OPERATIONS MANUAL

TM2200

ONLINE TURBIDIMETER

3/25/07

CHEMTRAC

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Figures and Images

IMPORTANT INSTRUCTIONS

When using this instrument, basic safety precautions shall always be followed to reduce the risk of fire, electrical shocks and injury to persons, including the following:

- ☑ Before attempting to unpack, set up, or operate this instrument, please read this entire manual.
- ☑ Follow all warnings marked on the instrument. Failure to follow these precautions could result in personal injury or damage to the equipment.
- ☑ Do not attempt to disassemble the unit.
- ☑ Do not modify any internal electrical wiring or electronics.
- ☑ Make certain the unit is disconnected from the power source before attempting to service or remove any component.
- ☑ Water must not enter the housing of the unit. Be sure to close and fasten the covers of the unit following any opening.
- ☑ Use a mild non-abrasive cleanser when cleaning the outer cover of the unit.
- ☑ Do not drop or jar the unit.

SAFETY PRECAUTIONS

In order to provide maximum user safety this instrument was designed with all electrical circuitry enclosed within a protective non-conductive housing. The label below will be visible at any location where high voltage is present.

WARRANTY INFORMATION

Chemtrac® Systems, Inc. warrants its equipment to be free from defects in material and workmanship for a period of one (1) year from date of shipment to the original purchaser. Upon receipt of written notice from purchaser, seller shall repair or replace the equipment (at option of Chemtrac® Systems, Inc.).

Chemtrac® Systems, Inc. assumes no responsibility for equipment damage or failure caused by:

1. Improper installation, operation, or maintenance of equipment
2. Abnormal wear and tear on moving parts caused by some processes
3. Acts of nature (i.e., lightning, etc.)

This warranty represents the exclusive remedy of damage or failure of equipment. In no event shall Chemtrac® Systems, Inc. be liable for any special, incidental, or consequential damage such as loss of production or profits.

Should you experience trouble with the equipment, please contact:

Chemtrac Systems, Inc
6991 Peachtree Industrial Blvd., Building 600
Norcross, GA 30092

Phone: 800-442-8722 (Inside US only), 770-449-6233
Fax: 770-447-0889
Email: chemtrac@chemtrac.com
Website: www.chemtrac.com

SECTION 1
GENERAL INFORMATION

OVERVIEW

The Chemtrac TM2200 is an online nephelometric turbidimeter. The TM2200 continuously monitors, records, and reports (integrated with SCADA) turbidity compliance data for municipal water filtration processes. A local display prompts the user with calibration steps, diagnostic data, and immediate turbidity data without the need for a laptop or data recorder. The TM2200 design permits easy access to the light source for maintenance and replacement. By incorporating an all-in-one package, the TM2200 design simplifies installation and assists the operator with monitoring water quality from multiple filter effluents.

Debubbler

The debubbler maximizes the removal of entrained air bubbles that would otherwise interfere with the turbidity measurement. The debubbler unit is within the enclosure of the TM2200. The separate inlet and outlet barbed tube connections facilitate an easy connection to the water source. A slipstream is taken off of the debubbler for sampling and the constant head pressure from the debubbler ensures a constant flow to the sample cell.

The modular design of the debubbler allows for convenient cleaning and maintenance.

Convertible Cuvette

The up-flow cuvette sample cell is a sampling improvement over the common approach of using a larger reservoir for turbidity measurements.

The 35 mL cuvette same sample cell is easily converted for use in the calibration process. Index marks on the cuvette and the seam created by the two parts of the sensor block assure that the optical surface of the cell is consistently lined-up for the calibration and online phases of operation. See ***Photo 2***

Light Source

The light source does not come in direct contact with the sample, nor does it have any large air spaces that could lead to the accumulation of dust or moisture.

The tungsten bulb has a better than 15,000 hour life expectancy (20+ months). For replacement, the watertight bulb housing is conveniently accessible from the side of the sensor head.

SELECTING PROPER SAMPLE POINT

The high sensitivity of the instrument makes sample handling and delivery critical for proper operation. Poor results caused by improper sample handling will not only reduce the value of the instrument to the user, but they can result in regulatory penalties. An increase in a small number of particles in the filter effluent caused by poor sample control can cause a significant increase in measured turbidity.

It is not difficult to achieve proper sample delivery in virtually any treatment plant. The important thing is to make sure the sample is a proper representative of the process stream. There are three ways in which the sample can be distorted:

1. Adding particles to the sample stream. Choosing an improper location for the sample tap, such as the bottom of a pipe where sediment can accumulate, or an open sample point where particles can be introduced from outside the process.

2. Losing particles from the sample stream. Long sample lines can cause particle dropout, especially at low flow rates. If the sample line must be long (more than 10 or 15 feet), a large pipe should be used with a flow rate that keeps the sample moving as fast as the process stream. Particles will settle out of standing water.

3. Altering the particle distribution. Sample pumps can chop up larger particles creating more small particles. Valves and other obstructions can cause "shedding." Particles collect on cracks and edges and then break loose later. "T-fittings" can cause larger particles to miss the sample line because they do not necessarily make the sharp right angle "turn."

Of course, it is seldom possible to avoid all of these pitfalls. Valves are often needed to control sample flow rates, or pumps are used to get the sample to a usable point. The important thing is to minimize these problems. Filtered water can be pumped with fewer problems than raw or settled water since only very small particles are usually present, and they are less likely to be broken up. Ball valves, or other types with minimal edges to trap particles, can be used. "Y-fittings" can be used instead of "T'-fittings."

Sample Taps

The diagram below shows proper and improper sample locations on a process pipe. These are the same as for any instrument requiring a representative sample flow. See ***Figure 1***.

Make sure that the sample point has the minimum pressure available at all times to provide enough flow.

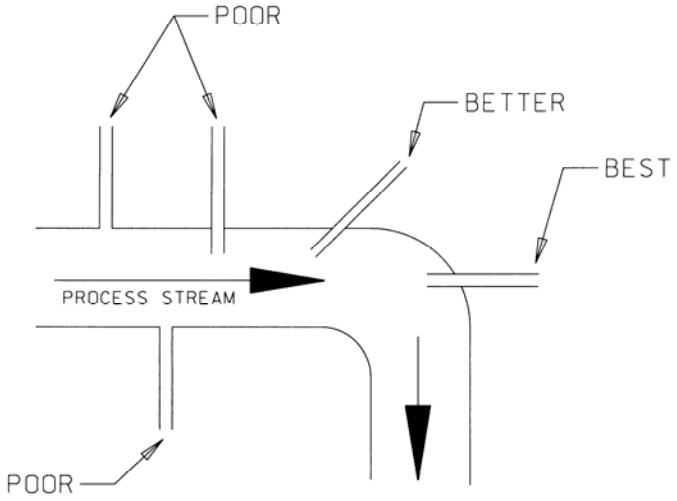


Figure 1. Sample Tap

TECHNICAL SPECIFICATIONS

Compliance:	USEPA 180.1
Range:	0 - 100 NTU
Resolution:	0.0001 Up to 2.0000 NTU; 0.001 From 2.001 to 9.999 NTU; 0.01 Greater than 9.999 NTU
Repeatability:	Better than ± 1.0% of reading or ± 0.002 NTU
Signal Averaging:	User selectable from 1-90 seconds
Sample Flow:	100 to 1000 mL/min.
Sample Temperature:	0-50° C, (32-122° F)
Operating Temperature:	0-50° C, (32-122° F)
Light Source:	Tungsten lamp
Lamp Life (MTTF):	Greater than 15,000 hours (20 months)
Outputs:	Two selectable 4-20 mA isolated, adjustable over entire range Both outputs transmit current turbidity value
Digital Communications:	RS485 (Modbus RTU & Modbus ASCII), Ethernet (Modbus TCP), & Bluetooth
Certifications:	CSA, CE
Enclosure:	NEMA 4X
Power Requirements:	100-240 VAC, 47-63 Hz, 0.5 A
Mounting:	Single module design; wall, rack or stand mount
Dimensions:	53 cm H x 23 cm W x 20 cm D (21"H x 9"W x 8"D)
Shipping Weight:	6 Kg (13 Lbs.)

SECTION 2
MOUNTING AND INSTALLATION

MOUNTING

The TM2200 Turbidimeter should be permanently mounted in an upright position using the mounting holes on the enclosure. See ***Figure 2*** for details.

WIRING SAFETY

Please observe the following safety precautions prior to wiring the unit:

- Power must be locally fused or switched prior to entering the unit
- Disable power circuit prior to hardwiring the unit
- Observe polarity when connecting the unit. The unit may not function properly, and can be damaged, if polarity is crossed
- All wire connections should be tinned prior to connecting to ensure proper contact and to prevent corrosion
- The unit must be connected to earth ground

WIRING

Following the installation guidelines outlined in this manual should result in proper operation with minimal problems. Individual plant requirements and layouts will vary, resulting in alterations to the procedures. All wiring connections are located beneath the connection cover plate. See ***Figure 3***.

- Disable power circuit that supplies power to the unit
- During installation, a local isolation point must be supplied
- Mount the TM2200 in the upright position (Chemtrac logo upright) using the four mounting holes on the back of the enclosure. Unit may be fastened to mounting brackets, pipe stand or similar
- Wiring should be fed through the compression fitting on the bottom of the enclosure.

NOTE

When feeding wire into unit it is always important to feed through the compression fitting that is closest to that wire connection.

All external electrical connections are shown in ***Figure 3***.

Electrical power should be connected in the following order.

1. Insert the ground (earth) wire into the middle terminal labeled “G”
2. Insert the Line wire into the left terminal labeled “L”
3. Insert the neutral wire into the right terminal labeled “N”

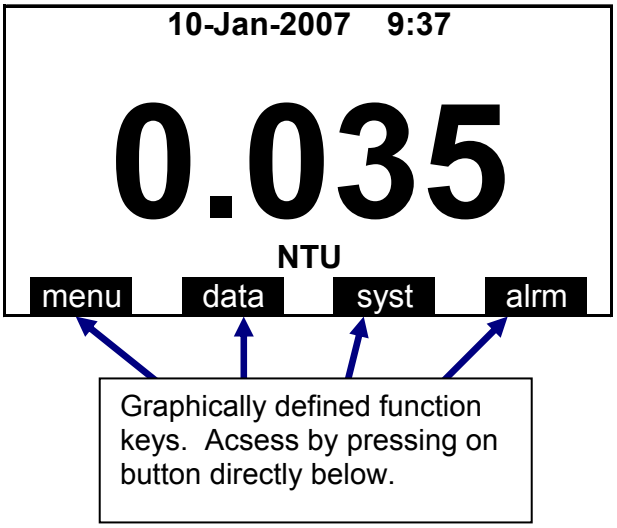
SAMPLE CONNECTION

- Sample inlet and drain are connected to the debubbler (See ***Photo 4***). The sample inlet connection is a ¼" barbed fitting suited for ¼" ID tubing. The sample drain fitting is a ½" barbed fitting suited for ½" ID tubing. The debubbler outlet connects to the cuvette inlet with quick connect fittings requiring ¼" OD tubing. The outlet of the cuvette connects to the drain section of the debubbler through quick connect fittings and ¼" OD tubing. See ***Photo 1***.
- Sample should flow to the debubbler at a rate of between 100mL/min to 1000mL/min. Prior to starting sample flow, ensure the sample line has been adequately flushed to prevent fouling of the debubbler or cuvette.

SECTION 3
OPERATION

DISPLAY/USER INTERFACE

The TM2200 is equipped with user interface keys, LED indicators, and audible beeps. The interface keys are up (▲), down (▼), and the four function keys. The label directly above each key on the display defines the function keys.



There are four red LED lights to the left of the graphical display. These are:

- Power – Illuminates when AC power is applied and instrument is turned on
- Service – Illuminates if there is a hardware failure (electronics)
- Alarm1 – High or low turbidity value, illuminates if turbidity value reaches alarm set-point
- Alarm2 – Lamp status alarm, illuminates if the lamp has failed

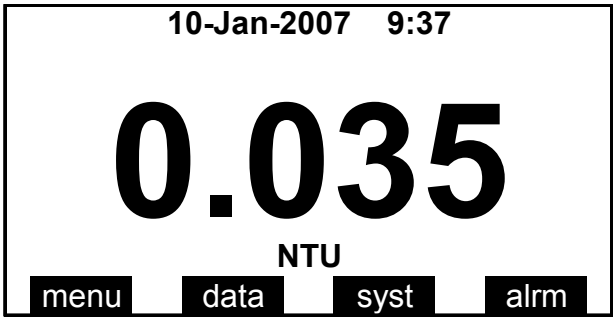
TM2200 READOUT, MENUS, AND CONTROLS

The menu system for the TM2200 is simple to navigate; below you will find the different screens accessible through the function keys (**menu**, **data**, **syst** and **alrm**):

TM2200 Home Screen

The **Home** screen on the TM2200 is the screen used under normal operation of the instrument. From this screen, all other features and menus can be accessed.
The main screen displays:

- System date and time
- Present turbidity value (NTU's)
- Function key labels



FUNCTION KEYS:
menu – Changes display to the Main Menu screen. From here, you can access:

- Alarms – To enable High or low alarms and adjust the setpoint for each alarm.
- Settings – To adjust system settings such as Time/Date, Signal Averaging, Log Interval, etc.
- Service – To adjust critical system settings such as Calibration, Output Hold, etc.

Each of the options under the service menu will be explained in detail in a later section.

data – Displays the data log. This log displays the last 60 logged values based on the Log Interval selected in the Settings menu.

syst – Displays the system log. This function label is only present if the is information in the system log. The system log contains such information as alarm occurrences and date/time of calibrations.

alrm – Displays the status of each Alarms 1 & 2.

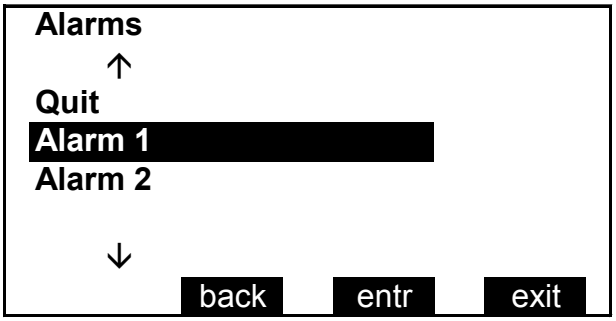
back – Will always bring you back to the previous screen.

exit – Will always bring you back to the main screen.

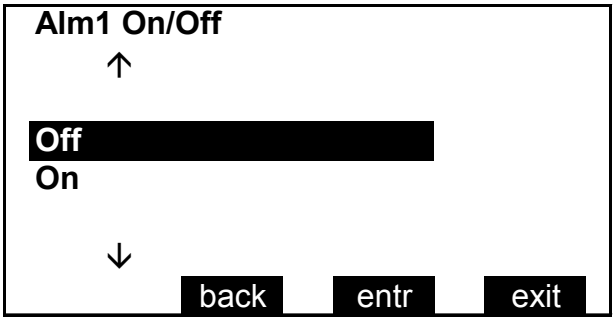
TM2200 Menu Screen

Use the up and down arrow buttons to highlight the desired menu item then press the function button under “entr” to select.

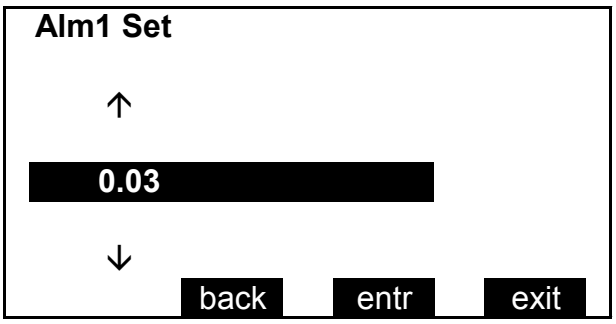
ALARMS



Select the desired alarm and press the function button under “entr” to select.

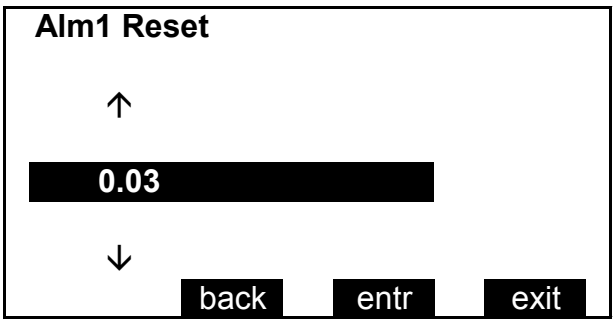


- “Off” disables the alarm feature.
- Selecting “On” and pressing the function key below “entr” enables the alarm and brings up the Setpoint screen.



The alarm setpoint screen allows you to set the value at which an alarm will be triggered. Once this value is set, the next screen “Reset” will allow you to set the value at which the alarm is cancelled. By setting a “Reset” value below the setpoint, you create a high alarm (alarm will trigger if turbidity increased to or above the setpoint). By setting a “Reset” value above the setpoint, you create a low alarm (alarm will trigger if turbidity falls below the reset point).

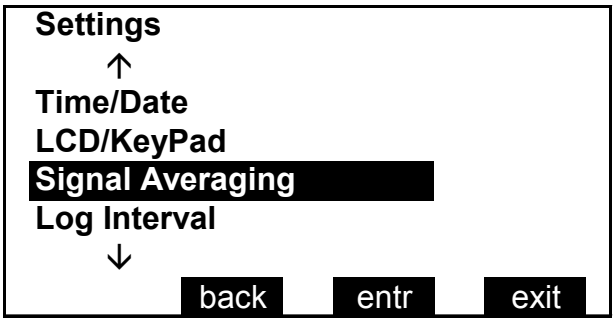
Use the up and down arrow buttons to select the desired alarm setpoint and press the function button labeled “entr” to store this value and proceed to the “Reset” screen.



Using the up and down arrow buttons, select the value at which the alarm will be cancelled. Remember, a reset value below the setpoint will create a high alarm and a reset value above the setpoint will create a low alarm.

Once the proper value has been entered, press the function button labeled “entr”. The screen will return to the “Alarms” menu screen. From this screen, press the function button labeled “exit” to return to the main screen or continue on with the other alarm setup.

SETTINGS



The “Settings” menu contains the following parameters:

- **Time/Date** – Used to set system time and date. For data logging purposes, it is important that the instrument's time and date are set accurately.

  ****NOTE: The instrument will not automatically adjust for Daylight Savings Time.**

- **LCD/Keypad** – Used to set display features including:
  - Keypad Tone – Beep when buttons are pressed (On/Off)
  - Backlight – Display backlight (On/Off/Auto) Auto turns the backlight off after 20 seconds without a button press.
  - Contrast – Adjusts the contrast of the display.

- **Signal Averaging** – Select duration of instruments built in signal averaging.
  - None – signal averaging is turned off.
  - 5 seconds, 10 seconds, 15 seconds, 30 seconds, 60 seconds

- **Log Interval** – Selects the interval that the instrument logs turbidity value into its internal memory. The instrument can log up to 36,000 data points. With a 15 minute log interval, data will be stored for over 1 year before the oldest data is overwritten with new data.
  - Options – 1 minute, 5 minutes, 10 minutes, 15 minutes, 30 minutes, 60 minutes

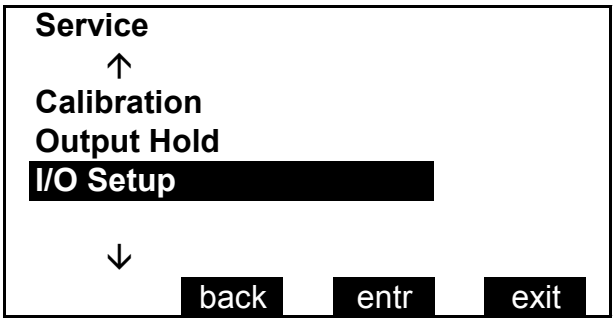
- **Resolution** – Allows the user to select the maximum displayed resolution.
  - Options – 4 decimal places (ex. X.XXXX), 3 decimal places (ex. X.XXX)
    2 decimal places (ex. XX.XX), 1 decimal place (ex. XXX.X)
  - Notes – This feature only sets the maximum displayable resolution. For example, if the resolution is set to 4 decimal places (X.XXXX) but the measured turbidity is greater than 3.2 NTU, only 3 decimal places will be displayed (ex. 3.257).

- **Output Scale** – Selects the output scaling for the 4 – 20 mA analog outputs.
  - Options -
    1. 0 – 1 NTU (4 mA = 0, 20 mA = 1 NTU)
    2. 0 – 2 NTU (4 mA = 0, 20 mA = 2 NTU)
    3. 0 – 10 NTU (4 mA = 0, 20 mA = 10 NTU)
    4. 0 – 100 NTU (4 mA = 0, 20 mA = 100 NTU)

- **RS-485 Addr** – Sets the instruments node address for Modbus communications. Selectable from 1 – 247.

Service

The Service menu contains settings that are critical to the proper, accurate performance of the TM2200 turbidimeter. These values should only be modified by properly trained plant personnel.



The features accessible through the Service Menu include:

- **Calibration** – The calibration of the instrument is covered in **Section 4 - Instrument Calibration**.
- **Output Hold** – Hold the 4-20mA analog output signal at the present value for a specified period of time. The Output Hold feature is covered in **Section 5 – Output Hold**
- **I/O Setup** – Allows the user to add an offset value to the 4-20mA analog output signal. I/O Setup is covered in **Section 6 – I/O Setup**.

Section 4
Instrument Calibration

EPA recommends that primary suspension standards should be used to initially calibrate on-line turbidimeters, and then used at least every three months to calibrate the units in order to prevent instrument drift (primary calibrations should also be performed more often if a need is determined in the more frequently run secondary standard calibration process).

EPA recommends that on-line turbidimeters have calibration verified on a weekly basis, if being utilized for combined filter effluent monitoring. Less frequent verification may be more appropriate for turbidimeters monitoring individual filter turbidity, but EPA recommends verification be conducted with a frequency of at least once per month. Calibration verification can be completed using primary suspension standards, secondary suspension standards, or by comparison to a properly calibrated turbidimeter. If verification indicates significant deviation from the standard (true) value (greater than ±10%), the instrument should be thoroughly cleaned and recalibrated using a primary standard.

The calibrations should be well documented and the standards should be replaced when they exceed the expiration date. Although the EPA recommends a few different primary standards for possible use, the TM2200 has been developed using **Amco Clear® standards** (available from GFS Chemicals) for all calibrations.

Regardless of calibration results, turbidimeters should be thoroughly cleaned and calibrated with primary standards at least quarterly.

The TM2200 Turbidimeter is designed with built in auto-ranging capabilities, which operate over three distinct ranges, 0 – 2 NTU, 2 – 10, NTU and 10 – 100 NTU. It is only necessary for the end user to calibrate the instrument in the ranges for which it will be used. For example, if the instrument is installed to monitor a sample stream from a filter, where the turbidity never exceeds 2 NTU, the end user might elect to calibrate the instrument only at 0 NTU and 2 NTU, which will cover the only range that will ever be utilized by the turbidimeter. However, in an application where the turbidity of the sample may range from 0 NTU to 15 NTU, the user should calibrate the instrument at all 4 calibration points (0, 2, 10 and 100 NTU) to ensure accuracy at all possible sample turbidities.

When performing either a primary or secondary calibration, it may be desirable to utilize the Output Hold function of the instrument. See the section labeled Output Hold.

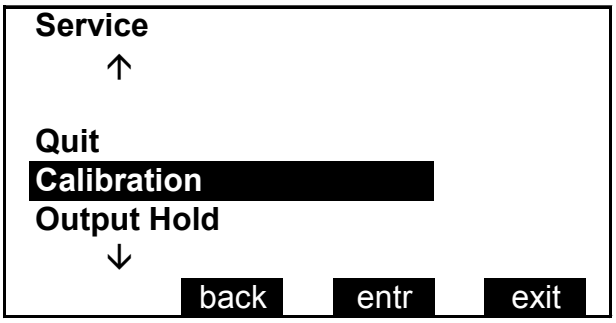
Primary Calibration

Primary calibration of the TM2200 Turbidimeter must be performed using the same cuvette that will be used during normal operation.
To disconnect the cuvette:

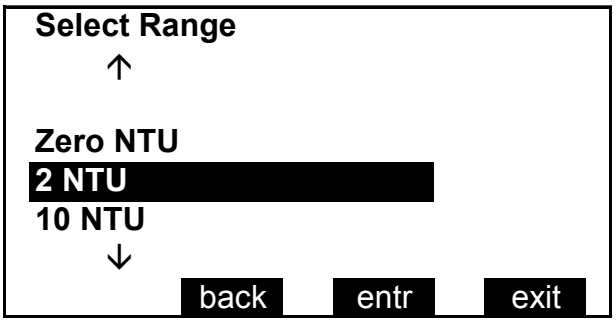
1. Close the ball valve at the outlet of the debubbler and remove the locking pin located in the probe block.
2. Remove the cuvette from the probe block and disconnect the tubing to drain the cuvette.
3. Thoroughly clean and rinse the cuvette.
4. Insert the provided plug into the fitting at the bottom of the cuvette.
5. Remove the top screw cap and fill the cuvette approximately half full with the proper calibration standard.
6. Gently swirl the standard around the cuvette to rinse and discard the standard.

7. Fill the cuvette up to the threads and replace the top screw cap.
8. Insert the cuvette containing the proper standard into the probe block being certain to align the indexing mark as indicated in ***Photo 2***.
9. Close the probe block and insert the locking pin.

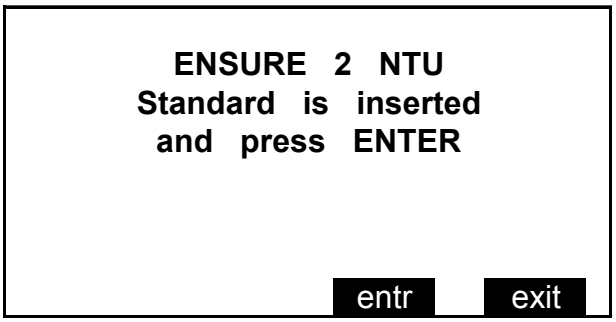
To begin the calibration function of the instrument, access the Service Menu and, using the up and down arrow keys, highlight **Calibration** and press the function button labeled **entr.**



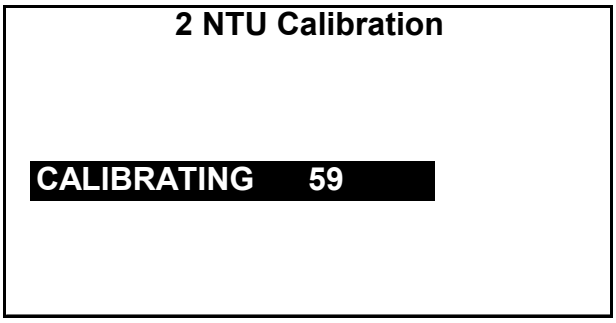
This will bring up the calibration menu shown below.



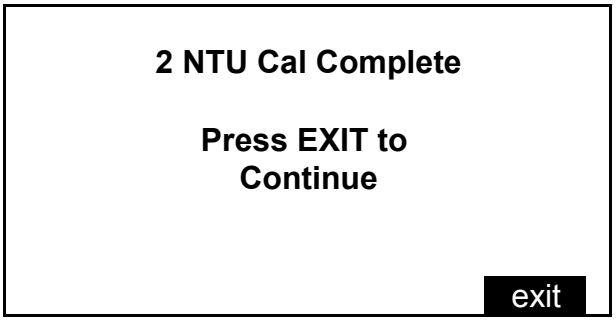
Once it has been determined which ranges are to be calibrated, select the first turbidity standard value by using the up and down arrow keys to highlight the desired value and press the function button labeled **entr.** The following screen will be displayed.



After inserting the proper standard, press the function button labeled **entr.** The calibration process will begin, and the display will begin counting down from 60 seconds as shown below.

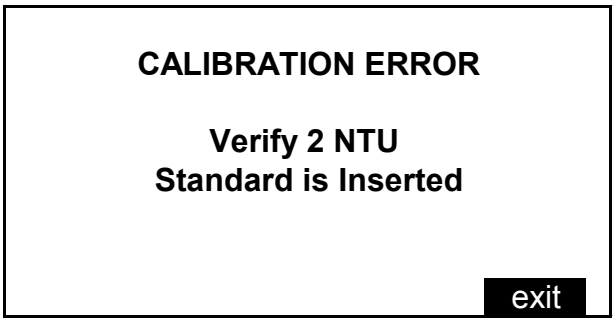


Once the calibration of the selected range is complete, the following screen will be displayed.



Press the function button labeled **exit** to return to the home screen. If additional ranges are to be calibrated, follow the above steps again using the appropriate range and standard.

If there is a problem with the calibration, the following screen will be displayed.



If this error appears, verify that the proper standard has been inserted for the range being calibrated and retry the calibration. If the error persists, contact the factory for assistance.

Secondary Calibration

Secondary calibration, or calibration verification, can be performed using a spare or sealed cuvette. When performing a secondary calibration on the instrument, it is not necessary to stop sample flow through the instrument.

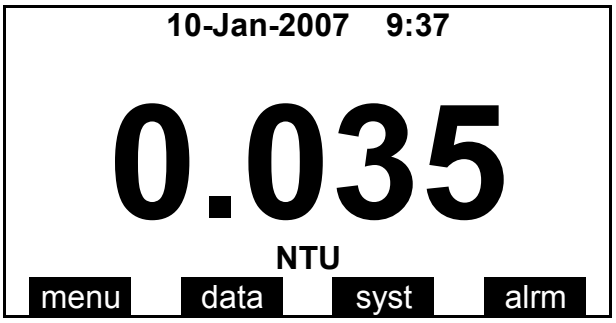
1. Remove sensor block locking pin and open sensor block.
2. Remove flow thru cuvette.
3. Place secondary standard cuvette in sensor block being certain to align the white indexing mark on cap with the line on the sensor block. See ***Photo 2***.
4. Allow one minute for reading to stabilize.
5. If the value indicated on the instrument display does not match (within +/- 10%) the stated value indicated on the secondary calibration cuvette, it is necessary to perform a primary calibration. (See section “Primary Calibration”)
6. If the value indicated on the instrument display matches (within +/- 10%) the stated value indicated on the secondary calibration cuvette, the calibration has been verified and no further steps are required.
7. Remove sensor block locking pin and open sensor block.
8. Remove secondary calibration cuvette.
9. Place flow thru cuvette in sensor block being certain to align the white indexing marks on cap and sensor block.
10. Re-install sensor block locking pin and close the instrument’s front panel.

Section 5
Output Hold

The output hold function of the instrument will hold the analog output signals (4 – 20 mA) at the present value, for the specified period of time, when enabled. This feature can be useful during calibration or routine maintenance, as it will prevent the instrument from transmitting erroneous turbidity values that may be generated by removing the cuvette or inserting a calibration standard.

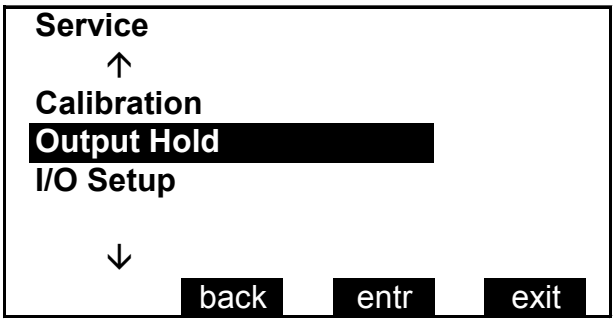
To access the output hold feature:

From the Home Screen, press the function button labeled **menu.**

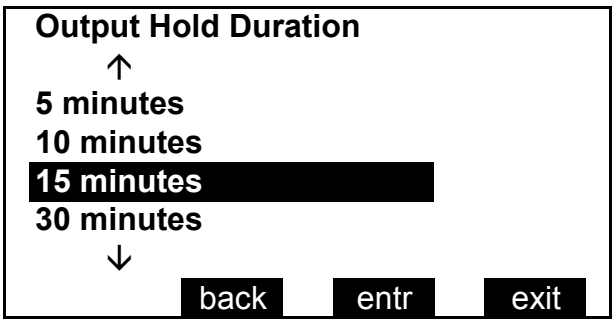


The Main Menu screen will appear as shown below. Utilizing the up and down arrow keys, highlight **Service** in the menu and press the function button labeled **entr** to enter the Service Menu.

From the Service Menu, highlight **Output Hold** and press the function button labeled **entr.**

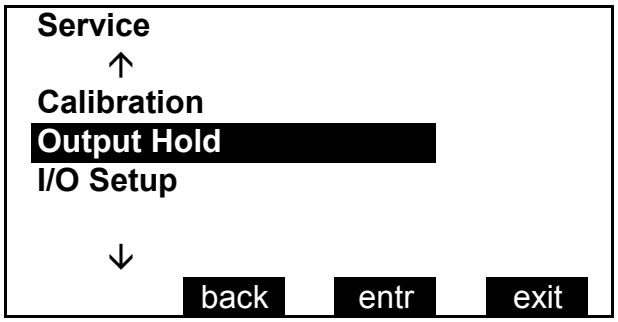


This will bring up the Output Hold Duration menu shown below.

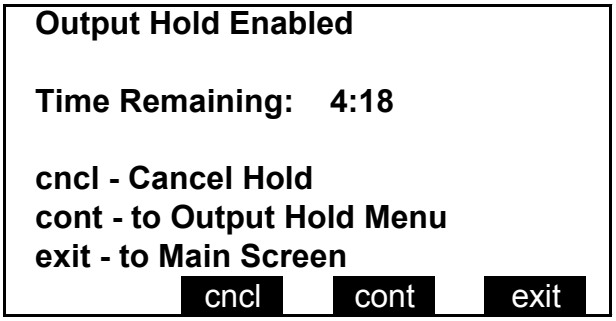


From this menu, using the up and down arrow keys, select the desired length of time the analog output (4 – 20 mA) signal is to be held at its present value and press the function button labeled **entr.** The options for duration include 5 minutes, 10 minutes, 15 minutes, 30 minutes and 60 minutes.

To cancel the output hold feature before the selected duration has ended or to see the time remaining on the output hold, return to the Service menu, highlight **Output Hold** and press the function button labeled **entr.**



If the output hold feature is still enabled, the following screen will appear, showing the time remaining in minutes and seconds.



From this screen, there is the option to either:

cncl – This cancels the output hold feature and the analog output (4 – 20 mA) signals will begin transmitting the current turbidity values.

cont – This will allow you to continue on to the **Output Hold Duration** Menu where you can elect to reset the duration of the output hold feature.

exit – Exits to the Home Screen without canceling or changing the output hold feature.

Section 6
I/O Setup

The I/O Setup feature provides an offset to the analog output signals (4 – 20 mA). This may be utilized to match the displayed value to the value shown in a PLC or SCADA computer. The amount of offset, and its affect on the analog output signal (4 – 20 mA) is dependent on the output scaling selected in the Settings Menu (Section 3.2.2.2). Table 1 illustrates the amount of offset required for a corresponding change in turbidity reading from the analog outputs (4 – 20 mA). The offset value can be entered as either positive, creating an increase analog output, or a negative value, resulting in a decrease in the analog output.

Output Scale	Offset Value	Turbidity Change
0 - 1 NTU	10	.005 NTU
0 - 2 NTU	5	.005 NTU
0 - 10 NTU	1	.005 NTU
0 - 100 NTU	1	.05 NTU

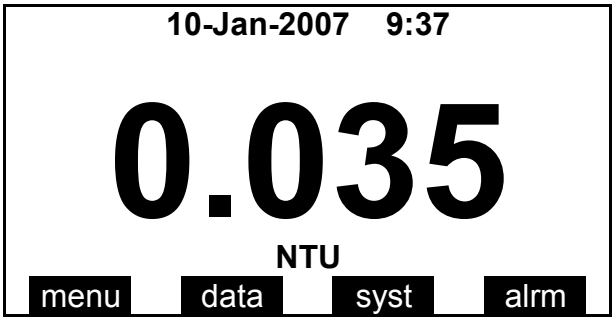
Table 1

Example 1: As indicated in Table 1, with the output scale set to 0 – 1 NTU, for every 10 units of offset applied, the measured turbidity at the PLC or SCADA computer will change by .005 NTU.

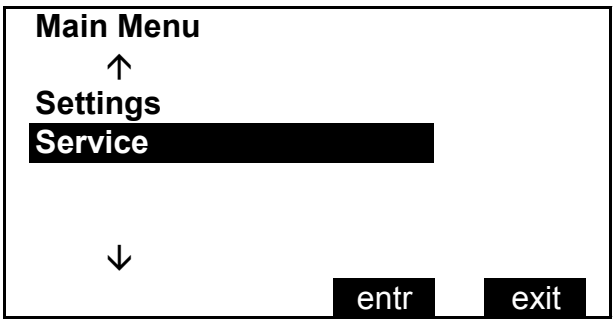
Example 2: If the turbidity, as displayed on the Home Screen of the instrument, is measured as .050 NTU, but the SCADA computer is showing .060 NTU, applying an offset value of negative 20 (-20) will change the value indicated on the SCADA computer to .050 NTU, matching the turbidity as measured by the instrument.

To access the I/O Setup feature:

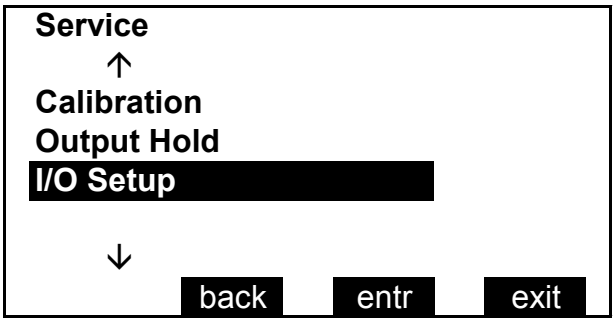
From the Home Screen, press the function button labeled **menu.**



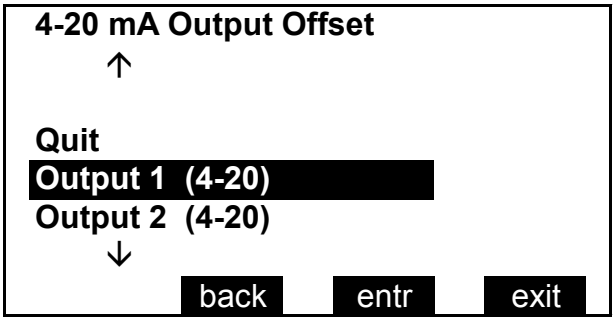
The Main Menu screen will appear as shown below. Utilizing the up and down arrow keys, highlight **Service** in the menu and press the function button labeled **entr** to enter the Service Menu.



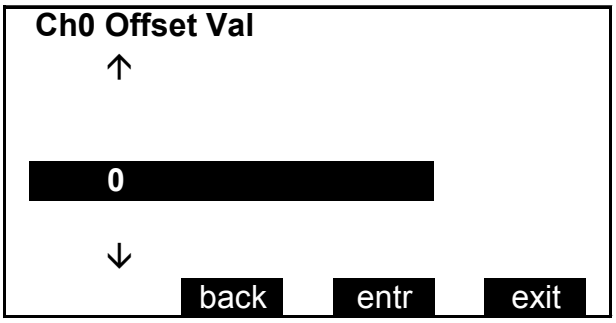
From the Service Menu, highlight **I/O Setup** and press the function button labeled **entr.**



This will bring up 4-20 mA Output Offset menu shown below.



Using the up and down arrow keys, highlight the analog output (Output 1 or Output 2) for which the offset will be adjusted. Once the proper analog output is highlighted, press the function button labeled **entr.** The following screen will appear.



Using the up and down arrow keys, adjust the offset value for the value calculated from Table 7. Once the proper value is indicated, press the function button labeled **entr.**

Section 7
Maintenance

LAMP REPLACEMENT

To ensure instrument accuracy, whenever the lamp assembly is replaced, a new calibration should be performed. The tungsten lamp has a life rated at greater than 15,000 hours (20+ months). The instrument will give an alarm, and indicate on the display, should it become necessary to replace the lamp. The lamp utilizes a threaded hood that screws into the sensor block. See ***Photo 5*****.**

To replace the lamp:

1. Using the switch located in the front panel, turn off AC power to the instrument.
2. Unplug the lamp electrical connection by turning it counter clockwise.
3. Remove the screw securing the lamp assembly to the sensor block and slide the lamp assembly out of the sensor block.
4. Insert the new lamp assembly and secure it in position with the screw removed in step 3.
5. Connect the lamp electrical connection by turning it clockwise until it locks into position.
6. Re-apply AC power to the instrument.

CLEANING

Cleaning the Cuvette

The cuvette must be cleaned using a tube/bottle cleaning brush with soft bristles, or a cleaning rag that is specifically designed to clean optical surfaces. Care must be taken to avoid leaving streak mark or blemishes on the outside of the glass as it will adversely affect the light refraction and the instrument readings.

Cleaning the Debubbler

The debubbler is designed to facilitate cleaning and maintenance. Whenever performing sensor cleaning it is recommended that the debubbler be checked for accumulation of debris. If there is any accumulation, the debubbler can be removed and rinsed thoroughly.

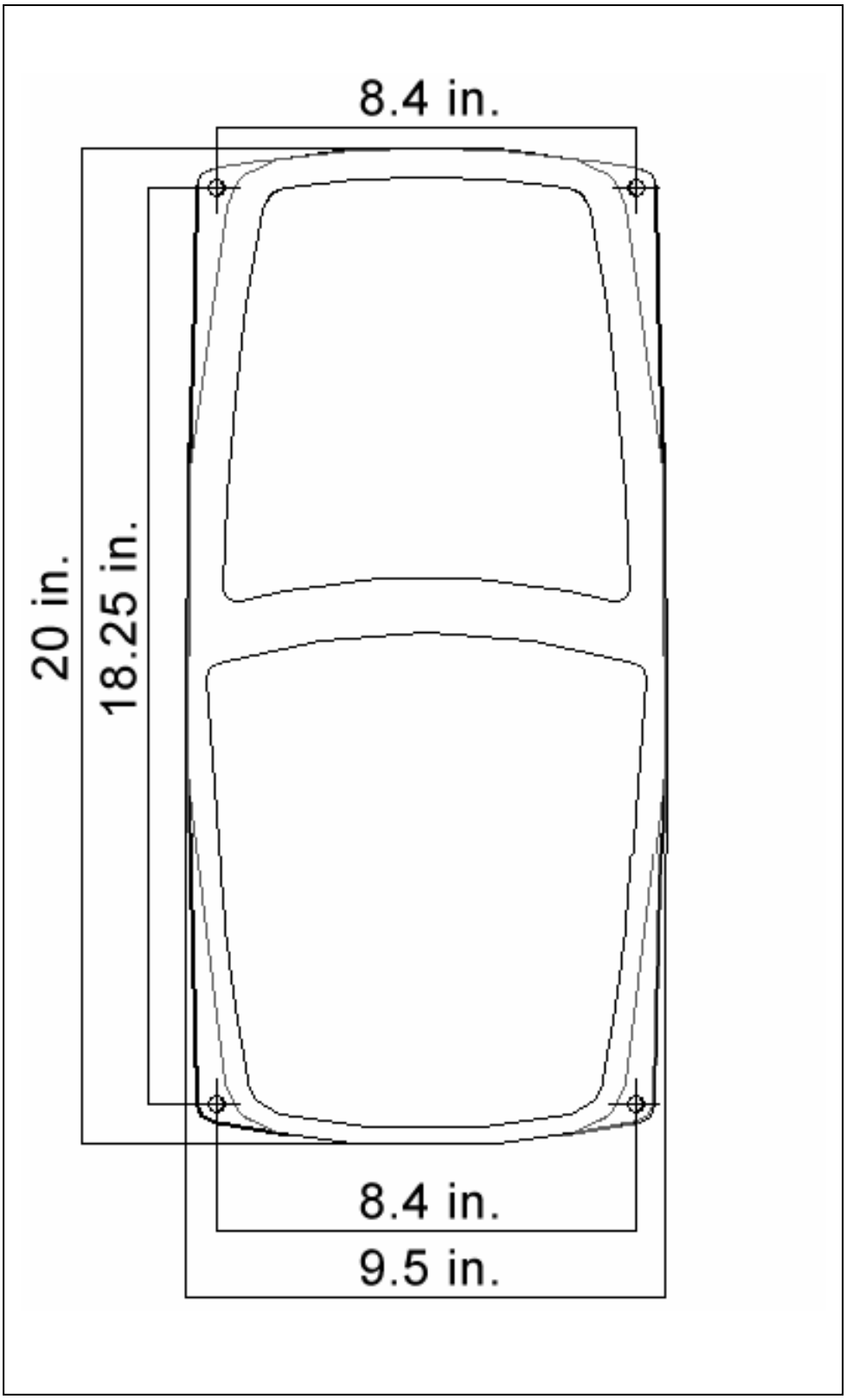


Figure 2 Mounting Dimensions

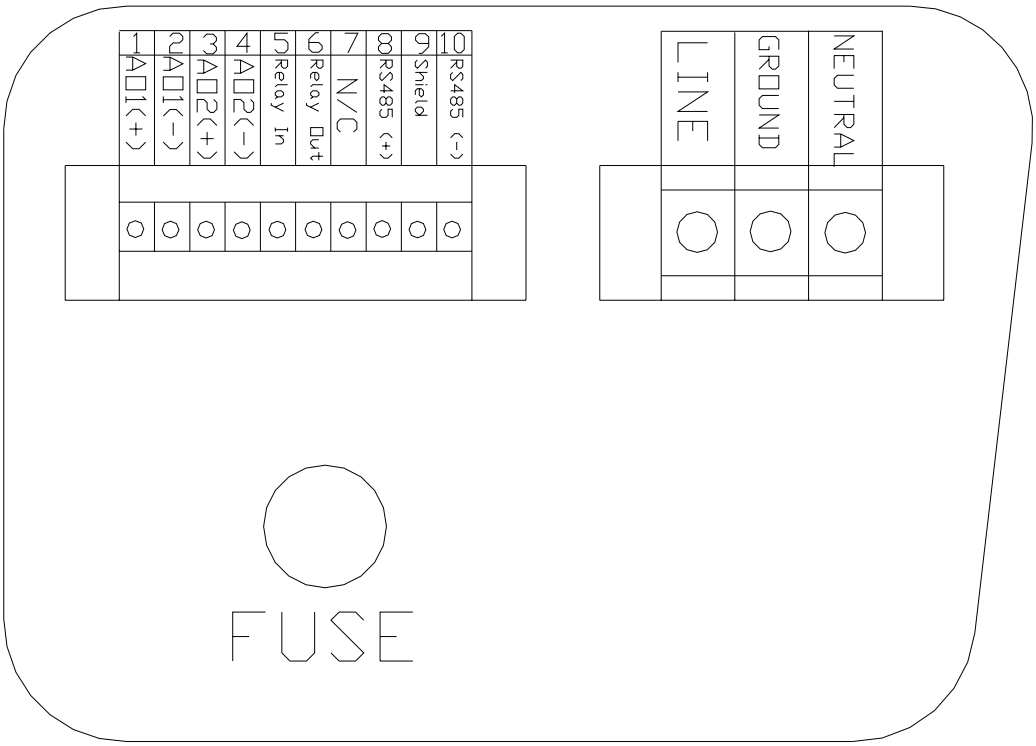


Figure 3 Electrical Connections

TABLE 2	
1	**Analog Output 1 (4 – 20 mA) (+)**
2	**Analog Output 1 (4 - 20 mA) (-)**
3	**Analog Output 2 (4 - 20 mA) (+)**
4	**Analog Output 2 (4 - 20 mA) (-)**
5	**Alarm Relay In (High/Low and Lamp Alarm)**
6	**Alarm Relay Out (High/Low and Lamp Alarm)**
7	**No Connection**
8	**RS485 (+)**
9	**RS485 Shield**
10	**RS485 (-)**

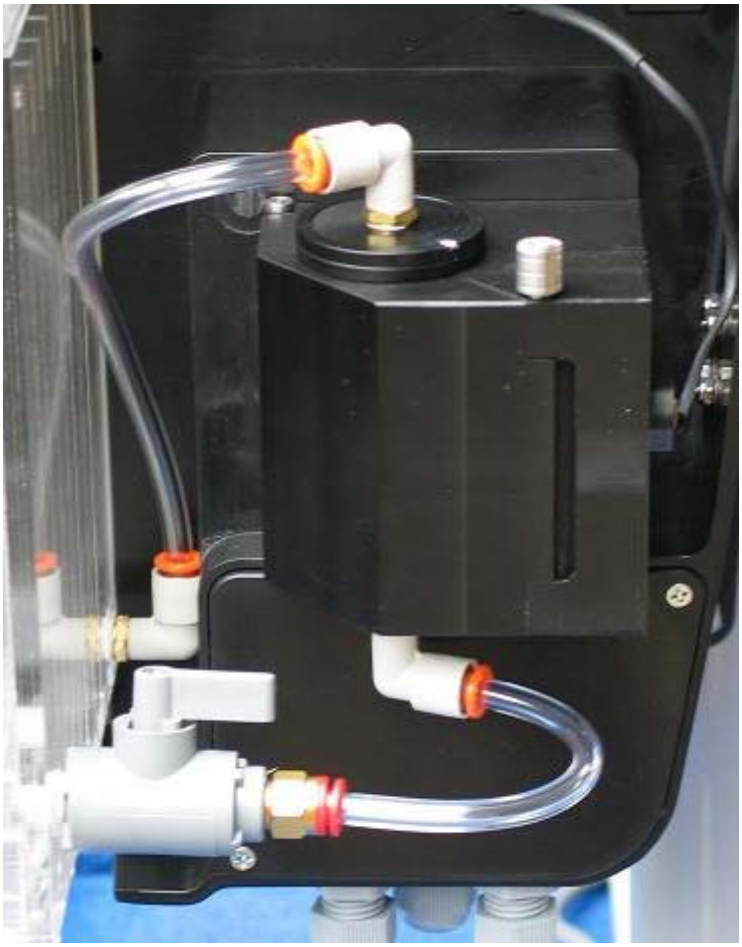


Photo 1 – Cuvette Sample Connection

Photo 2 – Cuvette Indexing

Photo 3 – Electrical Connections

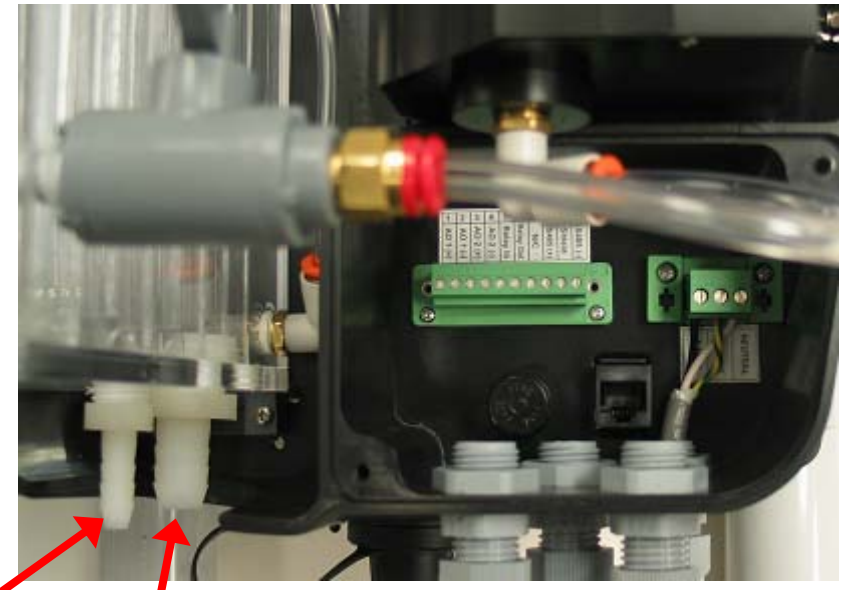


Photo 4 – Sample Inlet and Drain

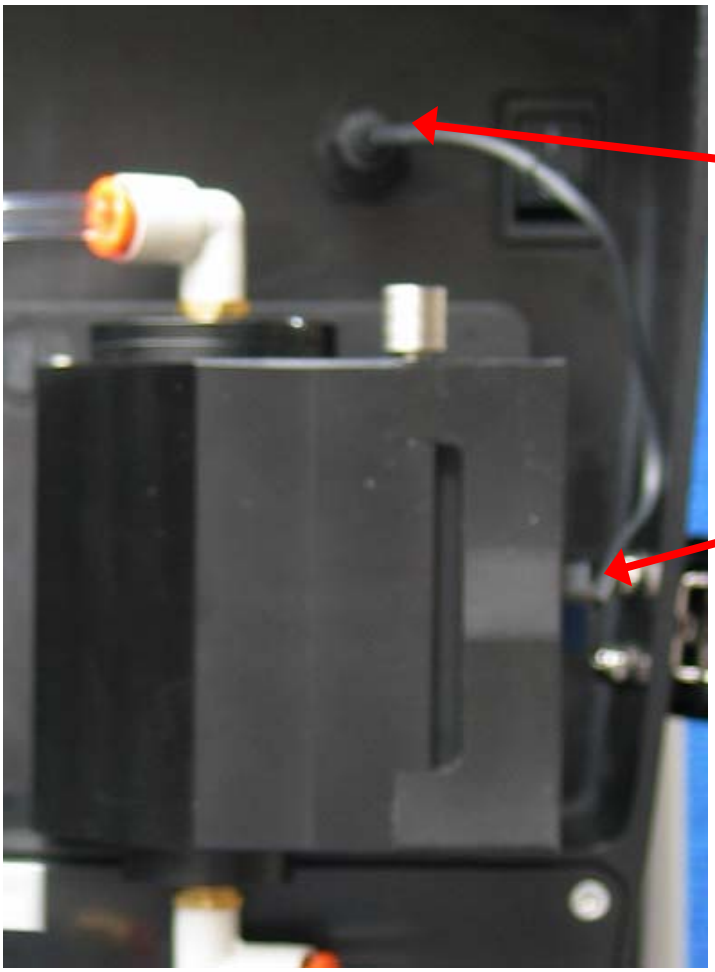


Photo 5 – Lamp Connections