



HygroPro

User's manual

916-099 Rev. D

HygroPro

Moisture transmitter

User's manual

916-099 Rev. D
November 2012

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Product registration

Thank you for purchasing a HygroPro moisture transmitter from Panametrics. Please register your product at <https://info.bakerhughesds.com/New-product-registration-LP.html> product support such as the latest software/firmware upgrades, product information and special promotions.

Services

Panametrics provides customers with an experienced staff of customer support personnel ready to respond to technical inquiries, as well as other remote and on-site support needs. To complement our broad portfolio of industry-leading solutions, we offer several types of flexible and scalable support services including: training, Product repairs, service Agreements and more. Please visit change to: <https://www.bakerhughesds.com/panametrics/services> for more details.

Terms and conditions


Panametrics’ sales terms and conditions for your recent purchase of a Panametrics product, including the applicable product warranty, can be found on our website at the following link: <https://www.bakerhughesds.com/sales-terms-conditions>.


Typographical conventions

Note: These paragraphs provide information that provides a deeper understanding of the situation, but is not essential to the proper completion of the instructions.


IMPORTANT:

These paragraphs provide information that emphasizes instructions that are essential to proper setup of the equipment. Failure to follow these instructions carefully may cause unreliable performance.

	<p>CAUTION!</p> <p>This symbol indicates a risk of potential minor personal injury and/or severe damage to the equipment, unless these instructions are followed carefully.</p>
---	--

	<p>WARNING!</p> <p>This symbol indicates a risk of potential serious personal injury, unless these instructions are followed carefully.</p>
---	--

Safety issues

	<p>WARNING!</p> <p>It is the responsibility of the user to make sure all local, county, state and national codes, regulations, rules and laws related to safety and safe operating conditions are met for each installation.</p>
---	---



	<p>Attention European customers!</p> <p>To meet CE marking requirements for all units intended for use in the EU, all electrical cables must be installed as described in this manual.</p>
---	---

Auxiliary equipment

Local safety standards

The user must make sure that he operates all auxiliary equipment in accordance with local codes, standards, regulations, or laws applicable to safety.

Working area

	<p>WARNING!</p> <p>Auxiliary equipment may have both manual and automatic modes of operation. As equipment can move suddenly and without warning, do not enter the work cell of this equipment during automatic operation, and do not enter the work envelope of this equipment during manual operation. If you do, serious injury can result.</p>
	<p>WARNING!</p> <p>Make sure that power to the auxiliary equipment is turned OFF and locked out before you perform maintenance procedures on this equipment.</p>

Qualification of personnel

Make sure that all personnel have manufacturer-approved training applicable to the auxiliary equipment.

Personal safety equipment

Make sure that operators and maintenance personnel have all safety equipment applicable to the auxiliary equipment. Examples include safety glasses, protective headgear, safety shoes, etc.

Unauthorized operation

Make sure that unauthorized personnel cannot gain access to the operation of the equipment.

Environmental compliance

RoHS

The HygroPro moisture transmitter fully complies with RoHS regulations (Directive 2011/65/EU).

Waste Electrical and Electronic Equipment (WEEE) directive

Panametrics is an active participant in Europe's Waste Electrical and Electronic Equipment (WEEE) take-back initiative (Directive 2012/19/EU).



The equipment that you bought has required the extraction and use of natural resources for its production. It may contain hazardous substances that could impact health and the environment.

In order to avoid the dissemination of those substances in our environment and to diminish the pressure on the natural resources, we encourage you to use the appropriate take-back systems. Those systems will reuse or recycle most of the materials of your end life equipment in a sound way.

The crossed-out wheeled bin symbol invites you to use those systems.

If you need more information on the collection, reuse and recycling systems, please contact your local or regional waste administration.

Please visit <https://www.bakerhughesds.com/health-safetyand-environment-hse> for take-back instructions and more information about this initiative.

Chapter 1: Installation

1.1 Introduction

The **HygroPro moisture transmitter** is a compact, intrinsically-safe, loop-powered, 4-20 mA transmitter that provides accurate dew/frost point measurements over a range of -110° to 20°C (-166° to 68°F). It features an integrated display and a six-button keypad, and it is housed in an IP67/Type 4X enclosure.

The **HygroPro** transmitter uses an aluminum oxide moisture sensor, and it includes a temperature thermistor and a pressure transducer on a common mount for calculation of parameters such as:

- ppm_v in gases
- ppm_w in liquids
- pounds per million standard cubic feet in natural gas
- process relative humidity.

IMPORTANT

To install the **HygroPro** in a hazardous (classified) area, see "Hazardous area wiring connections" on page 6.

1.2 Sample system guidelines

The **HygroPro** transmitter can be installed in a sample system or directly in the process line. However, Panametrics recommends that the unit be installed in a sample system to protect the probe from potentially damaging components in the process stream. *Figure 1* below shows a typical sample system.

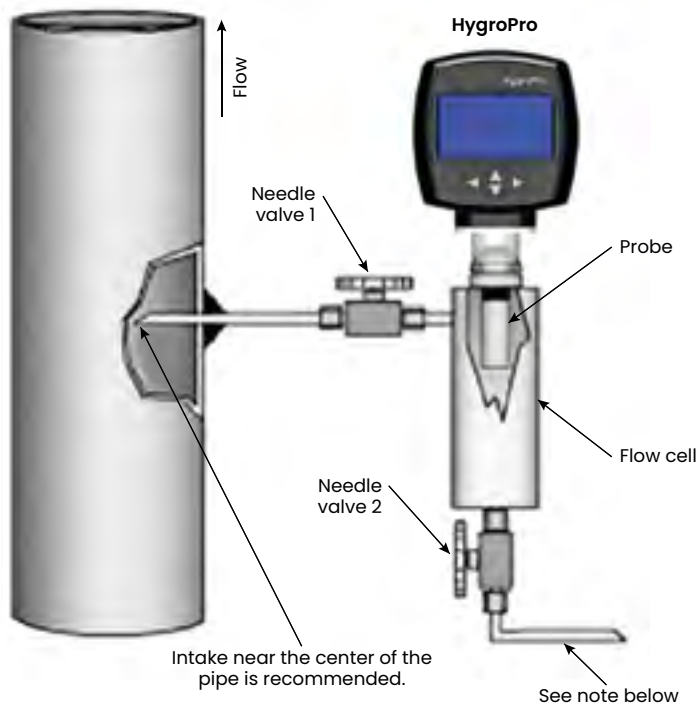


Figure 1: A typical sample system

Note: At least 5 ft (1.5 m) of 1/4" (6 mm) tubing vented to atmosphere will ensure an accurate process sample and avoid diffusion of ambient air moisture back into the process.

In the sample system shown in Figure 1 on page 2, fully open *valve 1* and use *valve 2* to regulate the sample flow for measurements at process system pressure. For measurements at atmospheric pressure, fully open *valve 2* and use *valve 1* to regulate the sample flow.

Before constructing a sample system, consult a Panametrics application engineer and observe the following guidelines:

- The sample system should be very simple and should contain as few components as possible. All or most of those components should be located downstream of the measurement point.
- Sample system components must not affect moisture readings. Most common filters and pressure regulators are not suitable for sample systems because the wetted parts adsorb moisture or release moisture into the sample system. They may also allow ambient contamination to enter the sample system. If possible, use stainless steel for all wetted parts.
- The HygroPro probe should be oriented perpendicular to the sample system inlet. For dimensions and other sample system requirements see "Mechanical specifications" on page 19.
- Sample systems should be tested for leaks prior to operation, using a *Snoop* leak detector, to verify the integrity of connections, components and fittings.

IMPORTANT

When pressurizing or depressurizing the sample system, be careful to avoid shock damage to the moisture sensor.

1.3 Mounting the transmitter



CAUTION!

If the HygroPro will be installed directly into the process line, consult Panametrics for proper installation instructions and precautions before proceeding.

Refer to *Figure 2* below and complete the steps on the next page to install the **HygroPro** transmitter.



Figure 2: HygroPro installation

1. Make sure the sintered or stainless-steel shield is in place over the sensor. This shield protects the aluminum oxide sensor from damage during operation.
2. Using the integral 3/4-16 straight male thread, screw the probe end of the transmitter into the process or sample system fitting. Make sure not to damage the threads.

Note: A 3/4-16 to G 1/2 thread adapter is available from Panametrics.

3. Using a 1-1/8" wrench on the probe hex nut, tighten the probe securely into the process or sample system fitting.



CAUTION!

Do not apply torque to the transmitter electronic module to tighten the unit into its fitting.

Note: If there is insufficient space to rotate the **HygroPro** during installation, remove the *replaceable transducer element (RTE)* from the transmitter, install it in the fitting, then re-install the transmitter onto the RTE.

1.4 Wiring the transmitter

Proceed to the appropriate section for instructions on:

- Standard wiring connections (below)
- "Hazardous area wiring connections" on page 6

1.4.1 Standard wiring connections

The **HygroPro** is a 4-20 mA loop-powered device that can use the same two wires for its measurement signal lines and its power supply lines. Follow the instructions in this section only for units **not** requiring hazardous (classified) area protection.

IMPORTANT

To install the **HygroPro** in a hazardous (classified) area, see "Hazardous area wiring connections" on page 6

The transmitter must be wired using the factory-supplied, 2-meter cable. If a different cable length is required, please contact the factory for assistance.

Note: If a longer cable is required, you may splice an extension onto the standard cable. Be sure to connect leads of the same color together. For example, connect blue lead to blue lead, brown lead to brown lead, etc.

The **HygroPro** may be connected to either of the following types of external systems:

- an external device that can provide the loop power to the HygroPro and can also receive and display the 4-20 mA measurement output from the HygroPro (proceed to next page)
- an external power supply to provide power to the **HygroPro** plus a personal computer (PC) running Panametrics' **PanaView™** interface software (proceed to page 13)

1.4.1a Standard connections – without a PC

IMPORTANT

To install the **HygroPro** in a hazardous (classified) area, see "Hazardous area wiring connections" on page 6.

Refer to "Figure 3" on page 5 and *Table 1* below, and complete the following steps to wire the transmitter.

Table 1: Cable leads – without a PC	
Lead	Connection description
Blue	Power supply (+) [12-28 VDC]
Brown	Power supply (–) [return]
Shield	Earth ground [recommended]

1. Push the female connector end of the factory-supplied cable into the mating male connector on the transmitter module. Make sure the pins are properly aligned. Then, secure the connectors together by sliding the metal sleeve on the cable over the connectors and turning it clockwise until it is tight.
2. Using the flying leads at the other end of the factory-supplied cable, connect the transmitter to the external system.

Note: The blue and brown leads also carry the measurement signal current output of 4-20 mA.

3. Trim any unused leads even with the outer cable jacket to remove any bare wire and prevent accidental short circuits.

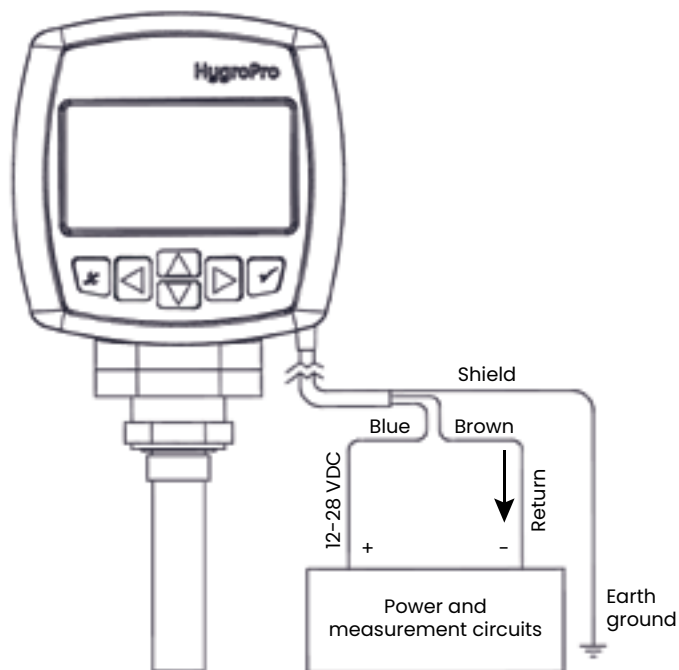


Figure 3: Standard connections - without a PC

1.4.1b Standard connections - with a PC

IMPORTANT

To install the **HygroPro** in a hazardous (classified) area, see "Hazardous area wiring connections" on page 6.

Refer to "Figure 4" on page 5 and Table 2 below, and complete the following steps to wire the transmitter.

Table 2: Cable leads - with a PC

Lead	Connection description
Blue	Power supply (+) [12-28 VDC]
Brown	Power supply (-) [return]
White	RS485-RS232 converter (+) [positive]
Black	RS485-RS232 converter (-) [negative]
Ground	Earth ground

1. Connect an **RS485-RS232 converter** (customer-supplied) to an available serial port on the PC.
2. Push the female connector end of the factory-supplied cable into the mating male connector on the transmitter module. Make sure the pins are properly aligned. Then, secure the connectors together by sliding the metal sleeve on the cable over the connectors and turning it clockwise until it is tight.
3. Using the flying leads at the other end of the factory-supplied cable, connect the transmitter to the external system.
4. Trim any unused leads even with the outer cable jacket to remove any bare wire and prevent accidental short circuits.

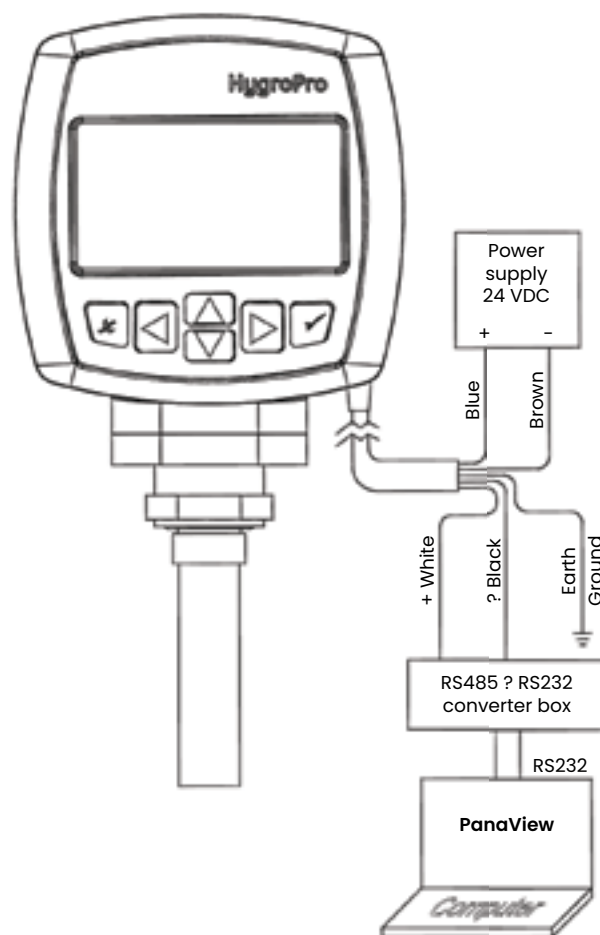


Figure 4: Standard connections with a PC

Before installing and using the **HygroPro** in a hazardous (classified) area, be sure to read and understand all applicable reference materials. This includes:

- Note:** It is the installer's responsibility to follow all applicable standards and procedures.



The diagram illustrates the connection of a HygroPro device to associated apparatus in two types of locations: Hazardous or non-hazardous and Non-hazardous.

Hazardous or non-hazardous location
 class I, division 1, group ABCD
 class II, division 1, group EFG
 class III, division 1

Non-hazardous location

HygroPro

Loop terminal
 Safety entity parameters:
 $V_{max} = 28\text{ V}$
 $I_{max} = 93.3\text{ mA}$
 $P_i = 0.653\text{ W}$
 $C_i = 0$
 $L_i = 62\text{ }\mu\text{H}$

RS485 comm terminal safety
 entity parameters:
 $V_{max} = 3.72\text{ V}$
 $I_{max} = 228\text{ mA}$
 $P_i = 212\text{ mW}$
 $C_i = 0$
 $L_i = 62\text{ }\mu\text{H}$

Associated apparatus
 Note 3

Loop-power device
 Note 4

Associated apparatus
 Note 3

RS485 comm
 Note 4

The diagram shows two parallel connection paths. The top path connects the HygroPro Loop terminal to an Associated apparatus (Note 3) and a Loop-power device (Note 4) via blue and brown wires. The bottom path connects the HygroPro RS485 comm terminal to an Associated apparatus (Note 3) and an RS485 comm device (Note 4) via black and white wires.

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1.4.2a Applicable standards and directives

When the **HygroPro** is installed in hazardous areas with potentially explosive atmospheres, it complies with the *ATEX directive* 2014/34/EU, the EU standards listed in *Table 3* below, and the *North American FM/CSA and IEC standards* listed in *Table 4* below.

Table 3: European Union (EU) standards

Title	Number
General requirements	IEC/EN 60079-0
Intrinsic safety "i"	IEC/EN 60079-11
Group II, category IG, zone 0 equipment	IEC/EN 60079-14

Table 4: North American standards

Title	Number
Electrical Equipment for Use in Hazardous (Classified) Locations General Requirements	Class No. 3600
Intrinsically Safe Apparatus and Associated Apparatus for use in Class I, II, and III, Division 1, and Class I, Zone 0 and 1 Hazardous (Classified) Locations	Class No. 3610
Electrical Equipment for Measurement, Control and Laboratory Use	Class No. 3810
Intrinsically Safe and Non-incendive Electrical for Use in Hazardous Locations	CSA-C22.2 No. 60079-II
Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 1: General Requirements (Adopted IEC 61010-1:2001, MOD) (Tri-National standard, with UL 61010-1 and ISA 82.02.01)	CSA-C22.2 No. 61010-1
Degrees of Protection Provided by Enclosures (IP Code)	ANSI/IEC 60529
Degrees of Protection Provided by Enclosures (IP Code)	CSA-C22.2 No. 60529

1.4.2b Compliance requirements

The **HygroPro** installation must comply with EN 60079-14 in Europe and with the National Electrical Code (ANSI/NFPA 70) or part one of the Canadian Electrical Code (C22.1), as applicable, in North America. In other regions, additional local codes may also apply.

1.4.2c Electrical connections

The **HygroPro** transmitter is certified intrinsically-safe for use in zone 0. However, the external power must be provided by one of the following methods:

- an isolated, intrinsically-safe, 24 VDC power supply mounted in the safe area
- an isolated zener barrier mounted in the safe area and installed between a standard 24 VDC power supply and the **HygroPro**

Refer to "Figure 6" on page 8 for a typical hazardous (classified) area **HygroPro** wiring diagram. This installation uses an **MTL706 zener barrier**, in accordance with the second option listed above.

If using serial communications with a PC, an isolated RS232-RS485 converter mounted in the safe area between the computer and **HygroPro** must be used. The converter is typically powered by its own standard 24 VDC power supply.



WARNING!

Do NOT power an RS232-RS485 converter from the same intrinsically-safe 24 VDC power supply used to power the HygroPro.

1.4.2d Requirements for external devices

When connecting the **HygroPro** to external devices, the allowable total load capacitance and inductance for those devices are listed in the manufacturer’s datasheets. The entity parameters of the external devices (e.g. voltage, current and power) must be equal to or lower than the same specifications for the **HygroPro**.


The entity parameters for the **HygroPro** are listed in Table 5 below.

Table 5: HygroPro entity parameters		
Loop power supply		
$U_i = 28\text{ V}$	$P_i = 0.653\text{ W}$	$L_i = 62\text{ }\mu\text{H}$
$I_i = 93.3\text{ mA}$	$C_i = 0$	
RS485 digital output		
$U_i = 3.72\text{ V}$	$P_i = 212\text{ mW}$	$L_i = 62\text{ }\mu\text{H}$
$I_i = 228\text{ mA}$	$C_i = 67\text{ }\mu\text{F at } 5.36\text{ V}$	

1.4.2e Special conditions for safe operation

The “X” at the end of the **HygroPro** ATEX certificate number, **Bas06ATEX0019X**, indicates that special conditions are required for safe operation in Europe. These conditions are:

1. The equipment must be protected against impact or friction with ferrous metals.
2. The bare ends of the connecting cable must be terminated in such a way that the terminations are afforded a degree of protection of not less than IP20 ingress protection.
3. The **HygroPro** is incapable of withstanding the 500 VAC test between all inputs and frame for one minute. Therefore, the **HygroPro** must be earthed by connecting the outer grounding screw on the **HygroPro** with the equipotential bonding system. Follow the local standards and electrical codes regarding the equipotential bonding system.



WARNING!

Never connect or disconnect the HygroPro in the hazardous area when supply power or the communication circuit is energized. Isolate the supply lines in the non-hazardous area first.

Following the same special conditions listed above is recommended for regions outside of Europe as well.

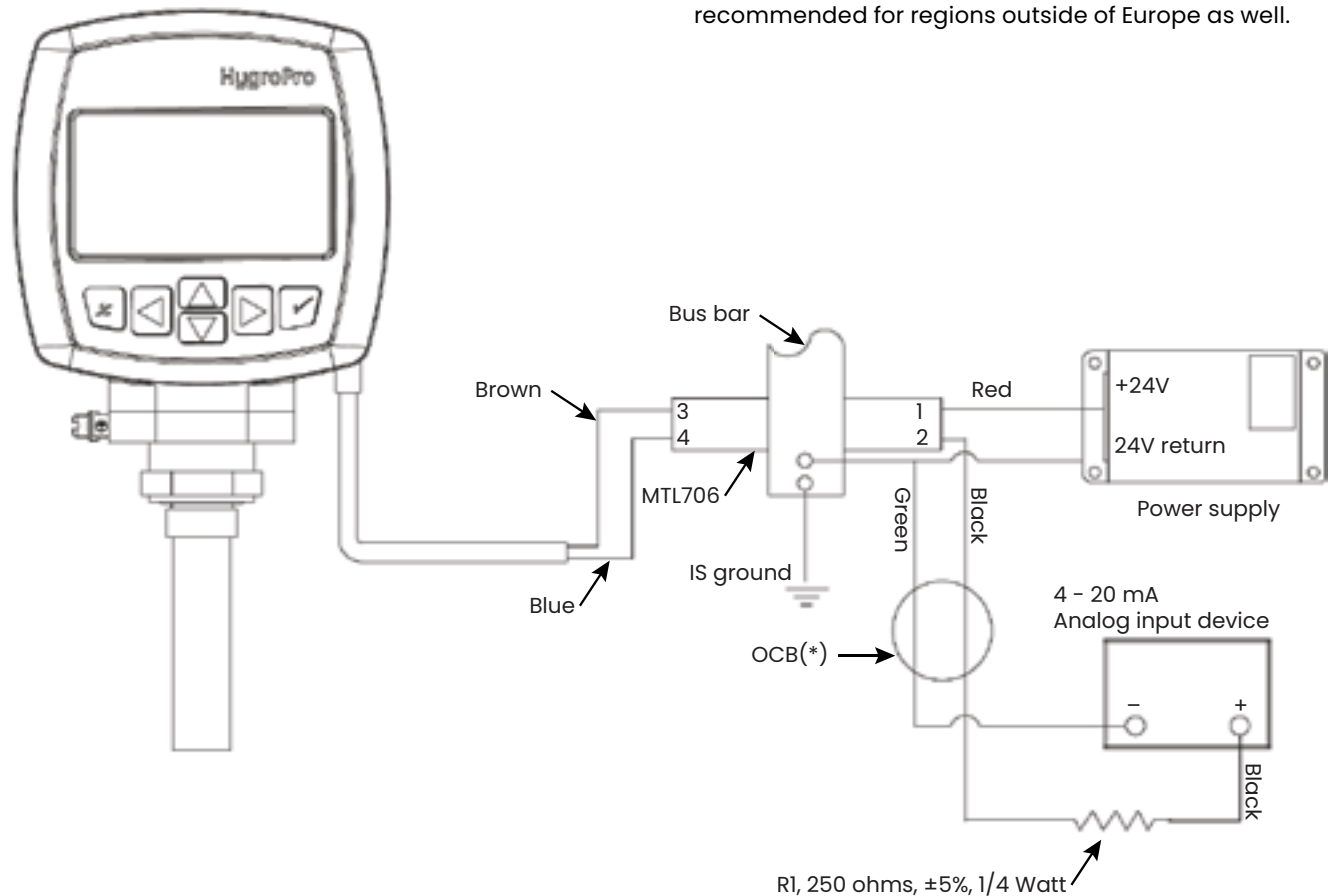


Figure 6: Hazardous area connections

Chapter 2: Operation

2.1 Powering up and programming

After the **HygroPro** has been installed as described in *chapter 1, installation*, power may be applied to the unit. The transmitter requires up to 60 seconds to initialize and begin normal operation. The unit will meet its specified accuracy within 3 minutes.

Figure 7 below shows a close-up view of the **HygroPro** display and keypad, and "Figure 8" on page 10 a complete menu map of the **HygroPro** setup program.



Figure 7: HygroPro display and keypad

2.1.1 Menu Map

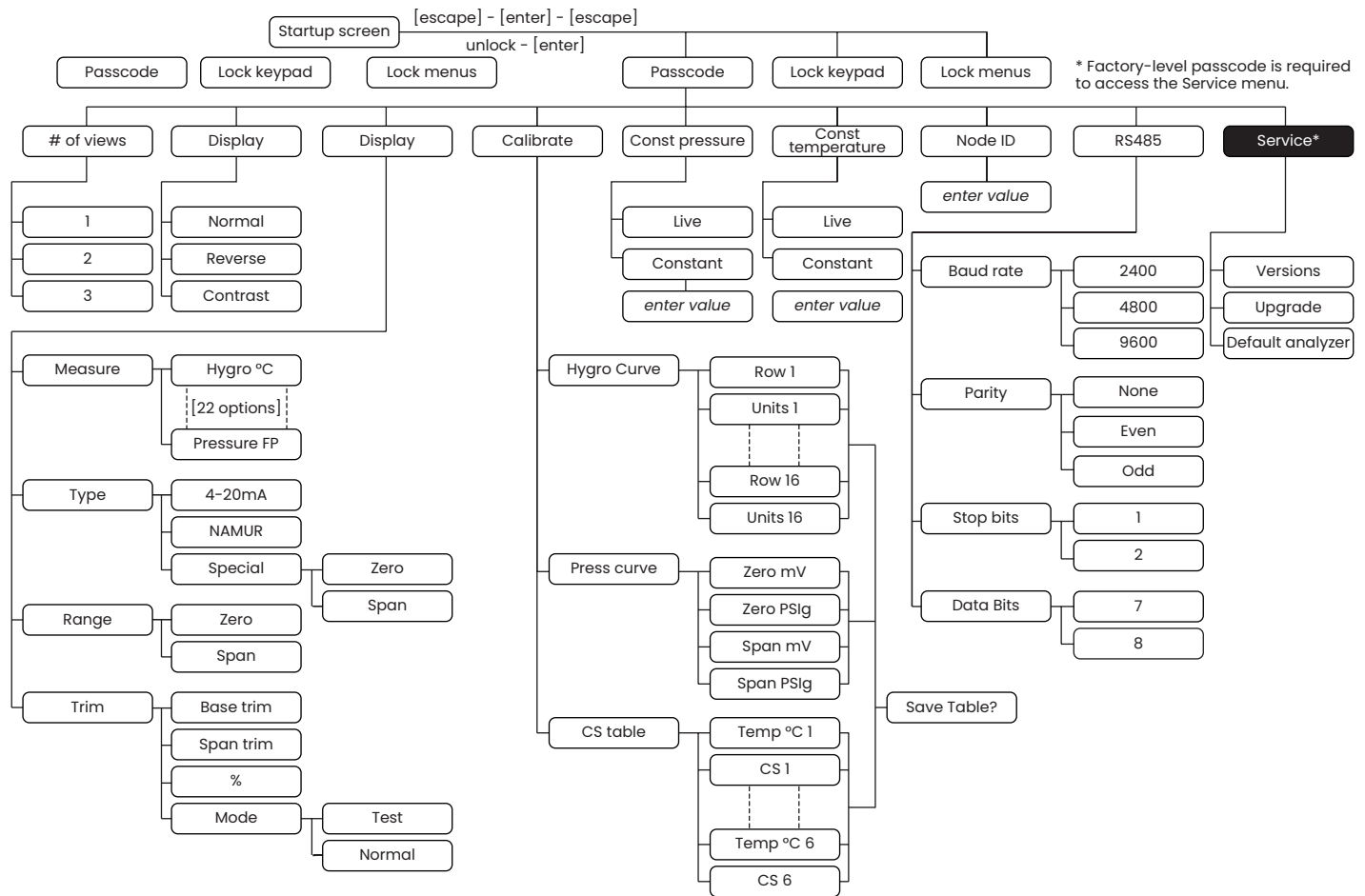


Figure 8: Programming menu map

2.1.2 Keypad

After entering the setup program, the keys on the **HygroPro** keypad (see "Figure 7" on page 9) perform the following functions:

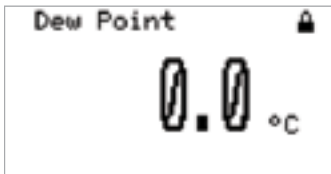
- **enter** - confirm a selection or move to the next screen
- **escape** - cancel a selection or move to the previous screen
- **up** - scroll upward through a list of options or increase the value of a selected character
- **down** - scroll downward through a list of options or decrease the value of a selected character
- **left** - move the cursor to the next character to the left
- **right** - move the cursor to the next character to the right

2.2 Basic setup

The HygroPro transmitter is easily programmed to meet the user's requirements by referring to the menu map in "Figure 8" on page 10 and following the instructions in this section.

2.2.1 Unlocking the display

Upon startup, the following screen appears on the **HygroPro** display:



The symbol in the upper right corner indicates that the screen is locked.

To unlock the screen, press



escape, enter, escape.

2.2.2 Entering the setup program

To enter the setup program, complete the following steps:

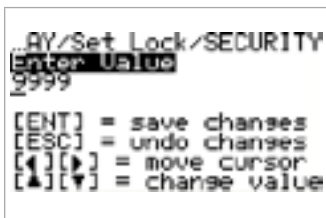


Using the arrow keys, highlight the opened lock and press **enter**.

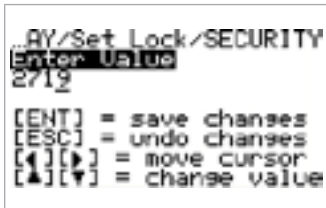


Select passcode and press **enter**.

Note: The default operator-level passcode is 2719.



Enter your passcode using the **up** and **down** keys to change the value of each passcode digit, and the **left** and **right** keys to move from one digit to the next.

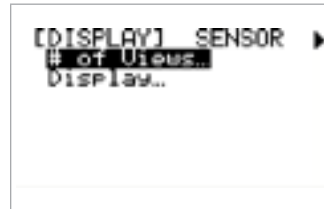


When the passcode is correct, press **enter**.

Note: To enter the service menu, the factory-level passcode must be entered.

2.2.3 Selecting measurement parameters

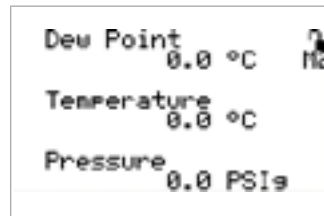
To select the measurement parameters, complete the following steps:



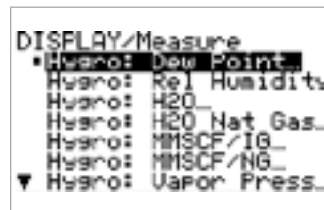
To select the number of measurements to be displayed on each screen, select **# of views** and press **enter**.



Use the **up** and **down** keys to select the number of views desired and press **enter**. Then, press **enter** again to return to the previous menu.



Press **escape** to see the view setup. To change a measurement parameter, use the arrow keys to highlight the parameter name and then press **enter**.



Use the **up** and **down** arrow keys to select a measurement parameter and then press **enter** twice.

Note: As an example, *dew point* has been selected as the measurement parameter to be changed.



Use the **up** and **down** arrow keys to select a unit of measure and press **enter** twice.

Repeat the previous steps to make any other desired measurement parameter changes. Then, continue as follows:

- If the **operator-level passcode** was used, highlight the lock symbol and press **enter** again to return to the **DISPLAY** menu.
- If the **service-level passcode** was used, continue the programming steps below.

```

DISPLAY/Unit/Format
Decimal 2

```

If the number of decimal places is acceptable, press **escape**. To change the number of decimal places, press **enter**.

```

DISPLAY/Unit/Format/
Enter Value
2
[ENT] = save changes
[ESC] = undo changes
[←][→] = move cursor
[↑][↓] = change value

```

Use the **up** and **down** keys to change the number of decimal places and press **enter**.

The programming sequence is now complete and you are returned to the view menu.

2.2.4 Setting up the display

To set up the display, complete the following steps:

```

DISPLAY/Set Lock
Passcode
Lock Keypad
Lock Menus

```

Use the **up** and **down** keys to select display and press **enter**. Then, enter your passcode and press **enter**.

```

[DISPLAY] SENSOR
# of Views...
Display

```

Use the **up** and **down** keys to select display and press **enter**.

```

...PLAY/DISPLAY/Display
Normal
Reverse 38%
Contrast...

```

If the display type is acceptable, press **escape** to return to the previous menu. To change the display type, use the **up** and **down** keys to select normal or reverse and press **enter**.

If you wish to change the display contrast, at the above screen, highlight that choice and press **enter**.

```

...LAY/DISPLAY/Display/
Enter Value
38%
[ENT] = save changes
[ESC] = undo changes
[←][→] = move cursor
[↑][↓] = change value

```

Use the arrow keys to change the contrast value and press **enter**. Then press **escape** twice to return to the main menu.

2.2.5 Setting up the analog output

To set up the analog output, complete the following steps:

```

←[SENSOR] COMMUNICA
Output
CALibrate...
Const Pressure...
Const Temperature...

```

After entering your password, use the **right** arrow key to scroll to output and press **enter**.

```

...ISPLAY/SENSOR/OUTPUT
Measure
Type...
Range...
Trim...

```

Select the measure option and press **enter**.

```

...SENSOR/OUTPUT/Measure
Hydro %
Hydro of
Hydro of K
Hydro %
Hydro PPMU
Hydro PPMW
Hydro PPMV

```

Use the arrow keys to scroll to the desired output parameter and press **enter**.

In the output menu, select type and press **enter**. The following screen appears:

```

...Y/SENSOR/OUTPUT/Type
4-20mA
NAMUR
Special...

```

Select the desired output type and press **enter**.

If special was chosen at the previous prompt, the following screen appears:

```

.../OUTPUT/Type/Special
Zero 0.00mA
Span... 0.00mA

```

Select zero and press **enter**.

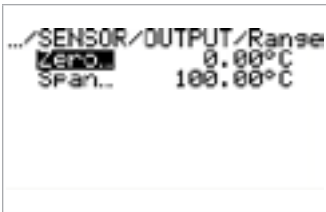
```

...OUTPUT/Type/Special/
Enter Value
0.00mA
[ENT] = save changes
[ESC] = undo changes
[←][→] = move cursor
[↑][↓] = change value

```

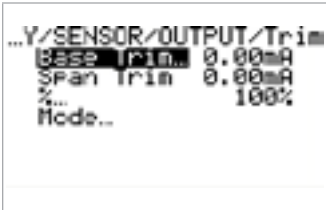
Use the arrow keys to enter the zero value for the special output and press **enter**.

Repeat the above two steps to enter the *span* value for the special output. In the output menu, select range and press **enter**. The following screen appears:



Enter the *zero* and *span* values for the range, using the same procedure on the previous page.

In the output menu, select trim and press **enter**. The following screen appears:

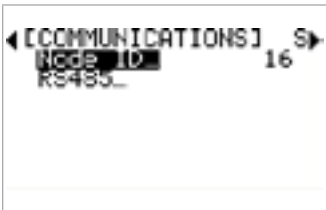


Enter your values for the base trim, span trim and %, using the same procedures as on the previous page.

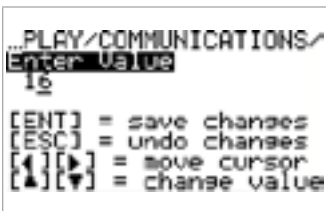
When you select the *mode* option at the above prompt, choose either test to verify the output or normal for normal operation.

2.2.6 Entering the node ID

The *node ID* is a unique network identifier that enables the **HygroPro** to be connected to a multi-drop network when used with PanaView™ interface software. To enter your nNode ID, proceed as follows:



Enter your passcode to access the setup program. Then use the arrow keys to select the Node ID menu. Press **enter**.



Use the arrow keys to enter the desired *node ID* value and press **enter**.

2.2.7 Setting up the RS485 output

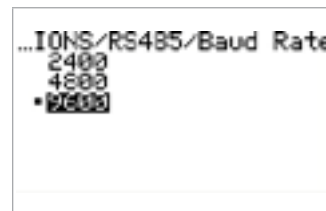
To set up the RS485 output, complete the following steps:



Enter your passcode to access the setup program. Then use the arrow keys to select the RS485 menu. Press **enter**.



To enter the *baud rate*, press **enter**.



Use the up and down keys to select the desired value and press **enter**.

Repeat the above procedure to enter the following RS485 parameters:

- Parity
- Stop bits
- Data bits

You have now completed the initial setup process.

2.3 Advanced setup

The following sections describe the procedures for completing the configuration of your **HygroPro** transmitter.

2.3.1 Setting up the pressure/temperature displays

The following steps set the displayed pressure and temperature values to live (changing with the current measurements) or constant (remaining the same, regardless of the current measurements). If constant is selected, the desired numerical value must be set.

```
◀[SENSOR] COMMUNICA▶
Output...
CALIBrate...
Const Pressure...
Const Temperature...
```

To set the pressure display, enter your password and use the arrow keys to select *const pressure*. Press **enter**.

```
...PLAY/SENSOR/Pressure
press 1.23 PSIa
•Live Pressure
Constant Pressure
```

Use the arrow keys to select either *live pressure* or *constant pressure* and press **enter**.

```
...PLAY/SENSOR/Pressure
press 0.00 PSIa
•Live Pressure
Constant Pressure
```

If you selected constant pressure, use the arrow keys to select *press...* and press **enter**.

```
...LAY/SENSOR/Pressure/
Enter Value
0.00 PSIa

[ENT] = save changes
[ESC] = undo changes
[←][→] = move cursor
[↑][↓] = change value
```

Use the arrow keys to **enter** the desired pressure value and press **enter**. The screen will be updated to show the new pressure value.

```
◀[SENSOR] COMMUNICA▶
Output...
CALIBrate...
Const Pressure...
Const Temperature...
```

To set the temperature display, enter your password and use the arrow keys to select *const temperature*. Press **enter**.

```
...Y/SENSOR/Temperature
Temp... 0.00 °C
•Live temperature
Constant Temperature...
```

Use the same procedure to set the temperature mode, and if *constant temperature* is selected, to enter the constant temperature value.

2.3.2 Entering sensor calibration data

```
◀[SENSOR] COMMUNICA▶
Output...
CALIBrate...
Const Pressure...
Const Temperature...
```

Enter your password and use the arrow keys to scroll to *calibrate*. Press **enter**.

```
...LAY/SENSOR/CALIBrate
Hygro Curve...
Press Curve...
CS Table...
```

Select *Hygro curve* and press **enter**.

```
...NSOR/CALIBrate/Hygro
•Row1...
Row2...
Row3...
Row4...
Row5...
Row6...
▼ Row7...
```

Select *row 1* and press **enter**.

```
...CALIBrate/Hygro/Row1
0.00 0.000
DP °C...
```

Select the desired units and press **enter**.

```
...ALIBrate/Hygro/Row1/
Enter Value
0.000

[ENT] = save changes
[ESC] = undo changes
[←][→] = move cursor
[↑][↓] = change value
```

Use the arrow keys to enter a value and press **enter**.

Repeat the previous steps until all of your *Hygro Curve* data points have been entered.

```
...NSOR/CALIBrate/Hygro
▲ Row13...
Row14...
Row15...
Row16...
SAVE HYGRO TABLE?
Save
•Cancel
```

To save the data you have entered, scroll to the bottom of the *Hygro Curve* options list to the **SAVE HYGRO TABLE?** section. Then, select *save* and press **enter**.

IMPORTANT

Any data not saved at the above prompt will be lost.

Repeat the above process to enter any available *press curve* and *CS table* data points.

Note: The CS table is required only if ppmw measurements will be made. Consult Panametrics for the table values to use for your application.

2.3.3 Locking and unlocking the keypad

To lock the keypad to prevent it from being used, enter the user program as described on page 11.



DISPLAY/Set Lock
Passcode...
▪ Lock Keypad
Lock Menu

Use the **down arrow** key to select lock keypad on the initial screen and press **enter** twice. The keypad is now locked.

To unlock the keypad, just re-enter the user program as described on page 11. No further programming steps are required.

2.3.4 Locking and unlocking the menus

To lock the menus to prevent them from being changed, enter the user program as described on page 26.



DISPLAY/Set Lock
Passcode...
▪ Lock Keypad
Lock Menu

Use the **down arrow** key to select lock menus on the initial screen and press **enter** twice. The menus are now locked.

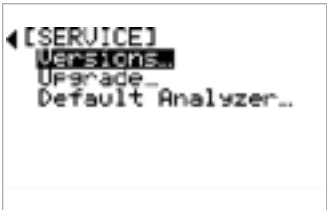
To unlock the menus, just re-enter the user program as described on page 11. No further programming steps are required.

Chapter 3: Service and maintenance

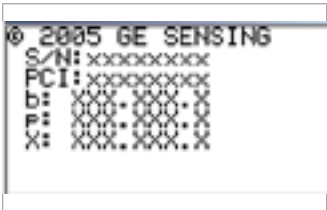
3.1 The service menus

IMPORTANT

The service menus are accessible only by using the factory-level passcode.



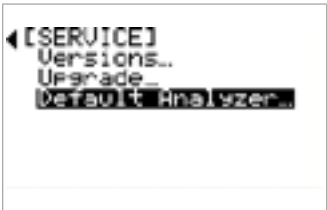
After entering the factory level passcode, use the arrow keys to scroll to service and press enter.



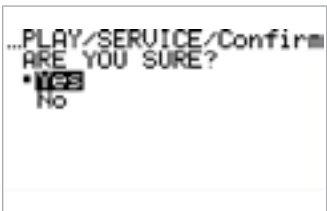
To check the version levels of your HygroPro firmware, select versions and press enter. The information for your unit is displayed.

The following HygroPro service menu options are also available:

- Upgrade - used to install an updated firmware version
- Default analyzer - used to reset all settings to the factory defaults



Select the desired service menu option and press enter. Then, follow the on-screen instructions.



After completing the above step, respond to the ARE YOU SURE? question. Be sure to respond yes, if you wish to save the new information.

3.2 Moisture probe error conditions

IMPORTANT

All moisture probes require periodic cleaning to maintain optimum accuracy. Consult the Panametrics service center for the recommended probe cleaning interval for your application.

If there is a problem with the moisture probe during operation, the HygroPro is programmed to indicate the error condition via its analog output signal. To indicate a probe error condition, the analog output signal is forced to the following values:

- ≥ 22 mA to indicate a short circuit in the probe
- ≤ 3.5 mA to indicate an open circuit in the probe

If you have one of the above error conditions, follow the probe cleaning instructions in the next section.

3.3 Cleaning the moisture probe

To clean your HygroPro moisture probe, carefully follow the instructions in this section.

3.3.1 Preparing to clean the probe



CAUTION!

Be sure to perform the probe cleaning procedure in a well-ventilated area. Observe all necessary safety precautions when handling the cleaning solvents

To clean the moisture probe, the following items are required:

- Two glass (NOT metal) containers with approximately 300 ml of reagent-grade hexane or toluene in each container.
- One glass (NOT metal) container with approximately 300 ml of distilled (NOT deionized) water.

IMPORTANT

Make sure the containers are deep enough to completely submerge the moisture probe. Do not place the transmitter module into the solvents. Insert only the moisture sensor into the solvents.

- Rubber or latex gloves
- An oven set at $50^{\circ}\text{C} \pm 2^{\circ}\text{C}$ ($122^{\circ}\text{F} \pm 3.6^{\circ}\text{F}$)
- 1-1/8" wrench

3.3.2 Replacing the RTE

To maximize HygroPro performance, Panametrics recommends recalibration of the aluminum oxide moisture sensor on the replaceable transducer element (RTE) every 6 to 12 months. The optimum interval depends on the specific application. To accomplish this, either return the RTE to Panametrics for recalibration or install a new RTE. The HygroPro electronics will automatically read and store the calibration data whenever a new or recalibrated RTE is installed.

IMPORTANT

The programmed probe calibration data should not be changed without consulting Panametrics.

3.3.3 Removing the transmitter from the system

Complete the following steps to remove the transmitter from the installation site:

1. Refer to "Figure 2" on page 3 and use a 1-1/8" wrench on the probe hex nut to unthread the transmitter from the fitting on the sample system or process line.
2. Record the dew point of the ambient air.
3. Disconnect the cable from the transmitter module.

3.3.4 Removing the probe from the transmitter

To remove the probe from the transmitter, refer to "Figure 9" on page 17 and proceed as follows:

1. Loosen the four captive screws on the bottom of the transmitter.
2. Carefully remove the metal plate without touching the sensor.
3. Carefully pull the probe out of the transmitter.
4. Disconnect the probe cable by turning the locknut at the top of the probe. Then, detach the sensor.

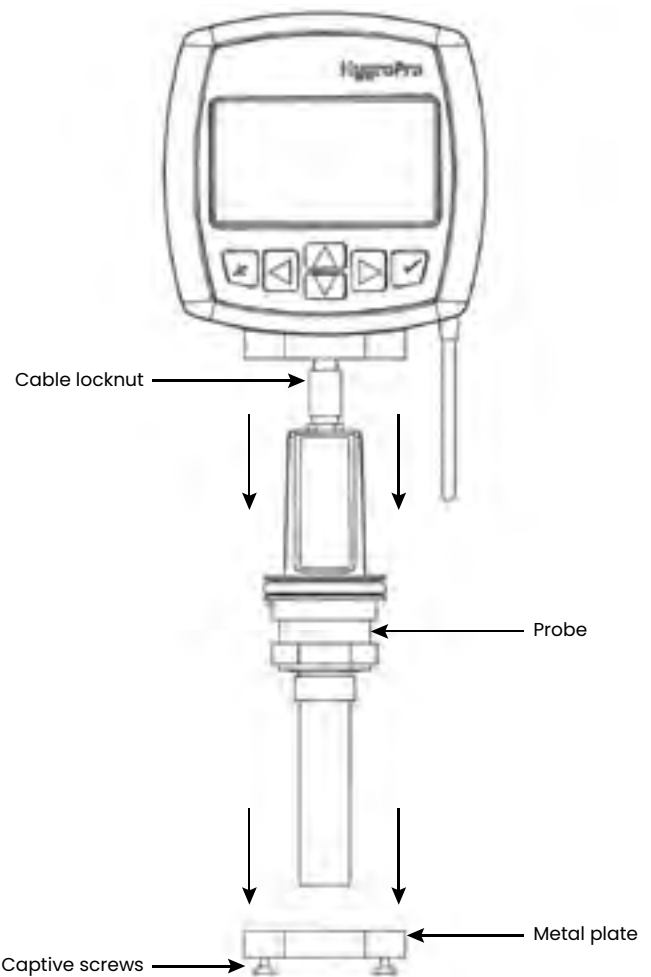


Figure 9: Removing the probe from the transmitter

3.3.5 Cleaning the sensor and the shield



CAUTION!

Do not place the transmitter module into the solvents. Insert only the sensor portion of the instrument. Do not allow the sensor to come into contact with the surfaces of cleaning containers or with any other hard surface.

1. While wearing protective gloves, place the sensor in the first container of hexane or toluene and allow it to soak for 10 minutes.
2. Remove the sensor from the hexane or toluene and soak it in the container of distilled water for 10 minutes.
3. Remove the sensor from the distilled water and soak it in the second (clean) container of hexane or toluene for 10 minutes.
4. Remove the sensor from the hexane or toluene and set it aside in a clean area.
5. Repeat steps 1 to 3 to clean the shield. To ensure the removal of any contaminants that may have become embedded in the porous walls of the shield, swirl the shield in the solvents during the soaking procedure.
6. Remove the shield from the hexane or toluene.
7. Carefully replace the shield over the exposed sensor without touching the sensor.
8. Place the sensor with the installed shield in an oven set at $50^{\circ}\text{C} \pm 2^{\circ}\text{C}$ ($122^{\circ}\text{F} \pm 3.6^{\circ}\text{F}$) for 24 hours.

3.3.6 Installing the probe in the transmitter

To install a new or cleaned probe in the transmitter, complete the following steps:

1. Reconnect the probe cable to the top of the probe by turning the locknut.
2. Carefully push the probe into the transmitter.
3. Replace the metal plate without touching the sensor.
4. Tighten the four captive screws on the metal plate into the bottom of the transmitter.

3.3.7 Evaluating the cleaned probe

Note: All new probes are calibrated at the factory, and no evaluation is required after installation.

1. Reconnect the probe cable to the transmitter module and measure the ambient air dew point. Make sure to measure the same ambient air as measured during removal of the transmitter.
2. Compare the two ambient air readings. If the new ambient air reading is within $\pm 2^{\circ}\text{C}$ ($\pm 3.6^{\circ}\text{F}$) of the first reading, the cleaned probe is properly calibrated and normal operation may be resumed.
3. If the probe is still not reading the ambient air accurately, repeat the cleaning procedure using soaking times that are five times those used in the previous cleaning sequence. Repeat the cleaning cycles until two consecutive ambient air readings are identical.

If the above cleaning procedure does not result in accurate readings, contact Panametrics for assistance.

Chapter 4: Specifications

4.1 General

Dew point/frost point calibration range

- Standard: 50 to -112°F (+10 to -80°C) with data from +68 to -166°F (+20 to -110°C)

Operating temperature:

- -4°F to 140°F (-20°C to 60°C)

Storage temperature:

- 158°F (70°C) maximum

Warm-up time

- Meets specified accuracy within three minutes

Calibrated accuracy (dew/frost point)

- $\pm 3.6^\circ\text{F}$ ($\pm 2^\circ\text{C}$) above -148°F (-100°C)
- $\pm 5.4^\circ\text{F}$ ($\pm 3^\circ\text{C}$) below -148°F (-100°C)

Repeatability (dew/frost point)

- $\pm 0.4^\circ\text{F}$ ($\pm 0.2^\circ\text{C}$) above -148°F (-100°C)
- $\pm 0.9^\circ\text{F}$ ($\pm 0.5^\circ\text{C}$) below -148°F (-100°C)

4.2 Electrical

Power

- **Input:** 12 to 30 VDC (loop-powered, customer supplied)
- **Output:** 4 to 20 mA analog, RS485 digital
- **Output resolution:** 0.01 mA/12 bits
- **Maximum load resistance:** $\Omega = (\text{PSV} \times 33.33) - 300$, where PSV = power supply voltage
Example: Given a 24 VDC power supply,
Max. load resistance = $(24 \times 33.33) - 300 = 500 \Omega$
- **Cable:** 6 ft (2 m), standard (consult Panametrics for custom lengths)

Input parameters for loop-powered intrinsic safety

$U_i = 28\text{V}$	$P_i = 0.653\text{W}$	$L_i = 62\mu\text{H}$
$I_i = 93.3\text{mA}$	$C_i = 0$	
RS485		
$U_{ij} = 3.72\text{V}$	$P_i = 212\text{mW}$	$L_i = 62\mu\text{H}$
$I_i = 228\text{mA}$	$C_i = 67\mu\text{F}$ at 5.36V	

4.3 Mechanical

Sample connection

- 3/4-16 (19 mm) straight male thread with o-ring
- G ½ with optional adapter

Operating pressure

- 5 $\mu\text{mm Hg}$ to 5,000 psig (345 bar)

Enclosure

- Type 4x / IP67

Dimensions

- Overall (H x W x D):
7.88 x 3.99 x 2.56 in. (200 x 101 x 65 mm)
- Weight: 1.2 lb (550 g)

4.4 Moisture sensor

Sensor type

- Thin-film aluminum oxide moisture sensor probe

Calibration

- Each sensor is individually computer-calibrated against known moisture concentrations, traceable to NIST

Calibration interval

- Sensor recalibration at Panametrics is recommended every six to twelve months, depending on the application

Flow rate

- **Gases:** Static to 100 m/s linear velocity at a pressure of 1 atm.
- **Liquids:** Static to 10 cm/s linear velocity at density of 1 g/cc

4.5 Built-in temperature sensor

Type

- Nonlinear NTC thermistor (resultant temperature linearized by microprocessor)

Measurement range

- -22° to 158°F (-30° to 70°C)

Accuracy

- $\pm 0.9^\circ\text{F}$ ($\pm 0.5^\circ\text{C}$) overall

Response time (maximum)

- One second in well stirred oil, or 10 seconds in still air, for a 63% step change in increasing or decreasing temperature

4.6 Built-in pressure sensor

Type

- Solid state/piezoresistive

Available ranges

- 30 to 300 psig (3 to 21 bar)
- 50 to 500 psig (4 to 35 bar)
- 100 to 1000 psig (7 to 69 bar)
- 300 to 3000 psig (21 to 207 bar)
- 500 to 5000 psig (35 to 345 bar)

Note: Psig ranges are based on a constant pressure, with the value provided at the time of order placement.

Accuracy

- $\pm 1\%$ of full scale (FS)

Warm-up time

- Meets specified accuracy within 3 minutes

Pressure rating

- Three times the span of the available range, to a maximum of 7500 psig (518 bar)

4.7 Certifications

European compliance

Complies with EMC Directive 2014/30/EU and PED 2014/68/EU for DN<25



Figure 10: HygroPro certification label

Warranty

Each instrument manufactured by Panametrics is warranted to be free from defects in material and workmanship. Liability under this warranty is limited to restoring the instrument to normal operation or replacing the instrument, at the sole discretion of Panametrics. Fuses and batteries are specifically excluded from any liability. This warranty is effective from the date of delivery to the original purchaser. If Panametrics determines that the equipment was defective, the warranty period is:

- one year from delivery for electronic or mechanical failures
- one year from delivery for sensor shelf life

If Panametrics determines that the equipment was damaged by misuse, improper installation, the use of unauthorized replacement parts, or operating conditions outside the guidelines specified by Panametrics, the repairs are not covered under this warranty.

The warranties set forth herein are exclusive and are in lieu of all other warranties whether statutory, express or implied (including warranties of merchantability and fitness for a particular purpose, and warranties arising from course of dealing or usage or trade).

Return policy

If a Panametrics instrument malfunctions within the warranty period, the following procedure must be completed:

1. Notify Panametrics, giving full details of the problem, and provide the model number and serial number of the instrument. If the nature of the problem indicates the need for factory service, Panametrics will issue a RETURN AUTHORIZATION NUMBER (RAN), and shipping instructions for the return of the instrument to a service center will be provided.
2. If Panametrics instructs you to send your instrument to a service center, it must be shipped prepaid to the authorized repair station indicated in the shipping instructions.
3. Upon receipt, Panametrics will evaluate the instrument to determine the cause of the malfunction.

Then, one of the following courses of action will then be taken:

- If the damage is covered under the terms of the warranty, the instrument will be repaired at no cost to the owner and returned.
- If Panametrics determines that the damage is not covered under the terms of the warranty, or if the warranty has expired, an estimate for the cost of the repairs at standard rates will be provided. Upon receipt of the owner's approval to proceed, the instrument will be repaired and returned.

Customer support centers

Americas

U.S.A.

The Boston Center
1100 Technology Park Drive
Billerica, MA 01821

U.S.A.

Tel: +1 800 833 9438 (toll-free)

Tel: +1 978 437 1000

E-mail: mstechsupport@bakerhughes.com

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Ireland

Tel: +353 61 61470200

E-mail: mstechsupport@bakerhughes.com

Panametrics, a Baker Hughes business, provides solutions in the toughest applications and environments for moisture, oxygen, liquid and gas flow measurement.

Experts in flare management, Panametrics technology also reduces flare emissions and optimizes performance.

With a reach that extends across the globe, Panametrics' critical measurement solutions and flare emissions management are enabling customers to drive efficiency and achieve carbon reduction targets across critical industries including: Oil & Gas; Energy; Healthcare; Water and Wastewater; Chemical Processing; Food & Beverage and many others.

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