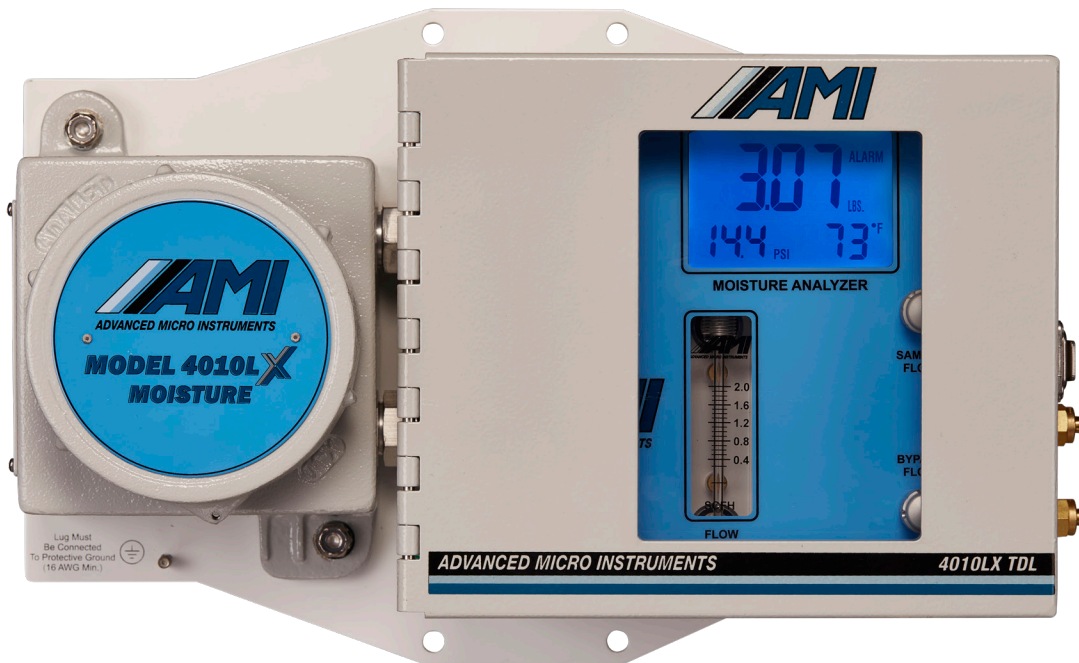




THE BARRACUDA

MODEL 4010LX

TUNABLE DIODE
LASER ABSORPTION SPECTROMETER



Operator Manual

Special Message from Advanced Micro Instruments® (AMI):

Thank you for purchasing this **BARRACUDA MODEL 4010LX** for your trace moisture measurement needs. It has a state-of-the-art design and is the industry's most advanced TDL Moisture Analyzer. You will find that this Analyzer will set a new bar for high performance, reliability and intuitive design.

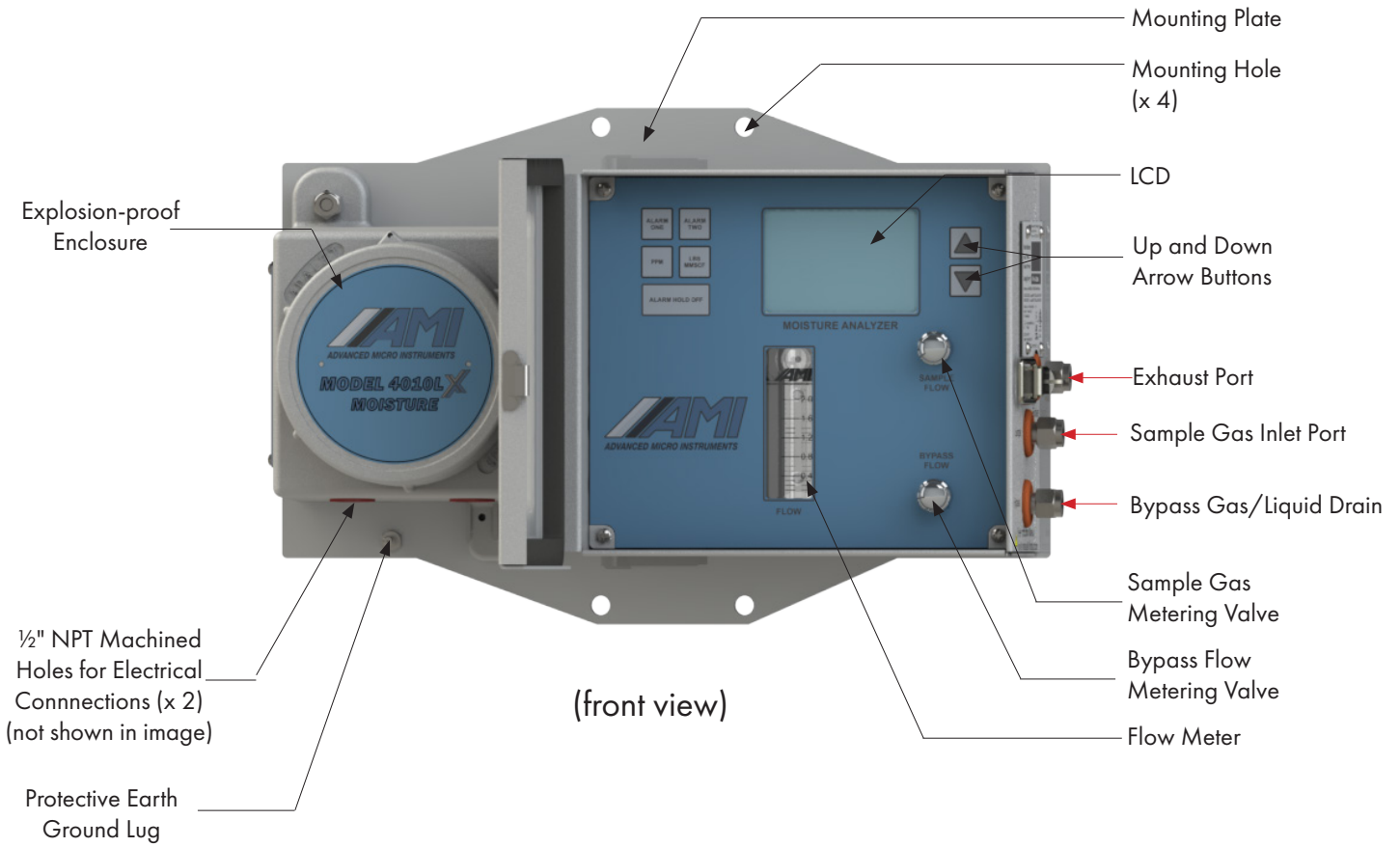
Note: Read this manual carefully prior to installation. Please take extra precautions against any potential leaks when installing and operating your **BARRACUDA MODEL 4010LX**.

If you have any questions, contact AMI at 714.848.5533 or www.amio2.com.

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ANALYZER OVERVIEW



(Note: No Customer Connections)

METHOD OF MEASUREMENT: WAVELENGTH-MODULATED TUNABLE DIODE LASER SPECTROSCOPY (WMTDL)

THE BARRACUA MODEL 4010LX utilizes a state-of-the-art, next generation technology called Wavelength-modulated Tunable Diode Laser Spectroscopy (WMTDL) for fast, accurate and highly reliable moisture measurements. This proven technology is based on the *Beer-Lambert Law*.

**TUNABLE DIODE LASER
ABSORPTION SPECTROSCOPY (TDLAS)**

The Beer-Lambert Law

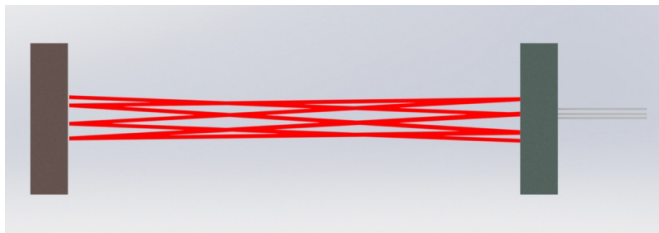
$$A = \log_{10} \frac{I_0}{I} = \epsilon l c$$

A = Absorbance
I₀ = Incident Laser Intensity
I = Laser Intensity transmitted through the Sample

Absorption Coefficient
Moisture Partial Pressure
Absorption Path Length (that the laser passes through)

The *Beer-Lambert Law* states that the amount of light absorbed by the natural gas sample is proportional to the amount of water vapor in the path of the laser. Hence, by measuring the amount of absorbed light and the total pressure, the concentration of moisture in a particular sample can be accurately determined.

HOW WMTDL WORKS



The measurement in a **MODEL 4010LX** is made by tuning the laser wavelength rapidly 2 times per second, back and forth, across the narrow absorption line for a single vibrational/rotational mode of a water molecule. The number of water vapor molecules in the path of the laser is determined by the ratio of the detected signal when the laser wavelength is on the absorption line to the signal when it is off the absorption line. Any variances in the laser intensity, laser detector gain, obstructions in the optical path or other changes are the same on and off the absorption line and will cancel out when the ratio is taken – thus, keeping the measurement stable (in calibration) if variances occur.

Over longer periods of time, the laser wavelength can drift. A standard feature of the **MODEL 4010LX** Moisture Analyzer is that it tracks the original location of the background methane absorption. Using AMI's **COMMAND CENTER Software**, the customers can easily check for any drift in the laser wavelength and, if necessary, correct it with a simple click of a button. (Learn more about this in the Command Center Software overview)

AMI FACTORY CONFIGURATION AND CALIBRATION

Every **MODEL 4010LX** Moisture Analyzer is rigorously tested and calibrated at the factory over the entire measurement, temperature, and pressure ranges, using NIST traceable gases and sophisticated mass flow controllers within a temperature chamber. The performance of the Analyzer during the 30+ hours of testing and calibration is validated, using NIST traceable master analyzers, which are further validated using chilled mirrors. The master calibration variables, which are specific to each analyzer, are permanently loaded into the Analyzer's firmware. During the validation, performance testing of all results across all temperatures must meet a 1% or better accuracy specification prior to passing.

FIELD PERFORMANCE VALIDATION

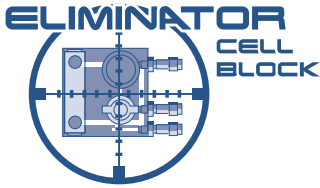
This factory calibration performed by AMI and the inherent stability of the ratio metric WMTDL measurement result in an Analyzer that will hold its calibration for many years. A customer may want to periodically verify the accuracy of the **MODEL 4010LX** using their own NIST traceable calibration gas, but it is important to follow AMI's specific steps so that errors are not introduced. You can read AMI's recommendations for field validation of a **MODEL 4010LX** in appendix A.



KEY INNOVATIONS

Advanced Micro Instruments has developed and patented key technologies that enable our devices to deliver the highest levels of **PERFORMANCE**, **RELIABILITY** and **EASE-OF-USE**. These technologies are included in **THE BARRACUDA MODEL 4010LX** and cannot be replicated by any other company.

ELIMINATOR CELL BLOCK

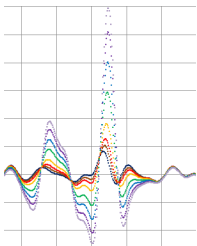


Our patented Cell Block Technology provides the next generation of innovation for a complete, very compact sample system that virtually eliminates all potential leak paths while optimizing flow efficiencies. The volume and distance the sample gas travels prior to entering the laser chamber has been dramatically reduced.

All sample handling components, including the Herriott Cell, have been machined from a series of solid compact blocks with precision-drilled intersecting passages in place of long lengths of tubing and compression fittings. Additionally, metering valves, pressure sensor and flowmeter are all directly integrated into the machined blocks.

Finally, the **ELIMINATOR CELL BLOCK** features a unique liquid rejection/particulate membrane that is sealed between cell blocks. As a result, all liquids and particulate are effectively exhausted through the bypass without ever reaching the optical components.

MEASUREMENT ALGORITHM AND SMART CALIBRATION



THE BARRACUDA MODEL 4010LX is programmed with a proprietary measurement algorithm to carry out trace moisture measurements. Not only will **THE BARRACUDA** complete multiple scans every second for the signature H_2O peak and CH_4 (methane) peak, its algorithm contains a compensation function to account for pressure and temperature. This ensures maximum stability and accuracy regardless of the methane levels.

A **Smart Calibration** feature is also enabled on **THE BARRACUDA**. Over time, laser-based Moisture Analyzers eventually see a gradual movement of their signature peaks on the x-axis of the measurement waveform. **THE BARRACUDA MODEL 4010LX** can easily realign the laser to the critical H_2O peak and CH_4 peak through the touch of a button.










COMMAND CENTER INTERFACE SOFTWARE



This powerful software platform comes standard with every **MODEL 4010LX** purchase and provides users with access to a full suite of advanced features, including:

- Settings & logic adjustments for 2-fully independent Alarm Relay Contacts
- Security settings to prevent unauthorized adjustments to the Analyzer via the front panel
- Changing the analog outputs from 4 –20 mA to 1–5 VDC or vice versa
- Datalogger that records measurement readings, temperature of the Cell Block, gas pressure, brown-outs and power voltage over a period of 15 days @1-min intervals (data can be displayed on a graph or in tabular format)
- Error Status Display that alerts users to any error(s) detected by the Analyzer
- Communication with the Analyzer via USB Virtual COMport and Modbus bi-directional RS485 Communication

SYMBOL TABLE

	WARNING - RISK OF DANGER OR HARM TO THE USER or RISK OF DAMAGE TO THE PRODUCT. Consult the operator manual.		RISK OF SHOCK (DC)
	Relay		RISK OF SHOCK (AC)
	Earth Ground		Protective Ground
	DC (Direct Current)		AC (Alternating Current)
	Frame Chassis Terminal		

SAFETY, WARNINGS & CAUTIONS

A **WARNING** identifies conditions or procedures that can be dangerous to the user.

A **CAUTION** identifies conditions or procedures that can cause damage to the Product.

WARNING

Make sure no hazardous gas is present in the area before and during installation.

Violation of the National Electrical Code requirements (especially Article 500 that deals with hazardous areas) may cause a fire or explosion with the potential for serious injury or loss of life.

WARNING

Drilling any holes in the enclosure will violate the safety approval and may create risk of harm.

WARNING

Due to non-conductive surfaces, there exists a POTENTIAL ELECTROSTATIC CHARGING HAZARD.

EN RAISON DE SURFACES NON CONDUCTRICES, IL EXISTE UN RISQUE POTENTIEL DE CHARGE ELECTROSTATIQUE

 **WARNING**

You must follow the National Electrical Code (NEC) in your installation. Consult the NEC Handbook for the correct guidelines and standards.

Class I, Div 1 areas must use rigid conduit with seal-offs.

Class I, Div. 2 areas can use flexible conduit with seal-offs.

The Analyzer has approval for Class I, Division 1, Groups B,C,D. To comply with these requirements, you need to assure the following:

- The Protective Earth Ground Lug on the front lower left of the Analyzer mounting bracket must be connected to the High Quality Protective Earth Ground using a 16-gauge wire. Please refer to the image on page 2 of the front view of the Analyzer for the location of the Protective Earth Ground Lug

 **WARNING**

The following power requirements must be met by the installer of the DC/AC power connections to the Analyzer:

- You must include an electrical disconnect means and a current limiting device, such as a switch and fuse. The disconnect device must be marked as a 'disconnect device' and readily accessible to shut off power to the Analyzer. This will allow the Analyzer to be quickly shut-off in case of an emergency. The disconnect and current limiting device must be housed in an enclosure rated for the area classification. Conduit seals may be required on the enclosure, depending on the area classification.

DC-powered version

Use a 1.0-Amp fuse disconnect.

AC-powered version

Use a 0.50-Amp fuse disconnect.

The voltage rating for the AC Analyzer is 100 to 240VAC at 50/60Hz \pm 10%.

AC voltages outside this may cause the Analyzer to malfunction.

 **WARNING**

Enclosure materials contain a light metal content of over 10% Aluminum and pose a potential impact spark ignition hazard. The end user shall carry out a risk assessment prior to installation in an EPL Ga environment and shall only install the equipment where the risk of impact has been considered to be negligible.

Les matériaux de boîtier contiennent une teneur en métaux légers de plus de 10% d'aluminium et constituent un risque potentiel d'inflammation. L'utilisateur final doit procéder à une évaluation des risques avant de l'installer dans un environnement EPL Ga et ne doit installer le matériel que dans les cas où le risque d'impact a été considéré comme négligeable.

 **WARNING**

A SEAL SHALL BE INSTALLED WITHIN 50 mm OF THE ENCLOSURE.

UN SCELEMENT DOIT ETRE INSTALLE A MOINS DE 50 mm DU BOITIER.

 **WARNING**

SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY.

LE REMPLACEMENT DE COMPOSANTS PEUT COMPROMETTRE LA SECURITE INTRINSEQUE.

 **CAUTION**

The voltage rating of the DC Analyzer is 10–28V.

- DC input has to be an approved Class 2 or limited energy circuit for DC power
- Voltages outside this range may cause the Analyzer to malfunction.

The voltage rating of the AC Analyzer is 100 to 240VAC at 50/60Hz \pm 10%.

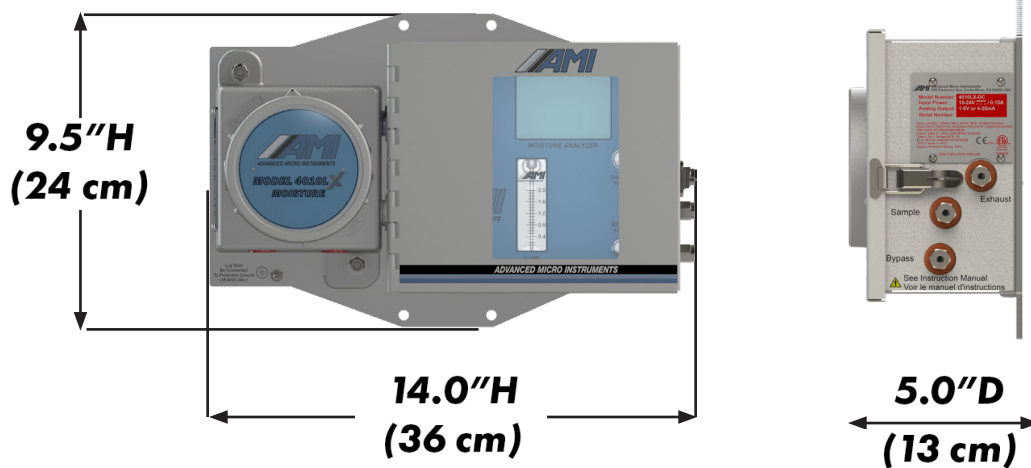
- Any AC voltages outside this range may cause the Analyzer to malfunction

Any use of this equipment in a manner not specified in this manual or approved AMI documentation may impair the protection provided by the equipment.

Toute utilisation de cet équipement d'une manière non spécifiée dans ce manuel ou dans la documentation AMI approuvée peut altérer la protection fournie par l'équipement.

ANALYZER INSTALLATION

Part I: Mounting the Analyzer



note: Analyzer weighs 17.0 lbs (7.7 kg)

Key Points

- The Analyzer can be mounted either indoors or outdoors, where the ambient temperature remains between 20°F (-6.7°C) and 149°F (65°C)
- For installation, where temperature drops down to 10°F (-12°C), order a **MODEL 4010LX with the factory-installed EXTREME WEATHER ENCLOSURE**



- When using a solar panel to power the Analyzer, we recommend mounting the solar panel just above the Analyzer, using the same mast, to serve as a sunshield



WARNING:

For both DC and AC models, do not use above 3,200 m (10,500 ft).



WARNING:

The Analyzer weighs 17.0 lbs (7.7 kg) and can pose a risk to the user if dropped.

STEPS

1. Determine a convenient location to place the Analyzer. The location should ideally be eye-level.
2. Mount the Analyzer to a wall or bulkhead using the 4 mounting holes or to a 2-inch (5 cm) pipe using 1/4" x 2" U-brackets with 1/4 nuts.

Note: Equipment shall only be installed and operated in the upright orientation with the mounting plate vertical.

Part II: Electrical Connections for the Analyzer

Key Points:

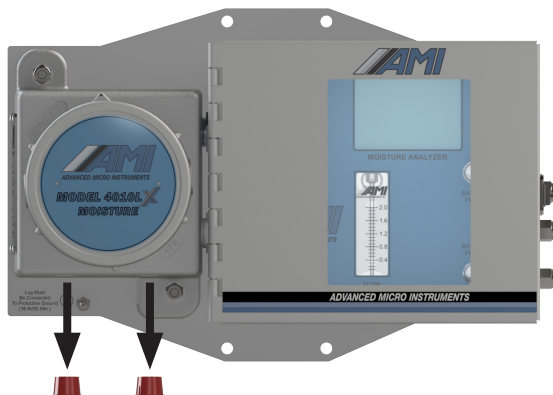
- Verify your rated power supply matches the operating voltage of your Analyzer before you begin
- **THE MODEL 4010LX** is available with either AC or DC Power (you must request your desired power at the time of your purchase)

Note: Refer to page 60 for the power requirements of your Analyzer

Note: Both alarm relays are rated for 5A @ 115VAC or 24VDC

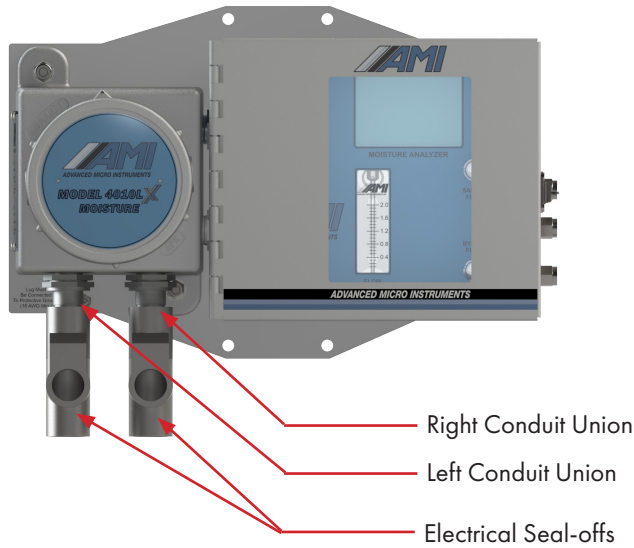
- Your Analyzer has an isolated active analog output that can be configured as either a 1–5 VDC or 4–20mA output. It has been setup at the factory per your analog output requirements at the time of purchase. However, this can be easily changed in the field by following the instructions CHANGING ANALOG OUTPUTS on page 28.

STEPS

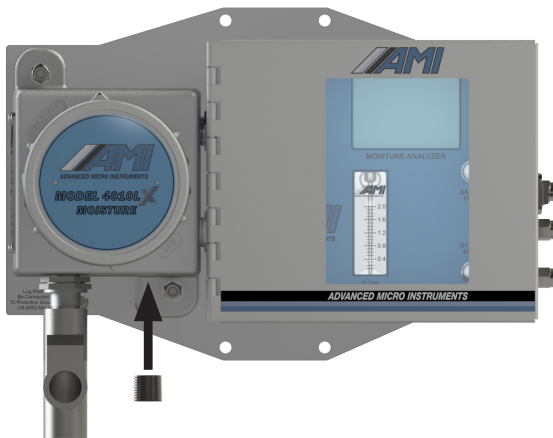


1. Remove the two red plastic protective caps from the ½" NPT conduit holes on the explosion-proof side of the Analyzer. These plastic caps protect the threads of the unit during shipping.
- We provide 2 (two) separate ½" NPT conduit holes to accommodate all electrical connections. The first conduit opening should be used for power and alarm relay connections. The second is for analog output and RS485 connections

Note: AC Power and the opening and closing of alarm relays produce both electrical noise and large inductive spikes that can have an undesirable effect on the measurement readings. This is why we provide two conduit openings and strongly recommend separating the sensitive analog signal wiring from the power and relay wiring.



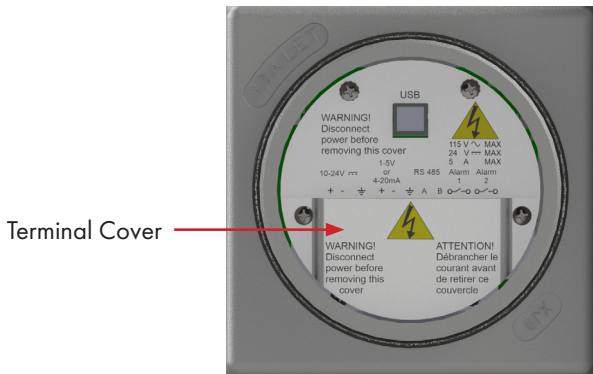
2. Install the conduit unions between the explosion-proof housing of the Analyzer and the electrical seal-off. **DO NOT** fill the electrical seal-offs yet.
- In order to meet electrical codes for Class 1, Div 1 and Class 1, Div 2, Groups B,C,D, you must use electrical seal-offs in your installation
 - We recommend that you install conduit unions between the explosion-proof housing of the Analyzer and the seal-offs. This will prove very useful in the event that you have to remove the Analyzer for servicing, without cutting wires



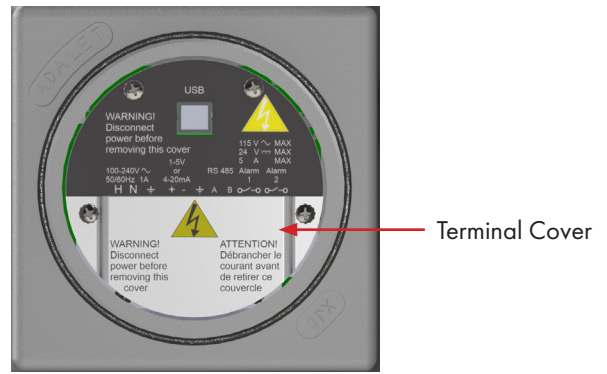
WARNING:

If you are using DC Power and intend on using the analog output only feature (which is the same as using 'NO RELAYS'), you can safely run both DC Power and Analog Output Signal in a single conduit. However, you must install an approved 1/2" NPT plug for hazardous locations in the unused 1/2" NPT port.

FAILURE TO DO SO WILL VIOLATE ALL SAFETY REQUIREMENTS AND POTENTIALLY RESULT IN AN EXPLOSION!



DC Version with Terminal Cover and white information panel



AC Version with Terminal Cover and black information panel

3. Remove the explosion-proof cover by rotating it counterclockwise.

Note: A white sheet metal panel inside the explosion-proof housing indicates the Analyzer has been built for use with DC power, while a black sheet metal panel indicates AC power.

4. Then remove the Terminal Cover to access the electrical connections.
5. Verify the operating voltage of your Analyzer and the correct power requirements before you continue.
6. Make sure the power source has been turned-off before you begin installing wiring.

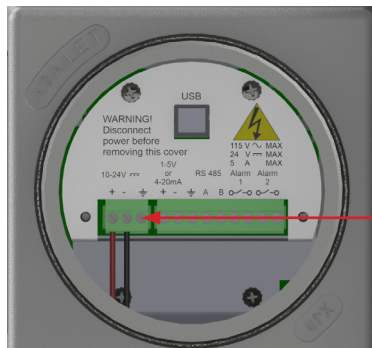


- The green terminal block connectors are combination connectors, which allows you to unplug the connector during the wiring process. Combination connectors can accommodate 12–24 AWG wire sizes for your electrical connections

IMPORTANT: When attaching wiring to the green terminal connectors, use either solid wire or stranded wire with wire ferrule(s) attached. Verify no loose strands are visible after installation of wire ferrule(s).

1st CONDUIT (POWER & ALARMS):

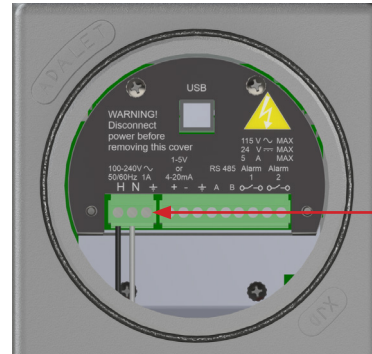
For DC Power:



Shield Earth Ground Terminal Connection

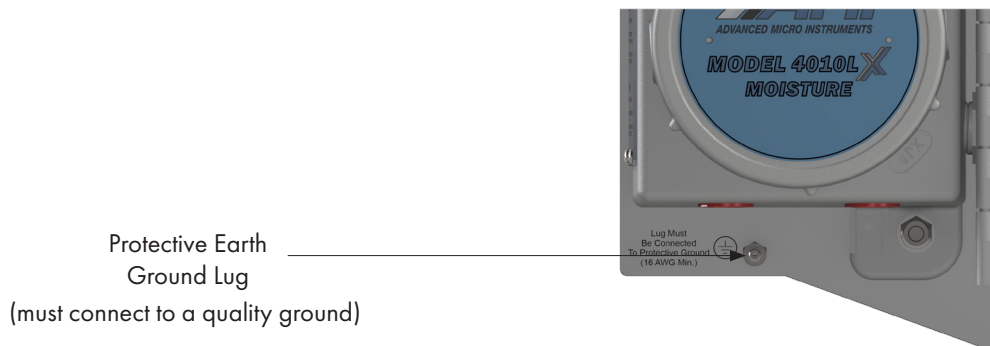
7. Connect the DC power wires to the appropriate terminals on the left.
- The + positive and - negative are clearly marked on the sheet metal cover
 - If you decide to use a 2-wire cable with shield for the power supply connection, AMI provides quality Shield Earth Ground Terminal Connection next to the + positive and - negative terminals

For AC Power:



AC Power Ground Terminal Connection (A)

7. Connect the AC power wires to the appropriate terminals on the left. The wire designations are clearly marked on the black metal cover.
- H is for the Hot Wire
 - N is for the Neutral Wire
 - Position (A), as shown above, is for the AC Power Ground



Protective Earth Ground Lug

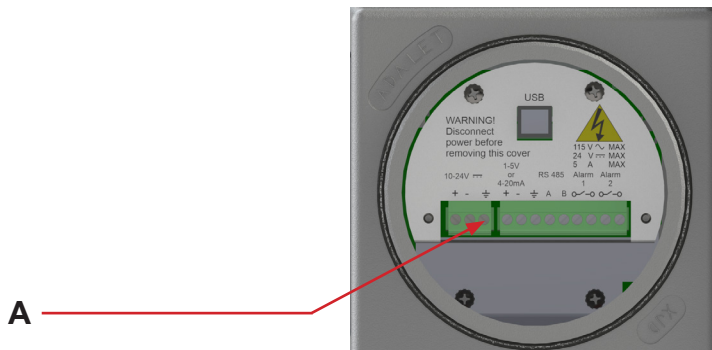
(must connect to a quality ground)

! WARNING:

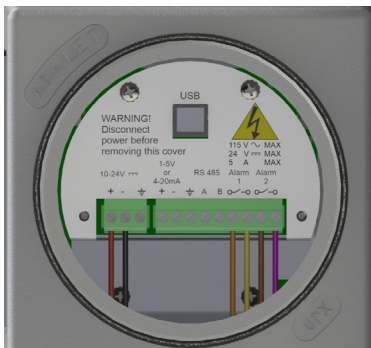
Analyzer must be connected to a Quality Protective Earth Ground for safety and the highest level of RFI protection. This is accomplished by connecting an 16-gauge wire from the Analyzer's Protective Earth Grounding Lug to an 8 foot ground rod or equivalent quality ground. (The Protective Grounding Lug is located just below the explosion-proof housing as seen in the image above)

! WARNING:

When using a AC power, never rely on the AC Power Ground as a source for Analyzer safety or ground protection. Always connect the Protective Earth Ground Lug, shown above, to a high quality ground, such as an 8 foot ground rod or equivalent.



RECOMMENDED: WHEN USING DC POWER, USE A SHIELDED-TWISTED PAIR CABLE AND CONNECT THE CABLE SHIELD TO THE SHIELD EARTH GROUND TERMINAL SHOWN IN POSITION 'A' OF THE ILLUSTRATION ABOVE. DO NOT CONNECT THE OTHER END OF THE SHIELD WIRE AS IT WILL CAUSE UNDESIRABLE GROUND LOOPS!

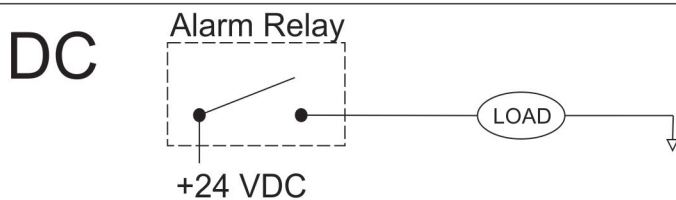
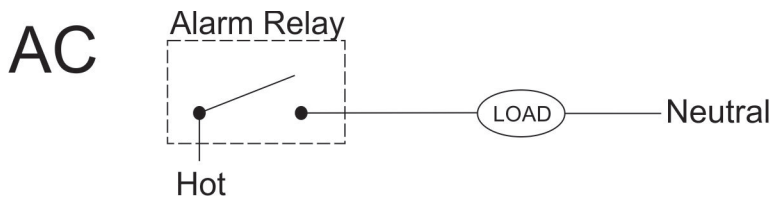


(DC Power Version is shown for alarm wiring. The AC version will be identical for alarms, analog output and RS-485 connections.)

- Connect the wires for the two fully adjustable alarm contact relays to their proper terminals.

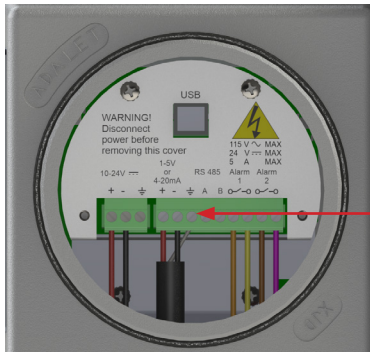
Note: Both alarm relays are rated for 5A @ 115VAC or 24VDC.

IMPORTANT: IF YOU DESIRE TO USE THE ALARM CONTACT RELAYS, THE ALARM WIRES MUST BE PULLED THROUGH THE SAME CONDUIT AS THE SUPPLY POWER.



IMPORTANT: The relay contacts act like a simple switch breaking only a single leg of the circuit. In keeping with good electrical practices while wiring the alarm contacts, We suggest **SWITCH/BREAK THE HOT LEG only, NOT THE GROUND LEG OF YOUR CIRCUIT.**

2nd CONDUIT (ANALOG OUTPUTS & RS485 COMMUNICATION):



(DC Power Version is shown. Instructions are the same for the AC Power Version)

Analog Output is self-powered (Active) and is connected using a twisted 2-conductor wire with shield

NOTE: Always use a twisted 2-conductor cable with shield. **Never connect both ends of the shield to both devices (Analyzer and other device) as it will cause ground loops.** Connect the analog output shield to the shield earth ground shown above.

Never apply external power to the analog output connections, the analyzer sources power to the analog output and is a self-powered (Active) type. The analyzer may be damaged if any other equipment provides power to any of the 3 terminals on the analog output. Any attached equipment or devices are to be setup and configured as passive resistive loads such that **ONLY** the AMI analyzer is providing power to the analog output.

A load of the proper range is required. The load attached to the analog output must be within the allowed load range. The load allowed is different for 1-5V and 4-20mA. If the load is out of range the analog output may partially or fully shutdown and typically results in a lower signal or measurement than expected. When overloaded, output calibration may be difficult or impossible to calibrate. To reset an overloaded analog output, the load must be corrected to the proper range. The isolated analog output driver will typically self-reset when the load is corrected but in extreme cases the analyzer will need to be reset (power cycled).

The attached load must account for all components, not just a terminating resistor. The total attached load (resistance) is the combined load of the wiring, the internal load of the external device, and any additional load attached to the external device.

Best performance is achieved when the analyzer analog output is calibrated to the load — see CHANGING ANALOG OUTPUTS page 27.

4-20mA: Verify total load resistance is between 0.5 to 600 ohm. When configured as a current output, common loads used are 100 to 250 ohm, where a 250 ohm load is useful for converting a 4-20mA signal to 1-5V for troubleshooting. A load resistance of 0.5 ohm is supported so the output can be verified with a hand held current meter. The analyzer powers the current loop with a maximum of 15-16V depending on temperature and load.

1-5V: Verify total load resistance is between 10k to >1Mohm. When configured as a voltage output, common loads are in the 100k to 1M ohm range. The output can be verified with a hand held multimeter. Loads with a resistance less than 10k ohm are not supported and the analyzer output may be overloaded delivering up to 8mA for a short time and **then partially or completely shut the output down** to protect the analog output.



(DC Power Version is shown. Instructions are the same for the AC Power Version)

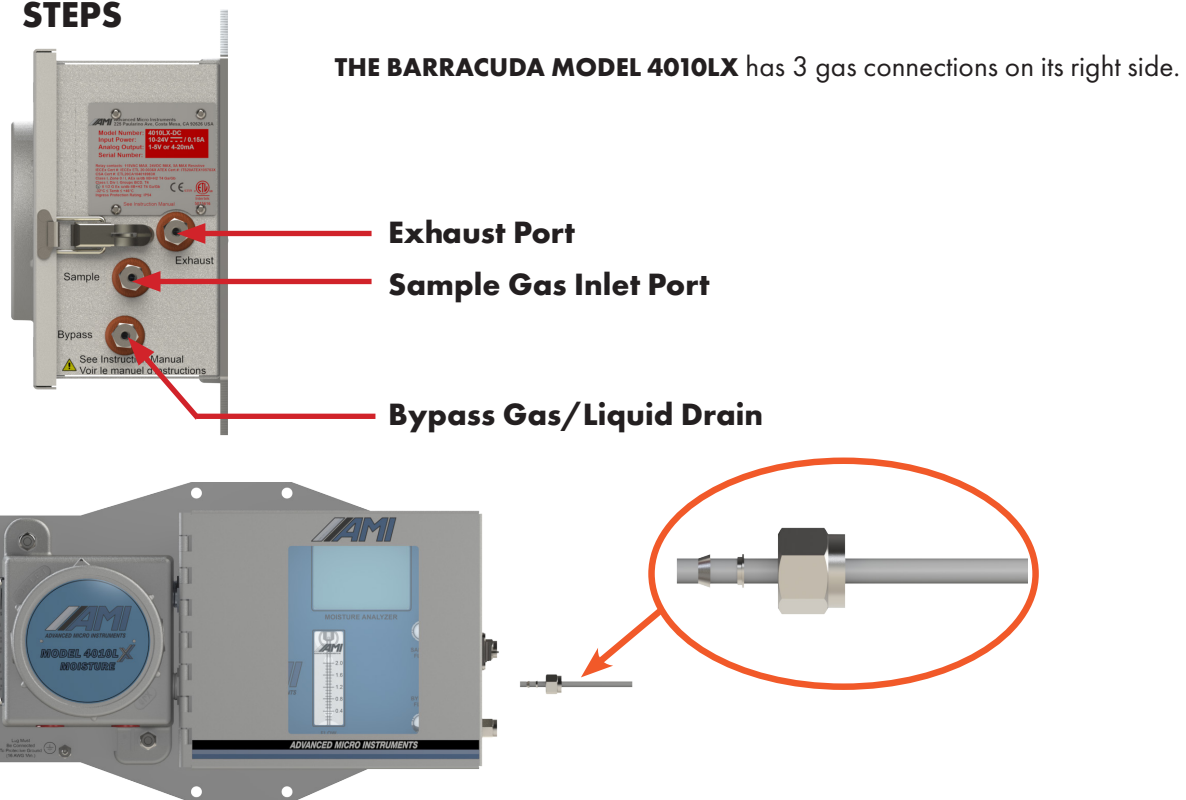
9. Last, connect the wires for RS485 communication to their proper terminals.
 10. Verify all electrical connections and then turn on the source of power. The Analyzer will power-up and the LCD will blink for a few seconds during power-up. You may see some LEDs blinking within the explosion-proof housing and NEMA 4X box as this is normal during operation.
 11. Once you have tested all electrical functions, pour approved potting compound into the electrical seal-offs.
-

Part III: Gas Connections

Key Points:

- All gas connections will require using the supplied ferrule set, ¼" stainless steel compression fittings and customer-supplied ¼" stainless steel tubing
- Sample Gas Inlet Pressure to the Analyzer should be regulated down to the range of 1.0 to 20.0 psig (0.07–1.4 bar), depending on line pressure
- **THE BARRACUDA MODEL 4010LX** comes internally equipped with a complete Sample System, including a Liquid Separator that effectively removes liquids and particulates
- However, it is highly recommended that you install a regulated Insertion Gas Probe with Filter Feature into the pipeline at the Sample Point. An Insertion Probe dramatically reduces pipeline liquids, condensation and particulates from reaching both the Sample Gas Line and Moisture Analyzer
- **We recommend the Genie® 755 Direct Drive Probe™ (offered by A+ Corporation) or equivalent product**

STEPS

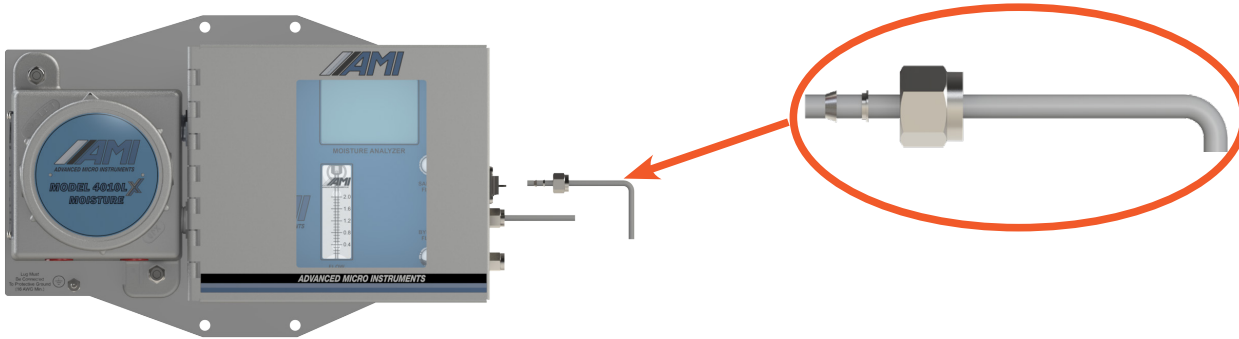


Sample Gas Connection

1. Take a deburred length of ¼" stainless steel tubing and slip it through the supplied compression nut and ferrule set. Confirm that the ferrule properly orientated at one end, and connect it to the SAMPLE GAS INLET PORT.

Make sure the ¼" stainless steel tubing slips all the way into the compression fitting until it bottoms out. Tighten the compression nut with 1 & ¼ turns.

2. Connect the other end to the pipeline gas tap or pressure reducing regulator.



Exhaust Gas Connection

3. Take another deburred length of ¼" stainless steel tubing and slip it through the supplied compression nut and ferrule set. Confirm that the ferrule set is properly oriented and then connect to the EXHAUST PORT.

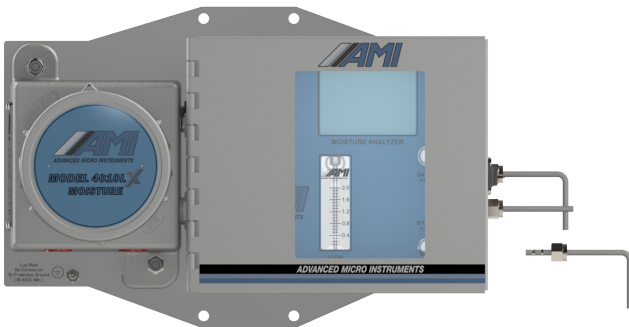
Make sure the ¼ stainless steel tubing slips all the way into the compression fitting until it bottoms out. Tighten the compression nut with 1 & ¼ turns.

4. Run the other open end of the ¼" stainless steel tubing to a safe vented area outside of the meter building.



CAUTION

The EXHAUST LINE must run slightly downhill the entire way to a safe area to allow any condensate to drain outside and not back into the Analyzer. If you must run the EXHAUST LINE vertically through the ceiling, install a 'knock-out' pot to capture the liquid condensate just prior to going vertical. This will prevent condensate from running back into the Analyzer.



Bypass Gas Connection

5. Take the final deburred length of ¼" stainless steel tubing and slip it through the supplied compression nut and ferrule set. Confirm that the ferrule set is properly oriented and then connect to the BYPASS/DRAIN PORT.

Make sure the ¼ stainless steel tubing slips all the way into the compression fitting until it bottoms out. Tighten the compression nut with 1 & ¼ turns.

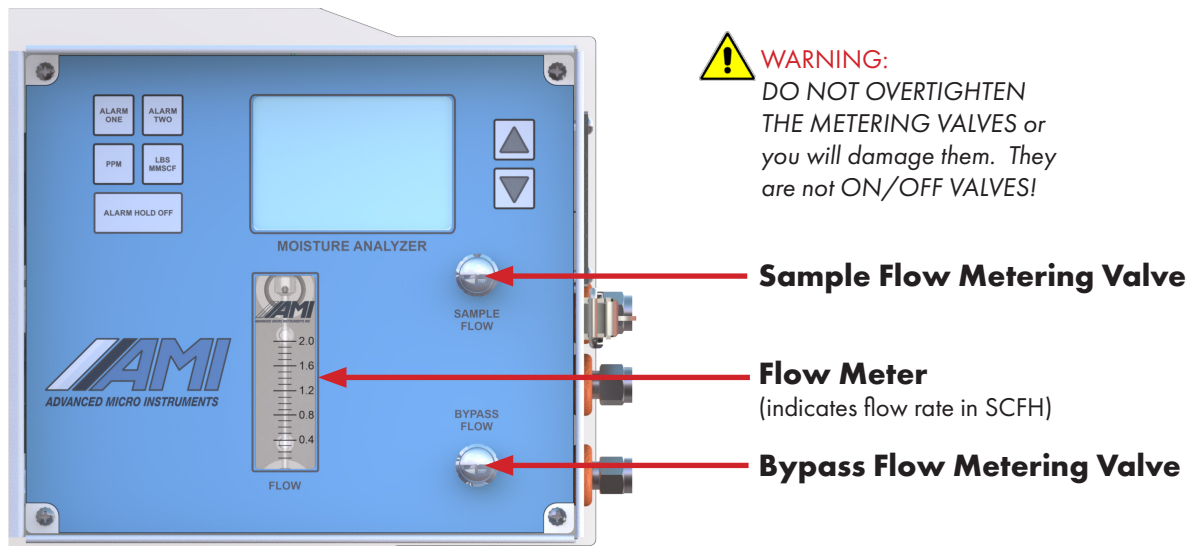
6. Run the other open end of the ¼" stainless steel tubing to a safe vented area outside of the meter building.



CAUTION

Run the Bypass Line to the outside of the Meter Building in a downhill direction all the way to a safe location. This will prevent water traps from forming and later freezing in cold weather, creating a back pressure. A 24" H₂O column will create 1 lb of back pressure and cause readings to fluctuate. A 48" H₂O column will create 2 lbs of back pressure and cause readings to fluctuate even more.

INITIATION OF SAMPLE FLOW TO THE ANALYZER



WARNING:
DO NOT OVERTIGHTEN THE METERING VALVES or you will damage them. They are not ON/OFF VALVES!

Sample Flow Metering Valve

Flow Meter
(indicates flow rate in SCFH)

Bypass Flow Metering Valve

Sample Gas Flow Rate

This can be adjusted using the SAMPLE FLOW METERING VALVE Knob. To increase the Flow Rate, turn the Knob counterclockwise. To decrease, clockwise.

Bypass Gas Flow Rate

This can be adjusted using the BYPASS FLOW METERING VALVE Knob. To increase the Flow Rate, turn the Knob counterclockwise. To decrease, turn clockwise.

STEPS

Note: SCFH = standard cubic feet per hour

1. Turn the SAMPLE FLOW METERING VALVE to the full clockwise position to the Off Position. Do not overtighten it! Turn until finger tight only.
2. Turn the BYPASS FLOW METERING VALVE to the full clockwise position to the Off Position. Do not overtighten it! Turn until finger tight only.
3. Apply a gas pressure of approximately 20 psig (1.4 bar) and leak test check all fittings back to the Sample Tap while looking for tiny bubbles (We recommend using SNOOP®). *DO NOT USE the spray bottle as this technique produces bubbles and does not achieve the best results.*
4. Once the installation has passed the Leak Test, slowly turn the SAMPLE FLOW METERING VALVE Knob counterclockwise until the Flow Meter reads approximately 1.0 SCFH (0.5 Lpm).
5. Now open the BYPASS METERING VALVE by turning the Knob counterclockwise ½ a turn or temporarily using an external flowmeter, adjust the bypass flow for 1.0 SCFH. Then, remove the flowmeter and reattach the bypass tubing.

Note: AMI has chosen this technique since all bypass flow meters have a tendency to plug quickly due to the volume of liquids and particulates going through the bypass path.

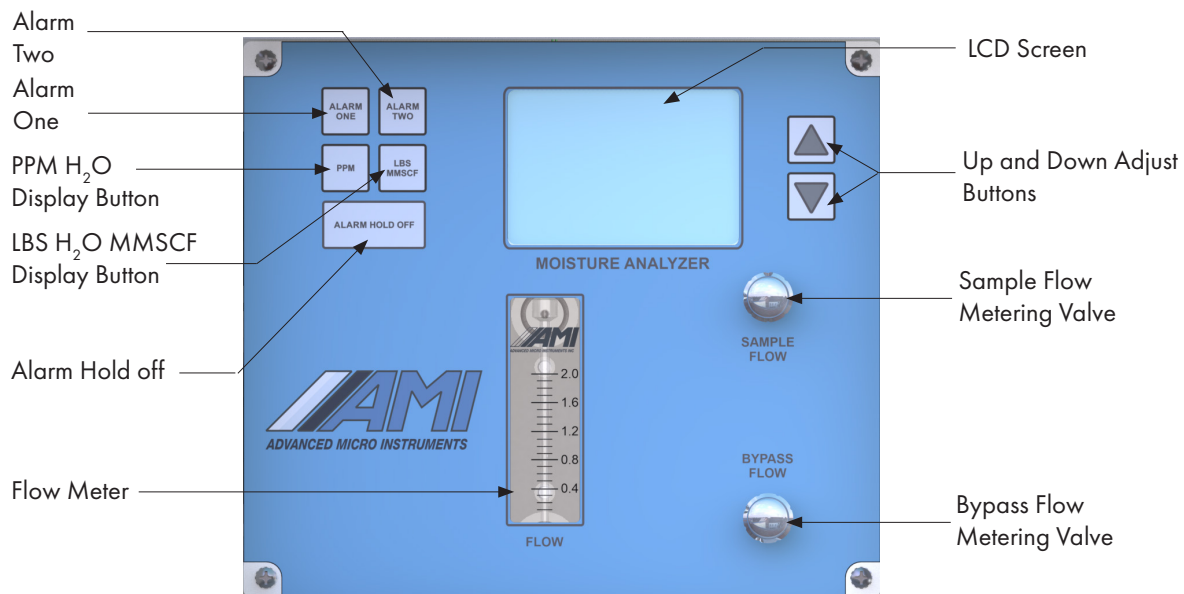
END OF INSTALLATION

CALIBRATION

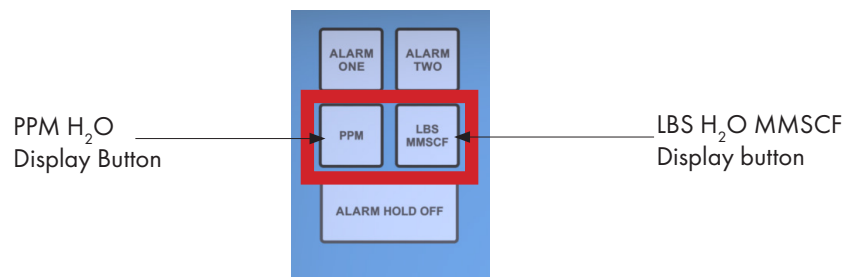
Unlike most gas sensing technologies, The **MODEL 4010LX** moisture analyzer does not require periodic calibrations. By design, there is no required method for field-calibrating a **4010LX**. Wavelength-modulated tunable diode laser (WMTDL) spectroscopy-based instruments, like the **4010LX**, are extremely stable and reliable.

ANALYZER OPERATION

Front Panel Interface

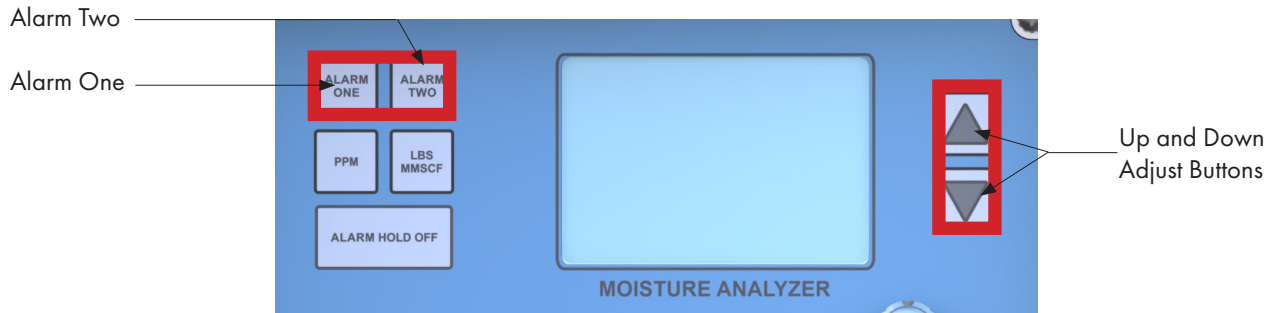


How to change the measurement units of the moisture readings displayed on the LCD screen?



Moisture readings on **THE BARRACUDA MODEL 4010LX** are shown in units of pounds per million standard cubic feet (lbs/mmscf) by default. To display in parts per million (ppm) by volume, press the PPM H₂O DISPLAY BUTTON. To display the moisture readings in lbs/mmscf, simply press the LBS H₂O MMSCF DISPLAY BUTTON.

How to set the Alarms on THE BARRACUDA MODEL 4010LX?



THE BARRACUDA MODEL 4010LX comes standard with two fully, adjustable independent alarms (ALARM ONE and ALARM TWO) that can be adjusted over **THE BARRACUDA**'s entire moisture measurement range.

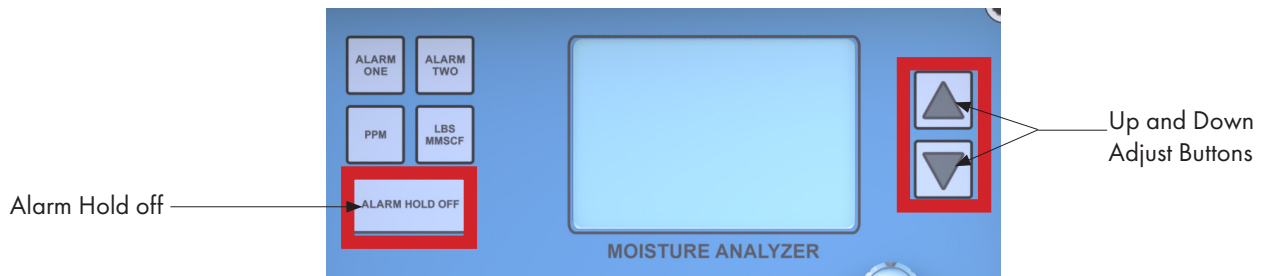
To set ALARM ONE, press the ALARM ONE Button and quickly release. The LCD alarm flag will blink, and within 3 seconds, press either the UP or DOWN buttons to set your alarm setpoint. Once pressed, just hold the button until you reach your desired alarm setpoint. The longer you hold, the faster the alarm setpoint adjusts. If no buttons are pressed within 3 seconds, the Analyzer will revert to measurement mode.

If you make a mistake at any time, simply let go of the button for 3-4 seconds, and the LCD will return to measurement mode. Then try again.

To set ALARM TWO, repeat the same steps as used in ALARM ONE.

*Note: If you want to adjust any other alarm settings, you must do so through the **COMMAND CENTER**.*

How to set the Alarm Hold Off ?



Press the ALARM HOLD OFF button, and the Alarm Hold Number will appear. And within 3-4 seconds, push either the UP or DOWN Button to adjust the duration of your ALARM HOLD OFF. The ALARM HOLD OFF can be engaged from 0 to 120 minutes.

After the time for setting the ALARM HOLD OFF expires, both Alarms and the Analog Output will revert to measurement mode.

ADDITIONAL NOTES:

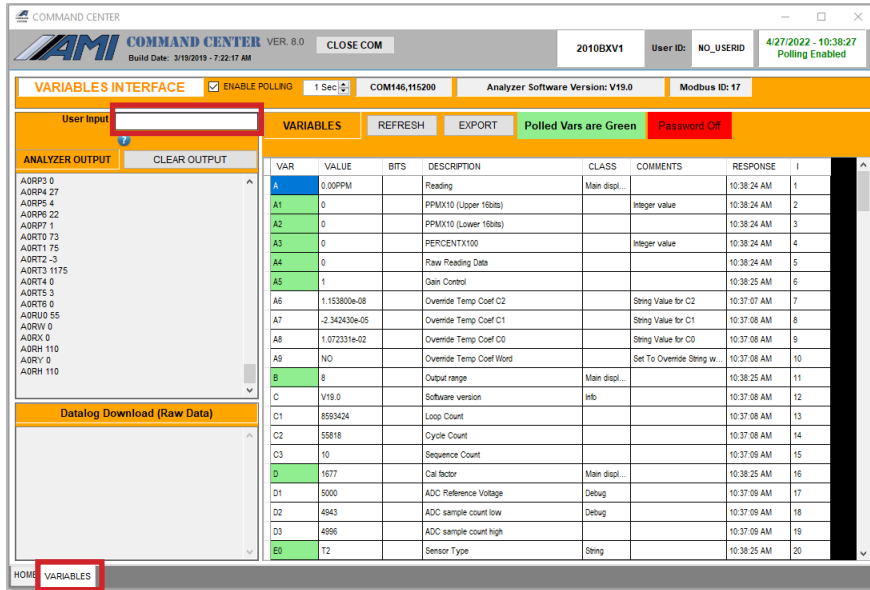
If you need more time for the setup, simply push the ALARM HOLD OFF Button again, and it will automatically reset to the adjusted Hold Off Time.

If you complete the calibration task quicker than expected and want the Alarms and Analog Output to become functional immediately, you can simply run the Hold Off Time to zero by pushing the Hold Off Button until the LCD blinks and then pushing the DOWN ARROW until the LCD shows zero.

Changing Display to Metric Units

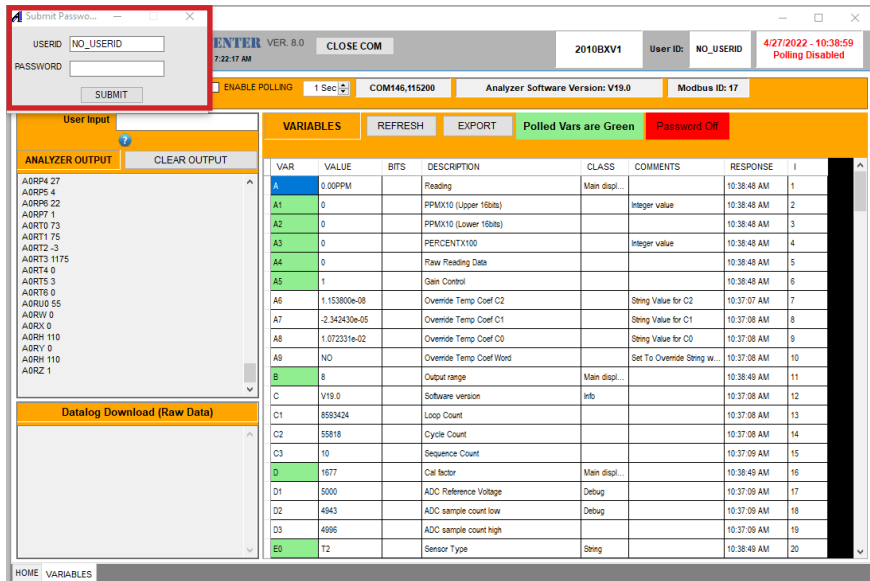
To change the units, the **COMMAND CENTER Software** needs to be installed on a laptop computer (see the **COMMAND CENTER Software Set-up Section** in this manual), and that computer needs to be connected to the Analyzer prior to proceeding.

This section will require a password. Contact AMI before proceeding with the instructions below.



Note: MODEL 2010BX Screenshots shown

- Click on the 'VARIABLES' Tab at the bottom left-hand window.
- Click the 'USER INPUT' Cell at the upper left-hand area of the window.



- Once the small SUBMIT PASSWORD window opens, enter the password that you received and press SUBMIT.

COMMAND CENTER VER. 8.0 CLOSE COM 2010BXV1 User ID: NO_USERID 4/27/2022 - 10:38:27 Polling Enabled

VARIABLES INTERFACE ENABLE POLLING 1 Sec COM146,115200 Analyzer Software Version: V19.0 Modbus ID: 17

User Input: [Empty] REFRESH EXPORT Polled Vars are Green Password Off

ANALYZER OUTPUT CLEAR OUTPUT

VAR	VALUE	BITS	DESCRIPTION	CLASS	COMMENTS	RESPONSE	I
A	0.00PPM		Reading	Main displ...		10:38:24 AM	1
A1	0		PPMX10 (Upper 16bits)		Integer value	10:38:24 AM	2
A2	0		PPMX10 (Lower 16bits)			10:38:24 AM	3
A3	0		PERCENTX100		Integer value	10:38:24 AM	4
A4	0		Raw Reading Data			10:38:24 AM	5
A5	1		Gain Control			10:38:25 AM	6
A6	1.153800e-08		Override Temp Coef C2		String Value for C2	10:37:07 AM	7
A7	-2.342430e-05		Override Temp Coef C1		String Value for C1	10:37:08 AM	8
A8	1.072331e-02		Override Temp Coef C0		String Value for C0	10:37:08 AM	9
A9	NO		Override Temp Coef Word		Set To Override String w...	10:37:08 AM	10
B	8		Output range	Main displ...		10:38:25 AM	11
C	V19.0		Software version	Info		10:37:08 AM	12
C1	8593424		Loop Count			10:37:08 AM	13
C2	55818		Cycle Count			10:37:08 AM	14
C3	10		Sequence Count			10:37:09 AM	15
D	1677		Cal factor	Main displ...		10:38:25 AM	16
D1	5000		ADC Reference Voltage	Debug		10:37:09 AM	17
D2	4943		ADC sample count low	Debug		10:37:09 AM	18
D3	4956		ADC sample count high			10:37:09 AM	19
E0	T2		Sensor Type	String		10:38:25 AM	20

HOME VARIABLES

- Uncheck ENABLE POLLING.
- Click CLEAR OUTPUT.

COMMAND CENTER VER. 8.0 CLOSE COM 2010BXV1 User ID: NO_USERID 4/27/2022 - 10:43:18 Polling Disabled

VARIABLES INTERFACE ENABLE POLLING 1 Sec COM146,115200 Analyzer Software Version: V19.0 Modbus ID: 17

User Input: CENTIGRADE REFRESH EXPORT Polled Vars are Green Password On

ANALYZER OUTPUT CLEAR OUTPUT

VAR	VALUE	BITS	DESCRIPTION	CLASS	COMMENTS	RESPONSE	I
A	0.00PPM		Reading	Main displ...		10:41:20 AM	1
A1	0		PPMX10 (Upper 16bits)		Integer value	10:41:20 AM	2
A2	0		PPMX10 (Lower 16bits)			10:41:20 AM	3
A3	0		PERCENTX100		Integer value	10:41:21 AM	4
A4	0		Raw Reading Data			10:41:21 AM	5
A5	1		Gain Control			10:41:21 AM	6
A6	1.153800e-08		Override Temp Coef C2		String Value for C2	10:37:07 AM	7
A7	-2.342430e-05		Override Temp Coef C1		String Value for C1	10:37:08 AM	8
A8	1.072331e-02		Override Temp Coef C0		String Value for C0	10:37:08 AM	9
A9	NO		Override Temp Coef Word		Set To Override String w...	10:37:08 AM	10
B	8		Output range	Main displ...		10:41:21 AM	11
C	V19.0		Software version	Info		10:37:08 AM	12
C1	8593424		Loop Count			10:37:08 AM	13
C2	55818		Cycle Count			10:37:08 AM	14
C3	10		Sequence Count			10:37:09 AM	15
D	1677		Cal factor	Main displ...		10:41:21 AM	16
D1	5000		ADC Reference Voltage	Debug		10:37:09 AM	17
D2	4943		ADC sample count low	Debug		10:37:09 AM	18
D3	4956		ADC sample count high			10:37:09 AM	19
E0	T2		Sensor Type	String		10:41:21 AM	20

HOME VARIABLES

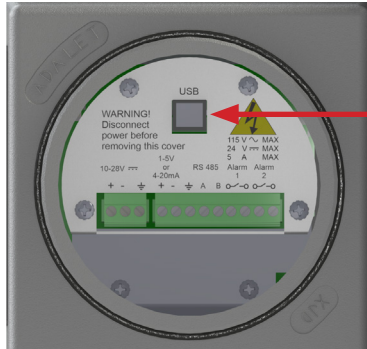
- Type 'CENTIGRADE' into the User Input area (shown above in the red box) and press RETURN. This will change BOTH Temperature to Celsius and Pressure to kPa.

Note: To return to Imperial Units, enter 'FAHRENHEIT' and press RETURN.

To access the more sophisticated features available on **MODEL 4010LX** requires installing the current version of the **COMMAND CENTER Software**.

COMMAND CENTER SOFTWARE SET-UP

Step 1: Remove the explosion-proof cover to access the USB Port (Type B) of the Analyzer

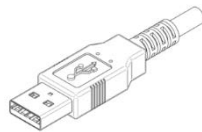


USB Port (Type B)

(DC Power Version is shown. Instructions are the same for the AC Power Version)

Step 2: Establish a Communication Link between your Laptop and the Analyzer

- a) Power up your Laptop and open the current version of the **COMMAND CENTER User Interface Software**.

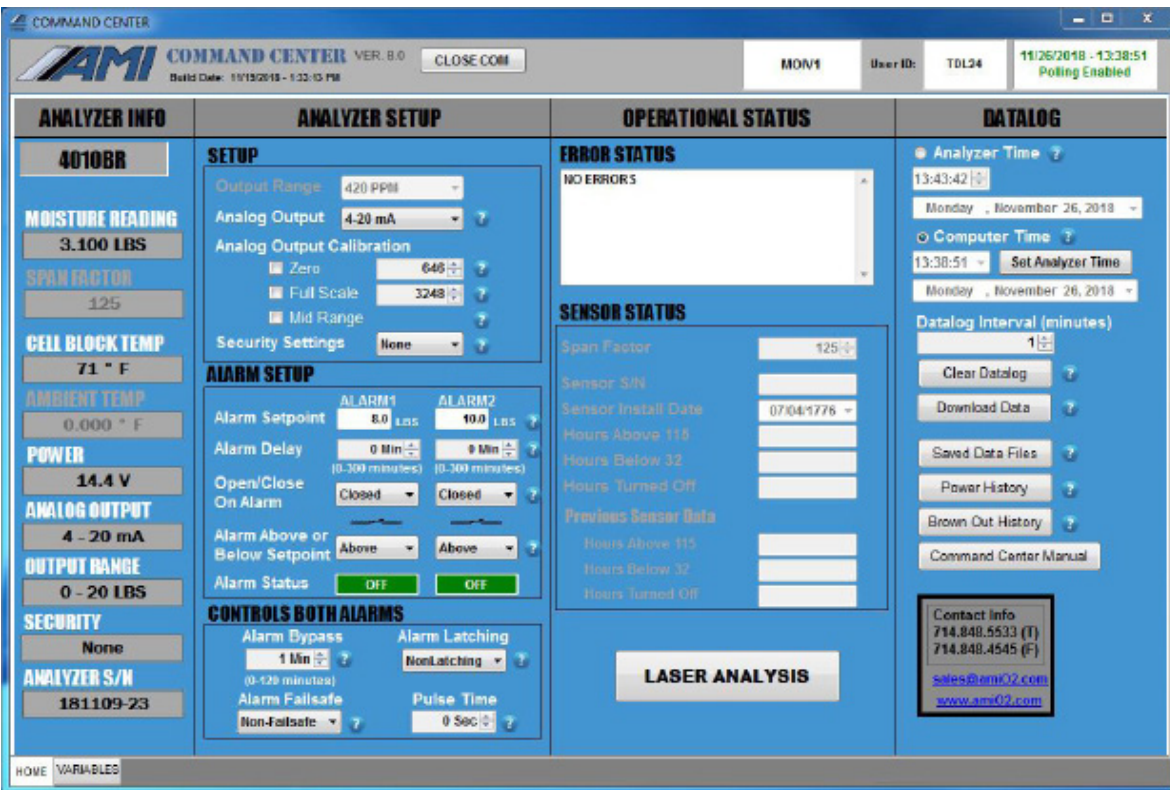


USB Type A Connector



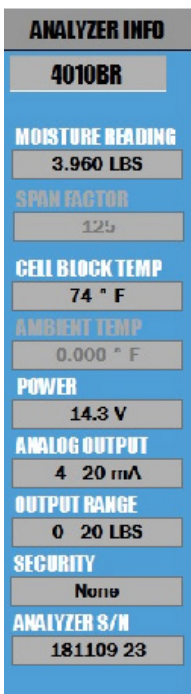
USB Type B Connector

- b) Using a USB cable with a Type A Connector on one end and a Type B Connector on the other, insert the Type A Connector into the USB port of your laptop and the Type B Connector into the USB port of the Analyzer on the Explosion-proof side.



Above: **COMMAND CENTER Software** window shown with settings for **MODEL 4010LX**

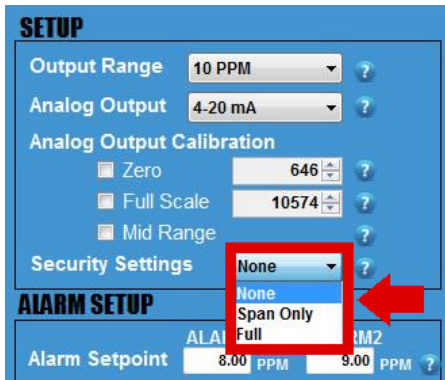
- c) Once the link is established, the software will automatically recognize the Analyzer and populate the Analyzer Info Column with information specific to your Analyzer.



View of the Left Status Column of the User Interface

- d) The Analyzer Info Column will display the following information about your Analyzer:
- Analyzer Model Number
 - Moisture Reading in either lbs or ppm, depending on your selection
 - Cell Block Temperature
 - Input Power, either AC or DC
 - Analog Output Setting (4-20mA or 1-5 VDC)
 - Output Range Selection
 - Security Selection
 - Analyzer Serial Number

Step 3: Selection of Options in Analyzer Setup Area & Syncing with EFM



a)

Set your desired SECURITY SETTINGS.
You have 2 options available to select from:

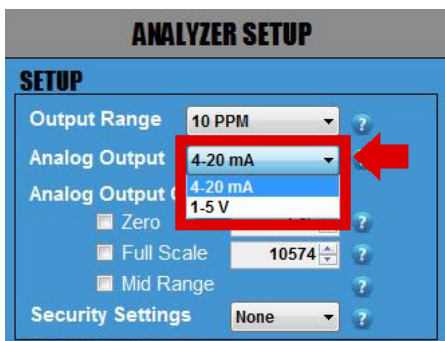
–NONE allows anyone to make changes to the Analyzer's settings using the front panel

–FULL **prevents** anyone from changing the Analyzer's settings using the front panel. However, you can still use the front panel to check the Analyzer's status values by pushing any of the buttons

(i.e., pressing the ALARM ONE Button displays the setpoint for ALARM ONE, pressing the ALARM TWO Button displays the setpoint for ALARM TWO, and so on)

While in the full security setting, once any front panel button is pushed, the LCD will flash FSEC as an indication of the security setting and then display status.

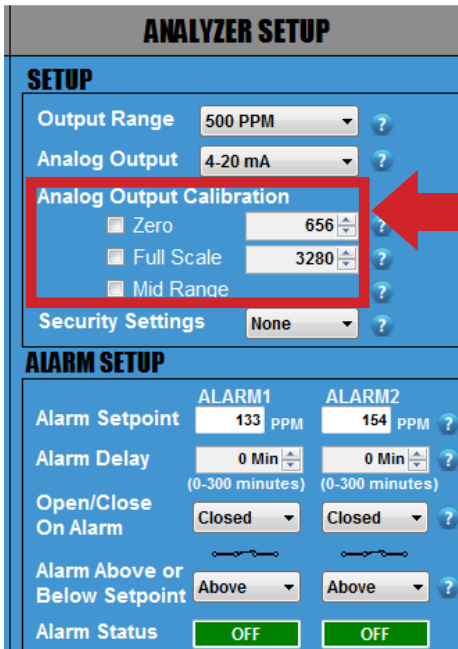
Note: To make setting adjustment in the COMMAND CENTER, the 'NONE' Security Setting must be selected.



b)

View ANALOG OUTPUT Setting.

This is set and calibrated at the factory per your order requirements prior to shipping. If you wish to change the analog output from 4–20mA or 1–5 VDC or vice versa, refer to the instructions CHANGING ANALOG OUTPUTS shown on page 27.



c) Sync your EFM (electronic flow meter) or similar device to your Analyzer. If this is the first time making the analog output connection to the analyzer or there are any issues with your connection, first complete the more detailed procedure in the next section CHANGING ANALOG OUTPUTS. Note the ZERO and FULL SCALE calibration limits described on page 29.

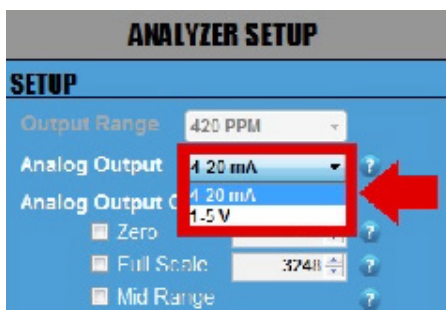
The following steps are critical because they will ensure that both devices display the same measurement readings and, thereby, prevent unnecessary confusion in the future.

1. By now, you have already wired your EFM or similar device to the Analyzer using the Analyzer's analog output terminals, see page 10.
2. Click on the small square box next to ZERO and the reading, and this will drive the analog output to exactly 4.00mA or 1.00VDC, depending on your selected output! Confirm that the reading on your EFM or similar device reads 0.00. If it does not, use the UP and DOWN ARROWS to the right of 'Zero' to adjust until the EFM or similar device now reads 0.00.

3. Once this is done, click on the square next to FULL SCALE, and this will drive the analog output to exactly 20.00mA or 5.00VDC, depending on your selected output.

Confirm that the reading on your EFM or similar device reads full scale. If it does not, use the UP and DOWN ARROWS to right of 'Full Scale' to adjust until the reading of the EFM or similar device reads FULL SCALE.

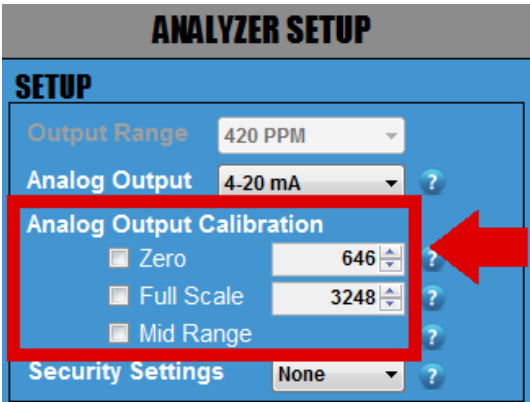
4. Repeat Step 2 (ZERO) and Step 3 (FULL SCALE) once more to confirm that both your EFM or similar device and the Analyzer are displaying the same readings.
5. Last, click on MID RANGE. This will check the linearity. There are no values to adjust as this is just a midpoint validation.



CHANGING ANALOG OUTPUTS (OPTIONAL)

d) Changing your ANALOG OUTPUT from 4–20mA to 1–5 VDC or vice versa. (Skip this step if you DO NOT want to change your ANALOG OUTPUT.)

Click on the drop down menu of ANALOG OUTPUT and select the output option that you wish to change to.



IMPORTANT

Whenever you change the ANALOG OUTPUT from 4–20mA to 1–5 VDC or vice versa, or significantly change the load, you will need to complete the following steps to verify your ANALOG OUTPUT. Remove any analog output wires from the Analyzer connection point!

1. Attach a multimeter to the Green Analog Out Terminal Connector of your Analyzer. Make sure your multimeter is set appropriately, either current for 4–20mA or voltage for 1–5 VDC .
2. Click on the square box next to ZERO to confirm that your multimeter is displaying either 4.00mA or 1.000VDC (the number of digits displayed on the screen will depend on the multimeter that you use). If the reading of the multimeter does not match the reading of the Analyzer, use the UP and DOWN ARROWS to the right of ZERO to adjust the values until the reading of the multimeter is either 4.00mA or 1.000VDC.
3. Once this is completed, click on the square box next to FULL SCALE to confirm that your multimeter is displaying either 20.00mA or 5.00VDC. If the reading of the multimeter does not match the reading of the Analyzer, use the UP and DOWN ARROWS to the right of FULL SCALE to adjust the values until the reading of the multimeter is now either 20.00mA or 5.00VDC .
4. Repeat Step 2 (ZERO) and Step 3 (FULL SCALE) again until you can confirm that your multimeter is displaying 4.00mA or 1.000VDC for ZERO and 20.00mA or 5VDC for FULL SCALE.
5. Click on MID RANGE. This will check the linearity. There are no values to adjust as this is just a midpoint validation.
6. Disconnect the multimeter from the analyzer and measure the wiring you are attaching to analog (+) and analog (-) and verify the load is supported. First, verify there is no voltage on these lines with your multimeter. Then, for a 4-20mA analog output, verify load is in the range 0.5 – 600 ohms. For 1-5VDC analog output, verify load is in the range 10k to >1Mohm.
7. Connect both the load and the multimeter to the analog (+) and analog (-) terminals as follows: For 1-5VDC the multimeter is connected and measures voltage across the terminals parallel to the load. For 4-20mA the multimeter is connected to measures current in series with the load. In Command Center, click on the square box next to ZERO and then FULL SCALE to verify the output into the load as shown on the multimeter. If there is an offset, repeat steps 2-4 to calibrate the analog output with the load attached.
8. Disconnect the multimeter from the system leaving the wiring attached to the analog output. Verify the reading in your attached device and If additional tuning is required continue calibrating any offset. This procedure is detailed in previous section SYNC YOUR EFM.

! CAUTION

The values of the analog output SPAN (FULL SCALE) and ZERO values must be set so that the analog output reflects the 1-5V or 4-20mA output during calibration.

ZERO value for 4mA or 1V output must be set between 500 to 700.

SPAN (FULL SCALE) value for 20mA or 5V output must be set between 3000 to 3500.

If these values are not set correctly, the analog output will not behave correctly.

Step 4: Alarm Logic & Setup

ALARM SETUP	
Alarm Setpoint	ALARM1: 7.0 LBS ALARM2: 10.0 LBS
Alarm Delay	ALARM1: 0 Min ALARM2: 0 Min
Open/Close On Alarm	ALARM1: Closed ALARM2: Closed
Alarm Above or Below Setpoint	ALARM1: Above ALARM2: Above
Alarm Status	ALARM1: OFF ALARM2: OFF

CONTROLS BOTHALARMS	
Alarm Bypass	1 Min
Alarm Latching	NonLatching
Alarm Failsafe	Non-Failsafe
Pulse Time	0 Sec

The Analyzer features 2 independent Moisture Concentration Alarms – one for ALARM 1 and one for ALARM 2. The settings for these alarms, including setpoints, relay contacts, close/open logic and alarm delays, are adjusted through the **COMMAND CENTER**.

It is important that you plan out how you want your ALARM LOGIC to work for each ALARM before you start adjusting the settings discussed in this section.

a) Set the ALARM SETPOINTS.

Enter your desired value for each setpoint and then press the ENTER key on your laptop. Keep in mind that your values cannot exceed the limit of the selected analog Output Range that you previously selected.

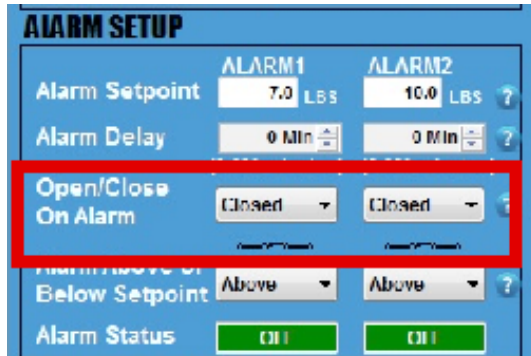
Both Alarms have a 1% hysteresis band that correlates with the measurement range.

b) Set the ALARM DELAYS.

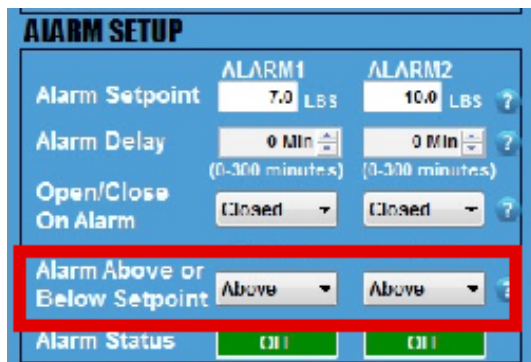
There are 2 ALARM DELAYS. Each ALARM DELAY setting is located beneath the corresponding ALARM that it controls.

Enter your desired time duration for each ALARM DELAY and press the ENTER key on your laptop. You can also adjust using the UP and DOWN ARROWS. The range is from 0 to 300 minutes.

*This feature is especially helpful at custody transfer points when customers are allowed to exceed contractual limits for a predetermined amount of time.



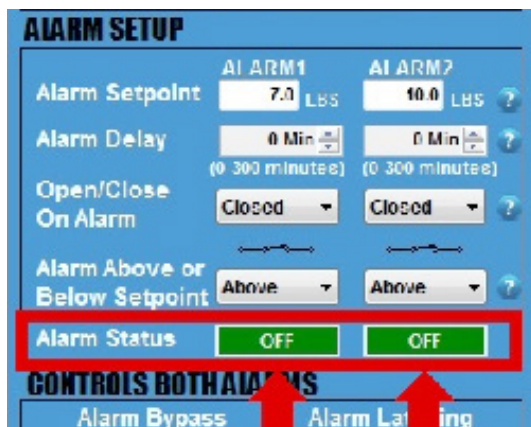
c) Click on the drop-down menu and set the ALARM to trigger ABOVE SETPOINT or BELOW SETPOINT. This causes the alarm flag located on the LCD to illuminate in accordance with your desired setting and the alarm relay contact to open or close as configured in the next step.



d) Click on the drop-down menu and set the alarm relay contact of each individual ALARM to OPEN or CLOSE when its respective ALARM is triggered.

Each alarm will be triggered above or below setpoint as you have selected in Step c).

The schematic symbol under the drop down menu represents the alarm logic that has been selected. If you select OPEN, the schematic will show an 'open' alarm relay contact. If you select CLOSED, the schematic will show a 'closed' alarm relay contact.



e) View the ALARM STATUS. Both independent ALARMS have their own ALARM STATUS.

If an ALARM is not triggered, the ALARM STATUS will display 'OFF' in green.

If an ALARM is triggered, its ALARM STATUS will display 'ON' in red.

*For an ALARM to be triggered, it will take into account the complete logic of how the ALARM was set up. This includes SETPOINT, DELAY, OPEN/CLOSE CONTACT ON ALARM, and ALARM ABOVE OR BELOW SETPOINT.

Step 5: Setup of the Controls for Both Alarms

IMPORTANT:

For this section, the adjustments discussed below will affect both ALARMS and **CANNOT** be set independently for each ALARM.



- a) Set the ALARM BYPASS. Use the UP and DOWN ARROWS to set the duration of your ALARM BYPASS (HOLDOFF).

*This is a helpful feature during a routine calibration so that you do not set off alarm devices.

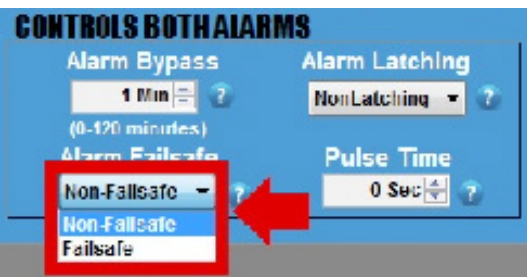
*This feature disables both ALARMS and ANALOG OUTPUTS for those of you using the analog output for control..



- b) Click on the drop-down menu and set the ALARM relay contacts to LATCHING or NONLATCHING.

-If set to NONLATCHING, the relay contacts will energize when the measurement readings exceeds the ALARM SETPOINTS and then de-energize when the measurement readings drop below the ALARM SETPOINTS.

- If this is set to LATCHING, the relay contacts will energize when the measurement readings exceeds the ALARM SETPOINTS but also remain engaged when the reading drops below the ALARM SETPOINTS. A person will have to press the ALARM HOLDOFF Button for 1 second on the front panel of the Analyzer to disengage the relay contacts.



LOW POWER FAILSAFE/NON-FAILSAFE

- c) Click on the drop-down menu and set the ALARMS to FAILSAFE or NON FAILSAFE.

- If set to FAILSAFE, the ALARMS will trigger if the power supplied to the Analyzer drops below 8.5V. However, the ALARMS will not clear until the power moves back up and exceeds 12V.

- If set to NONFAILSAFE, the ALARMS will not trigger if the power supplied to the Analyzer drops below 8.5V.



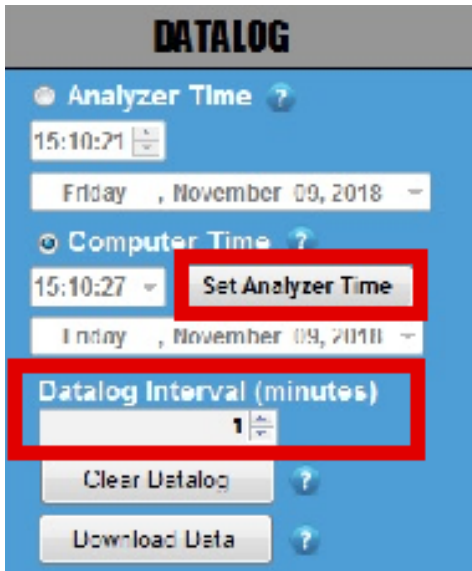
! CAUTION: DO NOT adjust this setting unless you are using a pulse-latch slam valve! Otherwise, you will override the relay logic for your Alarms.

- d) This feature is provided for powering a Pulse Latched Slam Valve. The valve manufacturer should indicate the time, in seconds, for the valve to Open or Close. Enter the time in seconds using the UP and DOWN ARROWS.

This sets the duration of time that the Analyzer sends power to the relay contacts to open or close the valve when an ALARM is triggered. The ALARM 1 Contact will open the slam valve, while the ALARM 2 Contact will close the valve.

This features is helpful because it eliminates the need to continually draw power while the valve is closed.

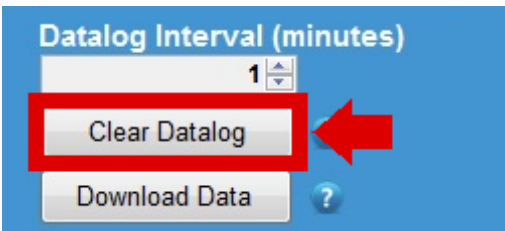
Step 6: Datalog Interval & Setup



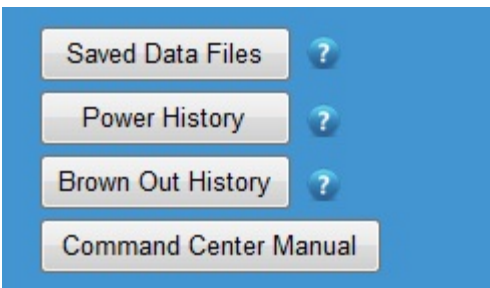
- a) SET ANALYZER TIME
Click the Analyzer Time and manually set the time. Or click Computer Time and then the SET ANALYZER TIME Button. The time should automatically adjust and closely match the time shown on your laptop.

- b) DATA COLLECTION INTERVAL (minutes)
Then set your desired collection interval for the DATALOGGER by adjusting the time (in minutes). The DATALOGGER allows you to store a time-stamped recording of the measurement reading, inlet gas pressure, temperature of the CELL BLOCK, power supply voltage and minimum voltage supplied to the Analyzer.

Note: The default setting has the DATALOGGER collects data for 5 days in 1-minute intervals. If you increase the duration of the interval, the data collection period also increases proportionally. Therefore, if you increase the interval to 2 minutes, the data collection period adjusts to 10 days. Every 3 minutes will increase the collection period to 15 days and so forth.

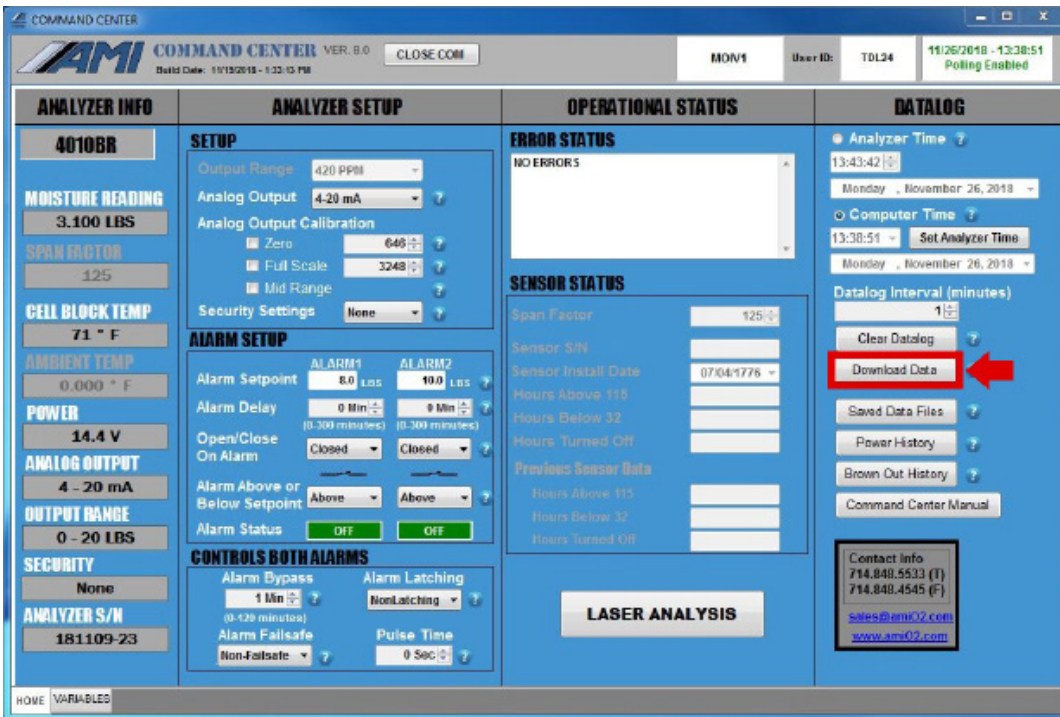


- c) CLEAR DATA LOG
Press the CLEAR DATALOG Button to clear any recorded data performed at the factory.

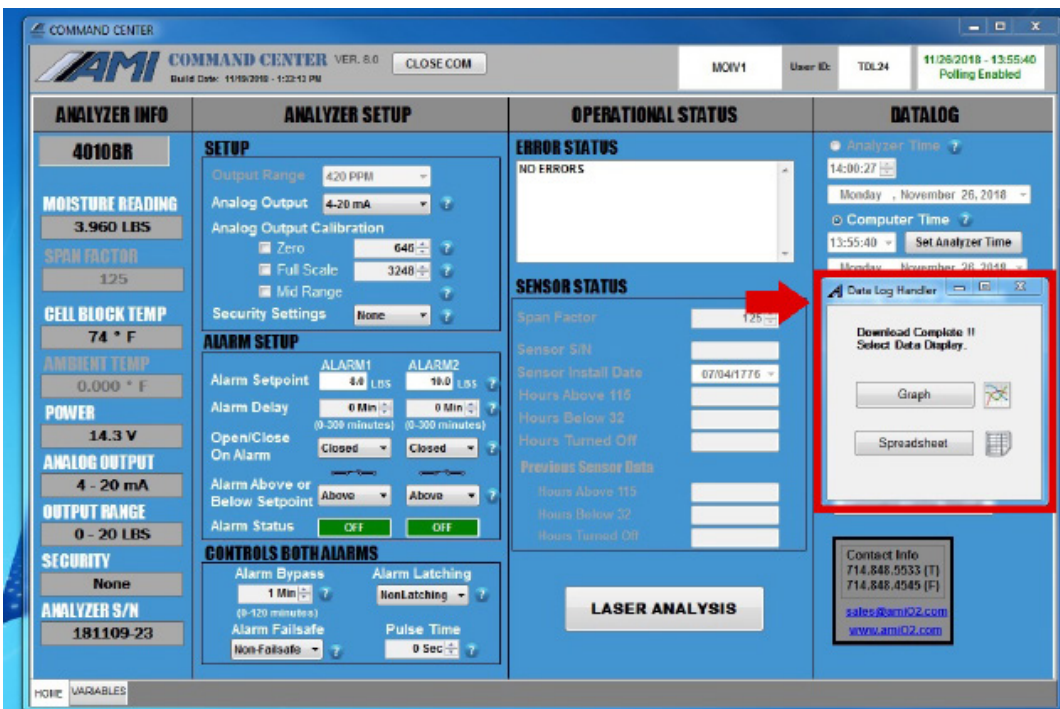


You can also view Saved Data Files, Power History, Brown-out History, and the Manual by pressing their respective buttons in this column.

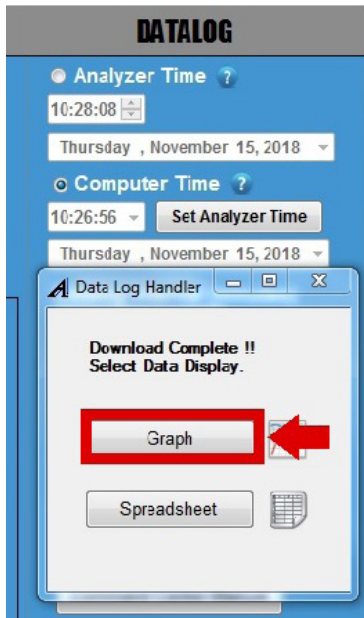
DOWNLOAD DATA



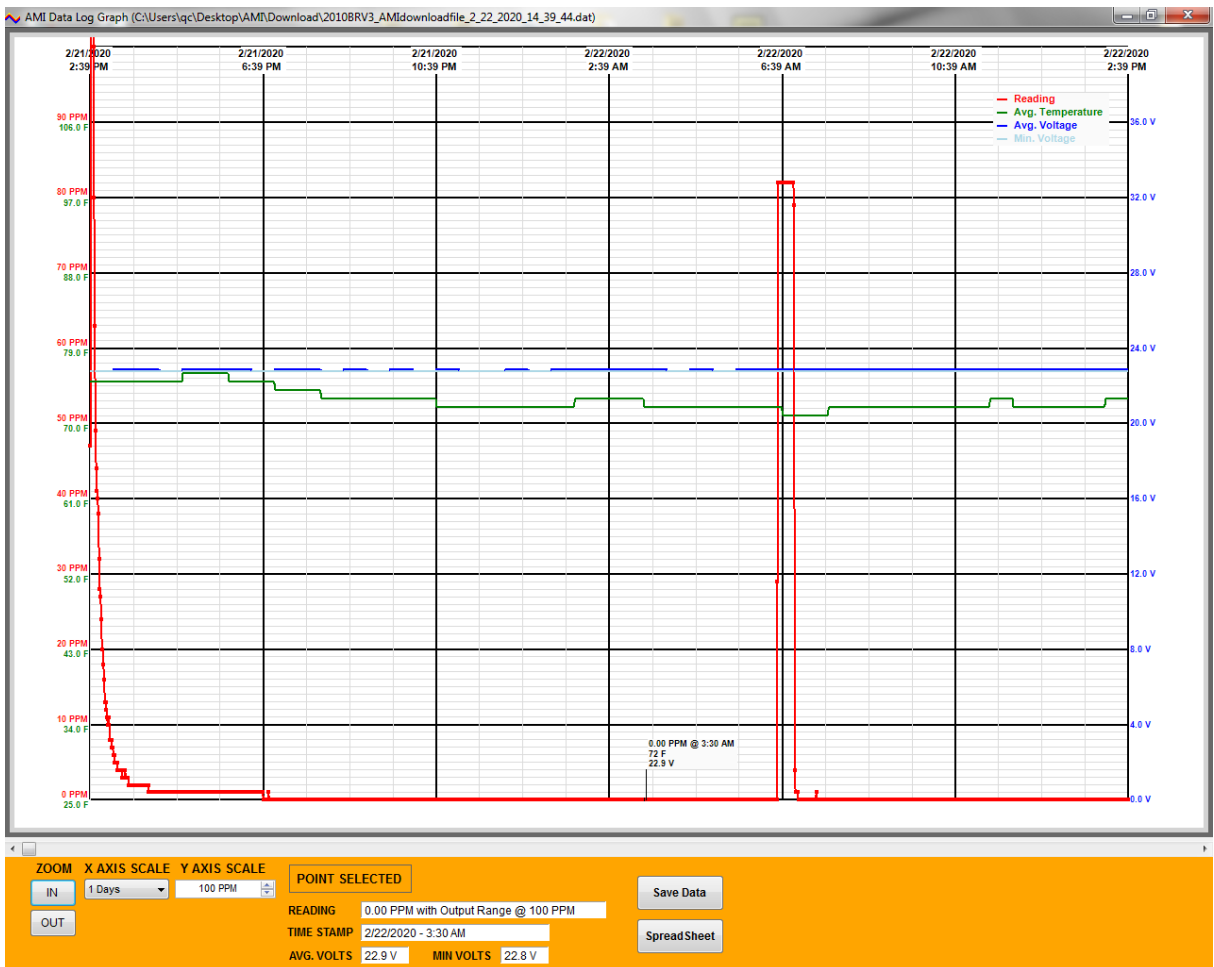
To begin, click the DOWNLOAD DATA Button located on the **COMMAND CENTER** Software.



A DATALOG HANDLER window will appear, giving you the options of seeing your downloaded data as either a graph or spreadsheet.

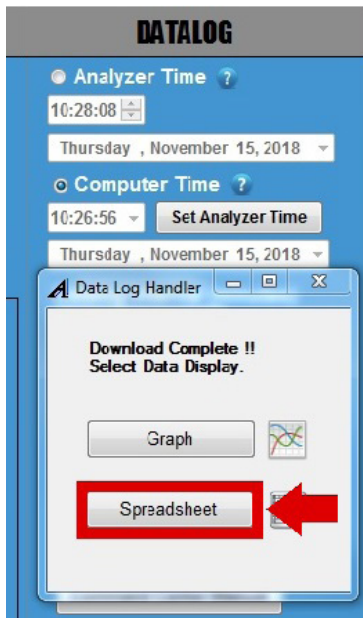


To see the graph, click the GRAPH Button.



(Sample Graph of Downloaded Data)

You can save your graph to a file by clicking the SAVE DATA Button.



To see your downloaded data as a spreadsheet instead, click the SPREADSHEET Button. on the DATALOG HANDLER Window.

Date	Time	Output Range	Log Period	Output Reading	Avg. Voltage	Min Voltage	Avg. Temp.
8/09/2018	04:44:13	420 PPM	1 min	302 PPM	11.9 V	11.8 V	81 F
8/09/2018	04:45:13	420 PPM	1 min	290 PPM	11.9 V	11.8 V	81 F
8/09/2018	04:46:13	420 PPM	1 min	277 PPM	11.9 V	11.8 V	81 F
8/09/2018	04:47:13	420 PPM	1 min	286 PPM	11.9 V	11.8 V	81 F
8/09/2018	04:48:13	420 PPM	1 min	294 PPM	11.9 V	11.8 V	81 F
8/09/2018	04:49:13	420 PPM	1 min	286 PPM	11.9 V	11.8 V	81 F
8/09/2018	04:50:13	420 PPM	1 min	277 PPM	11.9 V	11.8 V	81 F
8/09/2018	04:51:13	420 PPM	1 min	294 PPM	11.9 V	11.8 V	81 F
8/09/2018	04:52:13	420 PPM	1 min	302 PPM	11.9 V	11.8 V	81 F
8/09/2018	04:53:13	420 PPM	1 min	302 PPM	11.9 V	11.8 V	81 F
8/09/2018	04:54:13	420 PPM	1 min	302 PPM	11.9 V	11.8 V	81 F
8/09/2018	04:55:13	420 PPM	1 min	302 PPM	11.9 V	11.8 V	81 F
8/09/2018	04:56:13	420 PPM	1 min	302 PPM	11.9 V	11.8 V	81 F
8/09/2018	04:57:13	420 PPM	1 min	302 PPM	11.9 V	11.8 V	81 F
8/09/2018	04:58:13	420 PPM	1 min	302 PPM	11.9 V	11.8 V	81 F
8/09/2018	04:59:13	420 PPM	1 min	302 PPM	11.9 V	11.8 V	81 F
8/09/2018	05:00:13	420 PPM	1 min	302 PPM	11.9 V	11.8 V	81 F
8/09/2018	05:01:13	420 PPM	1 min	302 PPM	11.9 V	11.8 V	81 F
8/09/2018	05:02:13	420 PPM	1 min	302 PPM	11.9 V	11.8 V	81 F
8/09/2018	05:03:13	420 PPM	1 min	302 PPM	11.9 V	11.8 V	81 F
8/09/2018	05:04:13	420 PPM	1 min	302 PPM	11.9 V	11.8 V	81 F
8/09/2018	05:05:13	420 PPM	1 min	302 PPM	11.9 V	11.8 V	81 F
8/09/2018	05:06:13	420 PPM	1 min	302 PPM	11.9 V	11.8 V	81 F
8/09/2018	05:07:13	420 PPM	1 min	302 PPM	11.9 V	11.8 V	81 F
8/09/2018	05:08:13	420 PPM	1 min	302 PPM	11.9 V	11.8 V	81 F

(Sample Spreadsheet of Downloaded Data)

You can save your spreadsheet to a file by clicking the SAVE DATA Button.

END OF DATA DOWNLOAD

MAINTENANCE, TROUBLE SHOOTING & REPAIRS

Viewing the Moisture Readings

The screenshot displays the AMI Command Center software interface. The top header includes the AMI logo, version information (VER. 8.0), a 'CLOSE COM' button, and system status (MON1, User ID: TDL24, 11/9/2018 - 15:10:27, Polling Enabled). The main interface is divided into four columns: ANALYZER INFO, ANALYZER SETUP, OPERATIONAL STATUS, and DATALOG.

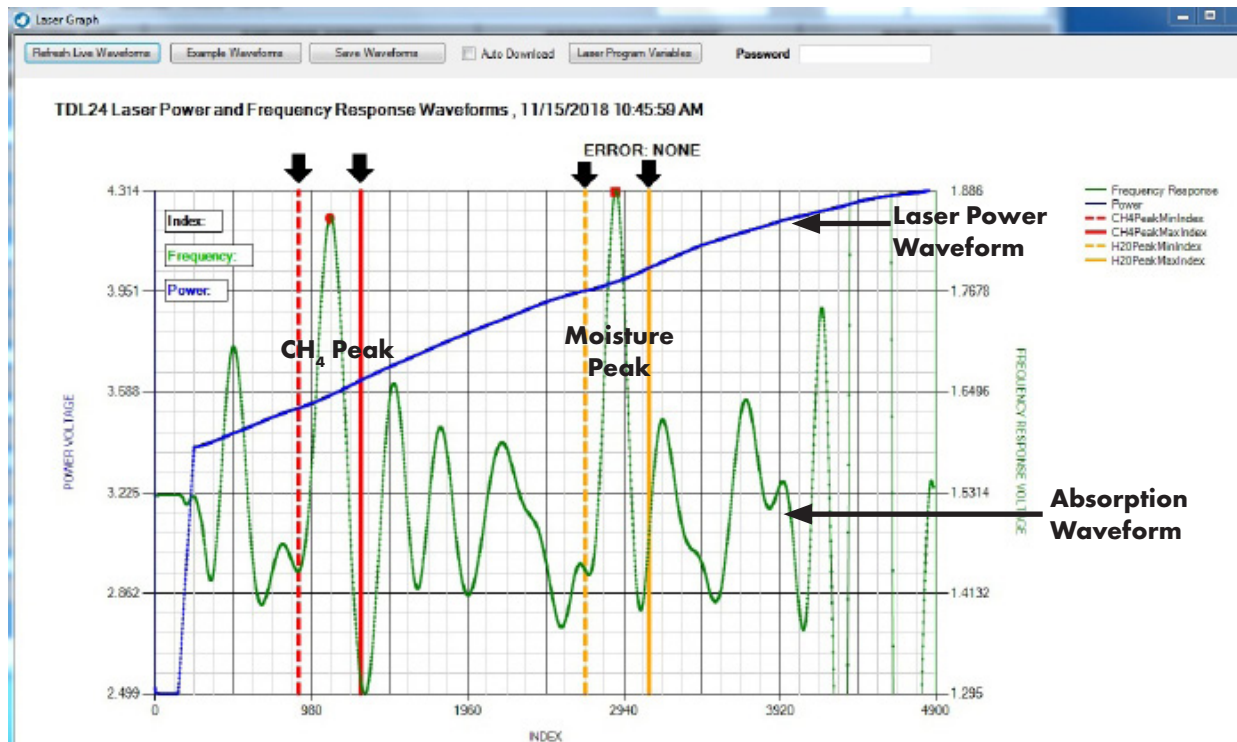
- ANALYZER INFO:** 4010BRV1, MOISTURE READING: 1.310 LBS, SPAN FACTOR: 125, CELL BLOCK TEMP: 72 ° F, AMBIENT TEMP: 0.000 ° F, POWER: 12.2 V, ANALOG OUTPUT: 4 - 20 mA, OUTPUT RANGE: 0 - 20 LBS, SECURITY: None, ANALYZER S/N: 181109-23.
- ANALYZER SETUP:** SETUP (Output Range: 420 PPM, Analog Output: 4-20 mA, Calibration: Zero 640, Full Scale 3248, Mid Range, Security Settings: None), ALARM SETUP (Alarm Setpoint: ALARM1 7.0 LBS, ALARM2 10.0 LBS, Alarm Delay: 0 Min, 9 Min, Open/Close On Alarm: Closed, Alarm Above or Below Setpoint: Above, Alarm Status: OFF), CONTROLS BOTH ALARMS (Alarm Bypass: 1 Min, Alarm Latching: NonLatching, Alarm Failsafe: Non-Failsafe, Pulse Time: 0 Sec).
- OPERATIONAL STATUS:** ERROR STATUS (NO ERRORS), SENSOR STATUS (Span Factor: 125, Sensor S/N, Sensor Install Date: 07/04/1776, Hours Above 115, Hours Below 32, Hours Turned Off, Previous Sensor Data: Hours Above 115, Hours Below 32, Hours Turned Off).
- DATALOG:** Analyzer Time: 15:10:21, Friday, November 09, 2018, Computer Time: 15:10:27, Set Analyzer Time, Friday, November 09, 2018, Datalog Interval (minutes): 1, Clear Datalog, Download Data, Saved Data Files, Power History, Brown Out History, Command Center Manual, Contact info: 714.848.5533 (T), 714.848.4545 (F), sales@ami02.com, www.ami02.com.

A red box highlights the 'LASER ANALYSIS' button located at the bottom of the OPERATIONAL STATUS column, with a red arrow pointing to it.

To view the waveform of your measurement readings, click the LASER ANALYSIS Button located on the bottom of the Operational Status Column of the **COMMAND CENTER**.

A separate Laser Graph Window will appear and display the waveform of the current moisture measurement.

Sample Waveform Displayed in the Laser Graph Window



The graph above shows a typical waveform that a user should see when **THE BARRACUDA** is measuring the concentration of H₂O in a sample.

- The size of the Moisture Peak will vary, depending on the concentration of H₂O vapor in the sample. The greater the concentration of H₂O vapor in the gas sample, the larger the height and size of the peak.
- The vertical dashed yellow line and solid yellow line represent the acceptable range for your signature water peak
- The CH₄ (methane) peak is a signature portion of the Laser Frequency Absorption Waveform and should always appear in every moisture reading. Its amplitude will be consistent from reading to reading unless there are changes in pressure. If the CH₄ peak is missing, it is an indication that something is likely wrong with your Analyzer
- The vertical dashed red line and solid red line represent the acceptable range for your signature methane peak
- The Laser Power Waveform shows that the laser is working and functional
- The Absorption Waveform shows the absorption that is occurring while the moisture measurement is being performed.

The following section identifies potential system issues and provides possible resolutions. The waveforms on the graph of each moisture measurement can indicate whether an issue needs to be addressed. If you are unable to resolve an issue after following the suggestion shown in this section, contact AMI for further support.

Graph with No Discernable Peaks or Waveforms



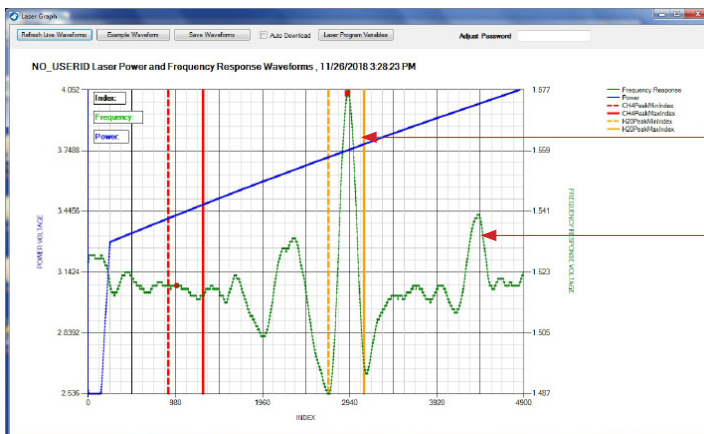
Potential Issue:

A graph with no visible waveforms and having no signature H₂O and CH₄ peaks is indicative of either **Laser Failure**, **Detector Failure** or **Detector Misalignment**.

Resolution:

Stop using **THE BARRACUDA MODEL 4010LX** for trace moisture measurements and contact AMI for support.

Waveform with Signature Moisture Peak but No Signature CH₄ (Methane) Peak



Moisture Peak is present

Absorption Waveform is normal

Potential Issue:

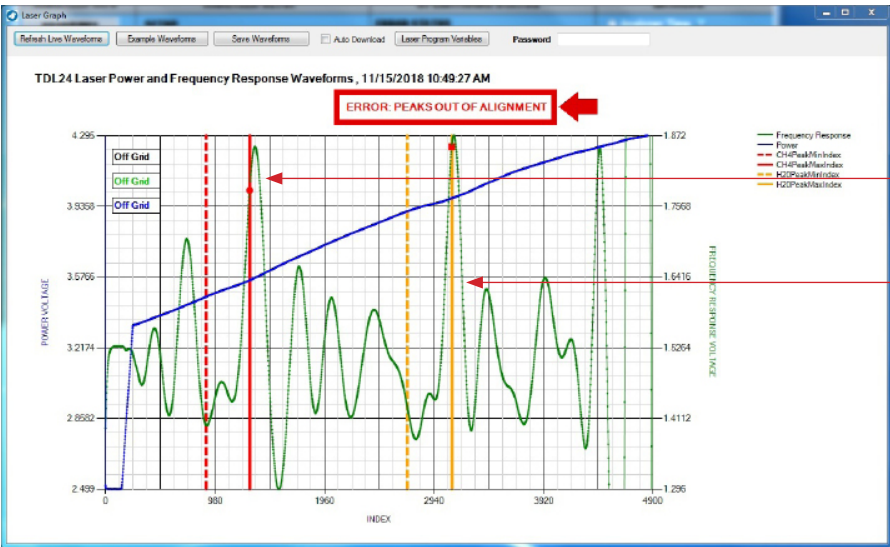
Whenever a waveform appears with the signature moisture peak but is missing the signature CH₄ peak, it may indicate an issue with the **Laser Power** or the **Gas Sample** entering the Analyzer.

Resolution:

First, check to verify that the laser power is present. The blue waveform represents the laser power of **THE BARRACUDA MODEL 4010LX**. If its pattern appears, as shown above, it means that the laser is functioning properly.

Then check your Sample Inlet from the pipeline to **THE BARRACUDA**, making sure that all connections are secured and have no leaks. Also, purge the Sample Line for a few minutes before resuming taking moisture measurements.

Graph with Shifted Waveforms Out of Tuning Range



CH₄ Peak has slightly moved from the frequency range that **THE BARRACUDA** targets

Moisture Peak has also moved from the frequency range that the Analyzer targets

Potential Issue:

Over time, laser-based Moisture Analyzers eventually see a gradual movement of their signature peaks on the x-axis of the measurement waveform. This shift can potentially affect the moisture measurement.

Resolution:

Use **SMART REALIGNMENT™** on the **COMMAND CENTER** to realign the critical H₂O and CH₄ peaks.

Cleaning the Mirrors

Note:

AMI has taken many precautions for keeping the critical laser path clean during use in harsh gas pipeline conditions. Our compact patented cellblock/sample system incorporates unique features; including a membrane that blocks liquids and particulates found in the gas stream and bypassing them prior to reaching the critical Herriott Measurement Cell.

It is important to remember that the analyzers bypass valve must be partially open, allowing approx. 1 SCFH of gas to be bypassed, for liquids and particulates to properly drain. Failure to do so will force the liquids through the membrane and contaminate the mirrors.

We highly recommend purchasing AMI's complete optical cleaning Kit prior to disassembly and cleaning the optical mirrors.
AMI'S Cleaning kit includes: a miniature ratchet, 7/64 hex socket, 1/16" hex key wrench, 99% Isopropyl alcohol with squeeze bottle, optical lens wipes, 3/4" suave, 16oz. can of compressed nitrogen and (2) new replacement o rings.

If liquid and debris from the pipeline do enter the analyzer, there are different actions that should be taken depending on the severity of contamination.

Situations Requiring Cleaning

Situation #1 – Heavy flooding contamination of analyzers due to water slug or other upset condition.

Heavy contaminate loading in the analyzer can happen if the analyzer is not isolated during pigging operations or other significant upset conditions. One sign of this is visible liquids or debris in the flow meter of the analyzer. When this happens the small passages of the entire cell block have also been saturated with liquids and they have been carried into the Herriot laser cell. As simple mirror cleaning will not resolve this issue. If the unit is put back into service in this condition after a mirror cleaning it is very likely more trapped contaminates will be forced onto the mirrors. If the analyzer has been heavily flooded it should be returned to the factory for cleaning.

Situation #2 – Condensate and light oil build up on mirrors.

It is possible for a thin film or layer of oily residue accumulate on mirrors as the result of ambient heating and cooling of the gas as well as long term use. This condition would present itself as slight signal loss over time. It is appropriate to utilize the mirror cleaning procedure to try to resolve this condition.

Safety, Warnings and Cautions

This procedure describes the method for field servicing and cleaning of the MODEL 4010LX's Herriot cell mirrors.

 **WARNING**

All power must be turned off and disconnected from the Analyzer before performing the mirror cleaning procedure.

 **WARNING**

The Herriot cell mirrors are a key component of our precision optics. Any damage to the surface of the mirrors can result in degradation of analyzer performance.

 **WARNING**

Be careful not to damage the (2) alignment dowel pins of Herriot cell when removing either endcaps. Proper alignment of the laser during reassembly is dependent on these precision dowel pins.

 **WARNING**

Fiber Optic Cables are extremely fragile and can be damaged by excessive flexing, bending or impact to the cables. Care must be taken when using tools around the fiber optic cables and when setting mirror end cap down.

 **WARNING**

Fiber optic cable has a minimum bend radius of 1 inch (25mm). A smaller bend than 1 inch (25mm) in will result in permanent loss of signal.

STEPS

1. Turn off mains power supply to the analyzer.

 **WARNING**

All power must be turned off and disconnected from the Analyzer. The 'Lock out and tag out' method is preferred.

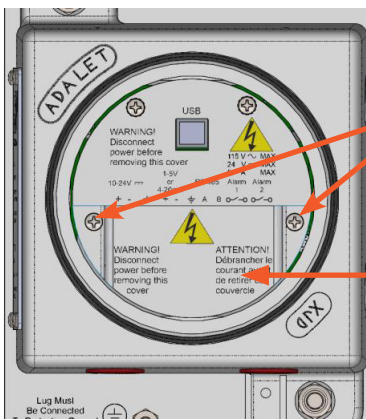
 **WARNING**

Do not service while energized.

2. Remove the cap of explosion proof housing by unscrewing counter-clockwise.

 **WARNING**

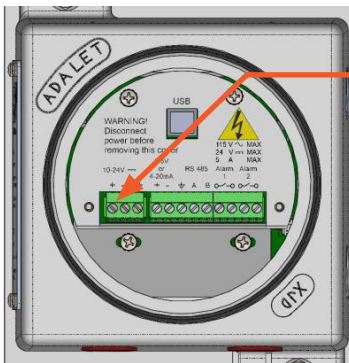
Do not open the enclosure while in an explosive atmosphere.



Philips Screws (2x)

Connector Cover

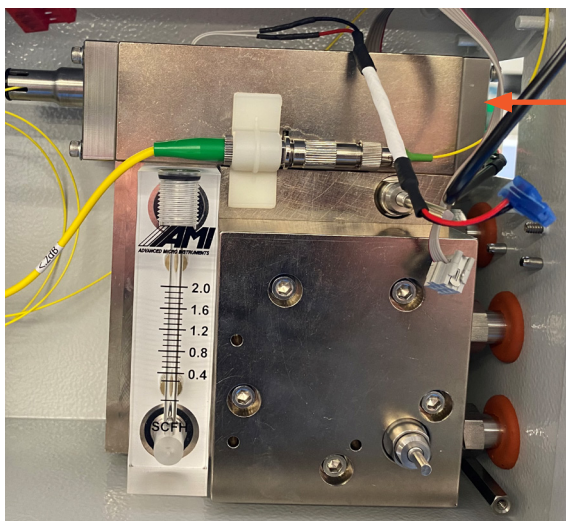
3. Remove the two Philips screws and connector cover to access the electrical connections.



Mains Power Supply

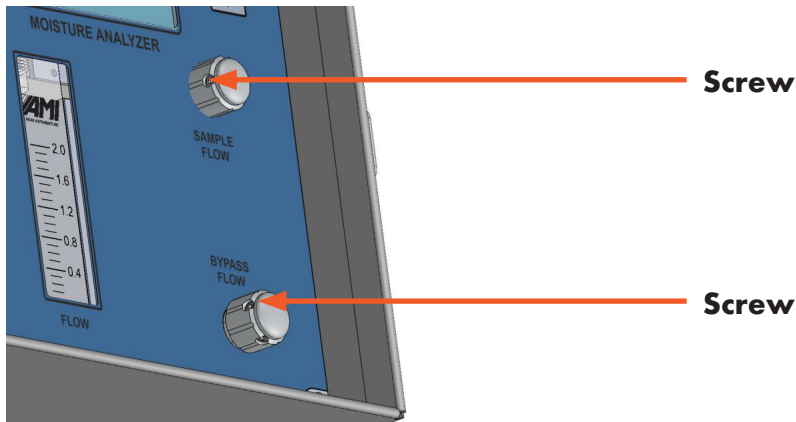
4. Disconnect mains power supply from analyzer by removing the green Phoenix connector from the terminal strip.

Far Mirror Disassembly and Inspection – Detector End

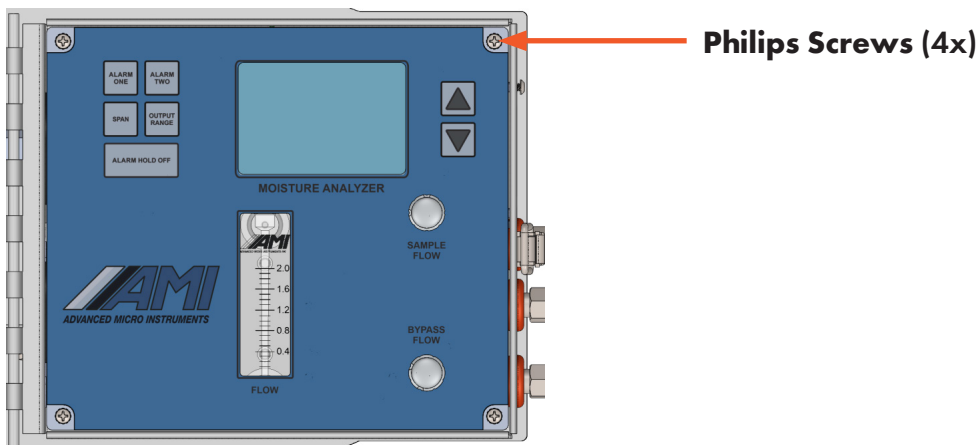


Far Side End Cap

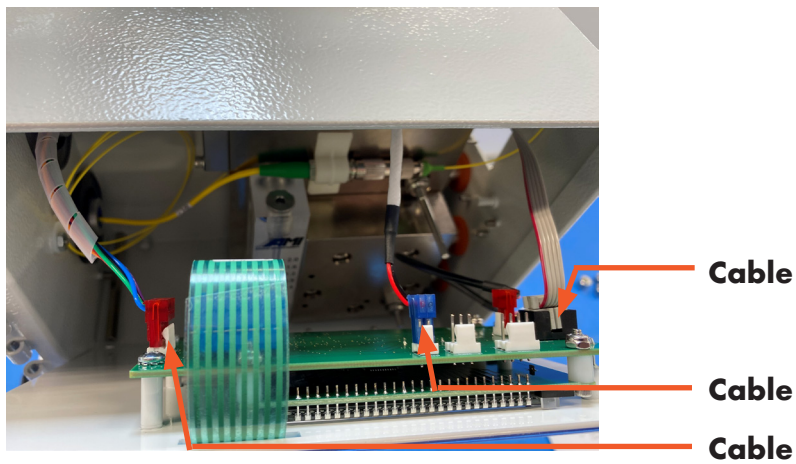
The Far Mirror – Detector End (right hand side of block) is the most likely to have a light layer of residue coating the mirror. By removing the far mirror, it can be inspected, and the operator will have the ability to visually inspect the Herriott cell bore and the near mirror – laser end (located on the left hand side of the cell block).



5. Open the enclosure door. Remove both flow control knobs by loosening the 2 set screws with 1/16" Hex wrench until the knobs slip off the valve stem.



6. Remove the (4) Philips screws holding the front panel. Lift the front panel carefully off of the analyzer while monitoring the internal cabling.



7. When accessible, disconnect the 3 cables from the front panel and set front panel aside.



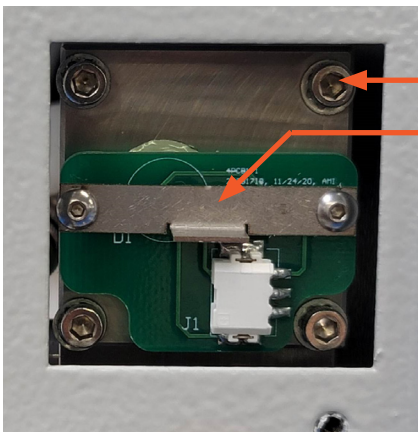
Name Plate

8. Remove the nameplate by removing the 4 x panhead screws with a 5/64" hex wrench.



Detector Cable

9. Disconnect the detector cable from the detector PCB. Tuck away the cable so it is out of the way.



Socket Head Cap Screw

Bracket

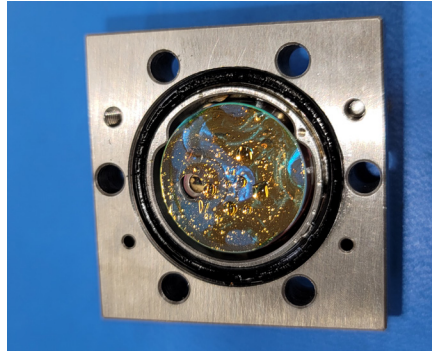
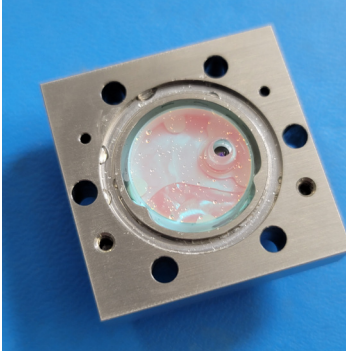


WARNING

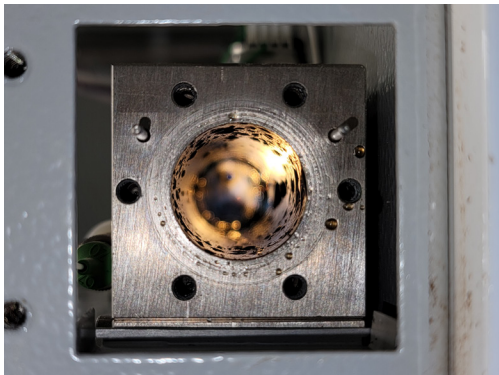
Be careful not to damage dowel pins of Herriot cell when removing end caps. Proper alignment of the laser during re-assembly is dependent on the dowel pins.

10. Remove the (4) socket head cap screws of the Herriot cell near end cap with a 7/64 hex wrench. Utilizing the pull bracket, pull the end cap directly away from the Herriot cell block. Set the endcap down with the mirror facing up, protecting the mirror with supplied lens wipe. Discard the endcap O- ring and prepare to clean the mirrors.

Mirrors and Herriot Cell Inspection



11. Inspect far mirror – detector end (left side) for visible signs of contamination. Small levels contamination can be removed using the cleaning steps outlined in the mirror cleaning procedure below.
12. If contamination is visible behind the far side mirror (figure 11) the analyzer has been heavily flooded and will require cleaning at the factory



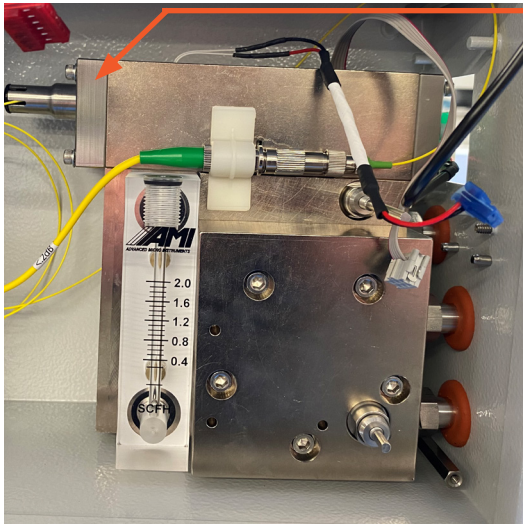
13. Look inside the Herriott cell for signs of moisture.

If there is a small level of contamination on the near end (laser end) mirror, proceed to step 14 to remove the mirror from the Herriott cell block.

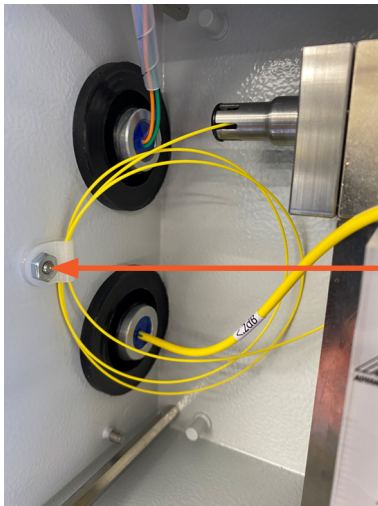
If there is significant contamination on the Herriott cell walls (image above), the analyzer will need to be sent back to the AMI factory for service.

Re-assemble the analyzer prior to return to AMI.

Near Mirror Disassembly and Inspection — Laser End

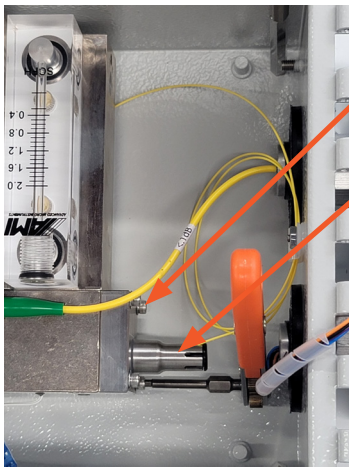


Near Side End Cap



Head Cap Screw

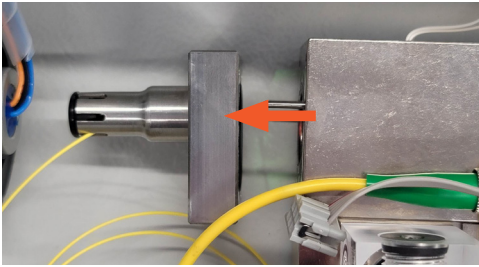
14. Remove the white fiber optic loop hanger by unscrewing the 6-32 nut and carefully removing the hanger from the left side of the case.



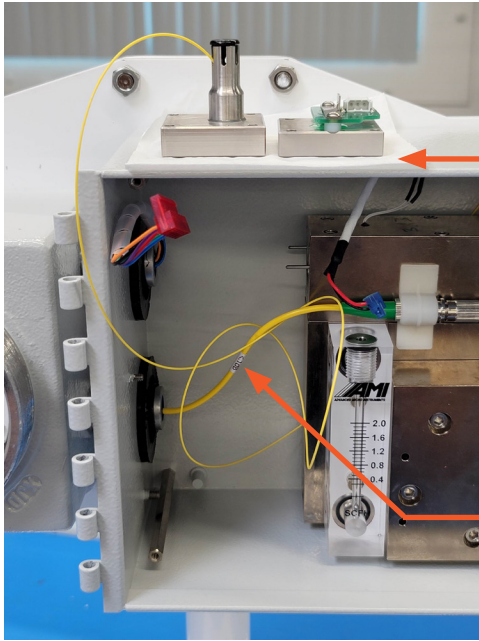
Cap Screw

Fiber Optic Strain Relief Tube

15. Remove the (4) socket head cap screws holding the far end cap in place with a miniature ratchet and 7/64 hex wrench. Start by loosening all 4 cap screws $\frac{1}{4}$ turn before completely removing any of the screws.



16. Utilizing laser fiber optic strain relief tube, very carefully pull the far end cap directly away from the Herriott cell block, making sure to clear both alignment dowel pins before lifting from the enclosure. The dowel pins stick out roughly .375" from the Herriott cell block.



Optical Wipe

Fiber Optic Laser Hoop

17. Set end cap on top of the case, with an optical wipe underneath it and do not damage this yellow fiber optic laser hoop during the cleaning process.



CAUTION

The Herriot cell mirrors are precision optics. Any damage to the surface of the mirrors can result in degradation of analyzer performance.



CAUTION

Be careful not to damage dowel pins of Herriot cell when removing endcaps. Proper alignment of the laser of the laser during reassembly is dependent on the dowel pins.



CAUTION

Fiber Optic Cables are extremely fragile and can be damaged by excessive flexing, bending or impacting the cables. Pay attention where tools are and when setting mirror end cap down.

Mirror Cleaning Process

WARNING

The Herriot cell mirrors are precision optics. Any damage to the surface of the mirrors can result in degradation of analyzer performance. Please use the following steps for cleaning the mirror surfaces.

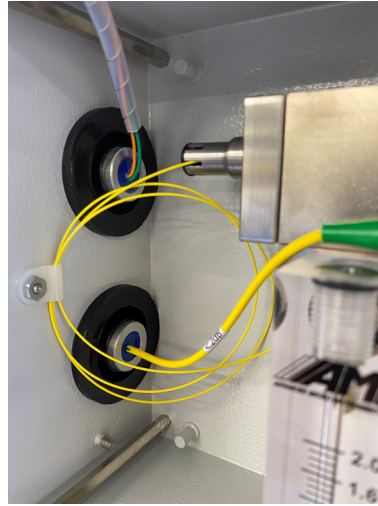
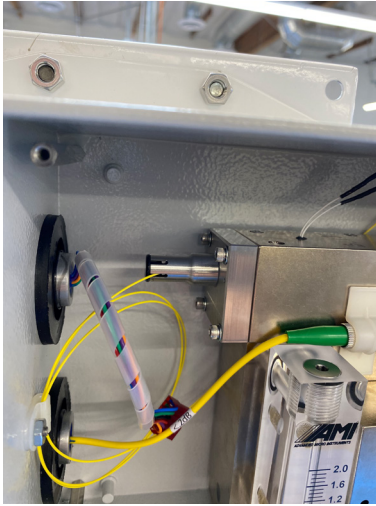
18. Remove and discard o-rings from removed endcaps.
19. Using the AMI supplied optical wipes and 99% pure isopropyl alcohol, apply a few drops onto the wipe and then lightly rub one of the mirrors surfaces. Use light pressure only and small circular motion.
20. Repeat this process with a new wipe and additional alcohol drops until all contamination is removed. Carefully blow dry with the can of dry nitrogen.
21. Make sure the mirrors surface is free of any streaks. If not repeat steps 18 and 19.
22. After both mirrors are clean, pre-lubricated o-rings and carefully into endcaps.
23. Wet the suave with alcohol and carefully run it through the full length of the Herriott Cell block until clean. Then blow dry with the can of Nitrogen.

Analyzer Re-assembly

WARNING

When re-installing the Ends Caps, be careful not to hit the mirrors on the dowel pins. This can cause scratches on the mirror and any damage to the surface of the mirrors can result in degradation of analyzer performance.

24. Begin the reassemble by carefully reinstalling the near side mirror – laser end cap. Holding the strain relief, make sure the dowel pins are aligned and slip the near end cap into place.
25. Make sure the fiber optic loop is still intact with its appoximately. 1" (25mm) radius and secure with the 6-32 nut (figure 17).
26. Place the 4 socket head screws in place and begin tightening in a star pattern. When assembling near mirror endcap.

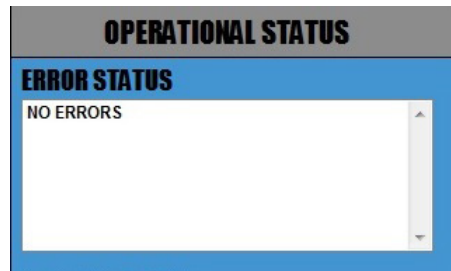


27. Reinstall the far end mirror assembly (right detector end) by carefully aligning the dowel pins with the end cap and slip into place.
28. Slip screws into place and tighten in a star pattern.
29. Reattach white detector connector.
30. Replace the side cover and screws.
31. Reattach front panel by carefully reconnecting the 3 cables and then front panel screws.
32. Place both flowmeter knobs back in place and tighten with 1/16" hex key.
33. Reconnect power plug, protective cover and explosion proof lid.
34. Reapply power to the Analyzer.

Error Status Display: Error Reference Guide

The following section shows the existing error(s) that can be detected by the Analyzer and displayed on the Error Status Display. Each error has an assigned number and message.

Error Number	Message
0	No 2F Trigger
1	No DC Trigger
2	TEC Set Pt Low
3	TEC Set Pt High
4	DC Avg Value Low
5	2F Avg Value Low
6	Power Supply Low
7	PPM OverRange
8	LBS Over Range
9	2F MaxtoMin Too Low
10	2F H2O Peak Out of Index
11	2F CH4 Peak Out of Index
12	Over/Under Pressure
13	H2O DC Peak Too Large
14	Over/Under Temperature
15	
16	FPGA Bad Read
17	Memory Bad Read
18	Memory Bad Write
19	Analytical Timeout
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	
31	
32	ADC Sample High
33	ADC Sample Low
34	ADC Conversion TimeOut
35	DC SAMPLE TO LOW
36	
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44	
45	



Note:
Once troubleshooting is completed and the error is resolved, the message will automatically be removed from the Error Status Display by the Analyzer.

Sealing/Ingress Protection Maintenance

Whenever the Adalet Explosion-proof cap is opened, visually inspect the O-ring for any signs of damage or excessive wear.

Action:

- If the O-ring needs to be replaced, contact AMI
-

IMPORTANT MESSAGE ABOUT REPAIRS

Where repair is possible:



WARNING

SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY.

LE REMPLACEMENT DE COMPOSANTS PEUT COMPROMETTRE LA SECURITE INTRINSEQUE.

IMPORTANT MESSAGE ABOUT CLEANING REQUIREMENTS

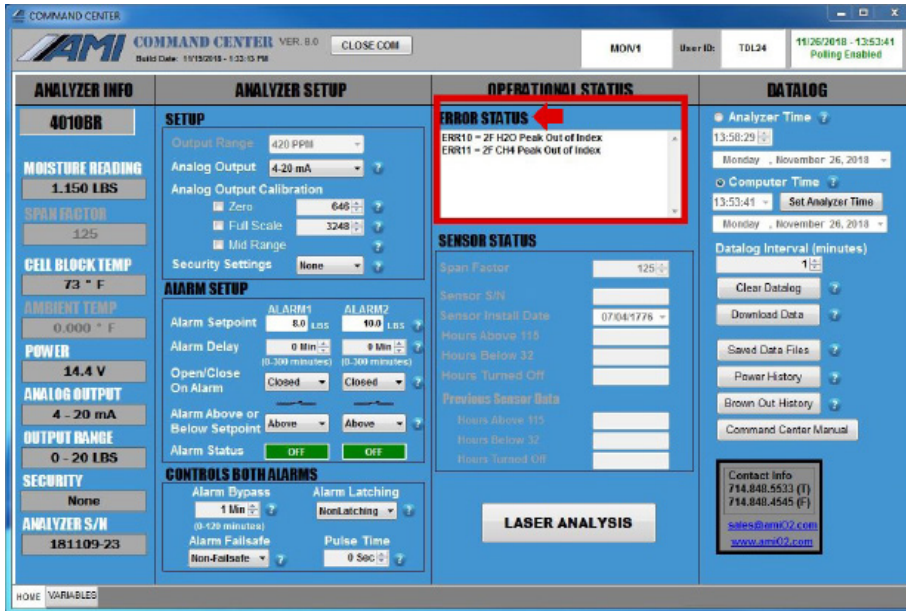
The Analyzer is designed to function properly without cleaning requirements.

For any other issue not covered in this section, contact AMI at 714.848.5533 or visit us at www.amio2.com for support.

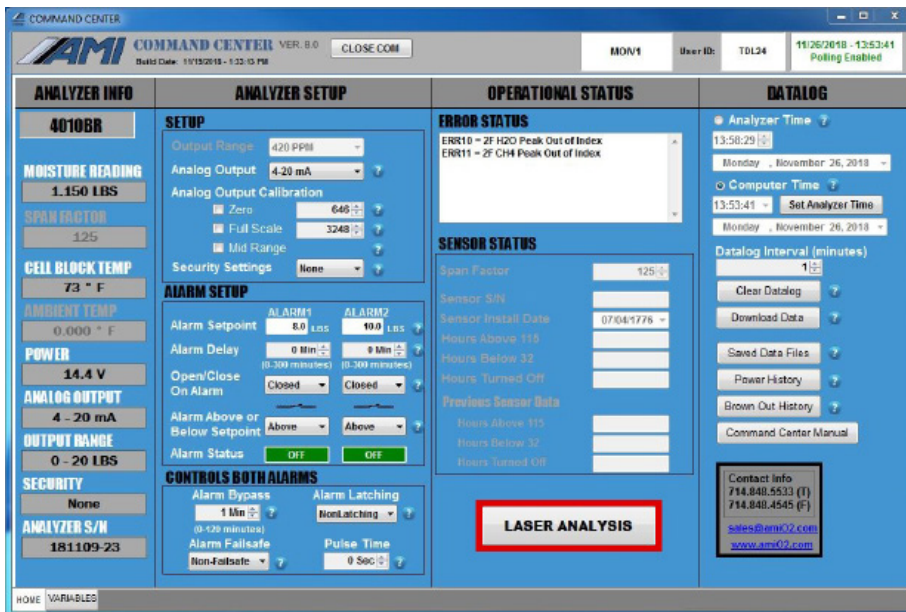
END OF MAINTENANCE, TROUBLESHOOTING & REPAIRS

SMART REALIGNMENT

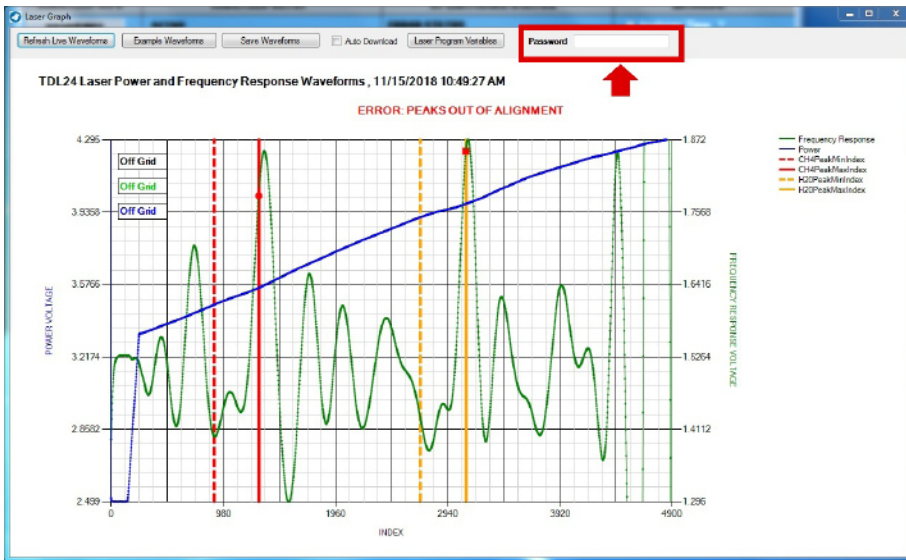
Using SMART REALIGNMENT to Realign the Signature Peaks



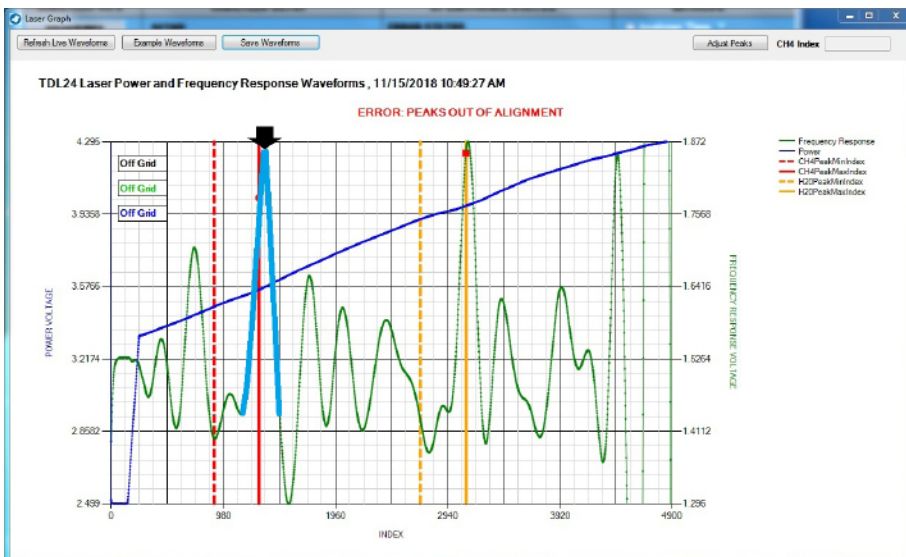
If your signature peaks have shifted, the ERROR STATUS DISPLAY will automatically display the error messages, alerting you to the need to realign your peaks.



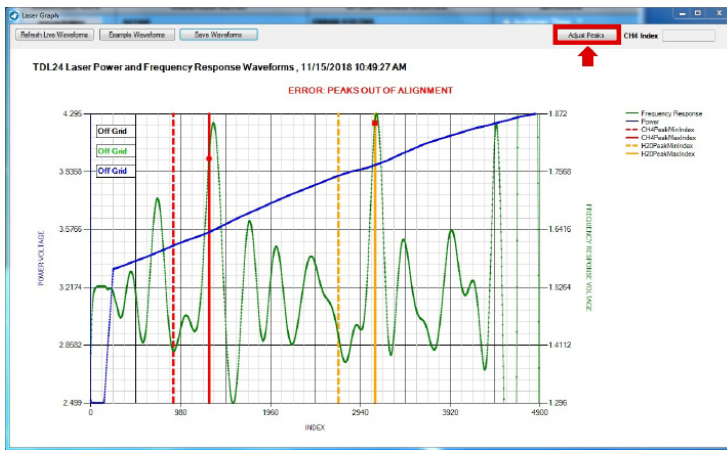
STEP 1: To begin, click on the LASER ANALYSIS Button at the bottom on the Operational Status Column. A new window will appear and display the current measurement waveform.



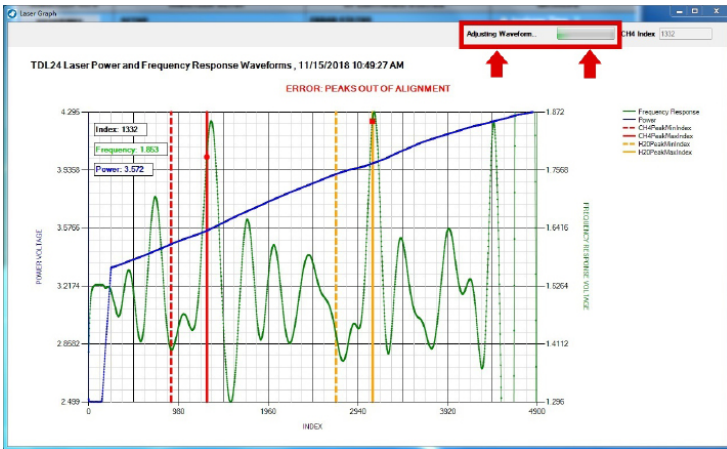
STEP 2: Type in the correct password that you received from an AMI phone call in the password entry area. The display window will slightly change.



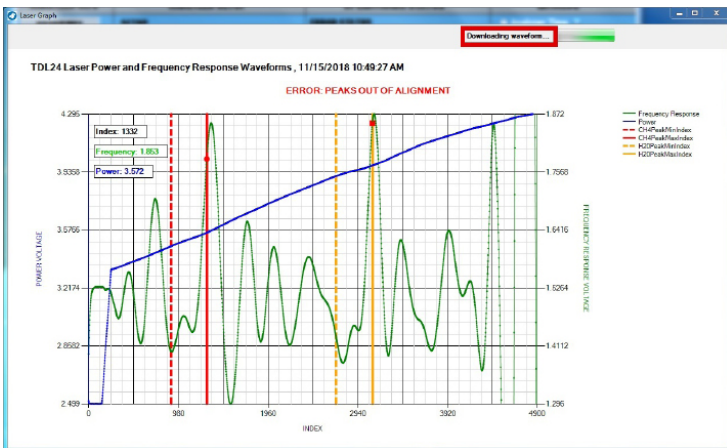
STEP 3: Click on the **TIP** of the misaligned methane signature peak.
Note: This peak is in the left area of the waveform and separated from the signature weak peak by 3 non-designated peaks. It is critical that you click on the tip and no where else on the waveform during this step.



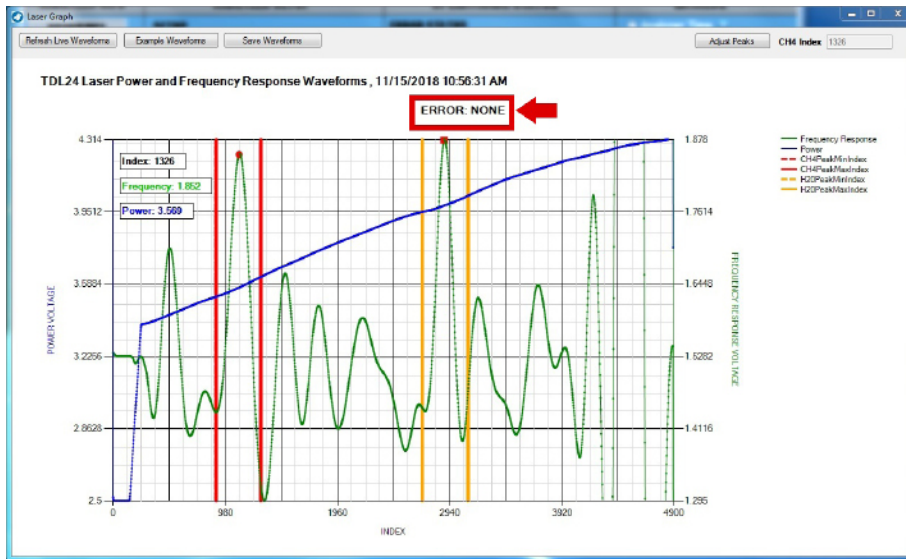
STEP 4: Click on ADJUST PEAKS on the upper right-hand corner of the screen. The display will slightly change again.



While the realignment process is taking place, you will see the screen displaying ADJUSTING WAVEFORM and an adjacent 'working bar' in the upper right-hand corner, highlighted by the red box.



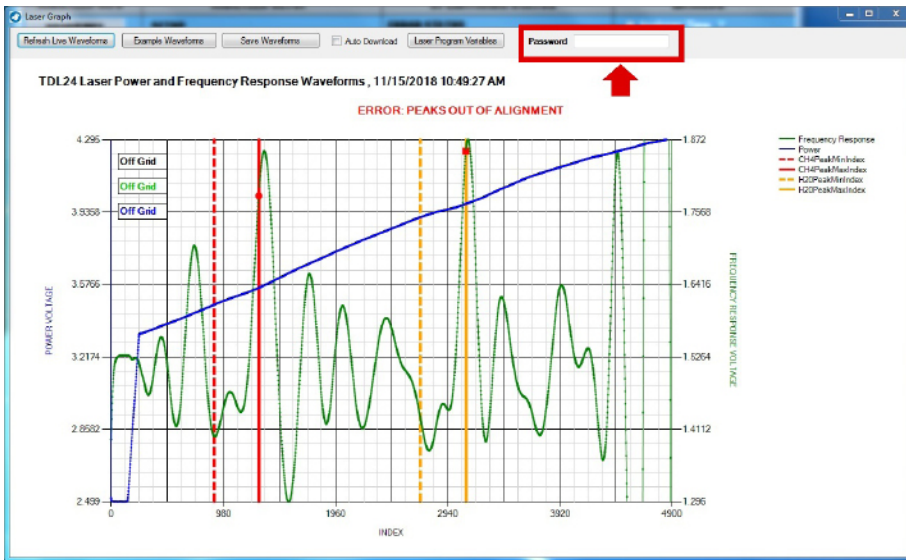
When the process is nearing completion, the screen will adjust once more and display DOWNLOADING WAVEFORM.



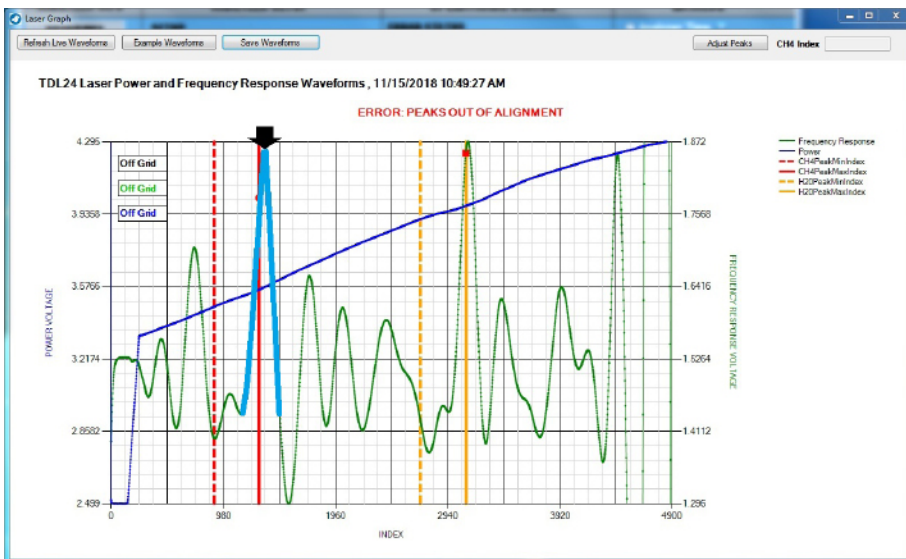
Once everything is done, a new waveform will appear, displaying the fully adjusted signature methane peak and water peak. The Red Error Message will also disappear and be replaced with ERROR: NONE.

You have now successfully completed **SMART REALIGNMENT**. At this point, you can close the **COMMAND CENTER** Window.

END OF SMART REALIGNMENT



STEP 2: Type in the correct password that you received from AMI in the password entry area. The display window will slightly change.



STEP 3: Click on the **TIP** of the misaligned methane signature peak.
Note: This peak is in the left area of the waveform and separated from the signature weak peak by 3 non-designated peaks. It is critical that you click on the tip and no where else on the waveform during this step.

MODBUS RTU Protocol over RS485 Communications

The Modbus address is entered in variable N1 for the Analyzer.

Directions for Writing to this Variable

- Open the COMMAND CENTER and initiate communication with the Analyzer
- When the COMMAND CENTER communicates with the Analyzer, go to the VARIABLES Page of the COMMAND CENTER
- Go to the User Input of the Variable Page. Click on the USER INPUT and enter 'AMI' for the password when prompted. Then, return to the USER INPUT
- In the USER INPUT, enter the following to change the address of the Modbus:

AOWN1<Address>, where <Address> is 1-255

Note: By default, it is set to 17.

Using the Modbus RTU command, you can read the Analyzer's Modbus register(s):
(Note: There are a total of eight bytes to send)

- Byte 0 = Address (Modbus Bus Slave addressed to be entered into variable N1)
- Byte 1 = 3
- Byte 2 = 0
- Byte 3 = Register (Register equals the Starting Register for the Modbus read)
- Byte 4 = 0
- Byte 5 = Count (Count equals the Number of Registers to be read)
- Byte 6 = CRC Bytes
- Byte 7 = CRC Bytes

Table I: Holding Registers for BARRACUDA MODEL 4010LX

Register	Number of Register Used	Variable Name	Description	Type	Comment
0	16	A0RA0	Reading String	String	
141	2	A0RZ2	PPM Value	Two 16-bit Unsigned Integers	v7.0 Firmware or Above
143	1	A0RZ3	LBS x 100 Value	16-bit Unsigned Integer	v7.0 Firmware or Above
16	1	A0RA1	2F Baseline	16-bit Unsigned Integer	
17	1	A0RA2	2F H Peak Value	16-bit Unsigned Integer	
18	1	A0RA3	2F H Peak Index	16-bit Unsigned Integer	
19	1	A0RA4	2F C Peak Value	16-bit Unsigned Integer	
20	1	A0RA5	2F C Peak Index	16-bit Unsigned Integer	
21	1	A0RA7	Output in Pounds Flag	16-bit Unsigned Integer	
22	1	A0RB0	Output Range	16-bit Unsigned Integer	
23	1	A0RB1	Frequency Code (1)	16-bit Unsigned Integer	
24	1	A0RB2	Phase Code (2)	16-bit Unsigned Integer	
25	1	A0RB3	Bandwidth Code (3)	16-bit Unsigned Integer	
26	1	A0RB4	Scan Period (4)	16-bit Unsigned Integer	
27	1	A0RB5	Laser Enable (5)	16-bit Unsigned Integer	
28	1	A0RB6	Two F Offset (7)	16-bit Unsigned Integer	
29	1	A0RB7	Amplitude (8)	16-bit Unsigned Integer	
30	1	A0RB8	Null Width Storage (11)	16-bit Unsigned Integer	
31	1	A0RB9	Ramp Coefficient 1 (12)	16-bit Unsigned Integer	
32	1	A0RB10	Ramp Coefficient 2 (13)	16-bit Unsigned Integer	
33	1	A0RB11	Ramp Coefficient 3 (14)	16-bit Unsigned Integer	
34	1	A0RB12	Low Pass Gain (MSW) (22)	16-bit Unsigned Integer	
35	1	A0RB13	Low Pass Gain (LSW) (23)	16-bit Unsigned Integer	
36	1	A0RB14	TEC Set Point (Disabled)	16-bit Unsigned Integer	
37	1	A0RB15	TEC Enable	16-bit Unsigned Integer	
38	8	A0RC0	Software Version	String	
46	1	A0RC2	Loop Count	16-bit Unsigned Integer	
47	1	A0RD0	Cal Factor	16-bit Unsigned Integer	
48	1	A0RD1	Samples Per Scan	16-bit Unsigned Integer	
49	1	A0RD8	ADC TEC Raw Value 4	16-bit Unsigned Integer	
50	1	A0RE3	Analog Zero Offset	16-bit Unsigned Integer	
51	1	A0RE4	Analog Full Scale	16-bit Unsigned Integer	
52	1	A0RE6	E6 Config Variable	16-bit Unsigned Integer	
53	1	A0RF0	Alarm 1 Setpoint	16-bit Unsigned Integer	
54	1	A0RG0	Alarm 2 Setpoint	16-bit Unsigned Integer	
55	1	A0RH0	Alarm Configuration	16-bit Unsigned Integer	
56	1	A0RH1	Unused	16-bit Unsigned Integer	
57	1	A0RI0	Error Register 0	16-bit Unsigned Integer	
58	1	A0RI1	Error Register 1	16-bit Unsigned Integer	
59	1	A0RI2	Error Register 2	16-bit Unsigned Integer	
60	1	A0RI3	Error Register 3	16-bit Unsigned Integer	

Table I: Holding Registers for BARRACUDA MODEL 4010LX (continued)

Register	Number of Register Used	Variable Name	Description	Type	Comment
61	8	A0RJ0	Analyzer Type	String	
69	1	A0RJ1	Analyzer Configuration	16-bit Unsigned Integer	
70	8	A0RL0	Analyzer Serial Number	String	
78	8	A0RL1	Analyzer Tracking Number	String	
86	8	A0RL2	Analyzer User ID	String	
94	8	A0RL3	Analyzer Laser S/N	String	
102	10	A0RM0	Latest Startup Info	String	
112	2	A0RN0	Write Com ID	String	
114	1	A0RN1	Modbus ID	16-bit Unsigned Integer	
115	10	A0RO0	Low Power Event	String	
125	1	A0RP0	RTC Seconds	16-bit Unsigned Integer	
126	1	A0RP1	RTC Minutes	16-bit Unsigned Integer	
127	1	A0RP2	RTC Hours	16-bit Unsigned Integer	
128	1	A0RP3	RTC DOW	16-bit Unsigned Integer	
129	1	A0RP4	RTC DOM	16-bit Unsigned Integer	
130	1	A0RP5	RTC Month	16-bit Unsigned Integer	
131	1	A0RP6	RTC Year	16-bit Unsigned Integer	
132	1	A0RP7	Log Interval	16-bit Unsigned Integer	
133	1	A0RT0	Block Temperature +26	16-bit Unsigned Integer	
134	1	A0RT2	Pressure x 10000 (bar)	16-bit Unsigned Integer	
135	1	A0RT3	Power Voltage x 100	16-bit Unsigned Integer	
136	1	A0RU0	Hours of Operations	16-bit Unsigned Integer	
137	1	A0RW0	Alarm Pulse Time	16-bit Unsigned Integer	
138	1	A0RX0	Delay on for Alarm 1	16-bit Unsigned Integer	
139	1	A0RY0	Delay on for Alarm 2	16-bit Unsigned Integer	
140	1	A0RZ0	Alarm Hold of Time	16-bit Unsigned Integer	

SPECIFICATIONS

USAGE

Both indoor and outdoor use

Altitude for Use _____ ≤3,200 meters (10,500 ft) for DC and AC models

Relative Humidity _____ <95%, non-condensing

Ingress Protection _____ IP65

PHYSICAL

Dimensions _____ 14.0"W x 9.5"H x 5.0"D (36 cm x 24 cm x 13 cm)

Weight _____ 17.0 lbs (7.7 kg)

Digital Display _____ 4-digit LCD

Mounting _____ Wall mount or 2.0" pipe

Gas Connections _____ 1/4" 316 S.S. compression fittings

Wetted Parts _____ 316 S.S. fittings, electro-less nickel-plated cell block,
acrylic-flow meter & O-rings (Viton, kalrez, and Buna-N)

Materials _____ Cases (painted aluminum, Door Seal (urethane foam),
Window (plastic), O-ring (neoprene)

TECHNOLOGY

Principle of Measurement _____ Tunable Diode Laser Absorption Spectroscopy
(TDLAS) *specific to moisture only

Key Technologies _____ Patented Wavelength and **ELIMINATOR CELL BLOCK**,
MEASUREMENT ALGORITHM and **SMART REALIGNMENT**,
and **COMMAND CENTER** (which includes the following:
Datalogger, Error Status Display, Brown-out History, Power-up History,
USB Virtual Comport, and Modbus RS485 and Modbus TCP/IP)

PERFORMANCE

Measurement Range _____ 0.0 – 20.0 lbs of H₂O
(0.0 – 420 ppm)

Low Minimum Detection Threshold _____ 0.25 lbs (5.25 ppm) of H₂O

Response Time _____ 90% < 2 sec, Incredibly fast upscale/downscale

Repeatability _____ ±1% of range or ±0.25 lbs (±5.25 ppm) of H₂O, whichever is greater

Accuracy _____ ±0.25 lbs (±5.25 ppm) of H₂O

Data Collection Capacity _____ 5 days of data recording @1 datapoint per minute

Sample Cell Pressure Range _____ 700 – 1100 mBarA

Inlet Gas Pressure _____ 1.0 –20.0 psig (0.07–1.4 bar)

Protection _____ RFI-protected

OPERATION

Ambient Operating Temperature Range _____ 20°F to 149°F (–6.7°C to 65°C)
with **Extreme Weather Enclosure**: 10°F to 149°F (–12°C to 65°C)

Recommended Sample Gas Flow Rate _____ 1.0 to 2.0 SCFH* (0.5 to 1.0 Lpm)

Recommended Bypass Flow Rate _____ 0.5 SCFH* (0.25 Lpm)

*SCFH = standard cubic feet/hour

Isolated Analog Output Signals (Active) _____ 1–5 VDC and 4–20 mA

ALARMS

Number of Alarms _____ 2 Fully, Adjustable Moisture Concentration Alarms


Alarm Delays _____ Programmable from 0 – 300 minutes

Alarm Hold-off / Bypass _____ Programmable from 0 – 120 minutes

AREA CLASSIFICATION

Area Classification _____ US/Canada:
Class I, Division 1, Groups B-D, T4
Class I Zone 0/1, AEx ia op is/db IIB+H2 T4 Ga/Gb
Ex ia op is/db IIB+H2 T4 Ga/Gb
-20°C ≤ Tamb ≤ +65°C

IECEX/PESO:
Ex ia op is/db IIB+H2 T4 Ga/Gb
-20°C ≤ Tamb ≤ +65°C

ATEX:
 II 1/2 G Ex ia op is/db IIB+H2 T4 Ga/Gb
-20°C ≤ Tamb ≤ +65°C

UKCA
Ex ia op is/db IIB+H2 T4 Ga/Gb
-20°C ≤ Tamb ≤ +65°C

Environmental Conditions _____ OVII, PD2, Wet Location

POWER

Requirements _____ 10 – 24 VDC, Um 24 VDC, 1.00 A max
100 – 240 VAC, 50/60Hz, Um 240 VAC, 500 mA max
Use only approved Class 2 or limited energy circuits

AMI® WARRANTY & SUPPORT

LIMITED WARRANTY/DISCLAIMER

The warranty period is **TWO YEARS** for the Analyzer. Any failure of material or workmanship will be repaired free of charge for that specified period from the original purchase (shipping date) of the instrument. AMI will also pay for 1-way ground shipment back to the customer.

The warranty period for the electrochemical oxygen sensor is 6 months.

The warranty period for the electrochemical H₂S sensor is 6 months.

The warranty period for the zirconium oxide sensor is 2 years.

Any indication of abuse or tampering of the instrument will void the warranty.

Receiving the Analyzer

When you receive the instrument, check the package for evidence of damage and if any is found contact the shipper. Although every effort has been made to assure that the Analyzer meets all performance specifications, AMI takes no responsibility for any losses incurred by reason of the failure of this analyzer or associated components. AMI's obligation is expressly limited to the Analyzer itself.

EXCEPT FOR THE FOREGOING LIMITED WARRANTY, AMI MAKES NO WARRANTIES, EXPRESS, IMPLIED OR STATUTORY, AS TO THE NON-INFRINGEMENT OF THIRD-PARTY RIGHTS, MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE. IF APPLICABLE LAW REQUIRES ANY WARRANTIES WITH RESPECT TO THE SYSTEM, ALL SUCH WARRANTIES ARE LIMITED IN DURATION TO TWO (2) YEARS FROM THE DATE OF DELIVERY.

LIMITATION OF LIABILITY

IN NO EVENT WILL AMI BE LIABLE TO YOU FOR ANY SPECIAL DAMAGES, INCLUDING ANY LOST PROFITS, LOST SAVINGS, OR OTHER INCIDENTAL OR CONSEQUENTIAL DAMAGES, EVEN IF THE COMPANY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, OR FOR ANY CLAIM BY ANY OTHER PARTY.

LIMITATION OF REMEDIES

AMI's entire liability and your exclusive remedy under the Limited Warranty (see above) shall be the replacement of any Analyzer that is returned to the Company and does not meet the Company's Limited Warranty.

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HIGH PERFORMANCE

RELIABILITY

INTUITIVE DESIGN

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OM-300-039 Rev E
01/22/2024

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