

HygroPro XP

Moisture Transmitter User's Manual



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User's Manual

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panametrics.com

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Services



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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.



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



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

Safety Issues



WARNING! 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.



Attention European Customers!To meet CE Mark requirements for all units intended for use in the EU, all electrical cables must be installed as described in this manual.

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



WARNING! 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.



WARNING! Make sure that power to the auxiliary equipment is turned OFF and locked out before you perform maintenance procedures on this equipment.

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.

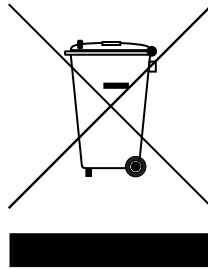
Unauthorized Operation

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

Environmental Compliance

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 of 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 www.bakerhughesds.com/health-safety-and-environment-hse for take-back instructions and more information about this initiative.

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Chapter 1. Installation

1.1 Introduction

The HygroPro XP moisture transmitter is a compact, 4–20 mA transmitter that uses a hybrid design with an explosion proof enclosure and intrinsically safe probe to provide accurate dew/frost point measurements over a range of -110°C to 20°C (-166°F to 68°F). It features an integrated display and a six-button keypad, and is housed in an IP66/67, NEMA 4X rated enclosure. As shown in Figure 1, the HygroPro XP transmitter consists of two major components - the display head with the end user connection and the replaceable transducer element (HYGROXPRTTE) or probe assembly that includes all the sensors and read-out electronics.

The HygroPro XP transmitter uses a state-of-the-art Aluminum Oxide trace moisture sensor that is temperature compensated for optimal accuracy. It includes a sample temperature sensing thermistor as well as an optional piezo-resistive pressure transducer. All three sensors are mounted on a common hermetically sealed mount isolated from the read-out electronics. In addition to process dew/frost point, it can provide in real time calculated process parameters such as:

- Water dewpoint in gases
- ppm_v in gases
- ppm_w in liquids
- Pounds per million standard cubic feet in natural gas
- Relative humidity

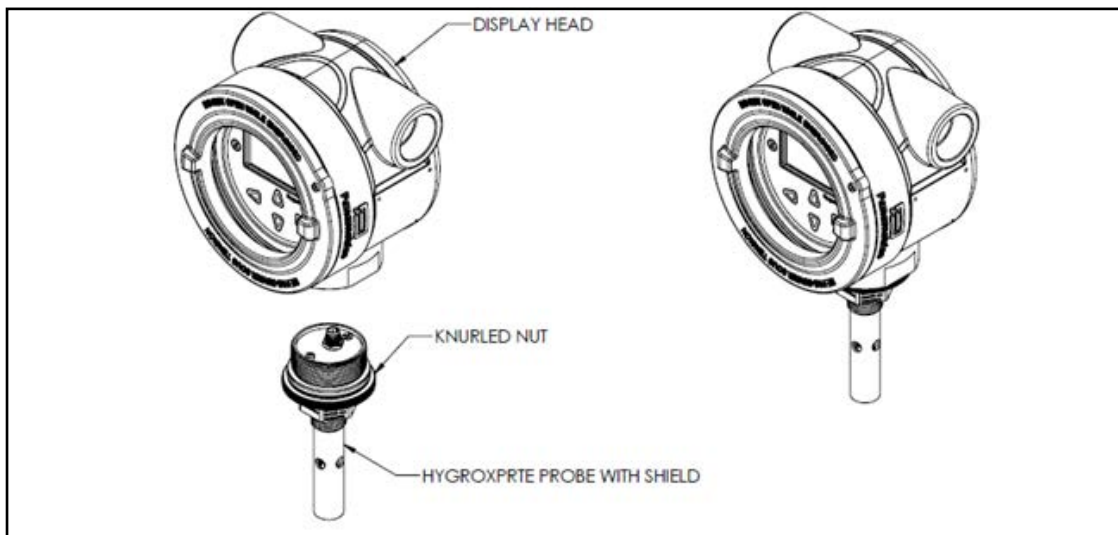


Figure 1: Major components of the HygroPro XP – the display head and HYGROXPRTTE probe assembly

1.2 Sample System Guidelines

The HygroPro XP transmitter can be installed in a sample system or directly in the process line. However, Panametrics recommends that the transmitter be installed in a sample system to protect the sensor probe from potentially damaging components in the process stream. Figure 2 below shows a typical sample system.

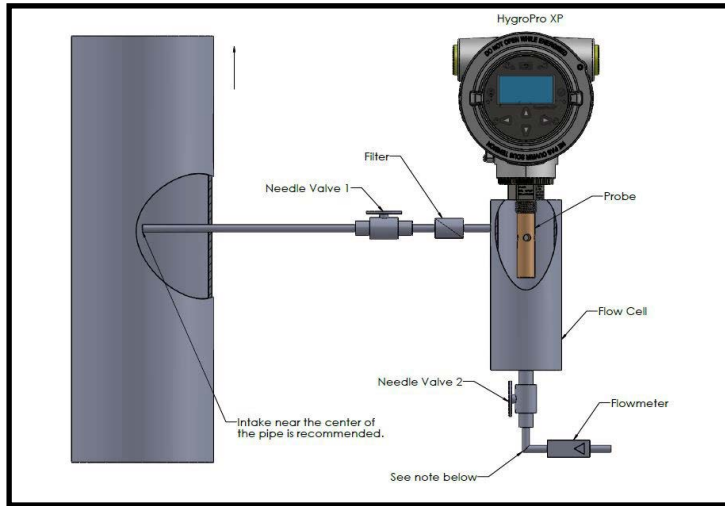


Figure 2: A Typical Sample System

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 to the moisture probe.

In the sample system shown in *Figure 2* above, 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:

- In gas applications, the sample system should provide a sample gas, free of any solid or liquid phase contaminants, including but not limited to any glycol mists, hydrocarbon liquids (condensate) etc. In liquid applications, the sample system should provide a sample liquid free of any solid or particulate contaminants, and no bubbles present. The sample system should also condition the sample in terms of pressure, flowrate and temperature to ensure a representative sample is delivered to the probe within the allowable limits for each of those parameters.
- Sample system components must not affect moisture readings. In general, components should be 316 Stainless Steel material.
- The HygroPro XP probe should be oriented perpendicular to the sample system inlet. For dimensions and other sample system requirements, see *section 4.3 "Mechanical"* on page 34.
- 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. Also, the sample pressure should be increased/decreased gradually to avoid explosive decompression of the O-ring.



CAUTION! The O-ring on the HYGROXPRT probe mount at the base of the 1/4"-16 straight thread should be checked prior to mounting the HygroPro XP and replaced if necessary. Failure to replace the O-ring when the probe is dismounted and replaced can result in hazardous gas leaks.

1.3 Mounting the Transmitter



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

Note: When installing or removing the display head from a sample cell, $\varnothing 7$ inches (178mm) of clearance is required to rotate the display head (see Figure 3 below). This should be done without any cable glands or adaptors fitted to the device.

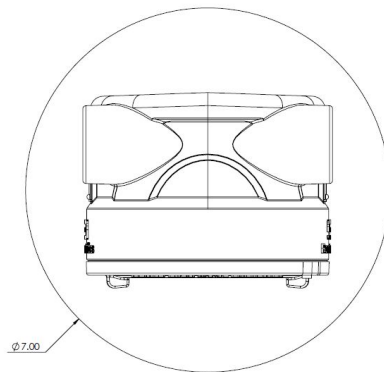


Figure 3: Free space required for HygroPro XP display head to rotate

Refer to Figure 4 below and complete the steps on the next page to install the HygroPro XP transmitter.



Figure 4: Key HygroPro XP parts relevant to installation

1. Make sure the stainless-steel sensor 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 display module to tighten the unit into its sample system fitting.

Note: Do not unscrew and remove the metal desiccant cap from the probe until just prior to installation of the probe in the process.

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

Installation of this transmitter on the process can be done in three easy steps as described below:

Step 1: Just prior to installation on the process, gently unscrew the Aluminum desiccant cap from the bottom of the probe to expose the shielded Aluminum Oxide moisture sensor to the process gas. Discard the desiccant packs enclosed in the cap.



Figure 5: HygroPro XP installation step 1 – removing desiccant cap

Step 2: Install the HygroPro XP into the process by threading it into the sampling port or sample cell. Please note the transmitter should be tightened using a 1-1/8" wrench only on the hex nut of the probe until it is sealed on the O-ring surface.



Figure 6: HygroPro XP installation step 2 - installing into sample cell

Step 3: Loosen the set screw on the enclosure lid and unscrew the lid from the enclosure.



Figure 7: HygroPro XP installation step 3 - loosen the set screw and unscrew the enclosure lid

Step 4: Unfasten the HMI assembly inside the enclosure, leaving the earth connection in place.



Figure 8: HygroPro XP installation step 4 - unfasten the HMI

Step 5: Feed power supply (wired per section 1.4 "Wiring the Transmitter") through cable entry on enclosure. Make connection with back of the main board. If required, fasten earthing wire of power cable to grounding point specified in Figure 12 "HygroPro XP Grounding Diagram".

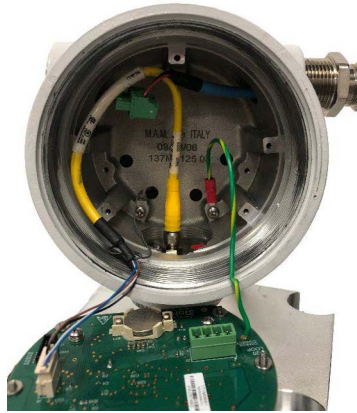


Figure 9: HygroPro XP installation step 5 – connect power supply to the main board

Step 6: Refasten the HMI assembly into the enclosure.

Step 7: Screw lid back into enclosure and tighten set screw.

1.4 Wiring the Transmitter

1.4.1 CE Marking Compliance

For CE marking compliance or installation in high noise areas, the HygroPro XP must be wired in accordance with the instructions in this section.

IMPORTANT: CE marking compliance is required for all units intended for use in EU countries.

The HygroPro XP must be wired with the recommended cable and all connections must be properly shielded and grounded. Grounding of the chassis must be within 10ft (3m) of the transmitter.

1.4.2 Hazardous Area Wiring Connections

Note: A cable gland or adaptor must be installed on any used cable entry ports.

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

- All EU or North American Standards and Directives (see *Table 3* and *Table 4*)
- All local safety procedures and practices
- This user's manual

Note: It is the installer's responsibility to follow all applicable technical regulations, standards and procedures.



WARNING! The procedures in this section must be performed only by trained technicians who have the necessary skills and qualifications.



WARNING! Always disconnect the line power from the HygroPro XP before removing the lid. This is especially important in a hazardous environment.

1.4.3 Wiring Connections

The HygroPro XP is a 4-20 mA loop-powered device that can use the same two conductors for its measurement signal lines and its power supply lines.

Note: Class 2 rated power supplies (with functional GND) are recommended.

The HygroPro XP may be connected to the following types of external data acquisition and control systems:

1. An external device (such as a process controller) that can provide the loop power to the HygroPro XP and can also receive and display the 4–20 mA analog output from the HygroPro XP.
2. A Highway Addressable Remote Transducer (HART) communicator (handheld device or plant control system) that can communicate digitally with the HART enabled HygroPro XP transmitter over the same two wires as used for the analog output in either a point-to-point or multi-drop configuration).
3. An external power supply to provide power to the HygroPro XP plus a personal computer (PC) running TeraTerm or other terminal emulator that can be used for field upgrade of the HygroPro firmware.

1.4.3.1 Standard Connections to Process Controller via Analog Output

Refer to *Figures 10, 11* and *Table 1* below, and complete the following steps to wire the transmitter.

Table 1: Cable leads for Power In/Analog Output

Pin	Connection Description
TBI-1	Power Supply (+) [12–28 VDC]
TBI-2	Power Supply (–) [Return]

Note: Cable shielding may be terminated in cable gland.

1. Connect the cable on the HygroPro XP side to the unit by wiring the cable into the screw terminal block provided. Pinout described in *Table 1*.
2. Using the flying leads at the other end of the factory-supplied cable, connect the transmitter to the external analog power and measurement device.

Note: The Power in 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.

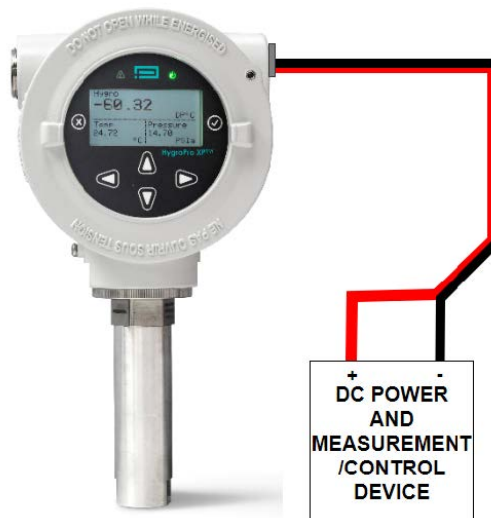


Figure 10: Connection to Process Controller via Analog Output

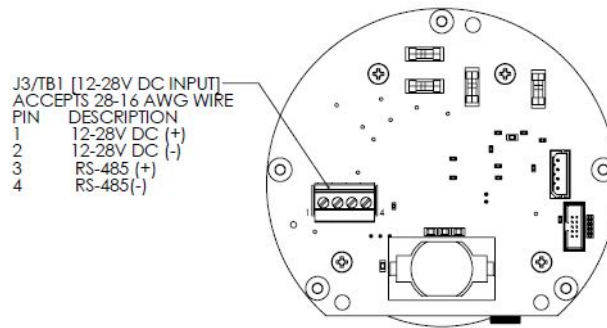


Figure 11: HygroPro XP Wiring Diagram

Figure 12 shows the grounding points on the enclosure, both internal and external, which should be followed in all wiring setups.



WARNING! Proper grounding of the HygroPro XP enclosure via the external grounding screw on the enclosure (see *Figure 12*) is required to prevent the possibility of electric shock. All ground screws should be hand tightened only, to 10in-lbs.

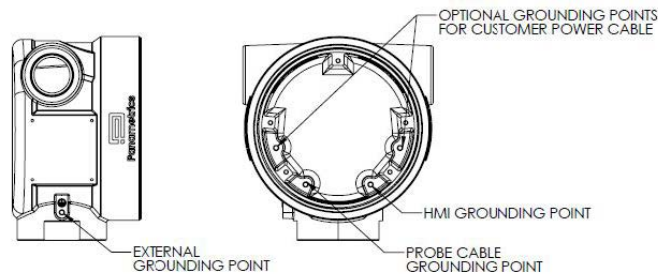


Figure 12: HygroPro XP Grounding Diagram

1.4.3.2 Standard connection with a HART master (handheld device or control system)

1. Using the flying leads at the other end of the cable, connect the HygroPro XP as shown below to the 24 VDC power supply through the 250 Ω load resistor that is used to convert the 4 – 20 mA output to a 1 – 5 VDC signal.
2. Trim any unused leads even with the outer cable jacket to remove any bare wire and prevent accidental short circuits.
3. The HART protocol allows for up to two masters to be connected simultaneously to a single HART slave (HygroPro XP).

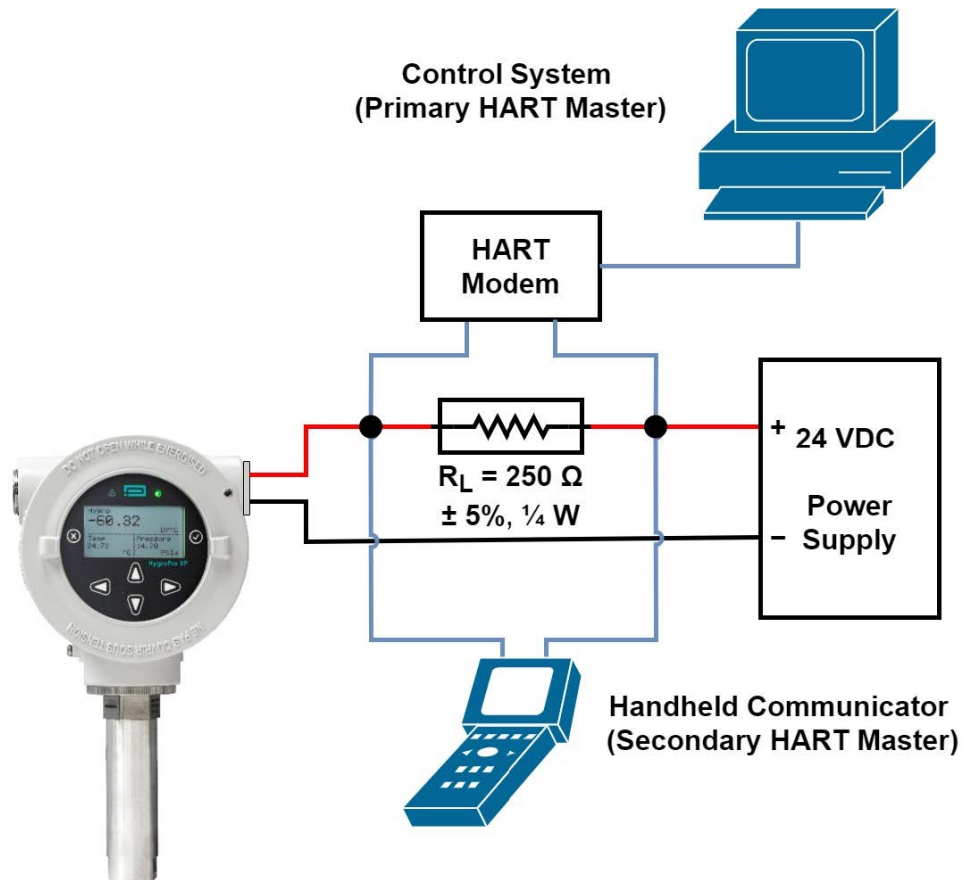


Figure 13: Standard connections with HART master devices (handheld and Plant Control system)

1.4.3.3 Standard Connections with a PC for field software upgrade

Refer to *Figure 14* above and *Table 2* below and complete the following steps to wire the transmitter for field software upgrade.

Table 2: Cable leads for Power In/Analog Output & RS-485

Pin	Connection Description
TBI-1	Power Supply (+) [12-28 VDC]
TBI-2	Power Supply (-) [Return]
TBI-3	RS-485 (+)
TBI-4	RS-485 (-)

1. Connect the cable end on the HygroPro XP side to the unit by wiring the cable wires into the screw terminal block provided. Pinout described in *Table 2*.
2. Connect an RS485-to-USB adapter (customer-supplied) to an available serial port on the PC.
3. Using the appropriate flying leads at the other end of the cable, connect the transmitter to the RS-485-to-USB adapter.
4. Using the appropriate flying leads at the other end of the cable, connect the transmitter to the external analog power and measurement device.



Figure 14: Standard connections with a PC

1.4.3.4 Applicable Standards and Directives

When the HygroPro XP is installed in hazardous areas with potentially explosive atmospheres, it complies with the ATEX 2014/34/EU equipment directive, 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	Date
Electrical apparatus for explosive gas atmospheres: Part 0: General Requirements Equipment	EN/IEC 60079-0	2018
Explosive atmospheres: Part II: Equipment Protection by intrinsic safety "i"	EN/IEC 60079-11	2012
Degrees of Protection Provided by Enclosures (IP Code)	EN/IEC 60529	2013

Table 4: North American Standards

Title	Number	Date
Electrical Equipment for Use in Hazardous (Classified) Locations General Requirements	Class No. 3600	2021
Intrinsically Safe Apparatus and Associated Apparatus for use in Class I, II, & III, Division 1, and Class I, Zone 0 & 1 Hazardous (Classified) Locations	Class No. 3610	2021
Electrical and Electronic Test, Measuring and Process Control Equipment	Class No. 3810	2021
Non-incendive Electrical Equipment for Use in Class I, Division 2, Hazardous Locations.	CSA-C22.2 No. 213	R2013
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/UL No. 61010-1	2012
Degrees of Protection Provided by Enclosures (IP Code)	ANSI/IEC 60529	2004
Degrees of Protection Provided by Enclosures (IP Code)	CSA-C22.2 No. 60529	R2016

1.4.3.5 Compliance Requirements

The HygroPro XP installation must comply with EN 60079-14 standard 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.

1.4.3.6 Specific Conditions for Use

The HygroPro XP has hazardous area certifications for multiple regions. Special conditions are required for safe operation. These are as follows:

1. Under the 60079 series standards, the apparatus has an internal separation element; it may be mounted across a boundary between a process atmosphere requiring EPL Ga and an ambient area requiring a lower EPL, gas or dust.
2. Under NEC 500, the apparatus has an internal Single Seal construction rated to 5000 PSIG; it may be mounted through a boundary wall between a high risk process atmosphere and a lower risk ambient atmosphere.
3. For Division 1 installations, a conduit seal is required within 18 inches of the apparatus.
4. Do not open when an explosive atmosphere is present.
5. Only RENATA or PANASONIC CRI632 cells may be fitted.

6. The apparatus cannot be repaired by the user. Specifically, the flameproof design was assessed with non-standard thread lengths and cemented joints; these cannot be repaired. Substitution of parts on the internal PCB may impair Intrinsic Safety; consult Panametrics for genuine replacement boards.
7. The apparatus should only be cleaned with a damp cloth. Guidance on protection against the risk of ignition due to electrostatic discharge can be found in ANSI/UL 60079-32 & C22.2 No. 60079-32.
8. The apparatus should be regularly cleared of any dust accumulation.

1.5 HART Communications

The HART protocol is an open industry standard maintained by the FieldComm Group that makes use of the Frequency Shift Keying (FSK) standard to superimpose digital communication signals at a low level on top of the 4-20 mA analog output. This enables two-way field communication to take place between one or more HART masters and intelligent field transmitters such as the HygroPro XP. Superimposing digital signals on the analog output makes it possible for additional diagnostic information beyond just the normal process variable to be communicated with a smart field instrument. The HygroPro XP is compatible with HART® 7.0 protocol. Hart 7.0 is compatible with earlier versions of the HART protocol. The device supports both Multi-drop and point-to-point communication technology.

1.5.1 HART Connection Point to Point

HART technology is a master/slave protocol, which means that a smart field (slave) device only speaks when spoken to by a master. The HART protocol can be used in various modes such as point-to-point or multi-drop for communicating information to/from smart field instruments and central control or monitoring systems. The HART Protocol provides for up to two masters (primary and secondary) as shown in *Figure* above. This allows secondary masters, such as handheld communicators to be used, without interfering with communications to/from the primary master, i.e., control/monitoring system.

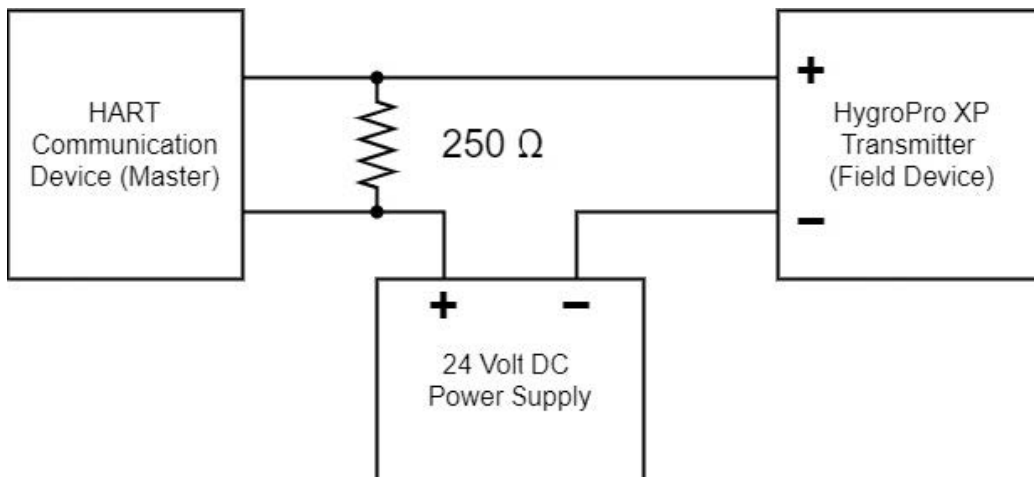


Figure 15: Point-to-point HART connection where up to 2 master devices can be used with HygroPro XP

1.5.2 HART Connection Multi-Drop

The multi-drop mode allows for several devices to be connected using the same pair of wires and communicate with the HART master. The HART devices are typically set to addresses other than 0 and the loop current mode is set to disabled. In multi-drop mode the devices will communicate with digital HART communications only. The 4-20mA control signal for the PV is set to a constant value of 4 mA.

Note: The equivalent device capacitance and resistance values are $>5nF$ and $<20k\Omega$ respectively.

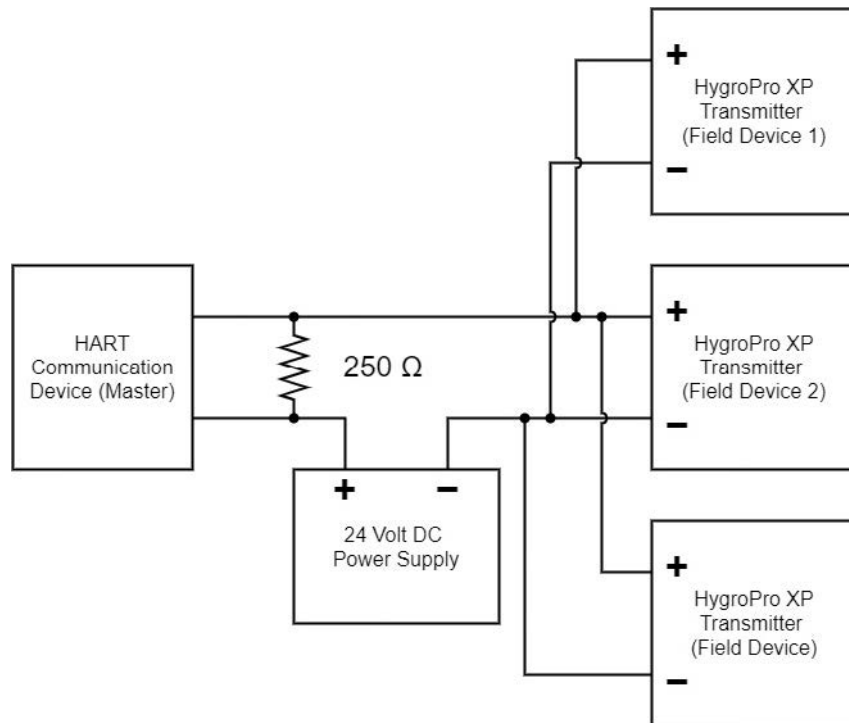


Figure 16: Multi-drop HART connection showing multiple HygroPro XP transmitters, each with a unique address, connected to a single HART master

1.6 Software Setup

The HygroPro XP is shipped from the factory with HART enabled and configured for point-to-point communication. The HART interface for the device allows for setting up 4 dynamic variables, calibration of the HART DAC and limited programming of the instrument configuration parameters. The device provides three process variables: moisture, temperature, and pressure. Note that some device functions are not available via HART communication.

Three sets of commands - Universal HART commands, Common practice HART commands, and Device specific HART commands - are supported by the HygroPro XP. Universal commands are supported by all HART compatible devices. Common practice commands are commands that every field device is expected to support. Device specific commands are specific to the device. For a detailed description of the HygroPro XP device specific commands, refer to the HART Field Device specification (FDS) in Appendix A.

Table 5: Valid HART Parameters and Units

Description	Unit	Format	Access Type
Dew point	Dp °C	fp	R
Dew point	Dp °F	fp	R
Dew point	Dp °C Equip	fp	R

Description	Unit	Format	Access Type
ppmw	ppmw	fp	R
Scale low		fp	R/W
Scale high		fp	R/W
Output measurement		fp	R/W
Output Unit		int	R/W
Output mode		int	R/W
Format: fp = IEEE floating point, int = integer, uchar = unsigned character, ucharX = X bytes of unsigned characters. R/W/B:R = read only, W = write only, B = read or write using HART Valid HART Parameters and Units			

1.7 Standard DD File

The Device Description file (rev A) for the HygroPro XP field device for HART is available from Panametrics. A Device Description ("DD") is a formal description of the data and operating procedures for a field device, including commands, menus and display formats. It describes exactly what you can do to that particular device by HART communication.

It is written as plain text, but is converted into a coded ("tokenised") form for use, for greater efficiency. The DD file contains the standard table view and enhanced view.

The main things the DD describes are Variables, Commands, Methods and Menus. Every accessible variable in the device is included. That means the process measurements, any derived values, and all the internal parameters such as range, sensor type, choice of linearization, materials of construction, etc.

For each Variable, the DD specifies, among other things, the data type (e.g., integer, floating point, alphanumeric, enumerated), how it should be displayed, a name for display to an operator, any associated units, and help text, perhaps describing the meaning of the variable or how it is used.

For each Command, the DD specifies the data structure of the command and its response, and the meaning of any command response status bits.

Methods describe operating procedures, so that a user can be guided through a sequence of actions, for example to re-calibrate the moisture or pressure sensor.

The DD also defines a Menu structure, which a host can use for an operator to find each variable or method.

The standard DD has three top-level menus: Process Variables, Diagram/Service and Detailed Setup. Each of these menus have several sub-menus providing the user with access to the transmitter variables, diagnostics, and some programming capability.

Chapter 2. Operation

2.1 Powering Up & Programming

After the HygroPro XP has been installed in a process as described in Chapter 1 (Installation), 12 – 28 V DC power may be applied to the unit. The loop-powered transmitter will show a start-up screen and may require up to 60 seconds for properly initializing, and subsequently commencing normal operation.

The unit will meet its specified Dew Point accuracy within 3 minutes. As noted in the previous Chapter, the AlOx sensor should be kept desiccated and dry down response of the HYGROXPRT probe depends on the initial moisture level of the AlOx sensor. If the probe has been kept sufficiently dry using the desiccant cap and not exposed to the ambient moisture, it will typically dry down to < 5 PPMv (-65°C Dew Point at 1 atm pressure) in under 15 minutes.

Figure 17 below shows a close-up view of the HygroPro XP display and keypad, and Figure 18 on the next page shows a complete menu map of the HygroPro XP setup program.



Figure 17: HygroPro XP Display and Keypad

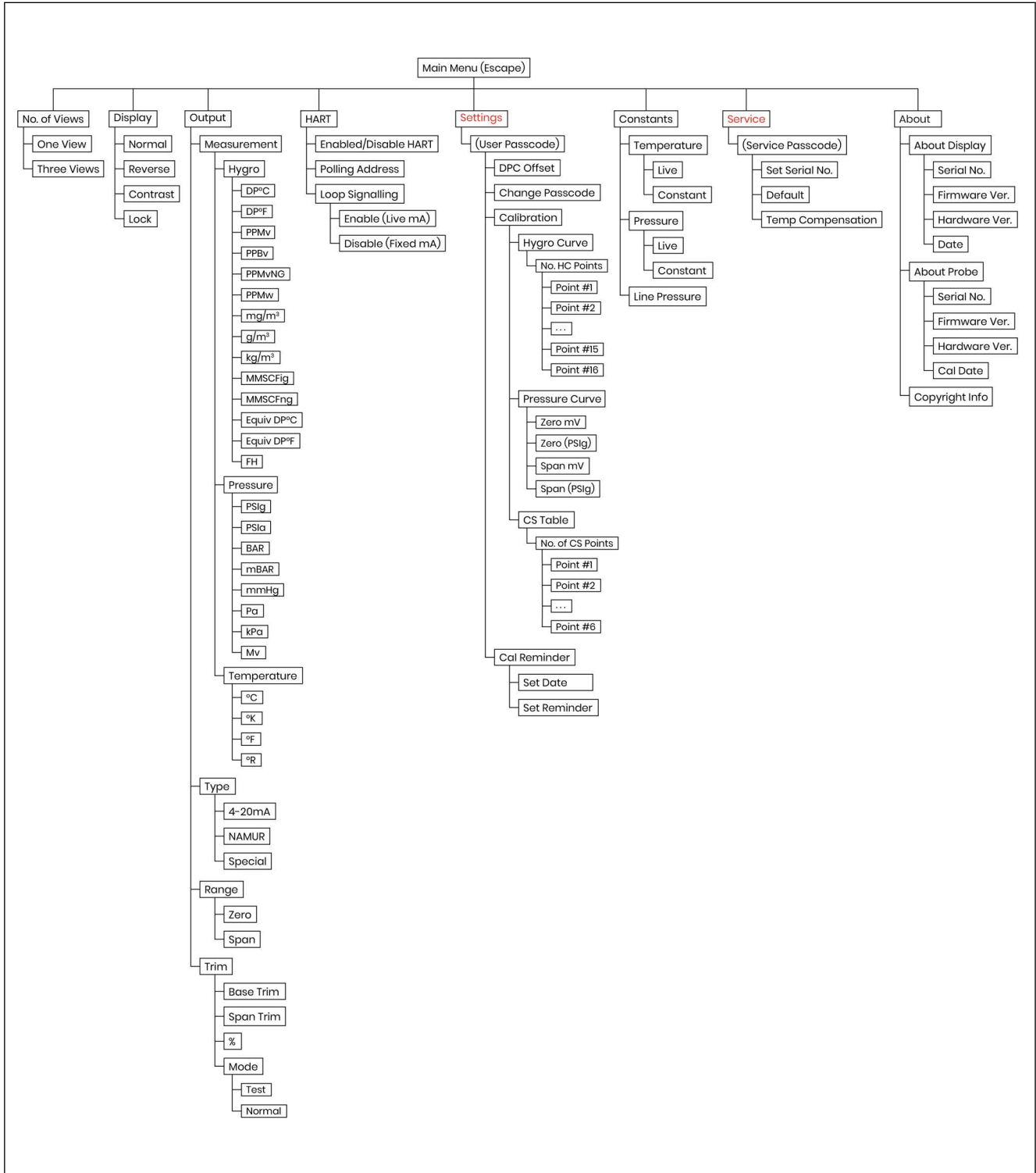


Figure 18: Programming Menu Map

The main menu map shown above can be accessed by pressing the Escape **X** key. In Figure 18, red text indicates a password is required to access the succeeding section of the menu map.

2.1.1 Keypad

After entering the setup program, the keys on the HygroPro XP keypad (see Figure 17 on page 15) perform the following functions:

- Enter ✓ – confirm a selection or move to the next screen.
- Escape ✗ – cancel a selection, move to the previous screen or open main menu.
- 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/field to the left.
- Right → – move the cursor to the next character/field to the right.

2.2 Basic Setup

The HygroPro XP transmitter is easily programmed to meet the user's requirements by referring to the menu map in Figure 13 on the previous page and following the instructions in this section. As noted in the figure, the following six top-level parameters can be accessed and set on the HMI without any passcode.

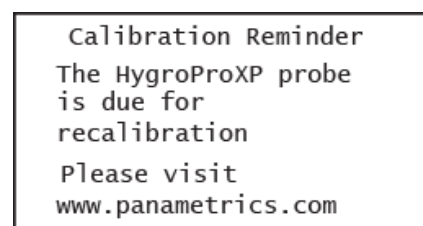
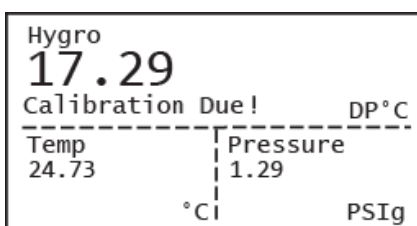
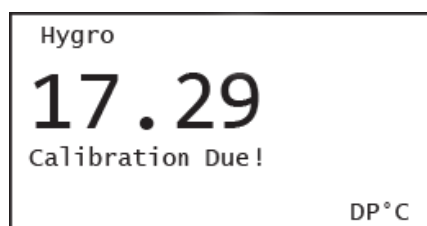
- No. of Views
- Display
- Output
- HART
- Constants
- About

The Settings menu requires a 6-digit User passcode (default value 111111) while the Service menu (see Chapter 3) requires a device-specific 6-digit Service passcode (contact Panametrics Tech Support) for access.

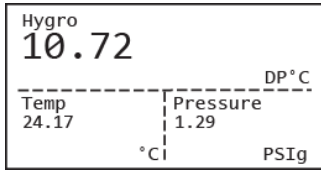


CAUTION! Panametrics strongly recommends that the HYGROXP RTE probe be sent back to the Billerica, USA or Shannon, IE facilities for recalibration every 6–12 months to ensure accuracy and reliability of the moisture readings.

As shown below the **Calibration Due!** notation flashing on the display under the main display measurand indicates the probe is due for recalibration. Note this reminder occurs on the same location on the display regardless of its format (i.e., single view or triple view).



If the user selects the **Calibration Due!** reminder by navigating to it on the display using the Up arrow and pressing Enter, then the description of the calibration reminder is displayed along with the Panametrics web page URL.

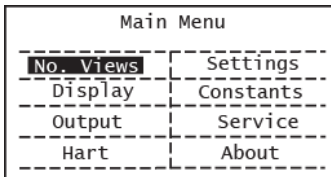


If the date and time are saved to the device non-volatile memory correctly, depending on the calibration date of the HYGROXPRT probe attached, the **Calibration Due!** warning will not appear on the display as shown.

If it does appear for a new HygroPro XP installation, please contact Panametrics Technical support to check the calibration date of the probe (Serial number engraved on probe mount).

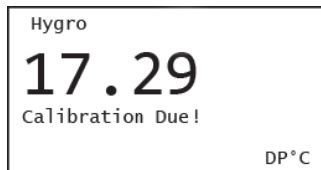
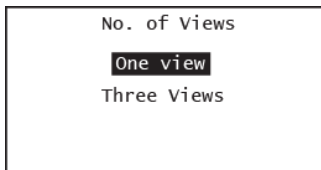
2.2.1 Selecting Measurement Parameters

To select the measurement parameters, complete the following steps:



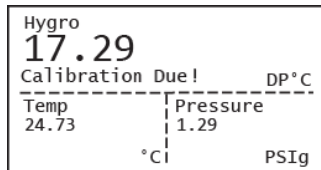
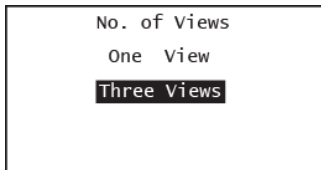
To enter the main menu press Escape **X**.

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 **✓**.

Each selection is confirmed by "Saving to Memory" prompt flashing on the screen after pressing Enter **✓**.



Typical examples of the single and triple measurement views for a given set of measurement choices are shown on the left.

The typical format shows the type of measurement in the top left, the measured value in the middle and the units chosen on the bottom right.

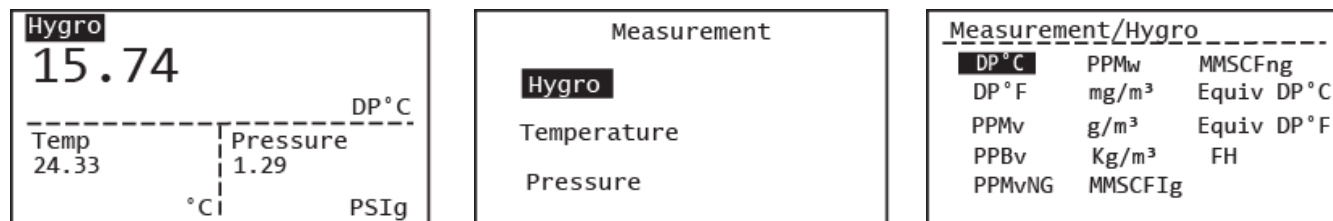
Press Escape to access the Main menu (Figure 18) and access the No. of Views setup to change the view.

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.

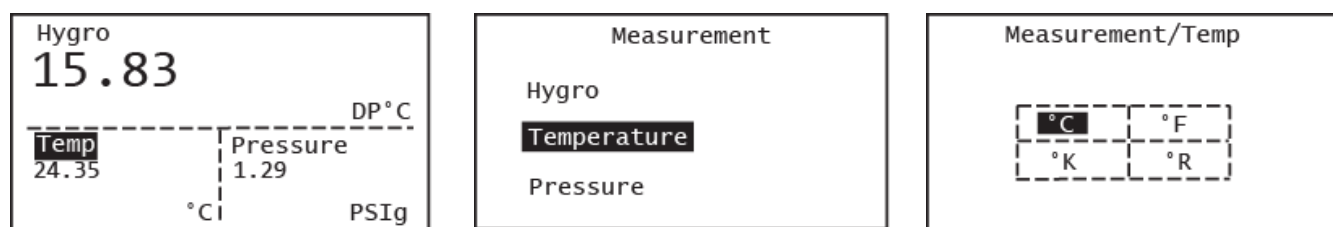
Note: As an example, shown below are the steps for setting up a typical 3-view display where Dew Point, sample temperature and sample pressure have been selected as the measurement parameters to be changed.

Use the arrow keys to highlight Hygro and press Enter to set up this measurement. The next screen shows the three measurements available with Hygro highlighted. Press Enter to display all possible hygrometry measurements available, then use the up and down to navigate to the particular measurement you would like to choose.

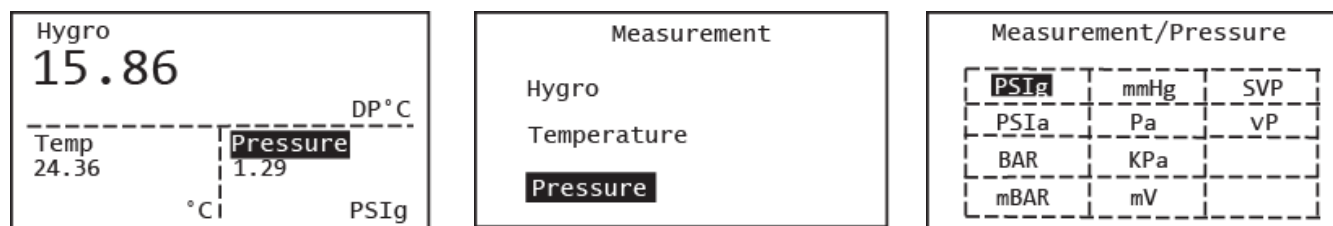
Press Enter. Again, any change in this selection is confirmed by a "Save Successful" prompt flashing on the screen after pressing Enter.



Use the arrow keys to highlight Temp and press Enter to set up this measurement. The next screen shows the three measurements available with Temperature highlighted. Press Enter to display all possible temperature measurements available, then use the up and down arrows to navigate to the particular measurement you would like to choose. Press Enter to return to the main display screen.



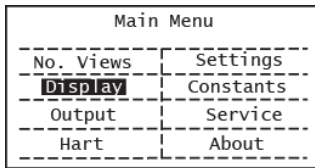
Use the arrow keys to highlight Pressure and press Enter to set up this measurement. The next screen shows the three measurements available with Pressure highlighted. Press Enter to display all available pressure measurements, then use the up and down arrows to navigate to the particular pressure measurement you would like to choose. Press Enter to return to the main display screen.



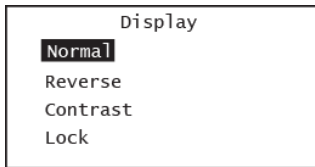
The programming sequence is now complete and you are returned to the View menu. Please note each measurement in HygroPro XP has a pre-determined range and resolution, and the number of digits after the decimal point is fixed.

2.2.2 Setting up the Display

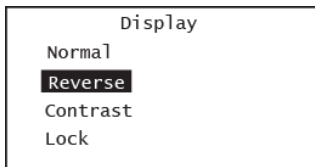
To set up the display, complete the following steps:



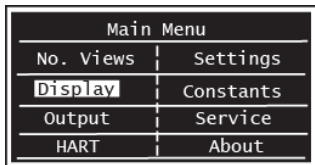
Press Escape to access the main menu, use the up and down keys to select Display and press enter.



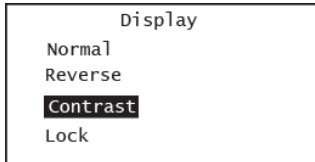
You will see 4 choices under the Display menu as shown on the left.



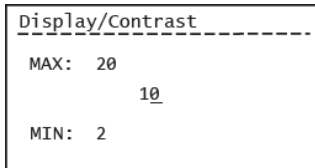
If the Normal display type is acceptable, press Escape to return to the previous menu.



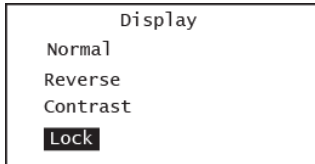
To change the display type, use the up and down keys to select Normal or Reverse and press enter. The reverse display mode is shown on the left.



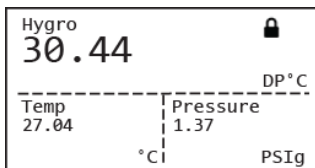
If you wish to change the display Contrast, at the above screen, highlight that choice and press enter.



Use the arrow keys to change the Contrast value and press Enter. The default value is set to 10. Then press Enter to return to the main menu.



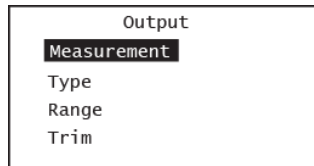
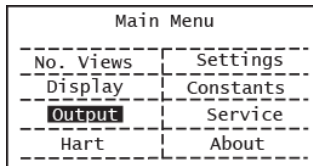
To lock the display press Lock. The display then shows up with lock sign in the top right corner as shown. Please note the default mode for the display is unlocked.



To unlock the display press Enter ✓ / Escape ✗, Enter ✓ in that sequence. The Lock sign will disappear from the display.

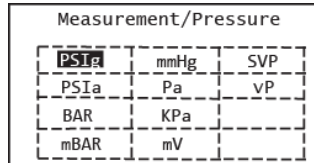
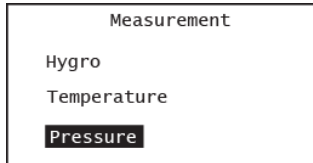
2.2.3 Setting up the Analog Output

To set up the analog output, complete the following steps (no Passcode required):



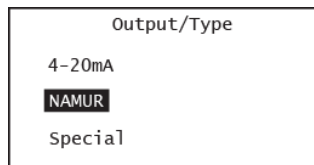
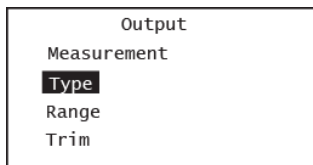
After pressing Escape to access the Main Menu, use the right arrow key to scroll to Output and press Enter.

Select the Measurement option and press Enter. Use the arrow keys to scroll to the desired output parameter and press Enter.



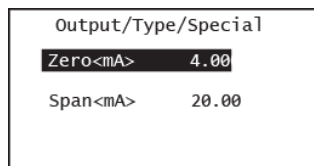
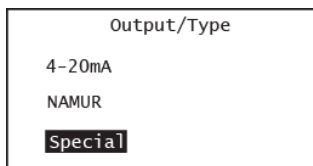
In this example, the Pressure measurement is selected. Press Enter to see choice of units available.

Press Enter and the display goes back to the previous screen after briefly showing "Saved to Memory" if any setting is changed.



In the Output menu, select Type and press Enter. The screen on the left appears (with 4–20 mA as the default choice):

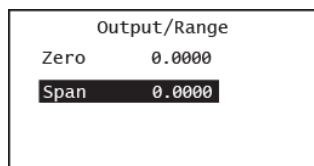
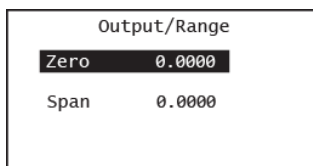
Select the desired output Type and press Enter. If NAMUR is selected instead, the display goes back to the previous screen on pressing Enter.



If Special is chosen at the previous prompt, the screen shown on the left appears.

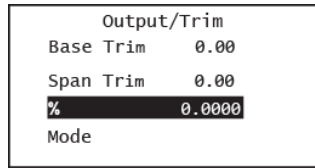
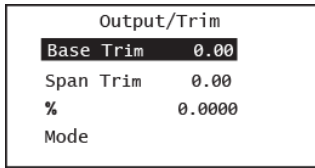
Select Zero and press Enter. Use the arrow keys to enter the zero value for the special output and press Enter.

Repeat the above two steps to enter the Span value for the special output.



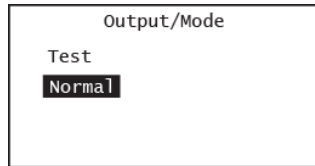
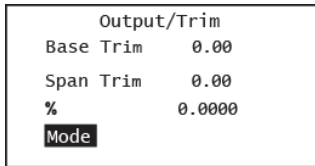
In the Output menu, select Range and press Enter. The screen shown on the left appears.

Enter the Zero and Span values for the range, using the same procedure as above.



In the Output menu, select Trim and press Enter. The screen shown on the left appears.

Enter your values for the Base Trim, Span Trim and %, using the same procedures as on the previous screen.



When you select the Mode option at the above prompt, choose either Test to verify the output or Normal for normal operation.

In the Test mode, you can check (and trim if necessary) the output values at any desired % level between 0 and 100%.

2.3 Advanced Setup

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

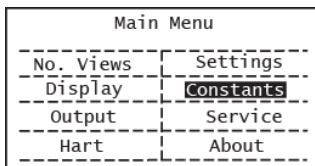
2.3.1 Setting Up the Pressure/Temperature Displays

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 the Constant option is selected, the desired numerical value must be set. Please note there is no indication on the display if either value is set to Live or Constant.

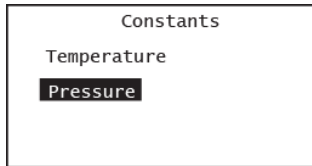


CAUTION!

Please be careful to select sample pressure and temperature settings to the best option for the chosen hygrometry measurement. Certain absolute measurements like mg/m³, g/m³ and PPMv do not depend on sample temperature and/or pressure, while others such as Dew Point, Equivalent DP, and lbs/MMSCF require an accurate live sample pressure and temperature reading.

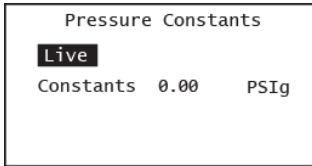


In the Main menu (press Escape) navigate to Constants and press Enter.



To set the pressure/temperature display, use the arrow keys to select Pressure/Temperature. Press Enter.

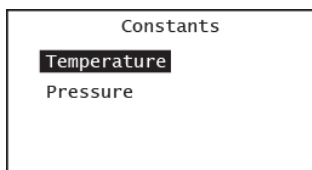
Use the arrow keys to select either Live or Constant Pressure or Temperature and press Enter. For example, constant pressure of 70 bar could be selected if the desired measurement output is the Equivalent DP @ 70 bar.



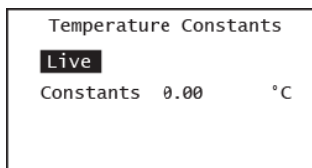
If you selected Constant Pressure, please note the default units, which can be changed by navigating to the Measurements menu as described above.

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

Note: As shown in the Menu map in Figure 13, the default value for Pressure is Constant (0.00 PSIG) as the pressure sensor is optional.



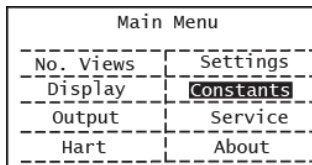
Use the same procedure to set the temperature mode, and if Constant Temperature is selected, to enter the constant temperature value.



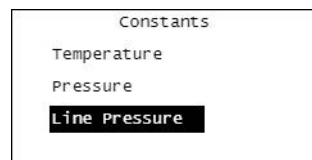
Note: The default value for Temperature is Live as all HYGROXPTE probes include a temperature sensor.

2.3.2 Setting the Line Pressure

The Line Pressure variable is used to tell the device the process line pressure when calculating an equivalent dew point measurement.



In the Main menu (press Escape) navigate to Constants and press Enter.



Use the arrow keys to select Line Pressure.

Input your desired Line pressure. For example 70 bar could be input if the desired measurement output is the Equivalent DP @ 70 bar.

2.3.3 Entering Sensor Calibration Data

Main Menu	
No. Views	Settings
Display	Constants
Output	Service
Hart	About

Calibration data for the AIOx moisture sensor and the optional pressure sensor are located under the Settings option on the Main Menu.

Enter the Passcode
000000

These settings are protected by the User Passcode – the default value is **111111** and can be changed as shown below.

Enter your User password and press Enter.

Settings
DPC Offset
Calibration
Cal Reminder
Change Passcode

Use the arrow keys to scroll to Calibration. Press Enter.

Calibration
Hygro Curve
Pressure Curve
CS Table

Select Hygro Curve and press Enter.

No. of HC Points
MAX: 18
14
MIN: 2

Select Hygro Curve and press Enter.

This will bring you to the No. of HC points screen. Default number of calibration points is 14 (standard HYGROXPRTTE calibration), maximum number is 18 (extended calibration). The HC table that appears on pressing Enter will display as many points from point 1 as you select.

Hygro Curve			
1	5	9	13
2	6	10	14
3	7	11	
4	8	12	

Select point 1 (or any point you wish to edit) and press Enter. It is advisable to start at the top and check every single calibration point in order to ensure the probe calibration curve has been entered properly.

Hygro Curve/Pt. 1	
FH	8.7200
Dew Pt C	-110

The next screen shows the FH (independent variable) and Dew Point (dependent variable) values for that calibration point. As shown on the left, the first calibration point typically has a DP setting of -110°C while the last (14th) point has a DP setting of +20°C.

```

Hygro Curve/Pt. 14
FH      186.3500
Dew Pt C      20

```

Use the arrow keys to choose either value, enter a desired value and press Enter. Repeat the previous two steps until all of your Hygro Curve data points (14 typical, 18 extended) have been entered.

To save the data you have to press Enter. If any numerical value has changed an intermediate screen showing "Save Successful" appears.

If nothing has been changed you will go back to the Hygro Curve table screen.

```

Calibration
Hygro Curve
Pressure Curve
CS Table

```

```

Pressure Curve
Zero mV      0.0000
Zero PSig    0.0000
Span mV      100.0000
Span PSig    100.0000

```

If you have an optional pressure sensor, you can also adjust the 2-point pressure calibration curve by choosing the Pressure Curve option and pressing Enter.

This will bring you to a display showing the 4 variables on the 2-point pressure calibration curve.

```

-----
Pressure/Zero mV
MAX: 100.00
      _0.0000
MIN: 0.00

```

```

-----
Pressure/Zero PSig
MAX: 5000.00
      _0.0000
MIN: 0.00

```

Choosing the Zero mV and pressing Enter lets you adjust the Zero mV corresponding to the Zero pressure, which can be adjusted by choosing the Zero pressure.

```

-----
Pressure/Span mV
MAX: 100.00
      _100.0000
MIN: 0.00

```

```

-----
Pressure/Span PSig
MAX: 5000.00
      _100.0000
MIN: 0.00

```

Similarly, you can also adjust the Span mV corresponding to the Span pressure.

IMPORTANT: Any changes under Settings that are not saved by pressing Enter will be lost after a time-out period of **1 minute**. The display will revert to the previous screen without the "Save Successful" intermediate screen.

Repeat the above process to enter any available CS Table data points as shown below.

```

Calibration/CS Table
-----
Pt 1 | Pt 5 |
Pt 2 | Pt 6 |
Pt 3 |      |
Pt 4 |      |
-----

```

```

CS Table/Pt. 1
Temp C      0.0000
CS Value    0.0000

```

```

-----
Temperature C
MAX: 80.00
      _0.0000
MIN: -40.00

```

```

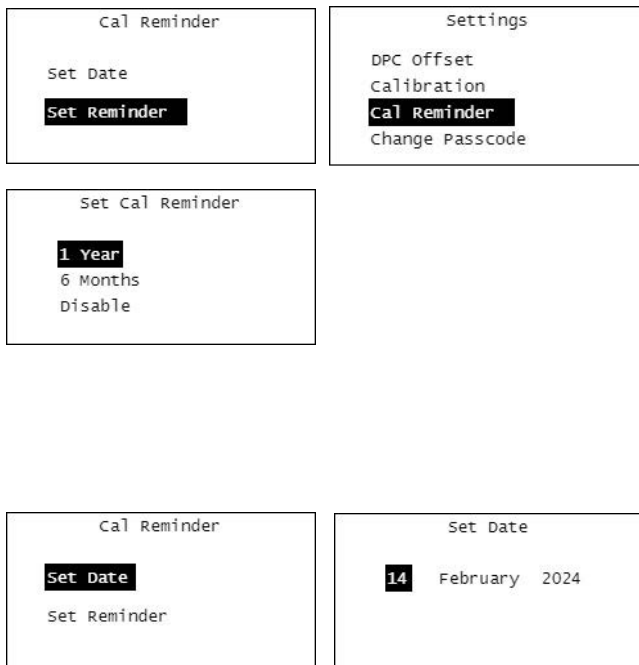
-----
CS Value
MAX: 10000.00
      _0.0000
MIN: 0.00

```

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

2.3.4 Changing the Calibration Reminder

The HygroPro XP comes from the factory with a 1 year reminder to re-calibrate your HygroPro XP RTE Probe. The calibration reminder option and current date can be edited underneath the Cal Reminder Menu.



To change the calibration reminder option choose Cal Reminder under the Settings menu and press Enter.

In the next screen choose Set Reminder and press Enter.

Choose the calibration reminder you want and press Enter.

1 Year will set a reminder for 1 year after the HYGROXP RTE probe's factory calibration. Similarly for 6 months.

To disable the reminder choose Disable and press Enter.

To change date choose Set Date from the Cal Reminder menu.

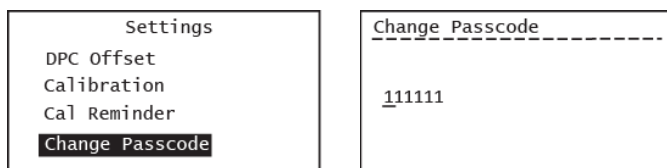
The next screen will allow you to set the current date. Use the left and right arrow keys to select the field. Use the up and down arrow keys to increment and decrement the fields.

Once you have set the date correctly press Enter to save.

2.3.5 Changing the User Passcode

As described above the User Passcode is a generic 6-digit code (i.e., not tied to the device ID or Serial No.) with a factory (default) setting of 111111.

IMPORTANT: The only device settings locked by a device-specific Service passcode are under the Service menu (see Chapter 3). The end user can adjust all other device parameters shown in the Menu Map in Figure 13. Since the probe calibration data are protected by the User passcode, we strongly advise the end user to change the default passcode and make a note of the updated passcode.



To change the User passcode choose the Change Passcode option under settings and press Enter.

The next screen lets you set the 6-digit code to any value of your choice. Press Enter to save the new passcode.

Note: The user passcode can be changed as many times as the end user wishes. The new passcode will persist through power cycling the unit

2.3.6 Configuring HART Options

As described in Chapter 1 the HygroPro XP is compatible with the HART® 7.0 protocol and supports both point-to-point and multi-drop digital communication by superimposing low-level digital signals on top of the 4–20 mA analog output. This enables 2-way field communication between one or more HART masters the HygroPro XP wherein additional diagnostic information beyond the normal process variable can be communicated.

```

HART
Enable/Disable HART
Polling Address
Loop Signaling
  
```

```

HART Enable/Disable
Enable HART
Disable HART
  
```

In order to configure HART settings, choose the HART option on the Main Menu and press Enter to access the HART screen.

Use the Up and Down arrow keys to select Enable/Disable HART and press Enter. The next screen shown on the left enables you to either disable (default is enabled) or enable HART on the 4 – 20 mA output. Press Enter.

```

HART
Enable/Disable HART
Polling Address
Loop Signaling
  
```

```

HART Polling Address -----
MAX: 20
      _0
MIN: 0
  
```

In a multi-drop configuration, each HART slave (HygroPro XP unit) has a unique polling address. This can be set by the Polling address option.

Pressing Enter will enable you to change this address (default = 0) between 0 and 20. Press Enter to save your selection.

```

HART
Enable/Disable HART
Polling Address
Loop Signaling
  
```

```

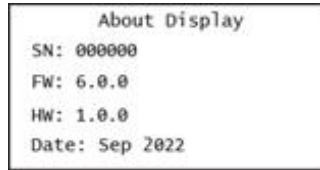
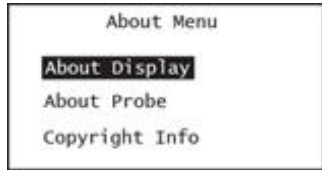
Loop Signaling
Enable (Live mA)
Disable (Fixed mA)
  
```

Even when HART is enabled, the 4 – 20 mA continues to work as a standard analog output that can be configured as described in Section 2.2.4 above.

To change the Loop Signaling configuration choose it and press Enter. This brings you to the next screen that lets you choose between Enable (default) and Disable. If the latter is chosen, you can set the fixed mA value for the analog output on the next screen.

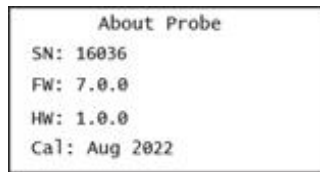
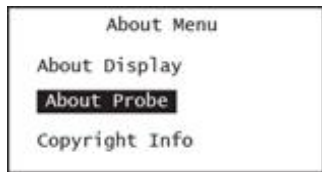
2.3.7 About Display/Probe

The HygroPro XP has two independent components – the display and the HYGROXPTE probe – each with its dedicated electronics and firmware. As described in Appendix B, the display and/or probe firmware can be independently updated in the field via the RS-485 port.



To review the Display and/or Probe configurations, choose the About option on the Main Menu and press Enter to access the About Menu screen.

Use the Up and Down arrow keys to select About Display and press Enter. The next screen shown on the left shows the Serial no., firmware and hardware versions and the manufacturing date of the display. Press Escape to return to the About menu.



Use the Up and Down arrow keys to select About Probe and press Enter. The next screen shown on the left shows the Serial no., firmware and hardware versions and the last Calibration date of the probe. Press Escape to return to the About menu.

2.3.8 Guidelines to Customers

Following guidelines can help the user operate PanaView Plus software application securely:

- Only download supporting software apps from locations given in this document.
- Install and scan the PC's with well-known Anti-Virus software.
- Customers are not allowed to connect to Meter via Service Remote Connect. Only Panametrics services personnel are allowed to connect remotely with proper authorization.
- For any kind of software issues, please write to Software team.
- Be vigilant and report back any unusual activity on the device such as:
- Unknown installed software applications,
- Change of security configurations without knowledge, and Unknown files.

IMPORTANT: It is the user's responsibility to abide to the above recommendations. BAKER HUGHES has no control over the usage environment or misuse of the Software. User assumes all risk and responsibility for the use of the product.

Chapter 3. Service and Maintenance

3.1 The Service Menus

IMPORTANT: The Service menus on the HygroPro XP are accessible only by using a unique factory-level passcode that is tied to the Serial number of your device. Please note this code is different from the User Passcode that allows for access to the Settings menu in Chapter 2, "Operation". Please contact Panametrics Service to obtain this passcode for your device.

Main Menu	
No. Views	Settings
Display	Constants
Output	Service
HART	About

After unlocking the display (if required) and pressing Escape **X**, use the arrow keys to scroll to Service and press Enter **✓**.

Service	
Set Serial No.	
Default	
Temp Compensation	

The following HygroPro XP Service menu options are available:

1. Set Serial No. - Used to reset the HygroPro XP display serial number that is connected to the display head.
2. Default - used to reset ALL user settings to their factory defaults.
3. Temp Compensation - Used to Enable/Disable temperature compensation of the measured Dew Point.

Enter the Passcode

000000



CAUTION!

Please do NOT change the factory setting of the Serial number unless advised by Panametrics Service, as it will change the service passcode without any traceability.

The Service passcode is uniquely tied to the serial number of the probe. Please contact Panametrics Service to obtain Service Menu access.

IMPORTANT: Any changes under Service that are not saved by pressing Enter will be lost after a time-out period of 5 minutes. The display will revert to the previous screen without the "Save Successful" intermediate screen.

Select the desired Service menu option and press Enter **✓**. Then, follow the on-screen instructions.

Service	
Set Serial No.	
Default	
Temp Compensation	

Restore Defaults	
Are you sure?	
Yes	
No	

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.

Please note your input has not been accepted until the display echoes the choice selected by indicating briefly on the display, "Save Successful".

Service	
Set Serial No.	
Default	
Temp Compensation	

Temp Compensation	
Disable	
Enable	

Please refer to Section Section 2.3.7 "About Display/Probe" in the end of Chapter 2 to understand how to display the firmware, calibration, and hardware information about the HygroPro XP display and /or HYGROXPRT probe.

The firmware of the display and/or the probe can be updated in the field via the RS-485 port. Please see Appendix B. "HygroPro XP Field Service Update User Manual" of this user manual for detailed instructions.

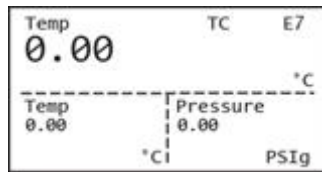
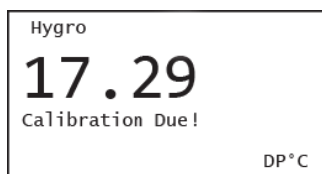
3.2 Moisture Probe Error Conditions

IMPORTANT: All moisture probes require periodic recalibration and 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 XP is programmed to indicate the error condition via its 4 – 20 mA analog output signal.

Note: The NAMUR error handling scheme described below is followed only if the analog output is set to NAMUR as shown in Section 2.2.3 of Chapter 2, "Operation".

- ≥ 22 mA to indicate an Over Range error, i.e., a short circuit in the AIOx sensor on the probe
- ≤ 3.5 mA to indicate an Under Range error, i.e., an open circuit in the AIOx sensor on the probe



Run-time errors can also be displayed on the HygroPro XP LCD (in a specific pre-assigned spot) as well as by HART.

The figures on the left show the location of error codes on the top line right corner of the display as well as the calibration reminder error (Calibration Due!) under the main measurand.

Table 6 below lists all error codes displayed HygroPro XP screen.

Table 6: List of error codes displayed HygroPro XP screen

Error Code	Description	On screen Message
E1	Error happens when probe can't be found	No Probe Error
E2	When measurement is out of the defined calibration curve range	Out of range Error
E3	When measurement is above the defined calibration curve range	Over Range Error
E4	When measurement is below the defined calibration curve range	Under Range Error
E7	This error happens when the link to the probe is dead	No Link Error
E8	The message Probe received does not have the correct CRC	Bad CRC Error
E13	The calibration curves were never entered, they have their zero default entries	No Calibration
E19	This error happens when there is a hardware fault with the moisture sensor	Hygro Sensor Fault
E20	This error happens when there is a hardware fault with the temperature sensor	Temp Sensor Fault
E21	This error happens when there is a hardware fault with the pressure sensor	Pressure Sensor Fault
E26	The ADC for the pressure measurement failed	ADC Failure

3.3 Cleaning the Moisture Probe

To clean your HygroPro XP moisture probe (i.e., HYGROXP RTE), 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 or laminar fume hood. 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 reagent-grade Hexane or Toluene in each container.
- One glass (**NOT** metal) container with distilled (NOT deionized) water.

IMPORTANT: Make sure the containers are deep enough to completely submerge the moisture probe after it is disconnected from the display head. Do not place the transmitter module into any of these solvents. Insert only the moisture sensor mounted on the probe 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 XP 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 XP electronics will automatically read and store the calibration data whenever a new or recalibrated RTE is installed.

IMPORTANT: The factory programmed probe calibration data should not be modified without consulting Panametrics.

3.3.3 Removing the Transmitter from the System

IMPORTANT: Disconnect device from power supply and remove cable gland/adaptor from device before removing from system.

To remove the transmitter from the installation site, refer to *Figure 5 on page 4* 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.

3.3.4 Removing the Probe from the Transmitter

The HYGROXP RTE probe can be removed from the dismantled transmitter by following this procedure:

1. By following the procedure outlined in Section 1.3, open the enclosure lid and unfasten the HMI assembly.
2. Disconnect the yellow probe cable from the back of the HMI assembly and unfasten the earthing wire from the grounding point.
3. Loosen the knurled nut on the probe mount and unthread the probe from the transmitter.
4. Disconnect the M8 connector of the internal yellow probe cable by turning the locknut at the top of the probe.

3.3.5 Cleaning the Sensor and the Shield



CAUTION! Do not place the display head/transmitter module into any of the solvents. Insert only the sensor portion of the probe. Do not allow the Aluminum Oxide sensor to come into contact with the surfaces of cleaning containers or with any other hard surface.

1. While wearing protective gloves, place the sensors on the probe in the first container of Hexane or Toluene and allow them to soak for 10 minutes.
2. Remove the sensors from the Hexane or Toluene and soak them in the container of distilled water for 10 minutes.
3. Remove the sensors from the distilled water and soak them in the second (clean) container of Hexane or Toluene for 10 minutes.
4. Remove the sensors from the Hexane or Toluene and set the probe 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 stuck to the 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 sensors without touching them.
8. Place the probe, i.e., cleaned sensors 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



CAUTION! Please check both the probe sealing O-rings (2X Silicone) and the process sealing O-ring (Viton) on the probe mount prior to installing or re-installing a HygroPro XP into the process. These transmitters should be supplied with a new process O-ring after each recalibration to ensure safe and reliable process seal.

To install a new, recalibrated or cleaned probe back in the transmitter. This procedure requires completing the following steps:

1. Connect the M8 connector of the yellow probe cable to the probe by turning the locknut.
2. Thread the probe into the enclosure until it is fully tightened.
3. Fasten the earthing wire of the probe cable to the specified grounding point in the enclosure and reconnect the cable to the connector on the back of the HMI assembly.
4. Follow the procedure outlined in Section 1.3 to remount the HMI assembly and fully close the enclosure once the probe has been threaded into the enclosure.

3.3.7 Evaluating the Cleaned Probe

Note: All new probes are calibrated at the factory, and therefore, 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 Technical Support for assistance.

Chapter 4. Specifications

4.1 General

Dew Point/Frost Point Calibration Range

- -80°C to $+10^{\circ}\text{C}$ (-112°F to 50°F) standard with data from -110°C to $+20^{\circ}\text{C}$ (-166°F to 68°F)
- Optional low end calibration: -166 to -58°F (-110 to -50°C)

Operating/Storage Temperature

- -20°C to 60°C (-4°F to 140°F) operating temperature
- -30°C to 70°C (-22°F to 158°F) storage temperature

Warm-Up Time

- Meets specified accuracy within three minutes after initial power up

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 28 VDC (loop-powered, customer supplied)
- *Outputs:* 4 to 20 mA analog, HART and RS-485 digital
- *Output Resolution:* 0.01 mA/12 bits
- *Maximum Load Resistance:* $RL = ((PSV - 12) * 45) + 264$, where PSV = Power Supply Voltage PSV must be $\geq 12\text{V}$ (lowest input voltage).
Example: Given a 24 VDC Power Supply, Max. Load Resistance = $((24 - 12) * 45) + 264 = 804\Omega$

4.3 Mechanical

Sample Connection

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

Operating Pressure

- 5 µm Hg to 5,000 psig (345 bar)

Enclosure

- Type 4x, IP 66, IP67

Dimensions

- H x W x D: 8.63 x 4.80 x 3.51 in. (219 x 122 x 89 mm)
- Weight: Aluminium: 5.5lbs (2.5kg)
Stainless Steel: 11lbs (5kg)

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 national standards

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°F to 158°F (-30°C to 70°C)

Accuracy

- ±0.9°F (±0.5°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 Optional Built-In Pressure Sensor

Type

- Solid-state, Piezo resistive

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)

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 2014/65/EU for DN<25

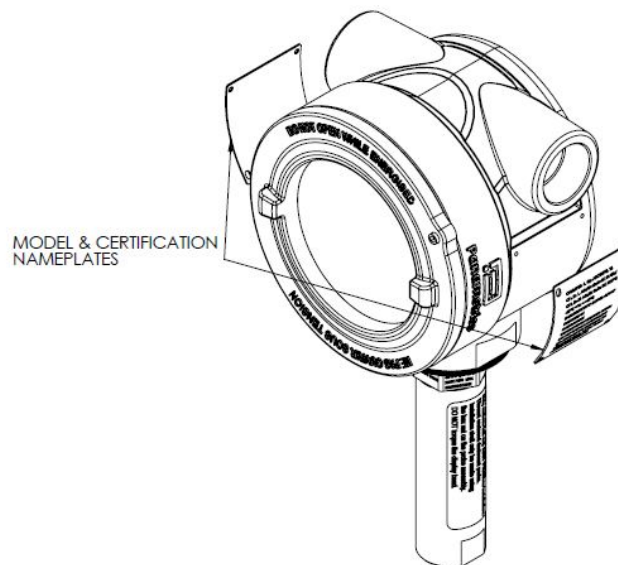


Figure 17: HygroPro XP Certification Label

[no content intended for this page]

Appendix A. HygroPro XP HART® Field Device Specification

A.1 Introduction

A.1.1 Scope

The Baker Hughes Panametrics HygroPro XP moisture transmitter, revision 1 complies with HART Protocol Revision 7.5. This document specifies all the device specific features and documents HART Protocol implementation details (e.g., the Engineering Unit Codes supported). The functionality of this Field Device is described sufficiently to allow its proper application in a process and its complete support in HART capable host applications.

A.1.2 Purpose

This specification is designed to complement other documentation by providing a complete, unambiguous description of this Field Device from a HART Communication perspective.

A.1.3 Who should use this document?

The specification is designed to be a technical reference for HART capable host application developers, system integrators and knowledgeable end users. It also provides functional specifications (e.g., commands, enumerations and performance requirements) used during Field Device development, maintenance and testing. This document assumes the reader is familiar with HART Protocol requirements and terminology.

A.1.4 Abbreviations and definitions

ADC	Analog to Digital Converter
CPU	Central Processing Unit (of microprocessor)
DAC	Digital to Analog Converter
EEPROM	Electrically-Erasable Read-Only Memory
ROM	Read-Only Memory
MPU	Measurement Process Unit

A.1.5 References

- HART Field Communication Protocol Specification. HCF_SPEC-13.
- FSK Physical Layer Specification. HCF_SPEC-54.
- Data Link Layer Specification. HCF_SPEC-81.
- Command Summary Specification. HCF_SPEC-99.
- Universal Command Specification. HCF_SPEC-127.
- Common Practice Command Specification. HCF_SPEC-151.
- Device Families Command Specification. HCF_SPEC-160.
- Common Tables Specification. HCF_SPEC-183

A.2 Device Identification

Manufacturer Name:	Baker Hughes Panametrics	Model Name(s):	HygroPro XP
Manufacture ID Code:	157 (0x9D Hex)	Device Type Code:	122 (0x7A Hex)
HART Protocol Revision	7.8	Device Revision:	1
Number of Device Variables	4		
Physical Layers Supported	FSK		
Physical Device Category	Current Output		

The Panametrics HygroPro XP transmitter is housed IP66/IP 67 rated enclosure suitable for both indoor and outdoor use. The product certification nameplates are located on the sides of the enclosure and indicates the model name and serial number. Revision information is shown on the LCD when the meter is energized.

A.3 Product Overview

The Panametrics HygroPro XP transmitter is a new transmitter platform, with a 4-to-20mA output.

Any programmable logic controller (PLC), distributed control system (DCS) or other process control console configured to multiplex HART digital data on a 4-to-20-mA analog signal can read all available measurements, computations and diagnostics.

A.4 Product Interfaces

A.4.1 Process Interface

A.4.1.1 Sensor Input Channels

A single removable transducer element (moisture probe) is connected to the device. Refer to the manuals for connection instructions.

A.4.2 Host interface

A.4.2.1 Analog Output

There is a single 4-20mA output from the Panametrics HygroPro XP transmitter and HART is supported on it.

A.4.2.2 Digital Output

There is one RS 485 digital output channel on the Panametrics HygroPro XP transmitter.

A.4.3 Local Interfaces, Jumpers and Switches

A.4.3.1 Local Controls and Displays

A 128X64 LCD and six-button keypad facilitate programming at the device.

A.4.3.2 Internal Jumpers and Switches

The Panametrics HygroPro XP transmitter has a write-enable switch to allow "write" and "command" commands to execute.

A.5 Device Variables

The device Variables are showed below.

Measurement	Device Variable code	Device Variable Classification Code	
		Code	Classification
Moisture	0	0	Not Classified
Temperature	1	64	Temperature
Pressure	2	65	Pressure
Frequency Hygrometry	3	90	Concentration

Dynamic Variables

The following device variables listed in the table can be used as Primary Variable (PV):

0, 1, 2, 3

Any device variable listed in the table may be assigned as secondary variables (SV), tertiary variables (TV) or quaternary variables (QV).

A.6 Status Information

A.6.1 Device Status

Bit 4 ("More Status Available") is set whenever any failure is detected. Command #48 gives further detail.

A.6.2 Extended Device Status

- Code 0x01, Maintenance Required, is never set by the Panametrics HygroPro XP transmitter.
- Code 0x02, Device Variable Alert, is never set by the Panametrics HygroPro XP transmitter.
- Code 0x04, Critical Power Failure, is never set by the Panametrics HygroPro XP transmitter.

A.6.3 Additional Device Status (Command #48)

Command #48 returns 25 bytes of data, with the following status information:

HART Additional Device Status				
Byte	Bit	Error Description	Class	Device Status Bits Set
0	0	Reserved	Warning	4, 7
	1	No Probe Error	Error	4, 7
	2	Out of Range Error	Error	4, 7
	3	Over Range Error	Error	4, 7
	4	Under Range Error	Error	4, 7
	5	No Link Error	Error	4, 7
	6	Bad CRC Error	Error	4, 7
	7	No Cal. Error	Error	4, 7
1	0	Hygro Fault	Error	4, 7
	1	Temperature Fault	Error	4, 7
	2	Pressure Fault	Error	4, 7
	3	ADC Failure	Error	4, 7
	7	Reserved	Error	4, 7

Byte	Bit	Error Description	Class	Device Status Bits Set
2	0	Reserved	Error	4, 7
	1	Reserved	Error	4, 7
	2	Reserved	Error	4, 7
	3	Reserved	Error	4, 7
	4	Reserved	Error	4, 7
	5	Reserved	Error	4, 7
	6	Reserved	Error	4, 7
HART Additional Device Status				
Byte	Bit	Error Description	Class	Device Status Bits Set
3	0	Reserved	Error	4, 7
	1	Reserved	Error	4, 7
	2	Reserved	Error	4, 7
	3	Reserved	Error	4, 7
	4	Reserved	Error	4, 7
	5	Reserved	Error	4, 7
	6	Reserved	Error	4, 7
	7	Active TW error	Error	4, 7

Bytes 4 & 5 are reserved for future use, Byte 4 is for generic warnings, Byte 5 for generic failures.

Byte 6 is the Extended Device Status, which, as stated above, the Panametrics HygroPro XP never sets and are always 0.

Byte 7 is for the Device Operating Mode, the Panametrics HygroPro XP only has one operating mode and as such does not use this byte, all bits are 0.

Bytes 8, 9, 11, and 12 are standardized status bits that the Panametrics HygroPro XP does not make use of, they are all 0.

Byte 10 is the Analog Channel Saturated Byte, if the Loop Current is saturated the lowest bit will read 1, otherwise all bits are 0.

Byte 13 is the Analog Channel Fixed Byte, if the loop current is fixed then the lowest bit will read 1, otherwise all bits are 0.

"Reserve/Not used" bits are always set to 0. These bits are set or cleared by the self-test executed at power up, or following a reset. They are also set (but not cleared) by any failure detected during continuous background self-testing.

A.7 Universal Commands

Command	Function	Description
0	Read Unique Identifier	Returns identity information about the meter including: the Device Type, revision levels, and Device ID.
1	Read Primary Variable	Returns the Primary Variable value along with its Unit Code
2	Read Loop Current And Percent Of Range	Reads the Loop Current and its associated Percent of Range.
3	Read Dynamic Variables and Loop Current	Reads the Loop Current and up to four predefined Dynamic Variables. The Dynamic Variables and associated units are defined via Commands 51 and 53.
6	Write Polling Address	Writes the polling address and the loop current mode to the field device.
7	Read Loop Configuration	Read polling address and the loop current mode.
8	Read Dynamic Variable Classification	Reads the Classification associated with the Dynamic variable.
9	Read Device Variables with Status	Request the value and status of up to eight device Device or Dynamic Variables.
11	Read Unique Identifier Associated With Tag	If the specified tag matches that of the meter, it responds with the Command 0 response.
12	Read Message	Reads the Message contained within the meter.
13	Read Tag, Descriptor, Date	Reads the Tag, Descriptor, and Date contained within the meter.
14	Read Primary Variable Transducer Information	Reads the Transducer (meter) Serial Number, Limits/Minimum Span Units Code, Upper Transducer Limit, Lower Transducer Limit, and Minimum Span for the Primary Variable transducer.
15	Read Device Information	Reads the alarm selection code, transfer function code, range values units code upper range value, Primary Variable lower range value, damping value, write protect code, and private label distributor code.
16	Read Final Assembly Number	Reads the Final Assembly Number associated with the meter.
17	Write Message	Write the Message into the meter.
18	Write Tag, Descriptor, Date	Write the Tag, Descriptor, and Date Code into the meter.
19	Write Final Assembly Number	Write the Final Assembly Number into the meter.
20	Read Long Tag	Read the 32-byte Long Tag.
21	Read Unique Identifier Associated with Long Tag	Read Unique Identifier Associated with Long Tag
22	Write Long Tag	Write the 32-byte Long Tag
38	Reset Configuration Changed Flag	Resets the configuration changed indicator (Device Status Byte bit 6).
48	Read Additional Device Status	Returns meter status information not included in the Response Code or Device Status Byte.

A.8 Common-Practice Commands

A.8.1 Supported Commands

Command	Function	Description
50	Read Dynamic Variable Assignments	Reads the Device Variables assigned to the Primary, Secondary, Tertiary, and Quaternary Variables.
51	Write Dynamic Variable Assignments	Allows the user to assign Device Variables to the Primary, Secondary, Tertiary, and Quaternary Variables
54	Read Device Variable Information	Get device variable information
59	Write Number of Response Preambles	Sets the number of asynchronous preamble bytes to be sent by the meter before the start of a response message.
72	Squawk	Causes the addressed device's LCD backlight to flash to indicate the reception of this command.

A.8.2 Burst Mode

This Field Device does not support Burst Mode.

A.8.3 Catch Device Variable

This Field Device does not support Catch Device Variable.

A.9 Device-Specific Commands

The following device-specific commands are implemented:

- Command 129 (0x81): Read Cal Reminder
- Command 130 (0x82): Set Loop Current Zero
- Command 131 (0x83): Set Loop Current Gain
- Command 132 (0x84): Set Loop Current Percentage
- Command 133 (0x85): Set Primary Variable Range Values
- Command 140 (0x8C): Read Primary Variable Range Values
- Command 144 (0x90): Set Loop Measurement Type
- Command 146 (0x92): Set Pressure Constant
- Command 147 (0x93): Read Pressure Constant
- Command 148 (0x94): Set Temperature Constant
- Command 149 (0x95): Read Temperature Constant
- Command 150 (0x96): Set Dew Point Offset
- Command 151 (0x97): Read Dew Point Offset
- Command 152 (0x98): Set Hygro Curve Number of Points
- Command 153 (0x99): Read Hygro Curve Number of Points
- Command 154 (0x9A): Set Hygro Curve
- Command 155 (0x9B): Read Hygro Curve
- Command 156 (0x9C): Set Pressure Curve
- Command 157 (0x9D): Read Pressure Curve
- Command 158 (0x9E): Set Saturation Table Number of Points
- Command 159 (0x9F): Read Saturation Table Number of Points

- Command 160 (0xA0): Set Saturation Table Point
- Command 161 (0xA1): Read Saturation Table Point
- Command 162 (0xA2): Set Temperature Coefficients
- Command 163 (0xA3): Read Temperature Coefficients
- Command 166 (0xA6): Set SAT Table Index
- Command 167 (0xA7): Read AT Table Index
- Command 168 (0xA8): Set Hygro Index
- Command 169 (0xA9): Read Hygro Index
- Command 170 (0xAA): Read Loop Measurement Type
- Command 171 (0xAB): Read Loop Current Trim Zero
- Command 172 (0xAC): Read Loop Current Trim Gain
- Command 173 (0xAD): Read Loop Current Pct
- Command 189 (0xBD): Read Vapor Pressure
- Command 190 (0xBE): Read Line Pressure
- Command 191 (0xBF): Set Line Pressure
- Command 192 (0xA4): Sends password
- Command 193 (0xA5): Sends new password
- Command 194 (0xA6): Read User Level
- Command 197 (0xA7): Commit the changed parameter
- Command 198 (0xA8): Cancel the changed parameter
- Command 202 (0xCA): Read Unit Group
- Command 203 (0xCB): Set Unit Group

A.9.1 Command 129 (0x81): Read Cal Reminder

Return Cal Reminder Info;

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0-1	Unsigned-16	Probe Cal Date (Number of days since 2000)
2	Unsigned-8	Selected Interval 0 - none 1 - 1 year 2 - 6 months
3	Unsigned-8	Cal Reminder Status 0 - Off 1 - On

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-4		Undefined
5	Error	Too few data bytes

A.9.2 Command 130 (0x82): Set Loop Trim Zero

This command is to trim the zero or low endpoint value to a value of 4 mA.

For example, if the zero value is 4.1 mA, then the correction entered should be -0.1 mA to achieve a result of 4 mA.

Request Data Bytes

Byte	Format	Description
0	Unsigned-8	Enumeration. 0 = Fixed 4 mA trim, 1 = Live mA Set for live analog output or fixed 4 mA for trim purposes
1~4	Float	mA correction value

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	Enumeration. 0 = Fixed 4 mA trim, 1 = Live mA Set for live analog output or fixed 4 mA for trim purposes
1~4	Float	mA correction value

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-2		Undefined
3	Error	Passed Parameter Too Large
4	Error	Passed Parameter Too Small
5	Error	Too Few Data Bytes Received
6	Error	Device-Specific Command Error
7	Error	In Write Protect Mode
8 ~ 10		Undefined
11	Error	Loop Current Not Active
12 ~ 15		Undefined
16	Error	Access Restricted
17-31		Undefined
32	Error	Busy
33 ~ 127		Undefined

A.9.3 Command 131 (0x83): Set Loop Current Gain

This command is to trim the zero or low endpoint value to a value of 4 mA. For example, if the zero value is 4.1 mA, then the correction entered should be -0.1 mA to achieve a result of 4 mA.

Request Data Bytes

Byte	Format	Description
0	Unsigned-8	Enumeration. 0 = Fixed 20 mA trim, 1 = Live mA Set for live analog output or fixed 20 mA for trim purposes
1~4	Float	mA correction value

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	Enumeration. 0 = Fixed 20 mA trim, 1 = Live mA Set for live analog output or fixed 20 mA for trim purposes
1~4	Float	mA correction value

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-2		Undefined
3	Error	Passed Parameter Too Large
4	Error	Passed Parameter Too Small
5	Error	Too Few Data Bytes Received
6	Error	Device-Specific Command Error
7	Error	In Write Protect Mode
8		Undefined
9	Error	Incorrect Loop Current Mode or Value
10		Undefined
11	Error	Loop Current Not Active
12 ~ 15		Undefined
16	Error	Access Restricted
17-31		Undefined
32	Error	Busy
33 ~ 127		Undefined

A.9.4 Command 132 (0x84): Set Loop Current Percentage

This command is to set the output percentage of loop 1 current.

This command sets the output to a user determined percent of the 4-20 mA output. Examples: 0 pct = 4 mA, 50% = 12 mA, and 100% = 20 mA.

Request Data Bytes

Byte	Format	Description
0	Unsigned-8	Enumeration. 0 = Fixed percent test, 1 = Live mA Sets live analog output or fixed mA value
1~4	Float	Loop Current Percentage, units of percent.

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	Enumeration. 0 = Fixed percent test, 1 = Live mA Sets live analog output or fixed mA value
1~4	Float	Loop Current Percentage, units of percent.

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-2		Undefined
3	Error	Passed Parameter Too Large
4	Error	Passed Parameter Too Small
5	Error	Too Few Data Bytes Received
6	Error	Device-Specific Command Error
7	Error	In Write Protect Mode
8		Undefined
9	Error	Incorrect Loop Current Mode or Value
10		Undefined
11	Error	Loop Current Not Active
12 ~ 15		Undefined
16	Error	Access Restricted
17-31		Undefined
32	Error	Busy
33 ~ 127		Undefined

A.9.5 Command 133 (0x85): Set Primary Variable Range Values

This command is to set the PV range.

Request Data Bytes

Byte	Format	Description
0	Unsigned-8	Upper and Lower Range Values Unit Class
1	Unsigned-8	Upper and Lower Range Values Unit Code
2 ~ 5	Float	Upper Range Value
6 ~ 9	Float	Lower Range Value

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	Upper and Lower Range Values Unit Class
1	Unsigned-8	Upper and Lower Range Values Unit Code
2 ~ 5	Float	Upper Range Value
6 ~ 9	Float	Lower Range Value

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1		Undefined
2	Error	Invalid Selection
3 ~ 4		Undefined
5	Error	Too Few Data Bytes Received
6	Error	Device-Specific Command Error
7	Error	In Write Protect Mode
8	Warning	Set To Nearest Possible Value (Upper or Lower Range Pushed)
9	Error	Lower Range Value Too High
10	Error	Lower Range Value Too Low
11	Error	Upper Range Value Too High
12	Error	Upper Range Value Too Low
13	Error	Upper and Lower Range Values Out Of Limits
14	Warning	Span Too Small
15		Undefined
16	Error	Access Restricted
17		Undefined
18	Error	Invalid Units Code
19 -28		Undefined
29	Error	Invalid Span
30 ~ 31		Undefined

Code	Class	Description
32	Error	Busy
33 ~ 127		Undefined

A.9.6 Command 140 (0x8C): Read Primary Variable Range Values

This command is to read the PV range.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	Upper and Lower Range Values Unit Class
1	Unsigned-8	Upper and Lower Range Values Unit Code
2 ~ 5	Float	Upper Range Value
6 ~ 9	Float	Lower Range Value

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1 ~ 127		Undefined

A.9.7 Command 144 (0x90): Set Loop Measurement Type

This command is to set the loop measurement type to 1 of 3 enumerations:

0 – 4–20 mA, 1 – NAMUR, 2 – Special Zero and Span Values

When the loop measurement type is set to Special, then the Special span value and special zero value will determine the endpoint mA values instead of 4 mA and 20 mA.

Request Data Bytes

Byte	Format	Description
0	Unsigned-8	Loop Measurement type
1~4	Float	Special Zero Value
5~8	Float	Special Span Value

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	Loop Measurement type
1~4	Float	Special Zero Value
5~8	Float	Special Span Value

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1		Undefined
2	Error	Invalid Selection
3-4		Undefined
5	Error	Too Few Data Bytes Received
6	Error	Device-Specific Command Error
7	Error	In Write Protect Mode
8 ~ 15		Undefined
16	Error	Access Restricted
17-127		Undefined

A.9.8 Command 146 (0x92): Set Pressure Constant

This sets the pressure constant to substitute for real pressure measurement. First byte is an enumeration: 0 = pressure constant active, 1 = live measurement instead of constant

Request Data Bytes

Byte	Format	Description
0	Unsigned-8	0 = use constant 1 = use live
1~4	Float	Pressure constant to substitute for real pressure measurement.

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	0 = use constant 1 = use live
1~4	Float	Pressure constant to substitute for real pressure measurement.

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-4		Undefined
5	Error	Too Few Data Bytes Received

Code	Class	Description
6	Error	Device-Specific Command Error
7	Error	In Write Protect Mode
8-15		Undefined
16	Error	Access Restricted
8-127		Undefined

A.9.9 Command 147 (0x93): Read Pressure Constant

This command reads the pressure constant used in place of a live pressure measurement. First byte is an enumeration: 0 = pressure constant active, 1 = live measurement instead of constant

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	0 = use constant 1 = use live
1 ~ 4	Float	Pressure constant used instead of live measurement.

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-127		Undefined

A.9.10 Command 148 (0x94): Set Temperature Constant

Sets a temperature constant to be used in place of a live measurement. First byte is an enumeration: 0 = temperature constant active, 1 = live measurement instead of constant

Request Data Bytes

Byte	Format	Description
0	Unsigned-8	0 = use constant 1 = live
1~4	Float	Temperature constant value.

Response Data Bytes

Byte	Format	Description
0		0 = use constant 1 = live
1~4	Float	Temperature constant value.

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-4		Undefined
5	Error	Too Few Data Bytes Received
6	Error	Device-Specific Command Error
7	Error	In Write Protect Mode
8-15		Undefined
16	Error	Access Restricted
8-127		Undefined

A.9.11 Command 149 (0x95): Read Temperature Constant

Reads the temperature constant used instead of the live measurement.
First byte is an enumeration: 0 = temperature constant active, 1 = live measurement instead of constant

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	0 = use constant 1 = live
1 ~ 4	Float	Temperature constant used instead of live measurement.

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-127		Undefined

A.9.12 Command 150 (0x96): Set Dew Point Offset

This command will set the Dew Point Offset adjustment.

Request Data Bytes

Byte	Format	Description
0	Float	Dew Point offset adjustment.

Response Data Bytes

Byte	Format	Description
0~3	Float	Dew Point offset adjustment.

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-4		Undefined
5	Error	Too Few Data Bytes Received
6	Error	Device-Specific Command Error
7	Error	In Write Protect Mode
8-15		Undefined
16	Error	Access Restricted
8-127		Undefined

A.9.13 Command 151 (0x97): Read Dew Point Offset

Reads the Dew Point offset adjustment.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0 ~ 3	Float	Dew Point offset adjustment.

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-127		Undefined

A.9.14 Command 152 (0x98): Set Number of Hygro Calibration Points

This command will set the number of points for the Hygro. Curve.

Request Data Bytes

Byte	Format	Description
0	Unsigned-8	Number of Hygro Calibration Points

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	Number of Hygro Calibration Points

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1	Error	Number of points out of range.
2-4		Undefined
5	Error	Too Few Data Bytes Received
6	Error	Device-Specific Command Error
7	Error	In Write Protect Mode
8-15		Undefined
16	Error	Access Restricted
8-127		Undefined

A.9.15 Command 153 (0x99): Read Number of Hygro Calibration Points

Reads the Dew Point offset adjustment.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	Number of Hygro Calibration Points.

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-127		Undefined

A.9.16 Command 154 (0x9A): Read Hygro Calibration Curve

This command is to read a selected Hygro Calibration Point.

Request Data Bytes

Byte	Format	Description
0	Unsigned-8	Index of Hygro curve point.

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	Index of Hygro curve point.
1 ~ 2	Signed-16	Dew Point Value of point.
3 ~ 6	Float	FH value of point.

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1	Error	Index Out of Bounds.
2 ~ 127		Undefined

A.9.17 Command 155 (0x9B): Write Hygro Calibration Curve

This command is to read the loop 0 current output error handling.

Request Data Bytes

Byte	Format	Description
0	Unsigned-8	Index of Hygro curve point.
1 ~ 2	Signed-16	Dew Point Value of point.
3 ~ 6	Float	FH value of point.

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	Index of Hygro curve point.
1 ~ 2	Signed-16	Dew Point Value of point.
3 ~ 6	Float	FH value of point.

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-3		Undefined
4	Error	Index Out of Bounds Error.
5	Error	Too Few Data Bytes Received
6	Error	Device-Specific Command Error
7	Error	In Write Protect Mode
8-15		Undefined
16	Error	Access Restricted
8-127		Undefined

A.9.18 Command 156 (0x9C): Set Pressure Curve

This command sets the two point pressure curve.

Request Data Bytes

Byte	Format	Description
0 ~ 3	Float	Low End mV
4 ~ 7	Float	Low End PSig
8 ~ 11	Float	High End mV
12 ~ 15	Float	High End PSig

Response Data Bytes

Byte	Format	Description
0 ~ 3	Float	Low End mV
4 ~ 7	Float	Low End PSig
8 ~ 11	Float	High End mV
12 ~ 15	Float	High End PSig

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-4		Undefined
5	Error	Too Few Data Bytes Received
6	Error	Device-Specific Command Error
7	Error	In Write Protect Mode
8-15		Undefined
16	Error	Access Restricted
8-127		Undefined

A.9.19 Command 157 (0x9D): Read Pressure Curve

This command reads the two point pressure curve.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0 ~ 3	Float	Low End mV
4 ~ 7	Float	Low End PSig
8 ~ 11	Float	High End mV
12 ~ 15	Float	High End PSig

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-127		Undefined

A.9.20 Command 158(0x9E): Set Saturation Table Number of Points

This command set the number of points for the saturation table.

Request Data Bytes

Byte	Format	Description
0	Unsigned-8	Number of Saturation Table Points

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	Number of Saturation Table Points

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1	Error	Number of points out of range.
2-4		Undefined
5	Error	Too Few Data Bytes Received
6	Error	Device-Specific Command Error
7	Error	In Write Protect Mode
8-15		Undefined
16	Error	Access Restricted
8-127		Undefined

A.9.21 Command 159 (0x9F): Read Saturation Table Number of Points

This command reads the number of saturation table points.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	Number of Saturation Table Points.

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-127		Undefined

A.9.22 Command 160 (0xA0): Set Saturation Table Point

Sets a saturation table point by index.

Request Data Bytes

Byte	Format	Description
0	Unsigned-8	Index of saturation table point.
1 ~ 4	Float	Temperature degC
5 ~ 8	Float	Saturation Constant

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	Index of saturation table point.
1 ~ 4	Float	Temperature degC
5 ~ 8	Float	Saturation Constant

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-3		Undefined
4	Error	Index Out of Bounds Error.
5	Error	Too Few Data Bytes Received
6	Error	Device-Specific Command Error

Code	Class	Description
7	Error	In Write Protect Mode
8-15		Undefined
16	Error	Access Restricted
8-127		Undefined

A.9.23 Command 161 (0xA1): Read Saturation Table Point

This command is to read a given temperature saturation table point.

Request Data Bytes

Byte	Format	Description
0	Unsigned-8	Index of Saturation point.

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	Index of Saturation Table point.
1 ~ 4	Float	Temperature deg C
5 ~ 8	Float	Saturation Constant

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1	Error	Index Out of Bounds.
2 ~ 127		Undefined

A.9.24 Command 162 (0xA2): Set Temperature Coefficients

This command sets the temperature coefficients.

Request Data Bytes

Byte	Format	Description
0 ~ 3	Float	Calibration Temperature
4 ~ 7	Float	Temperature Dependence
8 ~ 11	Float	Dampen Factor

Response Data Bytes

Byte	Format	Description
0 ~ 3	Float	Calibration Temperature
4 ~ 7	Float	Temperature Dependence
8 ~ 11	Float	Dampen Factor

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-4		Undefined
5	Error	Too Few Data Bytes Received
6	Error	Device-Specific Command Error
7	Error	In Write Protect Mode
8-15		Undefined
16	Error	Access Restricted
8-127		Undefined

A.9.25 Command 163 (0xA3): Read Temperature Coefficients

This command reads the temperature coefficients.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0 ~ 3	Float	Calibration Temperature
4 ~ 7	Float	Temperature Dependence
8 ~ 11	Float	Dampen Factor

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-127		Undefined

A.9.26 Command 166 (0xA6): Set Saturation Table Index

This command sets the read index for the Saturation Table.

Request Data Bytes

Byte	Format	Description
0	Unsigned-8	Saturation table index to be read

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	Saturation table index to be read

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
5	Error	Too few data bytes
15	Error	Index Out of Bounds

A.9.27 Command 167 (0xA7): Read Saturation Table Index to Read Table Array Element

This command reads the read index for the Saturation Table.

Request Data Bytes

Byte	Format	Description
0		

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	Saturation Table Index to be read

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
5	Error	Too few data bytes
15	Error	Index Out of Bounds

A.9.28 Command 168 (0xA8): Set Hygro Calibration Curve Index to Read Table Array Element

This command sets the read index for the Hygro Table.

Request Data Bytes

Byte	Format	Description
0	Unsigned-8	Hygro Table Index to be read

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	Hygro Table Index to be read

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
5	Error	Too few data bytes
15	Error	Index Out of Bounds

A.9.29 Command 169 (0xA9): Read Hygro Calibration Curve Table Index to Read Table Array Element

This command reads the read index for the Hygro Table.

Request Data Bytes

Byte	Format	Description

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	Hygro Table index to be read

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
5	Error	Too few data bytes
15	Error	Index Out of Bounds

A.9.30 Command 170 (0xAA): Read Loop Measurement Type

This command reads information about the output measurement.

Request Data Bytes

Byte	Format	Description

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	Output Measurement Type (4-20, NAMUR, Special)
1~4	Float	Special Zero Value
5~8	Float	Special Span Value

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
5	Error	Too Few Data Bytes

A.9.31 Command 171 (0xAB): Read Loop Current Zero Trim

This command reads the zero trim value.

Request Data Bytes

Byte	Format	Description

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	Zero Trim Type (Fixed 4 mA Trim, Live mA, Loop Current Fixed)
1~4	Float	Zero Trim Value

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
5	Error	Too Few Data Bytes

A.9.32 Command 172 (0xAC): Read Loop Current Trim Gain

This command reads the trim gain value.

Request Data Bytes

Byte	Format	Description

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	Span Trim Type (Fixed 4 mA Trim, Live mA, Loop Current Fixed)
1~4	Float	Span Trim Value

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
5	Error	Too Few Data Bytes

A.9.33 Command 173 (0xAD): Read Loop Current Percentage

This command reads the loop current percentage.

Request Data Bytes

Byte	Format	Description

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	Loop Current Percentage Type (Fixed 4 mA, Live mA, Loop Current Fixed)
1~4	Float	Loop Current Percentage value

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
5	Error	Too Few Data Bytes Received

A.9.34 Command 189 (0xBD): Read Vapor Pressure

This command reads the calculated vapor pressure.

Request Data Bytes

Byte	Format	Description

Response Data Bytes

Byte	Format	Description
0-3	Float	Vapor Pressure in mbar
4-7	Float	Saturated Vapor Pressure in mbar

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
8	Warning	Update in progress

A.9.35 Command 190 (0xBE): Read Line Pressure

This command reads the line pressure.

Request Data Bytes

Byte	Format	Description

Response Data Bytes

Byte	Format	Description
0-3	Float	Line Pressure

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors

A.9.36 Command 191 (0xBF): Set Line Pressure

This command sets the line pressure.

Request Data Bytes

Byte	Format	Description
0-3	Float	Line Pressure

Response Data Bytes

Byte	Format	Description
0-3	Float	Line Pressure

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
3	Error	Parameter too large
4	Error	Parameter too small

A.9.37 Command 192 (0xC0): Sends password

This command will send a password to the HygroPro XP. If the password is right, the transmitter will allow user to operate it for 10Mins.

Command		Function	Password Level		
			No Password	Operator	Admin
Universal Commands	6	Write Polling Address		•	•
	17	Write Message		•	•
	18	Write Tag, Descriptor, Date		•	•
	19	Write Final Assembly Number		•	•
	22	Write Long Tag		•	•
	44	Write Primary Variable Units		•	•
Common Practice Commands	51	Write Dynamic Variable Assignments		•	•
	59	Write Number of Response Preambles		•	•

Device Specific Commands	130	Set Loop Current Zero	●	●	●
	131	Set Loop Current Gain	●	●	●
	132	Set Loop Current Percentage	●	●	●
	133	Set Primary Variable Range Values	●		●
	134	Set Loop Current Error Handling	●		●
	144	Set Loop Measurement Type	●	●	●
	145	Enter / Exit Fixed Loop 0 Current	●	●	●
	146	Set Pressure Constant	●	●	●
	147	Read Pressure Constant	●	●	●
	148	Set Temperature Constant	●	●	●
	149	Read Temperature Constant	●	●	●
	150	Set Dew Point Offset	●	●	●
	151	Read Dew Point Offset	●	●	●
	152	Set Hygro Curve Number of Points	●	●	●
	153	Read Hygro Curve Number of Points	●	●	●
	154	Set Hygro Curve Point	●	●	●
	155	Read Hygro Curve Point	●	●	●
	156	Set Pressure Curve	●	●	●
	157	Read Pressure Curve	●	●	●
	158	Set Saturation Table Number of Points	●	●	●
	159	Read Saturation Table Number of Points	●	●	●
	160	Set Saturation Table Point	●	●	●
	161	Read Saturation Table Point	●	●	●
	162	Set Temperature Coefficients	●	●	●
	163	Read Temperature Coefficients	●	●	●
	164	Send Password	●	●	●
165	Send new Password	●		●	
166	Read User Level	●	●	●	
167	Commit the Changed Parameters	●	●	●	
168	Cancel the changed Parameters	●	●	●	
202	Read User Group		●	●	
203	Set User Group	●	●	●	

Request Data Bytes

Byte	Format	Description
0	Unsigned-8	Enum User level: 0: None 2: Operator User; 3: Admin User;
1 ~ 4	Unsigned-32	User password

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	User level: 0: None; 2: Operator User; 3: Admin User;

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-4		Undefined
5	Error	Too Few Data Bytes Received
6-127		Undefined

A.9.38 Command 193 (0xC1): Sends new password

This command will send a new password to the HygroPro XP. If the user has the right, the transmitter changes the user password.

- General user only can change the General user password.
- Advanced user can change the General user password and Advanced user password.

Request Data Bytes

Byte	Format	Description
0	Unsigned-8	User level: 2: Operator User; 3: Admin User;
1 ~ 4	Unsigned-32	User password

Response Data Bytes

Byte	Format	Description
None		

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-4		Undefined
5	Error	Too Few Data Bytes Received
6	Error	Device-Specific Command Error
7	Error	In Write Protect Mode
8-15		Undefined
16	Error	Access Restricted
17-127		Undefined

A.9.39 Command 194 (0xC2): Read User Level

This command will read the current user level.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	User Level

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-127		Undefined

A.9.40 Command 197 (0xC5): Commit the changed parameter

This command will send commit command to the HygroPro XP to confirm the changed parameter. The user must send the correct password to the HygroPro XP and send this command in 10Mins to confirm the change.

The changed parameters will not be available after the HygroPro XP reboots automatically until the password is right and this command is sent to the HygroPro XP in 10 minutes. After the HygroPro XP reboots automatically, the user should resend the password to change parameter.

If this command is not sent in 10 minutes, the changed parameters will be canceled automatically.

The following table is for the commands that need to send "Commit command":

130	Set Loop Current Zero		●
131	Set Loop Current Gain		●
132	Set Loop Current Percentage		●
133	Set Primary Variable Range Values		●
134	Set Loop Current Error Handling		●
144	Set Loop 0 Measurement Type	●	●
145	Enter / Exit Fixed Loop 0 Current	●	●
146	Set Pressure Constant	●	●
147	Read Pressure Constant	●	●
148	Set Temperature Constant	●	●
149	Read Temperature Constant	●	●
150	Set Dew Point Offset	●	●
151	Read Dew Point Offset	●	●
152	Set Hygro Curve Number of Points		●
153	Read Hygro Curve Number of Points		●
154	Set Hygro Curve Point		●
155	Read Hygro Curve Point		●
156	Set Pressure Curve		●
157	Read Pressure Curve		●
158	Set Saturation Table Number of Points	●	●
159	Read Saturation Table Number of Points	●	●
160	Set Saturation Table Point	●	●
161	Read Saturation Table Point	●	●
162	Set Temperature Coefficients	●	●
163	Read Temperature Coefficients	●	●
164	Send Password	●	●
165	Send new Password		●
166	Read User Level	●	●
167	Commit the Changed Parameters	●	●
168	Cancel the changed Parameters	●	●

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
None		

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-5		Undefined
6	Error	Device-Specific Command Error
7	Error	In Write Protect Mode
8-15		Undefined
16	Error	Access Restricted
17 - 32		Undefined
33	Error	Delayed Response Initiated
34	Error	Delayed Response Running
35-127		Undefined

A.9.41 Command 198 (0xC6): Cancel the changed parameter

This command will cancel the changed parameters. And the user should resend the password to change parameter.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
None		

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1 - 5		Undefined
6	Error	Device-Specific Command Error

Code	Class	Description
7	Error	In Write Protect Mode
8-15		Undefined
16	Error	Access Restricted
17-127		Undefined

A.9.42 Command 200 (0xC8): Set Line Pressure Constant

This sets the line pressure constant used to calculate the equivalent dew point.

Request Data Bytes

Byte	Format	Description
0-3	Float	Line Pressure for calculating equivalent dewpoint

Response Data Bytes

Byte	Format	Description
0-3	Float	Line Pressure for calculating equivalent dewpoint

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-4		Undefined
5	Error	Too Few Data Bytes Recieved
6	Error	Device-Specific Command Error
7	Error	In Write Protect Mode
8-15		Undefined
16	Error	Access Restricted
8-127		Undefined

A.9.43 Command 201 (0xC9): Read Line Pressure

This command reads the line pressure used to calculate equivalent dew point.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0~3	Float	Pressure constant used instead of live measurement

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-127		Undefined

A.9.44 Command 202 (0xCA): Read the Unit for a Specified Measurement Group

This command returns the assigned unit for a specified measurement group.

Request Data Bytes

Byte	Format	Description
None	Unsigned-8	1-Moisture 2-Temperature 3-Pressure 4-FH

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	1-Moisture 2-Temperature 3-Pressure 4-FH
1	Unsigned-8	0x0 for Moisture or FH 0x40 for Temperature 0x41 for Pressure
2	Unsigned-8	Requested Unit

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
5	Error	Too few data bytes

A.9.45 Command 203 (0xCB): Set the Unit for a Specified Measurement Group

This command sets the assigned unit for a specified measurement group.

Request Data Bytes

Byte	Format	Description
0	Unsigned-8	1-Moisture 2-Temperature 3-Pressure
1	Unsigned-8	0x0 for Moisture 0x40 for Temperature 0x41 for Pressure
2	Unsigned-8	New Unit Code

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	1-Moisture 2-Temperature 3-Pressure
1	Unsigned-8	0x0 for Moisture 0x40 for Temperature 0x41 for Pressure
2	Unsigned-8	Unit Code

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
5	Error	Too few data bytes

A.10 Tables

A.10.1 HART Engineering Units

The unit types allowed for the Panametrics HygroPro XP transmitter device variables are listed below.

Unit Types			
240	Moisture	240	Dew Point Degrees C
		241	Dew Point Degrees F
		243	Parts Per Million Volume (PPMv)
		244	Parts Per Million Volume (PPBv)
		245	Parts Per Million Volume Natural Gas (PPMvNG)

Unit Types			
		248	mg/m3
		249	g/m3
		246	kg/m3
		247	LBs(MMSCFig)
		242	LBs(MMSCFng)
		240	FH
64	Temperature	32	Celsius
		33	Fahrenheit
		34	Rankine
		35	Kelvine
65	Pressure	6	Pounds per square inch (gauge)
		7	Bar
		8	Millibar
		11	Pascal
		[no content intended for this page]	
		12	Kilopascal
		13	Torr
		14	ATM
		175	Pounds per square inch (absolute)
		176	Kilograms per square meter
		237	Megapascals

A.11 Performance

A.11.1 Sampling Rates

All moisture rates are updated at least once 1 time per half second.

A.11.2 Power-Up

The transmitter needs at most 55 seconds to boot after it is energized. The analog output will default to 3.6mA until the PV is available.

A.11.3 Reset

The transmitter does not support Command 42 ("Device Reset") to reset itself.

A.11.4 Self-Test

The self-test procedure is executed at power up.

A.11.5 Command Response Times

Minimum	20ms
Typical	50ms
Maximum	150ms

A.11.6 Busy and Delayed-Response

The transmitter may respond with "busy" status if a further command is received while MPU testing is underway.

Delayed-response is not used.

A.11.7 Long Messages

The largest data field used is in the response to Command 183: 21 bytes including the two status bytes.

A.11.8 Non-Volatile Memory

EEPROM is used to hold the device's configuration parameters. New data is written to this memory immediately on execution of a write command.

A.11.9 Modes

When the system is in fixed current mode, it will continue measuring, it just will not update the 4-20mA output.

A.11.10 Write Protection

The transmitter has one write protect jumper. When the jumper is present, all commands are available. When the jumper is absent, neither "write" nor "command" commands are accepted.

A.11.11 Damping

Damping constant is not relevant to this meter.

A.12 Capability Checklist

Manufacturer, model and revision	Baker Hughes Panametrics HygroPro XP, rev. 1
Device type	Current Output
HART revision	7.5
Device Description available	Yes
Number and type of sensors	3
Number and type of actuators	0
Number and type of host side signals	1: 4 - 20mA analog
Number of Device Variables	4
Number of Dynamic Variables	4
Mapable Dynamic Variables?	Yes
Number of common-practice commands	5
Number of device-specific commands	43
Bits of additional device status	15
Alternative operating modes?	No
Burst mode?	No
Write-protection?	Yes

A.13 Default Configuration

Parameter	Default value
Lower Range Value	Calculated based on velocity limits and pipe dimensions
Upper Range Value	Calculated based on velocity limits and pipe dimensions
PV Units	DP deg C
Sensor type	Ultrasonic
Number of wires	2
Damping time constant	0 second
Fault-indication jumper	None
Write-protect jumper	Switch default closed (i.e. write enabled)
Number of response preambles	5

Appendix B. HygroPro XP Field Service Update User Manual

B.1 Setup

B.1.1 Required Tools

- Power Supply (capable of delivering 20V at 20mA)
- 5 Wire Cable with 6 Pin Female M8 connector for the HygroPro XP
- 2 Wire RS485 Cable with USB adapter
- Windows Laptop PC
- TeraTerm Software (open source terminal emulator)

B.1.2 Hardware Setup

1. Connect the RS485 wires to the 4 way terminal block connector.
 - a. Connect the RS485 Data+ (Non Inverting) to terminal 3 of the connector.
 - b. Connect the RS485 Data – (Inverting) to terminal 4 of the connector.

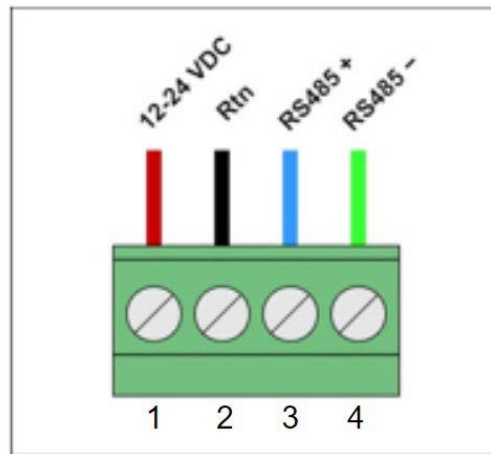


Figure 18: Pin Out for the 4-way terminal block connector

2. Connect the 5 Wire cable to the power supply
 - a. With the power supply turned off
 - b. Connect the negative lead of the power supply to the wire corresponding to Pin 2.
 - c. Connect the positive lead of the power supply to the wire corresponding to Pin 1.
 - d. **Do not turn on** the power supply
3. Connect the USB plug of the RS485 adapter to your laptop
4. Set up the values for the power supply, but do not power on the device
 - a. Set the Voltage to 24 V
 - b. Set the current to 30 mA

B.1.3 Software Setup

1. Make sure the drivers for your RS485 to USB Adapter are installed
2. Start the Tera Term Application
3. The New Connection Menu will open
 - a. Select "Serial"
 - b. Select the USB to RS485 adapter from the drop-down menu (It will be labeled "USB Serial Port")

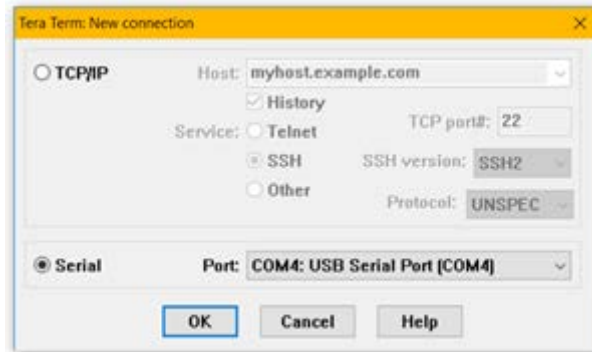


Figure 19: Select Serial Connection

4. Set the correct settings for the serial terminal
 - a. From the menu at the top of the window select "Setup" > "Serial Port..."
 - b. Set the settings as shown below
 - i. PORT: This does not need to be changed
 - ii. Baud rate: 9600
 - iii. Data: 8 bit
 - iv. Parity: none
 - v. Stop: 1 bit
 - vi. Flow Control: none
 - vii. Transmit Delay 0,0
 - c. Click "OK"

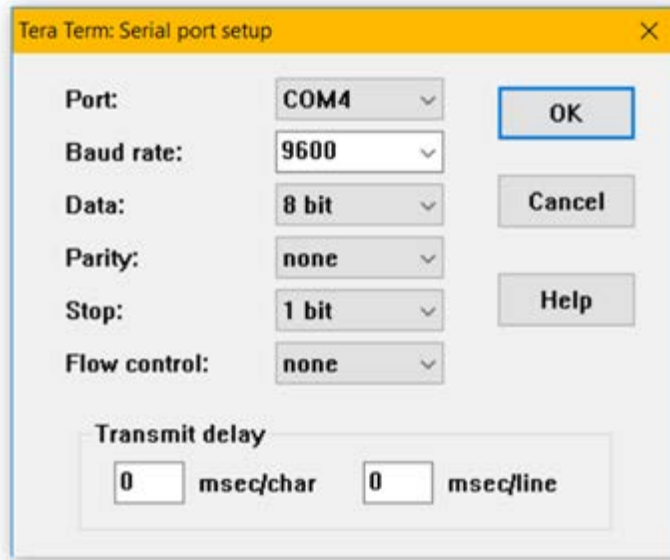


Figure 20: Serial Port Setup

5. Set the correct font and text size (Optional for readability)
 - a. From the menu at the top of the window select "Setup" > "Font..."
 - b. Set the font to "Arial"
 - c. Set the font style to "Regular"
 - d. Set the size to "12"
 - e. NOTE: These are recommended settings, you may choose whichever font you are comfortable with
 - f. Click "OK"

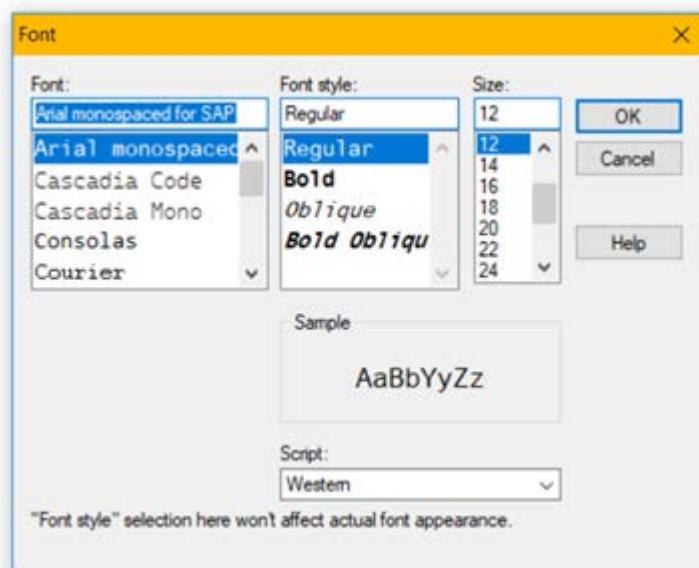


Figure 21: Optional Font Setup

B.2 Accessing the Bootloader

When the device is powered up, the HygroPro XP will check for a signal on the RS485 line. If it receives nothing it will jump past the Bootloader and run the normal Instrument Program.

B.2.1 Activating the Bootloader

To activate the bootloader, we will send a signal while the device is powering up.

1. Click into the Tera Term window
2. Press and hold the “y” key on your keyboard
3. While keeping the “y” key held down, turn on the power to the HygroPro XP
4. Continue to hold the “y” key down for approximately 3 seconds
5. Release the “y” key
6. The Tera Term window will show the Password Menu

B.2.2 Entering the Password

The password for the HygroPro XP Bootloader is generated using the unique Device ID Number. The Bootloader password is separate from the Service passcode. This Device ID number is independent from the device Serial Number.

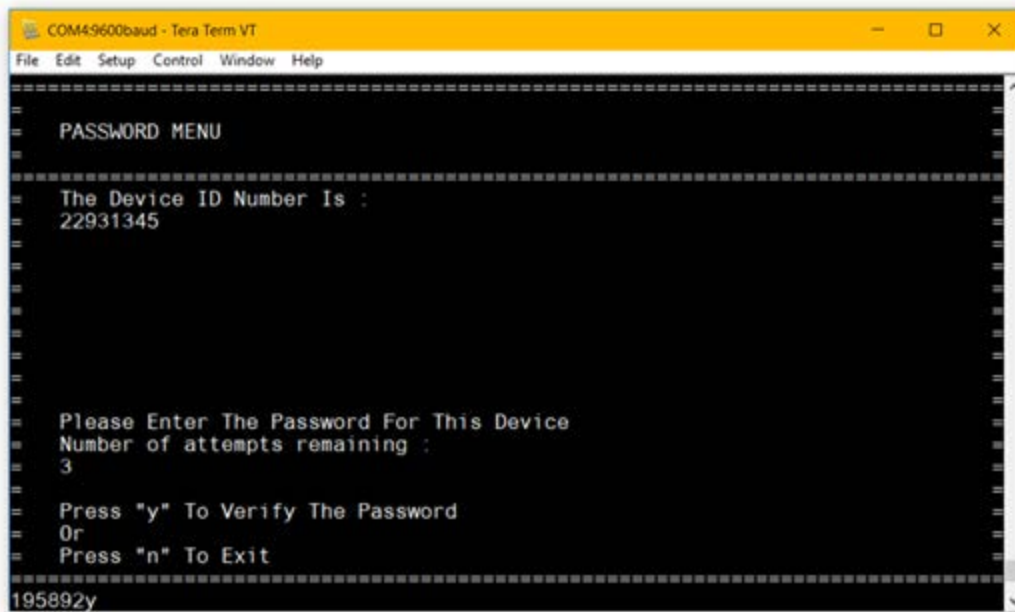


Figure 22: Password Menu

B.2.2.1 To enter the password

1. Record the Device ID Number shown in the Tera Term window
2. Contact Panametrics Tech Support with details of the Device ID Number for your HygroPro XP to receive your device’s password

B.2.2.2 To enter the password

1. Enter the password into the Tera Term window by typing each number
2. When you have typed all 6 digits press “y” to check the password
3. If the password is correct Tera Term will bring you to the Main Menu of the Bootloader

Note: *If you type the password incorrectly there is no way to change it, instead press “y” to attempt to verify the password. This will count as a failed attempt, but the device will allow you to retry entering the password two more times.*

B.2.2.3 Incorrect Passwords

You will have 3 attempts to enter the correct passcode. If you failed to enter the passcode 3 times in a row, then the device will lock you out for an amount of time. After this time out has finished the device will allow you 3 more attempts to enter the passcode.

B.2.2.4 Exiting without inputting a passcode

1. To exit the Bootloader press "n"
2. The Instrument Program will now run

B.3 Using the Bootloader

B.3.1 The Main Menu

The Main Menu is where you can access all the features of the bootloader.

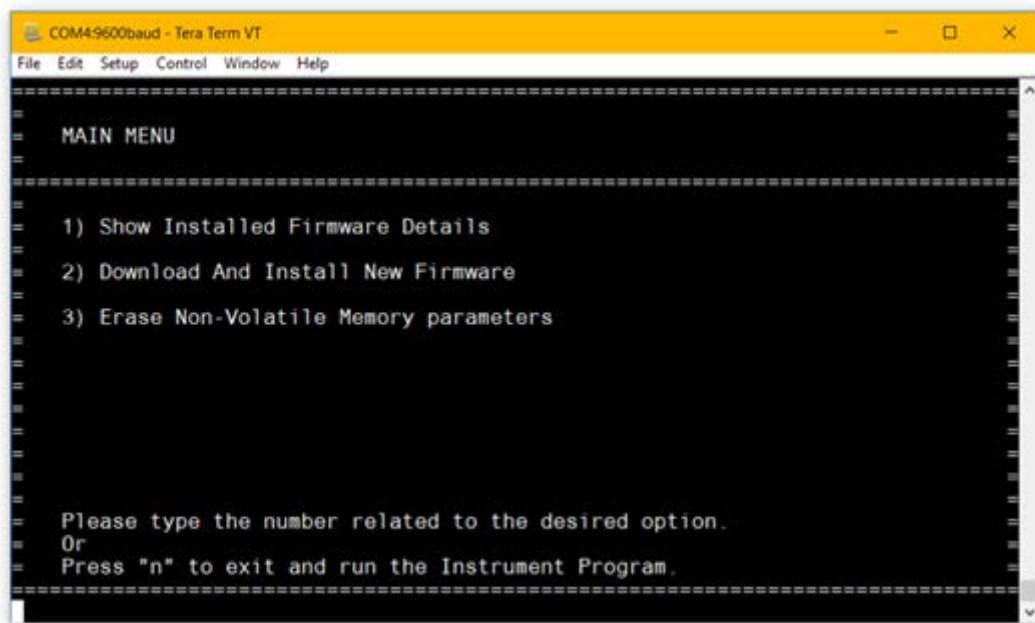


Figure 23: Main Menu

B.3.1.1 Accessing the sub menus

1. To access the sub menu, type the number shown beside that option in the Main Menu
2. The bootloader will show the selected menu

B.3.1.2 Exiting the bootloader

1. Press "n" to exit the bootloader
2. The instrument program will now run

B.3.1.3 Menu timeouts

All menus in the bootloader are set to time out after 5 minutes of inactivity. If you wish to keep in the same menu without it timing out, then type any letter or number. The bootloader will warn you if that was not a valid option, and this will reset the timeout.

If the bootloader is left to timeout fully then then it will exit, and the instrument program will run. You will have to power cycle to the device and re-enter the password.

B.3.2 Firmware Details Menu

The Firmware Details Menu will show the version numbers for both the installed bootloader and the installed instrument program. If the bootloader cannot verify that the firmware is genuine, or if the firmware is corrupted in any way then a warning shall appear here instead.

B.3.2.1 To view firmware details

1. From the Main Menu press "1" to open the Firmware Details Menu
2. The device will display the message "Checking Firmware..."
3. Once it has completed the menu below will be shown

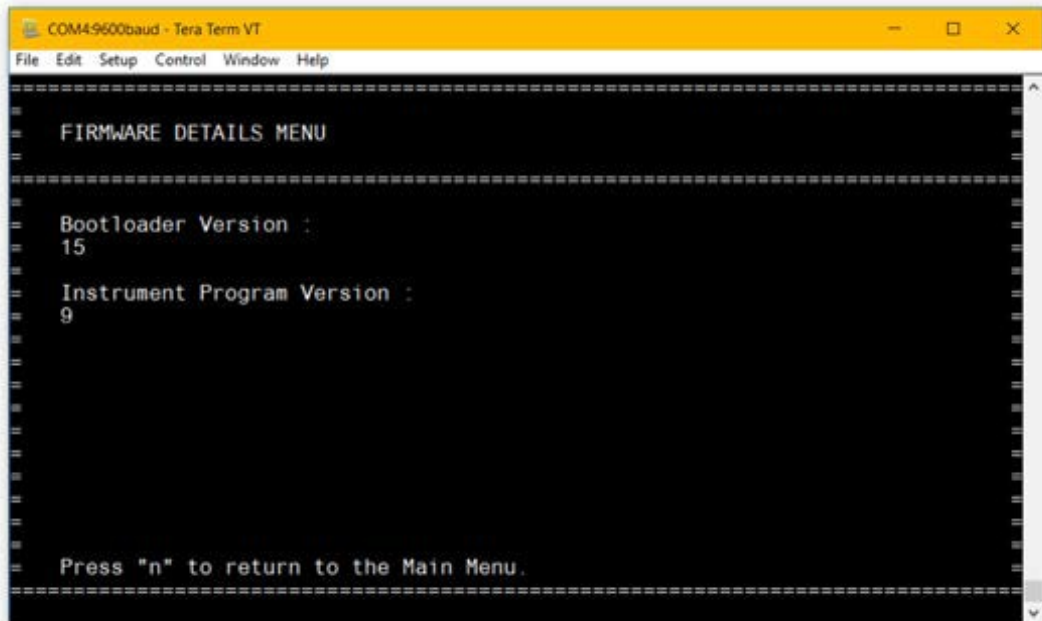


Figure 24: Firmware Details Menu

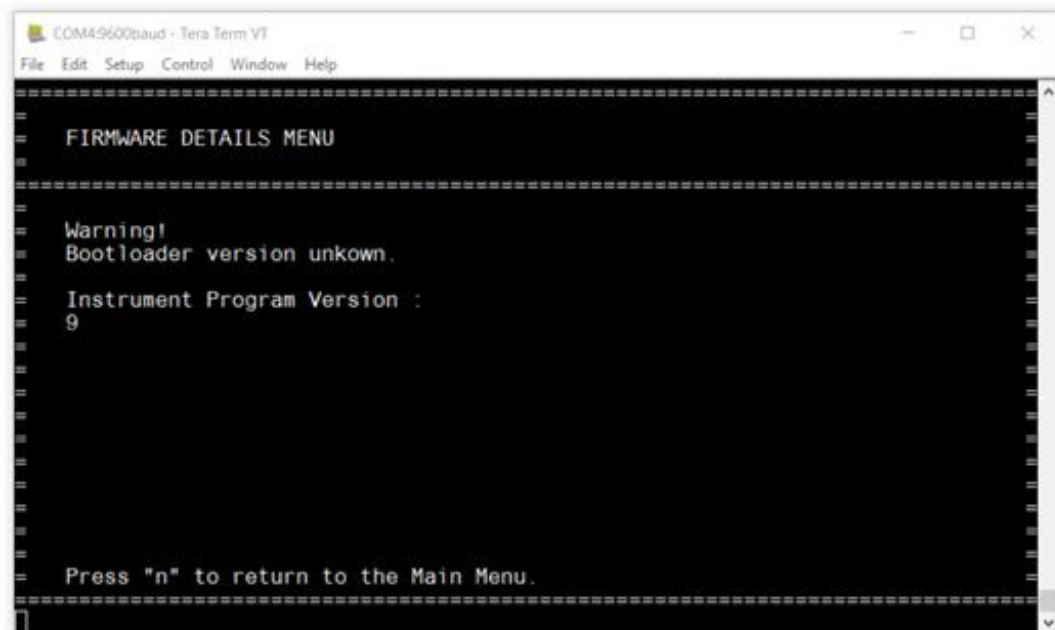


Figure 25: Firmware Details with Warning

B.3.2.2 To return to the Main Menu

1. Press "n" to exit the Firmware Details Menu and return to the Main Menu

B.3.3 Download and Install New Firmware Menu

This is where you can download and install both new bootloader and instrument program firmware. The device will require a signed firmware binary, ending in ".bin"

B.3.3.1 Download and install new firmware

1. From the Main Menu press "2" to open the Download and Install New Firmware Menu
2. The menu below will be shown

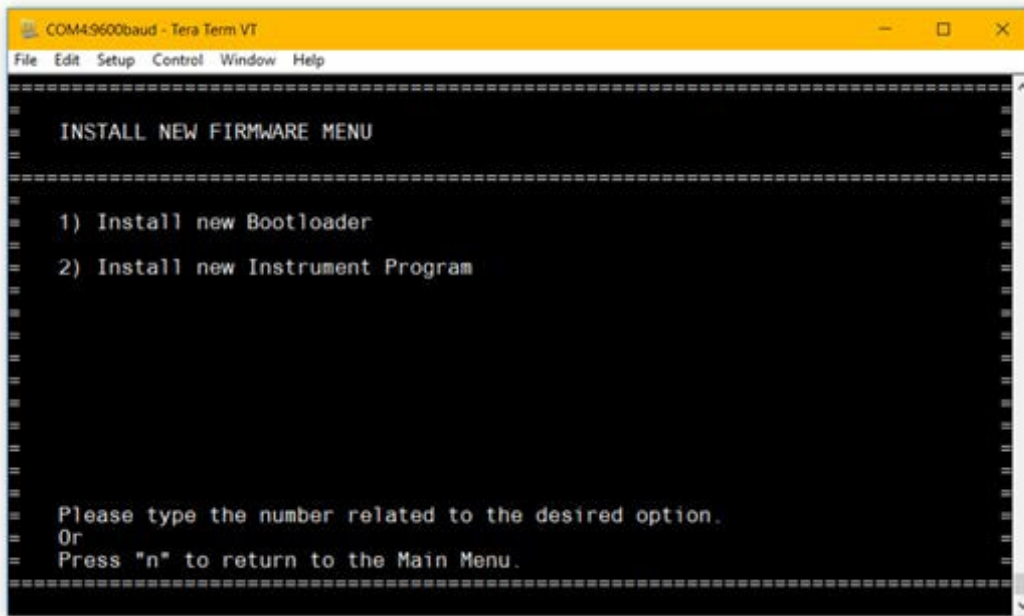


Figure 26: Install New Firmware Menu

3. Select which firmware you would like to install
 - a. Press "1" to install new bootloader firmware
 - b. Press "2" to install new Instrument program firmware

4. The menu below will be shown

IMPORTANT: *It is important that the device does not lose power from this point until the firmware installation is confirmed. If the device loses power during the installation procedure it may cause a permanent software failure of the device.*

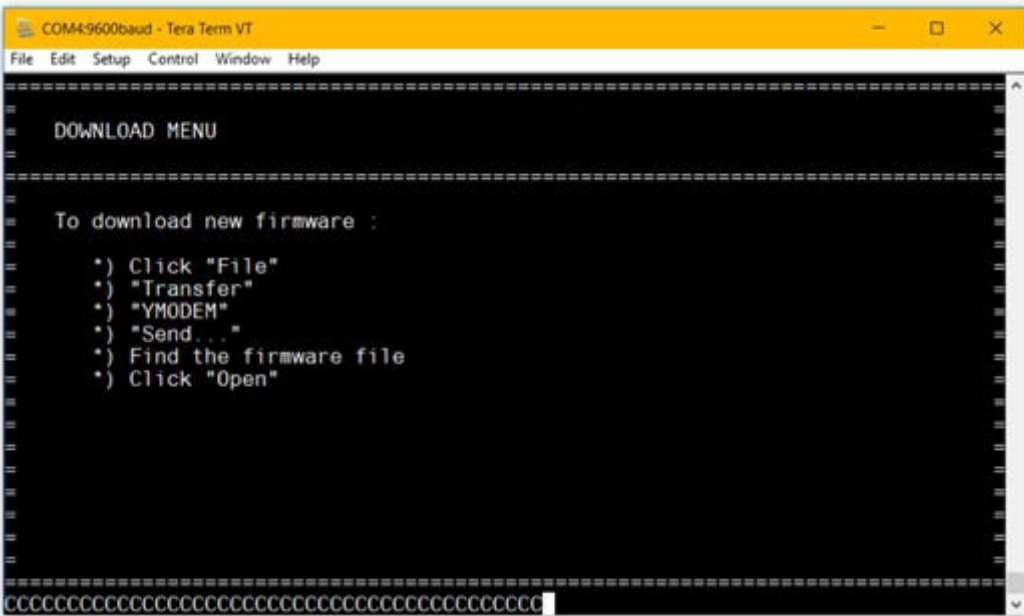


Figure 27: Download Menu

5. From the menu at the top of the window click "File" > "Transfer" > "YMODEM" > "Send..."

Note: If you wish to exit this menu you must press "a" twice in a row (This is a special command required to interrupt the file transfer)

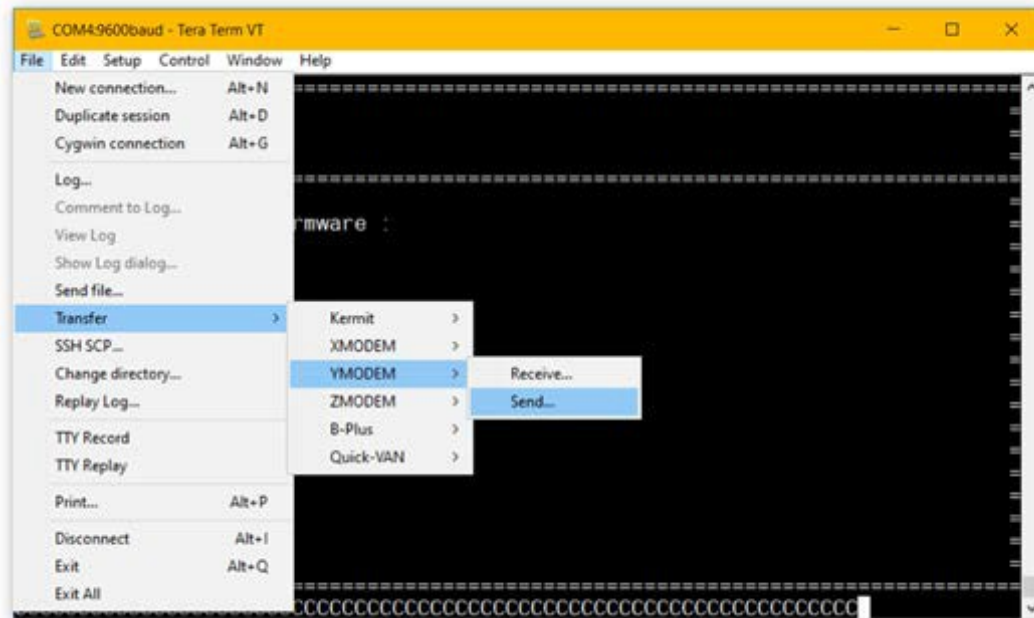


Figure 28: Firmware Download Menu

6. A file browser window will open
7. Find your firmware binary file ".bin" and select it
8. Click "Open"
9. A pop-up window shown below will open

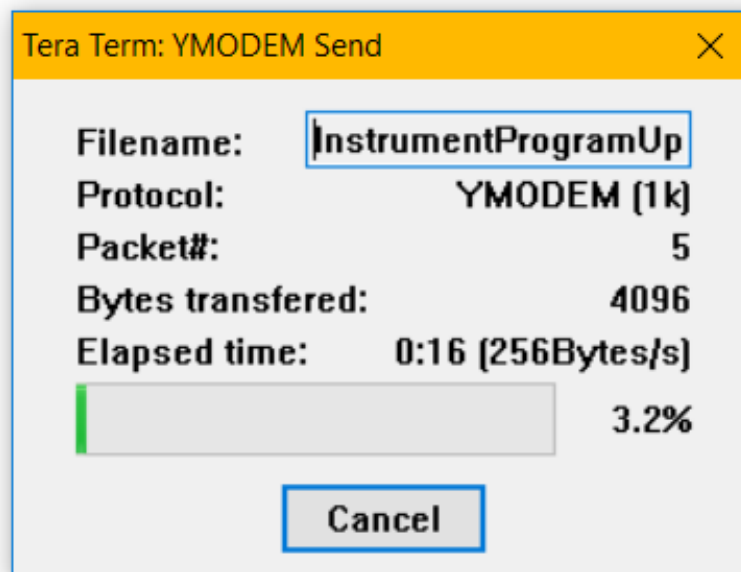


Figure 29: YMODEM Download

10. Wait for the firmware binary file to be downloaded (This may take a few minutes)
11. Once the file has been downloaded you will be shown the file details

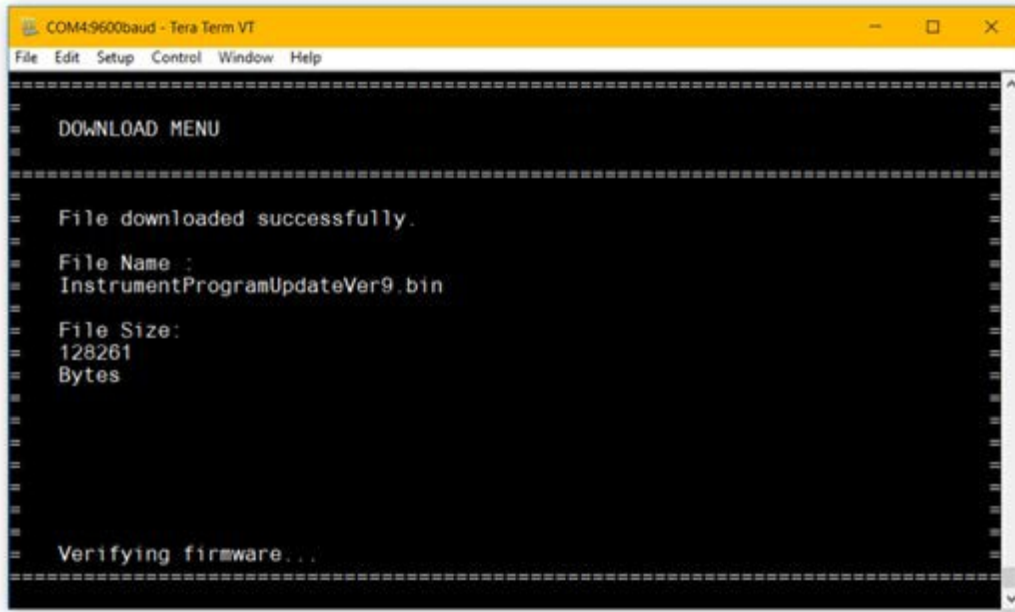


Figure 30: Downloaded Firmware Details

12. The bootloader will attempt to verify the downloaded firmware binary
 - a. If the instrument program firmware is valid, it will be installed
 - b. If the firmware is invalid or it cannot be installed, you will be asked to retry the download
13. The device will confirm the firmware has been installed correctly

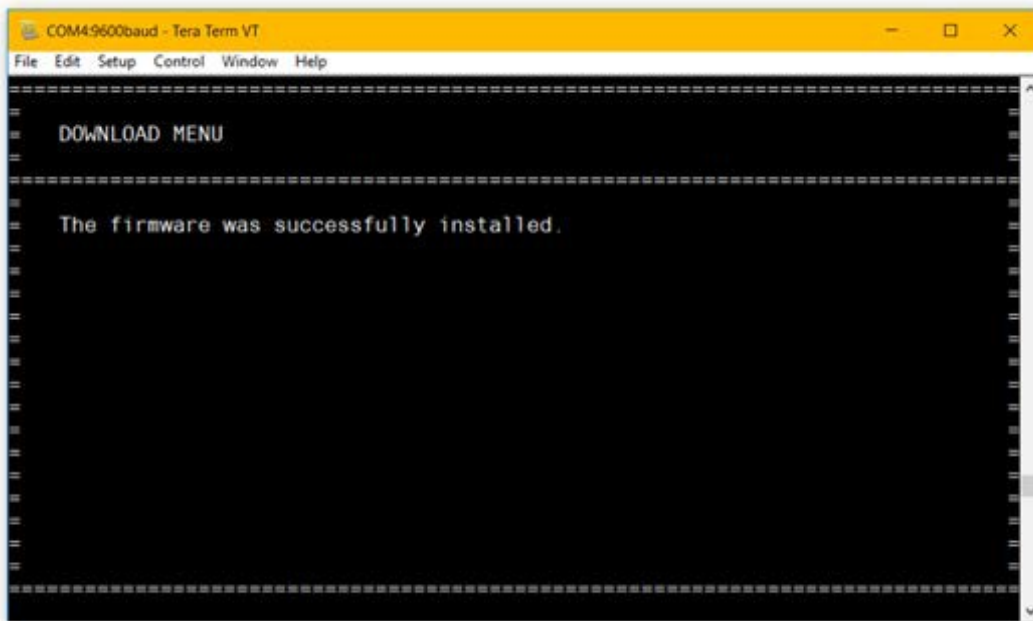


Figure 31: Installation Confirmed

14. If new instrument program firmware was installed the bootloader will return to the main menu
15. If new bootloader firmware was downloaded, then the device will automatically restart and run the new bootloader

Note: You will have to enter the password again

B.3.4 Erase NVM Menu

The Erase Non-Volatile Memory Menu is used to erase any settings or calibration data stored in the flash memory of the device. For the HygroPro XP Probe this includes all calibrations, calibration date and serial numbers. For the HygroPro XP Display this includes all 4-20mA output settings, display settings and serial numbers.

B.3.4.1 To erase non-volatile memory

1. From the Main Menu press "3" to open the Erase NVM Menu
2. Press "y" to confirm
3. The device will attempt to erase and show a status message
4. If the device is successful it will return to the Main Menu
 - a. If the device is unsuccessful it will return to the Erase NVM Menu
 - b. You may press "y" to attempt the erase again

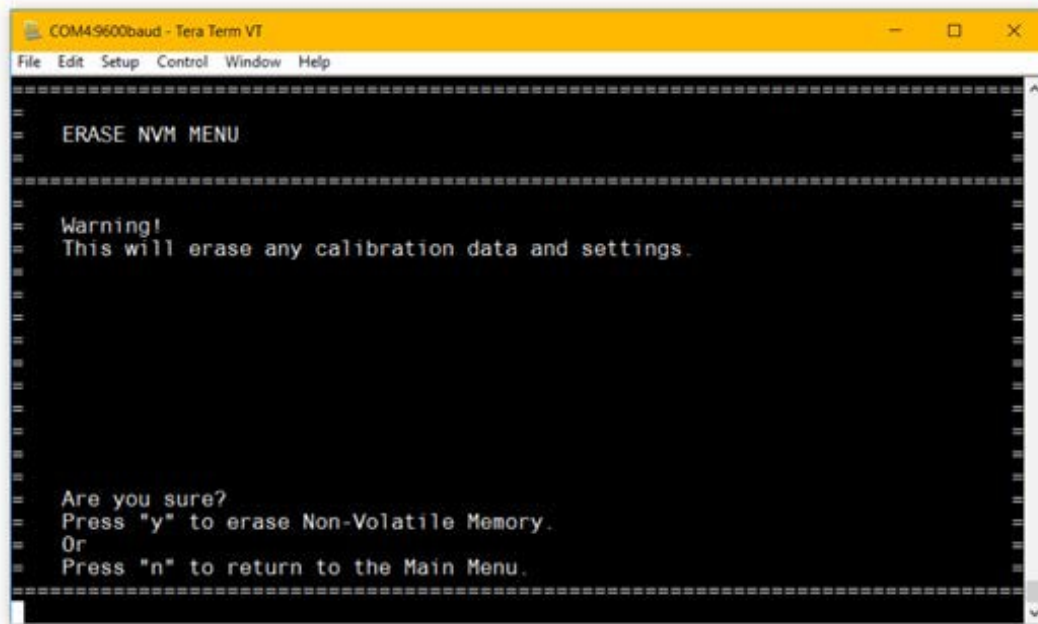


Figure 32: Erase Non-Volatile Memory Menu

[no content intended for this page]

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 or 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 MATERIAL AUTHORIZATION (RMA), 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.

[no content intended for this page]

Customer Support Centers

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