QUANTA®

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Q2000-G AC RMS Current
Process Monitors

Operator's Manual

NEWPORT Electronics, Inc.

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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.

QUANTA CROSS REFERENCE

Q	☐	☐	☐	☐	☐		
						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

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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

Note ☞ 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.

Note ☞

- 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.

1.0 MAIN ASSEMBLY - _2000 SPECIFICATIONS

1.1 GENERAL

The _2000 main assemblies are identified by an initial designator (_2) plus a power/ display option numeral, zero through nine (0-9).

The following table identifies the main assembly types:

Display Type	120 V ac	240 Vac	9-32 V dc	5 V ac	24 V ac
LED	_2**0**	_2**2**	_2**4**	_2**6**	_2**8**
LCD	_2**1**	_2**3**	_2**5**	_2**7**	_2**9**

The 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) (150 Vp per CE)
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) (100 Vp per CE)
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 blank, "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 Temp (Ambient):	0 to 60°C
Storage Temp.:	-40 to 85°C
Humidity:	To 95% RH, non-condensing, 0 to 40°C

1.6 MECHANICAL

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

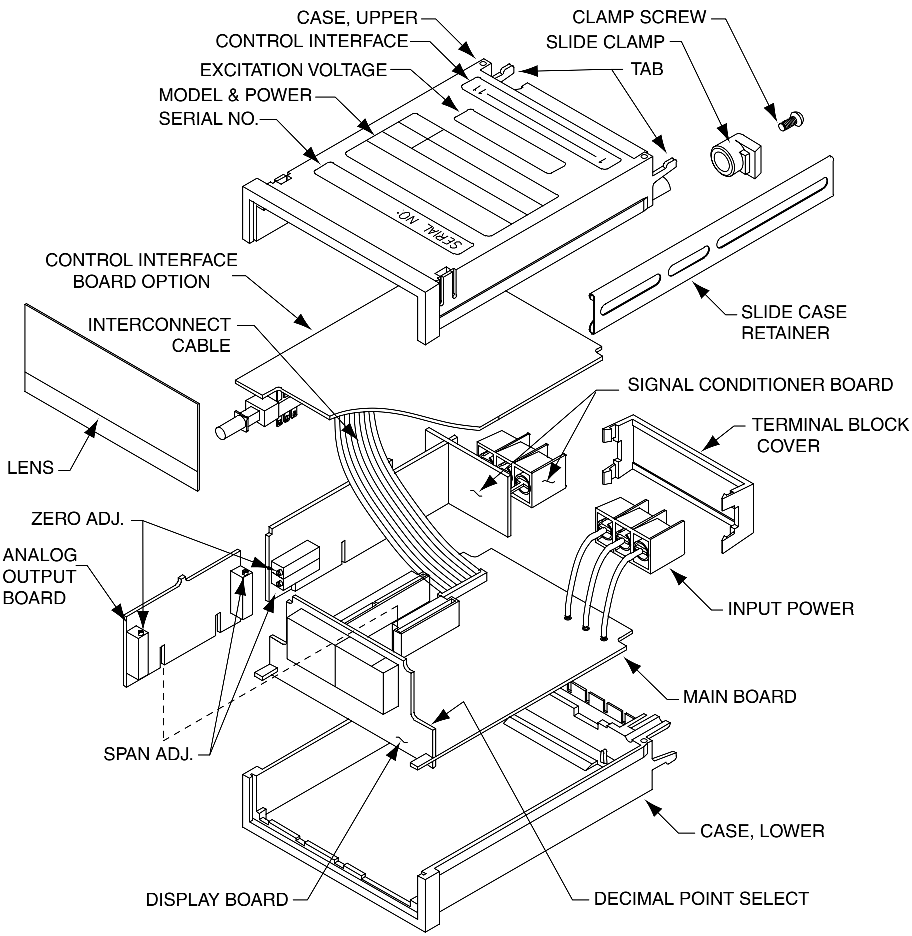


Figure 1 Exploded View

2.0 MECHANICAL ASSEMBLY & INSTALLATION

2.1 PANEL MOUNTING PROCEDURE (SEE FIGURE 1)

Remove the main board edge connector (J1), if installed.

Remove the interface board connector (J2), if installed.
Loosed two clamp screws on the rear of the case enough to rotate the two slide clamps.

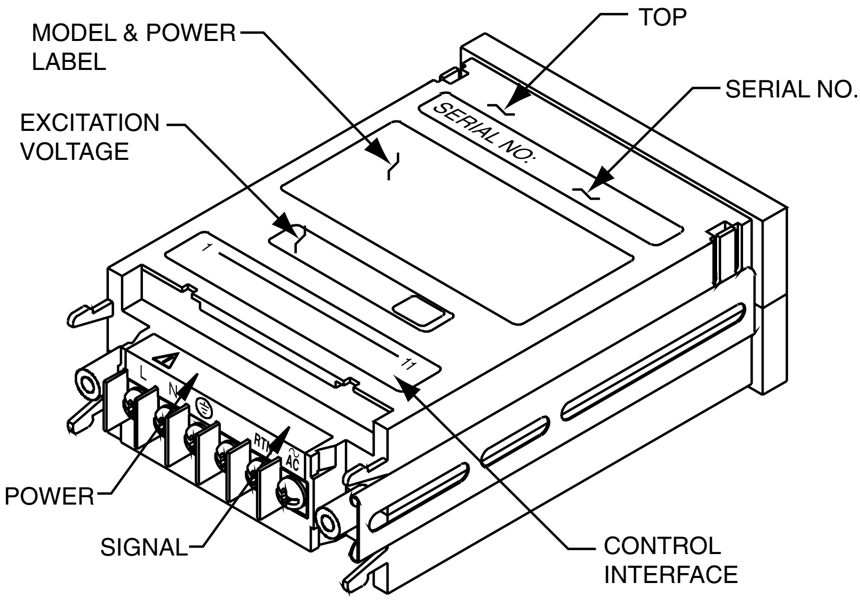
Slide two slide retainers toward the rear of the case and remove them.

From the front of the panel, insert the meter into the panel cutout.
Slide the slide retainers back into the case and push up tightly against the rear of the panel.

Rotate the slide clamps back into their original position and tighten enough to hold the case in place. Overtightening can break the clamps.

Install any connectors removed.

2.2 LABELS (SEE FIGURE 2 FOR PLACEMENT)



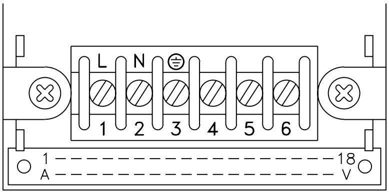
LABELS TO BE READ FROM THE REAR

Figure 2 Label Placement

3.0 POWER AND SIGNAL INPUT CONNECTIONS

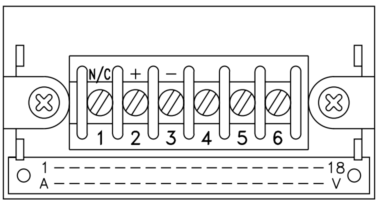
WARNING: Incorrect power input can damage your PANEL METER

3.1 POWER CONNECTIONS



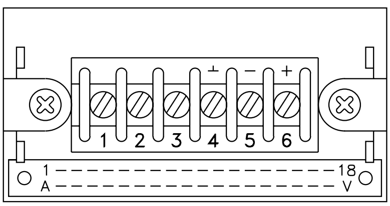
Terminal Connection	AC Versions	Wire Color
1	AC power HI	Black
2	AC power LO (neutral)	White
3	AC power GND	Green

REAR TERMINAL VIEW



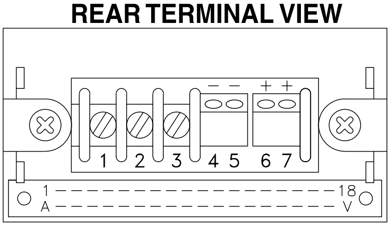
Terminal Connection	DC Versions
1	No connection
2	DC power +
3	DC power - (return)

3.2 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)

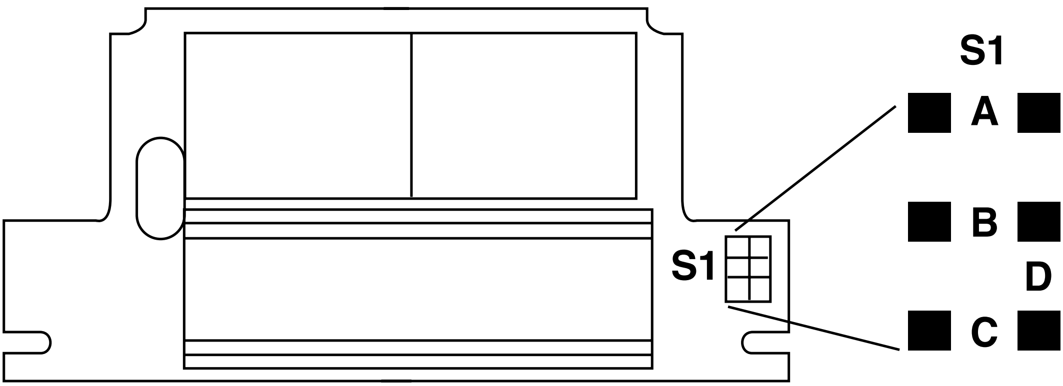
4.0 CONFIGURATION PROCEDURE

This procedure is used to set the decimal point of the display and interface board signal bypass selections for the configuration of the _2XXXX Display and power options 20 through 29 (see Cross Reference). For _9XXXX options 90 through 98 see Section 13.

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.

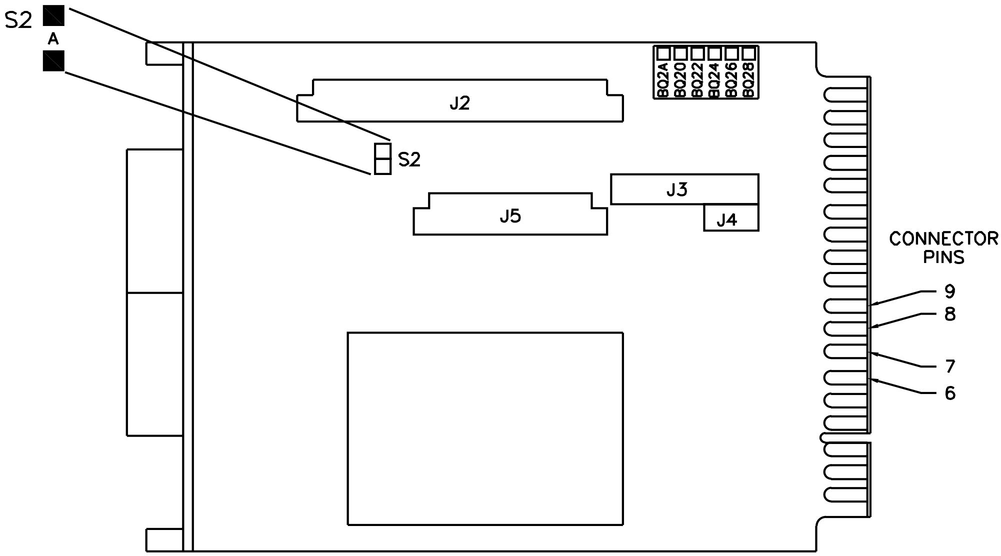
5.0 CONFIGURATION CHARTS

5.1 DECIMAL POINT SELECTION



Step 1:	Remove all push-on jumpers not used in the desired configuration(s).	
Step 2:	Select the desired configuration from the chart below, and install 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
Decimal Point (1999)	D	No connection

5.2 INTERFACE BOARD SIGNAL BYPASS SELECTION



Step 1:	Check your part number for a zero (0) in the following position; _2XX**0**X. 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

6.0 TESTS & DIAGNOSTICS

6.1 TEST CONFIGURATION REQUIREMENTS

The 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.

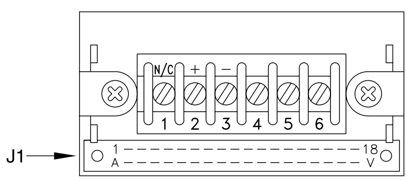
6.2 SIGNAL INPUT REQUIREMENTS

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

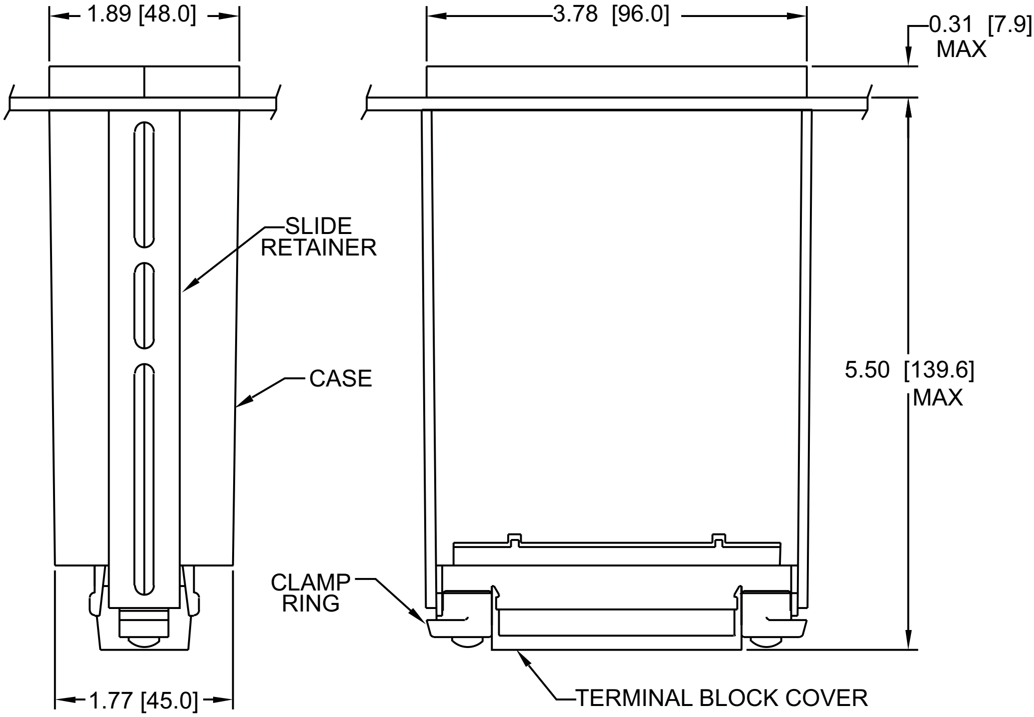
7.0 MAIN BOARD CONNECTOR PINOUTS (J1)

(Left to right, looking at rear of case)

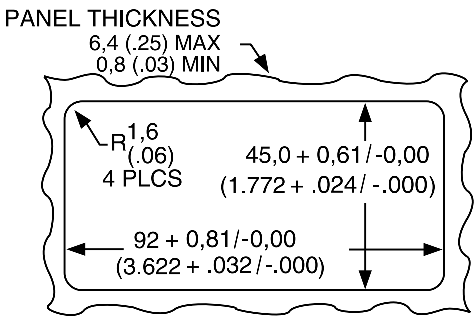
Connection	Function	
A - 1	Spare	
B	Oscillator	40 kHz
2	-8.2 V dc Analog power	Analog power
C - 3	Spare	
D	+ Pol (sign)	+ Polarity sign
4	$\overline{\text{HOLD}}$	LED version only
E - 5	Spare	
F	Buffer	Integrator output
6	Digital Ground	
H - 7	199.9 (Decimal point)	Use with pin 6
J - 8	19.99 (Decimal point)	Use with pin 6
K - 9	1.999 (Decimal point)	Use with pin 6
L - 10	Test (LED version only)	Use with pin M/11
M - 11	+5 V dc	Analog & digital power
N - 12	Analog output	Standard 1 mV/count
P - 13	Spare	
R - 14	Spare	Used with H & S options - Excitation sense
S - 15	Analog Ground	
T - 16	Analog Option - Return	Used with analog option
U	Analog Option - Out	Used with analog option
17	+30 V dc	Unregulated power
V - 18	Spare	Used with S option + Excitation sense
-	Indicates common pin	
	50 mA maximum power available from all internal sources	



8.0 DIMENSIONAL DRAWINGS

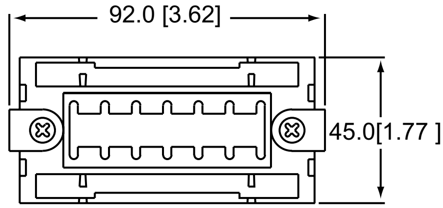


Notes: Dimensions are in inches ±0.01"
with millimeters in [ ] ±0.25 mm.



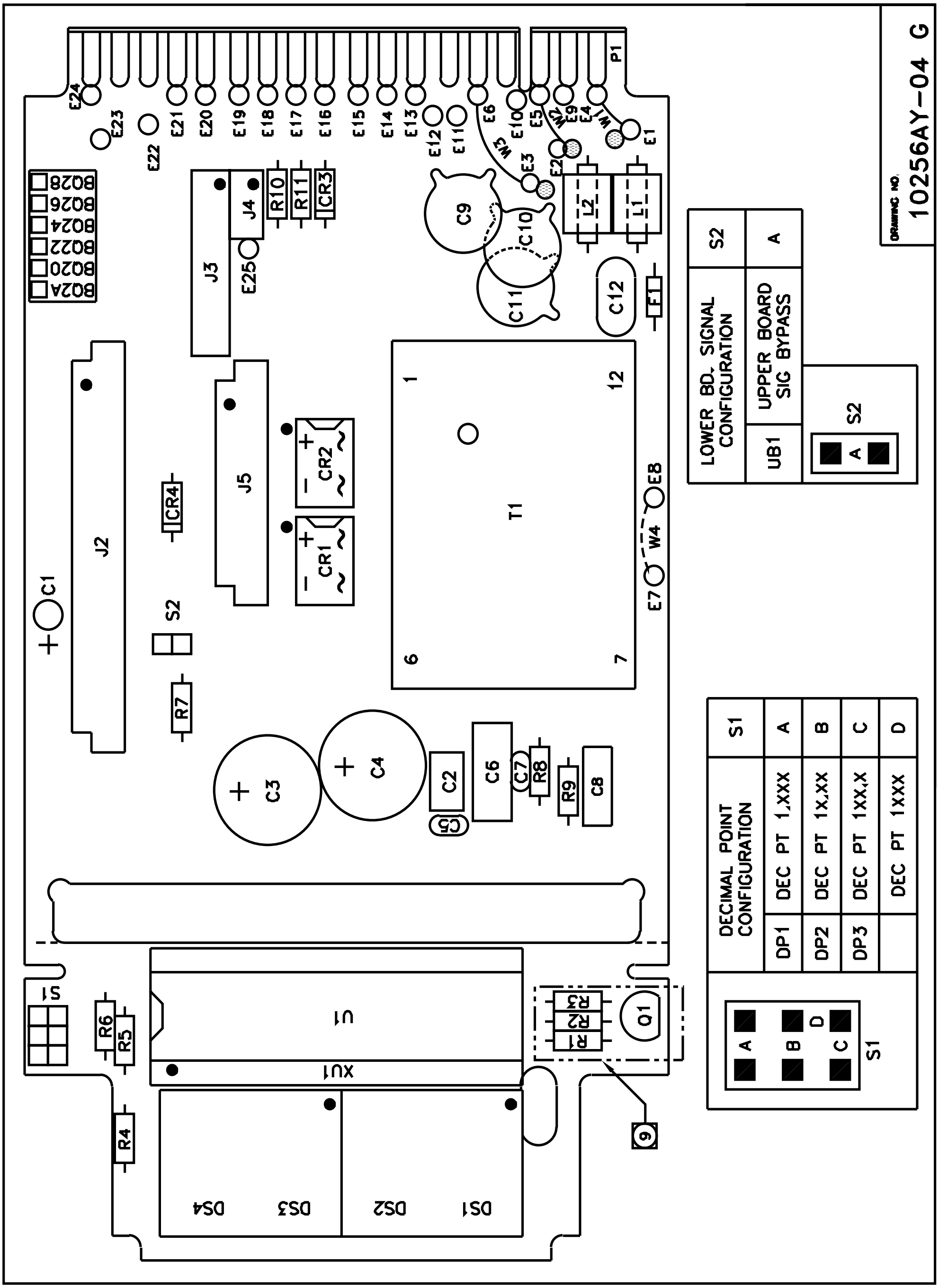
NOTE: Dimensions in Millimeters (Inches)

PANEL CUTOUT

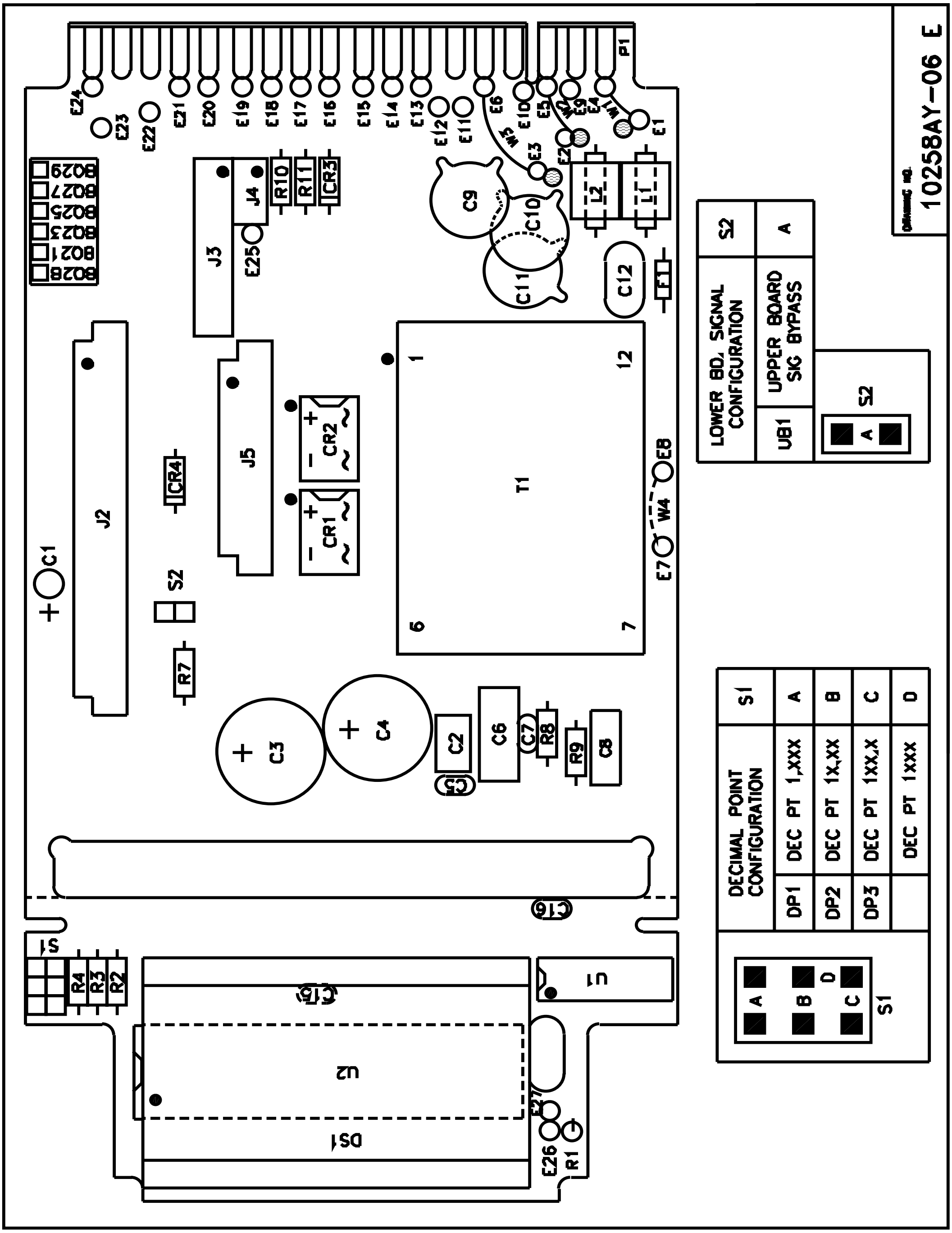


REAR VIEW

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



Assembly Diagram LED Display Used on 20, 22, 24, 26 & 28 (see Cross Reference)



Assembly Diagram LCD Display Used on 21, 23, 25, 27 & 29 (see Cross Reference)

9.0 MAIN ASSEMBLY _9000 SPECIFICATIONS

9.1 GENERAL

The _9000 main assemblies are identified by an initial designator (_9) 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	_9**0**	_9**2**	_9**4**	_9**6**	_9**8**

The 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).

9.2 POWER

AC Models:	24/120/240V +10/-15% 47-63 Hz
Common Mode Voltage:	1500Vp test (354 Vp per IEC spacing),
DC Models:	5V ±5% (5V return common to signal LO) 9 to 32V (300V isolation from 9-32V return to signal LO), (100Vp per CE)
Source Impedance:	3 ohms
Ripple:	250 mV maximum
Power Consumption:	5 watts maximum

9.3 DISPLAY

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

9.4 CONVERSION

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

9.5 ENVIRONMENTAL

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

9.6 MECHANICAL

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

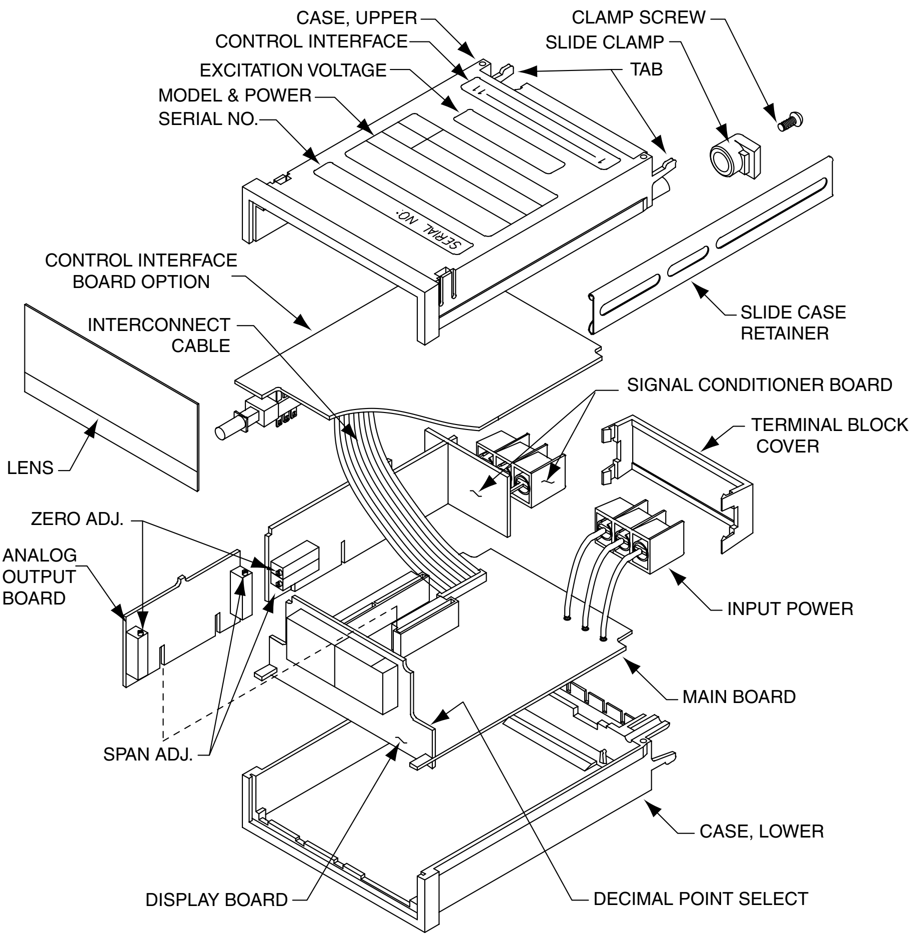


Figure 3 Exploded View

10.0 MECHANICAL ASSEMBLY & INSTALLATION

10.1 PANEL MOUNTING PROCEDURE (SEE FIGURE 3)

Remove the main board edge connector (J1), if installed.

Remove the interface board connector (J2), if installed.
Loosed two clamp screws on the rear of the case enough to rotate the two slide clamps.

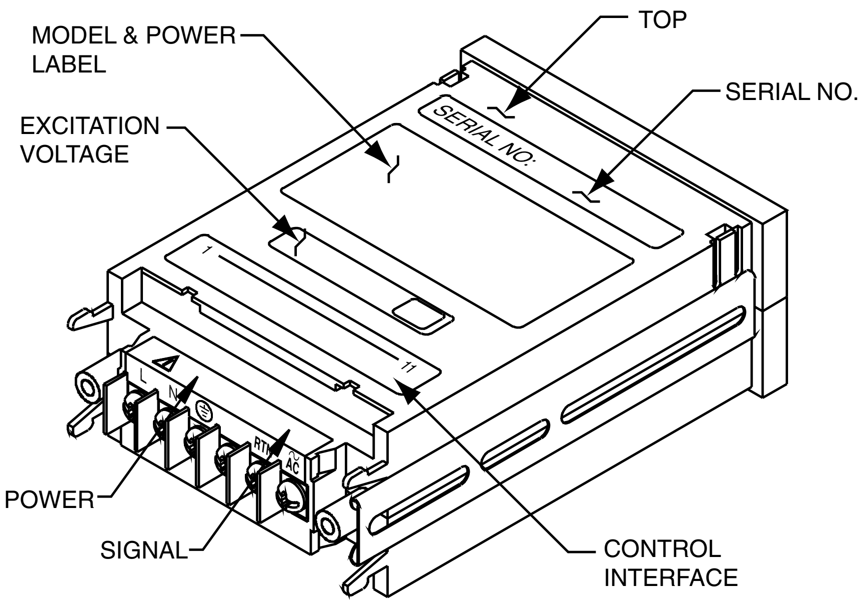
Slide two slide retainers toward the rear of the case and remove them.

From the front of the panel, insert the meter into the panel cutout.
Slide the slide retainers back into the case and push up tightly against the rear of the panel.

Rotate the slide clamps back into their original position and tighten enough to hold the case in place. Overtightening can break the clamps.

Install any connectors removed.

10.2 LABELS (SEE FIGURE 4 FOR PLACEMENT)



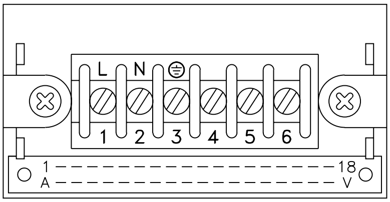
LABELS TO BE READ FROM THE REAR

Figure 4 Label Placement

11.0 POWER AND SIGNAL INPUT CONNECTIONS

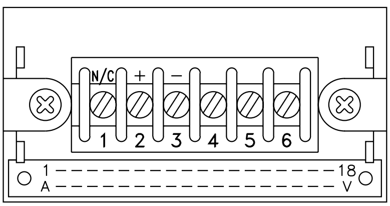
WARNING: Incorrect power input can damage your PANEL METER

11.1 POWER CONNECTIONS



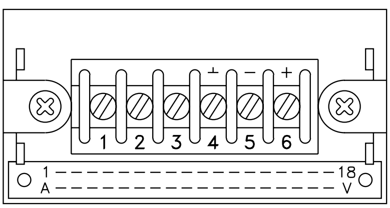
Terminal Connection	AC Versions	Wire Color USA	Wire Color Other
1	AC power HI	Black	Brown
2	AC power LO (neutral)	White	Blue
3	AC power GND	Green	Green

REAR TERMINAL VIEW



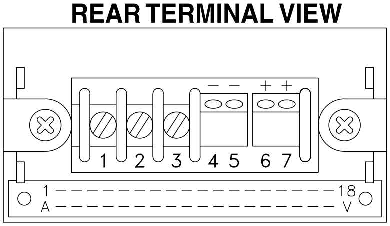
Terminal Connection	DC Versions
1	No connection
2	DC power +
3	DC power - (return)

11.2 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)

12.0 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 _9XXXX display and power options 90 through 98 (see Cross Reference).

The main assembly's configuration can be configured using the push-on jumpers provided or already positioned on the pin-forests. Pin-forest designations are shown at the top of every page of the configuration charts.

13.0 CONFIGURATION CHARTS

13.1 DECIMAL POINT SELECTION

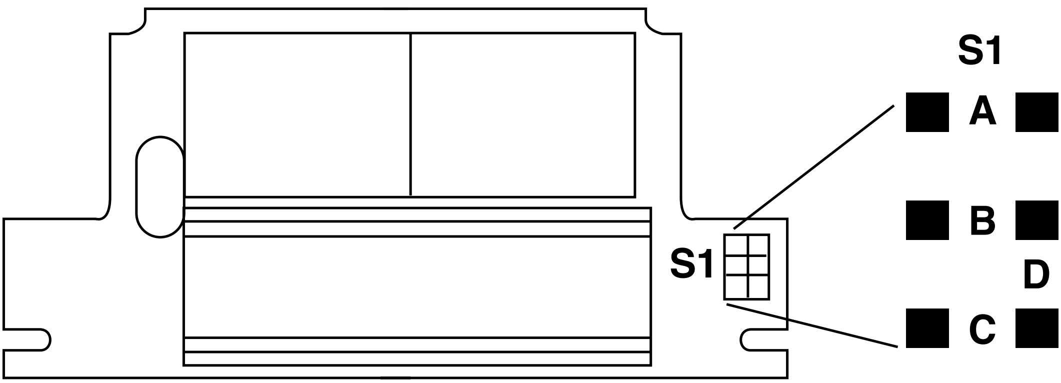
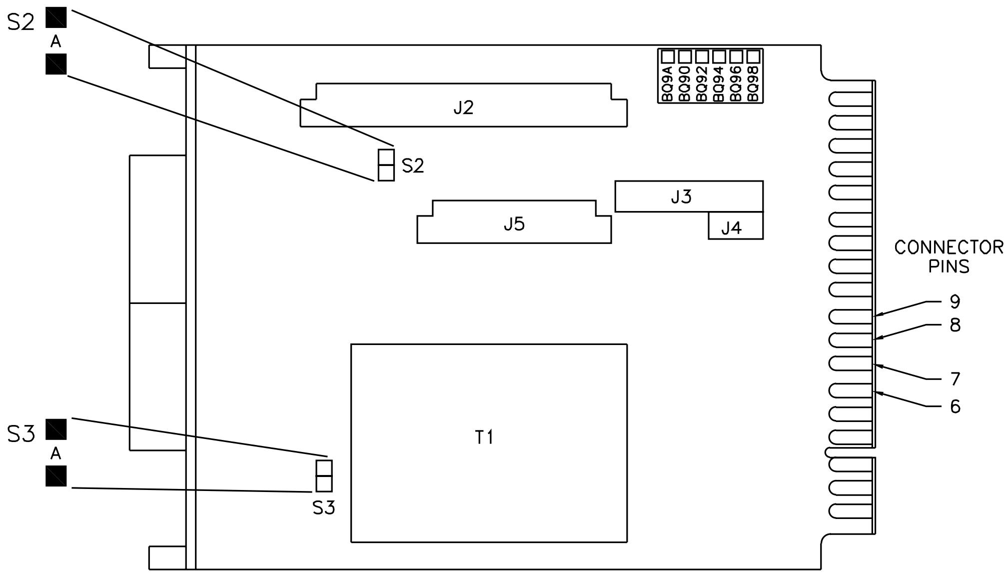


Figure 10

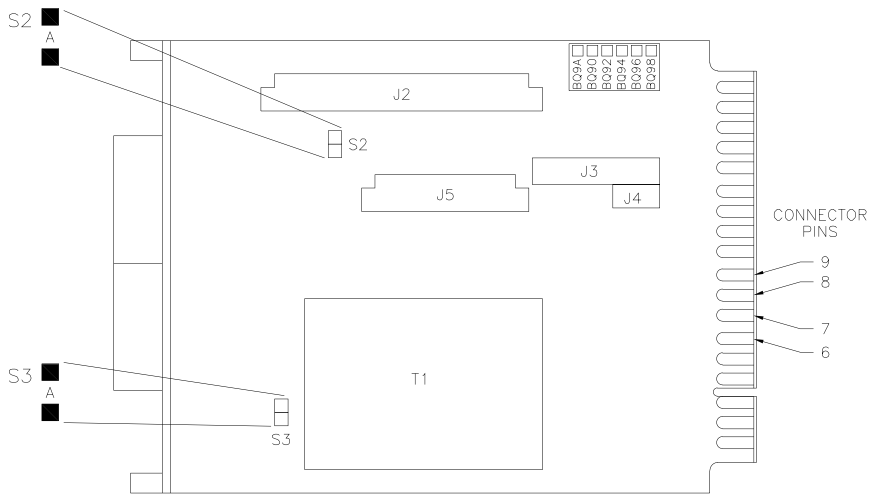
Step 1:	Remove all push-on jumpers not used in the desired configuration(s).	
Step 2:	Select the desired configuration from the chart below, and install the push-on jumpers indicated.	
Decimal Point Selection	S1	Alternate Decimal Point Selection Using Main Assembly Board (J1) Connector
Decimal Point (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

13.2 INTERFACE BOARD SIGNAL BYPASS SELECTION



Step 1: Check your part number for a zero (0) in the following position; _9XX**0**X. 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

13.3 REFERENCE VOLTAGE (RV1, RV2)



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	-

14.0 TESTS & DIAGNOSTICS

14.1 TEST CONFIGURATION REQUIREMENTS

The _9000 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.

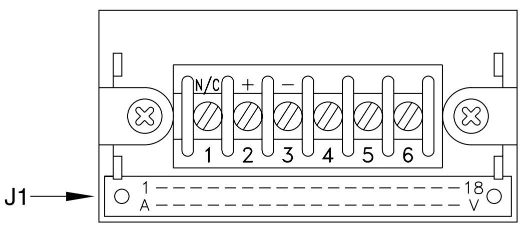
14.2 SIGNAL INPUT REQUIREMENTS

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

15.0 MAIN BOARD CONNECTOR PINOUTS (J1)

(Left to right, looking at rear of case)

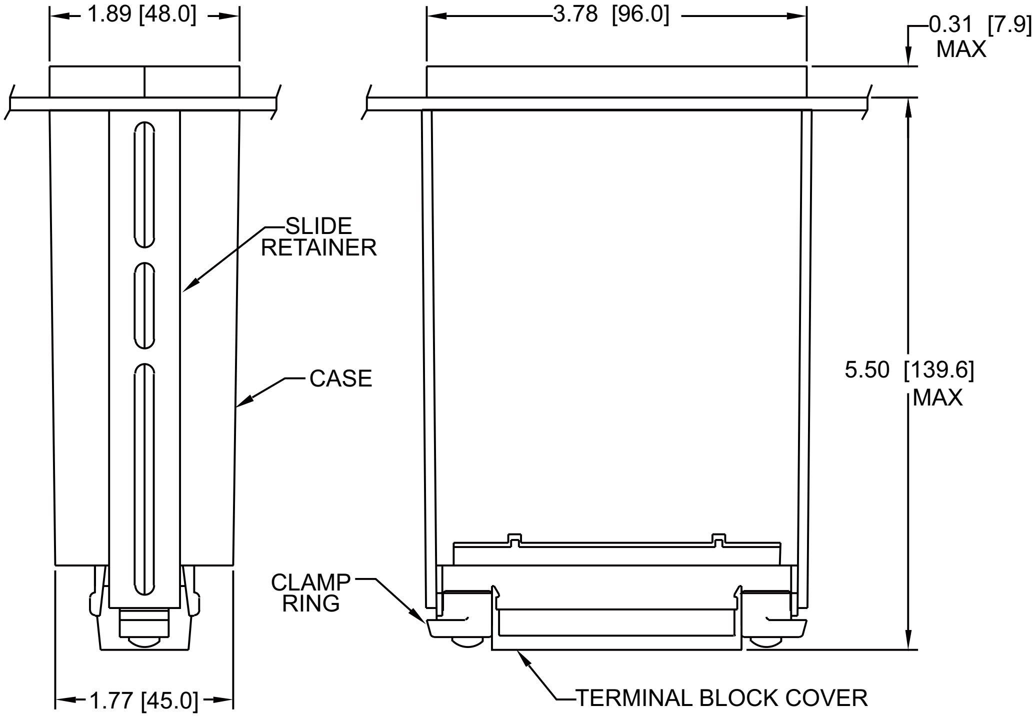
Connection	Function	
A - 1	Spare	
B	Oscillator	100 kHz
2	-8.2 V dc	Analog power
C - 3	Spare	
D	+ Pol (sign)	+ Polarity sign
4	$\overline{\text{HOLD}}$	Led version only
E - 5	Spare	
F	Buffer	Integrator output
6	Digital Ground	
H - 7	999.9 (Decimal point)	Use with pin 6
J - 8	99.99 (Decimal point)	Use with pin 6
K - 9	9.999 (Decimal point)	Use with pin 6
L - 10	Test	Use with pin M/11
M - 11	+5 V dc	Analog & digital power
N - 12	Analog output	Standard 0.1 mV/count
P - 13	Spare	
R	Spare	
14	Used with H & S options - Excitation sense	
S - 15	Analog Ground	
T - 16	Analog Option - Return	Used with analog option
U	Analog Option - Out	Used with analog option
17	+30 V dc	Unregulated power
V - 18	Spare	Used with S option + Excitation sense
-	Indicates common pin	
	50 mA maximum power available from all internal sources	



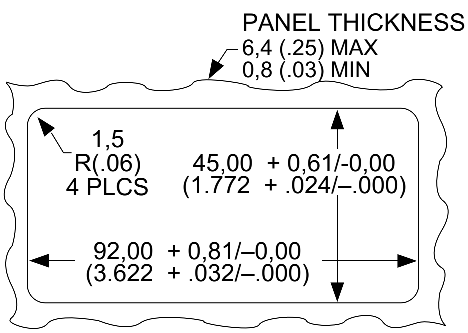
REAR TERMINAL VIEW

16.0 DRAWINGS

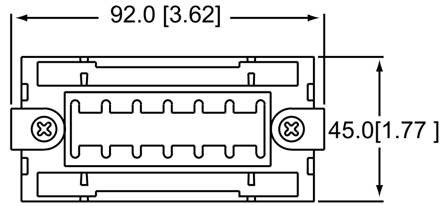
16.1 DIMENSIONS



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



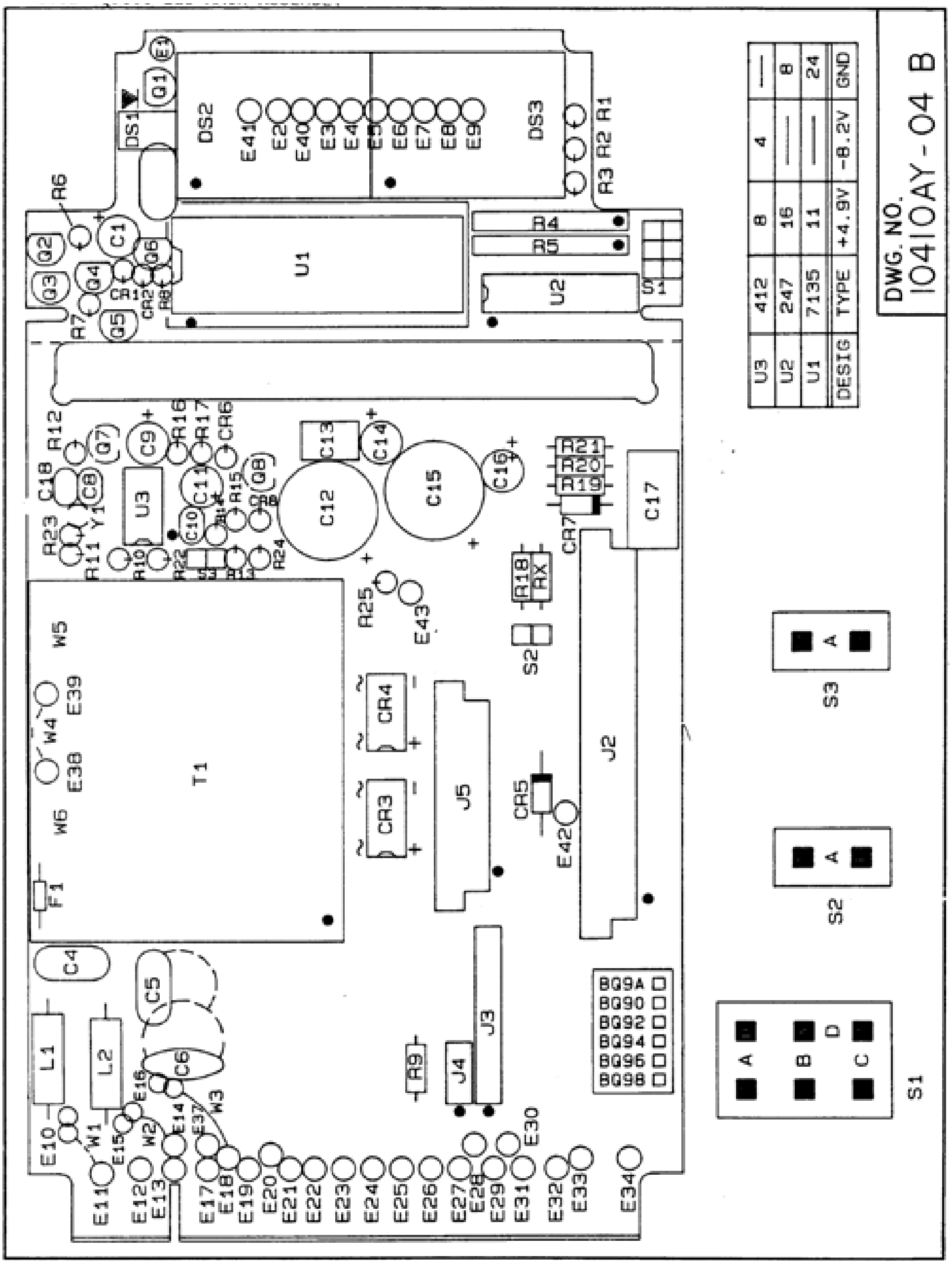
NOTE: Dimensions in Millimeters (Inches)



REAR VIEW

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

16.2 4 DIGIT LED MAIN ASSEMBLY



NOTES

17.0 17.0 SPECIFICATIONS: BSCF TRUE-RMS VOLTAGE - BSCF/G TRUE RMS CURRENT (_2000F, _2000G) AC RMS VOLTAGE, AC RMS CURRENT

17.1 GENERAL

The basic signal conditioner board is identified as a BSCF (_2000F or _9000F) for true-RMS voltage input. The _2000 and _9000 prefix is determined by the main assembly board used with the BSCF option board. When the BSCF board is configured differently, it is identified as a BSCF/G (_2000G or _9000G), used for ac RMS current input.

17.2 BSCF: TRUE-RMS VOLTAGE SIGNAL CONDITIONER

Five full-scale ranges are provided in the _2000F and _9000F series.

See TRUE-RMS VOLTAGE INPUT tables Section 20. The true-RMS -to-DC converter is a monolithic integrated circuit which computes the true-RMS value of complex input signals containing both AC and DC components. It converts the true-RMS values to DC outputs or inputs with a crest factor of 2:1 or less.

17.3 BSCF/G: TRUE-RMS CURRENT SIGNAL CONDITIONER

Ten current ranges are provided in this series. Special full-scale (FS) ranges for other current transformers can be provided on special order. See TRUE-RMS CURRENT INPUT tables in Section 21.

The true-RMS -to-DC converter is a monolithic integrated circuit which computes the true-RMS value of complex input signals containing both AC and DC components. It converts the RMS values to DC outputs or inputs with a minimum crest factor of 2:1 at full scale input.

17.4 _2000F & _9000F: AC VOLTAGE INPUT SPECIFICATIONS

Configuration: Single-ended, meter ground common to signal LO
Zero: Automatic

_2000F: TRUE-RMS VOLTAGE INPUT SPECS

RANGE	INPUT IMPEDANCE	RESOLUTION	FREQUENCY RANGE
0.1999 V	1.1 M ohm	0.1 mV	47Hz to 1KHz
1.999 V	1.1 M ohm	1 mV	47Hz to 1KHz
19.99 V	1 M ohm	10 mV	47Hz to 1KHz
199.9 V	1 M ohm 150.0 V for CE	100 mV	47Hz to 1KHz
650 V	10 M ohm 150 V for CE	1V	47Hz to 1KHz

Provides true-RMS accuracy for non-sinusoidal inputs with a crest factor of 2:1 or less.

_9000F TRUE-RMS VOLTAGE INPUTS

RANGE	INPUT IMPEDANCE	RESOLUTION	FREQUENCY RANGE
99.99 mV	1.1 MOhm	10 µV	47 Hz to 1 kHz
999.9 mV	1.1 MOhm	100 µV	47 Hz to 1 kHz
9.999 V	1 MOhm	1 mV	47 Hz to 1 kHz
99.99 V	1 MOhm	10 mV	47 Hz to 1 kHz
650 V	10 MOhm	100 mV	47 Hz to 1 kHz

Provides true-RMS accuracy for non-sinusoidal inputs with a crest factor of 4:1 or less at full scale.

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 (1 to 100% FS)	
_2000F	±0.25%R ±1 count
_9000F	±0.25%R ±10 counts
Reading Tempco	±0.01% R/°C
Zero Tempco	±0.1 count/°C
Warmup to rated accuracy	Less than 30 minutes

17.5 _2000G & _9000G: TRUE-RMS CURRENT INPUT SPECIFICATION

Configuration Single-ended, meter ground common to signal low

Please note:
For minimum voltage calibration, do not adjust the zero pot at 0 volts. See calibration procedure for detail information.

_2000G TRUE RMS Current Inputs

Range	Input Impedance (200 mV Shunt)	Resolution	Frequency Range
19.99 uA	10 kOhm	0.01 uA	47 Hz-1 kHz
199.9 uA	1 kOhm	0.1 uA	
1.999 mA	100 Ohm	1 uA	
19.99 mA	10 Ohm	10 uA	
199.9 mA	1 Ohm	100 uA	
1.999 A	0.1 Ohm	1 mA	
5.00 A *	0.01 Ohm	2.5 mA	
19.99 A	5 A CT	10 mA	
199.9 A	5 A CT	100 mA	
1999 A	5 A CT	1 A	

Provides true RMS accuracy for non-sinusoidal inputs with a crest factor of 2:1 or less.
* 50 mV shunt for a 5 A current transformer input.

_2000G SPECIAL FULL-SCALE COUNTS (50 mV or 5 A FULL-SCALE)

COUNT RANGE	R15 (1%)	COUNT RANGE	R15 (1%)
1900 to 2100	-	525 to 575	15.4 kOHm
1720 to1900	523 kOHm	475 to 525	13.3 kOHm
1560 to 1720	215 kOHm	435 to 475	11.8 kOHm
1415 to 1560	130 kOHm	390 to 435	10.5 kOHm
1285 to 1415	93.1 kOHm	355 to 390	8.87 kOHm
1165 to 1285	69.8 kOHm	325 to 355	7.87 kOHm
1055 to 1165	53.6 kOHm	295 to 325	6.98 kOHm
955 to 1055	47.5 kOHm	270 to 295	6.04 kOHm
860 to 955	38.3 kOHm	250 to 270	5.49 kOHm
775 to 860	29.4 kOHm	230 to 250	4.87 kOHm
700 to 775	24.3 kOHm	210 to 230	4.42 kOHm
635 to 700	20.5 kOHm	190 to 210	3.83 kOHm
575 to 635	18.2 kOHm		

Q9000G TRUE RMS CURRENT INPUTS

Range	Input Impedance (100 mV Shunt)	Resolution	Frequency Range
9.999 uA	10 kOhm	1 nA	47 Hz-1 kHz
99.99 uA	1 kOhm	10 nA	
999.9 uA	100 Ohm	100 nA	
9.999 mA	10 Ohm	1 uA	
99.99 mA	1 Ohm	10 uA	
0.999 A	0.1 Ohm	100 uA	
5.00 A *	0.01 Ohm	500 uA	
9.999 A	5 A CT	1 mA	
99.99 A	5 A CT	10 mA	
999.9 A	5 A CT	100 mA	

Provides true RMS accuracy for non-sinusoidal inputs with a crest factor of 4:1 or less.
* 50mV shunt for 5 A current transformer input with main board reference of 2V (from RV2 on main board

Q9000G SPECIAL FULL-SCALE COUNTS (5 A FULL-SCALE)

COUNT RANGE	R15 (1%)	COUNT RANGE	R15 (1%)
9500 to 10500	-	2625 to 2875	15.4 kOHm
8600 to 9500	523 kOHm	2375 to 2625	13.3 kOHm
7800 to 8600	215 kOHm	2175 to 2375	11.8 kOHm
7075 to 7800	130 kOHm	1950 to 2175	10.5 kOHm
6425 to 7025	93.1 kOHm	1775 to 1950	8.87 kOHm
5825 to 6425	69.8 kOHm	1625 to 1775	7.87 kOHm
5275 to 5825	53.6 kOHm	1475 to 1625	6.98 kOHm
4775 to 5275	47.5 kOHm	1350 to 1475	6.04 kOHm
4300 to 4775	38.3 kOHm	1250 to 1350	5.49 kOHm
3875 to 4300	29.4 kOHm	1150 to 1250	4.87 kOHm
3500 to 3875	24.3 kOHm	1050 to 1150	4.42 kOHm
3175 to 3500	20.5 kOHm	950 to 1050	3.83 kOHm
2875 to 3175	18.2 kOHm		

Common Mode	
Analog ground to ac power ground	
CMR @ dc to 60 Hz	120 dB
CMR @ dc to 60 Hz	±1500 Vp per HV test
	±354 Vp per IEC spacing
Accuracy @ 25°C	
Maximum Error	
(1 to 100% of FS)	
_2000G	±0.25% R ±1 count
_9000G	±0.25% R ±10 counts
Reading Tempco	±0.01% R/°C
Zero Tempco	±0.1 count/°C
Warmup to rated accuracy	30 minute

18.0 SIGNAL INPUT CONNECTIONS (TB1) (SEE FIGURE 5)

18.1 The signal input connections for the BSCF (_2000F) AC RMS Voltage Signal Conditioner are made at the standard 3-terminal barrier strip:

Terminal Connection	Signal	Input
4	Signal HI (dc coupled)	
5	Signal LO	AC
6	Signal HI (ac coupled)	Coupled

Terminal Connection	Signal	Input
4	Signal HI (dc coupled)	DC
5	Signal LO	Coupled
6	Signal HI (ac coupled)	

18.2 The signal input connections for the _2000G and _9000G true RMS Current Signal Conditioner are made at the standard 3-termianl barrier strip:

Terminal Connection	Signal	Input
4	Signal HI (dc coupled)	
5	Signal LO	AC
6	Signal HI (ac coupled)	Coupled

Terminal Connection	Signal	Input
4	Signal HI (dc coupled)	DC *
5	Signal LO	Coupled
6	Signal HI (ac coupled)	

* Terminals 4 & 6 must be connected. An alternate method is to replace **R2** on the signal conditioner barrier board with a wire.

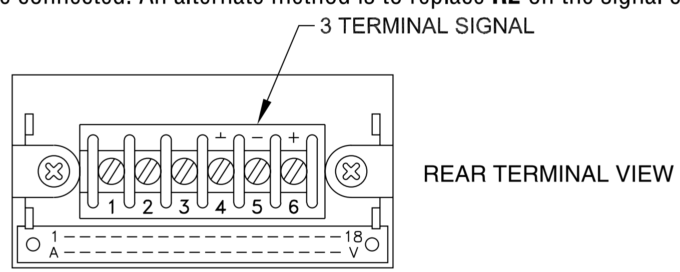


FIGURE 5. SIGNAL INPUT CONNECTIONS

19.0 TESTS & DIAGNOSTICS

The signal conditioner board BSCF 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 BSCF signal conditioner.

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

Note: If using Main Assembly _2000, refer to Section BQ20/BQ29.
If using Main Assembly _9000 refert to Section BQ90/BQ98

Inspect the panel meter for physical damage. If damage is apparent, resolve the damage with the shipper or your supplier. Save all packing materials.

19.1 FUNCTIONAL ELECTRICAL TESTING

NOTE: Perform this test after your meter has been configured.

1. Short terminals 4, 5, and 6 on barrier strip (TB1).

2. Apply proper power for your configuration to terminals 1, 2 and 3 on barrier strip (TB1). Display will read approximately zero (0000).

20.0 CONFIGURATION PROCEDURES

20.1 GENERAL

This procedure is used to determine the configuration of the true RMS voltage (BSCF) or true RMS current (BSCF/G).

The unit can be configured using the push-on jumpers provided separately or already positioned on the pin forests. Pin forest designations are shown at the top of every page of configuration.

20.2 GLOSSARY

The chart below explains various terms which appear throughout the following procedure:

Voltage Range

Selection	RMS Input Range
FVR1/F1	Voltage Range (0/50 mV RMS Input) (_2000 only)
FVR2/F2	Voltage Range (0/200 mV RMS Input)
FVR3/F3	Voltage Range (0/2 V RMS Input)
FVR4/F4	Voltage Range (0/20 V RMS Input)
FVR5/F5	Voltage Range (0/200 V RMS Input) (0/150 V for CE)
FVR6/F6	Voltage Range (0/650 V RMS Input) (0/150 V for CE)

Current Range

Selection	RMS Input Range
GCR1/G1	Current Range (0/20 uA RMS Input)
GCR2/G2	Current Range (0/200 uA RMS Input)
GCR3/G3	Current Range (0/2 mA RMS Input)
GCR4/G4	Current Range (0/20 mA RMS Input)
GCR5/G5	Current Range (0/200 mA RMS Input)
GCR6/G6	Current Range (0/2 A RMS Input)
GCR7/G7	Current Range (0/5 A RMS Input)

Abbr	Definition
V1	Largest Input Voltage
I1	Largest Input Current

20.3 SELECTION

If the Input is:

Voltage; then go to Section 20.3.1
Current; then go to Section 20.3.2

20.3.1 Input Voltage Range Selection (FVR/F 1, 2 ,3, 4, 5, 6)

Specify the magnitude of the largest input voltage:
V1 = ______________ Volts
Select the required range where V1 is equal to or less than the limit of that range.

FVR1/F1 = 50 mV RMS
FVR2/F2 = 200 mV RMS
FVR3/F3 = 2 V RMS
FVR4/F4 = 20 V RMS
FVR5/F5 = 200 V RMS
FVR6/F6 = 650 V RMS
FVR/F = ______________
Proceed to Installation (Section 20.4)

20.3.2 Input Current Range Selection (GCR/G 1, 2 ,3, 4, 5, 6, 7)

Specify the magnitude of the largest input current:
I1 = ______________ mA
Select the required current range where I1 is equal to or less than the limit of that range.

GCR1/G1 = 20 uA RMS	GCR4/G4 = 20 mA RMS
GCR2/G2 = 200 uA RMS	GCR5/G5 = 200 mA RMS
GCR3/G3 = 2 mA RMS	GCR6/G6 = 2 A RMS
	GCR7/G7 = 5 A RMS

GCR/G = __________________

Based on the current range selected pick a shunt resistor (R1) from the following:

GCR1/G1 = 10 kOhm, 1%, 1/8W, MF (P/N 8211002)
GCR2/G2 = 1 kOhm, 1%, 1/8W, MF (P/N 8211001)
GCR3/G3 = 100 Ohm, 1%, 1/8W, MF (P/N 8211009)
GCR4/G4 = 10 Ohm, 1%, 1/8W, MF (P/N 8211008)
GCR5/G5 = 1.0 Ohm, 1%, 1/8W, WW (P/N 8710006)
GCR6/G6 = 0.1 Ohm, 1%, 1/2W, WW (P/N 8910005)
GCR7/G7 = 0.01 Ohm, 1%, 2W, WW (P/N 8910004)

Proceed to Installation (Section 20.4)

20.4 INSTALLATION

20.4.1 GENERAL

Select the Voltage Range (FVR1-6/F1-6), or Current Range (GCR1-7/G1-7), required and install the push-on jumpers per Section 21.1 and 21.2, depending upon which range is required.

20.4.2 REFERENCE VOLTAGE(_9000F OR _9000G ONLY)

Select the Voltage Range RV1 by installing push-on jumper A as per Subsection 13.3 in Main Assembly Section BQ90/BQ98.

Note: Select the RV2 reference if using the GCR7 range. Remove any jumpers in the S3 position as per Subsection 13.3.

20.4.2 CURRENT

If a Current Range (GCR1-7/G1-7) is selected, you must install the shunt resistor (R1) chosen. Install the shunt resistor (R1) per Section 21.2

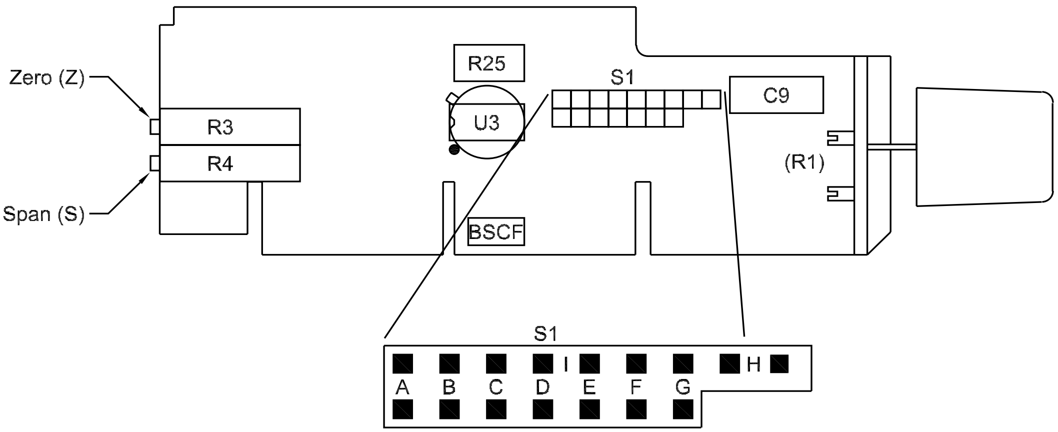
20.4.3 DECIMAL POINT

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

NOTE: If using Main Assembly _2000, refer to Section _20/_29.
If using Main Assembly _9000, refer to Section _20/_98

21.0 CONFIGURATION CHARTS

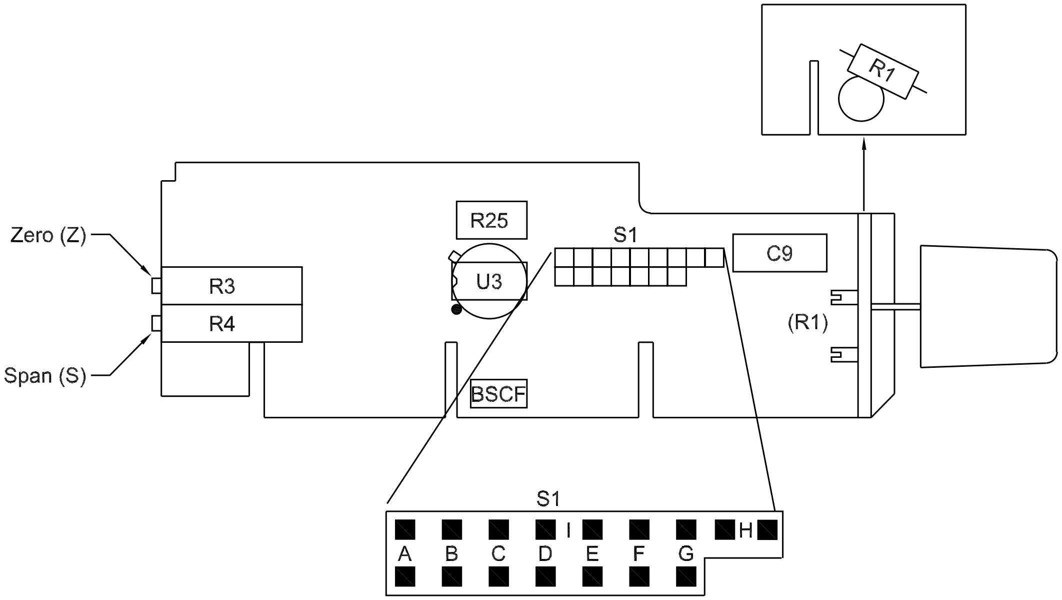
21.1 INPUT VOLTAGE (F1, 2, 3, 4, 5, 6) (FVR1, 2, 3, 4, 5, 6)



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

Input Voltage Configuration		S1					Used On
FVR1/F1	50 mV	F	G	H	I	-	_2000F/_9000F
FVR2/F2	200 mV	A	B	F	H	G	_2000F/_9000F
FVR3/F3	2 V	A	B	E	H	G	_2000F/_9000F
FVR4/F4	20 V	A	B	C	H	G	_2000F/_9000F
FVR5/F5	200V(150V Max for CE)	A	B	D	H	G	_2000F/_9000F
FVR6/F6	650V(150V Max for CE)	A	B	D	-	-	_2000F/_9000F

21.2 INPUT CURRENT(G1, 2, 3, 4, 5, 6, 7) (GCR1, 2, 3, 4, 5, 6, 7)



Step 1:	Remove all push-on jumpers not used in the desired configuration(s).							
Step 2:	Select the desired configuration from the chart below, and install the push-on jumpers indicated.							
Input Current Configuration		S1					R1	Used On
GCR1/G1	20 uA Input	A	B	F	H	G	10 kOhm	_2000G/_9000G
GCR2/G2	200 uA Input	A	B	F	H	G	1 kOhm	_2000G/_9000G
GCR3/G3	2 mA Input	A	B	F	H	G	100 Ohm	_2000G/_9000G
GCR4/G4	20 mA Input	A	B	F	H	G	10 Ohm	_2000G/_9000G
GCR5/G5	200 mA Input	A	B	F	H	G	1.0 Ohm	_2000G/_9000G
GCR6/G6	2 A Input	A	B	F	H	G	0.1 Ohm	_2000G/_9000G
GCR7/G7	5 A Input	-	F	H	G	I	0.01 Ohm	_2000G/_9000G

22.0 CALIBRATION _2000 F/G

Define the input for full scale (Span pot) and zero (Zero pot) and apply to the calibration procedures at the bottom of the page.

22.1 VOLTAGE RANGES (FVR1-6/F1-6)

For FVR1-5/F1-5: Full Scale = 2000 counts 1% FS = 20 counts

NOTE: Full Scale for FVR6/F6 is 650 V. Adjust the S pot to display a reading of 650 and Z pot to read 20.

22.2 CURRENT RANGES (GCR1-7/G1-7)

Full Scale = 2000 counts 1% FS = 20 counts

23.0 CALIBRATION _9000 F/G

Define the input for full scale (Span pot) and zero (Zero pot) and apply to the calibration procedures at the bottom of the page.

23.1 VOLTAGE RANGES (FVR1-6/F1-6)

Full Scale = 10000 counts 1% FS = 100 counts

NOTE: Full Scale for FVR6/F6 is 650 V. Adjust the S pot to display a reading of 650.0 and Z pot to read 10.0 .

23.2 CURRENT RANGES (GCR1-7/G1-7)

Full Scale = 10000 counts 1% FS = 100 counts

22.3 CALIBRATION PROCEDURES FOR _2000 AND _9000

1. Apply an input equal to 1% of full scale (FS)

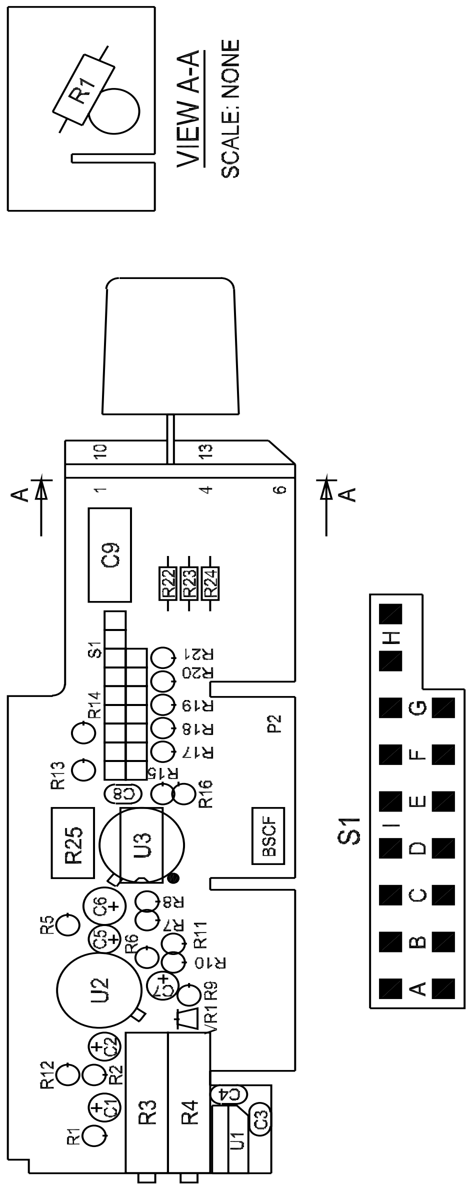
2. Null the input amplifier. Adjust the zero (Z) pot, R3 clockwise or counter-clockwise for a minimum reading on the display. The point where the digits reverse order (lower to higher) will be the null.

3. After adjusting the null, **slowly** adjust the internal zero-width (R25) pot to display the proper reading (1% of full scale).

4. Apply an input signal equal to 95% of the high end of the range selected and adjust the span pot (S), R4, for the proper reading (95% of full scale).

5. Repeat steps above as required for best overall linearity.

24.0 BSCF ASSEMBLY DIAGRAM



CURRENT RANGE CONFIGURATION		S1					R1
CR1	20µA INPUT	F	B	F	G	H	10KΩ
CR2	200µA INPUT	A	B	F	G	H	1KΩ
CR3	2MA INPUT	A	B	F	G	H	100Ω
CR4	20MA INPUT	A	B	F	G	H	10Ω
CR5	200MA INPUT	A	B	F	G	H	1Ω
CR6	2A INPUT	A	B	F	G	H	0.1Ω
CR7	5A INPUT	A	F	G	H	I	0.01Ω

VOLTAGE RANGE CONFIGURATION		S1					
VR1	50MV INPUT	A	F	G	H	I	
VR2	200MV INPUT	A	B	F	G	H	
VR3	2V INPUT	A	B	E	G	H	
VR4	20V INPUT	A	B	C	G	H	
VR5	200V INPUT	A	B	D	G	H	150 V Max for CE
VR6	2KV INPUT	A	B	D	—	—	150 V Max for CE
DC1	DIRECT COUPLED	—	A	—	—	—	

DRAWING NO.
10282AY-03 E

Assembly Diagram Used on Signal Conditioner Board BSCF (_2000F & _2000G)

25.0 DIGITAL PANEL METER INSTALLATION INSTRUCTIONS

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.

Power requirement (Section 25.3)

Analog output (see Analog Output Manual)

Control output (see Controller/ Interface Manual)

Signal input (Section 26.0)

Model prefix

Model Number __2 ___ ___ ___ ___

Model Number __9 ___ ___ ___ ___

25.1 UNPACKING & INSPECTION

Your 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.

25.2 MECHANICAL INSTALLATION

Insure that the panel cutout dimensions are as shown on Figure 6.

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.

Loosen two clamp screws on the rear of the case enough to rotate the two slide clamps.

Slide the two slide retainers toward the rear of the case and remove them.

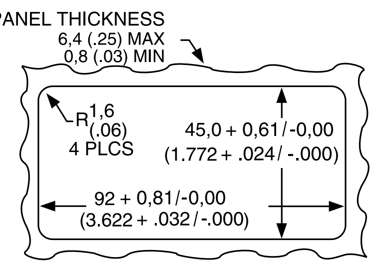
From the front of the panel, insert the meter into the panel cutout.

Slide the slide retainers back into the case and push up tightly against the rear of the case.

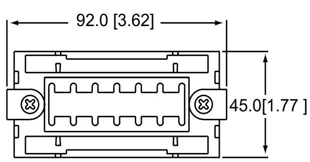
Rotate the slide clamps back into their original position and tighten enough to hold the case in place. Overtightening can break the clamps.

Install the lower printed circuit board edge connector, if supplied, by pushing it on to the printed circuit board connections. Install the upper printed circuit board edge connector, if used.

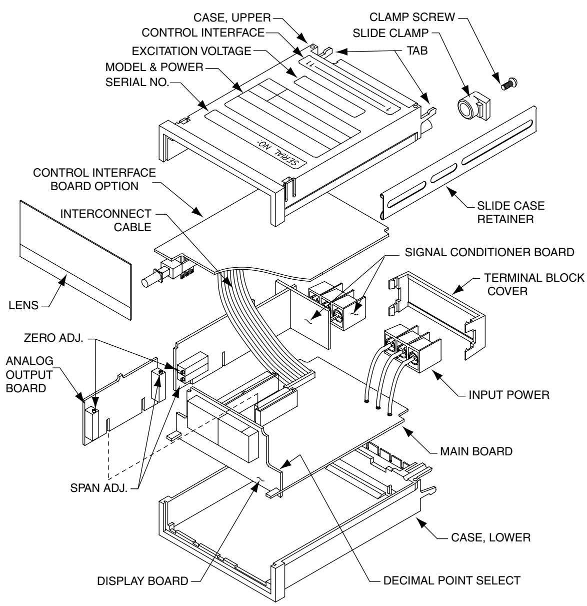
Figure 6 Panel Cutout Dimensions & Installation



NOTE: Dimensions in Millimeters (Inches)
PANEL CUTOUT



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

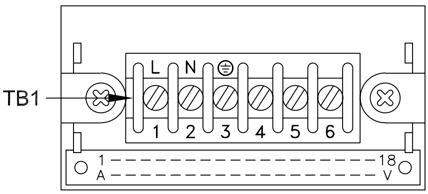


25.3 POWER REQUIREMENTS & CONNECTIONS (TB1)

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

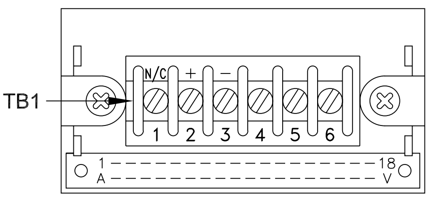
Models	Power Requirements
_20XXX, _21XXX, _90XXX	120 V ac (50-60 Hz)
_22XXX, _23XXX, _92XXX	240 V ac (50-60 Hz)
_24XXX, _25XXX, _94XXX	9-32 V dc
_26XXX, _27XXX, _96XXX	5 V dc
_28XXX, _29XXX, _98XXX	24 V ac (50-60 Hz)

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



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

REAR TERMINAL VIEW



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

26.0 SIGNAL INPUT CONNECTIONS (TB1)

26.1 The signal input connections for the BSCF (_2XXXF) AC RMS Voltage Signal Conditioner are made at the standard 3-terminal barrier strip:

Terminal Connection	Signal	Input
4	Signal HI (dc coupled)	
5	Signal LO	AC
6	Signal HI (ac coupled)	Coupled

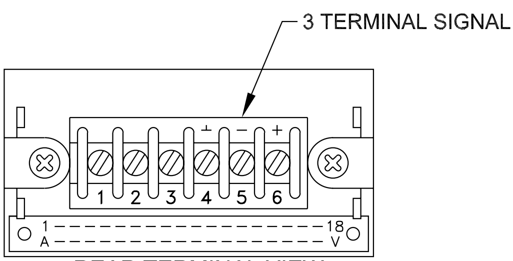
Terminal Connection	Signal	Input
4	Signal HI (dc coupled)	DC
5	Signal LO	Coupled
6	Signal HI (ac coupled)	

26.2 The signal input connections for the _2XXXG AC RMS Current Signal Conditioner are made at the standard 3-termianl barrier strip:

Terminal Connection	Signal	Input
4	Signal HI (dc coupled)	
5	Signal LO	AC
6	Signal HI (ac coupled)	Coupled

Terminal Connection	Signal	Input
4	Signal HI (dc coupled)	DC *
5	Signal LO	Coupled
6	Signal HI (ac coupled)	

* Terminals 4 & 6 must be connected. An alternate method is to replace **R2** on the signal conditioner barrier board with a wire.



REAR TERMINAL VIEW

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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