QUANTA®

Type T Thermocouple
Digital Panel Meter
QXXXXXT

Operator’s Manual
### Additional products from NEWPORT Electronics, Inc.

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**For Immediate Assistance**

In the U.S.A. and Canada: 1-800-NEWPORT®

In Mexico: (95) 800-NEWPORT™

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http://www.newportUS.com

**Internet e-mail**

info@newportUS.com

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

The information contained in this document is believed to be correct but NEWPORT Electronics, Inc. accepts no liability for any errors it contains, and reserves the right to alter specifications without notice. **WARNING:** These products are not designed for use in, and should not be used for, patient connected applications.

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

Information that is especially important to note is identified by three labels:

- NOTE
- WARNING
- CAUTION
- IMPORTANT

NOTE: provides you with information that is important to successfully setup and use.

CAUTION or WARNING: tells you about the risk of electric shock.

CAUTION, WARNING or IMPORTANT: tells you of circumstances or practices that can effect the meter’s functionality and must refer to accompanying documents.

1.0 MAIN ASSEMBLY Q2000 SPECIFICATIONS

1.1 GENERAL

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

The following table identifies the main assembly types:

<table>
<thead>
<tr>
<th>Display Type</th>
<th>120 V ac</th>
<th>240 V ac</th>
<th>9-32 Vdc</th>
<th>5 V dc</th>
<th>24 V ac</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED</td>
<td>BQ20</td>
<td>BQ22</td>
<td>BQ24</td>
<td>BQ26</td>
<td>BQ28</td>
</tr>
<tr>
<td>LCD</td>
<td>BQ21</td>
<td>BQ23</td>
<td>BQ25</td>
<td>BQ27</td>
<td>BQ29</td>
</tr>
</tbody>
</table>

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).
<table>
<thead>
<tr>
<th>Configured Model</th>
<th>Module No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q 2 9</td>
<td>BQ2X BQ9X</td>
</tr>
</tbody>
</table>

### Display Resolution
- ±1999 counts (3 1/2 digits)
- ±9999 counts (4 digits)

### Display Type & Meter Power
(LCD is only available on Q2000 models)
- LED, 120 V ac (50/60 Hz)
- LCD, 120 V ac (50/60 Hz)
- LED, 240 V ac (50/60 Hz)
- LCD, 240 V ac (50/60 Hz)
- LED, 9-32 V dc (isolated)
- LCD, 9-32 V dc (isolated)
- LED, 5 V dc
- LCD, 5 V dc
- LED, 24 V ac
- LCD, 24 V ac
- LED, 26-56 V dc (isolated)
- LCD, 26-56 V dc (isolated)

### Analog Outputs
- ±1 or ±2 V (standard, all models)
- 0-5 V dc
- 0-10 V dc
- 0-1 mA, source or sink
- 4-20 mA, source or sink
- 4-20 mA, sink (high-compliance)

### Control Outputs
- None
- Dual-setpoint 10 A relays
- Proportional 4-20 mA control, source or sink, plus drive for time-proportional solid-state relay
- Proportional 4-20 mA control, source or sink, plus time-proportional solid-state 2 A relay
- Parallel BCD (isolated)
- Single-setpoint 10 A relay

### Signal-Conditioner Inputs
- DC voltage
- DC current
- AC voltage
- AC current
- True RMS voltage
- True RMS current
- Frequency/rate
- Type J thermocouple (°C or °F)
- Type K thermocouple (°C or °F)
- Type T thermocouple (°C or °F)
- RTD, normal resolution (°C or °F)
- RTD, high resolution (°C or °F)
- 3-wire ratio (potentiometer)
- 2- or 4-wire resistance
- Process signal (e.g., 4-20 mA, 1-5 V)
- Process signal plus excitation
- Strain gauge/low-level input
- Prototyping
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 to 60°C
Storage Temperature: -40 to 85°C
Humidity: To 95% RH, non-condensing, 0 to 40°C

1.6 MECHANICAL

Case Material: UL-rated 94V-0, polycarbonate
Weight: 0.57 kg (with interface board)
2.0 MECHANICAL ASSEMBLY & INSTALLATION

2.1 PANEL MOUNTING PROCEDURE (SEE FIGURE 1)

1. Remove the main board edge connector (J1), if installed.
2. Remove the interface board connector (J2), if installed.
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 any connectors removed.

2.2 LABELS (SEE FIGURE 2)

NOTE: READ LABELS FROM THE REAR

FIGURE 2. LABEL PLACEMENT
3.0 POWER & SIGNAL INPUT CONNECTIONS

WARNING: Incorrect power input can damage your QUANTA PANEL METER

3.1 POWER CONNECTIONS

<table>
<thead>
<tr>
<th>Terminal Connection</th>
<th>AC Versions</th>
<th>Wire Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AC power HI</td>
<td>Black</td>
</tr>
<tr>
<td>2</td>
<td>AC power LO (neutral)</td>
<td>White</td>
</tr>
<tr>
<td>3</td>
<td>AC power GND</td>
<td>Green</td>
</tr>
</tbody>
</table>

REAR TERMINAL VIEW

<table>
<thead>
<tr>
<th>Terminal Connection</th>
<th>DC Versions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No connection</td>
</tr>
<tr>
<td>2</td>
<td>DC power +</td>
</tr>
<tr>
<td>3</td>
<td>DC power - (return)</td>
</tr>
</tbody>
</table>

3.2 SIGNAL INPUT CONNECTIONS

<table>
<thead>
<tr>
<th>Terminal Connection</th>
<th>6 Terminal Versions Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Analog GND</td>
</tr>
<tr>
<td>5</td>
<td>Signal LO</td>
</tr>
<tr>
<td>6</td>
<td>Signal HI</td>
</tr>
</tbody>
</table>

REAR TERMINAL VIEW

<table>
<thead>
<tr>
<th>Terminal Connection</th>
<th>7 Terminal Versions Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>-E (Excitation return)</td>
</tr>
<tr>
<td>5</td>
<td>-S (Signal LO input)</td>
</tr>
<tr>
<td>6</td>
<td>+S (Signal HI input)</td>
</tr>
<tr>
<td>7</td>
<td>+E (Excitation output)</td>
</tr>
</tbody>
</table>
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 QUANTA Q2XXX Display and power options (BQ20 through BQ29).

The main assembly 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.
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, then install the push-on jumpers indicated.

<table>
<thead>
<tr>
<th>Decimal Point Selection</th>
<th>S1</th>
<th>Alternate Decimal Point Selection Using Main Assembly Board (J1) Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decimal Point (1.999)</td>
<td>A</td>
<td>Connect J1-K/9 to J1-6</td>
</tr>
<tr>
<td>Decimal Point (19.99)</td>
<td>B</td>
<td>Connect J1-J/8 to J1-6</td>
</tr>
<tr>
<td>Decimal Point (199.9)</td>
<td>C</td>
<td>Connect J1-H/7 to J1-6</td>
</tr>
<tr>
<td>No Decimal Point (1999)</td>
<td>D</td>
<td>No Connection</td>
</tr>
</tbody>
</table>
Step 1: Check your QUANTA part number for a zero (0) in the following position; Q2XX0X. 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.

<table>
<thead>
<tr>
<th>Interface Board Signal Configuration</th>
<th>S2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Board Signal Bypass</td>
<td>A</td>
</tr>
</tbody>
</table>
6.0 TESTS & DIAGNOSTICS

6.1 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.

6.2 SIGNAL INPUT REQUIREMENTS

Signal input requirements for your configuration are identified in the signal conditioner section of this manual.
# MAIN BOARD CONNECTOR PINOUTS (J1)
(Left to right, looking at rear of case)

| Connection | Function                  | 40 kHz | Analog power | + Polarity sign | LED version only | Integrator output | Use with pin 6 | Use with pin 6 | Use with pin 6 | Use with pin M/11 | Analog & digital power | Standard 1 mV/count | Used with H & S options | Used with analog option | Used with analog option | Unregulated power | Used with S option | + Excitation sense |
|------------|---------------------------|--------|--------------|-----------------|------------------|------------------|----------------|----------------|----------------|-----------------------|------------------------|-----------------------|------------------------|------------------------|------------------------|---------------------|---------------------|
| A - 1      | Spare                     |        |              |                 |                  |                  |                |                |                |                      |                       |                      |                       |                        |                        |                      |
| B 2        | Oscillator                |        |              |                 |                  |                  |                |                |                |                      |                       |                      |                       |                        |                        |                      |
| C - 3      | Spare                     |        |              |                 |                  |                  |                |                |                |                      |                       |                      |                       |                        |                        |                      |
| D 4        | + Pol (sign)              | + Polarity sign | LED version only |                  |                  |                  |                |                |                |                      |                       |                      |                       |                        |                        |                      |
| E - 5      | Spare                     |        |              |                 |                  |                  |                |                |                |                      |                       |                      |                       |                        |                        |                      |
| F 6        | Buffer                    |        |              |                 |                  |                  |                |                |                |                      |                       |                      |                       |                        |                        |                      |
| H - 7      | Digital Ground            |        |              |                 |                  |                  |                |                |                |                      |                       |                      |                       |                        |                        |                      |
| J - 8      | 199.9 (Decimal point)     |        |              |                 |                  |                  |                |                |                |                      |                       |                      |                       |                        |                        |                      |
| K - 9      | 19.99 (Decimal point)     |        |              |                 |                  |                  |                |                |                |                      |                       |                      |                       |                        |                        |                      |
| L - 10     | Test (LED version only)   |        |              |                 |                  |                  |                |                |                |                      |                       |                      |                       |                        |                        |                      |
| M - 11     | +5 V dc                   |        |              |                 |                  |                  |                |                |                |                      |                       |                      |                       |                        |                        |                      |
| N - 12     | Analog output             |        |              |                 |                  |                  |                |                |                |                      |                       |                      |                       |                        |                        |                      |
| P - 13     | Spare                     |        |              |                 |                  |                  |                |                |                |                      |                       |                      |                       |                        |                        |                      |
| Q - 14     | Spare                     |        |              |                 |                  |                  |                |                |                |                      |                       |                      |                       |                        |                        |                      |
| R - 15     | Analog Ground             |        |              |                 |                  |                  |                |                |                |                      |                       |                      |                       |                        |                        |                      |
| S - 16     | Analog Option - Return    |        |              |                 |                  |                  |                |                |                |                      |                       |                      |                       |                        |                        |                      |
| T - 17     | Analog Option - Out       |        |              |                 |                  |                  |                |                |                |                      |                       |                      |                       |                        |                        |                      |
| U - 18     | Spare                     |        |              |                 |                  |                  |                |                |                |                      |                       |                      |                       |                        |                        |                      |

- Indicates common pin. 50 mA maximum power available from all internal sources.
### PANEL THICKNESS:

- 0.25 [6.4] MAX
- 0.03 [0.8] MIN

**TERMINAL BLOCK COVER**

**CLAMP RING**

**SLIDE RETAINER**

**CASE**

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

**Terminal block cover and bezel not shown for clarity. Clamp rings rotated and slide retainers removed as shown for installation.**
9.0 MAIN ASSEMBLY Q9000 SPECIFICATIONS

9.1 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:

<table>
<thead>
<tr>
<th>Display Type</th>
<th>120 V ac</th>
<th>240 V ac</th>
<th>9-32 V dc</th>
<th>5 V ac</th>
<th>24 V ac</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED</td>
<td>BQ90</td>
<td>BQ92</td>
<td>BQ94</td>
<td>BQ96</td>
<td>BQ98</td>
</tr>
</tbody>
</table>

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).
9.2 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

9.3 DISPLAY
LED: 14.2 mm (0.56 in), 7-segment light emitting diode
Lens color: Red
Range: 0 to ±9999, digits flash form 10K-20K counts
Overload Indication: Four digits flash zeros 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 Temp. (Ambient): 0 to 60°C
Storage Temp.: -40 to 85°C
Humidity: To 95% RH, non-condensing, 0-40°C

9.6 MECHANICAL
Case Material: UL-rated 94V-0, polycarbonate
Weight: 0.57 kg (with interface board)
10.0 MECHANICAL ASSEMBLY & INSTALLATION

10.1 PANEL MOUNTING PROCEDURE (SEE FIGURE 3)

1. Remove the main board edge connector (J1), if installed.
2. Remove the interface board connector (J2), if installed.
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 any connectors removed.

10.2 LABELS (SEE FIGURE 4)

NOTE: READ LABELS FROM THE REAR

FIGURE 4. LABEL PLACEMENT
WARNING: Incorrect power input can damage your QUANTA PANEL METER.

11.1 POWER CONNECTIONS

<table>
<thead>
<tr>
<th>Terminal Connection</th>
<th>AC Versions</th>
<th>Wire Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AC power HI</td>
<td>Black</td>
</tr>
<tr>
<td>2</td>
<td>AC power LO (neutral)</td>
<td>White</td>
</tr>
<tr>
<td>3</td>
<td>AC power GND</td>
<td>Green</td>
</tr>
</tbody>
</table>

REAR TERMINAL VIEW

11.2 SIGNAL INPUT CONNECTIONS

<table>
<thead>
<tr>
<th>Terminal Connection</th>
<th>DC Versions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No connection</td>
</tr>
<tr>
<td>2</td>
<td>DC power +</td>
</tr>
<tr>
<td>3</td>
<td>DC power - (return)</td>
</tr>
</tbody>
</table>

REAR TERMINAL VIEW

<table>
<thead>
<tr>
<th>Terminal Connection</th>
<th>6 Terminal Versions</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Analog GND</td>
</tr>
<tr>
<td>5</td>
<td>Signal LO</td>
</tr>
<tr>
<td>6</td>
<td>Signal HI</td>
</tr>
</tbody>
</table>

REAR TERMINAL VIEW

<table>
<thead>
<tr>
<th>Terminal Connection</th>
<th>7 Terminal Versions</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>-E (Excitation return)</td>
</tr>
<tr>
<td>5</td>
<td>-S (Signal LO input)</td>
</tr>
<tr>
<td>6</td>
<td>+S (Signal HI input)</td>
</tr>
<tr>
<td>7</td>
<td>+E (Excitation output)</td>
</tr>
</tbody>
</table>
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 QUANTA Q9XXXX display and power options (BQ90 through BQ98).

The main assembly 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

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.

<table>
<thead>
<tr>
<th>Decimal Point Selection</th>
<th>S1</th>
<th>Alternate Decimal Point Selection Using Main Assembly Board (J1) Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decimal Point (9.999)</td>
<td>A</td>
<td>Connect J1-K/9 to J1-6</td>
</tr>
<tr>
<td>Decimal Point (99.99)</td>
<td>B</td>
<td>Connect J1-J/8 to J1-6</td>
</tr>
<tr>
<td>Decimal Point (999.9)</td>
<td>C</td>
<td>Connect J1-H/7 to J1-6</td>
</tr>
<tr>
<td>No Decimal Point (9999)</td>
<td>D</td>
<td>No connection</td>
</tr>
</tbody>
</table>
Step 1: Check your QUANTA part number for a zero (0) in the following position: 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.

<table>
<thead>
<tr>
<th>Interface Board Signal Configuration</th>
<th>S2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Board Signal Bypass</td>
<td>A</td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>Reference Voltage Configuration</th>
<th>S3</th>
</tr>
</thead>
<tbody>
<tr>
<td>RV1</td>
<td>1 Volt</td>
</tr>
<tr>
<td>RV2</td>
<td>2 Volts</td>
</tr>
</tbody>
</table>
14.0 TESTS & DIAGNOSTICS

14.1 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.

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)

<table>
<thead>
<tr>
<th>Connection</th>
<th>Function</th>
</tr>
</thead>
</table>
| A - 1      | Oscillator 100 kHz  
| B 2        | -8.2 V dc  
| C - 3      | Spare  
| D 4        | + Pol (sign)  
| E 5        | HOLD  
| F 6        | Analog power  
| H - 7      | Digital Ground  
| J - 8      | XXX.X (Decimal point)  
| K - 9      | XX.XX (Decimal point)  
| L - 10     | X.XXX (Decimal point)  
| M - 11     | TEST  
| N - 12     | +5 V dc  
| P 13       | Analog output  
| R 14       | Spare  
| S - 15     | Used with H & S options  
| T - 16     | - Excitation sense  
| U 17       | Used with analog option  
| V - 18     | +30 V dc  
| -          | + Excitation sense  

**Indicates common pin**:  
50 mA maximum power available from all internal sources.

**Diagram**: REAR TERMINAL VIEW
FIGURE 6. PANEL CUTOUT DIMENSIONS AND INSTALLATION

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

Terminal block cover and bezel not shown for clarity. Clamp rings rotated and slide retainers removed as shown for installation.
17.0 SPECIFICATIONS: BSCT, TYPE T THERMOCOUPLE

17.1 GENERAL

The BSCT will measure the temperature using an ANSI type "T" thermocouple. The digital display can be scaled by internal push-on jumpers for °C or °F. The basic board is identified as a BSCT (Q2000T or Q9000T). The Q2000 or Q9000 prefix is determined by the main assembly board used with the BSCT option board.

The Q2000T has a high-accuracy temperature range of -184°C to +371°C, or -300°F to +700°F. The Q2000T displays temperatures beyond this range (except beyond 1999°), but the specified accuracy is not guaranteed.

The Q9000T has a high-accuracy temperature range of -184.0°C to 371.0°C, or -300.0°F to 700.0°F. The Q9000T displays temperature beyond this range, but the specified accuracy is not guaranteed for such readings.

17.2 TEMPERATURE SENSOR (customer-supplied)

<table>
<thead>
<tr>
<th>Type</th>
<th>Thermocouple</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material</td>
<td>Copper-Constantan</td>
</tr>
<tr>
<td>Type T</td>
<td>NBS (based on IPTS-68)</td>
</tr>
<tr>
<td>Calibration</td>
<td></td>
</tr>
<tr>
<td>Lead Resistance, max</td>
<td>200 ohms</td>
</tr>
<tr>
<td>Type T</td>
<td></td>
</tr>
</tbody>
</table>

17.3 INPUT SIGNAL CONDITIONER

<table>
<thead>
<tr>
<th>Configuration</th>
<th>Single-ended (+T/C lead connected to analog ground through 10 ohms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polarity</td>
<td>Bipolar</td>
</tr>
<tr>
<td>Zero</td>
<td>Adjustable ±5°C (±10°F)</td>
</tr>
<tr>
<td>Overvoltage Protection</td>
<td>120 V RMS (continuous), 240 V RMS (30 s max)</td>
</tr>
<tr>
<td>(SIG LO to HI or SIG GND)</td>
<td></td>
</tr>
<tr>
<td>Sensor Break Detection</td>
<td></td>
</tr>
<tr>
<td>Q2000T</td>
<td>3 least-significant digits blanked</td>
</tr>
<tr>
<td>Q9000T</td>
<td>4 digits flash zeros</td>
</tr>
<tr>
<td>Sensor Break Detection Current</td>
<td></td>
</tr>
<tr>
<td>NMR at 50/60 Hz</td>
<td>70 dB</td>
</tr>
<tr>
<td>Common Mode</td>
<td></td>
</tr>
<tr>
<td>Analog ground to ac power ground</td>
<td></td>
</tr>
<tr>
<td>CMR at dc to 60 Hz</td>
<td>120 dB</td>
</tr>
<tr>
<td>CMV at dc to 60 Hz</td>
<td>±1500 Vp per HV test</td>
</tr>
<tr>
<td></td>
<td>±354 Vp per IEC spacing</td>
</tr>
<tr>
<td>Linearization</td>
<td>POLYLOG III</td>
</tr>
</tbody>
</table>
Accuracy at 25°C
OF or °C Scale Selection  By internal push-on jumpers
Reference Junction Tempco ±0.06 degree/degree
from 10°C to 40°C 0.01% R/°C
Span Tempco from 10° to 40°C Less than 15 minutes
Warmup time

Q2000T

<table>
<thead>
<tr>
<th>MODEL</th>
<th>RANGE</th>
<th>ACCURACY ±1/2 COUNT</th>
<th>RESOLUTION</th>
</tr>
</thead>
</table>
| BSCT °C | -184 to +371°C | -184 to -59°C: ±1.5% R  
               -59 to +93°C: ±1°C  
               +93 to +371°C: ±0.6% R | 1°C        |
| BSCT °F | -300 to +700°F | -300 to -75°F: ±1.5% R  
               -75 to +200°F: ±1.5°F  
               +200 to +700°F: ±0.5% R | 1°F        |

Q9000T

<table>
<thead>
<tr>
<th>MODEL</th>
<th>RANGE</th>
<th>ACCURACY ±2 COUNTS</th>
<th>RESOLUTION</th>
</tr>
</thead>
</table>
| BSCT °C | -184.0 to +371.0°C | -184 to -59°C: ±1.5% R  
               -59 to +93°C: ±1°C  
               +93 to +371°C: ±0.6% R | 0.1°C      |
| BSCT °F | -300.0 to +700.0°F | -300 to -75°F: ±1.5% R  
               -75 to +200°F: ±1.5°F  
               +200 to +700°F: ±0.5% R | 0.1°F      |
18.0 SIGNAL INPUT CONNECTIONS (TB1) (SEE FIGURE 5)

18.1 The signal input connections for the BSCT Type T, Thermocouple signal conditioner are made at the standard 3-terminal barrier strip:

<table>
<thead>
<tr>
<th>Terminal Connection</th>
<th>Signal</th>
<th>Type T Thermocouple</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Analog ground</td>
<td>• RED</td>
</tr>
<tr>
<td>5</td>
<td>- Signal LO</td>
<td>• BLUE</td>
</tr>
<tr>
<td>6</td>
<td>+ Signal HI</td>
<td></td>
</tr>
</tbody>
</table>

3 TERMINAL SIGNAL

REAR TERMINAL VIEW

FIGURE 5. SIGNAL INPUT CONNECTIONS
19.0 TESTS AND DIAGNOSTICS

- The signal conditioner board BSCT 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 BSCT signal conditioner.

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

  NOTE: If using Main Assembly Q2000, refer to Section BQ20/BQ29.
  If using Main Assembly Q9000, refer to Section BQ90/BQ98.

- Inspect the QUANTA panel meter for physical damage. If damage is apparent, resolve the damage with the shipper or your supplier.

19.1 FUNCTIONAL ELECTRICAL TESTING

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

  1. Short terminals 5 and 6 on barrier strip (TB1).
  2. Apply proper power for your configuration to terminals 1, 2 and 3 on barrier strip (TB1).
  3. Display will read approximately ambient room temperature.
20.0 CONFIGURATION PROCEDURE

20.1 GENERAL

Use this procedure to determine the configuration of the BSCT thermocouple option.

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

20.2 INSTALLATION

Select the degrees format required after calibration.

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

NOTE: If using Main Assembly Q2000, refer to Section BQ20/BQ29.
If using Main Assembly Q9000, refer to Section BQ90/BQ98.

20.2.1 Reference Voltage

Select reference RV1 by installing jumper A as per Subsection 5.3 in Main Assembly Section BQ90/BQ98.
21.0 CONFIGURATION CHART
21.1 DEGREES (TDF1, TDC1)

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.

<table>
<thead>
<tr>
<th>Degrees Configuration *</th>
<th>S1</th>
</tr>
</thead>
<tbody>
<tr>
<td>TDF1</td>
<td>B</td>
</tr>
<tr>
<td>Degrees &quot;F&quot;</td>
<td>D</td>
</tr>
<tr>
<td>TDC1</td>
<td>A</td>
</tr>
<tr>
<td>Degrees &quot;C&quot;</td>
<td>C</td>
</tr>
</tbody>
</table>

* Used on Q2000T or Q9000T
22.0 CALIBRATION

22.1 DEGREES CALIBRATION Q2000T

The following procedure is for use with a precision millivolt source connected as shown in figure below. Alternately a standard thermocouple calibrator can be used which does not require an ice bath for cold junction compensation. When using a thermocouple calibrator dial in the temperature required for each reading in the procedure. In either case, ensure that the correct thermocouple wire is used between the calibrator or cold junction, and the meter screw terminals.

NOTE: After calibration is completed, adjust the zero for each thermocouple used.

22.1.1 Calibration for 0°C

1. Install push-on jumpers S1-A and S1-C as shown in the configuration chart (Section 20.0).

2. Apply an input of 0 V and adjust R1 (zero) for a reading of 000.

3. Apply an input of +19.09 mV and adjust R2 (span) for a reading of 371.

4. Apply an input of -5.32 mV and adjust R15 for a reading of -182. Calibration for degrees Celsius is now complete.

22.1.2 Calibration for 0°F

1. Perform steps 1 through 3 in Subsection 22.1.1.

2. Remove push-on jumpers S1-A and S1-C and place the jumpers on S1-B and S1-D as shown on the configuration chart (Section 5.0).

3. Apply an input of -0.66 mV and adjust R1 (zero) for a reading of 000.

4. Apply an input of +19.09 mV and adjust R24 for reading of 700. Calibration for degrees Fahrenheit is now complete.
22.2 DEGREES CALIBRATION Q9000T

For the following procedure, use a precision millivolt source connected as shown in the figure below. Alternately, a standard thermocouple calibrator can be used which does not require an ice bath for cold junction compensation. When using a thermocouple calibrator dial in the temperature required for each reading in the procedure. In either case, ensure that the correct thermocouple wire is used between the calibrator or cold junction, and the meter screw terminals.

NOTE: After calibration is completed, adjust the zero for each thermocouple used.

22.2.1 Calibration for °C

1. Install push-on jumpers S1-A and S1-C as shown in the configuration chart (Section 20.0).

2. Apply an input of -0.02 mV and adjust R1 (zero) for a reading of 000.0.

3. Apply an input of +19.09 mV and adjust R2 (span) for a reading of 371.0.

4. Apply an input of -5.32 mV and adjust R15 for a reading of -182.0. Calibration for degrees Celsius is now complete.

22.2.2 Calibration for °F

1. Perform steps 1 through 3 in Subsection 22.2.1.

2. Remove push-on jumpers S1-A and S1-C and place the jumpers on S1-B and S1-D as shown in the configuration chart.

3. Apply an input of -0.66 mV and adjust R1 (zero) for a reading of 000.0.

4. Apply an input of +19.09 mV and adjust R24 for a reading of 700.0. Calibration for degrees Fahrenheit is now complete.
24.0 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 24.3)
::--- Analog output (see Analog Output Manual)
:::--- Control output (see Controller/Interface Manual)
:::--- Signal input (Section 25.0)

Model number Q2
Model number Q9

24.1 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.

24.2 MECHANICAL INSTALLATION

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

2. 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 connections. Install the upper printed circuit board edge connector, if used.
(TERMINAL BLOCK COVER AND BEZEL NOT SHOWN FOR CLARITY)
SLIDE CLAMPS ROTATED AND SLIDE RETAINERS REMOVED AS SHOWN FOR INSTALLATION.

PANEL THICKNESS:
0.25 [6.4] MAX
0.03 [0.8] MIN

4 PLCS

1.772 +0.024/-0.000
[45.00 +0.61/-0.00]
24.3 POWER REQUIREMENTS AND CONNECTIONS (TB1)

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

<table>
<thead>
<tr>
<th>Models</th>
<th>Power Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q20XXX, Q21XXX, Q90XXX</td>
<td>120 V ac (50-60 Hz)</td>
</tr>
<tr>
<td>Q22XXX, Q23XXX, Q92XXX</td>
<td>240 V ac (50-60 Hz)</td>
</tr>
<tr>
<td>Q24XXX, Q25XXX, Q94XXX</td>
<td>9-32 V dc</td>
</tr>
<tr>
<td>Q26XXX, Q27XXX, Q96XXX</td>
<td>5 V dc</td>
</tr>
<tr>
<td>Q28XXX, Q29XXX, Q98XXX</td>
<td>24 V ac (50-60 Hz)</td>
</tr>
</tbody>
</table>

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

**TB1 Terminal Connection**

<table>
<thead>
<tr>
<th>Connection</th>
<th>AC Operation</th>
<th>Wire Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>24 V, 120 V, 240 V</td>
<td>Black</td>
</tr>
<tr>
<td>2</td>
<td>AC power HI</td>
<td>White</td>
</tr>
<tr>
<td>3</td>
<td>AC power LO (neutral)</td>
<td>Green</td>
</tr>
</tbody>
</table>

REAR TERMINAL VIEW

**TB1 Terminal Connection**

<table>
<thead>
<tr>
<th>Connection</th>
<th>DC Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No Connection</td>
</tr>
<tr>
<td>2</td>
<td>DC power +</td>
</tr>
<tr>
<td>3</td>
<td>DC power - (return)</td>
</tr>
</tbody>
</table>
**25.0 SIGNAL INPUT CONNECTIONS (TB1)**

The signal input connections for the BSCT (Q2XXXT) Type T, thermocouple signal conditioner are made at the standard 3-terminal barrier strip:

<table>
<thead>
<tr>
<th>Terminal Connection</th>
<th>Signal</th>
<th>Type T Thermocouple</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Analog Ground</td>
<td>• Red</td>
</tr>
<tr>
<td>5</td>
<td>- Signal L0</td>
<td>• Blue</td>
</tr>
<tr>
<td>6</td>
<td>+ Signal HI</td>
<td></td>
</tr>
</tbody>
</table>

![Diagram of 3 terminal signal connections]

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

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

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

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

Return Requests/Inquiries

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

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

FOR WARRANTY RETURNS, please have the following information available BEFORE contacting NEWPORT:
1. P.O. number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR NON-WARRANTY REPAIRS, consult NEWPORT for current repair charges. Have the following information available BEFORE contacting NEWPORT:
1. P.O. number to cover the COST of the repair,
2. Model and serial number of product, and
3. Repair instructions and/or specific problems relative to the product.