

PendoTECH Conductivity Sensor Monitor™ User Guide Model CMONT

Revision 4



www.pendotech.com

Model CMONT User Guide

Revision 4



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The information in this User Guide is believed to be accurate and reliable for use and operation of the control system, however, PendoTECH assumes no responsibility for the use of this product except for what is covered in the Limited Warranty and Terms and Condition of Sale. Goods and Software are not designed, intended or authorized for use as components in life support or medical devices. They are not designed for any application in which the failure of the product could result in personal injury, death or property damage.

WARNING: “WARNING” is used to indicate the presence of a hazard which can cause severe personal injury, death, or substantial property damage if the warning is ignored

NOTE: “NOTE” is used to notify the user of installation or operation information which is important but not hazard related.



Dangerous voltage inside the box. Control box only to be opened by PendoTECH or authorized representative. No user serviceable parts inside.



Warning potential shock hazard. Do not use this product near water or if you are wet. Do not submerge this product. Use only in a grounded electrical outlet. Unplug the product from the outlet before cleaning with any liquids. Install securely on a stable surface. Install in a location where no one can step on or trip over the power cord and where the power cord will not be damaged

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1. Overview of Monitor

Product features include:

- Reads raw conductivity and temperature from the PendoTECH Single Use Conductivity Sensor™
- Handles 2 sensors
- Cell constant prompt when new sensor is connected
- Perform temperature normalization to 25°C with adjustable mS/ °C factor with default factor of 2.1% per °C
- 4 - 20mA outputs for both conductivity and temperature
- RS232 output for data collection to a PC
- Panel mount kit and benchtop stand available
- Ability to do a manual calibration

System Components Supplied:

- Monitor system
- Two cables for connection of PendoTECH Conductivity Sensors
- Power connector
- Power cord for North America or other geography as required (unless panel mount kit is included- then connector only)
- User Guide

1.1. Monitor

The monitor with its user interface is used to display sensor measurements and access the set-up menu functions. The back panel is used to connect the sensors, power and outputs, if required.

1.2. Monitor Details

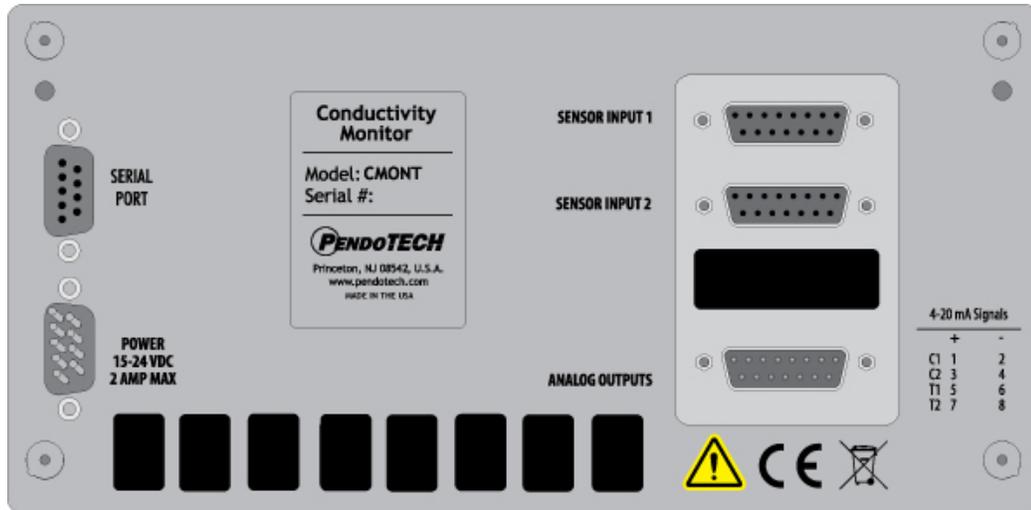
1.2.1. Hardware Details

The Front and Back Panels details are as shown:

FRONT:



BACK:



Connector	Wiring Details
<p>Sensor Inputs</p> <p>For field wired cables:</p> <p>12: White 9: Green</p> <p>2: Red 7: Black</p>	
<p>Power Input</p>	<p>Power 15 to 24VDC</p>
<p>Analog Outputs (4-20mA with Conductivity default scaled from 0-100mS/cm and temperature from 0-70°C)</p> <p>Analog Inputs (for custom applications only): Pin 15 Analog Input 1 (4-20mA) Pin 13 Analog Input 2 (4-20mA)</p>	<p>Temperature 2 - Scaled Temperature 1 - Scaled Conductivity 2 - Scaled Conductivity 1 - Scaled</p> <p>DB15-Male</p>
<p>Serial Port</p>	<p>RS232 communication protocol 19200 baud, 8-NONE-1-NO HANDSHAKE Pin 2: Tx Pin 3: Rx Pin 5: GND</p>

Control System Component	Specifications
Enclosure	H x W x D: 7.86" x 4.47" x 2.25" (19.96 x 11.35 x 5.72 cm) Approx: 1.43 lbs. (0.65 kgs) Material: ABS Plastic Panel/wall mount optional NEMA 4X front panel
Environmental	Temperature: 0–55° C (32–132° F) Humidity: 0–95% RH non-condensing (warm up to rated accuracy = 6 min.)
Keypad	8 button keypad with LEXAN® overlay
Display	4 line x 20 char LCD backlit
Power Inlet	DB9F (Pin 4 is plus and Pin 1 is minus) 15-24 Volts DC 4 Watts
Conductivity Sensor Inputs	Connector on 10 foot reusable cable: DB15 with sensors connector on the other end for PendoTECH sensor*
Regulatory Compliances	CE Mark
Analog Outputs (4-20 mA)	DB15M with connector included to break out 15 pins to screw terminals 4-20mA Range: Conductivity scaled from 0-100mS/cm default [20mA value can be adjusted] Temperature scaled from 0-70°C Load Impedance: Zero Ohm minimum resistance, The analog output spec is: <ul style="list-style-type: none"> • 4-20mA • 850ohm max • 24 VDC • 1% linearity, 12-bit.
Data (dual purpose for software upgrades and data output)	RS232 communication protocol 19200 baud, 8-NONE-1-NO HANDSHAKE
Software Version	Software Revision number displayed at start-up

* See Appendix for important information on this product.

1.2.2. Software Details

The software interface consists of the keypad (shown below) and the 4 line LCD backlit display. The program/firmware is stored in memory in the control system and cannot be edited by users. Only settings in the software menus can be changed. The system does not store any data.



Keypad

KEY	Function
HOME/START	FUTURE USE
STOP	FUTURE USE
LEFT ARROW /TARE	Used when in a setup menu to scroll the cursor left
RIGHT ARROW/ALT	Multiple Purpose: 1- Used when in the program menu to scroll the cursor right 2- Used during to numeric entry to skip the step and retain the previous value
UP ARROW	Multiple Purposes: 1- When on a HOME screen used to select a different view 2- Within a program menu, used to change a selected value 3- Scroll through Setup menu
DOWN ARROW	Multiple Purposes: 1- When on a HOME screen used to select a different view 2- Within a program menu, used to change a selected value 3- Scroll through Setup menu
SELECT/PROG	Used to enter the Setup menu; used to confirm and save changes to a setting
BACK	FUTURE USE

Home Screens

When the system is turned on, the following screen appears:

```
1:XXX.X mS TT.TC
2:XXX.X mS TT.TC
```

- Xs are conductivity normalized to 25°C in mS/cm
- Ts are temperature in °C (N/C if sensor not connected)

At this screen, press the DOWN arrow on the keypad to go to View 2:

```
1:XXX.X mS TT.TC
2:XXX.X mS TT.TC
1:CellK: 1.130
2:CellK: 0.970
```

- Xs are conductivity normalized to 25°C in mS/cm
- Ts are temperature in °C (0.0C if sensor not connected)
- CellK is the user entered Cell Constant

At this screen, press the DOWN arrow on the keypad to go to View 3:

```
1:YYY.YYmS-raw TT.TC
   XXX.XX mS  AA.A mA
2:YYY.YYmS-raw TT.TC
   XXX.XX mS  AA.A mA
```

- Ys indicate raw conductivity in mS/cm
- Ts are temperature in °C (0.0C if sensor not connected)
- Xs are conductivity normalized to 25°C in mS/cm
- As are the calculated 4-20mA output

Connecting a New Sensor *

1. Connect a new sensor then the following prompt appears (where z is the sensor #):

```
Use Arrows to  
Change values.  
Then press PROG or  
BACK to skip.
```

2. If BACK is pressed, the home screen will be displayed. If PROG is pressed, the following screen then appears:

```
Cell Constants  
CellKz: 001.000  
[Press PROG or  
BACK to skip]
```

3. Each sensor has a predetermined cell constant to achieve best accuracy by accounting for small differences in positions and surface area in individual sensor electrodes. If required, use the right arrow to move the cursor and the up/down arrows to change the digit value. Press BACK to escape and not retain a new value entered (previous value remains). Press SELECT/PROG button to confirm.

*** These prompts can be suppressed for remote panel mount installations where the keypad/LCD are not visible using the Sensor Prompts menu. If the BACK or PROG are not pressed OR Sensor Prompts turned Off, the monitor will not function.**

Programming New Parameters

Press the SELECT/PROG to change the unit parameters via the Setup mode. Use the UP/DOWN arrows to scroll through a list of parameters:

- 1) Cell Constants
- 2) Temperature Correction
- 3) Output Scaling
- 4) Stability
- 5) Tare Sensors
- 6) Restore Defaults
- 7) Sensor Prompts
- 8) System Settings [not accessible- PendoTECH use only]

<p>Cell Constants The Cell Constant or K-factor is a factor that is determined when a sensor is made. It is used to account for slight differences in sensor electrode surface area and orientation.</p>	<p>Press the SELECT/PROG button and the following screen appears with instructions on setting the cell constant. Press any button to go to the next screen.</p>	<p>If required, use the right arrow to move the cursor and the up/down arrow to change the digit value. Press BACK to escape and not retain any new value entered or press SELECT/PROG button when complete to confirm.</p>	<p>The following screen will then appears. If required, use the right arrow to move the cursor and the up/down arrow to change the digit value. Press BACK to escape and not retain any new value entered or press SELECT/PROG button when complete to confirm and return to the Setup mode main menu. Then use the UP/DOWN arrows to scroll through the list of Setup parameters or BACK is used to return to the main screen.</p>
<div style="border: 1px solid black; padding: 5px; width: fit-content;"> <p>Setup Mode 1)Cell Constants</p> </div>	<div style="border: 1px solid black; padding: 5px; width: fit-content;"> <p>Use arrows to change values. Then press PROG or BACK to skip.</p> </div>	<div style="border: 1px solid black; padding: 5px; width: fit-content;"> <p>Setup Mode Cell Constants CellK1:00<u>1</u>.000</p> </div>	<div style="border: 1px solid black; padding: 5px; width: fit-content;"> <p>Setup Mode Cell Constants CellK2:00<u>1</u>.000</p> </div>

<p>Temperature Correction</p> <p>Since the raw conductivity of the same liquid can vary dramatically based on liquid temperature, conductivity is typically normalized to 25C so the relative conductivity can be measured. The correction factor in % per degree C can be changed from its default value of 2.1%. This Main screen can be used to view raw conductivity and temperature measurements and determine this factor if required.</p>	<p>Press the SELECT/PROG button and the following screen appears with instructions. Press any button to go to the next screen.</p>	<p>If required, use the right arrow to move the cursor and the up/down arrow to change the digit value. Press BACK to escape and not retain any new value entered or press SELECT/PROG button when complete to confirm and return to the Setup mode main menu.</p> <p>Then use the UP/DOWN arrows to scroll through the list of Setup parameters or BACK is used to return to the main screen.</p>
<div style="border: 1px solid black; padding: 5px; width: fit-content;"> <p>Setup Mode 2)Temp Correction</p> </div>	<div style="border: 1px solid black; padding: 5px; width: fit-content;"> <p>Use arrows to change values. Then press PROG or BACK to skip.</p> </div>	<div style="border: 1px solid black; padding: 5px; width: fit-content;"> <p>Temp Correction Value(%):002.100 [Press PROG or BACK to skip]</p> </div>

<p>Output Scaling</p> <p>For optimal resolution on the 4-20mA analog output signal for conductivity, the conductivity value proportional to 20mA can be programmed. The 4mA value is set to 0mS.</p> <p>For temperature, the 4-20mA range is fixed from 0 to 70°C.</p>	<p>Press the SELECT/PROG button and the following screen appears with instructions on setting 20mA output value. Press any button to go to the next screen.</p>	<p>The default value is 100mS. If required, use the right arrow to move the cursor and the up/down arrow to change the digit value. Press BACK to escape and not retain any new value entered or press SELECT/PROG button when complete to confirm and return to the Setup mode main menu.</p> <p>Then use the UP/DOWN arrows to scroll through the list of Setup parameters or BACK is used to return to the main screen.</p>
<div style="border: 1px solid black; padding: 5px;"> <p>Setup Mode 3)Temp Correction</p> </div>	<div style="border: 1px solid black; padding: 5px;"> <p>Use arrows to change values. Then press PROG or BACK to skip.</p> </div>	<div style="border: 1px solid black; padding: 5px;"> <p>Setup Mode Set 20mA output Value (mS):100.</p> </div>

<p>Stability</p> <p>There are three options for stability: Lowest, Medium or Highest. The default is medium. This mainly impacts the readings above 20mS. With electrical noise present at higher conductivity (low resistivity), by changing to the Highest Stability setting, some of the noise is filtered out, but this results in a slight lag in response time for large and rapid shifts in conductivity.</p>	<p>Press the SELECT/PROG button and the following screen appears. The default value is Medium. If required, use the up/down arrow to change the setting. Press BACK to escape and not retain any new value entered or press SELECT/PROG button when complete to confirm and return to the Setup mode main menu.</p> <p>Then use the UP/DOWN arrows to scroll through the list of Setup parameters or BACK is used to return to the main screen.</p>
<div style="border: 1px solid black; padding: 5px;"> <p>Setup Mode 4)Stability</p> </div>	<div style="border: 1px solid black; padding: 5px;"> <p>Setup Mode Stability: Medium [Press PROG or BACK to skip]</p> </div>

<p>Tare Sensors This can only be completed with the sensor in AIR with no liquid in the sensor. The tare accounts for any inherent resistance with the dry sensor connected to the cable. NOTE: this menu is locked and not required in typical installations</p>	<p>Press the SELECT/PROG button and the following screen appears. Press the TARE button (left arrow on the keypad) to tare sensor 1 or any other button to skip this step.</p>	<p>The following screen will then appear.</p> <p>Press the TARE button (left arrow on the keypad) to tare sensor 2 or any other button to skip this step and return to the Setup mode main menu.</p> <p>Then use the UP/DOWN arrows to scroll through the list of Setup parameters or BACK is used to return to the main screen.</p>
<div style="border: 1px solid black; padding: 5px;"> Setup Mode 5) Tare Sensors </div>	<div style="border: 1px solid black; padding: 5px;"> Setup Mode Tare Sensor 1 [Press TARE or ALT to skip tare] </div>	<div style="border: 1px solid black; padding: 5px;"> Setup Mode Tare Sensor 2 [Press TARE or ALT to skip tare] </div>

<p>Restore Defaults This will restore the parameters to default values (Tare and K-factor,)</p>	<p>Press BACK to escape or press SELECT/PROG button to restore defaults.</p>	<p>The following screen will then appear.</p> <p>Press BACK to escape or press SELECT/PROG button to restore defaults.</p> <p>Then use the UP/DOWN arrows to scroll through the list of Setup parameters or BACK is used to return to the main screen.</p>
<div style="border: 1px solid black; padding: 5px;"> Setup Mode 6) Restore Defaults </div>	<div style="border: 1px solid black; padding: 5px;"> Setup Mode Restore Sensor 1 [Press PROG or BACK to skip] </div>	<div style="border: 1px solid black; padding: 5px;"> Setup Mode Restore Sensor 2 [Press PROG or BACK to skip] </div>

<p>Sensor Prompts The new sensor connected prompts can be suppressed for remote panel mount installations where the keypad/LCD are not visible by using the Sensor Prompts menu. If the BACK or PROG are not pressed when this menu is set to On, the monitor will not function.</p>	<p>Press the SELECT/PROG button and the following screen appears. The default setting is On. Use the UP/DOWN arrows to change On to Off as required.</p> <p>Press PROG to save entry and return to Setup menu.</p>
<div data-bbox="181 940 500 1075" style="border: 1px solid black; padding: 5px;"> <p>Setup Mode 7) Sensor Prompts</p> </div>	<div data-bbox="531 940 894 1075" style="border: 1px solid black; padding: 5px;"> <p>Setup Mode Prompts: On [Press PROG or BACK to skip]</p> </div>

1.3. Manual Calibration of a Sensor

Some users may desire to perform a manual calibration with a conductivity standard at a particular value. The cell constant (K) should be determined at the desired value. To perform this follow these steps:

- 1) In the monitor, set the K to a value of 1.000
- 2) With the sensor completely saturated by the standard of a known value, record the monitor reading
NOTE: Make sure all air including micro-bubbles are not present during the calibration. It is best to circulate the standard to aid in the removal of bubbles.
- 3) Calculate the K for the sensor: calculated K is the known standard value divided by the monitor reading (ie, if the known standard is 15.00mS and monitor reads 17.50mS, the $K = 0.857$)
- 4) Enter this calculated K value to the monitor
- 5) The monitor should now read the value of the known standard

1.4. Serial Output

The data coming from the serial port has the following structure:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
T1	T2	C1	C2	TCC1	TCC2	VT1	VT2	VC1	VC2	K1	K2	S1	S2	AV1	AV2

Where:

- T is temperature
- C is raw conductivity
- TCC is temperature corrected conductivity
- VT is the input voltage for temperature
- VC is the input voltage for conductivity
- K is the cell constant
- S is status of sensor connected (0 is not connected, 1 is connected)
- AV1 is the analog input value 1 (4-20mA input is scaled 0 to 100)
- AV2 is the analog input value 2 (4-20mA input is scaled 0 to 100)

APPENDIX A: PRODUCT WARRANTY

PENDOTECH LIMITED WARRANTY

LIMITED WARRANTY: Subject to the limitations contained in LIMITATION OF REMEDY AND LIABILITY and except as otherwise expressly provided herein, PendoTECH LLC ("Seller") warrants that the Software will execute the programming instructions provided by Seller, and that the products, systems and goods ("Goods") manufactured by Seller will be free from defects in materials or workmanship under normal use and service until the expiration of twenty-four (24) months from the date of shipment by Seller. Expendable items are warranted to be free from defects in material and workmanship under normal use and service for a period of ninety (90) days from the date of shipment by Seller. Products purchased by Seller from a third party for resale to Buyer ("Resale Products") shall carry only the warranty extended by the original manufacturer. Buyer agrees that Seller has no liability for Resale Products beyond making a reasonable commercial effort to arrange for procurement and shipping of the Resale Products. If, within thirty (30) days after Buyer's discovery of any warranty defects during the applicable warranty period, Buyer notifies Seller thereof in writing, Seller shall, at its option and as Buyer's sole and exclusive remedy hereunder, promptly correct any errors that are found by Seller to exist in the Software, or repair or replace F.O.B. point of manufacture, that portion of the Goods or Software found by Seller to be defective. All replacements or repairs necessitated by inadequate preventive maintenance, or by normal wear and usage, or by fault of Buyer, or by unsuitable power sources or by attack or deterioration under unsuitable environmental conditions, or by abuse, accident, alteration, misuse, improper installation, modification, repair, storage or handling, or any other cause not the fault of Seller are not covered by this limited warranty, and shall be at Buyer's expense. Seller shall not be obligated to pay any costs or charges incurred by Buyer or any other party except as may be agreed upon in writing in advance by an authorized Seller representative. All costs of dismantling, reinstallation and freight and the time and expenses of Seller's personnel for site travel and diagnosis under this warranty clause shall be borne by Buyer unless accepted in writing by Seller. Failure by Buyer to give such written notice of defects within the applicable time period shall be deemed an absolute and unconditional waiver of Buyer's claim for such defects. Goods repaired and parts replaced during the warranty period shall be in warranty for the remainder of the original warranty period or ninety (90) days, whichever is longer. All warranties, either express or implied, extend to BUYER only. All descriptions, representations and/or other information concerning Goods on the PendoTECH website and/or contained in PendoTECH's advertisements, brochures, promotional material, or statements made by employees or sales representatives of PendoTECH are solely for general informational purposes only and are not binding upon PendoTECH. No employee or sales representative of PendoTECH shall have any authority to establish, expand or otherwise modify PendoTECH's warranty associated with the sale of Goods. SELLER shall not be liable to BUYER in any manner with respect to Goods sold. SELLER MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY TYPE, EXPRESS OR IMPLIED, AND EXPRESSLY DISCLAIMS AND EXCLUDES ANY REPRESENTATION OR WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR USE, NON-INFRINGEMENT OR WARRANTY ARISING FROM USAGE OF TRADE, COURSE OF DEALING OR PERFORMANCE. PendoTECH, LLC makes no warranty or representation regarding whether or not a customer's end use of any PendoTECH product, system or good infringes the valid intellectual property rights of others.

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APPENDIX B: PendoTECH Conductivity Sensors

General Information:

Measure raw conductivity and temperature

Performance

- 0.1 - 50 mS/cm (100 mS/cm future)
- 5% of reading accuracy (+/- 0.1mS below 2mS)
- 75 psi (5 bar) pressure rating
- Fluid path materials
 - Gamma compatible
 - NaOH resistant
 - USP Class VI
 - No calibration required because of pre-determined cell constant

For More Information:

<http://www.pendotech.com/>