XTDL-HT™

Optical Moisture Dew Point Analyzer

User Manual

cosa+xentaur

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COSA Xentaur Corporation
www.cosaxentaur.com

Table of Contents

Unpacking

Unpack the XTDL-HT™ in a clean, dry area. Check the packing list for an itemized record of all equipment shipped. Examine all packing material for miscellaneous parts before discarding. Save the container until you determine that no shipping damage has occurred. Inspect the equipment for any signs of damage that may have occurred during shipment. If any part is damaged during shipment, file a claim against the carrier. Report the damage in detail, taking photographs if possible. Report any shipping damage to COSA Xentaur at the address listed on the back of this manual.

Warning Labels

The symbols shown below or their likeness may appear on the instrument to alert the user of potentially hazardous conditions.

Class 3B invisible laser radiation. When opened, avoid direct eye exposure. Class 1 laser product.

Caution – Risk of Electric Shock

Caution – Hot surface

Overview

The COSA Xentaur XTDL-HT™ is a tunable diode laser moisture analyzer with a new proprietary measurement cell designed for harsh environments, such as the dirty blanket gases in heat treating applications, where high particulate counts and corrosive gases cause other measuring systems to fail. It frees from the worry of cleaning the optics or frequently replacing sensing elements due to frequent drift or failure. Once calibrated at the factory, no further recalibration is required. A reliable on-line moisture system will improve the quality of the finished product and alert to process upsets, thus preventing the costly reworking of parts.

The XTDL-HT™ employs proprietary backscatter GasScan™[1] Wavelength Modulation Spectroscopy (WMS) technique developed by Physical Sciences Inc. With no mirrors in the gas flow path, the XTDL-HT™ can handle extreme gas stream conditions with high particulate without compromising the measurement. This adaptive measurement method is also independent of the light level so approximately 80% of the light intensity can be lost while still making an accurate measurement.

The integrated sample conditioning system aspires the sample from the low pressure furnace by means of an eductor, eliminates particulates through a self-cleaning sintered stainless steel tube filter and regulates the flow and pressure of the sample. The measurement cell is temperature and pressure controlled to ensure measurement accuracy and consistent results from the analyzer. This instrument software allows up to 6 different stored factory calibration curves based on the gas matrix or ambient conditions. Real-time pressure correction is employed to further enhance measurement repeatability.

The instrument comes factory calibrated against a NIST traceable reference standard. Under normal conditions, the instrument should not require calibration in the field due a proprietary algorithm, TruTune™, which checks and aligns the light source automatically in the background ensuring the instrument is properly tuned.

Up to three user-selected variables can be displayed: two in text form and a third in graphical form. The interface is flexible and allows the end user to display any combination of available variables. Even a single variable can be displayed in three different sets of engineering units.

[1]GasScan™ is a trademark of Physical Sciences Inc.

Specifications

Measurement Range	3,000-25,000ppmV H_2O -8.2 to 20.9°C (at 14.696 psiA)
Accuracy	±2% or ±200ppm, whichever is greater
Pressure Range	Operating: 0-30psiA
Temperature Range	Operating: -20 to 50°C
User Interface	Ultra high contrast graphical display Touch keys operation for user interface
Analog Output	1 standard, 1 optional High resolution (16-bit) 4-20mA, 0-20mA, 0-24mA, 0-5V, 0-10V, ±5V, ±10V options Isolated output option available
Alarm Contacts	1 standard, 2 optional SSR and Class I Division 2 relays option available
Digital Communication	Modbus RTU and Modbus/TCP support RS-232, RS-485 serial communication, Isolated interface option available Ethernet communication, 10/100 Mbps
Supply Voltage	110/220VAC 50-60Hz Maximum power consumption: 700VA
Enclosure	Wall mounting or pipe mounting
Dimension	21”Wx37”Hx10"D
Weight	Approximately 20 kg (53lbs) depending on options

Theory of Operation

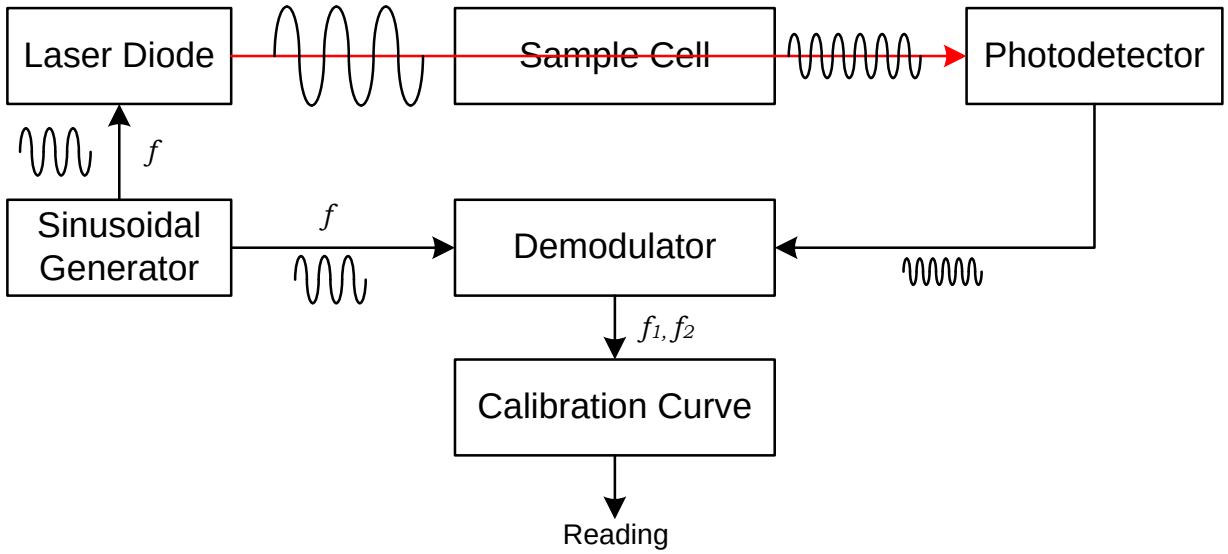
Atoms and molecules have absorption spectra that are distinctive to their species. The XTDL-HT™ measures water vapor in a sample by measuring an absorption line (wavelength) from the water vapor absorption spectrum. As a near-infrared laser beam passes through the sample cell, a photodetector measures the reduction in light intensity due to interaction with the sample. By Beer-Lambert law,

$$I = I_0 e^{-\sigma l N}$$

where

I is the intensity of the transmitted light
I_0 is the intensity of the incidental light
σ is the instrument-dependent absorption coefficient
l is the beam pathlength
N is the density of the absorbing particles

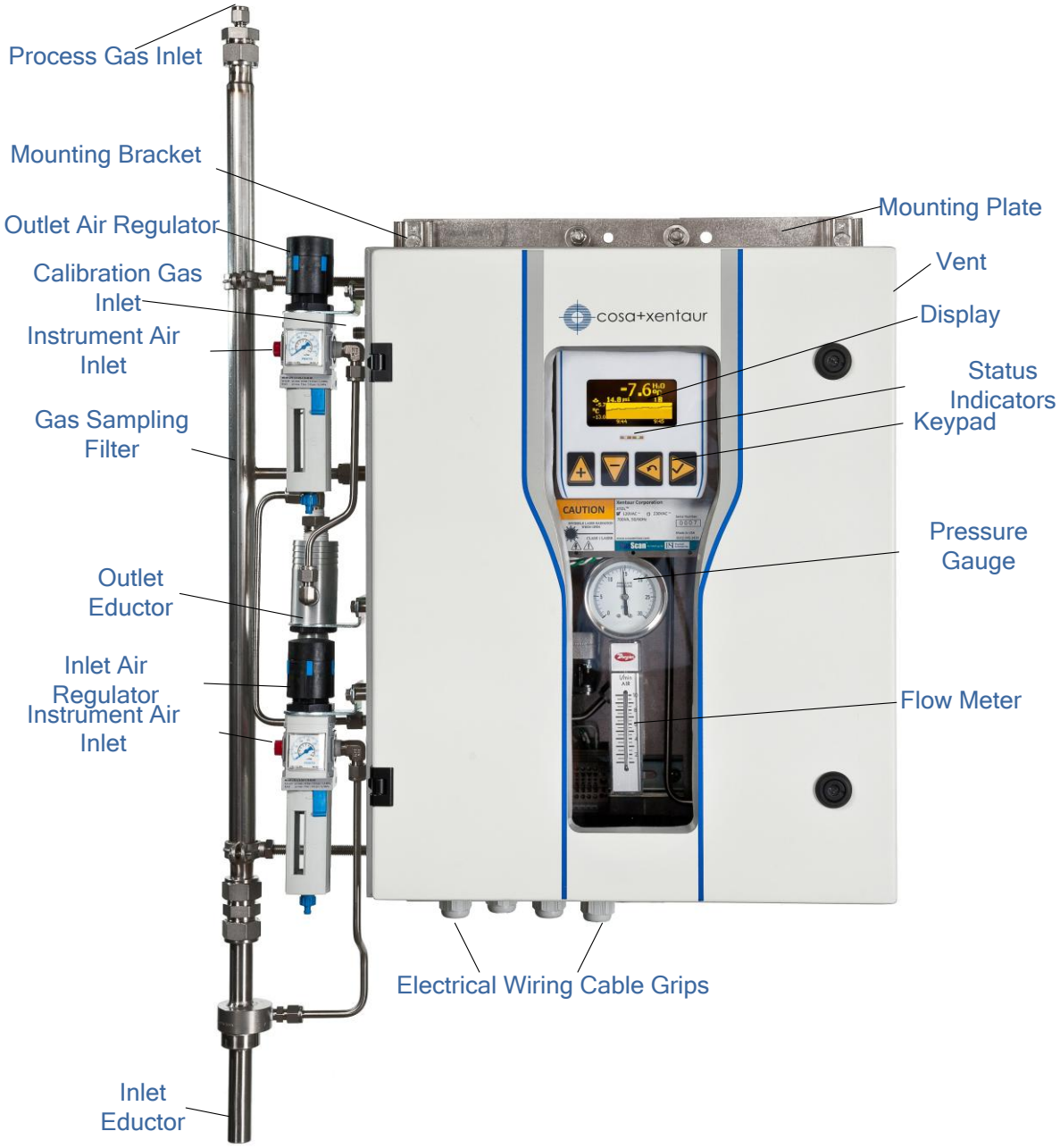
the instrument can calculate the water concentration. To improve the signal-to-noise ratio, the XTDL-HT™ employs the wavelength modulation spectroscopy (WMS) technique. In WMS, wavelength of the laser light is continuously modulated with a sinusoidal waveform with the target wavelength at the center, and the signal is detected as harmonics of the modulation frequency. The measurement value is computed using the harmonic amplitudes over the stored calibration curve.



The absorption coefficient in the Beer-Lambert law is a function of sample temperature and pressure. To ensure stable and accurate reading, the XTDL-HT™ maintains the sample temperature with a heated enclosure and the sample pressure is fixed with a back pressure regulator.

In typical laser absorption instruments, light beam is reflected on one or two mirrors inside the sample cell before reaching to the photodetector. When the mirror becomes fouled due to particulates or contamination, measurement will no longer be possible. The angle of reflection may change and the received light intensity may decrease too much affecting the calibration. Unlike these instruments, the XTDL-HT™ does not use any mirror in its sample cell; it uses a black body target allowing light to scatter inside the cell. It measures the water vapor concentration as a ratio of the harmonic amplitude to the absorbed light intensity. This allows accurate measurement regardless of how much light is received from scattering.

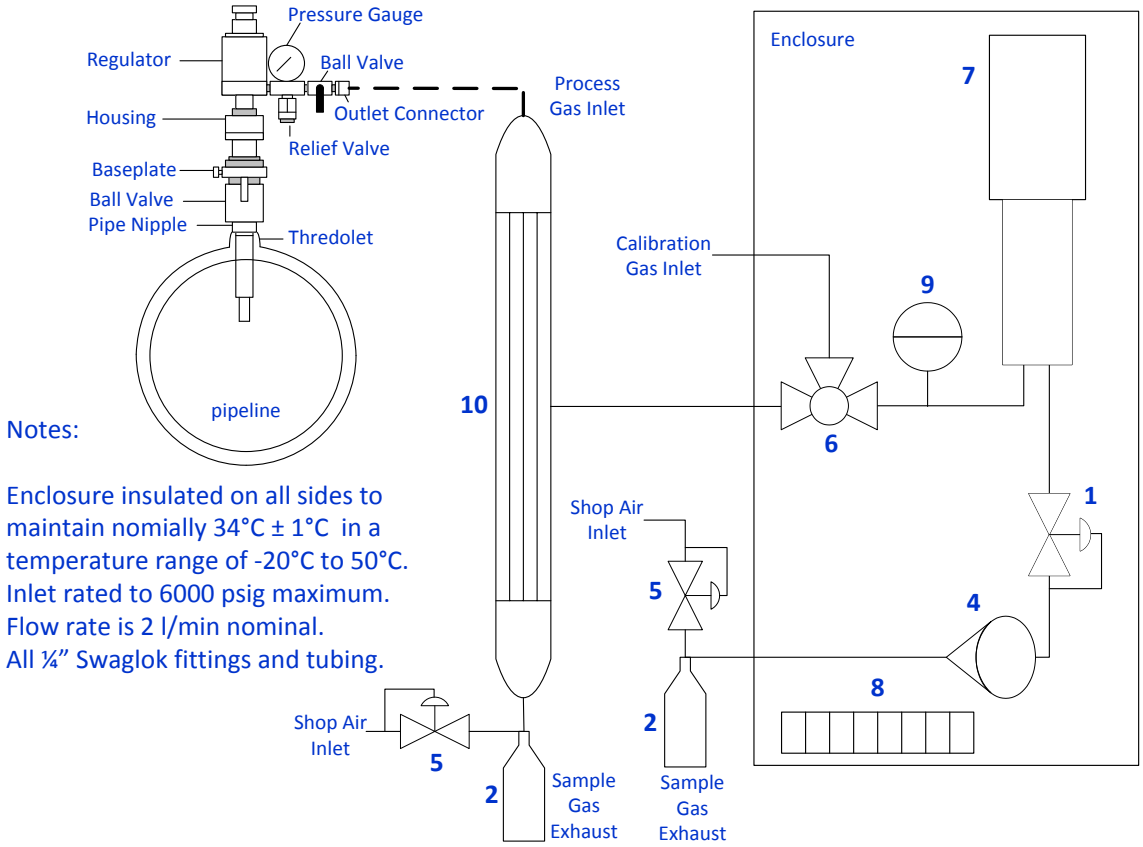
Installation



Enclosure Installation

For wall mounting installation, remove the top and bottom mounting plates and bolt the four mounting brackets to the wall. For pipe mounting installation, install pipe clamps (p/n ESS.98.M.0205) over the top and bottom mounting plates. Sunshade (p/n ESS.S2.M.9365) is recommended for outdoor installation.

Extractive Installation



Notes:

Enclosure insulated on all sides to maintain nomially 34°C ± 1°C in a temperature range of -20°C to 50°C.
Inlet rated to 6000 psig maximum.
Flow rate is 2 l/min nominal.
All ¼" Swaglok fittings and tubing.

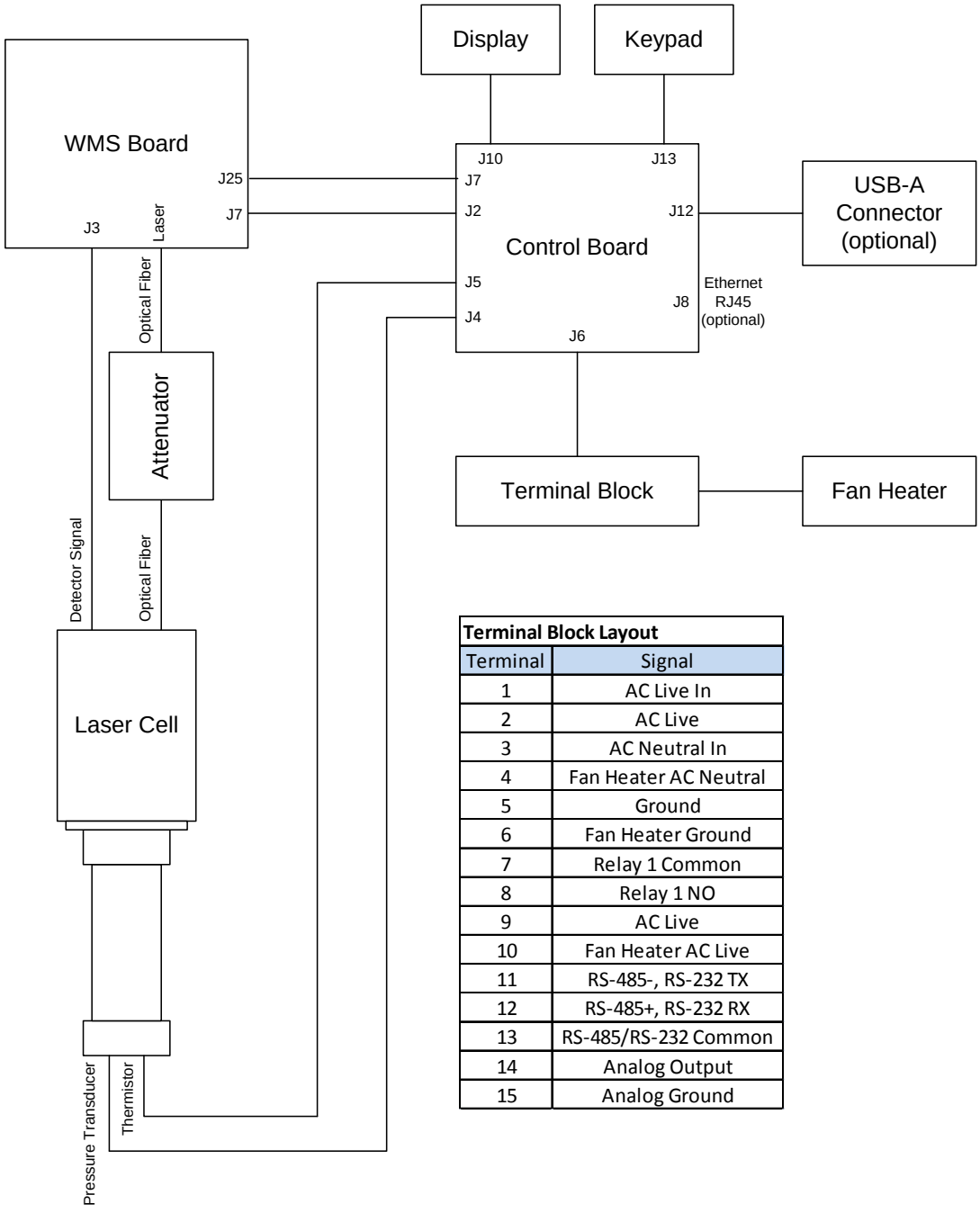
1. Back pressure regulator
2. Eductor
3. All ¼" stainless steel tubing
4. Flow meter
5. Adjustable regulator
6. 3-way valve
7. XTDL-HT™ laser cell
8. Enclosure heater
9. Pressure gauge (0-30 psig)
10. Gas sampling filter

The instrument should be installed in a slip stream of process gas. Please make sure that:

- The sample is taken from the upper surface of the main gas line to avoid problem of contamination.
- The sample is taken away from the pipe wall where flow rates may be low, and dewpoint change may lag.
- If regulators or shut-off valves are used up stream of the instrument, make sure that these do not contain rubber or other hygroscopic materials.
- Stainless steel tubing is preferred. Copper tubing is acceptable. **Do not use plastic, rubber, or Tygon tubing** due to water retention in these materials.
- Use small diameter pipes (1/4" or 1/8" OD).
- Do not install other devices up stream of the instrument, such as other measurement systems, which are not absolutely necessary as these are potential leak sources.

Electrical Connections

There are four watertight cable grips on the bottom of XTDL-HT™ enclosure. They accommodate cables with diameter between 0.197” (5mm) and 0.472” (12mm).To install a cable, loosen the nut, and feed the cable through the grip. After connecting the cable, tighten the nut. Unused cable grips should be plugged to maintain integrity of the enclosure.



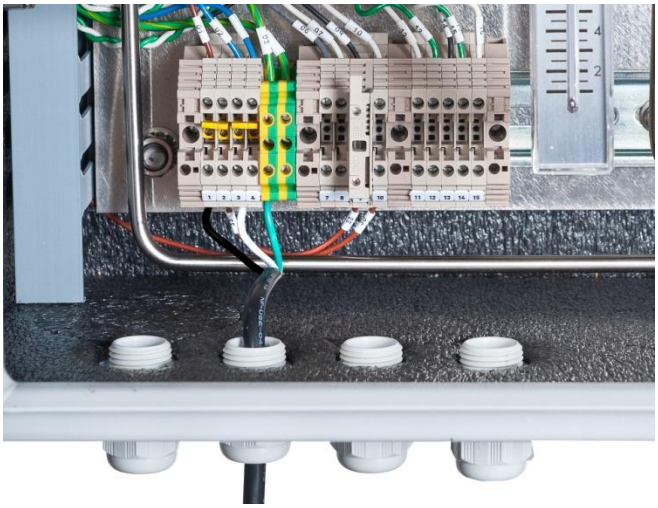
Terminal Block Layout	
Terminal	Signal
1	AC Live In
2	AC Live
3	AC Neutral In
4	Fan Heater AC Neutral
5	Ground
6	Fan Heater Ground
7	Relay 1 Common
8	Relay 1 NO
9	AC Live
10	Fan Heater AC Live
11	RS-485-, RS-232 TX
12	RS-485+, RS-232 RX
13	RS-485/RS-232 Common
14	Analog Output
15	Analog Ground

Electrical and optical connections

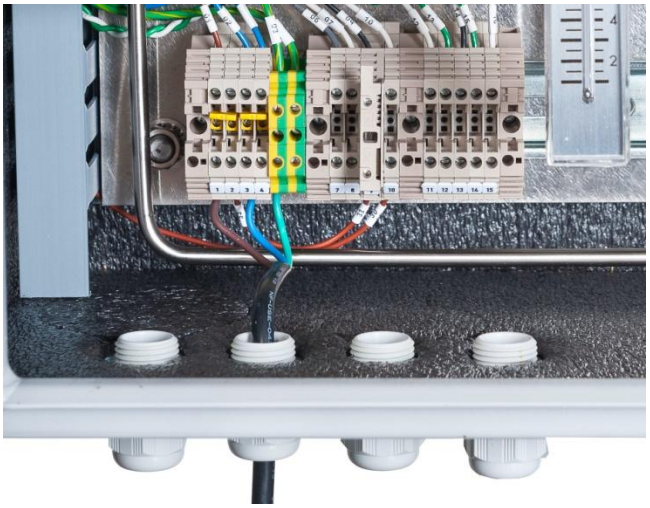
Connecting Power

The XTDL-HT™ requires AC power of 110/230VAC, 50/60 Hz. The voltage rating should be specified on the order and it is marked on the front panel label. Each instrument is provided with an international approved AC power cable, terminated with a connector according to the ordered option. This cable is provided strictly for testing the instrument; **it should not be used in the final installation**. For installation, the instrument must be field wired permanently connected and installed according to local and nationally recognized procedure for equipment of this type and stated power requirements. For North American installations, use UL 62 and/or CSA C22.2 No 49, 16AWG cable with black, white, and green color codes. For European and other international installations, use CENELEC harmonized type cable, with 1.31 mm² wire size or equivalent, with brown, light blue, and green/yellow stripe color codes. Power cable must be wired to the DIN-mounted terminal blocks marked 1 (AC live In), 3 (AC neutral In), and 5 (AC ground). The cable must be fed through one of the cable grips (second cable grip is recommended).

CAUTION: Do not connect to AC power without a proper grounding connection.



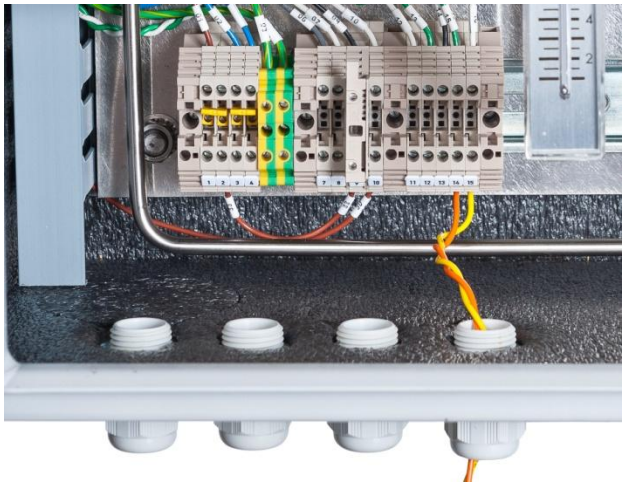
North American power cable installation



European and other international power cable installation

Interfacing to Analog Output

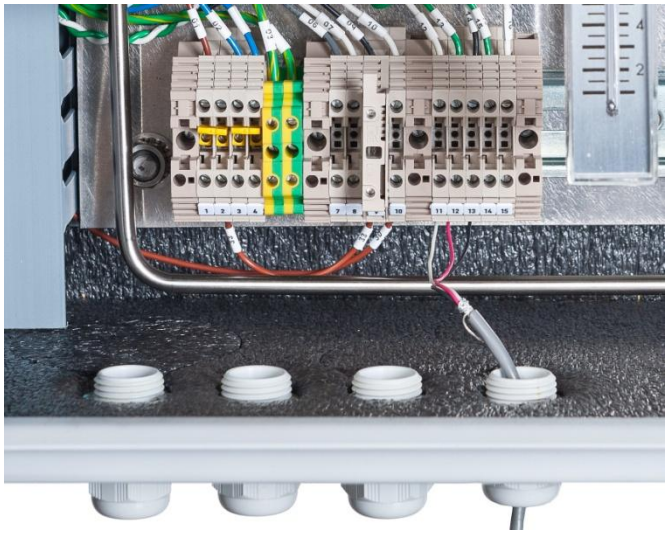
The optional analog outputs can be voltage or current depending on the ordered configuration. The analog output cable should be fed through one of the cable grips (fourth cable grip is recommended). Channel 1 output should be wired to the DIN-mounted terminal blocks marked 14 (positive) and 15 (negative). Isolation option on the analog outputs is available upon request. Refer to Analog Output chapter for setup information.



Analog output cable installation

Interfacing to RS-232/RS-485

Depending on the ordered configuration, the XTDL-HT™ supports RS-232 or half-duplex RS-485 serial interface option. The serial cable should be fed through one of the cable grips (fourth cable grip is recommended). For RS-232, TxD, RxD, and Common Ground signals should be wired to the DIN-mounted terminal blocks marked 11, 12, and 13, respectively. For RS-485, the inverting signal (TxD-/RxD-) should be wired to the terminal block marked 11, non-inverting signal (TxD+/RxD+) to the block marked 12, and common signal to the block marked 13. Isolation option is available on either interface. Refer to Modbus RTU section for setup information.



Serial cable installation

Interfacing to Ethernet

To use the optional Modbus/TCP communication, Ethernet cable once fed through a cable grip (first cable grip is recommended) should be hooked up to the RJ-45 connector on the Control Board. Make sure that there is enough cable slack to allow the door fully opened. Cat-5 or compatible cabling should be used. Refer to Modbus/TCP section for setup information.

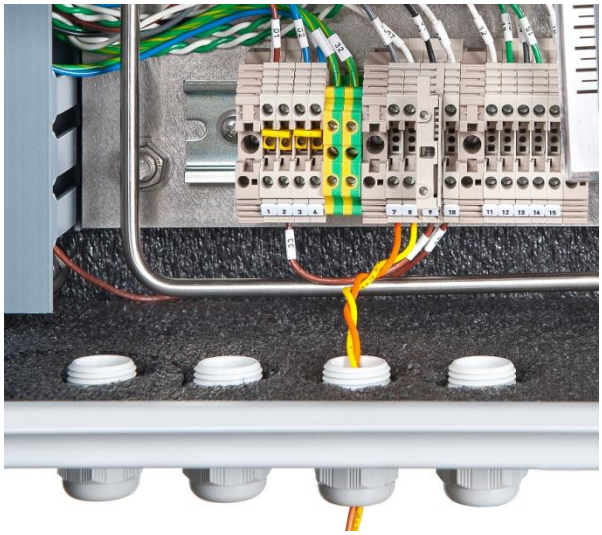
Ethernet cable installation

Wiring Relay Contacts

Standard XTDL-HT™ has one mechanical relay for user control. Two more relays are available when optional I/O board is installed. Depending on the ordered option, the instrument can be installed with:

- Mechanical relays (250VAC, 10A max. rating)
- Solid state relays (240VAC, 5A max. rating)
- Class I Division 2 relays (250VAC, 6A max. rating)

Use wiring appropriate for the voltage and current that will be switched by the relays. Wires to the relays should be fed through one of the cable grips (third cable grip is recommended). For relay 1, connect the wires to the DIN-mounted terminal blocks marked 7 and 8. Refer to Relays chapter for setup information.

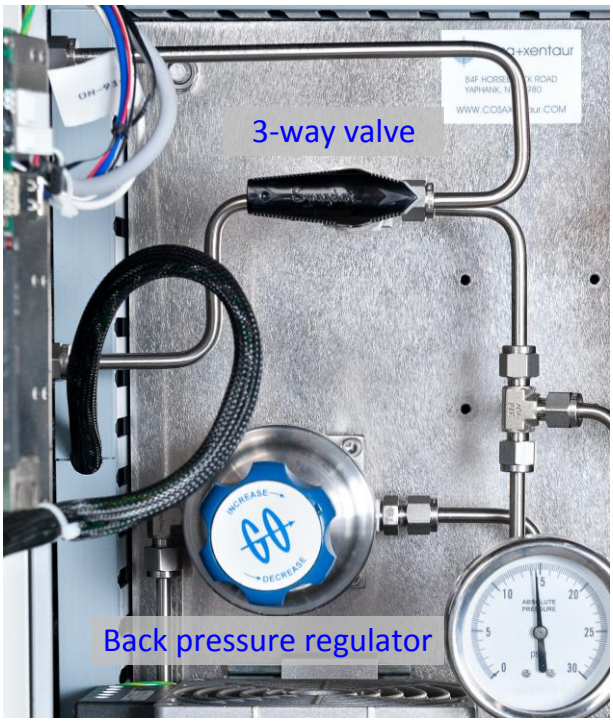


Relay cable installation

Startup

The instrument air pressure should be set at 60-70 psi on both regulators to allow sufficient pulling force to the eductors. The sample pressure should be held at a fixed value in order to maintain the measurement accuracy. This is accomplished by setting the back pressure regulator inside the enclosure. Any value in the operating range can be used as the instrument has pressure compensation on measurement. 1-2 psi below atmospheric pressure is recommended. To set the pressure:

1. Set the 3-way valve to process gas.
2. Set the back pressure regulator until the sample pressure is at the desired setpoint.



Close the enclosure door after the pressure is set. It will take about 1 ½ hours to reach the desired internal temperature depending on the ambient environment. Measurement reading may fluctuate until then. Monitor the sample temperature for stability if

unsure whether accurate measurement is ready. If the instrument has been inactive for more than a month, run TruTune™ once before using measurement.

TIP: Flow rate has no impact on instrument accuracy. Low flow rate increases the response time slightly. Therefore, it is more important to control the pressure than the flow rate.

User Interface

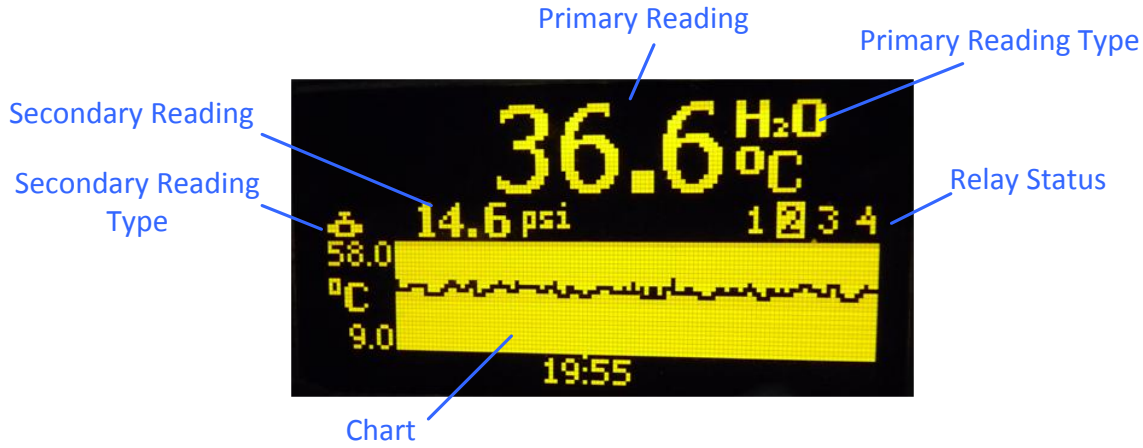
The user interface consists of a graphical display, status indicators, and a keypad.

Status Indicators

There are two LED indicators between the display and keypad. The green LED is lit when power is applied to the instrument. The red LED is lit when an error condition is detected.

Display

The XTDL-HT™ uses a high contrast OLED display. This allows both indoor and outdoor operation. The main screen shows two measurement readings (primary and secondary), a chart, and the states of the relays. The readings and chart are customizable via the menu system and the Modbus communication protocol.



In the event of a fault, the chart would be replaced with the flashing error information.

Menu is also displayed by occupying the chart area. To enter the menu, press the key from the main screen. The instrument automatically exits the menu after 20 minutes of inactivity.

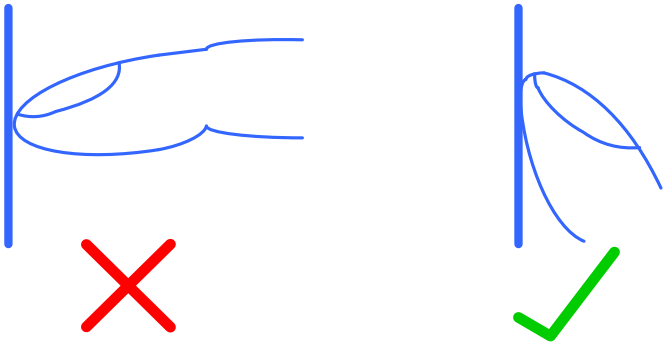
Change display contrast	Go to Display > Contrast

Touch Keys

Menu navigation is done through the four touch keys below the display. Each key has multiple functions depending on the state of the menu system.

Menu system state				
Menu item selection	Go to previous Item	Go to next item	Go back to previous menu	Select menu item
Field entry	Increment value	Decrement value	Cancel and return to menu	Accept current value
IP, password, or time field entry	Increment value	Decrement value	Go back to previous field	Go to next field

These touch keys work best when large key surface area is covered. Thereby, it should be operated by pressing the key with the finger instead tapping it with fingertip.



When entering a new field value, by pressing and holding the  key for 3 seconds the value will be incremented by the next magnitude. For example, if the current value is 100.0, every pressing of the key increments the value by 0.1. After holding the key for 3 seconds, the value will begin to increment by 1. After holding the key for another 3 seconds, the value will increment by 10, and so forth.

Similarly, holding the  key for 3 seconds will decrement the value by the next magnitude.

Chart Operation

The chart on the main screen shows the strip chart of the selected measurement. The update rate and the y-axis range can be changed via the menu and via Modbus communication.

Zoom in on the chart	Press the  key
Zoom out on the chart	Press the  key
Reset the zoom	Press the  key
Change the chart measurement variable	Go to Display > Chart > Variable
Change the chart update rate	Go to Display > Chart > Update Rate
Change the chart Y-axis upper limit to a fixed value	Go to Display > Chart > Upper Limit
Change the chart Y-axis lower limit to a fixed value	Go to Display > Chart > Lower Limit
Change the chart Y-axis to auto-ranging	Change chart upper and lower limits to 0

Readings

Change the primary reading	Go to Display > Readings > Primary
Change the secondary reading	Go to Display > Readings > Secondary

> **TIP: Primary reading can be set to show dew point in one engineering unit while the secondary reading shows dew point in another engineering unit.**

Menu Access

Not all of the fields on the menu can be modified. Some are read-only while others require entering the user or the administrator access level. If a field is being changed without proper access level, the error beep Hi-Lo-Lo-Lo will be given. In locked mode, no changes are allowed to any field and a lock

icon appears next to the relay status. The default user passcode is 0000 and the default administrator passcode is 1234.

Enter user or administrator access level	Go to System > Login Enter 4-digit user or administrator passcode
Enter locked mode	Go to System > Logout
Change user or administrator passcode	Go to System > Login Enter current 4-digit passcode
	Go to System > Password Enter new 4-digit passcode

> **NOTE: Entering user or administrator access level in the menu does not grant same access on the Modbus communication and vice versa.**

Main Menu

Pressing the key from the main screen would enter the main menu. The menu items are shown below in their order. Some items may not appear if their corresponding features are not in the instrument configuration. Press the key or the key to select the submenu. Once item is selected, press the key to enter submenu. Pressing the key from the main menu exits the menu system.

- Measurement
- Analog Output
- Communication
- Relays
- PID
- Display
- System
- Reset Alarm

Measurements

In addition to the sample dew point, the XTDL-HT™ measures sample temperature, sample pressure, and enclosure temperature. All of these measurements have a set of parameters that can be modified via the menu and Modbus communication. With the optional I/O board, the XTDL-HT™ can read up to four external analog inputs that can also be used as measurements.

Each measurement can be configured to trigger an alarm when it goes out of range. The alarm by default would trigger an error message on the screen. It can also be programmed to trigger a relay (see Relays chapter). An alarm can be configured as a critical alarm. In this case, the alarm is considered a system fault.

Measurement value is averaged over a specified period. The averaging buffer sizes can be set via the menu or via Modbus communication. Increasing the buffer size reduces noise on measurement but it will also increase the measurement response time.

Moisture Measurement

The XTDL-HT™ measures dew point by detecting the light absorption from moisture molecules at a specific wavelength. This allows the instrument to react quickly and accurately. However, certain elements such as CO_2 can affect the moisture measurement. To ensure accurate reading, the XTDL-HT™ stores calibration curves for multiple gas matrices and it must be configured for the correct gas matrix in the application. The instrument can hold calibration curves for up to 6 different gas matrices. Inform COSA Xentaur about your gas matrix when your order is placed.

TruTune™

Once the instrument is calibrated at the factory, no further re-calibration is required. The XTDL-HT™ monitors and re-tunes its circuit daily to ensure peak performance. Tuning generally takes about 2-3 minutes. During this time, the instrument holds the last known dew point measurement. Tuning can also be initiated manually via the menu. In normal circumstances, there is no need to do so as the unit automatically tunes itself at midnight daily. However, it may be prudent to initiate manual tuning after the unit has been inactive for a long period of time, such as reactivating the unit after storage or long period of maintenance.

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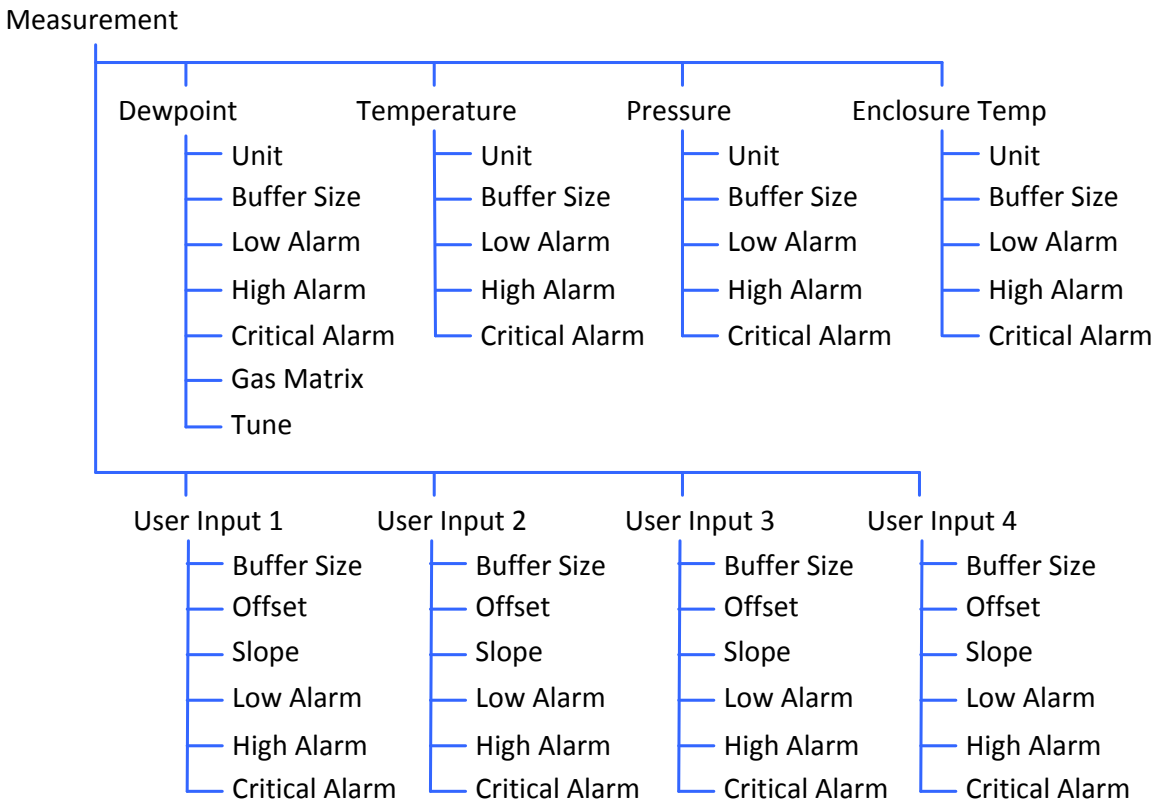
Setup Menu



User input menu would not appear if the instrument is not configured with optional analog inputs.

Change measurement X engineering unit	Go to Measurement > X > Unit
Change the number of samples for measurement X averaging	Go to Measurement > X > Buffer Size
Set desired operating range for measurement X[2]	Go to Measurement > X > Low Alarm Enter bottom range value Go to Measurement > X > High Alarm Enter top range value
Enable/disable treating measurement X alarm as system fault	Go to Measurement > X > Critical Alarm
Change dew point calibration curve to new gas matrix	Go to Measurement > Dewpoint > Gas Matrix
Manually initiate TruTune™ tuning	Go to Measurement > Dewpoint > Tune
Change correction curve for analog input X	Go to Measurement > User Input X > Offset Enter correction curve offset Go to Measurement > User Input X > Slope Enter correction curve slope
Reset measurement alarms	Select Reset Alarm on main menu

[2] Low Alarm and High Alarm values are automatically converted when the engineering unit parameter is changed.

Modbus Communication

The XTDL-HT™ can be monitored and controlled remotely via the standard Modbus communication protocol. Every measurement and every menu field can be accessed via Modbus. Each field is assigned to a unique Modbus register. See Appendix B for a complete list of Modbus registers supported by the instrument. The instrument can be configured at the factory to support serial communication and/or Ethernet communication.

The XTDL-HT™ supports the following Modbus commands:

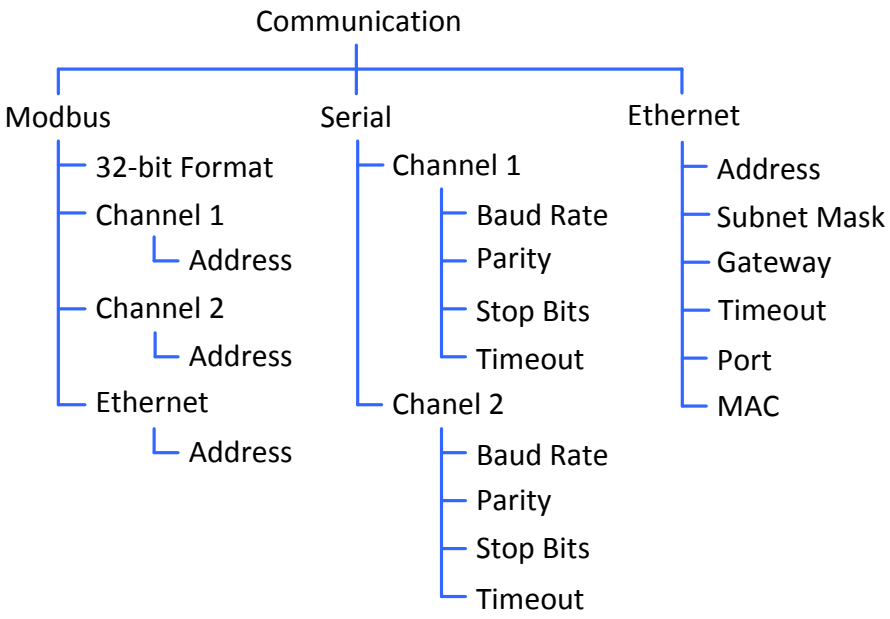
Read Discrete Inputs
Read Coils
Write Single Coil
Write Multiple Coils
Read Input Register
Read Holding Registers
Write Single Register
Write Multiple Registers
Read/Write Multiple Registers
Mask Write Register
Report Slave ID
Read Device Identification

Refer to the COSA Xentaur Modbus Protocol User's Guide for protocol details.

Modbus is a multi-node protocol. Each device on a Modbus network must have a unique address. Be sure that no other device is using XTDL-HT™ address (default is 2). If there is a conflict, change the address on the conflicting device or on the instrument.

Since Modbus is a master/slave protocol, it is important that the Modbus master waits for a response before proceeding to the next command. The XTDL-HT™ can respond to most commands within 100msec but a 2 second wait time is recommended.

Setup Menu



Serial and/or Ethernet menu would not appear if the instrument is not configured with serial and Ethernet interface.

Modbus RTU

The XTDL-HT™ supports Modbus RTU protocol on its serial ports. At the factory, it can be configured to support RS-232 or half-duplex RS-485 interface.

Isolation option is available on the serial interfaces for intrinsically-safe application.

The default communication settings are 9600 baud, 8 data bits, even parity, and 1 stop bits.

Change serial port X baud rate	Go to Communication > Serial > Channel X > Baud Rate
Change serial port X parity	Go to Communication > Serial > Channel X > Parity
Change the wait time on serial port X for a complete command message from the master	Go to Communication > Serial > Channel X > Timeout
Change the number of stop bits on serial port X	Go to Communication > Serial > Channel X > Stop Bits
Change Modbus address on serial port X	Go to Communication > Modbus > Channel X > Address

Modbus/TCP

The Modbus/TCP protocol is used on Ethernet communication. The XTDL-HT™ supports traditional IPv4 internet layer and EUI-48 MAC addressing. Each Ethernet device on a local network must have unique address. If multiple XTDL-HT™ instruments are installed, each unit must be configured to a unique MAC address and a unique IP addresses. New address goes into effect once power to the instrument is recycled.

Change Ethernet IP Address	Go to Communication > Ethernet > Address
Change Ethernet subnet mask	Go to Communication > Ethernet > Subnet Mask
Change Ethernet default gateway address	Go to Communication > Ethernet > Gateway
Change the wait time on Ethernet port for a complete command message from the master	Go to Communication > Ethernet > Timeout
Change Modbus Ethernet port[3]	Go to Communication > Ethernet > Port
Change Ethernet MAC address	Go to Communication > Ethernet > MAC
Change Modbus address on Ethernet port	Go to Communication > Modbus > Ethernet > Address

[3] Modbus/TCP uses port 502. User is not recommended to change port assignment unless the Modbus master is known to use a different port.

Analog Outputs

The XTDL-HT™ supports a variety of analog output options. It can be configured to output 4-20mA, 0-20mA, 0-24mA, 0-5V, 0-10V, ±5V, or ±10V. The instrument is factory configured to either current output or voltage output. Output range can be changed anytime.

Isolation option is available on the analog outputs for intrinsically-safe application.

Standard XTDL-HT™ includes one analog output channel. With the optional I/O board, the instrument gains another channel. Each output channel can represent any measurement or result of internal PID controller. It can also be controlled remotely via Modbus communication.

Current Output

The XTDL-HT™ analog output is a current source with a +15V output. No external power supply should be configured to the current loop.

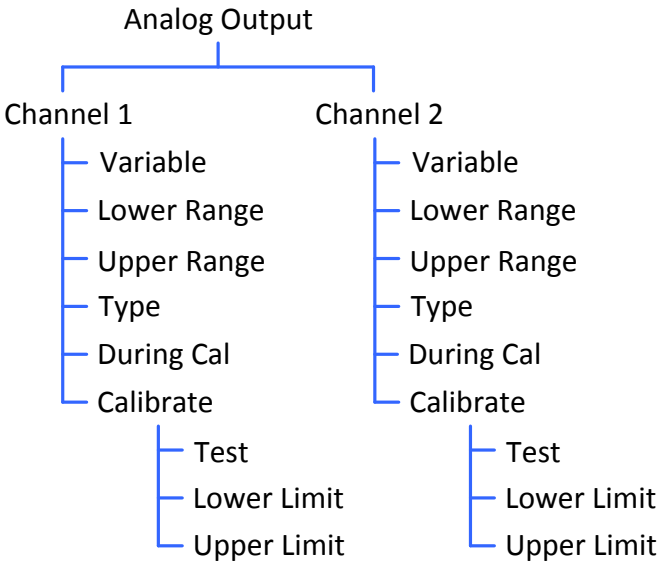
The instrument can detect fault on the current loop, such as shorted or opened. During such event, system fault is generated and error message is shown on the main screen. Therefore, the current loop should be wired to the process monitor before being enabled.

> NOTE: **Instrument signals Analog Output Error if current loop is left opened. Wire current loop to process monitor before enabling.**

Voltage Output

The XTDL-HT™ can provide voltage output down to 1kΩ load. If long cabling is used on voltage output, voltage drop from the cable can be compensated by re-calibrating the unit digital-to-analog converter once it is wired to the process monitor.

Setup Menu



Channel 2 menu would not appear if the instrument is configured with only one analog output channel.

Select measurement on analog output channel X	Go to Analog Output > Channel X > Variable
Set measurement range on analog output	Go to Analog Output > Channel X > Lower Range Set the measurement bottom range
	Go to Analog Output > Channel X > Upper Range Set the measurement top range
Change the type of analog output on channel X	Go to Analog Output > Channel X > Type
Test analog output by forcing it to a fixed value	Go to Analog Output > Channel X > Calibrate >Test
Calibrate the digital-to-analog converter	Go to Analog Output > Channel X > Calibrate >Test Set value to 0%
	Go to Analog Output > Channel X > Calibrate > Lower Limit Set lower limit to a value so that the output at process monitor is exactly at its bottom range
	Go to Analog Output > Channel X > Calibrate > Test Set value to 100%
	Go to Analog Output > Channel X > Calibrate > Upper Limit Set upper limit to a value so that the output at process monitor is exactly at its top range

Remote Controlled

The analog outputs on the XTDL-HT™ can be remotely controlled via its Modbus interfaces. In addition to configuring the channels remotely, the instrument allows the Modbus master to directly control its analog outputs. This allows the DCS system to control another device via the XTDL-HT™ without setting up a Remote Terminal Unit.

Remotely change the analog output signal	Set Modbus register Analog Output Variable to 32768
	Set Modbus register Analog Output Value to the desired digital-to-analog converter input value

	Channel 1	Channel 2
Analog Output Variable	Register 40405	Register 40415
Analog Output Value	Register 40410	Register 40420

Relays

The XTDL-HT™ can control up to four relays. Relay 2 is reserved for controlling the enclosure heater. Relays 3 & 4 require the optional I/O board. Each relay can be configured to activate by the following conditions:

- Measurement alarm
- System event
- PID controller
- Time and day
- Modbus command

If a relay variable is assigned to a measurement, the relay will be activated when the measurement value meets the relay alarm state which can be:

- Measurement value < low alarm threshold
- Measurement value > high alarm threshold
- Measurement value is outside of low and high alarm thresholds
- Measurement value > low alarm threshold
- Measurement value < high alarm threshold
- Measurement value is between low and high alarm thresholds

The instrument has a hysteresis built-in so that the relays would not continuously toggle when the measurement value is close to the threshold value.

If a relay variable is set to an event or a PID controller, the alarm state indicates the relay polarity which can be either normally-on or normally-off.

The relays can also be configured to operate on system fault even when they are set to operate on measurement alarm or event. On the event of a system fault, a relay can be triggered as an alarm or it can continuously toggle at a 2-sec interval. This function is useful for signaling the DCS system with two events by using only one relay signal. For example, a relay can be configured to trigger when dew point measurement goes out of range or when a system fault occurs.

Once a relay is activated by a measurement alarm or a system fault, it can stay activated or it can be deactivated automatically when the condition clears. If the Self Cleared function is enabled, the relay will deactivate itself when the instrument clears the triggering condition. Otherwise, user is required to select the Reset Alarm menu item to reset the relays.

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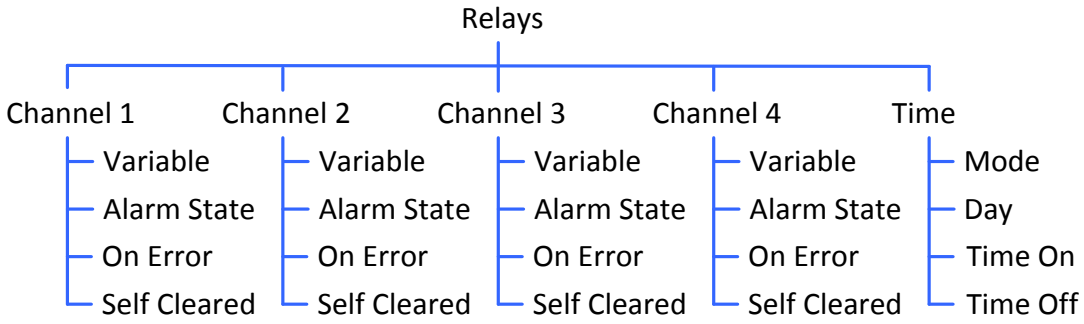
Setup Menu



Channel 3 and 4 menu would not appear if the instrument is not configured with the extra relays.

Set relay X to operate on a measurement Y alarm	Go to Measurement > Y > Low Alarm Set the alarm low threshold
	Go to Measurement > Y > High Alarm Set the alarm high threshold
	Go to Relays > Channel X > Variable Select the desired measurement
	Go to Relays > Channel X > Alarm State Select the desired alarm condition
Set relay X to operate on a system event	Go to Relays > Channel X > Variable Select the desired event
	Go to Relays > Channel X > Alarm State Select the relay polarity
Select how relay X behaves on system fault	Go to Relays > Channel X > On Error
Turn on/off self-cleared function on relay X	Go to Relays > Channel X > Self Cleared

NOTE: Relay 2 is reserved for controlling the enclosure heater.

Time Controlled

The relay can be automatically turned on and off based on a specific time and day. For example, it can be set to turn on automatically every weekday at 7:00AM and to turn off at 5:00PM. This is an added benefit for the customers to utilize the instrument as a small local control system.

Set relay X to time and day controlled	Go to Relays > Channel X > Variable Select Time
Select the day relay turning on/off	Go to Relays > Time > Mode Select the one of the following: ➢ Everyday ➢ Every weekday ➢ Weekly ➢ Monthly
Select the day when relay operates on weekly or monthly basis	Go to Relays > Time > Day
Change the time when relay turns on/off	Go to Relays > Time > Time On Set the time relay turning on in 24-hour format
	Go to Relays > Time > Time Off Set the time relay turning off in 24-hour format

Remote Controlled

Individual relay can be controlled remotely via the Modbus communication. Once the relay is set to operate on communication command, it can be turned on/off by changing the Modbus coil registers. This allows the DCS system to control another device via the XTDL-HT™ without setting up a Remote Terminal Unit.

Set relay X to remote controlled	Go to Relays > Channel X > Variable Select Communication

PID Controllers

A PID controller is a generic control loop feedback mechanism that attains a process output setpoint with minimal error. The XTDL-HT™ has four PID controllers. PID controller 1 is reserved for operating the enclosure heater. User is free to use the other three controllers. The instrument uses the standard PID form:

$$MV\ t\ = K_p\ \ e\ t\ + \frac{1}{T_i}\int_0^t e\ \tau\ d\tau + T_d \frac{d}{dt} e\ t$$

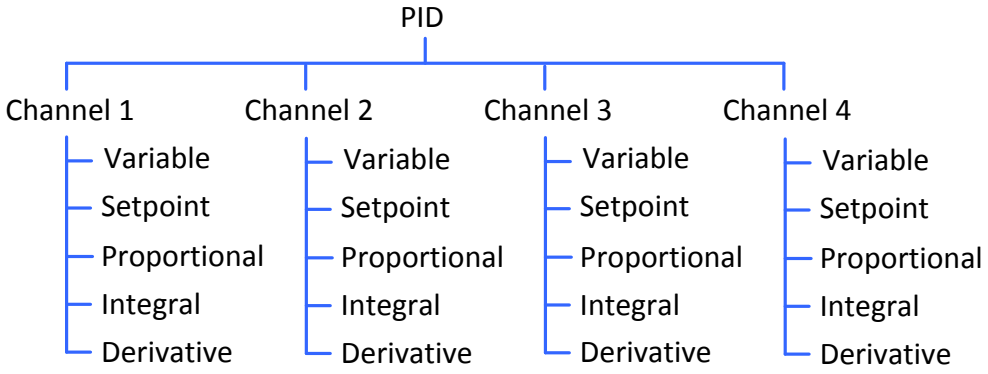
where:

MV(t) is the manipulated variable
e(t) is the error = setpoint – process value
K_p is the proportional gain
T_i is the integral time
T_d is the derivative time

With this form, the controller can adjust how the process setpoint is reached by changing the proportional gain, the integral time, and/or the derivative time. Increasing the proportional gain decreases the rise time on the process but increases overshoot. Increasing the integral time decreases the steady-state error but increases the settling time. Increasing the derivative time increases the process stability. Therefore, it is important that these parameters are set with the right balance to avoid undesirable error.

Any one of the XTDL-HT™ measurements can be a PID controller input, even the external analog inputs. The PID controller outputs can be applied to analog outputs and/or relays. This is another benefit to use XTDL-HT™ for small local control system.

Setup Menu



Select the measurement input to PID controller X	Go to PID > Channel X > Variable
Change the process setpoint to PID controller X	Go to PID > Channel X > Setpoint
Change process parameters to PID controller X	Go to PID > Channel X > Proportional Set the proportional gain
	Go to PID > Channel X > Integral Set the integral time
	Go to PID > Channel X > Derivative Set the derivative time
Set relay X to use PID controller Y	Go to Relays > Channel X > Variable Select PID Y
Set analog output X to use PID controller Y	Go to Analog Output > Channel X > Variable Select PID Y

NOTE: PID controller 1 is reserved for controlling the enclosure heater.

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Support Information

Restoring default values

If something is wrong with instrument operating parameters, the factory default values can be restored by selecting the menu item System > Restore Defaults. This will also restore the calibration values to the states when the instrument was shipped from factory.

Setting clock

Change the date	Go to System> Clock > Date
Change the time	Go to System > Clock > Time
Turn daylight saving on/off	Go to System > Clock > Daylight Save
Change the date display format	Go to System > Clock > Date Format

Troubleshooting

Symptoms	Solutions
Dewpoint reading is consistently higher than expected	Check all connections for leaks. Make sure that no plastic, rubber, or Tygon tubing is used.
Dewpoint reading is lower than expected	The laser may be mistuned. Run TruTune™ tuning manually (Measurement > Dewpoint > Tune) with a gas sample at least 5000 ppm of moisture. Tuning process takes 2-3 minutes.
Screen is flashing Temperature Too Low	Set the secondary reading to display sample temperature. If reading is -128.3°C, check the cable connection J5 on the control board and check cable connector for any sign of damage. Once problem is correct select Reset Alarms on menu. If cable is damaged or cable is properly connected, replace temperature sensor assembly.
Screen is flashing Temperature Too High	You may get this error during the first 90 minutes after startup. The PID controller to the instrument heater may have overshot the setpoint temperature. The controller is configured in 25°C ambient temperature at the factory; its settings may produce larger overshoot in hotter environment. In such case, re-tune PID controller 1, starting with reducing Proportional value.
	Verify the Sample Temperature > High Alarm value is set above PID > Channel 1 > Setpoint value with room for overshoot.
Menu item does not take new value	Changing some items on the menu require appropriate access level. Log in using administrator password to gain full access to the menu.
Keypad is not responding	The touch keys require sufficient surface contact to work. Try pressing down the key with the finger instead of tapping it with fingertip.
Screen is flashing Analog Output Error	If instrument is configured for current output, make sure that the current loop is hooked up to the DCS system. The instrument will give error on an open loop to signal a cable breakage. If unsure whether the loop is opened, try measuring the current with a multimeter. There is a cable breakage if the error disappears when the output is being measured.
	Make sure that the output + and – signals are not shorted. Remove cable to the analog output and check for short circuit at the cable end.

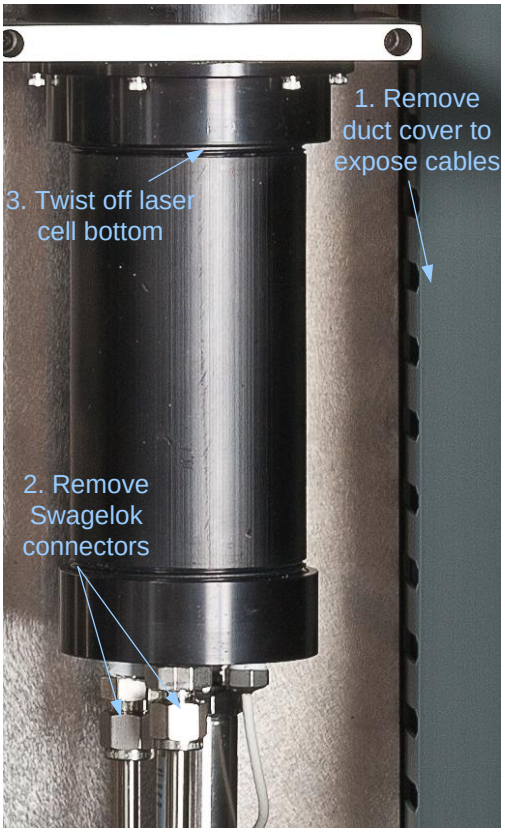
Symptoms	Solutions
Ethernet communication not working	Make sure that each XTDL-HT™ instrument has a unique MAC address and IP address on your network. If your installation has more than one XTDL-HT™ instrument, give each instrument a unique MAC address. Contact your network administrator for an unused IP address for this instrument and the gateway address. Recycle power to the instrument to apply the new address settings.
	The instrument supports only one Modbus/TCP channel. Make sure that the channel is not being used.
RS-485 serial communication not working	XTDL-HT™ uses half-duplex RS-485 interface. The inverting data line must be connected to terminal block 11, and the non-inverting data line to terminal block 12. If unsure, try swapping the two lines.
	XTDL-HT™ uses address 2 by default for Modbus RTU communication. Make sure that no other device on your Modbus network is using this address.
	Make sure that the baud rate, stop bits, and parity settings on instrument match the DCS.
Modbus communication comes and goes	Modbus is a master/slave protocol. Make sure that sufficient time is given to wait for response to each command. If the instrument is not responding to a command, wait 2 seconds before issuing another command. For tighter timing, change Timeout value on instrument.
Screen is flashing Error 2	Check connections on the WMS power cable and the WMS serial cable. Inspect cable connectors for any sign of damage. Once problem is corrected, it will take about 5 seconds for the error to clear.
Ball on flow meter bouncing wildly	Not enough flow to the sampling system. Increase flow rate.

If problem is not resolved with the solutions above, please contact COSA Xentaur for services.

Maintenance

Although the XTDL-HT™ laser cell is designed to withstand high level of contamination, the instrument is recommended for periodic cleaning to prevent contamination buildup on the gas sampling line. Annual inspection and cleaning are sufficient for general use, more often for dirty application. Maintenance procedure includes:

1. Check the pressure regulators and pressure gauge for correct pressure. Remove and clean if necessary.
2. Check the flow meter for correct flow rate. Remove and clean if necessary.
3. Flush the sampling system with solvent appropriate for the application.
4. Remove bottom of the laser cell and drain any liquid. Clean before re-installing.



Removing bottom of laser cell

Warranty

This instrument is warranted to be free from defects in workmanship and materials. Liability under this warranty is limited to servicing, calibrating, and replacing any defective parts of the instrument returned to the factory for that purpose. Fuses are specifically excluded from any liability. This warranty is effective for one year from the date of delivery to the original purchaser. The equipment must be examined by COSA Xentaur and found to have been defective for this warranty to be considered valid.

If any damage is determined to have been caused by misuse or abnormal conditions of operation, the owner will be notified and repairs will be billed at standard rates after approval.

Maintenance Policy

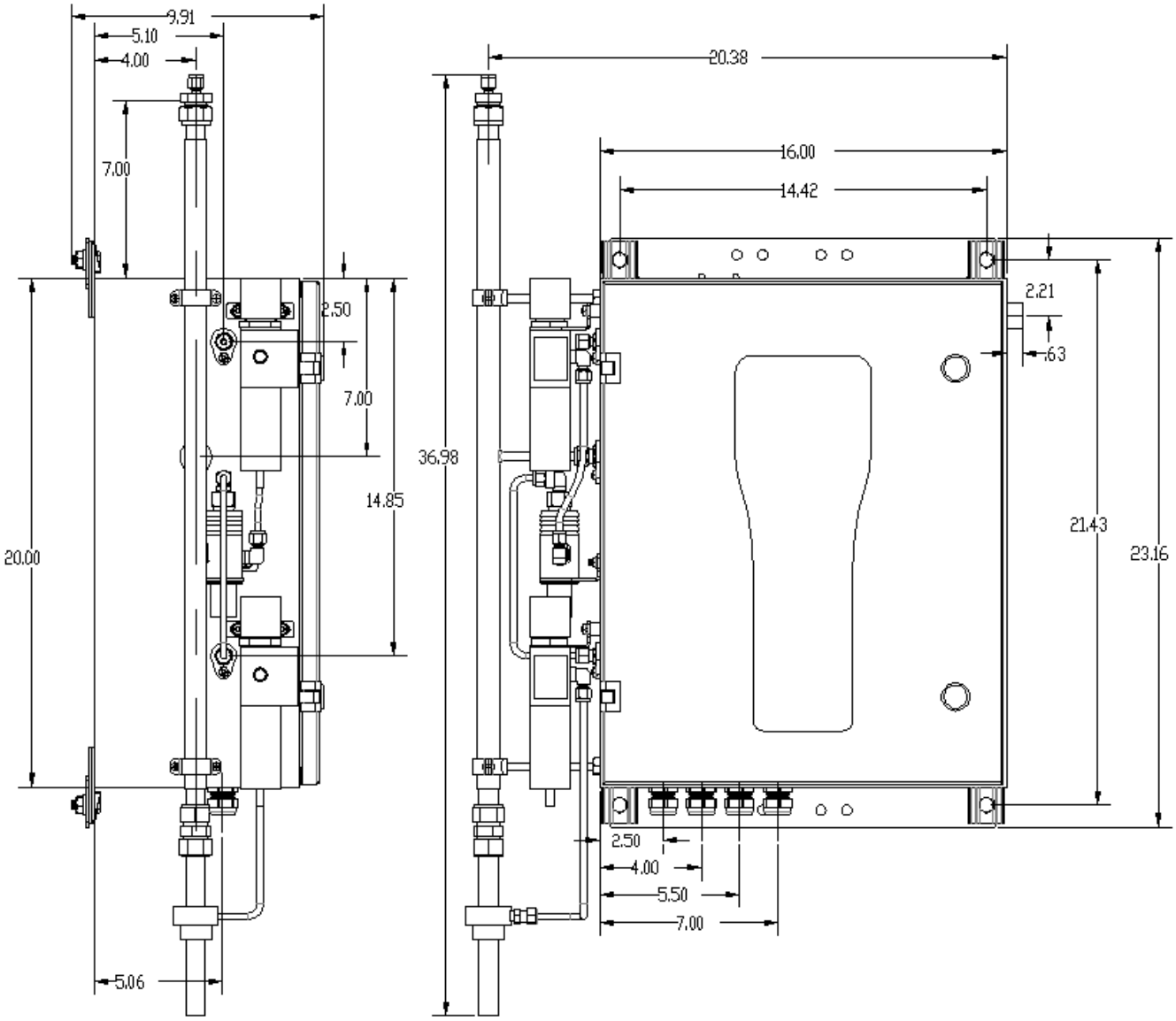
In cases when equipment fault is suspected, please notify your representative of the problem; be sure to provide them with model and serial numbers. If the problem cannot be resolved, then ask for a Return Material Authorization (RMA) number and shipping instructions. Issuance of an RMA number does not automatically imply that the equipment is covered by our warranty that will be determined after we receive the equipment. Pack the equipment in a suitable box with sufficient padding, include the RMA number on your paperwork, and send the equipment, prepaid, to the designated address. Equipment returned without an RMA number, or with reversed shipping or import/export charges, will not be accepted.

If the warranty has expired, or the damage is due to improper use or exposure of the equipment; then the repair facility will provide an estimate and wait for approval before commencing repairs.

Spare List

Item	Part number	Description
1	LAS.10.E.2000	Control board
2	LAS.98.E.0041	Display
3	LAS.98.M.0001	Fan heater (120VAC)
4	LAS.98.S2.9869	Temperature sensor
5	LAS.98.S2.9870	Pressure transducer
6	LAS.S2.E.9774	WMS serial cable
7	LAS.S2.E.9875	WMS power cable
8	LAS.S2.E.9901	Control cable assembly
9	ESS.98.M.0214	Flow meter
10	ESS.98.M.0051	Pressure gauge (0-30 psig)
11	CHA.98.M.0013	Back pressure regulator
12	CAL.98.M.0010	Adjustable filter regulator
13	LAS.98.M.0003	Inertial gas sampling filter with eductor
14	CAL.98.M.0035	Outlet eductor

Appendix A: Enclosure Dimensional Drawing



Appendix B: Modbus Registers

Coil Registers

Register Number	Address	Access Level	Description
Physical output			
1	0 (0h)	User	Relay 1
2	1 (1h)	User	Relay 2
3	2 (2h)	User	Relay 3
4	3 (3h)	User	Relay 4

Discrete Input Registers

Register Number	Address	Access Level	Description
Physical input			
10001	0 (0h)	Read-Only	Digital input 1 state
10002	1 (1h)	Read-Only	Digital input 2 state
10003	2 (2h)	Read-Only	Digital input 3 state
10004	3 (3h)	Read-Only	Digital input 4 state
Logical output			
11101	1100 (44Ch)	Read-Only	System fault
11102	1101 (44Dh)	Read-Only	Calibration fault
11103	1102 (44Eh)	Read-Only	Calibrating
11104	1103 (44Fh)	Read-Only	Validating
11105	1104 (450h)	Read-Only	Analog Output 1 Valid
11106	1105 (451h)	Read-Only	Analog Output 2 Valid

Input Registers

Register Number	Address	Access Level	Data Type	Description
30001	0 (0h)	Read-Only	Float	Dewpoint
30003	2 (2h)	Read-Only	Float	Sample Temperature
30005	4 (4h)	Read-Only	Float	Sample Pressure
30007	6 (6h)	Read-Only	Float	Enclosure Temperature
30009	8 (8h)	Read-Only	Float	User Input 1
30011	10 (Ah)	Read-Only	Float	User Input 2
30013	12 (Ch)	Read-Only	Float	User Input 3
30015	14 (Eh)	Read-Only	Float	User Input 4

Holding Registers

Register Number	Address	Access Level	Data Type	Description	Values
				Measurement setting registers	
40099	98 (62h)	Admin	32-bit	Critical Alarms	bit 0: Dewpoint bit 1: Sample Temperature bit 2: Sample Pressure bit 3: Enclosure Temperature bit 4: User Input 1 bit 5: User Input 2 bit 6: User Input 3 bit 7: User input 4 bits 8-31: Unused
40101	100 (64h)	User	16-bit	Dewpoint engineering unit	0=°C 1=°F 2=ppmV 3=lbs H_2O/mm scf 4=g/m^3
40102	101 (65h)	Read-Only	Float	Dewpoint low limit	Valid values are -100 - 99999.9
40104	103 (67h)	Read-Only	Float	Dewpoint high limit	Valid values are -100 - 99999.9
40106	105 (69h)	Admin	Float	Dewpoint low alarm	Valid values are -100 - 99999.9
40108	107 (6Bh)	Admin	Float	Dewpoint high alarm	Valid values are -100 - 99999.9
40110	109 (6Dh)	User	16-bit	Sample temperature engineering unit	0=°C 1=°F
40111	110 (6Eh)	Read-Only	Float	Sample temperature low limit	Valid values are -100 - 100
40113	112 (70h)	Read-Only	Float	Sample temperature high limit	Valid values are -100 - 100
40115	114 (72h)	Admin	Float	Sample temperature low alarm	Valid values are -100 - 100
40117	116 (74h)	Admin	Float	Sample temperature high alarm	Valid values are -100 - 100
40119	118 (76h)	User	16-bit	Sample pressure engineering unit	0=psiA 1=mbar
40120	119 (77h)	Read-Only	Float	Sample pressure low limit	Valid values are 0 - 100

Register Number	Address	Access Level	Data Type	Description	Values
40122	121 (79h)	Read-Only	Float	Sample pressure high limit	Valid values are 0 - 100
40124	123 (7Bh)	Admin	Float	Sample pressure low alarm	Valid values are 0 - 100
40126	125 (7Dh)	Admin	Float	Sample pressure high alarm	Valid values are 0 - 100
40128	127 (7Fh)	User	16-bit	Enclosure temperature engineering unit	0=°C 1=°F
40129	128 (80h)	Read-Only	Float	Enclosure temperature low limit	Valid values are -100 - 100
40131	130 (82h)	Read-Only	Float	Enclosure temperature high limit	Valid values are -100 - 100
40133	132 (84h)	Admin	Float	Enclosure temperature low alarm	Valid values are -100 - 100
40135	134 (86h)	Admin	Float	Enclosure temperature high alarm	Valid values are -100 - 100
40142	141 (8Dh)	Admin	Float	User input 1 low alarm	Valid values are -99999.9 - 99999.9
40144	143 (8Fh)	Admin	Float	User input 1 high alarm	Valid values are -99999.9 - 99999.9
40151	150 (96h)	Admin	Float	User input 2 low alarm	Valid values are -99999.9 - 99999.9
40153	152 (98h)	Admin	Float	User input 2 high alarm	Valid values are -99999.9 - 99999.9
40160	159 (9Fh)	Admin	Float	User input 3 low alarm	Valid values are -99999.9 - 99999.9
40162	161 (A1h)	Admin	Float	User input 3 high alarm	Valid values are -99999.9 - 99999.9
40169	168 (A8h)	Admin	Float	User input 4 low alarm	Valid values are -99999.9 - 99999.9
40171	170 (AAh)	Admin	Float	User input 4 high alarm	Valid values are -99999.9 - 99999.9
				Relay registers	
40300	299 (12Bh)	Admin	16-bit	Measurement Hysteresis	Valid values are 0 - 65535 sec
40301	300 (12Ch)	Admin	16-bit	Time to open relay	Valid values are 0 - 2359
40302	301 (12Dh)	Admin	16-bit	Time to close relay	Valid values are 0 - 2359

Register Number	Address	Access Level	Data Type	Description	Values
40303	302 (12Eh)	Admin	16-bit	Day of the week or day of the month	For relay time mode=monthly, Valid values are 1 - 31 For relay time mode=weekly, 0=Sunday 1=Monday 2=Tuesday 3=Wednesday 4=Thursday 5=Friday 6=Saturday
40304	303 (12Fh)	Admin	16-bit	Relay time mode	0=Daily 1=Weekday 2=Weekend 3=Weekly 4=Monthly

Register Number	Address	Access Level	Data Type	Description	Values
40305	304 (130h)	Admin	16-bit	Relay 1 mode	bit 0: Polarity (0=normally closed, 1=normally opened) bits 1-8: Variable ID[4] bit 9: Assert when variable below low threshold (0=disabled, 1=enabled) bit 10: Assert when variable above high threshold (0=disabled, 1=enabled) bit 11: Self cleared (0=disabled, 1=enabled) bit 12: Unused bit 13: Assert on fault (0=disabled, 1=enabled) bit 14: Time controlled (0=disabled, 1=enabled) bit 15: Remote controlled (0=disabled, 1=enabled)
40306	305 (131h)	Admin	16-bit	Relay 2 mode	See Relay 1 mode
40307	306 (132h)	Admin	16-bit	Relay 3 mode	See Relay 1 mode
40308	307 (133h)	Admin	16-bit	Relay 4 mode	See Relay 1 mode

[4] Valid relay variable ID's are:

Value	Description	Value	Description	Value	Description	Value	Description
0	Off	5	Analog output 1 valid	67	Enclosure temperature	120	PID 1
1	System fault	6	Analog output 2 valid	68	User input 1	121	PID 2
2	Calibration fault	64	Dewpoint	69	User input 2	122	PID 3
3	Calibrating	65	Sample temperature	70	User input 3	123	PID 4
4	Validating	66	Sample pressure	71	User input 4		

Register Number	Address	Access Level	Data Type	Description	Values
				Digital input registers	
40351	350 (15Eh)	Admin	16-bit	Digital input 1 mode	bit 0: Polarity (0=active high, 1=active low) bits 1-7: input variable ID bits 8-15: Unused
40352	351 (15Fh)	Admin	16-bit	Digital input 2 mode	bit 0: Polarity (0=active high, 1=active low) bits 1-7: input variable ID bits 8-15: Unused
40353	352 (160h)	Admin	16-bit	Digital input 3 mode	bit 0: Polarity (0=active high, 1=active low) bits 1-7: input variable ID bits 8-15: Unused
40354	353 (161h)	Admin	16-bit	Digital input 4 mode	bit 0: Polarity (0=active high, 1=active low) bits 1-7: input variable ID bits 8-15: Unused
				Analog output registers	
40401	400 (190h)	Read-Only	16-bit	Analog output 1 type	0=0-5V 1=0-10V 2=±5V 3=±10V 5=4-20mA 6=0-20mA 7=0-24mA
40402	401 (191h)	Admin	16-bit	Analog output 1 low limit DAC value	Valid values are 0 - 65535
40403	402 (192h)	Admin	16-bit	Analog output 1 high limit DAC value	Valid values are 0 - 65535
40404	403 (193h)	Admin	16-bit	Analog output 1 during calibration operation	0=Set to low state 1=Hold output 2=Track calibration measurement

Register Number	Address	Access Level	Data Type	Description	Values
40405	404 (194h)	Admin	16-bit	Analog output 1 variable	0=Off 64=Dewpoint 65=Sample temperature 66=Sample pressure 67=Enclosure pressure 68=User input 1 69=User input 2 70=User input 3 71=User input 4 120=PID 1 121=PID 2 122=PID 3 123=PID 4 32768=Remote controlled
40406	405 (195h)	Admin	Float	Analog output 1 low limit	Valid values are -100 - 99999.9
40408	407 (197h)	Admin	Float	Analog output 1 high limit	Valid values are -100 - 99999.9
40410	409 (199h)	Admin	16-bit	Analog output 1 remote controlled value	Valid values are 0 - 65535
40411	410 (19Ah)	Read-Only	16-bit	Analog output 2 type	0=0-5V 1=0-10V 2=±5V 3=±10V 5=4-20mA 6=0-20mA 7=0-24mA
40412	411 (19Bh)	Admin	16-bit	Analog output 2 low limit DAC value	Valid values are 0 - 65535
40413	412 (19Ch)	Admin	16-bit	Analog output 2 high limit DAC value	Valid values are 0 - 65535
40414	413 (19Dh)	Admin	16-bit	Analog output 2 during calibration operation	0=Set to low state 1=Hold output 2=Track calibration measurement

Register Number	Address	Access Level	Data Type	Description	Values
40415	414 (19Eh)	Admin	16-bit	Analog output 2 variable	See Analog output 1 variable
40416	415 (19Fh)	Admin	Float	Analog output 2 low limit	Valid values are -100 - 99999.9
40418	417 (1A1h)	Admin	Float	Analog output 2 high limit	Valid values are -100 - 99999.9
40420	419 (1A3h)	Admin	16-bit	Analog output 2 remote controlled value	Valid values are 0 - 65535
				Analog input registers	
40502	501 (1F5h)	Admin	16-bit	User input 1 averaging buffer size	Valid values are 0 - 60 sec
40503	502 (1F6h)	Read-Only	Float	User input 1 calibration offset	Valid values are -99999.9 - 99999.9
40505	504 (1F8h)	Read-Only	Float	User input 1 calibration slope	Valid values are -99999.9 - 99999.9
40508	507 (1FBh)	Admin	16-bit	User input 2 averaging buffer size	Valid values are 0 - 60 sec
40509	508 (1FCh)	Read-Only	Float	User input 2 calibration offset	Valid values are -99999.9 - 99999.9
40511	510 (1FEh)	Read-Only	Float	User input 2 calibration slope	Valid values are -99999.9 - 99999.9
40514	513 (201h)	Admin	16-bit	User input 3 averaging buffer size	Valid values are 0 - 60 sec
40515	514 (202h)	Read-Only	Float	User input 3 calibration offset	Valid values are -99999.9 - 99999.9
40517	516 (204h)	Read-Only	Float	User input 3 calibration slope	Valid values are -99999.9 - 99999.9
40520	519 (207h)	Admin	16-bit	User input 4 averaging buffer size	Valid values are 0 - 60 sec
40521	520 (208h)	Read-Only	Float	User input 4 calibration offset	Valid values are -99999.9 - 99999.9
40523	522 (20Ah)	Read-Only	Float	User input 4 calibration slope	Valid values are -99999.9 - 99999.9
40526	525 (20Dh)	Admin	16-bit	Enclosure temperature averaging buffer size	Valid values are 0 - 60 sec
40527	526 (20Eh)	Read-Only	Float	Enclosure temperature calibration offset	Valid values are -99999.9 - 99999.9
40529	528 (210h)	Read-Only	Float	Enclosure temperature calibration slope	Valid values are -99999.9 - 99999.9
40532	531 (213h)	Admin	16-bit	Sample pressure averaging buffer size	Valid values are 0 - 60 sec
40533	532 (214h)	Read-Only	Float	Sample pressure calibration offset	Valid values are -99999.9 - 99999.9
40535	534 (216h)	Read-Only	Float	Sample pressure calibration slope	Valid values are -99999.9 - 99999.9
40538	537 (219h)	Admin	16-bit	Sample temperature averaging buffer size	Valid values are 0 - 60 sec
40539	538 (21Ah)	Read-Only	Float	Sample temperature calibration offset	Valid values are -99999.9 - 99999.9
40541	540 (21Ch)	Read-Only	Float	Sample temperature calibration slope	Valid values are -99999.9 - 99999.9
40544	543 (21Fh)	Admin	16-bit	Dewpoint averaging buffer size	Valid values are 0 - 60 sec

Register Number	Address	Access Level	Data Type	Description	Values
				Serial Link Registers	
40602	601 (259h)	User	16-bit	Serial link 1 stop bits	Valid values are 1 - 2
40603	602 (25Ah)	User	16-bit	Serial link 1 baud rate	0=1200 baud 1=2400 baud 2=4800 baud 3=9600 baud 4=19200 baud 5=38400 baud 6=57600 baud
40604	603 (25Bh)	User	16-bit	Serial link 1 parity	0=No parity 1=odd 2=even
40605	604 (25Ch)	User	16-bit	Serial link 1 message timeout	Valid values are 0 - 65535 msec
40607	606 (25Eh)	User	16-bit	Serial link 2 stop bits	Valid values are 1 - 2
40608	607 (25Fh)	User	16-bit	Serial link 2 baud rate	0=1200 baud 1=2400 baud 2=4800 baud 3=9600 baud 4=19200 baud 5=38400 baud 6=57600 baud
40609	608 (260h)	User	16-bit	Serial link 2 parity	0=No parity 1=odd 2=even
40610	609 (261h)	User	16-bit	Serial link 2 message timeout	Valid values are 0 - 65535 msec
				Ethernet Registers	
40651	650 (28Ah)	User	32-bit	IPv4 Address	
40653	652 (28Ch)	User	32-bit	Subnet mask	
40659	658 (292h)	User	32-bit	IPv4 Default Gateway	
40667	666 (29Ah)	User	16-bit	Keep alive timeout	Valid values are 0 - 65535 msec

Register Number	Address	Access Level	Data Type	Description	Values
40668	667 (29Bh)	User	16-bit	TCP port	Valid values are 0 - 65535
40669	668 (29Ch)	Admin	48-bit	EUI-48 MAC Address	
				Beeper Registers	
40791	790 (316h)	User	16-bit	Master volume	Valid values are 0 - 100%
				Display Registers	
40801	800 (320h)	User	16-bit	Screen saver time	0=Off 1=5 minutes 2=10 minutes 3=30 minutes 4=1 Hour 5=2 Hours 6=4 Hours
40802	801 (321h)	User	16-bit	Display enable time	Valid values are 0 - 2359
40803	802 (322h)	User	16-bit	Display disable time	Valid values are 0 - 2359
40804	803 (323h)	User	16-bit	Contrast	Valid values are 0 - 100%
				Reading Registers	
40831	820 (334h)	User	16-bit	Primary reading variable	0=Dewpoint 1=Dewpoint in °C 2=Dewpoint in °F 3=Dewpoint in ppmV 4=Dewpoint in lbs H_2O/mm scf 5=Dewpoint in g/m^3 6=Sample temperature 7=Sample pressure 8=Enclosure pressure 9=User input 1 10=User input 2 11=User input 3 12=User input 4
40832	821 (335h)	User	16-bit	Secondary reading variable	See primary reading variable

Register Number	Address	Access Level	Data Type	Description	Values
				Chart Registers	
40842	841 (349h)	User	16-bit	Chart update rate	0=every second 1=every minute
40844	843 (34Bh)	User	16-bit	Chart variable	0=Dewpoint 1=Sample temperature 2=Sample pressure 3=Enclosure pressure 4=User input 1 5=User input 2 6=User input 3 7=User input 4
40845	844 (34Ch)	User	Float	Chart minimum value	Valid values are -100 - 99999.9
40847	846 (34Eh)	User	Float	Chart maximum value	Valid values are -100 - 99999.9
				PID Control Registers	
40901	900 (384h)	Admin	16-bit	PID 1 variable	0=Off 1=Dewpoint 2=Sample temperature 3=Sample pressure 4=Enclosure pressure 5=User input 1 6=User input 2 7=User input 3 8=User input 4
40902	901 (385h)	Admin	Float	PID 1 setpoint	Valid values are -100 - 99999.9
40904	903 (387h)	Admin	Float	PID 1 proportional gain	Valid values are -99999.9 - 99999.9
40906	905 (389h)	Admin	16-bit	PID 1 integral time	Valid values are 0 - 65535
40907	906 (38Ah)	Admin	16-bit	PID 1 derivative time	Valid values are 0 - 65535
40909	908 (38Ch)	Admin	16-bit	PID 2 variable	See PID 1 variable
40910	909 (38Dh)	Admin	Float	PID 2 setpoint	Valid values are -100 - 99999.9
40912	911 (38Fh)	Admin	Float	PID 2 proportional gain	Valid values are -99999.9 - 99999.9

Register Number	Address	Access Level	Data Type	Description	Values
40914	913 (391h)	Admin	16-bit	PID 2 integral time	Valid values are 0 - 65535
40915	914 (392h)	Admin	16-bit	PID 2 derivative time	Valid values are 0 - 65535
40917	916 (394h)	Admin	16-bit	PID 3 variable	See PID 1 variable
40918	917 (395h)	Admin	Float	PID 3 setpoint	Valid values are -100 - 99999.9
40920	919 (397h)	Admin	Float	PID 3 proportional gain	Valid values are -99999.9 - 99999.9
40922	921 (399h)	Admin	16-bit	PID 3 integral time	Valid values are 0 - 65535
40923	922 (39Ah)	Admin	16-bit	PID 3 derivative time	Valid values are 0 - 65535
40925	924 (39Ch)	Admin	16-bit	PID 4 variable	See PID 1 variable
40926	925 (39Dh)	Admin	Float	PID 4 setpoint	Valid values are -100 - 99999.9
40928	927 (39Fh)	Admin	Float	PID 4 proportional gain	Valid values are -99999.9 - 99999.9
40930	929 (3A1h)	Admin	16-bit	PID 4 integral time	Valid values are 0 - 65535
40931	930 (3A2h)	Admin	16-bit	PID 4 derivative time	Valid values are 0 - 65535
				System Registers	
41001	1000 (3E8h)	User	16-bit	System year	Valid values are 0 - 65535
41002	1001 (3E9h)	User	16-bit	System month	Valid values are 1 - 12
41003	1002 (3EAh)	User	16-bit	System day	Valid values are 1 - 31
41004	1003 (3EBh)	User	16-bit	System hour	Valid values are 0 - 23
41005	1004 (3ECh)	User	16-bit	System minute	Valid values are 0 - 59
41006	1005 (3EDh)	User	16-bit	System second	Valid values are 0 - 59
41007	1006 (3EEh)	User	16-bit	Daylight saving enable	0=Disabled 1=Enabled
41008	1007 (3EFh)	User	16-bit	Date format	0=mm/dd/yyyy 1=dd/mm/yyyy
41010	1009 (3F1h)	User	16-bit	32-bit word order	0=Low word first 1=High word first
41011	1010 (3F2h)	Read-Only	16-bit	Model number	
41012	1011 (3F3h)	Read-Only	32-bit	Serial number	

Register Number	Address	Access Level	Data Type	Description	Values
41014	1013 (3F5h)	Read-Only	32-bit	Software revision	byte 0=Build revision byte 1=Custom revision byte 2=Minor revision byte 3=Major revision
41016	1015 (3F7h)	Read-Only	32-bit	Available options	
41021	1020 (3FCh)	User	16-bit	Access request	0=Locked mode 1=User mode 2=Administrator mode 129=Change user password 130=Change administrator password
41022	1021 (3FDh)	Admin	10-register String	Password	Only the lower 8-bits are used on each register
				Device Specific Registers	
41501	1500 (5DCh)	User	16-bit	Operation delay	Valid values are 0 - 65535 msec
41502	1501(5DDh)	User	16-bit	Gas Matrix Calibration Select	0=Calibration curve 1 1=Calibration curve 2 2=Calibration curve 3 3=Calibration curve 4 4=Calibration curve 5 5=Calibration curve 6

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