
VR10	2.0 V Input	B	C	E	745/1452	3725/7260
VR11	2.0 V Input	A	D	E	1450/2157	7250/10785
VR12	2.0 V Input	C	D	E	2155/2750	10775/13750
VR13	5.0 V Input	A	B	F	8/231	40/1155
VR14	5.0 V Input	B	C	F	230/449	1150/2245
VR15	5.0 V Input	A	D	F	448/667	2240/3335
VR16	5.0 V Input	C	D	F	666/860	3330/4300
VR17	10.0 V Input	A	B	A	4/114.5	20/572
VR18	10.0 V Input	B	C	A	114/223	570/1115
VR19	10.0 V Input	A	D	A	222.5/331	1110/1655
VR20	10.0 V Input	C	D	A	330.5/428	1652/2140
VR21	20.0 V Input	A	B	D	2/56.8	10/284
VR22	20.0 V Input	B	C	D	56.5/110.3	282/551
VR23	20.0 V Input	A	D	D	110/164.4	550/822
VR24	20.0 V Input	C	D	D	164.2/220	820/1100

13.4 CURRENT RECEIVER (CR1-24)

Step 1: Remove all push-on jumpers not used in the desired configuration(s).							
Step 2: Select the desired configuration from the chart below, then install the push-on jumpers indicated.							
	Current Receiver Configuration	S4		S5	S7	Counts/mA Q2000E	Counts/mA Q9000E
CR1	0.2/1.0 mA Input	A	B	C	F	50/1405	250/7025
CR2	0.2/1.0 mA Input	B	C	C	F	1400/2730	7000/3650
CR3	0.2/1.0 mA Input	A	D	C	F	2725/4055	13625/20275
CR4	0.2/1.0 mA Input	C	D	C	F	4050/5264	20250/26320
CR5	0.4/2.0 mA Input	A	B	C	E	25/702	125/3510
CR6	0.4/2.0 mA Input	B	C	C	E	700/1365	3500/6825
CR7	0.4/2.0 mA Input	A	D	C	E	1363/2027	6815/10135
CR8	0.4/2.0 mA Input	C	D	C	E	2025/2632	10125/13160
CR9	1.0/5.0 mA Input	A	B	C	D	10/282.5	50/1412
CR10	1.0/5.0 mA Input	B	C	C	D	281.5/550	1407/2750
CR11	1.0/5.0 mA Input	A	D	C	D	548/816	2740/4080
CR12	1.0/5.0 mA Input	C	D	C	D	815/1059	4075/5295
CR13	2.0/10.0 mA Input	A	B	C	A	5/141	25/705
CR14	2.0/10.0 mA Input	B	C	C	A	140.5/274.5	702/1372
CR15	2.0/10.0 mA Input	A	D	C	A	274/407.5	1370/2037
CR16	2.0/10.0 mA Input	C	D	C	A	407/529	2035/2645
CR17	4.0/20.0 mA Input	A	B	C	B	2.5/70.4	12/352
CR18	4.0/20.0 mA Input	B	C	C	B	70.2/137	351/685
CR19	4.0/20.0 mA Input	A	D	C	B	136.6/203.4	683/1017
CR20	4.0/20.0 mA Input	C	D	C	B	203/264	1015/1320
CR21	10.0/50.0 mA Input	A	B	C	C	1/28.2	5/141
CR22	10.0/50.0 mA Input	B	C	C	C	28.1/55	140/275
CR23	10.0/50.0 mA Input	A	D	C	C	54.8/81.6	274/408
CR24	10.0/50.0 mA Input	C	D	C	C	81.5/106	407/530

13.5 ZERO OFFSET (ZO1-4)

Step 1:	Remove all push-on jumpers not used in the desired configuration(s).			
Step 2:	Select the desired configuration from the chart below, then install the push-on jumpers indicated.			
	Zero Offset Configuration Q2000E	Q9000E	S1	S2
ZO1	-3000/-1895 counts	-15000/-9475 counts	B	-
ZO2	-1900/-600 counts	-9500/-3000 counts	A	-
ZO3	-605/+870 counts	-3025/+4350 counts	-	A
ZO4	+865/+2100 counts	+4325/+10500 counts	-	B

13.6 EXCITATION VOLTAGE (EV1-2)

Step 1:	Remove all push-on jumpers not used in the desired configuration(s).	
Step 2:	Select the desired configuration from the chart below, then install the push-on jumpers indicated.	
Excitation Voltage Configuration		S6
EV1	10 Volts	B
EV2	15 Volts	A

13.7 SIGNAL OUTPUT POLARITY (SO1-2)

Step 1:	Remove all push-on jumpers not used in the desired configuration(s).	
Step 2:	Select the desired configuration from the chart below, then install the push-on jumpers indicated.	
Signal Output Configuration		S3
SO1	Non Inverted	A
SO2	Inverted	B

14.0 CALIBRATION FOR Q2000E and Q9000E

NOTE: The numbers used below are derived from the selection in Section 12, BSCE Configuration.

14.1 VOLTMETER (VM1-15)

1. Apply a short to the input terminals and adjust the zero (Z) pot (R10) to make the display read 000 (Q2000E) or 0000 (Q9000E).

2. Apply an Input Voltage equal to the largest (+) magnitude of the VM range selected and adjust the span (S) pot (R11) to make the display read the appropriate number.

3. Repeat above steps as required to set the display to within ±1 count.

14.2 AMMETER (AM1-18)

1. Apply a short to the input terminals and adjust the zero (Z) pot (R10) to make the display read 000 (2000E) or 0000 (Q9000E).

2. Apply an Input Current equal to the largest (+) magnitude of the AM range selected and adjust the span (S) pot (R11) to make the display read the appropriate number.

3. Repeat above steps as required to set the display to within ±1 count.

14.3 VOLTAGE RECEIVER (VR1-24)

1. Apply a short to the input terminals and adjust the zero (Z) pot (R10) to make the display read the Zero Offset Number (ZON) calculated.

2. Apply an Input Voltage equal to the Upper Input (UI) number used and adjust the span (S) pot (R11) to make the display read that number.

3. Repeat above steps as required to set the display readings to within ±1 count.

14.4 CURRENT RECEIVER (CR1-24)

1. Apply a short to the input terminals and adjust the zero (Z) pot (R10) to make the display read the zero offset number (ZON) calculated.

2. Apply a Input Current equal to the Upper Input (UI) number used and adjust the span (S) pot (R11) to make the display read that number.

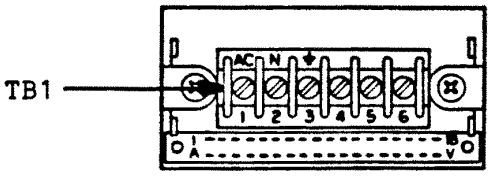
3. Repeat above steps as required to set the display to within ±1 count.

15.0 POWER REQUIREMENTS AND CONNECTIONS (TB1)

The standard meter is wired to operate from one of five power sources.

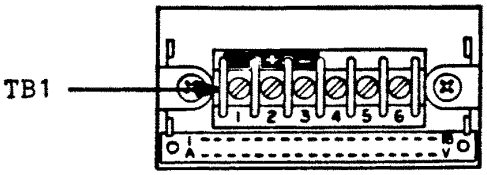
Models	Power Requirements
Q20XXX, Q21XXX, Q90XXX	120 V ac (50-60 Hz)
Q22XXX, Q23XXX, Q92XXX	240 V ac (50-60 Hz)
Q24XXX, Q25XXX, Q94XXX	9-32 V dc
Q26XXX, Q27XXX, Q96XXX	5 V dc
Q28XXX, Q29XXX, Q98XXX	24 V ac (50-60 Hz)

Regardless of the power source used, connections are made to the same terminal barrier strip, TB1, as follows:



REAR TERMINAL VIEW

TB1 Terminal Connection	AC Operation 24 V,120 V,240V	Wire Color
1	AC power HI	Black
2	AC power LO (neutral)	White
3	AC power GND	Green



TB1 Terminal Connection	DC Operation 5 V or 9-32 V
1	No Connection
2	DC power +
3	DC power - (return)

16.0 SIGNAL INPUT CONNECTIONS (TB1)

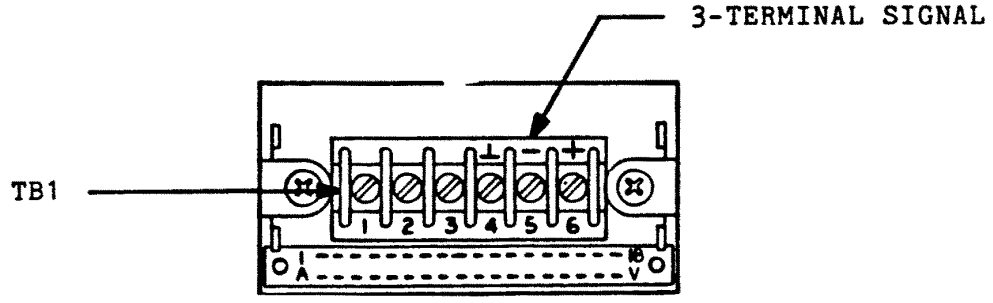
The signal input connections for the BSCE process signal conditioner are made at the standard 3-terminal barrier strip:

Signal input connections and excitation supply output connection for an amplified voltage output transducer:

Terminal Connection	Signal	Input
4	+ Excitation	+Supply Voltage
5	- Signal LO/-Exc	Common
6	+ Signal HI	Signal Output

Signal input connections for an amplified current output transducer:

Terminal Connection	Signal	Input
4	+ Excitation	+Supply Voltage
5	- Signal LO/-Exc	
6	+ Signal HI	Return



REAR TERMINAL VIEW

17.0 TESTS AND DIAGNOSTICS

The signal conditioner board BSCE is designed to function with a main assembly as a minimum configuration. There is no provision for testing a signal conditioner board alone.

Signal input requirements for your configuration are identified in the specifications for the BSCE signal conditioner, Section 10.0.

Operating power and connections for your configuration are identified in the Main Assembly Sections of this manual.

17.1 FUNCTIONAL ELECTRICAL TESTING

Perform this test after your meter has been configured.

1. Apply proper power for your configuration to terminals 1, 2 and 3 on barrier strip (TB1). Display will read approximately the zero offset number (ZON) from Section 12.

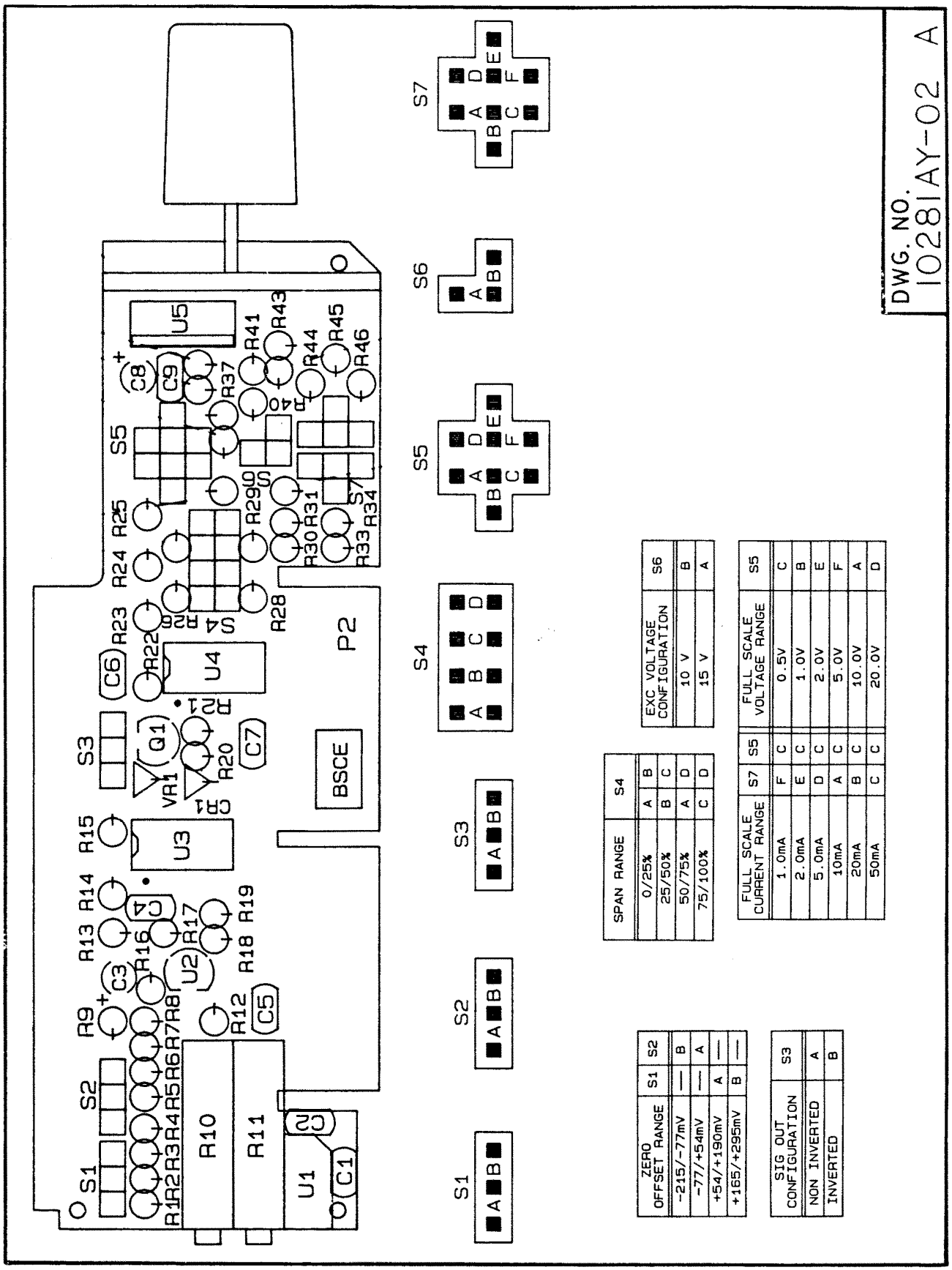


Figure 18-1 BSCE Assembly Diagram

NOTES

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.

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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.

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