BC Biomedical
A UNIT OF BC GROUP INTERNATIONAL, INC.

# HIGH PRECISION / RESOLUTION DIFFERENTIAL DIGITAL PRESSURE METERS


## DPM-2350 SERIES

## USER MANUAL

# BC BIOMEDICAL
# DPM-2350 SERIES
# TABLE OF CONTENTS

## WARNING - USERS

**The DPM-2350 is for use by skilled technical personnel only.**

## WARNING - USE

**The DPM-2350 is intended for testing only and should never be used in diagnostics, treatment or any other capacity where it would come in contact with a patient.**

## WARNING - CONNECTIONS

**All connections to patients must be removed before connecting the DUT to the DPM-2350. A serious hazard may occur if the patient is connected when testing with the DPM-2350.**

## CAUTION - MODIFICATIONS

**The DPM-2350 is intended for use within the published specifications. Any application beyond these specifications or any unauthorized user modifications may result in hazards or improper operation.**

## CAUTION - SERVICE

**The DPM-2350 is intended to be serviced only by authorized service personnel. Troubleshooting and service procedures should only be performed by qualified technical personnel.**

## CAUTION - INSPECTION

**The DPM-2350 Series Meters should be inspected before each use for wear and the Meter should be serviced if any parts are in question.**

## CAUTION - CLEANING

**Do not immerse. The Meter should be cleaned by wiping gently with a damp, lint-free cloth. A mild detergent can be used if desired.**

## CAUTION - LIQUIDS

**Do not submerge or spill liquids on the DPM-2350. Do not operate the DPM-2350 if it may have been exposed to fluid.**

## CAUTION - ENVIRONMENT

**Exposure to environmental conditions outside the specifications can adversely affect the performance and accuracy of the DPM-2350. If the unit is outside the Operating Specifications, allow it to acclimate to specified conditions for at least 30 minutes before attempting to operate it.**

## CAUTION – MEDIA COMPATIBILITY

**The DPM-2350 is intended to be used with only non-corrosive, non-ionic, or otherwise pure fluids and/or gases that are compatible with sensor materials including glass, silicon, ceramic, epoxy, RTV, gold, aluminum and nickel.**

## CAUTION – LO PRESSURE PORT LIQUIDS INCOMPATIBILITY

**The Lo port of the DPM-2350 is not intended for liquids, use only dry gases.**

# NOTICE – CE

**The DPM-2350 Series Meters bear the CE mark**
**Based on the following testing standards:**

## ELECTROMAGNETIC COMPATIBILITY DIRECTIVE
**EMC – Directive 89/336/EEC as amended by 92/31/EEC and 93/68/EEC**

**EN 61326-1:1997 + A1:1998 + A2:2001 + A3:2003**
**"Electrical equipment for measurement, control and laboratory use – EMC requirements"**

This equipment has been type tested by an independent, accredited testing laboratory and compliance was demonstrated to the above standard to the extent applicable.

EMISSIONS
Radiated and Line Conducted Emissions

| | |
|---|---|
| EN 61000-3-2:2000 | Harmonic Current Emissions |
| EN 61000-3-3:1995 + A1:2001 | Voltage Fluctuation and Flicker |

IMMUNITY– CLASS C

| | |
|---|---|
| EN 61000-4-2:1995 + A1:1998 + A2:2001 | Electrostatic Discharge |
| EN 61000-4-3:2002 | Radiated Electric Field Immunity |
| EN 61000-4-4:1995 + A1:2001 + A2:2001 | Electrical Fast Transients / Bursts |
| EN 61000-4-5:1995 + A1:2001 | Surge Voltage |
| EN 61000-4-6:1996 + A1:2000 | Conducted Disturbance |
| EN 61000-4-11:1994 + A1:2001 | Voltage Dips and Short Interrupts |

## LOW VOLTAGE DIRECTIVE
**EC – Directive 73/23/EC**

**EN 61010-1:2001**
**"Safety requirements for electrical equipment for measurement, control, and laboratory use – General requirements"**

This equipment has been type tested and compliance was demonstrated to the above standard to the extent applicable.

# NOTICE – SYMBOLS

| Symbol | Description |
|---|---|
|  | Center Negative |

# NOTICE – ABBREVIATIONS

| | |
|---|---|
| ANSI | American National Standards Institute |
| ASCII | American Standard Code for Information Interchange |
| BCD | Binary Coded Decimal |
| C | Celsius |
| $cmH_20$ | centimeters of water |
| ° | degree(s) |
| DUT | Device Under Test |
| DC | Direct Current |
| Euro | European |
| F | Fahrenheit |
| FS | Full Scale |
| inHg | inches of mercury |
| $inH_20$ | inches of water |
| kg | kilogram(s) |
| $kg/cm^2$ | kilogram(s) per centimeter squared |
| kHz | kilohertz |
| kPa | kilopascal(s) |
| Max | Maximum |
| µA | microampere(s) |
| mA | milliampere(s) |
| mBar | milliBar(s) |
| mm | millimeter(s) |
| mmHg | millimeter(s) of mercury |
| Min | Minimum |
| NEDA | National Electronic Distributors Association |
| Lbs | pounds |
| PSI | pounds per square inch |
| Pres | Pressure |
| RH | Relative Humidity |
| RTD | Resistive Thermal Device |
| s | second(s) |
| Temp | Temperature |
| USA | United States of America |
| V | Volt(s) |
| VDC | Volt(s) Direct Current |

## NOTICE – DISCLAIMER

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## NOTICE – CONTACT INFORMATION

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# BC BIOMEDICAL
# DPM-2350 SERIES
# DIGITAL PRESSURE METERS

The Model DPM-2350 Series is a family of microprocessor-based, high-precision Differential Pressure Meters, which are intended for use in the evaluation and servicing of a wide variety of medical, commercial and industrial applications. These meters measure compatible differential gas and liquid pressures in various engineering units. Available optional features include a RS-232 port for remote control and data collection, a DC analog output option, and an optional temperature sensor input (either YSI 700 Series or 100 Ω RTD Probe). The following are highlights of the main features:

DPM-2351 (Basic Features):

- GRAPHICAL LCD DISPLAY WITH CURSOR SELECTION OF OPTIONS AND SETUP OF PARAMETERS
- ± 0.05% FS PRESSURE ACCURACY
- DIGITAL CALIBRATION AND ZERO OFFSET ADJUSTMENT – NO POTS TO TURN
- 24 BIT MEASUREMENT
- PROGRAMMABLE DIGITAL FILTER
- 13 ENGINEERING UNITS:
    - PSI
    - $inH_2O$ @ 4 °C
    - $inH_2O$ @ 20 °C
    - $inH_2O$ @ 60 °F
    - $cmH_2O$ @ 20 °C
    - inHg @ 0 °C
    - inHg @ 20 °C
    - mmHg @ 0 °C
    - mmHg @ 20 °C
    - $kg/cm^2$
    - kPa
    - mBar
    - Bar
- SELECTABLE DISPLAY OPTIONS AND DIGIT SIZES
- BATTERY LIFE DISPLAY (0 to 100%)
- SOFTWARE-ADJUSTABLE DISPLAY CONTRAST
- MAX and MIN PRESSURE VALUE CAPTURE AND STORAGE

DPM-2352 MODEL ADDS:

- RS-232 SERIAL COMMUNICATIONS

ANALOG OUTPUT OPTION (OPTION DC) ADDS:

- OPTION DC - DC ANALOG OUTPUT (REFRESH RATE DEPENDENT UPON DIGITAL FILTER SETTING)
- BNC OUTPUT CONNECTOR
- ± 0.1% FS ACCURACY

TEMPERATURE OPTION ADDS:

- OPTION Y7 - YSI 700 TEMPERATURE PROBE INTERFACE
- OPTION R1 - 100 Ω RTD TEMPERATURE PROBE INTERFACE
- -20.0 TO 100.0 °C / -4.0 TO 212.0 °F TEMPERATURE RANGE
- ± 0.5% FS ACCURACY
- MAX and MIN TEMPERATURE VALUE CAPTURE AND STORAGE

OPTIONAL ACCESSORIES:

- BC20-21100 BATTERY ELIMINATOR (USA Version)
- BC20-21101 BATTERY ELIMINATOR (Euro Version)
- BC20-41337 RS-232 COMMUNICATIONS CABLE (7PIN MINI-DIN TO DB-9F)
- BC20-41339 USB COMMUNICATIONS ADAPTER (DB-9M TO USB-A) FOR USE WITH BC20-41337
- BC20-30106 SOFT-SIDED CARRYING CASE
- BC20-01005 UNIVERSAL MANOMETER (PRESSURE) ADAPTER KIT
- BC20-01006 YSI 700 TEMPERATURE PROBE
- BC20-01008 RTD (100 Ω) TEMPERATURE PROBE

# MODEL INFORMATION

Use the following model configuration guide to construct or decode a DPM235X series differential Digital Pressure Meter model number:

**DPM 235X XX N XX XX**

Options
- DC = DC (Direct Current) Analog Output
- FC = Female Quick-Disconnect
- MC = Male Quick-Disconnect
- Sxx = Special Coupler Configuration, see table

Temperature Sensor
- N = Not Applicable
- Y7 = YSI 700
- R1 = 100 Ω RTD

Pressure Range
- 100 = Max 100 PSI (Default Quick-Disconnect)
- 75 = Max 75 PSI (Default Quick-Disconnect)
- 10 = Max 10 PSI (Default Male Luer Lock)
- 5 = Max 5 PSI (Default Male Luer Lock)
- .3 = Max 0.3 PSI (Default Male Luer Lock)

Model
- 2351 = Basic Differential Model
- 2352 = Adds RS232

**Note:** The FC or MC options are not applicable when the "–Sxx" option is specified.

| COUPLER TYPES | | |
|---|---|---|
| MALE LUER LOCK | FEMALE QUICK-DISCONNECT | MALE QUICK-DISCONNECT |
|  |  |  |

Example model numbers:

- DPM-235175NNFC
  - Model DPM-2351 (Basic Model)
  - Pressure Range:
    - 75 PSI
    - Right Port: Female Quick-Disconect Coupler
    - Left Port: Female Quick-Disconnect Coupler
  - Not equipped with Temperature Sensor Option
  - Not equipped with Analog Output Option

- DPM-2352100NY7DCFC
  - Model DPM-2302 (Basic Model plus RS-232)
  - Pressure Range:
    - 100 PSI
    - Right Port: Female Quick-Disconnect Coupler
    - Left Port: Female Quick-Disconnect Coupler
  - YSI 700 Series Temperature Sensor Option
  - DC Analog Output Option

For additional coupler options, the "-Sxx" Special Coupler Configurations option over-rides default coupler options to those listed in the following table:

| SPECIAL COUPLER CONFIGURATIONS | | |
|---|---|---|
| Option | Right Port Coupler | Left Port Coupler |
| S01 | Female Quick-Disconnect | Female Quick-Disconnect |
| S02 | Female Quick-Disconnect | Male Quick-Disconnect |
| S03 | Female Quick-Disconnect | Male Luer Lock |
| S05 | Male Quick-Disconnect | Female Quick-Disconnect |
| S06 | Male Quick-Disconnect | Male Quick-Disconnect |
| S07 | Male Quick-Disconnect | Male Luer Lock |
| S09 | Male Luer Lock | Female Quick-Disconnect |
| S10 | Male Luer Lock | Male Quick-Disconnect |
| S11 | Male Luer Lock | Male Luer Lock |

Examples of model numbers with "-Sxx" Special Coupler Configurations option:

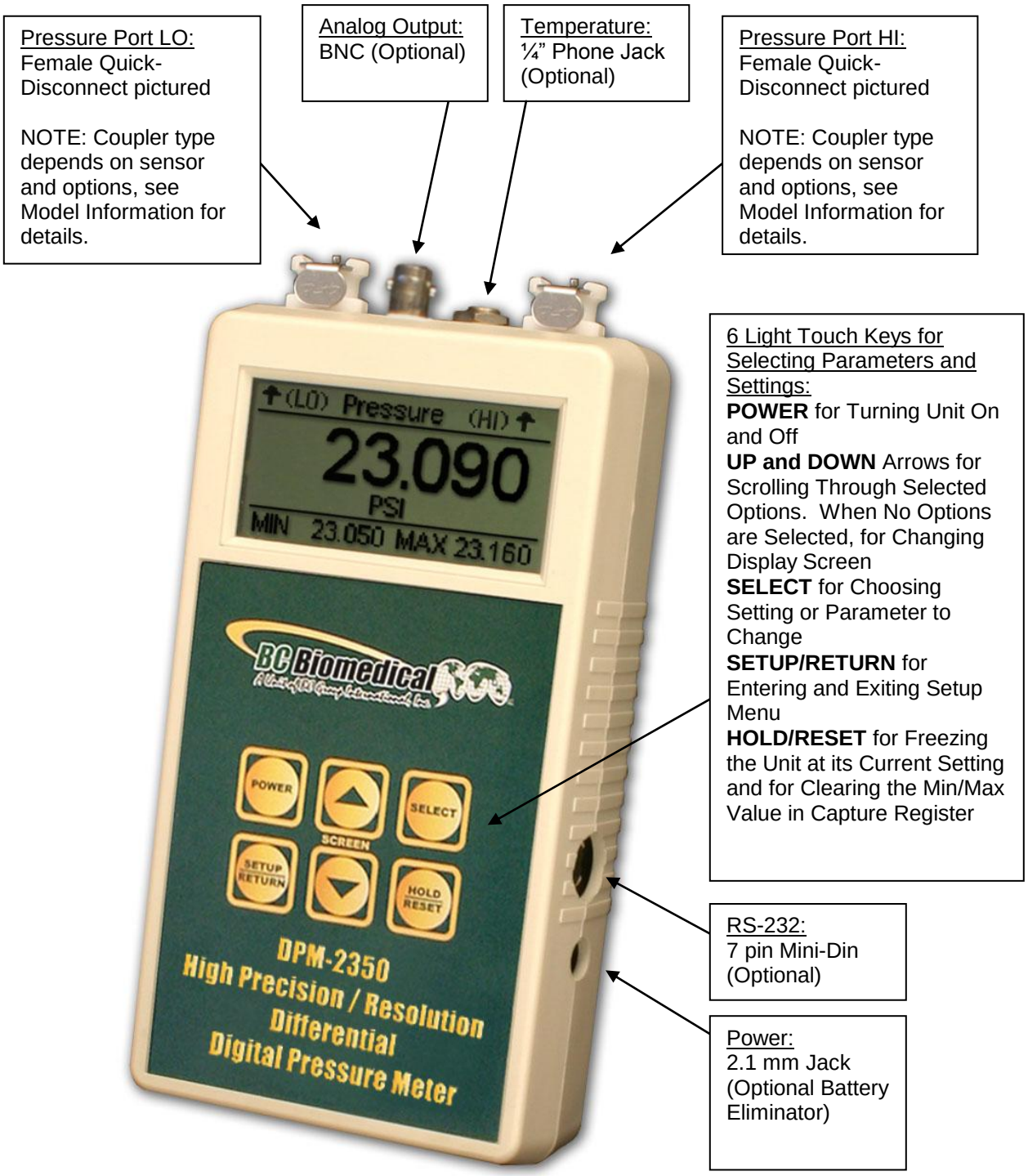
- DPM-235110NNS03
  - Model DPM-2351 (Basic Model)
  - Pressure Range:
    - 10 PSI
    - Right Port: Female Quick-Disconnect Coupler
    - Left Port: Male Luer Lock Coupler
  - Not equipped with Temperature Sensor Option
  - Not equipped with Analog Output Option

- DPM-235210NY7DCS09
    - Model DPM-2352 (Basic Model plus RS-232)
    - Pressure Range:
        - 10 PSI
        - Right Port: Male Luer Lock Coupler
        - Left Port: Female Quick-Disconnect Coupler
    - YSI 700 Series Temperature Sensor Option
    - DC Analog Output Option

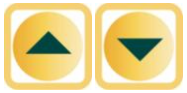
| PRESSURE RANGES BY SENSOR RANGE | | | | | |
|---|---|---|---|---|---|
| PRESSURE UNITS | PRESSURE SENSOR RANGE | | | | |
| | 100 PSI | 75 PSI | 10 PSI | 5 PSI | 0.3 PSI |
| PSI | -13.500 to 100.000 | -13.500 to 75.000 | -10.0000 to 10.0000 | -5.0000 to 5.0000 | -.30000 to .30000 |
| mmHg @ 0° C | -698.2 to 5171.5 | -698.2 to 3878.6 | -517.15 to 517.15 | -258.57 to 258.57 | -15.514 to 15.514 |
| mmHg @ 20° C | -700.6 to 5190.3 | -700.6 to 3892.7 | -519.00 to 519.03 | -259.51 to 259.51 | -15.571 to 15.571 |
| inHg @ 0° C | -27.486 to 203.602 | -27.486 to 152.702 | -20.3602 to 20.3602 | -10.1801 to 10.1801 | -.61081 to .61081 |
| inHg @ 20° C | -27.586 to 204.342 | -27.586 to 153.256 | -20.4342 to 20.4342 | -10.2171 to 10.2171 | -.61303 to .61303 |
| $cmH_2O$ @ 20° C | -951.8 to 7043.2 | -951.8 to 5282.4 | -704.32 to 704.32 | -352.16 to 352.16 | -21.129 to 21.129 |
| $inH_2O$ @ 4° C | -373.6 to 2768.1 | -373.6 to 2076.1 | -276.81 to 276.81 | -138.40 to 138.40 | -8.304 to 8.304 |
| $inH_2O$ @ 20° C | -374.3 to 2772.9 | -374.3 to 2079.7 | -277.29 to 277.29 | -138.64 to 138.64 | -8.319 to 8.319 |
| $inH_2O$ @ 60° F | -374.1 to 2770.8 | -374.1 to 2078.1 | -277.08 to 277.08 | -138.54 to 138.54 | -8.312 to 8.312 |
| $kg/cm^2$ | -.9491 to 7.0306 | -.9491 to 5.2730 | -.70307 to .70307 | -.35153 to .35153 | -.021092 to 0.21092 |
| kPa | -93.08 to 689.48 | -93.08 to 517.11 | -68.948 to 68.948 | -34.473 to 34.473 | -2.0684 to 2.0684 |
| mBar | -930.8 to 6894.8 | -930.8 to 5171.1 | -689.48 to 689.48 | -344.74 to 344.74 | -20.684 to 20.684 |
| Bar | -.9308 to 6.8948 | -.9308 to 5.1711 | -.68948 to .68948 | -.34474 to .34474 | -.020684 to .020684 |

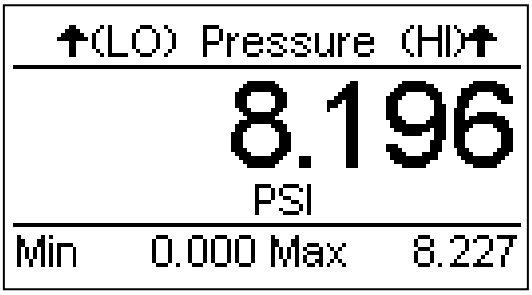
# LAYOUT

This section looks at the layout of the DPM-2350 and gives descriptions of the elements that are present.

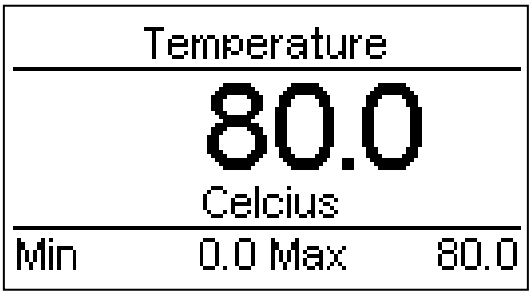


# SCREENS

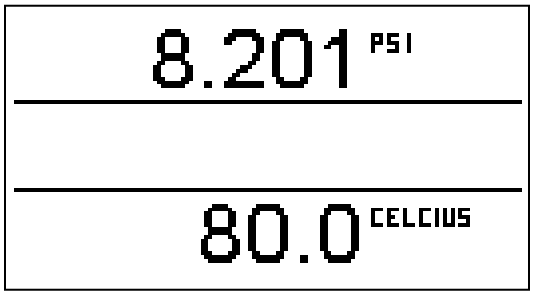
**MAIN SCREENS** – There can be up to four main screens, depending on the model. They are PRESSURE, TEMPERATURE, COMBINED and INPUTS. The available screens can be toggled through using  .



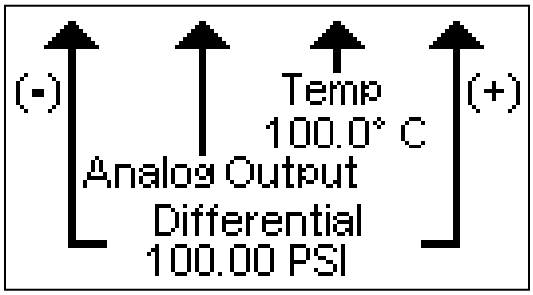

Pressure Display with Min/Max Option selected




Temperature Display with Min/Max Option selected




Combined Screen showing both Pressure & Temperature



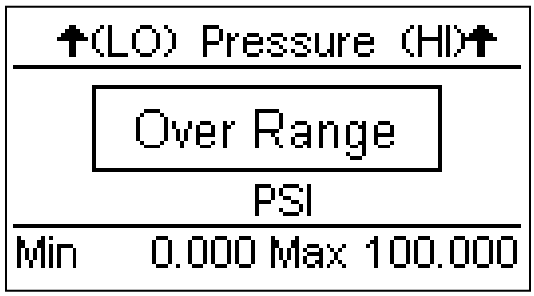

Input Identification Screen
**Note:** Sensor limits are displayed based on selected range.

**PRESSURE SCALE** – The pressure scale is indicated by the units displayed under the reading. The scale can be changed by using 

to highlight the unit line and  to toggle between available pressure units as listed below.

| Pressure Units (Differential) | |
|---|---|
| PSI | mmHg @ 0 °C |
| $inH_2O$ @ 4 °C | mmHg @ 20 °C |
| $inH_2O$ @ 20 °C | $kg/cm^2$ |
| $inH_2O$ @ 60 °F | kPa |
| $cmH_2O$ @ 20 °C | mBar |
| inHg @ 0 °C | Bar |
| inHg @ 20 °C | |

**NOTE**: If the measured pressure is outside of the range of the instrument, an OVER RANGE or UNDER RANGE message box will be displayed.

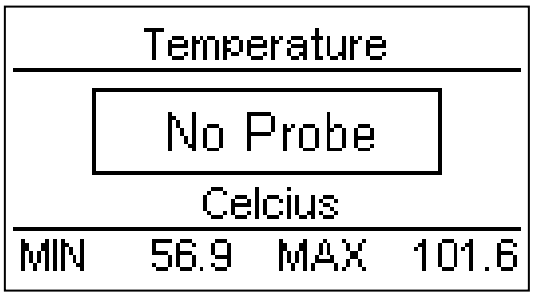



Typical display with "Over Range" message box.

**TEMPERATURE SCALE** – The temperature scale is indicated by the units displayed under the reading. The scale can be changed by using 

to highlight the unit line and  to toggle the temperature units between Degrees Celsius (°C) and Fahrenheit (°F).

**NOTE**: If the measured temperature is outside of the range of the instrument, an OVER RANGE or UNDER RANGE message box will be displayed. For models with the YSI option, the NO PROBE message box will be displayed when the unit detects an open connection. For models with the RTD option, the OVER RANGE message box will also be displayed with an open connection.

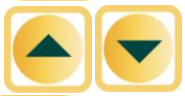



Typical display with "No Probe" message box.

NOTE: YSI option only

**SYSTEM SETUP** – The Setup Mode allows the user to adjust the configuration of the meter. The Setup screen can be entered using the 

key. The parameters can be changed by using 

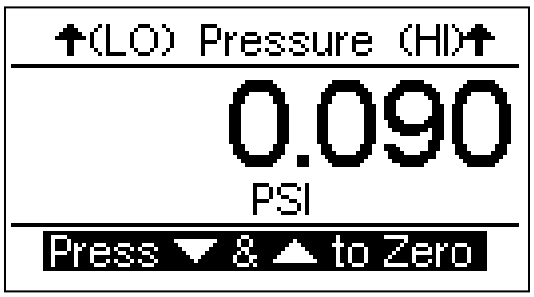
to highlight the line and  to toggle the available options. The Setup screen can be exited using the 

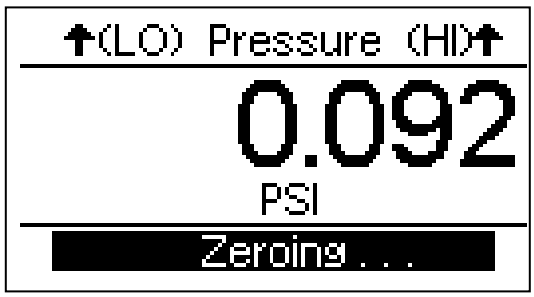
key.

The following is a breakdown of the parameters available in the configuration of the unit and their available options:

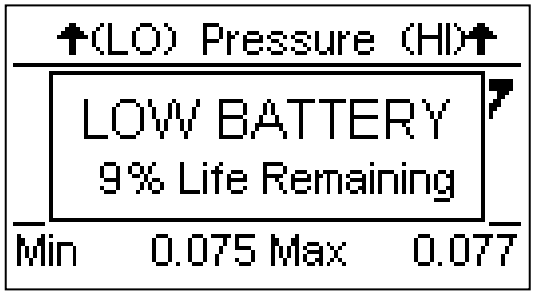
| System Setup Configuration | | |
|---|---|---|
| **Parameter** | **Description** | **Range** |
| Display Min/Max | Selects whether the Min and Max values will be displayed on the main screens (except COMBINED). | yes/no |
| Analog Scale | Analog Output Scaling voltage. This is the maximum analog output voltage. The output is scaled to this voltage over the positive range of the selected analog source. | 1.0 to 4.0 Volts |
| Analog Source | Selects the source reading for the analog output | Pres or Temp |
| Contrast Adjust | Sets the contrast of the display screen. | 0 to 20 |
| Auto Off Timer | Determines the period of inactivity before the meter is turned OFF. A timer is started when the meter is turned ON and is reset each time a key is pressed. When the timer reaches the value set in this parameter, the power is automatically turned OFF. (NOTE: Setting this parameter to 0 disables the Auto Off timer. When running from line power, the meter does not automatically shut off.) | 0 to 30 Minutes |
| Battery Life | Displays current life of the battery. At 10%, a warning screen will appear. | 0 to 100% (Read Only) |
| Beep Length | Sets audible beep duration. | 0 to 15 |
| Filter – Pres | Determines the number of samples that are averaged in the digital filter. The software has a Digital Filter that averages the readings to produce a stable display. (NOTE: Increasing this setting will cause a more stable display. However, it will also cause a slower response to small changes. The best setting is the smallest number that provides a stable display.) | 0 to 10 Seconds |
| Filter – Temp | | |
| RTD Type (OPTION R1) | Sets the Temperature Coefficient (alpha) to match that of the RTD probe. | 0.00385/°C or 0.00392/°C |
| Software | Displays current software program. | (Read Only) |

**ZEROING PRESSURE SCALES** – When there is no pressure applied to either port, the display should read "0." It may be necessary to zero the pressure scales to remove any errors due to ambient conditions. This is done by pressing the SELECT key until the zeroing instructions are displayed, then pressing ▲ ▼ simultaneously to begin the process. The "ZEROING…" message will flash while the scale is being zeroed. When the zeroing instructions are displayed again, the process is complete.




**LOW BATTERY** – When the battery life reaches 10 percent, the LOW BATTERY message box will be displayed.




Typical display with "Low Battery" message box.

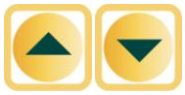
**NOTE**: A battery eliminator receptacle is provided so that the unit can be powered by the optional 9 VDC Battery Eliminator, enabling continuous operation.

**NOTE**: The unit is shipped with a Red Battery Lock-Out plug installed into the line power receptacle as shown below. Its purpose is to prevent the unit from accidentally being turned on during handling and transport, subsequently depleting the battery. This plug must be removed before any use!

# KEYS

Six tactile-touch keys are provided for system operation:

– This key turns the unit off and on. The unit will return to the main screen that was active when it was turned off.

 – In the DISPLAY MODE, these keys toggle the display through the available main screens.

In the SELECT MODE, if a parameter has been highlighted, these keys will scroll through the available settings.

– On any screen, there are a number of parameters that may be selected and changed. This key sequences the cursor (Highlight) through those parameters.

– This key is used to Hold (freeze) and Reset (unfreeze) any of the input displays. Depressing this key will hold the currently displayed Pressure or Temperature reading until reset. Each input can be held independently.

When active, the word “HOLD” is in the display. Depressing this key on a screen that is held will reset that input and remove the word “HOLD” from the display.

NOTE: In the composite screen, the hold feature requires that the specific input be selected using 

before 

is used.

– This key toggles the unit into and out of the Setup Mode. Depressing this key will enter the Setup screen where the configuration can be viewed and adjusted. Depressing the key again will exit the Setup Mode and return to the previously viewed main screen. This will also save any changes to the internal EEPROM memory so they will be retained even with the power turned off or battery removed.

# OPTIONS

**ANALOG OUTPUT** – The unit may be ordered with a DC Analog Output Option. This option provides a filtered analog output that is representative of the displayed pressure or temperature, and is provided via a BNC connector on the top of the unit. The source parameter for the analog output is selectable in the Setup Menu between Pressure (Pres) or Temperature (Temp). The output is scaled to match the 0 to FS range of the selected source parameter over a variable internally generated reference voltage. This reference voltage is selectable from 1.0 to 4.0 VDC in 0.1 V increments through the Setup Menu. Filtering is dependent on the Digital Filter Setting (See System Setup section for more information).

**TEMPERATURE** – The unit may be ordered with the Temperature Option. This option allows the unit to read an external temperature sensor/transducer and display temperatures between -20 to 100 °C (-4.0 to 212.0 °F). The temperature probe interface is a standard ¼" Phone Jack.

- **YSI 700 Temperature Input (Y7)** – This option allows the unit to display temperature measured by a YSI 700 series standard temperature probe.
- **RTD Temperature Input (R1)** – This option allows the unit to display temperature measured by a standard 100 Ω RTD. This option supports selectable temperature coefficients (alpha) to match that of the sensor or probe:
  - 0.00385 Ω/Ω/°C (most common)
  - 0.00392 Ω/Ω/°C

# COMMUNICATIONS

Since the meter does not handle a great deal of data, the RS-232 communications link has been optimized to allow the user, through very simple instructions, to control and request data from the meter. Refer to Specifications section for RS-232 Settings (Baud, etc).

Data transmitted/received is in standard ASCII format, and all numerical values are in BCD format. All commands sent to the unit should be terminated with a "Carriage Return" character (<CR> or in hexadecimal, 0x0D). All commands and responses are echoed by the unit for confirmation of communication, and are terminated with "Carriage Return" and "Line Feed" characters (<CR><LF> or in hexadecimal, 0x0D0A). If an invalid command is received, the unit will respond with the characters "??".

The following section describes the protocol used by the meter in detail:

<table>
<tr>
<td>R - <u>READ</u></td>
<td>The READ command allows the user to read system settings and data.<br><br><u>Usage:</u><br>R(Location)(CR)<br>Where:<br>R - READ command<br>Location - contains two digits indicating the data location to be read<br>CR - Carriage Return<br><br><u>Example:</u><br><br>
<table>
<tr><th><u>Data Sent</u></th><th><u>Data Returned</u></th><th><u>Meaning</u></th></tr>
<tr><td>R08<CR></td><td>R08<CR><LF></td><td>Echo of Command Sent</td></tr>
<tr><td></td><td>10.25 mmHg<CR><LF></td><td>10.25 mmHg measured</td></tr>
</table>
</td>
</tr>
<tr>
<td>W - <u>WRITE</u></td>
<td>The WRITE command allows the user to update the system settings.<br><br><u>Usage:</u><br>W(Location – 2 digits)(Data – 5 digits)(CR)<br>Where:<br>W - WRITE command<br>Location - contains two digits indicating the data location to be written<br>Data – five-digit field containing the data to be written at the Location set above<br>CR - Carriage Return</td>
</tr>
</table>

<table>
<tr><td></td><td>Examples:<br><br>
<table>
<tr><th>Data Sent</th><th>Data Returned</th><th>Meaning</th></tr>
<tr><td>W064<CR></td><td>W064<CR><LF></td><td>Echo of Command Sent<br>(Set Pressure units to “in$H_2O$”)</td></tr>
<tr><td>W0600004<CR></td><td>W0600004<CR><LF></td><td>Echo of Command Sent<br>(Set Pressure units to “in$H_2O$”)</td></tr>
<tr><td>W05100<CR></td><td>W05100<CR><LF></td><td>Echo of Command Sent</td></tr>
<tr><td>??<CR><LF></td><td colspan="2">Invalid Command Response<br>(Location 05 is Read Only)</td></tr>
</table></td></tr>
<tr><td>U - <u>UPLOAD</u></td><td>The UPLOAD command allows the user to read all of the selected device data from locations 1 through 16 with a single command. The data returned will be formatted as a single block per location separated by a carriage return, line feed character sequence (CRLF – equivalent to hexadecimal 0x0D0A). See the table below for details on the data structure.<br><br><u>Usage:</u><br>U(CR)<br><br>Where:<br>U – UPLOAD command<br>CR - Carriage Return</td></tr>
<tr><td>Q - <u>QUICKSEND</u></td><td>QUICKSEND is a feature that allows the user to receive an automatic update of all of the meter data without any further user interaction. When the QUICKSEND command is received, the feature is turned ON and the meter will automatically send all of the device data every half second. The Quicksend feature is toggled ON and OFF with the QUICKSEND command. See the table below for details on the data structure.<br><br><u>Usage:</u><br>Q(CR)<br><br>Where:<br>Q – QUICKSEND command<br>CR - Carriage Return</td></tr>
<tr><td>V - <u>VERSION</u></td><td>The VERSION command allows the user to read the Software Version that the unit is currently running.<br><br><u>Usage:</u><br>V(CR)<br><br>Where:<br>V – VERSION command<br>CR - Carriage Return</td></tr>
</table>

| | |
|---|---|
| X - **CANCEL** | The CANCEL command is simply a way to re-establish proper control, should a communications error occur or an incorrect command be transmitted. For the most part, an incorrect command will simply be ignored and the meter will return to listening for future commands. However, a prior command may be cancelled midstream by transmitting the CANCEL command anytime.<br><br>Usage:<br>X<br><br>This command does not require a carriage return, nor will it acknowledge with a carriage return. However, it will echo an 'X' character to indicate that the CANCEL command has been received.<br><br>NOTE: The VERSION or CANCEL commands may also be utilized as an acknowledgement of the meter being on line. |

| DATA LOCATIONS | | | | |
|---|---|---|---|---|
| LOCATION | ACCESS | DESCRIPTION | RANGE | |
| 01 | READ | BATTERY LIFE REMAINING | 0 to 100% | |
| 02 | READ/WRITE | CONTRAST | 0 to 20 | |
| 03 | READ/WRITE | AUTO POWER OFF | 0 to 30 (seconds) | |
| 04 | READ | MODEL | RESERVED | |
| 05 | READ | PRESSURE 1 TYPE | 1 | 100 PSI Max |
| | | | 2 | 75 PSI Max |
| | | | 3 | 10 PSI max |
| | | | 4 | 5 PSI max |
| | | | 5 | 0.3 PSI max |
| 06 | READ/WRITE | PRESSURE 1 UNITS | 0 | PSI |
| | | | 1 | mmHg @ 0 °C |
| | | | 2 | mmHg @ 20 °C |
| | | | 3 | inHg @ 0 °C |
| | | | 4 | inHg @ 20 °C |
| | | | 5 | $cmH_2O$ @ 20°C |
| | | | 6 | $inH_2O$ @ 4 °C |
| | | | 7 | $inH_2O$ @ 20 °C |
| | | | 8 | $inH_2O$ @ 60 °F |
| | | | 9 | $kg/cm^2$ |
| | | | 10 | kPa |
| | | | 11 | mBar |
| | | | 12 | Bar |
| 07 | READ/WRITE | PRESSURE 1 FILTER | 0-60 (seconds) | |
| 08 | READ | PRESSURE 1 | See Note 1 | |
| 09 | READ/WRITE | PRESSURE 1 MAX | See Note 1, 3 | |
| 10 | READ/WRITE | PRESSURE 1 MIN | See Note 1, 3 | |

| DATA LOCATIONS (Temp option only) | | | | |
|---|---|---|---|---|
| LOCATION | ACCESS | DESCRIPTION | RANGE | |
| 17 | READ | TEMPERATURE SENSOR TYPE | 0 | Not Applicable |
| | | | 1 | YSI 700 |
| | | | 2 | RTD 100 |
| 18 | READ/WRITE | TEMPERATURE UNITS | 0 | °C |
| | | | 1 | °F |
| 19 | READ/WRITE | TEMPERATURE FILTER | 0-60 | |
| 20 | READ | TEMPERATURE | See Note 2 | |
| 21 | READ/WRITE | TEMPERATURE MAX | See Note 2, 3 | |
| 22 | READ/WRITE | TEMPERATURE MIN | See Note 2, 3 | |

**NOTES**

1. Pressure readings are returned in the currently set Pressure Units parameter in Location 6. This may be changed via the WRITE command or manually via the keys.
2. Temperature readings are returned in the currently set Temperature Units parameter in Location 18. This may be changed via the WRITE command or manually via the keys.
3. MIN/MAX readings may be reset at any time via a WRITE command to either MIN/MAX location, or manually via the keys.

# MANUAL REVISIONS

| Revision # | Program # | Revisions Made |
|---|---|---|
| Rev 01 | DT7321CA | Origination |
| Rev 02 | DT7321CB | Min/Max made standard, Quick-Disconnect added |
| Rev 03 | DT7321CB | MC and FC option for Quick-Disconnect added |
| Rev 04 | DT7321CG | Misc. Updates |
| Rev 05 | DT7321CH | Format Updated, Specifications Updated, Misc. Updates |
| Rev 06 | DT7321CI | Special Coupler Configurations option added, Max Overpressure Specification added |

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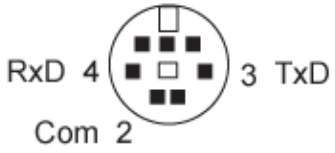
# SPECIFICATIONS

| PRESSURE MEASUREMENT (DIFFERENTIAL) | | |
|---|---|---|
| RANGE | 100 PSI SENSOR | -13.5 TO 100.0 PSI |
| | 75 PSI SENSOR | -13.5 TO 75.0 PSI |
| | 10 PSI SENSOR | -10.0 TO 10.0 PSI |
| | 5 PSI SENSOR | -5.0 TO 5.0 PSI |
| | 0.3 PSI SENSOR | -0.3 TO 0.3 PSI |
| RESOLUTION | 100 PSI SENSOR | 0.001 PSI |
| | 75 PSI SENSOR | 0.001 PSI |
| | 10 PSI SENSOR | 0.0001 PSI |
| | 5 PSI SENSOR | 0.0001 PSI |
| | 0.3 PSI SENSOR | 0.00001 PSI |
| MAXIMUM OVERPRESSURE | 100 PSI SENSOR | 200 PSI |
| | 75 PSI SENSOR | 200 PSI |
| | 10 PSI SENSOR | 45 PSI |
| | 5 PSI SENSOR | 15 PSI |
| | 0.3 PSI SENSOR | 5 PSI |
| ACCURACY | ± 0.05% FS | |
| DIGITAL FILTER | 0 to 10 seconds, Selectable | |
| COMPATIBLE MEDIA | Only non-corrosive, non-ionic, or otherwise pure fluids and/or gases that are compatible with sensor materials including glass, silicon, ceramic, epoxy, RTV, gold, aluminum and nickel.<br><br><u>NOTE:</u> FLUIDS/LIQUIDS ONLY TO BE USED ON HI PORT | |
| CONNECTIONS | See Model Number Breakdown | |

| TEMPERATURE MEASUREMENT (OPTIONAL) | | |
|---|---|---|
| RANGE | -20.0 to 100.0 °C (-4.0 to 212.0 °F) | |
| RESOLUTION | 0.1 °C (0.1 °F) | |
| ACCURACY | ± 0.5% FS | |
| CONNECTIONS | ¼" Phone Jack for use with ¼" Phone Plug terminated temperature cables or probes. | |
| TRANSDUCER COMPATIBILITY | OPTION Y7 | YSI 700 Transducers |
| | OPTION RTD | 100 Ω RTD<br><br>Supports 0.00385 and 0.00392 Ω/Ω/°C temperature coefficient (alpha) sensors |

| ANALOG OUTPUT (OPTIONAL) | |
|---|---|
| RANGE | 1.0 to 4.0 VDC/FS, Selectable |
| ACCURACY | ± 0.1% FS |
| RATE | Output dependent on Digital Filter setting |
| CONNECTIONS | Male BNC Connector |

| PHYSICAL & ENVIRONMENTAL | | |
|---|---|---|
| DISPLAY | 128 X 64 Pixels Non-Backlit Graphical LCD | |
| CONSTRUCTION | ENCLOSURE | ABS Plastic |
| | OVERLAY | Back-printed Lexan |
| SIZE | 7.69 x 3.97 x 1.80 Inches (195.3 x 100.8 x 45.7 mm) | |
| WEIGHT | < 1 Lbs (0.45 kg) | |
| OPERATING RANGE | 15 to 30 °C (59 to 86 °F) | |
| STORAGE RANGE | -40 to 60 °C (-40 to 140 °F) | |

<table>
<tr><th colspan="3">ELECTRICAL & MISC.</th></tr>
<tr><td>BATTERY</td><td colspan="2">9V Alkaline Battery<br>(ANSI/NEDA 1604A or equivalent)</td></tr>
<tr><td>BATTERY<br>ELIMINATOR</td><td colspan="2">9 VDC, 200 mA<br>⊕-(•-⊖<br>BC20-21100 (USA Version)<br>BC20-21101 (Euro Version)</td></tr>
<tr><td rowspan="2">POWER<br>CONSUMPTION</td><td>ON</td><td>< 35 mA</td></tr>
<tr><td>OFF</td><td>< 40 µA</td></tr>
<tr><td rowspan="2">BATTERY LIFE</td><td>CONTINUOUS</td><td>80 hours</td></tr>
<tr><td>OFF</td><td>1 year</td></tr>
<tr><td rowspan="8">RS-232<br>COMMUNICATIONS</td><td>BAUD</td><td>115200</td></tr>
<tr><td>DATA BITS</td><td>8</td></tr>
<tr><td>START BITS</td><td>1</td></tr>
<tr><td>STOP BITS</td><td>1</td></tr>
<tr><td>PARITY</td><td>None</td></tr>
<tr><td>HANDSHAKING</td><td>None</td></tr>
<tr><td>CONNECTIONS</td><td>Seven (7) pin Mini-DIN Receptacle<br><br><u>Pinout:</u><br>RS-232<br>  <br><br>NOTE: As Viewed from Unit Exterior</td></tr>
</table>

# NOTES

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**DPM-2350 Series User Manual**
**07/12 – Rev 06**