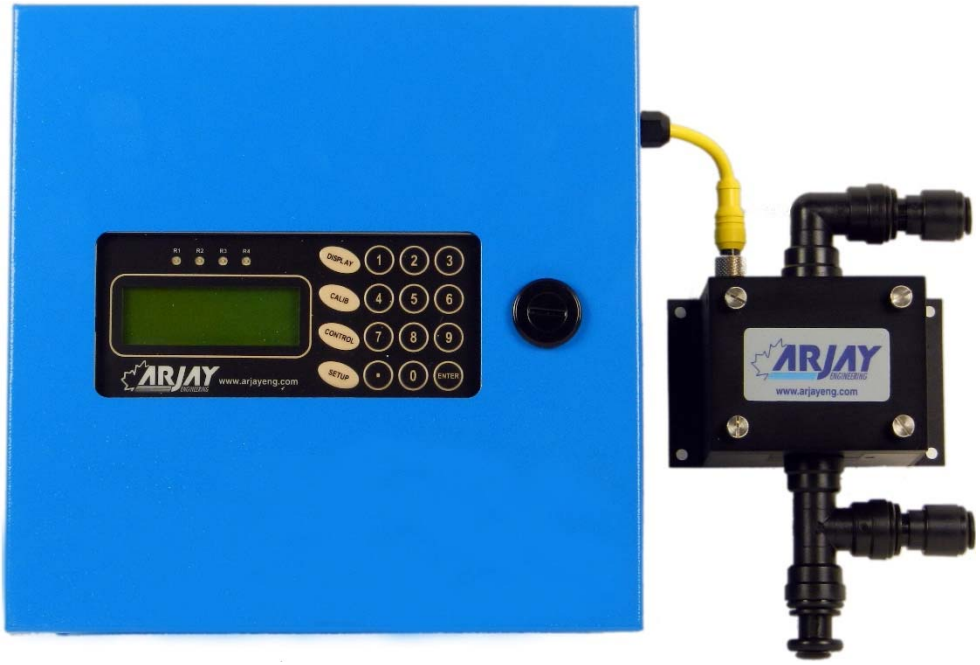
MODEL:

HYDROSENSE 4410-OCM-X

OIL CONTENT MONITOR WITH DEDICATED TURBIDITY SYSTEM



USER MANUAL (REV: 1.0)

ARJAY ENGINEERINGLTD.		
2851 Brighton Road Oakville (Toronto), Canada L6H 6C9	TEL: ++1 (905) 829-2418 FAX: ++1 (905) 829-4701 NORTH AMERICA: 1-800-387-9487	WEBSITE: www.arjayeng.com EMAIL: arjay@arjayeng.com

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NOTICE	***Please*** read the Installation Notes (4.1) prior to locating and mounting the instrument.

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1.0 SPECIFICATION

Specifications are subject to change without notice

Specification	***Details***
Power Input:	100 - 230VAC, 50/60Hz, 0.63 – 0.31A, 1A Fuse OPTIONAL: 24 VDC @ 360 mA max, 1/2 A Fuse
User Interface:	
Display	Four line LCD with simultaneous display in PPM or mg/L, NTU, current date
Resolution:	0.1 ppm and 0.1 NTU
Communication Interface:	RS-485 Modbus, optional HART or Fieldbus Foundation module for uni-directional communication of ppm.
Relays / Analog Outputs:	
Relay Outputs	3A SPDT @ 250V relays are available, dry contacts with LED panel indication ***R1, R2 & R3:*** Setpoint Alarm Relays: User settable alarm points and delay time ***R4:*** Fault / Maintenance Relay– Service is required (See Troubleshooting section 11.0)
Time Delay ON:	0 – 99 sec
mA Signal Outputs (two)	4-20 mA DC, 900 Ohms, field scalable (one for oil, one for NTU)
Instrument Performance:	
Measuring Range	0 - 250 ppm Hydrocarbon in Water, 0-50 NTU Turbidity
Instrument Accuracy	± 1% of calibration range
Process Accuracy	+/- 1.0 ppm of Full Scale (calibrated range) The process accuracy is reflected by the site calibration to a known oil concentration and a stable background water. Changes in the oil make-up and variations in the process may affect the instrument output. Through a simple calibration, this unit correlates with laboratory methods
Sensitivity	***Oil:*** 145 PPB (diesel reference) & 463 PPB (crude oil reference) ***Turbidity:*** Formazin reference
Calibration	***Oil:*** Up to five concentration entry points to maximize accuracy ***Turbidity:*** two point calibration
Response Time Signal Filtering	Adjustable 1-100 samples/average.
Environmental:	
Ambient Temperature	5-55 °C Protect from direct sun or rain. Instrument shelter or indoor use is recommended. Higher temperatures may be accommodated with air conditioning.
Relative humidity	Up to 80% (non-condensing) (Note: Heat transfer unit is recommended for high and extended levels above 80% humidity)

Specification	*Details*
Process Requirement:	
Process Sample Temperature	0-55 °C (32-130 °F) without cooler; above 55 °C (130 °F) with sample cooler.
Inlet Flow Rate	Minimum: 1.0 L/M (continuous and stable) at 2psig Maximum: 7.5 L/M (continuous and stable) at 100psig
Inlet Water Pressure	Minimum 2 psig OR 25psig with sample cooler option Maximum 300psi, Without Sample Take off assembly (With SS fittings) Maximum 125psi, Without Sample Take off assembly (With PVC fittings) Maximum 300psi, With Stainless Steel Sample Take off assembly (Option) Maximum 125psi, With PCV Sample Take off assembly (Option)
Instrument Air	5-10psi (30-60 SCFH / 14-28 LPM), used to minimize condensation in humid and low dew point applications.
Mechanical Specification:	
Controller (Standard):	
Material	Steel with Polyester Powder Blue (RAL5015) painted
Enclosure Dimensions	305mm W x 305mm H x 127mm D (12.0"W x 12.0"H x 5.0"D)
Electrical / Signal Ports	1/2” Conduit Holes (Qty. 3)
Shipping Weight	8 Kg (17.6 lbs) approximate
Enclosure Rating	Type 4, IP66 with viewing window ***Custom sizes & materials available. Please consult factory for more detail.***
Sensor Block (Standard):	
Material	Steel with Polyester Powder Blue (RAL5015) painted
Enclosure Dimensions	355.6mm W x 305mm H x 152.4mm D (14.0"W x 12.0"H x 6.0"D)
Sample Inlet	1/4” NPT female (3/8” NPT female for SS bulkhead)
Sample Outlet	1/4” NPT female (3/8” NPT female for SS bulkhead)
Wetted Material	Quartz flow through tube, Quartz test tube, Polyurethane tubing (black), PVC fittings (Stainless Steel option available), PVC sample take off assembly (Stainless Steel option available).
Shipping Weight	9.1Kg (20 lbs)
Enclosure Rating	Type 4, IP66 ***Custom sizes & materials available. Please consult factory for more detail.***
Warranty:	1 Year from ship date
Approval Standards:	CSA SPE1000 and Canadian Electrical Code (CEC) USA National Electrical Code (NEC)

2.0 USE HAZARD INFORMATION

CAUTION	Indicates a potentially hazardous situation that may result in minor or moderate injury.
WARNING	Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.
DANGER	Indicates a potentially or imminently hazardous situation which, if not avoided, will result in death or serious injury.
NOTICE	Indicates a situation which, if not avoided, may cause damage to the instrument. Information that requires special emphasis.

3.0 INSTRUMENT OVERVIEW

3.1 Features

- Fluorescence technology for Oil; Light Scatter technology for Turbidity
- Closed loop flow-through sensor
- Continuous On-Line monitoring (slipstream)
- Instantaneous readings
- Multi-point automatic or manual calibration
- Temperature and light degradation compensation
- 4 Relays (R1, R2 and R3 for setpoint alarms, R4 for fault or Maintenance alarm),
- 2 LED boards
- 3 Receiver boards: Rx1 (ppm or mg/L), Rx2 (mV) and Rx3 (NTU or mg/L).
- 4-20 mA outputs, RS-485 Modbus output, optional HART and Fieldbus Foundation
- LCD display in PPM or mg/L for oil and NTU for turbidity
- No moving parts or consumables

3.2 Description

The HydroSense Oil Content and Turbidity Monitor from Arjay Engineering Ltd. has been designed for municipal and industrial applications to measure PPM levels of petroleum hydrocarbons and NTU levels of turbidity in aqueous solutions. Typical applications include stormwater runoff, oil in cooling water, produced water, desalination, filter systems and oil/water separators. Other measurements and mediums can be monitored on request (i.e. colorants in fluids, etc.).

A continuous sample flow is directed through the sensor block (Model: SBA-XXXXXXZ) using a pumped or process pressure source. The sample can be looped back to process line or to drain.

Two LED light sources are positioned directly in front of the sample flow. The receiver boards are positioned at a determined angle to maximize their response. Each LED board emits a selected and filtered wavelength for oil fluorescence and turbidity scattering.

The oil fluorescence receiver board (Rx1) is equipped with a precision light filter to control the wavelength of the fluoresced light being received. A relationship between the measured fluoresced light and the amount of oil in the sample is mathematically predictable over the measurement range of the instrument. The precision light filters maximize the predictability over alternative non-filtered methods of measurement.

The NTU Turbidity receiver board (Rx3) is also equipped with a precision light filter to control the wavelength of the scattered light being received. A relationship between the measured scattered light and the turbidity of the passing sample is mathematically predictable over the measurement range of the instrument. The precision light filters maximize the predictability over alternative non-filtered methods of measurement.

An additional direct path receiver (Rx2) monitors the optical surfaces for any maintenance concerns which are indicated through the maintenance relay and display.

The sample tube is easily accessed for any necessary cleaning. The ultraviolet light source is easily accessible for replacement as required.

For periodic testing and calibration, a 3-way valve in the inlet line is recommended to manually input a fresh water source to confirm the instrument response, zero and clean the instrument.

4.0 INSTALLATION

NOTICE	**If any damage to the instrument is found, please notify an Arjay Engineering representative as soon as possible prior to installation.**
NOTICE	**Qualified Personnel must undertake all installations.**

WARNING	**If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.**

4.1 Hydrosense Installation Notes

NOTICE	**Read these notes *before* installation.**

The system is comprised of two main components, the Controller and Sensor Block Assembly (SBA).

1) The Sensor Block Assembly receives the flow sample from the process and outputs it back to the process line or to drain.

2) The Sensor Block Assembly should be located close to the process to reduce the lag time of the sample to the unit. This will offer more instantaneous readings and real time recording.

3) The outlet can flow back to the process. Mount the unit where it is readily accessible for maintenance and periodic testing.

4) The inlet connection to the unit is a 1/4” NPT female thread (3/8” NPT female for SS bulkhead). A barb connection may be threaded to this when flexible inlet tubing is used.

NOTICE	**Clear tubing should not be used outdoors where algae build-up from sunlight is increased.**

5) An on/off valve from the process is required close to the sensor for maintenance and/or sample tube replacement. A 3-way valve is recommended at the inlet for a fresh water input for zeroing, cleaning, and testing.

6) The Sensor Block Assembly enclosure must be mounted indoors or in a heated housing if sample freezing may occur. The inlet and outlet tubing must not be exposed to freezing environments. For outdoor installations, the unit must be sun and rain shielded. A heat transfer unit (A/C) is recommended for high temperature, humid climates.

7) The controller operates using 100-230VAC, 50/60Hz, 1PH, 0.63A – 0.31A ***or*** 24 VDC as ordered.

8) The monitor provides LED indication of the relay status. The relays are dry contacts and will accept AC or DC inputs. Setpoint alarm levels are on Relay 1, 2 & 3. Relay 4 indicates Maintenance / Fault alarm, which indicates offset drift and that cleaning or re-calibration is necessary.

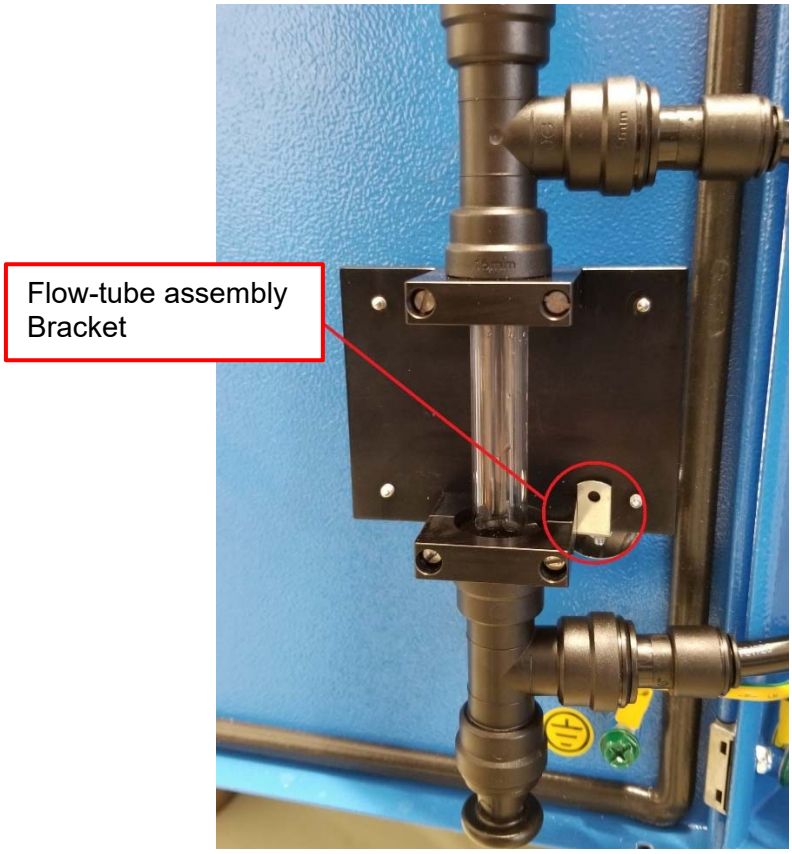
9) 4-20 mA DC output signals proportional to oil concentration and turbidity are provided. Each signal is capable of driving 900 ohms. Remote indicators, receiving devices and their distances should be considered when choosing a location for the Arjay Controller.

10) A RS-485 Modbus output is provided. This can be used to link to computers and other equipment. Optional HART, Fieldbus Foundation and other communications are available.

11) Shielded wiring is required between the controller and sample block enclosure as well as for the output alarms and signals to avoid EMI and RFI interference from other equipment near the sample unit. Shield should be connected to earth ground at controller side only.

12) The Controller and Sensor Block Assembly enclosures are housed in a Type 4 / IP66 enclosure. Other enclosure options are available (consult factory for more detail). Extremes in temperature and humidity should be avoided. Indoor or an environmentally mounted instrument shelter is recommended.

13) The Sensor Block assembly enclosure includes a door mount bracket for the tube assembly during testing and maintenance.



4.2 Unit Installation

1) Locate an area that is environmentally protected from wide variances in temperature and humidity. Indoor installations are recommended.

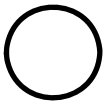
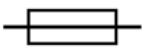
   When selecting the location, consider that regular maintenance and testing is desirable for the proper and accurate operation of the instrument.

   If the sample input is not from a pumped source, locate the instrument in a position that will receive a continuous representative sample from the process stream. The farther from the stream, the greater the lag time of readings vs. actual process variance.

2) Mount the enclosure on a vertical wall or support of minimal vibration. The sample will be flowing through a Flow tube. Be sure the unit is mounted level.

3) Make sure the inlet sources (process sample and clean water) are valved for future maintenance and testing operations. Connect the inlet sources to the 1/4” NPT female (3/8” NPT female for SS bulkhead) inlet of as per the drawings.

4.3 Glossary of Symbols

	Attention, consult accompanying documents Attention, veuillez consulter les documents ci-joints.		
	Protective Earth Terre de protection		Power on Marche (mise sous tension
	Direct Current (DC) Courant continu		Power off ArróÕ (mise hors tension)
	Normally closed relay contacts Contacts Repos	**L**	Live Sous tension
	Normally open relay contacts Contacts travail	**N**	Neutral Neutre
	Fuse Coupe-circuit; fusible	**G**	Ground Terre

4.4 Permanent Power Connection (AC Powered Model Only)

1) Connection to the building wiring system shall be in accordance with the Canadian Electrical Code (CEC), Part 1 in Canada, the National Electrical Code, ANSI/NFPA 70 in the USA, or the local electrical codes of the country where the equipment is being installed.
2) An external mains switch or external over-current protection / circuit breaker device is required as a disconnect device. This mains disconnect device shall be specified as complying with the requirements of IEC 947-1 and IEC 947-3.
3) An external switch or breaker shall be in close proximity to the equipment and within easy reach of the operator. The switch shall be marked as the disconnecting device for the equipment and include the symbols to its “ON” and “OFF” positions using the following symbols:


Power Off


Power On

4) The wiring for AC power should be minimum 14 – 16 AWG / 300V or as required by local / country codes.
5) After field wiring, the primary wires must be secured to the enclosure by tie-wraps to maintain the separation from the signal wires.
6) The equipment is suitable for connection to a 15A protected branch circuit.
7) Wiring diagram for permanent connection: See drawings at the back of this manual.
8) Use copper conductors only.

4.5 Electrical Installation

See drawings at the back of this manual.

5.0 STARTUP AND SETTINGS

NOTICE	Calibration must be performed after installation and any lamp replacement.

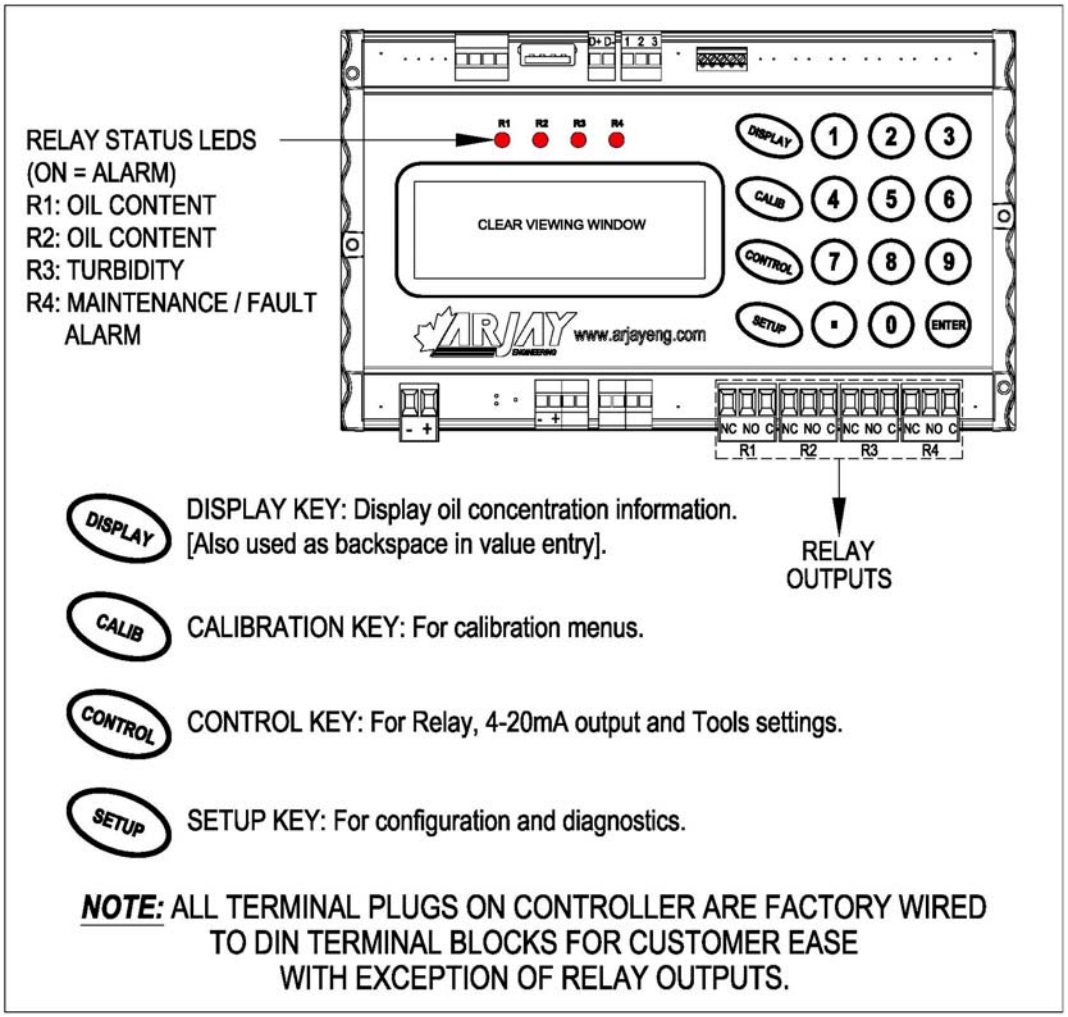


Figure 1 - USER INTERFACE

5.1 Notes on Value Entry

When entering in numeric values, the cursor can be backspaced to correct mistakes by pressing the DISPLAY key. This is only true if the cursor is not at the beginning of the displayed value.

The decimal point is the dot (■) key.

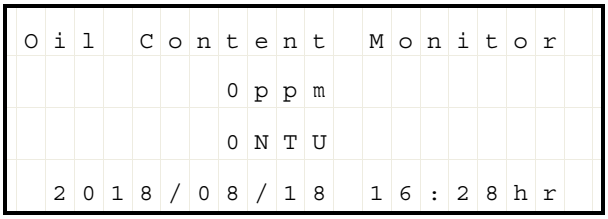
If the entered value is out of the allowed limits, the system displays the limiting value for 2 seconds. For example, if the alarm time delay value is entered as 5000 seconds, then **MAX. 99** is displayed for 2 seconds, and then entry is allowed again. The current value is not changed unless the entered value is within limits. During value entry, the oil concentration and NTU is constantly updated in the background.

5.2 Password Protection

A password must be entered to access any of the 3 value entry menus (CALIB, CONTROL, SETUP> 1-System) from the normal operating display menu. The factory default password is 2000. A customer password may be added from the setup menu as described in section ***7.1.4 Settings***. If a new password is entered then password 2000 is no longer available. Consult factory to reset if required. The prompt for entering the password is always 9999 regardless of the actual password.

5.3 Power-Up Display

After mechanical and electrical installation of the sample chamber and the controller have been successfully completed, power up the unit. The LCD should show a similar screen (Normal Operating Display):

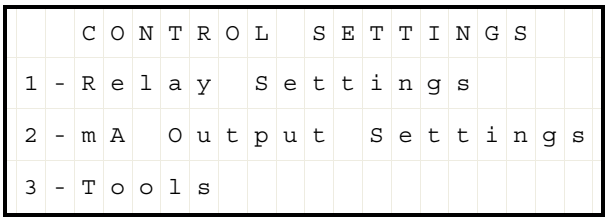


NOTE: The shown values are for example only.

The 2nd line shows the oil concentration value in PPM.
The 3rd line shows the turbidity value in NTU.
The 4th line shows the current date and time or error codes

6.0 CONTROL SETUP

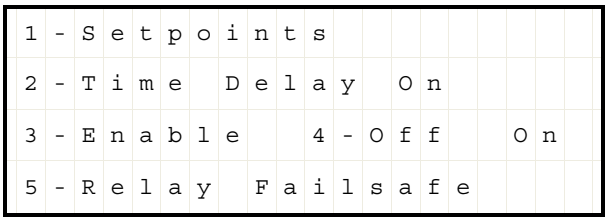
To access the control setup settings, you will require a password. The password is “2000” then press <Enter>.



6.1 Relay Settings <1>

Four relay alarm points are available for remote alarm. Of these, three are general-purpose alarm relays with user settable alarm points, dead band (differential alarm points), and time delay. The fourth relay (R4) is to indicate Maintenance and Fault alarms.

If the general-purpose alarm relays are to be used, press **<CONTROL>**, then press **<1>** for Relay Settings Menu.



6.1.1 Setpoint <1>

Press **<1>** for Setpoints. Enter the value in PPM or mg/L for relay R1 to activate. Press <ENTER>. Now enter the value for the relay R1 to de-activate and press <ENTER>. A small differential between Relay HI and Relay LO may be desired to eliminate relay chatter if the concentration is fluctuating at the alarm level. Similarly, enter the oil concentration high and low alarm points for the second relay. The third relay is designated for turbidity and the setpoints are entered in NTU.

Note: for a single point alarm with no differential, enter the LO alarm value identical to the HI alarm value.

6.1.2 Time Delay On <2>

To delay the relay alarm for a preset time (in seconds), press <2> for Time Delay On in the Relay Setting Menu. Select which relay is to be setup and then enter value in seconds. This will suppress the alarm to eliminate a spurious momentary alarm that may be caused by an oil globule or process variable not indicative of an alarm condition.

6.1.3 Relay Enable / Disable <3> OR <4>

The three general purpose relays may be disabled from operating for maintenance purposes. Confirm the relays are activated on the right side of line 3 in the RELAY SETTINGS menu. If the display reads On, the relays are activated. Press **<3>** to enable the relays or press **<4>** to disable the relays. As a reminder to turn the relays back on after maintenance the main display will show relays disabled on line 4.

6.1.4 Relay Failsafe <5>

The relays may be set as Failsafe or Non Failsafe. In failsafe mode the relays are energized under normal operation.

Failsafe typically means that the relay is held in an energized state when in a normal operating condition as opposed to an alarm condition. In an alarm condition, the relay de-energizes which is identical to when the instrument power is shut off. The rationale is that the alarm condition should match the Power Fail condition. The factory default is On for Failsafe.

6.2 mA Output Settings <2>

Determine the desired operating range of the instrument. This will reflect the 4 to 20 mA output range of the instrument. For example, an oil concentration range of 0 to 50 PPM may be desirable. The control signal of 4-20 mA will represent 0-50 PPM. Press **<CONTROL>** on the keypad, enter the password at the prompt, then press **<2>** for mA output settings. The display will prompt you to set up Output # 1, which is the oil concentration output. Press **<1>** for mA Zero / Span setup. The zero output will typically be **0.0** ppm. Enter the desired value and press **<ENTER>**. The display will prompt you to enter the span value (i.e., 50.0). Enter the desired value and press **<ENTER>**.

```
  Set mA Output #1
1=mA Zero/Span setup
Out:4-20mA    2=0-20mA
mA=DIR        3=INV ->
```

6.2.1 4-20mA Out OR 0-20mA Out <2>

The mA output signals can be set for 4-20mA or 0-20mA. The third line of display will show the present setup (Out: 4-20mA). Press <2> to change the desired setting.

6.2.2 mA Direct OR Inverse <3>

The mA output signal can be set for direct acting (4-20mA = 0-50ppm), or inverse acting (20-4mA = 0-50ppm). The lower left display will read the present setup *(mA: DIR)*. Press <3> to change the desired setting.

6.3 Tools <3>

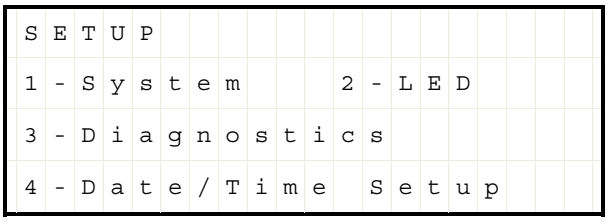
6.3.1 Relay Test <1>

This feature allows the user to toggle ON and OFF each relay for maintenance purpose. Press the # keypad for each corresponding relay. (e.g.1=R1). Press “Enter” To Exit this menu.

6.3.2 mA Output Test <2>

This feature allows the user to check the mA output at 4mA <1> and 20mA <2> OR Enter a desired value <3>. This is for maintenance purpose only.

7.0 SETUP (OPERATION AND DIAGNOSTICS) (<SETUP> KEY)



7.1 System Settings <1>

Press the <SETUP> key then Press <1> for system settings, enter the password at the prompt, then press <ENTER>.

7.1.1 Net ID <1>

Press <1> for Net ID address. The modbus address is used only for network applications and is always factory set to 1. To communicate on a network, each controller must have a unique modbus address.

Important: If multiple units on a network have the same address, network errors will result. Enter the desired tag number if multiple units are installed in a network.

Enter the desire modbus address, press <ENTER>.

7.1.2 Filter <2>

Press <2> for filter. The moving average filter tracks the average of the last # of samples. Higher values provide more stable readings. Max value is 100. The default value is 20. Alarms may come on while the filter is re-calculating.

7.1.3 Units <3>

Press <3> for units. There are 4 display units available: ppm, mg/L, FLR and NTU. Press <1> for ppm, <2> for mg/L, <3> for FLR and <4> for NTU.

7.1.4 Password <4>

Press <4> to change the password if desired, enter a new password at the prompt, then press <ENTER>. Note: Once a new password is entered, password 2000 is not available. Consult factory to reset to original password if required.

7.1.5 More <5>

Press <5> for further options.

7.1.6 mA Output Trim <1>

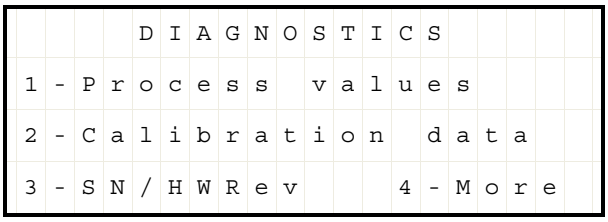
Press <1> for mA output Trim. This procedure trims the mA output for maximum accuracy by compensating for the mA output circuitry tolerances. Note: THIS PROCEDURE IS PERFORMED AT THE FACTORY AND IS TO BE PERFORMED BY AUTHORIZED PERSONNEL ONLY. IF IMPROPERLY DONE, THE ACCURACY OF THE MA OUTPUT CAN BE IMPAIRED.

7.1.7 Decimal Point <2>

Press <2> to change the place of decimal. Press desired decimal place from the selection (0, 1 or 2). Once selected the screen will go back to system Setup menu.

7.2 Diagnostics <3>

There are a number of diagnostic screens to monitor the performance of the unit. Press <3> for diagnostics.



7.2.1 Process Value <1>

Press <1> for Process values. There are 3 sensor receiver boards monitoring the process. Rx1 receiver board is mounted on a 45° angle to LED 1 board and is used to receive the fluorescent signal for ppm oil content. Rx2 receiver board is 180° to LED 1 board and used to monitor LED degradation and flow tube fouling. Rx3 receiver board is mounted 90° to LED 2 board and used to monitor the turbidity of the process water. Each screen displays the concentration in the selected units of each receiver board. The value when the LED is On as well as Off is displayed. The respective difference between the On and Off values is shown in mV. The Off values are typically a measure of the background fluorescence and are therefore subtracted from the On values. The 3rd line shows the current concentration in the selected units and mV (sample fluorescence). The 4th line shows the current temperature (T) on the receiver board as well as the current temperature compensation. To read only the live process mV of all sensors on the same screen, press <4> for all.

7.2.2 Calibration Data <2>

Press <2> for calibration data values. This section will show the calibration points for each receiver board at calibration. Press Enter to continue to next receiver board.

7.2.3 More <4>

Press <4> for more diagnostic data values. The screen displays the current relay settings and mA output settings.

7.2.4 SN / HWRev <3>

This section records the serial number, hardware revision, software revision and Modbus ID number.

7.3 Date / Time Setup <4>

This feature allows the user to set the current date and time. Press <1> to change Date and press <2> to change Time.

8.0 CALIBRATION (<CALIB> KEY)

NOTICE	**To access the calibration settings, you will require a password. The password is '2000' or user selected password (See section 7.1.4)**
NOTICE	**Calibration must be performed after installation and any LED or Receiver board replacement.**
NOTICE	**Allow a minimum of 24 hours of power up prior to calibration to allow the LED light source to stabilize.**

Using actual process stream flows for the calibration is desirable to provide the best accuracy. This will Zero out any background influences that may be present in the process water. The unit is factory set for two calibration entry points to create a calibration slope specific to your installation. Two calibration points are typical for most applications. For high accuracy or high range applications, up to 5 calibration points can be entered. To change the number of calibration entry points see 8.2.4.

There will be two separate calibrations: one for oil content in water and one for turbidity.

The first calibration point for each will be 0 ppm (mg/l) oil in water and 0 NTU turbidity. Clean process water is preferred. If not available, tap water connected to a 3-way valve can be used.

The second calibration point for oil should be process water with a preferred ppm(mg/l) concentration of 50% or more of the desired operating range. If the present process water concentration has an oil concentration in this range but the ppm value is unknown, a random value can be entered during the calibration. A sample taken during this step can be tested by your lab and the value can be corrected when known.

If process water with oil contamination is not available, a sample can be blended and pumped into the unit or placed in the unit using the Test Tube Assembly supplied. See Section 9.0 for Sample Preparation.

A factory turbidity calibration was performed prior to shipment. As a minimum, when running clean turbid-free process water, a Zero Offset adjustment is required. For higher accuracy a full calibration is recommended. The turbidity second calibration point requires a Formazin Standard blended to a known NTU value within your desired range.

Prepared samples may be used for calibration and testing although variations in personal blending techniques, the source of the hydrocarbon and background water, the container used, and the retention time prior to use can affect the concentration reliability and repeatability.

8.1 BEFORE CALIBRATION

Open the sensor block by loosening the 4 thumb screws and remove the tube assembly. Check that the quartz tube is in place. Check that all internal and external plumbing connections are secure. Keep the tube assembly off the block by placing it on the hook in inner door.

Slowly open the process sample valve to allow a steady flow through the unit. Tilt the tube assembly few times to release any trapped air. Shake or tap the metal assembly, not the tube, gently to release any bubbles attached to the tube.

Check there are no bubbles in the flow. If there are bubbles in the flow, check for plumbing connections that may be suctioning in air.

A back-pressure regulator is supplied on the outlet tubing if there are excessive bubbles due to rapid pressure changes between the process inlet flow and the exit flow. This is a white thumbwheel on the

exit tubing. Tighten the thumbwheel slightly to compress the tubing and create back pressure to eliminate bubble releases.

Place the tube assembly back into the block. Be sure the block is the upright position according to the labelling. Note: The sample tubing enters the chamber from the top right, circles around and flows up into the block bottom. The sample tube exits the top of the block and circles out through the bottom right side of the chamber. Tighten the 4 thumb screws. Close the chamber door.

Note: if bubbles occur increase flow rate and ensure that all fittings are tight (air locked). A flow regulator and pressure regulator is available to regulate the process and remove the occurrence of bubbles.

8.2 CALIBRATION

Press <CALIB> , enter the password at the prompt. To access the calibration settings, you will require a password. The password is “2000”.

```
CALIBRATION      Rx1
1.Auto       2.Manual
3.Zero Offset
4.Cal Pts    5.More   *
```

8.2.1 Automatic Calibration <1>

Confirm that the desired receiver board is selected. See top right hand corner of display. Rx1 is for oil and Rx3 is for turbidity. Press <ENTER> to scroll to oil or turbidity. Press <1> for automatic calibration.

```
AUTO CAL          Rx1
Cal point 1 of 2
ENTER=Do Cal Point 1
1=Abort
```

Automatic Calibration Oil Content (Rx1):

The 1st point must be clean process water (0.0 ppm). If the process water is not clean of oil (0.0 ppm), open your clean water valve or pump clean water through the Hydrosense 4410-OCM. Press <ENTER> to proceed to 1st calibration point. The first point is fixed to 0.0ppm. Once the mV reading has stabilized press <ENTER> key. The display will now proceed to the second point. Press <ENTER> to continue.

A concentration of contaminated water is required. If the process stream has a higher concentration than 0 ppm, allow the ***process stream*** to flow through the Hydrosense 4410-OCM.

If the concentration of process stream is close to 0.0 ppm, a higher concentration prepared sample (refer to Section 9.0) and a sample pump should be used. Disconnect the inlet of the clean water and connect the prepared sample into the inlet. Pump the prepared sample through the Hydrosense 4410-OCM.

Enter the known or unknown* ppm value of stream concentration (i.e., 30.0 PPM). Once the reading (mV) has stabilized, press the <ENTER> key.

*If the ppm value is unknown, enter a random value that would be indicative of what is flowing through the unit and take a sample at about the same time as pressing <Enter>. Send the sample for lab analysis promptly. The laboratory ppm value will be entered in the manual calibration at a later date.

If more than 2 calibration points are entered in Section 8.2.4, the display will proceed to the 3rd point. Repeat the above procedure for each concentration level. A minimum of two inputs are required.

Automatic Calibration of Turbidity (Rx 3):

A factory turbidity calibration was performed prior to shipment. As a minimum, when running clean turbid-free process water, a Zero Offset adjustment should be done.

To do this, Enter <CALIB> key Confirm that the desired receiver board is selected. See top right hand corner of display. Rx3 is for turbidity. If not, Press <ENTER> to scroll to Rx3 for turbidity.
If doing a Zero Offset Adjustment only, ensure the process water is clean and turbid-free. Press <3>. Calibration is Complete.

For higher accuracy, a process calibration is recommended. Press <1> for automatic calibration.

The 1st point must be clean process water (0.0 ppm and 0.0 NTU). If the process water is not clean then open your clean water valve or pump and direct the flow through the Hydrosense 4410-OCM. Press <ENTER> to proceed to 1st calibration point. The first point is fixed to 0.0ppm. Once the mV reading has stabilized press <ENTER> key. The display will now proceed to the second point. Press <ENTER> to continue.

For best accuracy, run turbid process water through the unit and perform the Second point calibration. Enter a suspected NTU value for the turbidity. This will be corrected later. Have a sample taken while entering the second point and send to a lab for turbidity testing.

If more than 2 calibration points are entered in Section 8.2.4, the display will proceed to the 3rd point. Repeat the above procedure for each concentration level. A minimum of two inputs are required.

THIS COMPLETES THE CALIBRATION IF KNOWN VALUES WERE ENTERED. If a random unknown value was entered, the laboratory result will need to be entered in manual cal to correct the value of the sample. (see Section 8.2.2)

8.2.2 Manual Calibration With Laboratory Results <2>

When the lab results have been returned, press the <CALIB> key, enter the password at the prompt. Confirm that the desired receiver board is selected. See top right hand corner of display. Rx1 is for oil and Rx3 is for turbidity. Press <ENTER> to scroll to oil or turbidity.
Press <2> for Manual Calibration.

```
MANUAL CAL          Rx1
Cal point 1 of 2
ENTER=Do Cal Point 1
1=Abort
```

Press <ENTER> to proceed to 1st point value. Your initial 0.0 ppm value will be displayed. This is fixed and cannot be changed. The unit will prompt you to enter a mV value. This was recorded for you when you first took the 1st point (clean water) in automatic calibration. Press <ENTER> and proceed to 2nd calibration point (2nd point).
Correct your random entry (ppm or NTU) and key in the lab value of sample taken earlier. Press <ENTER>. The unit will again prompt you to enter a mV value that corresponds to your sample. Press <ENTER> to accept this value and proceed to 3rd calibration point if applicable.

Repeat the above procedure for each sample. If only two calibration points were selected (Section 8.2.4) the display will show “Calibration OK” and returns to main calibration menu.

Repeat this procedure for oil or turbidity if required.

THIS COMPLETES THE MANUAL CALIBRATION CORRECTION.

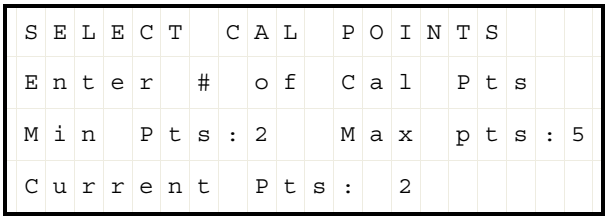
8.2.3 Zero Offset <3>

The feature allows the user to offset the ppm and turbidity values that have drifted slightly between calibration periods. This feature does not replace normal calibration intervals. A calibration on regular intervals is necessary for the accuracy of the ppm and NTU reading. The Zero Offset correction must only be done when the sample flow is 0 ppm and 0 NTU. Press <CALIB>, then <3> to do a zero adjustment. This adjusts the ZERO for both the PPM and the NTU at the same time. It does not matter if the top right screen reads Rx1 or Rx3.

8.2.4 Select # of Calibration Points <4>

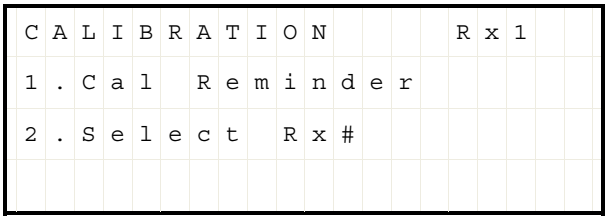
For Calibration, the Hydrosense 4410-OCM can accept up to 5 sample points to draw a calibration curve. The factory default is 2 points where 0ppm (clean process water) and a known ppm level is used. A calibration curve using more than 2 points is used to enhance accuracy over high ranges. Most applications use the two-point calibration only.

Press <4> for Cal Pts. The fourth line shows the current selection. Enter # of points if a change is required then press <ENTER>.



8.2.5 More <5>

For further options Press <5>.



8.2.6 Calibration Reminder <1>

The 4410-OCM controller has a calibration reminder feature. The factory setting is 180 days from last preformed calibration. After the determined number of days from the last calibration, the main display will show “Calibration Due”. Press <1> to change the amount of days from last calibration or <2> to exit. This counter will automatically reset when calibration is done.

8.2.7 Select Receiver Board <2>

This is not applicable on this model.

9.0 SAMPLE PREPARATION FOR OIL (FOR CALIBRATION OR TESTING)

Testing may be performed in a number of ways.

1. An unknown concentration may be used to provide a response test. This does not verify the accuracy or calibration of the instrument but does confirm that it will respond and alarm to a high concentration condition.

2. An unknown sample with a concentration of contaminant can be sent to a lab for analysis.

3. A concentration blend may be made using the stream fluid and a known concentration of contaminant.

If a sample concentration is to be made, the contaminant must be made to emulsify in the stream fluid. This can be difficult, as the concentrate often will not break down enough to provide an even distribution in the low PPM range.

For example, a sample of 50 PPM (parts per million) is equal to 1 oz in 20,000 oz. (125 gallons). To use an amount of stream for the base that is manageable such as one gallon, a syringe is required to inject a small enough amount of the concentrate to make 50 PPM. This droplet of oil will tend to separate (float) to the surface.

A typical approach to making a concentration is as follows:

1. Acquire 10 liters of 0 PPM process water in a glass jar (plastic containers will draw the hydrocarbons out of the prepared sample).

2. Separately, thoroughly mix 1 ml of the sample oil (type of oil to be found in stream) with 1 ml of acetone. The oil will readily mix with the acetone and the acetone will act as an agent to distribute the oil throughout the water.

3. Thoroughly mix the oil/acetone sample with the 10 liters of 0 PPM process water. This will make a 100 ppm sample.

e.g.: $\frac{\text{1ml (oil sample)}}{\text{10,000 ml (water)}} \times 1{,}000{,}000 = 100\text{ppm}$ *

Actual amount is 99.9ppm due to overall volume of 10 Liters + 2ml of oil/acetone mix.

This is not a precise method. Standing time, the volatility of the oil, operator measurements and equipment will all contribute to errors in the blend. This should be used quickly and only when actual process conditions cannot be sent to laboratory for calibration

10.0 PERIODIC TESTING AND MAINTENANCE

NOTICE	Calibration must be performed after installation and any LED or receiver board replacement.

10.1 ROUTING CLEANING PROGRAM

The HydroSense relies on a constant flow of water through the flow tube. Excessive particulates and algae in the water can build up on the flow tube. This will eventually affect the performance of the unit.

Setting up a Routine Cleaning Program is vital to the successful performance of the unit. Each application will vary in the frequency of cleaning. Some may require monthly cleaning, some less and and some more. A quick cleaning of the flow tube can be done without having to remove the flow tube. The inside of the flow tube can be accessed by removing the top stopper and inserting a white cleaning brush supplied with the shipment. The flow tube is accessible by loosening the thumb screws on the front of the block. Be sure to close off the inlet flow before removing the stopper.

Cleaning the flow tube should be done with clear non-fluorescing chemicals. An appropriate flow tube cleaner option is household vinegar. Low concentrate Muriatic acid (18%) or Isopropyl Alcohol are also effective. Use only chemicals approved for your site, personal safety and disposal. Be sure to thoroughly rinse the flow tube with clean water before installing.

An optical receiver (Rx2) monitors the flow tube and light source for possible contamination and influences that may affect the light path. A maintenance relay and display will indicate if cleaning is recommended.

10.2 CONDENSATION

Condensation may occur when the process water is at a cooler temperature than the ambient air. A port is available in the sensor block assembly (SBA) to allow clean compressed instrument air (max 5psi) to circulate around the flow tube to alleviate the condensation.

⚠ CAUTION	Repeated visual contact with the light source can be harmful. Avoid looking directly at the ultraviolet light source. Wear UV protection.

10.3 PERIODIC TESTING

The HydroSense is an electronic device used for environmental and personal protection, as well as general process monitoring. As with any calibrated sensing device, wetted parts may become contaminated and the light sources can deteriorate over time. The Arjay system has a Maintenance and a fault alarm (R4) included, however, a scheduled periodic test is recommended to ensure that the unit and remote alarms and devices are operating to specifications. This periodic test can be set up in the calibration reminder.

A quartz glass flow tube is used and can accumulate a film build-up of algae and silt overtime. It is suggested that routine maintenance be scheduled to verify that this build-up is not extreme and the flow tube is cleaned as necessary.

There are three standard tests to assure the operation or accuracy of this unit.

DILUTION BUMP TEST: This confirms that a process stream that is continuously indicating a ppm(mg/l) reading is responsive by diluting the process stream with clean water. Divert a 3-way valve slightly to introduce fresh clean water into the process stream. Observe that the display reading decreases. Divert completely to clean water to observe that the reading decreases to 0 ppm(mg/l).

OIL BUMP TEST: For applications that are routinely 0 ppm(mg/l), a quartz test tube assembly is provided with the unit for testing. Prepare a sample of water with oil contamination and fill the test tube. Place the assembly into the block and observe a reading increase on the display.

CALIBRATION VERIFICATION: Observe and record the ppm(mg/l) reading. Take a grab sample at the same time and have it tested by the same lab and method that was used during the calibration procedure. Confirm results.

NOTICE	**Any sample sent to a lab may incur separation and evaporation during transit and will affect the results. Advise the lab to thoroughly mix the sample prior to testing.**

10.4 FLOW TUBE CLEANING

The unit is designed for quick and easy cleaning. Turn off the sample line flow. Loosen the 4 thumb screws and remove the flow tube assembly and pull away from the sample enclosure to avoid any spills. Wipe the outside of flow tube with a clean damp cloth. The flow tube may be removed for cleaning if desired. Alternatively the top stopper can be removed and a soft test tube cleaner brush can be inserted to clean the inside of glass. Do not use soap as this may cause an inaccurate reading if not rinsed completely. Use household vinegar to clean the flow tube. For persistent stains use Muriatic acid (18%) or Isopropyl Alcohol. Replace the flow tube.

10.5 LED REPLACEMENT

Disconnect the yellow cord connected to sensor block assembly (SBA) and remove the block from the subplate of the enclosure. Dismantle the side covers to access the led board. Remove the 4 screws keeping the LED main board in place and gently remove the LED main board white ensuring the filter is still place (if applicable). Remove the LED flyboard by sliding outward and insert the new LED flyboard at the same location. Insert the main LED board back to sensor block carefully and screw in all 4 screws back.

10.6 RECOMMENDED 2 YEAR SPARE PARTS LIST

Arjay Part No.	***Description***
A00794	Flow Through Tube Assembly
A00795	Reference standard Test Tube Assembly

11.0 CONTROLLER NETWORK

11.1 MODBUS CONFIGURATION

Parameter settings: 9600 Baud Rate; Even Parity, 8 Data Bits and 1 Stop Bit.
Wiring connection: RS485 (+) connect to D+; RS485 (-) connect to D-.

See section 11.2 for Modbus Register mapping.

Each controller must have a unique number to connect in a network system. See section 7.1.1 for details to change the ID number.

11.2 MODBUS REGISTER MAPPING

REG	Zero Based	DESCRIPTION	TYPE	No. of Reg	Note
40001	Configuration	current Rx number/ucNo_of_Rx	byte	1	
40002		spare0/ModbusID	byte	1	
40003		uc Precision/InteTime10msCount	byte	1	
40004		ucControlEnable/ucInstrumentsataus	byte	1	
40005		ucmAPolarity[1]/ucmAPolarity[0]	byte	1	
40006		ucmAType[1]/ucmAType[0]	byte	1	
40007		NTU Enable/LED Mode	byte	1	
40008		uiLED mA	short	1	
40009		uippmSamplesPerAverage	short	1	
40010		Digital Filter	short	1	
40011		Password	short	1	
40012		Serial Number (SN)	double	2	
40014		Software Rev.(SW)	double	2	
40016		Hardware Rev. (SW)	double	2	
40018		T_comp[0]	double	2	
40020		T_comp[1]	double	2	
40022		T_comp[2]	double	2	
40024		fmATrimSlope[0]	double	2	
40026		fmATrimSlope[1]	double	2	
40028		fmAtripOffset[0]	double	2	
40030		fmAtripOffset[1]	double	2	
40032		fmAScalePVZero[0]	double	2	
40034		fmAScalePVZero[1]	double	2	
40036		fmAscalePVSpan[0]	double	2	
40038		fmAscalePVSpan[1]	double	2	
40040		dmAOutputPercent[0]	double	2	
40042		dmAOutputPercent[1]	double	2	

40044	Relay 1	AlarmHigh	double	2	
40046		AlarmLow	double	2	
40048		Alarmstatus/AlarmSetup	byte	1	
40049		TempStatus/Failsafe	byte	1	
40050		OnDelay_Second	short	1	
40051		OffDelay_Second	short	1	
40052	Relay 2	AlarmHigh	double	2	
40054		AlarmLow	double	2	
40056		Alarmstatus/AlarmSetup	byte	1	
40057		TempStatus/Failsafe	byte	1	
40058		OnDelay_Second	short	1	
40059		OffDelay_Second	short	1	
40060	Relay 3	AlarmHigh	double	2	
40062		AlarmLow	double	2	
40064		Alarmstatus/AlarmSetup	byte	1	
40065		TempStatus/Failsafe	byte	1	
40066		OnDelay_Second	short	1	
40067		OffDelay_Second	short	1	
40068	Relay 4	AlarmHigh	double	2	
40070		AlarmLow	double	2	
40072		Alarmstatus/AlarmSetup	byte	1	
40073		TempStatus/Failsafe	byte	1	
40074		OnDelay_Second	short	1	
40075		OffDelay_Second	short	1	
40096	Process Value	RX1_PPM value	double	2	Read only
40106		RX1_Temperature	double	2	Read only
40148		RX2_Temperature	double	2	Read only
40150		RX2_mv value	double	2	Read only
40180		RX3_NTU Value	double	2	Read only
40190		RX3_Temperature	double	2	Read only

12.0 TROUBLESHOOTING

DISPLAY MESSAGE	ALARM STATUS	CHECK POSSIBLE ISSUES
LED board ERROR	R4 LED On	• No LED Board connected. Check cable is connected properly.
Receiver board ERROR	R4 LED On	• No Receiver board connected. Check cable is connected properly. • View Diagnostics to verify which Rx receiver board is in fault.
LED Error	R4 LED On	• LED failure, replace LED flyboard (Part# A00797)
Code #1	R4 LED On	• mA output is over range. The ppm or NTU reading is higher than the mA span value set and forced he output over 20 mA. . Check mA output span values to confirm they are higher than the normal ppm oil or NTU content range.
Code #2	R4 LED On	• FLR signal is over range. Set lower LED mA current for LED #1. See user manual to adjust.
Code #3	R4 LED On	• NTU signal is over range. Set lower LED mA current for LED #3. See user manual to adjust.
Code #4	R4 LED On	• COMP signal is over range. Set lower LED mA current on LED #1. See user manual to adjust.
Code #5	R4 LED On	• FLR signal is too low. The tube likely needs cleaning. If alert persists, re-zero or re-calibrate the unit.
Code #6	R4 LED On	• NTU signal is too low. The tube likely needs cleaning. If alert persists, re-zero or re-calibrate the unit.
Code #7	R4 LED On	• PPM reading is erratic or unstable. Check for HIGH turbidity in process. Turbidity high values can affect the ppm value.
Code #8	R4 LED On	• LED aging, replace LED flyboard (Part# A00797)
Calibration required	None	• Calibration is Due • Re-Calibrate unit and calibration due date will reset itself.

13.0 CONTROLLER SETTING SHEET

PARAMETER	*DESCRIPTION*	*FACTORY SETTING*	*USER SETTING*
Decimal Point		1	
Cal Point	# of calibration points (min. 2)	2	
Zero	Oil PPM value for zero scale mA output 1 (4 mA) or (0mA).	0.0ppm	
Span	Oil PPM value for full-scale mA output 1 (20 mA)	100.0ppm	
Zero	Turbidity value for zero scale mA output 2 (4 mA) or (0mA).	0	
Span	Turbidity value for full-scale mA output 2 (20 mA)	30	
mA Action	Direct (20mA when PPM is at Span) or Inverse (4mA when PPM is at Span.	DIR	
Relay1 Hi Set	Alarm Relay 1 High Setpoint: Alarm condition if PPM is above this value.	10 PPM	
Relay1 Lo Set	Alarm Relay 1 Low Setpoint: Alarm condition cleared if PPM is below this value.	8 PPM	
Relay2 Hi Set	Alarm Relay 2 High Setpoint: Alarm condition if PPM is above this value.	20 PPM	
Relay2 Lo Set	Alarm Relay 2 Low Setpoint: Alarm condition cleared if PPM is below this value.	18 PPM	
Relay3 Hi Set	Alarm Relay 3 High Setpoint: Alarm condition if NTU is above this value.	10 NTU	
Relay3 Lo Set	Alarm Relay 3 Low Setpoint: Alarm condition cleared if NTU is below this value.	8 NTU	
Alarm Delay	Amount of time in seconds the PPM value must be above the Hi Setpoint for the Alarm condition to activate. (Maximum 99 seconds)	0 sec	
Alarm Enable	“ON: – Enable Alarm Relay “OFF” – Prevents relays from reflecting the Alarm condition.	ON	
Filter	Moving Window Filter tracks the average of the last # of samples. Higher values provide more stable readings (Max. 100)	20	
Failsafe	Relays energized under normal conditions	ON	
Calibration Reminder	The amount of days until next calibration	180	
LED mA	The intensity of the LED output	20mA	
LED On/Off	The time between the LED is On and when it is Off	2sec/2sec	
Units	Rx1 Rx2 Rx3	ppm mV NTU	