



# 1/8 DIN BAR-DIGITAL METER/CONTROLLER

\*AUTOMATIC TRICOLOR BAR

\*RELAYS/DAC/SERIAL

\*NUCLEAR \*MIL-SPEC \* INDUSTRIAL GRADES

**MODEL**

**BDM**

### FEATURES:

- Proven Software (SV & V)
- Plastic or Metal Case (EMI/Seismic)
- USB, RS232, RS485, Ethernet
- Power For Your Transmitter (28VDC)
- Math Functions (+, -, x, ÷, √)
- Polynomials (9<sup>TH</sup>), X-Y Tables (25)
- 4 Relays, Isolated 16 bit DAC
- Over 20 Input Signal Conditioners (TC, RTD, S-G, pH, ORP, %RH, HZ)
- High Accuracy Digital Display (±0.01% F.S.)
- Lifetime Warranty



### SPECIFICATIONS @ 25°C 5VDC Power (Industrial Grade)

- Accuracy & Linearity: ±0.01% of F.S. ± 1 Digit
- Bargraph Resolution: 2% (51 Segments)
- Span & Zero Range: ± 3000 Counts
- C.M.V. - Signal to - Power: 2VDC Max.
- Digits: 0.4", 4 (9.9.9.9 to -1.9.9.9) Floating Decimal Point
- Temperature Coefficient: 50 PPM
- Operating/Storage Temp: 0-60/-20 + 80°C
- Power Consumption: 5 Watts @ 5VDC + Options
- Environmental: NEMA 4X, 5-95% RH N.C.
- Case: All Metal Machined or 94VO Plastic
- **CMTBF:** 100,000+ Hours
- Relays: 1 Amp 120VAC/30VDC (4) SPDT or
- O.C.T.: 30V/30mA
- Analog Out: 16 Bit ± 0.01% (0-1, 4-20mA & 1-5V)
- Serial I/O 300-19.2KB (8N1 Setting)
- Programmable Address
- Ethernet 10 Base T Compatible

### DESCRIPTION

We shrunk the **EBD**! By popular demand, we took our popular EBD (6x1.7x2") and made it fit in the industry's most popular panel meter size 1/8 DIN (3.6x1.6x2"), and kept all the outstanding features. This is a reduction of almost 50% in size, but not in performance and quality! The new **BDM** is ready for your DCS, SCADA or stand alone application with its autotricolor bargraph (popularized by OTEK in the nuclear and military industries) for best HMI (just like traffic lights).

**GRADES:** 3 grades are available: **Hi-Rel** Industrial (see specs.), **Mil-Spec** to specific standards, **Nuclear** to 10CFR50-B and to your requirements. Contact **OTEK** for availability.

**SIGNAL CONDITIONERS:** 20+ input signal conditioners are available (more soon). See ordering information and description sections.

**ZERO AND SPAN:** Either manual or via serial port.

**MATH FUNCTIONS:** RTD, TC & X-Y linearization plus Tare, Offset, Scale, Peak and more are programmable via simple commands.

**CONTROL OUTPUTS:** 4 each relays or 4 open collector transistors for High, High-High, Low and Low-Low Control.

**ANALOG OUTPUT:** Optional isolated 4-20mA, 0-1mA, 0-20mA or 0-5VDC with 16 Bit resolution.

**DISPLAY:** The 51 segment automatic tricolor bargraph can be programmed for any direction (up or down), any start (bottom, top, middle), segmented or pointer color change as limits are reached or fixed.

**SERIAL I/O** Standard is RS232 with optional RS485 or **USB**. You can even power the **BDM** via the **USB** port (2W Max.).

**POWER INPUT:** Standard is 5VDC with optional isolated 5-32VDC, 90-265VAC or USB powered.

### POWER OUTPUT FOR 4-20mA

**TRANSMITTER:** Non-Isolated (Options A& B) or isolated (Options 4, 7 or 8)

**PROGRAMMING:** OTEK will configure the **BDM** at no charge prior to shipment or you can reconfigure it via the serial port using simple commands (See User's Manual at [www.otekcorp.com](http://www.otekcorp.com))

*Warranty: Lifetime Ltd.*

**IF YOU DON'T SEE IT  
ASK FOR IT!**



**520-748-7900**

FAX: 520-790-2808

E-MAIL: [sales@otekcorp.com](mailto:sales@otekcorp.com)

<http://www.otekcorp.com>

**OTEK**™  
**CORP.**  
SINCE 1974

4016 E. TENNESSEE ST.  
TUCSON, AZ. 85714 U.S.A.



## BDM SERIES continued

### HOW IT WORKS:

#### Externally Powered (Digit

**5, Options 1-7):** Non-Isolated 5VDC or isolated 5-48VDC or 90-265VAC 50/60Hz is optional (Digit 5, Options 1-7). Max Power: 5 Watts + options.

**Serial I/O (Digit 4):** The CPU controls the Baud Rate (300-9600 Baud), the relays, analog output, math functions, linearization polynomial (9th) & X-Y tables.

#### Control & Power Out (Digit 6):

You can order 4-20mA as standard, or 0-5V, 0-20mA or 0-24mA on request, or you can order the isolated 30VDC (30mA) or Non-Isolated 28VDC out for your transmitter.

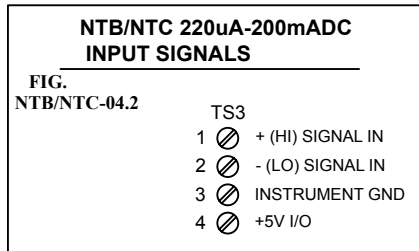
**Relays/O.C.T.:** Standard is normally open (N.O. SPST). On request we can give you normally closed (N.C.). All are 1A @ 120VAC rated. The O.C.T. are normally off, com. emitter 30VDC/100mA max.

## THE SIGNAL CONDITIONERS

### Option 01: 4-20mA Externally

**Powered:** It only drops 1V @ 20mA (50 Ohms). The "BDM" needs 5VDC @ 100mA to operate. **Accuracy:**  $\pm 0.01\%$  of F.S.

Digits 4, 5 & 6 must be Option "0." **Accuracy:**  $\pm 0.1\%$  of F.S.  $\pm 1$  digit.

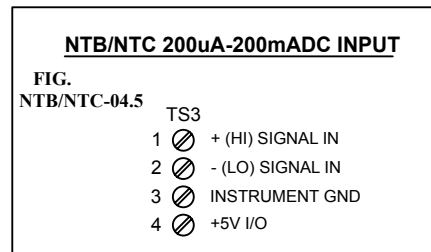


**Option 09: Custom:** Use this option to describe any custom input, scale or modification to the **BDM** and contact us for feasibility and cost.

### Options 10-13: 200uA - 200mADC:

Since the **BDM** is 2V full scale (10,000 Counts) the "Shunt" resistors used are 1K, 100, 100 or 10 Ohm. Don't forget that maximum display is 9999 or -1999.

**Accuracy:**  $\pm 0.01\%$  of F.S.  $\pm 1$  digit.



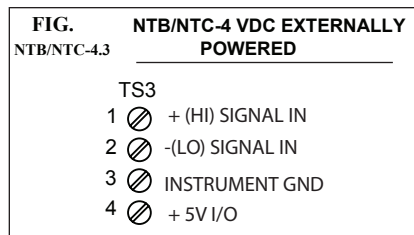
### Option 03: Serial Input Remote

**Display:** Here you can use the **BDM** as a remote display with modified (STD.) ASCII to alphanumeric display for DCS SCADA, PLC systems.

### Options 04-08: VDC Externally Powered:

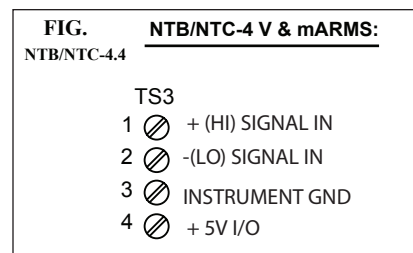
Input impedance is 1 Mega Ohms on all VDC ranges.

**Accuracy:**  $\pm 0.05\%$  of F.S.



### Options 14-22:

**V & mA RMS:** Here we use a **True RMS-DC** Converter for accurate ( $\pm 0.05\%$ ) measurement of sine waves up to 10KHz ( $\pm 0.1\%$  for 10-20KHz) and SCR;s fired to  $\pm 1\%$ . Input impedances vs. range are the same as for VDC & mADC ranges. **Warning: No Isolation!**



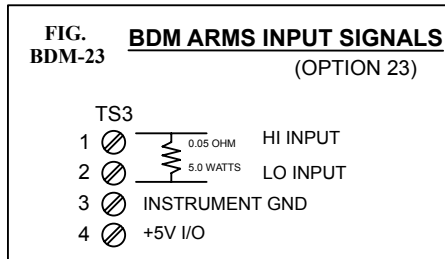
**BDM SERIES continued**

**Option 23: 5Amps AC:**

Specifically for current transformers (**C.T.**) this option requires an externally mounted (supplied) 0.05 Ohm, 0.1% 5 Watt resistor. You can mount the "Shunt" at your **C.T.** or next to the **BDM** but make sure the connections are "Perfect" to electrical codes. The C.T. might have "**Lethal**" High Voltage without a "Shunt" (Open) and the **BDM** will "Smoke". See OTEK's New **ACS & CTT** models for **C.T.** powered instruments (Patent # 7,626,378).

**Warning: No Isolation!**

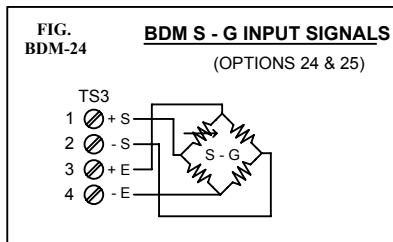
**Accuracy: ±0.05% of F.S.**



**Option 24: Strain-Gage (<1000 Ohm Type):**

Here we use highly accurate and stable constant current (~1mA) source, and a differential amplifier to convert the 2 or 3mV/V (typical) sensitivity of your "Loadcell". **Specify** your Strain-Gage sensitivity and full scale and the **BDM's** display at Zero and Full Scale Please!

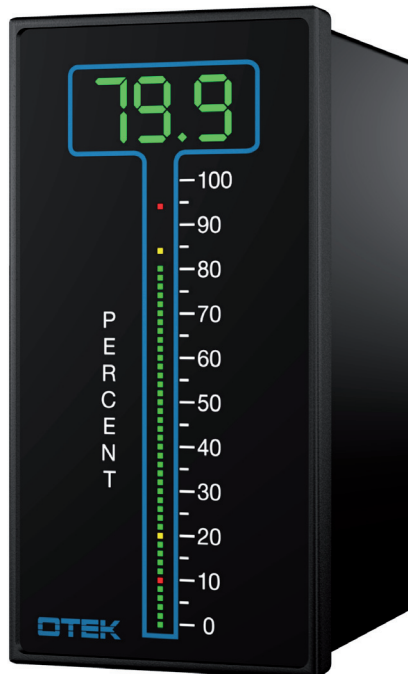
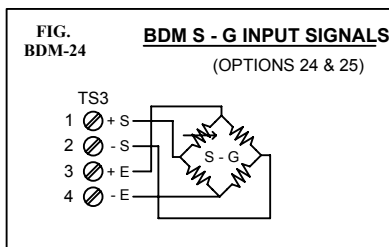
**Accuracy: ±0.05% of F.S.**



**Option 25: Strain-Gage (≥1K < 4K Ohm):** These are typically "Monolithic" **S-G** that require constant voltage (preferably) excitation. We use 4.096V for high stability and accuracy. **Specify** your S-G impedance and sensitivity and the **BDM's** display at Zero and Full Scale.

**Accuracy: ±0.1% of F.S.**

Note on S-G: Some S-G offer +/-1VDC or 4-20mA condition output. Use Option 9 and specify.

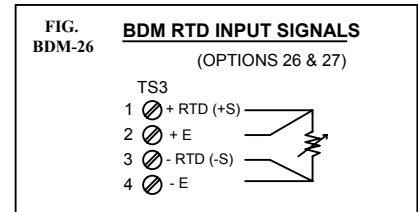


**Option 26: RTD (PT100):** We excite your 2 , 3 or 4 wire RTD with 200µA to avoid the "self heating" effect. The range of the **BDM** is the same as your **RTD** typically -200°C to +800°C (-328 + 1562°F). You can place the decimal point at will (typically -200.0 to 800.0 (-328.0 to 1562.0)). The **PT100** has a temperature coefficient of 0.00385 Ohms/Ohm/°C. (For legacy 0.00392 TC (known as ANSI 392) contact **OTEK** and use Option "09".)

Note: You can change °C to °F via serial port.

**Accuracy: ±0.5% of F/C plus sensor's error.**

Note: For 2 wire, jump - S to -E and +S to +E. For 3 wire only jump -S to -E.

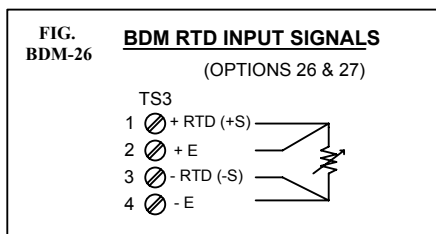


**BDM SERIES continued**

**Option 27: RTD (PT1000):** Same as PT100 except it is 1000 Ohms at 0°C instead of 100 Ohms @ 0°C. The same technique is used for copper **RTD** (10 Ohm), contact **OTEK**. Same connection as Option 26 apply.

**Accuracy:** ±0.05% of F/C plus sensor's error.

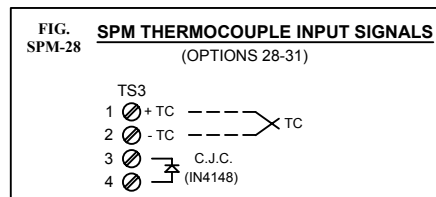
Note: For long distances use a 4-20mA transmitter such as our 900 or LPT series.



**Option 28: Thermocouple (Type J):** This **TC** has a range of -210 to + 760°C (-350 + 1390°F). Its color is white (+) and Red (-), cold junction (CJ) is inside the **BDM** at the connector base. Make sure the connections from the **BDM** and your **TC** are as close to the **BDM's** connector as possible to avoid errors. If you short out the **BDM's** +**TC** & -**TC** together, the **BDM** will read the ambient temperature due to its built-in C.J.C at TS3.

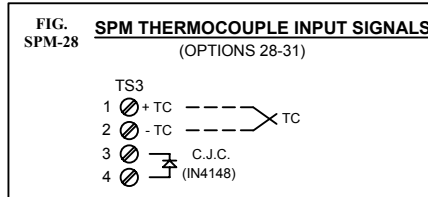
Note: You can change °C to F and TC type via serial port.

**Accuracy:** ± 2° F/C of signal input.



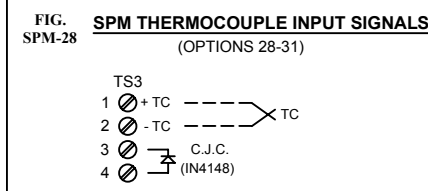
**Option 30: TC (Type K):** This is yellow (+) and red (-) and has a range of -270 + 1370°C (-440 + 2500°F). The same notes as Option 28 apply.

**Accuracy:** ± 2° F/C of signal input



**Option 31: TC (Type T):** This blue (+) and red (-) **TC** wire has the range of -270° + 400°C (-440 + 750°F). Same notes as Option 28 apply.

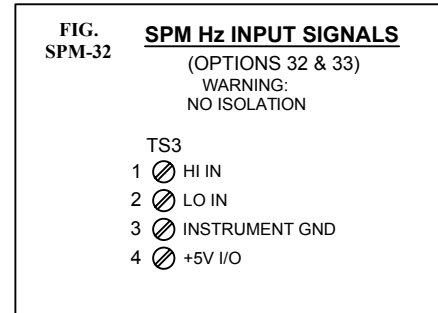
**Accuracy:** ± 2° F/C of signal input.



**Options 32-33: Frequency Input:**

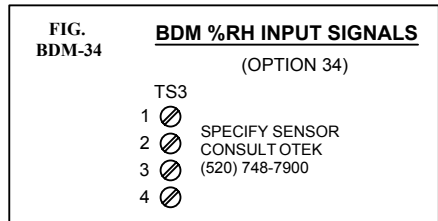
We use an **F-V** to accept frequencies from 40 - 20KHz and amplitudes from 1-400V peak or dry contact or open collector transistor (O.C.T.). For 50 to 440 Hz power line frequency measurement. Use Option # "33," or see our **ACS** Powerless™ Series.

**Accuracy:** ±0.05% of F.S.



**Option 34: %RH:** This conditioner is designed to interface to a typical (capacitance type) 2-3pF/% of **RH** made by several manufacturers. Use Option "09" and contact **OTEK** to specify your sensor's specifications.

**Accuracy:** ± 2% RH of signal input.

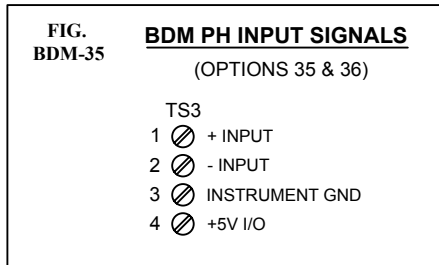


**BDM SERIES continued**

**Option 35: pH (Acidity):** We use a FET input ( $10^{15}$ ) amplifier and calibrate the **BDM** for 0-14.00 pH using the Industry's standard  $\pm 413$  mV =  $\pm 7$ pH co-efficient.

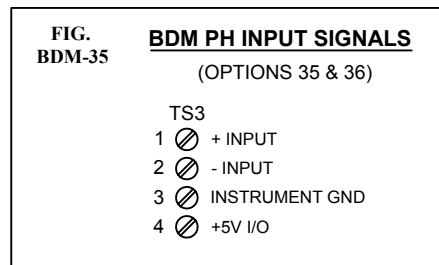
Note: Not temperature compensated.

**Accuracy:**  $\pm 0.05\%$  of F.S.



**Option 36: ORP (Oxygen Reduction Potential):** Our FET amplifier ( $10^9$ ) accepts the industry standard 2000mV F.S. of the probe and the **BDM** displays it in % (0-100.0%).

**Accuracy:**  $\pm 0.05\%$  of F.S.



**Option 37: Hi Speed Peak & Hold (P&H):** Now you can capture fast transients greater than 50 microseconds (even faster soon) with resolution greater than 0.1% of F.S. and retention of greater than 10 years (Due to OTEK's new and patent-pending P&H Option).

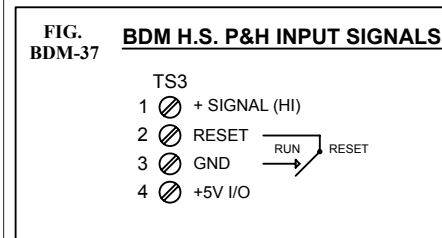
Input: V or mADC (Specify Range). Contact OTEK for V/mA RMS or Loop Powered).

**Accuracy:**  $\pm 0.1\%$  of F.S.  $\pm 1$  Digit

**Linearity & Resolution:**  $\pm 0.5\%$  of F.S.

**Response time:**  $>20$ KHz ( $<50$ us)

**Retention:**  $>10$  years (with power on).

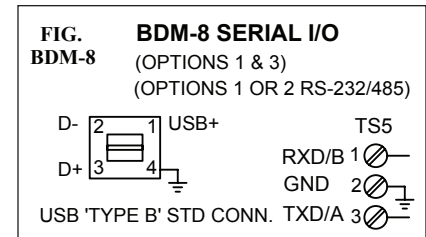


**Serial I/O (DIGIT 4): Option 1:** RS232: 1200-19.2kb, all ASCII (8N1) open protocol screw connector terminals.

**Option 2:** RS485: 1200-19.2kb, all ASCII (8N1) open protocol screw connector.

**Option 3:** USB: 1200-19.2kb, all ASCII (8N1) open protocol "USB Type B."

Any terminal program (Hyperterminal, Procomm, Kermit) will work with OTEK's serial com. ports. For USB download our Driver at [www.otekcorp.com/Support/Downloads/PC-USB-Driver](http://www.otekcorp.com/Support/Downloads/PC-USB-Driver).



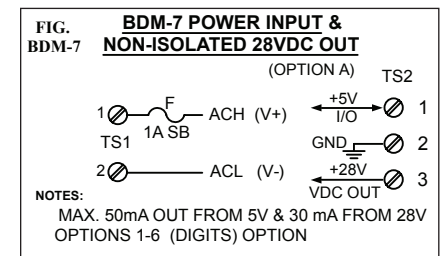
**Option 1 or 7: Non-Isolated 5 or 7-32 VDC Power:** See Specific Option # & Connections.

All listed I/O options are available. Power requirements vary with options included. The **BDM** with No Control and Power Out (Digit 6, Option 0) requires under 500 mW (100 mA@5VDC) for LED.

**Options 2-6: Isolated Power**

These options offer minimum isolation of 500 VAC or DC and their efficiency is about 80%. Again, add all the options: power x1.2 to arrive at total power required. Options 3, 4, 5 & 7 have wide input range, all others  $\pm 5\%$ .

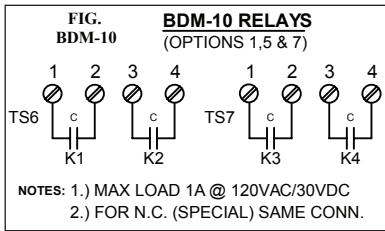
Option 7 is non-isolated 7-32 VDC/input range.



**BDM SERIES continued**

**CONTROL & POWER OUT (DIGIT 6):**

**Option 1: Relays (4):** Standard outputs are SPST, N.O. of all 4 relays. For N.C. of all 4 relays or SPDT of only 2 relays or other contact combination select option 9 and specify. Contacts are rated at 1 amp at 120 VAC/30 VDC resistive load. Also applies to option 5 & 7 (Relays). Power required by each relay is 200 mW (40mA@5VDC) x 4=800 mW. (Contact OTEK for 10 A contacts).



**Option 2: Open Collector Transistors (O.C.T):**

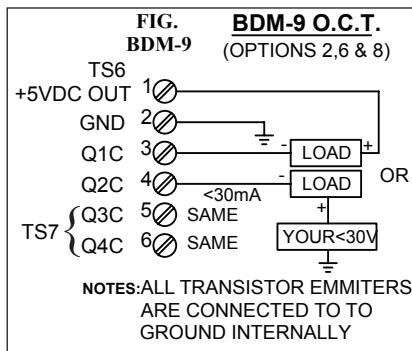
**Factory Default Settings:**

- HI-HI LIMIT:** K1 on at >90% of full scale (F.S).
- HI LIMIT:** K2 on at >80% of F.S.
- LO LIMIT:** K3 on at <20% of F.S.
- LO-LO LIMIT:** K4 on at <10% of F.S.

Example: Reading is 40% of F.S.: None  
 Reading is 81% of F.S.: K2 or Q2 on.  
 Reading is at 91% of F.S.: K1 & K2 or Q1 & Q2 on.  
 Reading is at 19% of F.S.: K3 or Q3 on.  
 Reading is at 9% of F.S.: K3 & K4 or Q3 & Q4 on.

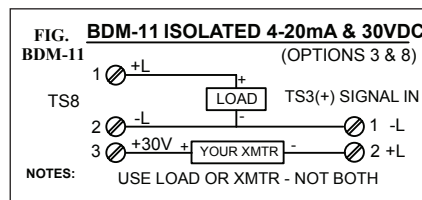
**Option 2: Open Collector Transistors (O.C.T) {Continued}:**

Four O.C.T are included and all are common emitter (sinking) to digital ground (terminal TS2-2). The 5 VDC internal powers is available at terminal TS2-1. Maximum current allowed per O.C.T. (From the internal 5 VDC) is 20mA/O.C.T. if external VCC is used, the maximum VCE is 30 VDC and 30 mA per O.C.T. Switching time is under one (1) uSecond.



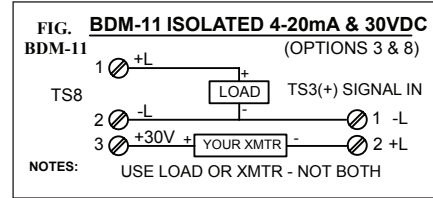
**Option 3: Isolated 4-20 mA:** (Must include serial I/O options 1-3 Digit 4)

This option is offset & scaled via the serial port (digit 4) and can be configured for 4-20, 0-20 or 0-24 mA or 0-5 VDC via internal jumpers (standard is 4-20 mA). This option requires under 200 mA@5VDC internal power due to step up from 5-30 VDC compliance. Accuracy & linearity is +/- .1% of setting and can drive up to 1K ohms load. Also see Option B.



**Option 4: Isolated 30 VDC**

You can use it to excite your transmitter at up to 25mA. It consumes under one (1) watt at full load. Also see Option A.



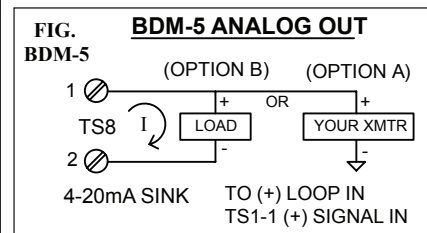
**Option 5-8: Combinations of Option 1-4.**

Don't forget to add all power requirements of each option desired.

See Options 1-4 & Connections.

**Option A: Non-Isolated 28VDC For Transmitters.**

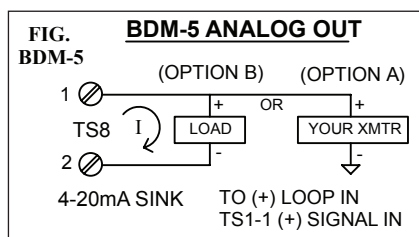
It converts the internal 5 VDC to 28 VDC and requires under 0.8 watts@5 VDC with max current output of 25mADC.



## **BDM SERIES continued**

### **Option B: Non-Isolated 4-20 mA Out.**

This option converts the **BDM** to a low-cost transmitting DPM. The output is referenced to the **BDM's** Signal input after it has been conditioned by the signal conditioner (such as strain-gage, Hz, pH, etc.), and it has its own zero and span potentiometers for your customized range. Standard connections are for sourcing with burden under 700 ohms @ 20 mA. For external compliance and sinking, select option #9 and specify "external compliance" (you supply the VDC power for the 4-20mA transmitter). Minimum voltage is 5 VDC plus your load. Max is 30 VDC plus your load. Accuracy and linearity is +/- 0.05% of full scale. Power requirement is 800mW@5VDC internal compliance or 50mW with external (yours) compliance. Also see Option 3.



### **CASE TYPE (DIGIT 7):**

**Option 0, Plastic:** ABS 94VO black is standard. All options have 2 piece plug-in screw terminal connectors and seismic tested mounting slides (2).

**Option 1, Metal:** Aluminum machined, nickel plated (ready for EMI/RFI compliance), black powder coated.

**Option 2 & 3, Nema 4X:** We add a neoprene or monel gasket for full front panel water proof.(No Span or Zero front panel adjustments).

**Option 9, Custom:** Use this to specify your needs. M&N options, digit 1 automatically get metal housings (Option 3).

### **MOUNTING (DIGIT 8):**

Option 0: Horizontal

Option 1: Vertical

**Zero & Span Adjustments:** (Zero on right, span on left). Always adjust zero before span. NOTE: Nema 4X, MIL-STD and nuclear have no front panel adjustments. Unit must be removed from housing for calibration (Normally not required).

**Connectors:** All connectors are 2 piece plug-in on 3.5 mm centers. Min-Max Gauge accepted is 26-16.

## ***BDM MOUNTING INSTRUCTIONS***

### **MOUNTING INSTRUCTIONS:**

1. Remove mounting bracket and hardware.
2. Slide meter into panel cutout from front of panel.
3. Reattach mounting bracket and hardware
4. Tighten screws on rear of meter to secure in panel.

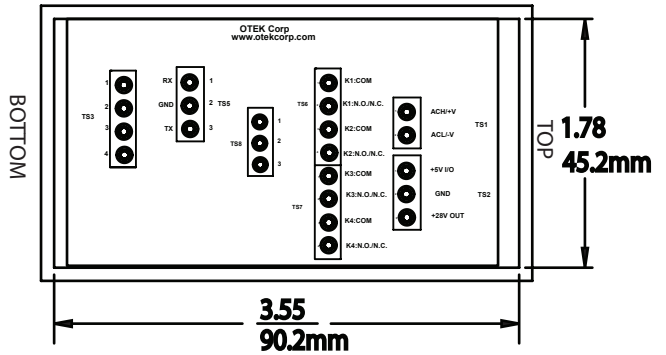
# BDM MECHANICAL INFORMATION

ACTUAL DISPLAY WILL VARY

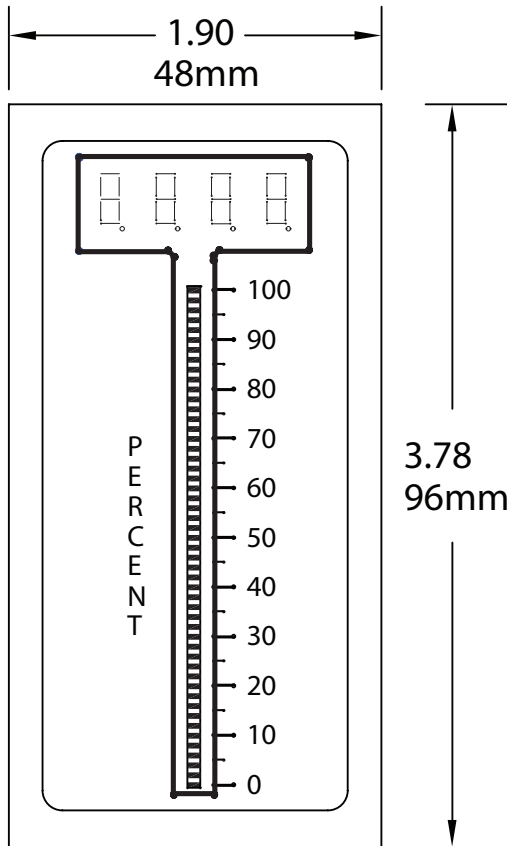
ACTUAL CONNECTORS WILL VARY



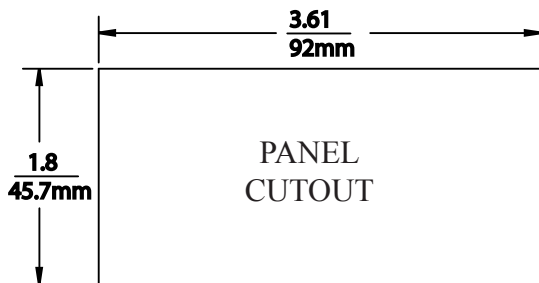
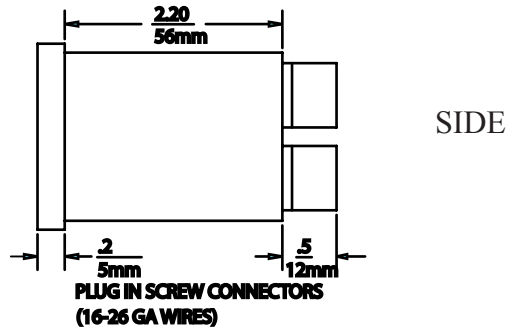
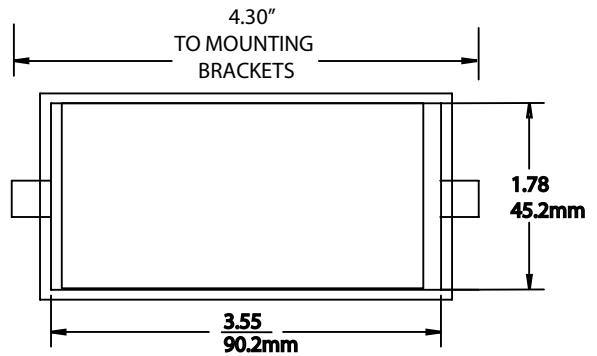
REAR



FRONT VIEW



REAR



# BDM ORDERING INFORMATION 8-1-13

Model: BDM - 1-2-3-4-5-6-7-8-9

<p><b>GRADE (1)</b></p> <p>I.....Industrial</p> <p>M.....Mil-Spec (Contact OTEK)</p> <p>N.....Nuclear (Contact OTEK)</p> <p>9.....Custom (Contact OTEK)</p> <p><b>INPUT SIGNAL (2)</b></p> <p>01.....4-20mA External Powered</p> <p>03.....Serial Input Remote Display</p> <p>04.....+200mVDC</p> <p>05.....+2VDC</p> <p>06.....+20VDC</p> <p>07.....+200VDC</p> <p>08.....+50mVDC</p> <p>09.....Custom (Contact OTEK)</p> <p>10.....+ 200µADC</p> <p>11.....+2mADC</p> <p>12.....+20mADC</p> <p>13.....+200mADC</p> <p>14.....200mV RMS</p> <p>15.....2V RMS</p> <p>16.....20V RMS</p> <p>17.....200V RMS</p> <p>18.....50mV RMS</p> <p>20.....2mA RMS</p> <p>21.....20mA RMS</p> <p>22.....200mA RMS</p> <p>23.....5 Amp RMS</p> <p>24.....Strain-Gage (&lt;1K Ohm)</p> <p>25.....Strain-Gage (&gt;1K Ohm)</p> <p>26.....RTD (PT100)</p> <p>27.....RTD (PT1000)</p> <p>28.....TC (Type J)</p> <p>30.....TC (Type K)</p> <p>31.....TC (Type T)</p> <p>32.....Frequency (40-20KHz)</p> <p>33.....Frequency (50-440Hz Line)</p> <p>34.....% RH (Specify Sensor)</p> <p>35.....pH (0-14.00)</p> <p>36.....ORP (0-2000mV)</p> <p>37...Hi Speed Peak &amp; Hold (2 VDC)</p>	<p><b>SCALE PLATE</b></p> <p>0.....Standard (0-100%)</p> <p>9.....Custom (Contact OTEK)</p> <p><b>MOUNTING</b></p> <p>0.....Horizontal</p> <p>1.....Vertical</p> <p>9.....Custom (Contact OTEK)</p> <p><b>CASE (3)</b></p> <p>0.....Plastic</p> <p>1.....Metal</p> <p>2.....Plastic/Nema 4X</p> <p>3.....Metal/Nema 4X</p> <p>9.....Custom (Contact OTEK)</p> <p><b>CONTROL &amp; POWER OUT</b></p> <p>0.....None</p> <p>1.....Relays (4)</p> <p>2.....O.C.T. (4)</p> <p>3.....Isol. 4-20mA</p> <p>4.....Isol. 30VDC For XMTR</p> <p>5.....Relays &amp; Isol. 4-20mA</p> <p>6.....O.C.T. &amp; Isol. 4-20mA</p> <p>7.....Relays &amp; Isol. 30VDC For XMTR</p> <p>8.....O.C.T. &amp; Isol. 30 VDC for XMTR</p> <p>9.....Custom (Contact OTEK)</p> <p>A.....Non-Isol. 28 VDC For XMTR</p> <p>B.....Non-Isol. 4-20 mA Out</p> <p><b>POWER INPUT</b></p> <p>1.....Non-Isolated 5VDC</p> <p>2.....Isolated 5VDC</p> <p>3.....Isolated 7-32VDC</p> <p>4.....Isolated 90-265VAC</p> <p>5.....Isolated 9-36VDC</p> <p>6.....Isolated 48VDC</p> <p>7.....Non-Isolated 7-32VDC</p> <p>9.....Custom (Contact OTEK)</p> <p><b>SERIAL I/O (3)</b></p> <p>1.....RS232</p> <p>2.....RS485</p> <p>3.....USB</p> <p>9.....Custom (Contact OTEK)</p>
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**NOTES:**

1. Otek will build to certain nuclear or MIL-standards but testing and confirmation of compliance, if required, will need to be done by a third party and at customer's expense.
2. See "ACS" series for V, A, W, Hz, AC Powerless™.
3. Nema 4x for front panel only.

**DOWNLOADS:** For manuals, user-software or drivers:  
[www.otekcorp.com](http://www.otekcorp.com)