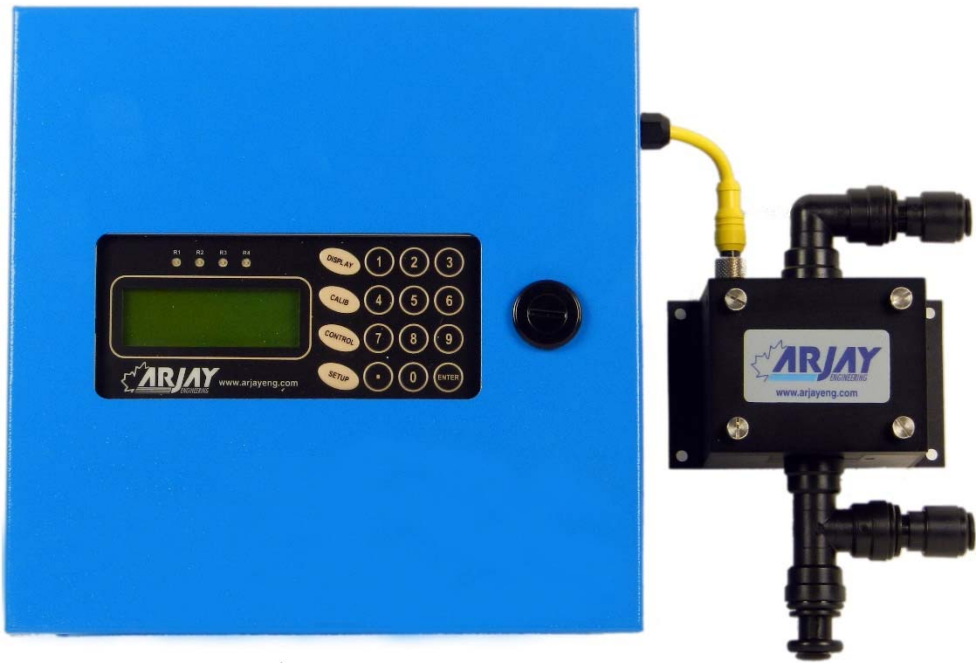
MODEL: HYDROSENSE 4410-OCM

OIL CONTENT MONITOR

USER MANUAL (REV: 0.0)



ARJAY ENGINEERING LTD.		
2851 Brighton Road Oakville (Toronto), Canada L6H 6C9	Tel: ++1 (905) 829-2418 Fax: ++1 (905)829-4701 North America: 1-800-387-9487	Web: www.arjayeng.com Email: arjay@arjayeng.com

This page intentionally left blank

TABLE OF CONTENTS

NOTICE	***Please*** read the HydroSense Installation Notes (3.1) prior to locating and mounting the enclosures.

SPECIFICATIONS 5

1.0 USER HAZARD INFORMATION 6

2.0 INSTRUMENT OVERVIEW 7

2.1 FEATURES 7
2.2 DESCRIPTION 7
2.3 INTERFERENCES AND AFFECTS TO ACCURACY 8
2.4 ROUTINE CLEANING PROGRAM 9
2.5 CONDENSATION 9

3.0 INSTALLATION 10

3.1 HYDROSENSE INSTALLATION NOTES 10
3.2 GLOSSARY OF SYMBOLS 11
3.3 UNIT INSTALLATION 12
3.4 PERMANENT POWER CONNECTION (AC POWERED MODELS ONLY) 13
3.5 ELECTRICAL INSTALLATION 13

4.0 STARTUP AND SETTINGS 14

4.1 NOTES ON VALUE ENTRY 14
4.2 PASSWORD PROTECTION 15
4.3 POWERUP DISPLAY 15

5.0 CONTROL SETUP (<CONTROL> KEY) 16

5.1 RELAY SETTINGS <1> 16
5.1.1 Setpoints <1> 16
5.1.2 Time Delay On <2> 16
5.1.3 Relay Enable / Disable <3> OR <4> 16
5.1.4 Relay Failsafe <5> 16

5.2 mA OUTPUT SETTINGS <2> 17
5.2.1 4-20 mA OUT OR 0-20mA OUT <2> 17
5.2.2 mA Direct OR Inverse <3> 17

5.3 TOOLS <3> 17
5.3.1 Relay Test <1> 17
5.3.2 mA Output Test <2> 17

6.0 SETUP (OPERATION AND DIAGNOSTICS) (<SETUP> KEY) 18

6.1 SYSTEM SETTINGS <1> 18
6.1.1 Net ID <1> 18
6.1.2 Filter <2> 18
6.1.3 Units <3> 18
6.1.4 Password <4> 18
6.1.5 More <5> 18
6.1.6 mA Output Trim <1> 19
6.1.7 Decimal Point <2> 19

6.2 DIAGNOSTICS <3> 19
6.2.1 Process values <1> 19
6.2.2 Calibration data <2> 19
6.2.3 More <4> 19
6.2.4 SN / HWRev <3> 19

6.3 DATE / TIME SETUP <4> 19

7.0 CALIBRATION (<CALIB> KEY) 20

7.1 BEFORE CALIBRATION 20
7.2 CALIBRATION 21
7.2.1 *Automatic Calibration <1>* 21
7.2.2 Manual Calibration With Laboratory Results <2> 22
7.2.3 Zero Offset <3> 22
7.2.4 Select # of Calibration Points <4> 22
7.2.5 More <5> 23
7.2.6 Calibration Reminder <1> 23
7.2.7 Select Receiver Board <2> 23

8.0 TROUBLESHOOTING 24

9.0 CONTROLLER SETTING SHEET 25

10.0 SAMPLE PREPARATION (FOR CALIBRATION OR TESTING) 26

11.0 PERIODIC TESTING AND MAINTENANCE 27

11.1 PERIODIC TESTING 27
11.2 FLOW TUBE CLEANING 27
11.3 LED REPLACEMENT 28
11.4 SPARE PARTS LIST 28

TABLE OF FIGURES

FIGURE 1 - USER INTERFACE 14

SPECIFICATIONS

Specifications are subject to change without notice:

Specification	*Details*
Power Input:	100 - 230VAC, 50/60Hz, 0.63 – 0.31A, 1A Fuse OPTIONAL: 24 VDC @ 3.5 A max
User Interface:	
Display	Four line LCD with simultaneous display in PPM or mg/L, current date
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 8.0)
Time Delay ON:	0 – 99 sec
mA Signal Output	4-20 mA DC, 900 Ohms, field scalable
Instrument Performance:	
Measuring Range	0 - 250 ppm Hydrocarbon in Water
Instrument Accuracy	± 0.1 PPM
Process Accuracy	+/- 1.0 ppm typical The process accuracy is reflected by the site calibration to a known hydrocarbon concentration and a stable background water. Changes in the hydrocarbon make-up and variations in the process may affect the instrument output. Through a simple calibration, this unit correlates with laboratory ISO and EPA methods
Sensitivity	145 PPB (diesel reference) & 463 PPB (crude oil reference)
Calibration	Up to five concentration entry points to maximize accuracy
Response Time Signal Filtering	Adjustable 20-100 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 90% (non-condensing)

Specification	Details
Process Requirement:	
Process Sample Temperature	10-40 °C (50-104 °F) without cooler; above 40 °C (104 °F) with cooler.
Inlet Flow Rate	Minimum: 1.0 L/M (continuous and stable) Maximum: 7.5 L/M (continuous and stable)
Inlet Water Pressure	Maximum 300psi, Without Sample Take off assembly (Optional) Maximum 150psi, With Sample Take off assembly
Instrument Air	1-5psi, 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	12.0"W x 12.0"H x 5.0"D (305mm W x 305mm H x 127mm 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	14.0"W x 12.0"H x 6.0"D (355.6mm W x 305mm H x 152.4mm D)
Sample Inlet	1/4” NPT female
Sample Outlet	1/4” NPT female
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)

1.0 USER 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.

2.0 INSTRUMENT OVERVIEW

2.1 FEATURES

- Fluorescence technology
- 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 PPM or mg/L alarms, R4 for fault or Maintenance alarm),
- Up to 2 LED boards
- 3 Receiver boards: Rx1 (ppm or mg/L), Rx2 (mV) and Rx3 (NTU or mg/L).
- 4-20 mA output, RS-485 Modbus output, optional HART and Fieldbus Foundation
- LCD display in PPM or mg/L
- No moving parts or consumables

2.2 DESCRIPTION

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

A continuous sample is directed through the sensor block (Model: SBA-0XXXXXZ) using a pumped or process pressure source. The sample can be looped back to process line or to drain.

The non-contacting ultraviolet light source is positioned directly in front of the sample flow. The receiver boards are positioned at a determine angle to maximize their response. The LED board emits a selected wavelength and the Rx1 receiver board is equipped with a precision light filter to control the wavelengths of the ultraviolet light being emitted and 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.

Additional receivers (Rx2 & Rx3) monitor the sample flow and optical surfaces for any maintenance concerns and 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 provided to manually input a fresh water source to confirm the instrument response, zero and clean the instrument.

2.3 INTERFERENCES AND AFFECTS TO ACCURACY

The UV fluorescence technique monitors the intensity of light emitted from the passing stream at a selected wavelength band.

This technique can be quite selective by eliminating the light effect of compounds in the water that do not share the same fluorescence characteristics of hydrocarbons.

1. When chemical compounds in the water are excited with light energy, only certain compounds will emit the light back out of the water at a higher wavelength than excited with. These are referred to as fluorescing compounds. The HydroSense does not respond to most chemicals because it only responds to fluorescing compounds, of which aromatic hydrocarbons are included.

2. The light used to excite the compounds is filtered to a specific wavelength. Of all the fluorescing compounds only certain ones will respond to this wavelength. Some respond to higher and some to lower wavelengths. This filter narrows the HydroSense response to only those that fluoresce within the selected band.

3. This limited number of compounds that do fluoresce from the emitted wavelength may emit light at any number of wavelengths such as 290nm, 310 nm, 350 nm 480nm, etc. Aromatic hydrocarbons will fluoresce at approximately 350 nm. By filtering the light sensor from all light except 350 nm +/-, only compounds that emit light at 350 nm +/- are indicated at the receiver.

4. Oil and Grease in water may be made up of hundreds or thousands of different hydrocarbon compound structures. The aromatic compounds are fluorescing compounds. The proportion of aromatics within the total hydrocarbons is generally consistent in a product or process. The aromatics are therefore used as a tag to correlate the monitor to total hydrocarbons in water.

Changing Oil Types and Sources

Different oils have a different make-up of compounds and the fluorescing strength may vary between oil types. For instance, diesel fuel may fluoresce much stronger than transformer oil. If the HydroSense is calibrated using 100 PPM of diesel, 100 PPM of transformer oil may only give a display reading of 50 PPM.

Crude oil may vary from one well to another, lubricating oils from different manufacturers may vary in their make-up; oils may be dissolved or free, and so on.

The calibration is therefore site selective and should be done using actual process water or with samples of oil that are to be targeted by the monitor.

The calibrated accuracy relies on the oil type and conditions being consistent. The HydroSense will respond positively to aromatic hydrocarbons but the display accuracy may be affected by variations in the types and sources of these hydrocarbons.

Other Chemicals in the Water

The light sensor is selective to compounds in the water that emit light at 350 nm. If there are background chemicals in the water that fluoresce at these wavelengths, the HydroSense may respond to them.

If this background chemical concentration is consistent, this interference will be zeroed out during calibration. Calibration is recommended using process water so that any background interferences are zeroed out.

If an interfering background chemical changes in concentration, the HydroSense may sense this change. Consideration to this affect is important for alarms and recording. Filtering of the water, changes to chemical use, or special light filtering may be required to provide more stable readings.

The periodic introduction of fluorescing chemicals into the water may also affect the reading. During these conditions, operators should be acknowledged that nuisance alarms may occur. Soap manufacturers will often include fluorescing dyes in the product for appearance and identification. Green dyes are typical in industrial degreasers and commercial soaps. Fluorescing chemicals are often included in detergents to enhance the visual effect of a cleaned product such as clothes.

Not all of these commercial dyes will affect the wavelengths of the HydroSense, however, green dyes have proven to be a common interference.

Suspended Solids and Turbidity

The unit is calibrated to a passing stream of water. The amount of light fluoresced by the aromatic hydrocarbons determines the calibration parameters. The light received by a hydrocarbon and then sent to the receiver is based on a stable light path through the water. If suspended solids or turbidity block the light getting to the hydrocarbon, light cannot be fluoresced back to the sensor. Readings can be dampened by an increase in solids or turbidity. When process water is used during the calibration, the offset effect of solids is taken into account and zeroed out.

2.4 ROUTINE 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. 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 is Windex brand “anti-fog”. 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.

2.5 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 compresssed 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.**

3.0 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.**

3.1 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 Sample Chamber 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. 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 included 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 when 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.

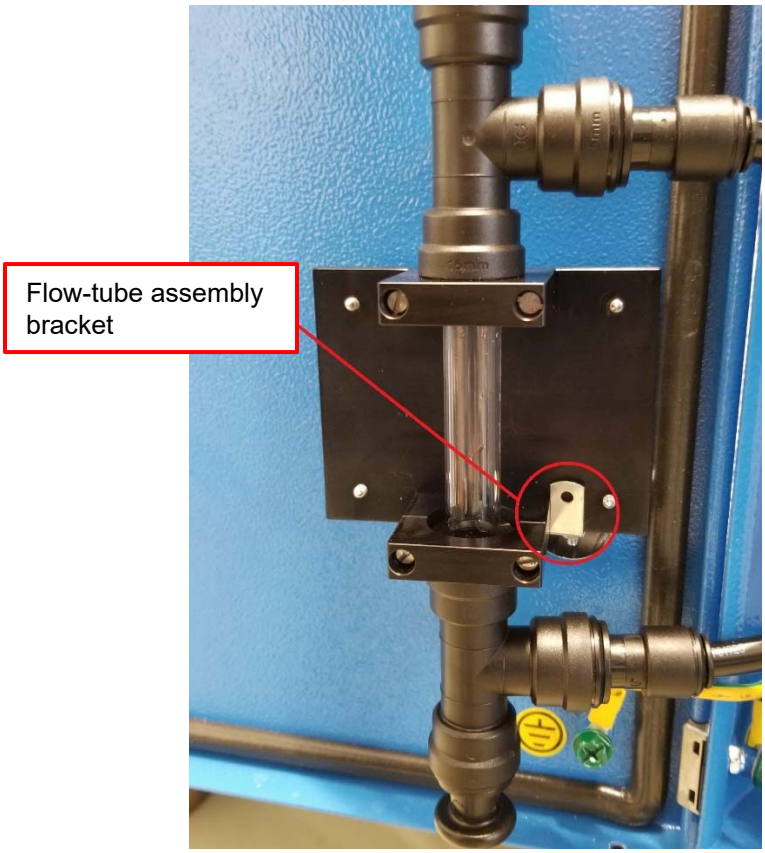
9) A 4-20 mA DC output signal proportional to the PPM or mg/L level is provided. This is a signal capable of driving 900 ohms. Remote indicators, receiving devices and their distances should be considered when choosing a location for the Arjay Controller.

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 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.

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 comes with easy in and out flow-tube assembly holder



3.2 GLOSSARY OF SYMBOLS

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

3.3 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) Be sure the sample take off (supplied loose) is installed as per drawings at the back of this manual. 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 inlet of the 3 way valve as per drawing.

3.4 PERMANENT POWER CONNECTION (AC POWERED MODELS 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) The external mains switch 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 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.

3.5 ELECTRICAL INSTALLATION

See drawings at the back of this manual.

4.0 STARTUP AND SETTINGS

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

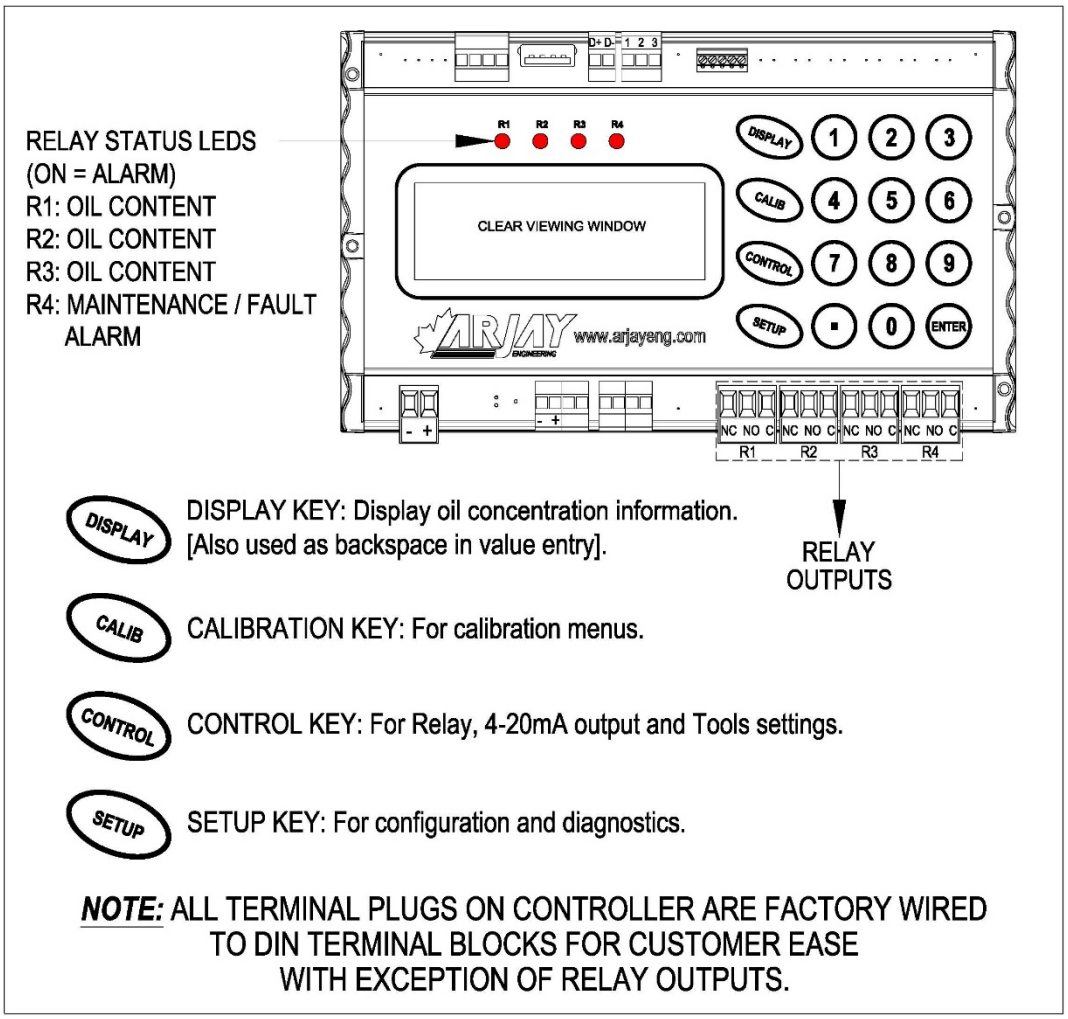


Figure 1 - USER INTERFACE

4.1 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.

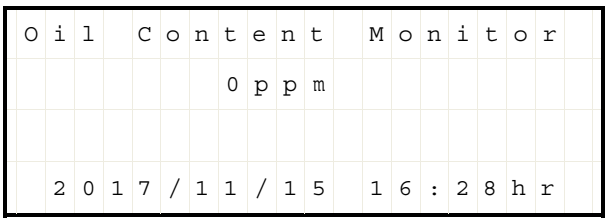
If the entered value is out of the allowed limits, the system displays the limiting value for 2 seconds. For example, if the alarm time delay value is entered as 5000 seconds, then **MAX. 99** is displayed for 2 seconds, and then entry is allowed again. The current value is not changed unless the entered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

4.2 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.

4.3 POWERUP 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):

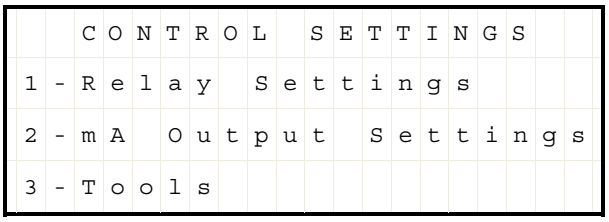


NOTE: The shown values are for example only.

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

5.0 CONTROL SETUP (<CONTROL> KEY)

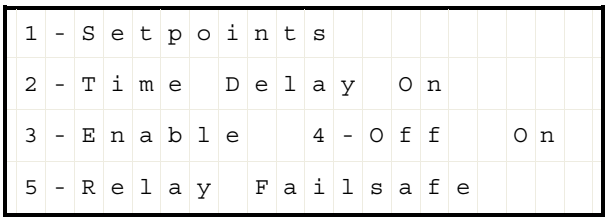
To access the control setup settings, you will require a password. The password is “2000” then press <Enter>.



5.1 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 alarm and Fault alarm.

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



5.1.1 Setpoints <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 high and low alarm points for the second and third relay Note: for a single point alarm with no differential, enter the LO alarm value identical to the HI alarm value.

5.1.2 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.

5.1.3 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 3.

5.1.4 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.

5.2 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, a 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. Press **<1>** for mA Zero / Span setup. The display will prompt you to enter the zero point in the unit selected. This will typically be **0.0**. Enter the 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 ->
```

5.2.1 4-20 mA OUT OR 0-20mA OUT <2>

The mA output signal 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.

5.2.2 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.

5.3 Tools <3>

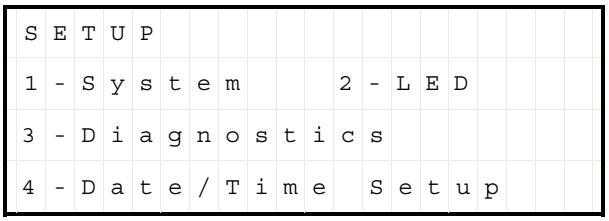
5.3.1 Relay Test <1>

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.

5.3.2 mA Output Test <2>

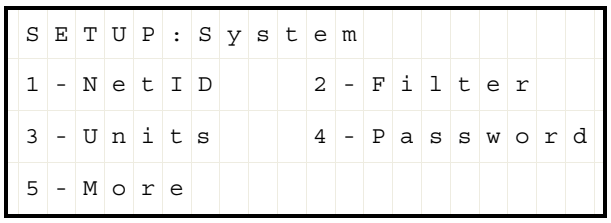
This feature allows the user to check the mA output at 4mA <1> and 20mA <2> OR Enter a desired value <3>. This is for maintenance purpose only.

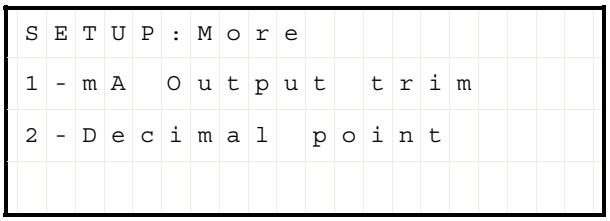
6.0 SETUP (OPERATION AND DIAGNOSTICS) (<SETUP> KEY)



6.1 System Settings <1>

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





6.1.1 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>.

6.1.2 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 filter is re-calculating.

6.1.3 Units <3>

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

6.1.4 Password <4>

Press <4> for 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.

6.1.5 More <5>

For further options Press <5>.

6.1.6 mA Output Trim <1>

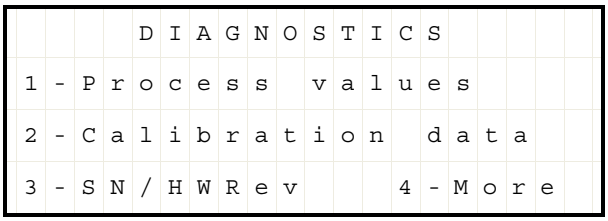
Press <1> for mA output Trim. This procedure trims the mA output for maximum accuracy by compensating for the mA output circuitry tolerances. Note: THIS PROCEDURE IS PERFORMED AT THE FACTORY AND IS TO BE PERFORMED BY AUTHORIZED PERSONNEL ONLY. IF IMPROPERLY DONE, THE ACCURACY OF THE MA OUTPUT CAN BE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

6.1.7 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.

6.2 DIAGNOSTICS <3>

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



6.2.1 Process values <1>

Press <1> for Process values. There are up to 3 receiver boards and up to 2 LED boards available. 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 1 board and used to monitor high turbidity of process water. Each screen displays the concentration in the selected units of each receiver board. The values when the LED is On as well as Off are displayed as well as the respective difference between the On and Off values 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.

6.2.2 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.

6.2.3 More <4>

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

6.2.4 SN / HWRev <3>

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

6.3 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.

7.0 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 7.2.4.

The first calibration point must be 0 ppm (mg/l) oil in water. Clean process water is preferred. If not available, tap water connected to the supplied 3-way valve can be used.

The second calibration point 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 10.0 for Sample Preparation.

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.

7.1 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.

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.

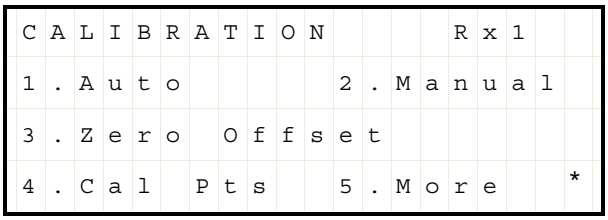
A back-pressure regulator is supplied on the outlet tubing if there are excessive bubbles due to rapid pressure changes between the process inlet flow and the exit flow. This is a white thumbwheel on the exit tubing. Tighten the thumbwheel slightly to compress the tubing and create back pressure to eliminate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

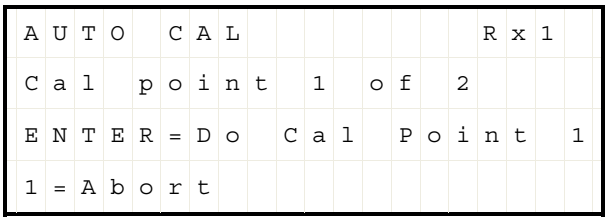
7.2 CALIBRATION

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



7.2.1 *Automatic Calibration <1>*

Confirm that the desired receiver board is selected. See top right hand corner of display (Rx1 is for oil). Press <1> for automatic calibration.



1. Automatic Calibration of Rx 1 (ppm) Oil Content:

The 1st point must be clean process water (0.0 ppm). If the process water is not clean of oil (0.0 ppm) then manually turn the handle of the 3 way valve to the ***clean water*** inlet 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.

A different concentration of contaminated water is required. If the process stream has a different concentration than 0 ppm, turn the handle of the 3 way valve to 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 10.0) 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 by opening the grab sample take off valve at the same time. Turn the sample take off valve back to close position. Send the sample for lab analysis promptly. The laboratory ppm value will be entered in manual calibration at a later date.

If more than 2 calibration points are entered in Section 6.2.2, 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 (see Section 6.2.4) to correct the value of the sample.

7.2.2 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 Rx1 is displayed at top right hand corner then press <2> for Manual Calibration.

```
MANUAL CAL
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 ppm entry and key in the lab ppm 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 6.2.2) the display will show “Calibration OK” and returns to main calibration menu.

THIS COMPLETES THE MANUAL CALIBRATION CORRECTION.

7.2.3 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 reading. This must only be done when the sample flow is 0ppm. Press <CALIB>, than <3> to do a zero adjustment.

7.2.4 Select # of Calibration Points <4>

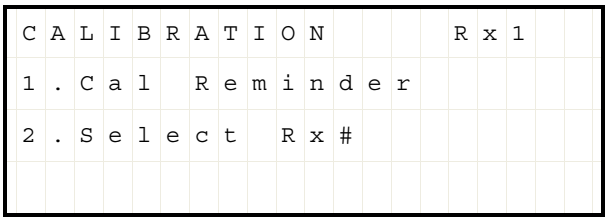
For Calibration, the Hydrosense 4410-OCM can accept up to 5 sample points to draw a calibration curve. The factory default is 2 points where 0ppm (clean process water) and a known ppm level is used. A calibration curve using more than 2 points is used to enhance accuracy over high ranges. Most applications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

```
SELECT CAL POINTS
Enter # of Cal Pts
Min Pts:2 Max pts:5
Current Pts: 2
```

7.2.5 More <5>

For further options Press <5>.



7.2.6 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.

7.2.7 Select Receiver Board <2>

This is not applicable on this model.

8.0 TROUBLESHOOTING

DISPLAY MESSAGE	ALARM STATUS	DO THESE STEPS
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, check mA output zero and span values to verify if they are lower than the expected ppm oil content range.
Code #2	R4 LED On	• FLR signal is over range. Set lower LED mA current.
Code #3	R4 LED On	• NTU signal is over range. Set lower LED mA current.
Code #4	R4 LED On	• COMP signal is over range. Set lower LED mA current.
Code #5	R4 LED On	• FLR signal is too low. The tube needs cleaning. If persists, re-calibrate the unit.
Code #6	R4 LED On	• NTU signal is too low. The tube needs cleaning. If persists, 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.

9.0 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).	N/A	
Span	Turbidity value for full-scale mA output 2 (20 mA)	N/A	
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 1 High Setpoint: Alarm condition if PPM is above this value.	50 PPM	
Relay3 Lo Set	Alarm Relay 1 Low Setpoint: Alarm condition cleared if PPM is below this value.	48 PPM	
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 ppm	

10.0 SAMPLE PREPARATION (FOR CALIBRATION OR TESTING)

Testing may be preformed 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.

11.0 PERIODIC TESTING AND MAINTENANCE

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

11.1 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 source 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 the 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.**

11.2 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 windex brand glass cleaner with “anti-fog” or similar, to clean the flow tube. For persistent stains use Muriatic acid (18%) or Isopropyl Alcohol. Replace the flow tube.

11.3 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.

11.4 SPARE PARTS LIST

Following is the spare parts list if in case need to order.

Arjay Part No.	***Desciption***
A00797	LED fly Board
A00801	Rx1 or Rx3 Receiver Board
A00800	Rx2 Receiver Board