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Frequency Meters
PID Controllers
Clock/Timers
Printers
Process Meters
On/Off Controllers
Recorders
Relative Humidity
Transmitters
Thermocouples
Thermistors
Wire

Rate Meters
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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.

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 DESCRIPTION

1.1 GENERAL

The Newport Model 204B Digital Panel Voltmeter is a low cost, reliable instrument for digital display of analog bipolar voltages. The display is 3999 counts on any of five ranges from 39.99 mV to 399.9 V. Included options are extended count ranges to 4999 or 5999 counts, and an extra zero to the right side of the display. Optical isolators are available to separate digital and analog ground by up to 350 V. An offset option is available for process transmitters.

The Model 204B DPVM is a line-powered meter with 14.2 mm high 7-segment LED readout. The housing is a break-resistant phenylene oxide case. No zero adjustment is required and full scale and offset adjustments are easily accessible with the front lens removed.

Accuracy at the low end of each range is not degraded by normal mode noise because the Model 204B performs true bipolar signal integration around zero. Many competitive meters rectify the signal before integration which erroneously adds the absolute value of the normal mode noise to the signal reading. The Model 204B average value circuit provides full normal mode and superior ac line transient noise rejection at signal levels from zero to full scale.

Ratio measurements are possible with the Model 204B without modifications or external logic. The configuration is 3-wire (common ground) and the reference must be within a specified voltage range.

Data output lines are parallel BCD, compatible with TTL and DTL. External control signals are also TTL and DTL compatible and increase the flexibility and ease of interfacing the Model 204B with other instruments.
### 1.2 SPECIFICATIONS

#### 1.2.1 Input

<table>
<thead>
<tr>
<th>Model</th>
<th>204B-1</th>
<th>204B-2</th>
<th>204B-3</th>
<th>204B-4</th>
<th>204B-5</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>0.04</td>
<td>0.4</td>
<td>4</td>
<td>40</td>
<td>400</td>
<td>V</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.01</td>
<td>0.1</td>
<td>1</td>
<td>10</td>
<td>100</td>
<td>mV</td>
</tr>
<tr>
<td>Overdrive Protection</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>250</td>
<td>500</td>
<td>V</td>
</tr>
<tr>
<td>Input Resistance</td>
<td>1000</td>
<td>1000</td>
<td>1000</td>
<td>2</td>
<td>1.1</td>
<td>MΩ</td>
</tr>
<tr>
<td>Input Bias Current</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0.1</td>
<td>0.01</td>
<td>nA</td>
</tr>
<tr>
<td>Reading Tempco (Typ)</td>
<td>±0.0075%</td>
<td>±0.005%</td>
<td>±0.01%</td>
<td>R/°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zero Noise Digits (Typ)</td>
<td>.4</td>
<td>.2</td>
<td>P-P</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full Scale Noise Digits (Typ)</td>
<td>.8</td>
<td>.4</td>
<td>.2</td>
<td>P-P</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Linearity</td>
<td>&lt;1.5</td>
<td>&lt;1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>External Reference Voltage</td>
<td>+0.01→</td>
<td>+0.1→</td>
<td>+1.00 →</td>
<td>+3.50</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Ratio Accuracy</td>
<td>99.8±0.2</td>
<td>%R</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ratio Linearity</td>
<td>2 (1 typ)</td>
<td>counts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ext Ref Input Resistance</td>
<td>47</td>
<td>471</td>
<td>4.72 k</td>
<td>Ω</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. 600 V when ordered with ER1 or ER2 options.
2. 1.1 M when ordered with ER1 or ER2 options.
3. 0.01% R/°C when ordered with ER1 or ER2 options.
4. 204B-1 must use HZ option to obtain stated accuracy.
5. Solder blob 'M' closed; a higher resistance is available with the HZ option.
6. This range exceeds CE specifications.

#### 1.2.2 Accuracy @ 25°C

- **Total Error**: ±0.02% ±1ct
- **Offset Tempco**: ±2 μV/°C
- **Warmup Time**: 1 hour

#### 1.2.3 Offset

- **Range**: ±14 counts
1.2.4 **Conversion Characteristics**

- **Technique**: Dual slope, average value
- **Signal integration Period**: 50 mSec (60 Hz); 40 mSec (50 Hz); trimmed within ±1% (type osc tempco ±0.025%/°C using 1% metal film trims)
- **Read Rate**: 3.6/sec @ full scale (50/60 Hz). 0-3.6/sec with external control
- **Polarity**: Automatic

1.2.5 **Input Characteristics**

- **Type**: Single ended (analog ground common to signal low)
- **Settling Time**: 2 readings (asynchronous input step)
- **NMR**: 40dB @ 50 Hz or 60 Hz
- **CMR**: 120dB @ 60 Hz
- **CMV**: 350 V signal low to digital ground with option 01 installed.
- **Zero**: Automatic
- **Ratio Measurement**: 3-wire

1.2.6 **Calibration Controls**

- **Full Scale Adjust (R41)**: 20 turn, accessible behind front lens; ±7.5%, 12°/count @ full scale.
- **Input Offset (R42)**: 20 turn, accessible behind front lens; ±14 counts, 257°/count.

1.2.7 **Display**

- **Type**: 14.2 mm (.56") 7-segment LED
- **Symbols**: 3.8.8.8
- **Decimal Points**: Three (to the right of the three MSD's)
- **Overload Indicator**: Display flashes.
- **Color**: Red filter.
- **Polarity Sign**: Minus
1.2.8 Digital Signals

DIGITAL I/O DRIVE REQUIREMENTS

<table>
<thead>
<tr>
<th>Description</th>
<th>Input</th>
<th>Output</th>
<th>Logical '0'</th>
<th>Logical '1'</th>
<th>Isink</th>
<th>Isource</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parallel BCD</td>
<td>X</td>
<td>0 V-.5 V</td>
<td>2.7 V-5.0 V</td>
<td>2.4 V-5.0 V</td>
<td>4.8 mA</td>
<td>.4 mA</td>
</tr>
<tr>
<td>+POLARITY</td>
<td>X</td>
<td>0 V-.4 V</td>
<td>2.4 V-5.0 V</td>
<td>2.4 V-5.0 V</td>
<td>1.6 mA</td>
<td>.4 mA</td>
</tr>
<tr>
<td>HOLD</td>
<td>X</td>
<td>0 V-.6 V</td>
<td>2.0 V-5.0 V</td>
<td>2.0 V-5.0 V</td>
<td>.04 mA</td>
<td>1.2 mA</td>
</tr>
<tr>
<td>DATA READY</td>
<td>X</td>
<td>0 V-.4 V</td>
<td>2.4 V-5.0 V</td>
<td>2.4 V-5.0 V</td>
<td>16.0 mA</td>
<td>.8 mA</td>
</tr>
<tr>
<td>BLANKING</td>
<td>X</td>
<td>0 V-.4 V</td>
<td>Open [6]</td>
<td></td>
<td></td>
<td>1.6 mA</td>
</tr>
</tbody>
</table>

[6] Not compatible with TTL totem-pole outputs; TTL open-collector devices (or equivalent) must be used to drive the BLANKING input.

1.2.9 Power

- Input Voltage 115 V ac ±10%
- Frequency Range 47 to 63 Hz
- Input Power 5W when display reads -3.888
- Optional Input Voltages
  - C6 - 115 V ac ±10% 50 Hz
  - C7 - 230 V ac ±10% 60 Hz
  - C1 - 230 V ac ±10% 50 Hz
  - C5 - 100 V ac ±10% 50 Hz
  - C8 - 24 V ac ±10% 60 Hz
  - C9 - 24 V ac ±10% 50 Hz
  - C3 - 5 V dc ±5% (60 Hz rejection)
  - C4 - 5 V dc ±5% (50 Hz rejection)

- Output Voltage +4.75 V ±.25 V @ 50 mA (mutually exclusive with all upper board options).

1.2.10 General

- Operating Temperature 0°C to 50°C
- Storage Temperature -40°C to 75°C
- Humidity Up to 95% non-condensing at <40°C
- Weight 480g
- Case Material Black Polycarbonate
### Case Size

**DIN**
- **Bezel (WxHxD)**: 96x48x6 mm (3.78x1.89x0.24 in)
- **Depth Behind Bezel W/Connector**: 135.4 mm (5.33 in)
- **Panel Cutout**: 92x45 mm (3.62x1.77 in)

**NEMA (optional)**
- **Bezel**: 104x48x19 mm (4.09x1.88x0.75 in)
- **Depth Behind Bezel W/Connector**: 125 mm (4.91 in)
- **Panel Cutout**: 99.6x42.9 mm (3.92x1.69 in)
2.0 RECEIVING AND INSTALLATION

2.1 UNPACKING AND INSPECTION
Your Model 2048 was fully inspected and tested, then carefully packed before shipment. Unpack the meter carefully and inspect it for obvious shipping damage.

2.2 INITIAL CHECKOUT PROCEDURE

CAUTION
Meters are internally connected for 24, 100, 115 or 230 V ac or 5 V dc power. Check label on meter for proper supply voltage.

2.2.1 Required Equipment
(1) Appropriate power source (5 watts) as indicated by the label.
(2) Calibrated voltage source.

2.2.2 Test Procedure
(1) Connect signal as follows:
   SIGNAL IN to pin 17.
   ANALOG GND IN to pin 16.

(2) Connect power as follows:
   AC HI to pin A.
   AC LO to pin 2.
   AC GND to pin C.

(3) Verify that a key is between pins 3 and 4.

(4) Pins 1, 3, and B must be removed from connector.

(5) Apply power and check that the meter reads correctly for its specified range.

![Diagram](Image)

Figure 1
2.2.3 Optional Pin Assignments For C3, D4 and RMS Options

(1) Option C3 Power and Input Connections To TB1
   TB1-1  No Connection
   TB1-2  +5 V dc
   TB1-3  5 V dc Return
   TB1-4  No Connection
   TB1-5  ANALOG GND IN
   TB1-6  SIGNAL IN

(2) Option C3 Power Connections to J1 (Rear Connector)
   J1-A  No Connection
   J1-2  +5 V dc
   J1-C  5 V dc Return

(3) Option D4 Power and Input Connections to TB1
   TB1-1  AC HI
   TB1-2  AC LO
   TB1-3  AC GND
   TB1-4  No Connection
   TB1-5  ANALOG GND IN
   TB1-6  SIGNAL IN

(4) Option RMS Input Connections to TB1
   TB1-4  AC/DC SIGNAL IN
   TB1-5  AC SIGNAL IN
   TB1-6  ANALOG GND IN

2.3 MECHANICAL INSTALLATION

Drawing number 06896, Outline and Mounting Drawing, illustrates the mounting method for your panel meter. The unit is inserted from the front of the panel and held in place by two extrusions. The panel thickness may be between .75 mm (.030") and 6.35 mm (.25").
REAR VIEW OF UNIT
3.0 OPERATING INSTRUCTIONS
3.1 PIN ASSIGNMENTS

<table>
<thead>
<tr>
<th>PIN</th>
<th>NAME</th>
<th>PIN</th>
<th>NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No Connection</td>
<td>A</td>
<td>AC HI</td>
</tr>
<tr>
<td>2</td>
<td>AC LO</td>
<td>B</td>
<td>No Connection</td>
</tr>
<tr>
<td>3</td>
<td>No Connection</td>
<td>C</td>
<td>AC GND</td>
</tr>
<tr>
<td>4</td>
<td>X.XXX (DP1)</td>
<td>D</td>
<td>BCD 1</td>
</tr>
<tr>
<td>5</td>
<td>XX.XX (DP2)</td>
<td>E</td>
<td>BCD 2</td>
</tr>
<tr>
<td>6</td>
<td>XXX.X (DP3)</td>
<td>F</td>
<td>BCD 4</td>
</tr>
<tr>
<td>7</td>
<td>BLANKING</td>
<td>H</td>
<td>BCD 8</td>
</tr>
<tr>
<td>8</td>
<td>BCD 80</td>
<td>J</td>
<td>BCD 100</td>
</tr>
<tr>
<td>9</td>
<td>BCD 40</td>
<td>K</td>
<td>BCD 200</td>
</tr>
<tr>
<td>10</td>
<td>BCD 20</td>
<td>L</td>
<td>BCD 400</td>
</tr>
<tr>
<td>11</td>
<td>BCD 10</td>
<td>M</td>
<td>BCD 800</td>
</tr>
<tr>
<td>12</td>
<td>BCD 1 k</td>
<td>N</td>
<td>+POLARITY</td>
</tr>
<tr>
<td>13</td>
<td>BCD 2 k</td>
<td>P</td>
<td>DATA READY</td>
</tr>
<tr>
<td>14</td>
<td>BCD 4 k</td>
<td>R</td>
<td>HOLD</td>
</tr>
<tr>
<td>15</td>
<td>+4.75 V dc Out</td>
<td>S</td>
<td>Spare</td>
</tr>
<tr>
<td>16</td>
<td>ANALOG GND IN</td>
<td>T</td>
<td>DIGITAL GND</td>
</tr>
<tr>
<td>17</td>
<td>SIGNAL IN</td>
<td>U</td>
<td>Spare</td>
</tr>
<tr>
<td>18</td>
<td>Spare</td>
<td>V</td>
<td>REFERENCE HI IN</td>
</tr>
</tbody>
</table>

Connector Type*  | SAE   | SCC18D/1-2
*               | ELCO  | 00-6007-036-450-012

Key

*Pins 1, 3, and 8 must be removed.

Figure 3

Connector Pin Orientation as Viewed From the Rear of the Meter.
3.2 POWER

3.2.1 Input Voltage

The standard Model 204B operates from 115 V ±10%, 60 Hz. It consumes about 5.0 watts. A three wire connection should be used to connect power to the meter. Two conductors provide power and the third provides a ground for noise rejection.

Options C1 and C7 are 230 V ±10%. To change the meter in the field from 115 to 230 V operation, use the following procedure. See Figure 5.

1. Remove power lines from meter and remove the meter from the case.
2. Remove the two jumpers on the transformer W1 and W2.
3. Add jumper W3 on the printed circuit board. The meter is now wired for 230 V.

To change the meter from 230 V to 115 V operation, reverse the above steps.

3.2.2 Input Frequency

The standard Model 204B is set at the factory for 60 Hz line operation. If a frequency change is required, the clock frequency must be changed.

The easiest method is to short the signal inputs and adjust R42 for a reading of ±0000. Change the value of R8 until the positive portion of DATA READY is 50 mS ±.5 mS for 60 Hz operation or 40 mS ±.4 mS for 50 Hz operation.

Normal mode rejection is highly dependent on the clock frequency, and it is important that the above adjustments are set to ±1% to prevent degradation of normal mode rejection of the Model 204B. R8 should be a ±1% metal film resistor.

3.2.3 Output Voltage

The ±4.75 V output is a regulated supply with the voltage range 4.75 V ±.25 V. A maximum current of 50 mA is available for external use which is mutually exclusive with all upper board options.
3.3 SIGNAL INPUT

3.3.1 Signal

For best results, shielded, twisted cable should be used for the input signal, with the shield terminated to ANALOG GND IN at the connector:

Analog ground and digital ground are internally connected and should not be connected externally.

If the meter has a noisy input signal, the input filter time constant may be lengthened for better noise rejection (at the expense of settling time). For the 400 mV and 4 V ranges, a 27 k ohm resistor in series with SIGNAL IN (pin 17) will provide 6 dB more rejection but will increase settling time to approximately 1.25 sec. The sum of the series resistor and the source impedance should be no greater than 100 k ohms. Some zero offset due to bias current may be observed on the 40 mV range if an external input resistor is used.

3.3.2 Ground Precautions

It is essential that the ground connections to the Model 204B be proper for accurate readings. The input stage is single-ended and analog ground is internally connected to digital ground through a low internal resistance.

![Diagram of Model 204B Internal Grounds](image)

**Figure 4**

Model 204B Internal Grounds

The contact resistances resulting from the connection between the connector and the printed circuit board are shown as lumped resistors, $R_{C17}$, $R_{C16}$ and $R_{CT}$. The internal resistance between the analog and digital grounds is shown as $R_I$. 
CORRECT GROUNDING
The correct grounding method is to connect the low side of the signal to ANALOG GND IN and the common for the digital outputs to DIGITAL GND. This allows the digital current to flow only through \( R_{CT} \), causing the no voltage drop across \( R_{C16} \) or \( R_I \) and the meter will read the signal correctly. There will exist a small voltage difference between pin 16 and pin T.

INCORRECT GROUNDING
An improper ground connection is to use a single ground pin for both analog and digital ground. When this is done, the return current for the digital outputs flows through either \( R_{C16} \) or \( R_{CT} \). This causes a voltage drop in series with the input signal and the meter reading will be incorrect.

An improper system ground connection for the Model 204B is to tie the two ground connections together at the source. This creates a ground loop and the voltage drop across \( R_{CT} \) appears across \( R_{C16} \) and \( R_I \) simultaneously. This presents an erroneous reading as in the previous case with a single tie point at the connector.

3.4 OFFSET
The input offset components supplied with the standard instrument provides \( \pm 14 \) counts of adjustment.

If the input offset adjustment range is not sufficient, it may be increased (to a maximum of \( \pm 10\% \) of full scale) by increasing the value of \( R_{37} \). The following formula may be used to calculate the value of \( R_{37} \) in ohms:

\[
R_{37} = \frac{(t_{\text{desired input offset digits}})(309,000)(x)(\text{meter resolution in V})}{6.3 - (t_{\text{desired input offset digits}})(x)(\text{meter resolution in V})}
\]

If an external offset voltage is required, cut R39's service loop and connect the top of R39 to E14. The external voltage is applied to pin S and 16. The meter will now read:

\[
\text{Offset digits} = \frac{(\text{external offset voltage in V})xR_{37}}{(R_{37}+309,000)(x)(\text{meter resolution in V})}
\]

3.5 RATIO
The REFERENCE HI IN allows an external voltage to be used as the reference source for conversion. In this mode, the meter reads the ratio of the signal voltage to the reference voltage rather than the average value of the input.

\[
\text{Reading in Counts} = 2000 \times \frac{\text{Signal voltage}}{\text{Reference voltage}}
\]

On the 40 V and 400 V ranges, the reference voltage must be scaled by 1/10 or 1/100 respectively. The reference input impedance for the 400 mV range is about 470 ohms. For the 4 V, 40 V and 400 V ranges the impedance is 4.7 k ohms. The reference voltage must be between the limits specified, and must be positive with respect to ANALOG GND IN. For high impedance ratio input open solder blob "M".
3.6 OPTICAL ISOLATION

The following procedure can be used to add the optical isolation option (OI):

3.6.1 Install three 100 ohm, ±5%, 1/4W, CF resistors (NEI P/N 8045101) at R25, R26, and R28.

3.6.2 Open solder switch "Y" on the component side of the board and solder switches "N", "V", "W", and "X" on the circuit side of the board.

3.6.3 Install 2 each NEI P/N 49789 Dual Optical Isolators. These Isolators provide 350 volts separation between digital and analog ground.

3.6.4 The value of R32 may need to be adjusted or solder blob "T" closed to optimize zero width.

3.7 DIGITAL SIGNALS

<table>
<thead>
<tr>
<th>Description</th>
<th>Input</th>
<th>Output</th>
<th>Logical '0'</th>
<th>Logical '1'</th>
<th>Isink</th>
<th>Isource</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parallel BCD</td>
<td>X</td>
<td></td>
<td>0 V-.5 V</td>
<td>2.7 V-5.0 V</td>
<td>4.8 mA</td>
<td>.4 mA</td>
</tr>
<tr>
<td>+POLARITY</td>
<td>X</td>
<td></td>
<td>0 V-.4 V</td>
<td>2.4 V-5.0 V</td>
<td>1.6 mA</td>
<td>.4 mA</td>
</tr>
<tr>
<td>HOLD</td>
<td>X</td>
<td></td>
<td>0 V-.6 V</td>
<td>2.0 V-5.0 V</td>
<td>.04 mA</td>
<td>1.2 mA</td>
</tr>
<tr>
<td>DATA READY</td>
<td>X</td>
<td></td>
<td>0 V-.4 V</td>
<td>2.4 V-5.0 V</td>
<td>16.0 mA</td>
<td>.8 mA</td>
</tr>
<tr>
<td>BLANKING</td>
<td>X</td>
<td></td>
<td>0 V-.4 V</td>
<td>Open [7]</td>
<td>-----</td>
<td>1.6 mA</td>
</tr>
</tbody>
</table>

[7] Not compatible with TTL totem-pole outputs; TTL open-collector devices (or equivalent) must be used to drive the BLANKING input.

3.7.1 Parallel BCD Outputs

The data outputs are parallel BCD and are TTL and DTL compatible. The outputs are stable and valid while DATA READY (Pin P) is low.

3.7.2 DATA READY (Pin P)

DATA READY will go to a logical '0' at the end of a conversion cycle and to a logical '1' at the beginning of a conversion cycle.

3.7.3 HOLD (Pin R)

When a logical '0' is applied to the HOLD input, the meter will finish the conversion cycle it is on and will hold that reading. If it is applied before the beginning of a conversion, the meter will not start that conversion upon a logical '1' at the HOLD input, a new conversion will begin within 133 milliseconds.
3.7.4 +POLARITY (Pin N)

The +polarity output is a logical '1' when the meter indicates a positive reading.

3.7.5 BLANKING (Pin 7)

The digital display may be blanked by grounding the BLANKING input. The internal blanking signal occurs at displayed readings > ±3999 (>±4999 for ER1 options; >±5999 for ER2 options).

3.7.6 Decimal Points

Any of the three decimal points to the right of the three most significant digits can be lighted. The decimal points blank during overload.

<table>
<thead>
<tr>
<th>Decimal Point</th>
<th>Ground P1 Pin</th>
<th>Solder-Blob</th>
</tr>
</thead>
<tbody>
<tr>
<td>X.XXX (DP1)</td>
<td>4</td>
<td>J</td>
</tr>
<tr>
<td>XX.XX (DP2)</td>
<td>5 [8]</td>
<td>L</td>
</tr>
<tr>
<td>XXX.X (DP3)</td>
<td>6 [9]</td>
<td>K</td>
</tr>
</tbody>
</table>


Decimal points are lit by grounding the appropriate pin (To P1-Pin T) or closing the appropriate solder blob. The grounding device must be capable of sinking 0.5 mA.

4.0 THEORY OF OPERATION

![Block Diagram of Model 204B](image)

Figure 6

Block Diagram of Model 204B
The Model 204B panel voltmeter uses the dual slope method of conversion. Many state-of-the-art panel meters use dual slope conversion, but the Model 204B includes automatic zeroing before each reading and does so with a minimum of parts for increased reliability.

At the beginning of a conversion, the voltage across C is zero. The signal is then applied to the integrator and the voltage across C rises by the formula

\[ V_{\text{capacitor}} = V_{\text{in}} \times \frac{\text{time (sec)}}{R \times C} \]

At the end of a fixed period of 2000 counts (T1), the counters are reset to 0000. The signal input is turned off and a stable reference voltage of the opposite polarity is now applied to the input. Since the reference voltage is constant, the slope, in volts/sec, during this second period (T2) is constant and independent of input signal levels. The time required to discharge the capacitor back to zero volts is then proportional to the signal voltage.

After the clock is stopped by the capacitor voltage reaching zero, a third period (T3) allows the circuit to auto-zero the integrator and comparator for the next reading.

A low level on the HOLD input prevents the reset pulse from starting the counters. The relationship between T1 (signal integrate) and T2 (reference integrate) time can be expressed by the formula:

\[ E_{\text{ref}} \times T2 = E_{\text{sig}} \times T1 \]
Figure 7

Voltage Wave Forms at e₁ and e₂
5.0 ADJUSTMENT AND CALIBRATION

The Model 2048 was calibrated at the factory with a precision voltage source. Frequent calibration is not necessary due to the stability and internal accuracy of the meter. If recalibration is necessary, use the following procedure.

5.1 Plug the 2048 to be tested into an appropriate test cable.
5.2 Turn on the power and adjust for 115 V ac.
5.3 With the voltage source set to 0 V, adjust R42 (input-offset; 100 k) until the polarity sign is bouncing between plus and minus polarity.
5.4 Apply an input signal equal to +3900.5 and slowly adjust R41 (full scale; 1 k ohm) until the display is bouncing between +3900 and +3901.
5.5 Using the voltage source, check linearity at 10, 100, 500, 1000, 2000, 3000 and 3999 counts. Verify that linearity is not worse than 1 count throughout this range in both polarities.
     NOTE: This test requires the effects of zero offset, and full scale turnover to be taken into account.
5.6 Using the voltage source, observe the DPM readout.
     5.6.1 Check all numbers for proper decoding.
     5.6.2 Check for Dim/Dead/Bright segments.
     5.6.3 Check individual displays for the same relative intensity/illumination.
     5.6.4 Check minus polarity sign.
EXPLODED VIEW - 204B, DIN 1A CASE
OUTLINE AND MOUNTING FOR DIN 1A CASE

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

Panel thickness
6.4 (.25) MAX
0.8 (.03) MIN

R (.06)
4 PLS
45.00 + 0.61
(1.772 + 0.024)
92.00 - 0.00
(3.622 + .032)
- 0.00

Panel cutout

Rear view
(Terminal block cover and bezel not shown for clarity)
Slide clamps rotated and slide retainers removed as shown for installation.
OUTLINE AND MOUNTING FOR OPTIONAL NEMA CASE
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.

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