MODEL: HYDROSENSE 4410-LMP

OIL IN WATER MONITOR

USER MANUAL (REV: 1.3)

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

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

TABLE OF FIGURES

SPECIFICATIONS

Specifications are subject to change without notice:

Specification	*Details*
Power Input:	100 - 230VAC (85-264VAC)*, 50/60Hz (47-63Hz)*, 1.26A – 0.62A, 2A Fuse OPTIONAL: 24 VDC @ 3.5 A max *Operational Range
User Interface:	
Display	Four line LCD with simultaneous display in PPM, current date and calibration due
Communication Interface:	RS-485 Modbus, optional HART or Fieldbus Foundation module for uni-directional communication of ppm.
Relays / Analog Outputs:	
Relay Outputs	6A DPDT Slave relays are available, dry contacts with LED panel indication R1 & R2: Setpoint Alarm Relays: User settable alarm points and delay time (0-99 seconds delay on) R3: Maintenance relay- Maintenance is required (See Troubleshooting section 8.0) R4: Fault alarm relay – Service is required (See Troubleshooting section 8.0)
mA Signal Output	4-20 mA DC, 900 Ohms, isolated, field scalable
Instrument Performance:	
Measuring Range	0 - 5000 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.
Sensitivity	145 PPB (diesel reference) & 463 PPB (crude oil reference)
Calibration	A library of up to 10 calibrations with up to five concentration entry points per calibration to maximize accuracy
Signal Filtering	20-1000 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)
Altitude	≤ 2000 m
Overvoltage Category	II
Pollution degree	2

Process Requirement:	
Process Sample Temperature	0-40 °C without cooler; above 40 °C with cooler.
Inlet Flow Rate	Minimum: 1.0 L/M (continuous and stable) Optimum: 3.0 to 5.0 L/M (continuous and stable)
Inlet pressure	Minimum 2 psi, maximum 1000 psi, *minimum 20 psi when equipped with optional cooler, ***For safety reasons a reducing valve should be used for pressure above 100 psi.***

Specification	***Details***
Mechanical Specification:	
Enclosure Dimensions	12.0"W x 37.5"H x 9.25"D (305mm W x 953mm H x 235mm D)
Sample Inlet	3/8” NPT female
Sample Outlet	2” NPT male (outfall must be unrestricted gravity to drain)
Weight	33Kg (73 lbs)
Enclosure Rating	Type 4X, IP65, 316 Stainless Steel with viewing window
Approval Standards:	CSA SPE1000 and Canadian Electrical Code (CEC) USA National Electrical Code (NEC)

1.0 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.

2.0 INSTRUMENT OVERVIEW

2.1 FEATURES

- Fluorescence technology
- Non-contact sensor
- Continuous On-Line monitoring
- Instantaneous readings
- Multi-point automatic or manual calibration
- Temperature and light degradation compensation
- 4 relays (DPDT 6A contacts) (R1 and R2 for PPM alarms, R3 and R4 for maintenance alarm),
- Isolated 4-20 mA output, RS-485 Modbus output, optional HART and Fieldbus Foundation
- LCD display in PPM
- No moving parts, complete maintenance without turning off the sample stream

2.2 DESCRIPTION

The HydroSense Oil in Water 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, and oil/water separators. Other measurements and mediums can be monitored on request (i.e. colorants in fluids, etc.).

A continuous sample is directed into the sample chamber using a pumped or process pressure source. **A stable flow rate is required.** The sample is released from the sample chamber by a gravity flow to a drain or sump.

The sample flow is dispersed evenly down an 88 mm x 200 mm flow plate. This dispersion accomplishes two favorable results. Firstly, the sample is spread over a wide area, providing a large surface area for the ultraviolet light to penetrate. This results in an increased excitation of the oil molecules. Secondly, the gravity flow against the flow plate minimizes the sample depth against the flow plate. This reduces the effect of suspended solids interference. Fewer oil molecules can ‘hide’ from the light source.

After the sample leaves the flow plate, it is allowed to gravity flow to the outlet port. The sample outfall must not be obstructed from gravity flow. For purge application a U-Trap would be required.

The ultraviolet light source is positioned directly in front of the sample flow. The receiver is positioned at an angle to the flow direction. Both the emitter and the receiver are equipped with precision light filters 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.

The sample tray is easily accessed for any necessary cleaning of the flow plate. 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 affect 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 254 nm +/-. 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 from 254 nm +/-.

3. This limited number of compounds that do fluoresce from 254 nm light may emit light at any number of wavelengths such as 290nm, 310 nm, 350 nm 480nm, etc. Aromatic hydrocarbons happen to 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 when excited from 254 nm light. If there is a background chemical in the water that fluoresces at these wavelengths, the HydroSense will 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 will 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 affect 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 affect of solids is taken into account and zeroed out.

The design of the large surface sensing area verses the small sensing depth minimizes the affect of turbidity in the HydroSense. In effect, the hydrocarbons have little place to hide behind solids. In circumstances of dramatic changes in turbidity, sample-conditioning techniques prior to the HydroSense should be considered.

Temperature Compensation

Temperature can affect the light sensor. Temperature compensation is built into the unit. The temperature compensation coefficient will be preset at the factory.

2.4 ROUTINE CLEANING PROGRAM

The HydroSense relies on a constant flow of water across the sensing plate. Excessive particulates and algae in the water can build up on the flow plate and in the overflow tray. 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 daily wipes and some may require monthly cleaning. A basic wipe down of the flow plate can be done without having to shutdown the stream or power. The wipe procedure will take 2 to 3 minutes.

To set up a schedule, it is recommended to program a daily wipe of the flow plate using a clean paper towel. After two weeks of daily cleaning, determine if every other day may be adequate. If so, set this program in place for two weeks. Slowly extend the frequency between cleanings until an adequate program frequency is determined for your individual site conditions.

Cleaning the flow plate and plastic surface should be done with clear non-fluorescing chemicals. An appropriate flow plate 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 plate with clean water before installing.

⚠ 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 Sample Chamber and the Controller.

1) The Sample Chamber receives the flow sample from the process and outputs it to drain. The chamber should be wall or rack mounted on a vertical and horizontal plane to allow a proper flow through the sensing unit.

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 gravity flows to drain, and consideration of a close proximity to the drain is important. Also, mount the unit where it is readily accessible for maintenance and periodic testing by manual insertion of known samples.

4) If the process flow is not under pressure, the chamber should be mounted below the process level so the sample can free flow down and through the unit. A pump may be used. The maximum input pressure is 1000 psi although a reducing valve to less than 100 psi is recommended. The minimum input flow rate is a continuous and stable 1 liter/minute. 3 – 5 liter/minute is recommended.

5) The inlet connection to the unit is a 3/8” female thread. A barb connection may be threaded to this when flexible inlet tubing is used. Clear flexible 3/8” or 1/2” inlet tubing is suggested for the inlet sample. This will provide a visible indication of the sample, as well as an indication of contaminant build-up. To minimize the contamination in the tubing, Teflon lined tubing may be desirable. Hazardous Locations or local regulations will dictate materials to be used.

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

6) An on/off valve at the process is recommended to shut down the system for maintenance and/or sample tube replacement. (An on/off valve is included within the unit for throttling flow. This can be used for internal maintenance). A 3-way valve is included at the inlet for a fresh water input for zeroing, cleaning, and testing.

7) The sample gravity flows out of the Sample Chamber. The outlet tube **must** only be installed in a downward vertical or downward graded horizontal direction. Any excessive upward direction will cause the sample to back up and could flood the sample chamber.

8) The outlet fitting is a 2” male thread. Do not reduce this size. This will cause a restriction and flood the system.

9) For non-purged/pressurized models the outlet of the tube should be open to air, **not** submerged in water or a process which would cause a backpressure. This could result in a restriction of the effluent flow and spillage within the lower chamber.

   For purged/pressurized models, a slight and constant backpressure is required to maintain a cabinet pressure. To accomplish this, submerge the effluent tubing approximately 10 cm below the water surface or run the outlet tube with a slight upward grade or drain trap prior to the downward outfall. Be sure the tube never rises higher than the bottom of the chamber outlet.

10) The Sample Chamber 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 installation, the unit must be sun and rain shielded.

11) The controller operates using 100-230VAC (85-264VAC)*, 50/60Hz (47-63Hz)*, 1PH, 1.26A – 0.62A ***or*** 24 VDC as ordered. (*Operational Range)

12) 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. Relay 3 is maintenance alarm, which indicates offset drift and that cleaning, or re-calibration is necessary. Relay 4 indicates a Lamp Replacement requirement or controller failure.

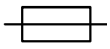
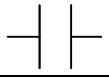
13) A 4-20 mA DC output signal proportional to the PPM level is provided. This is a signal capable of driving 900 ohms. Remote indicators, receiving devices and their distances should be considered when choosing a location for the Arjay Controller.

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

15) Shielded wiring is required for the output alarms and signals to avoid EMI and RFI interference from other equipment near the sample unit.

16) The Monitor is housed in a Type 4X 316 Stainless Steel enclosure. Extremes in temperature and humidity should be avoided. Indoor or an environmentally mounted instrument shelter is recommended.

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

The unit is 33kg and need two people to install the unit. Follow the steps to install the unit.

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 load bearing wall or a framework provided by the end user, the bolts used to attached the monitor need to be at least M10. To mounting the monitor to wall structure use four bolts with washer and nuts with mechanical anchor on the opposite side of the mounting wall or vertical mounting rack may be used. See the drawing of 20150470 for installation dimensions. Make sure that the door can be opened and that both sides of cabinet are accessible.

3) The sample will be flowing over a Flow Plate. A bubble level is provided in the sample chamber. Be sure the unit is mounted level. This is necessary for a proper flow across the Flow Plate.

4) Open the Blue Lamp Box and secure the new lamp into place with the metal band and knurled screw. Make sure the lamp is seated between two tabs of metal band as per picture below.

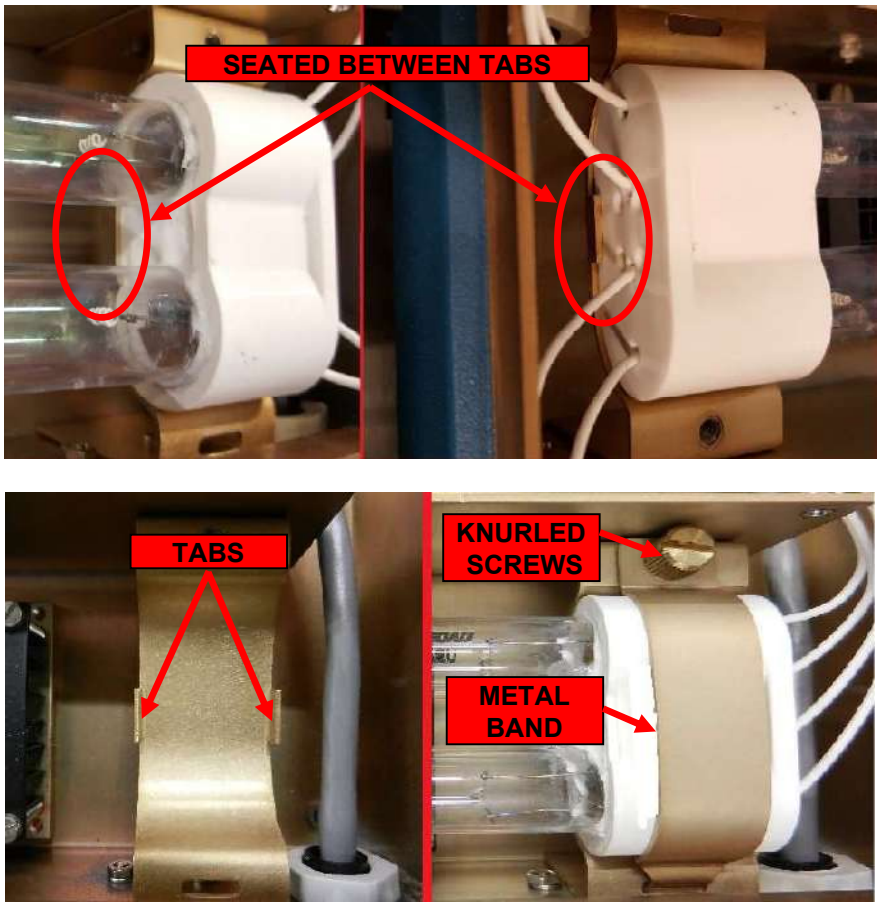


Figure 1 – SECURE LAMP INSIDE THE LAMP BOX

5) Plug the lamp terminal into the socket. Close the Blue Lamp Box.

6) Insert the flow plate as shown below. The flow plate has a special reflective core and **must** be placed in the Tray with the etched "UP" side facing out (toward you). Snug the knurled screws to hold the flow plate in place.

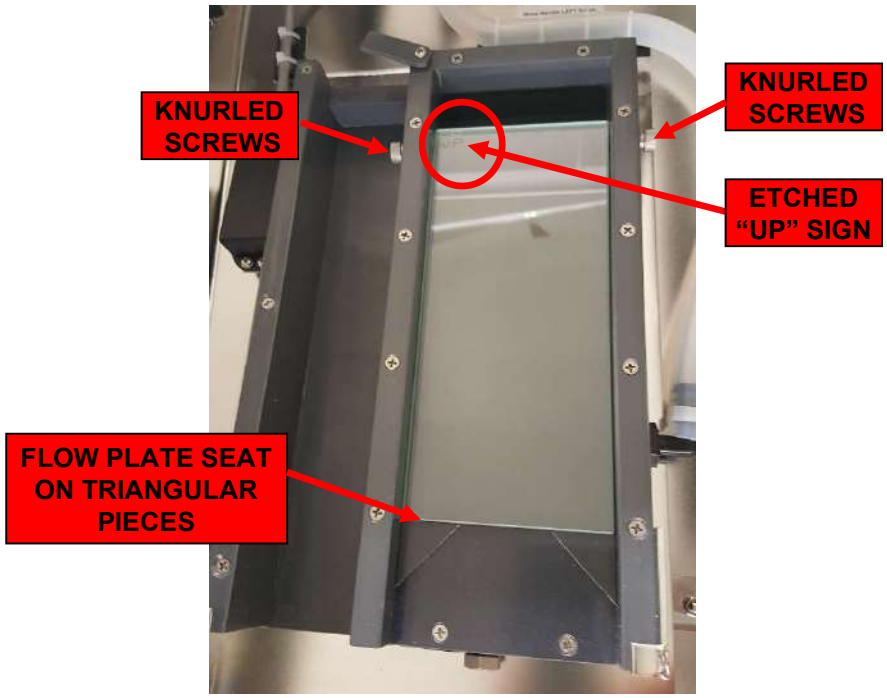


Figure 2 – FLOW PLATE SECURE AGAINST TRAY

7) Place the Blue Lamp Box against the Tray and secure it with the retaining latch.

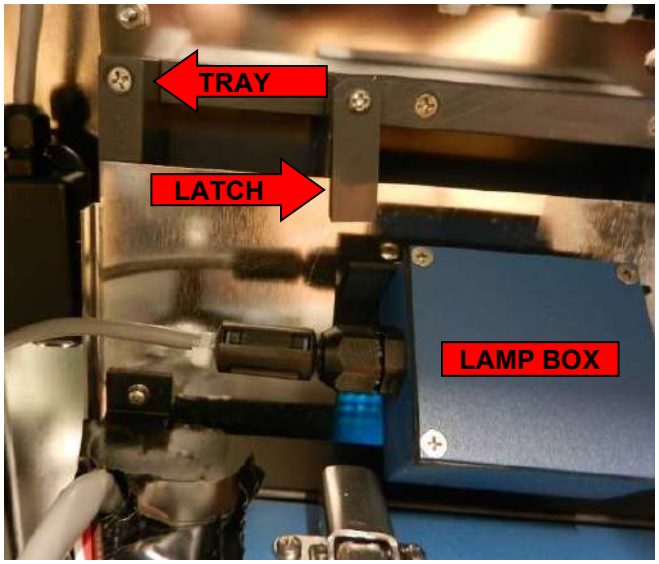


Figure 3 – BLUE LAMP BOX SECURE AGAINST TRAY

8) Be sure the 3 way valve with grab sample take off valve (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 3/8" inlet of the 3 way valve. DO NOT TURN ON THE INLET SOURCES.

Connect the outlet source to drain or a sump.

For non-purged/pressurized models the outlet of the tube should be open to air, **not** submerged in water or a process, which would cause a backpressure. This would result in an overflow inside the chamber.

For purged/pressurized models, a slight and constant backpressure is required to maintain a cabinet pressure. To accomplish this, submerge the effluent tubing approximately 10 cm below the water surface or run the outlet tube with a slight upward grade prior to the downward outfall such as a U-Trap. Be sure the tube never rises higher than the bottom of the chamber outlet.

9) Note that the outlet is a gravity feed line only. The outlet tube must NOT rise above the bottom of the lower chamber or be connected to a pressure process line.

See video on Arjay Enginnering Ltd. website (www.arjayeng.com) for more information in using HS4410-LMP Oil in Water Montior.

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:

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.

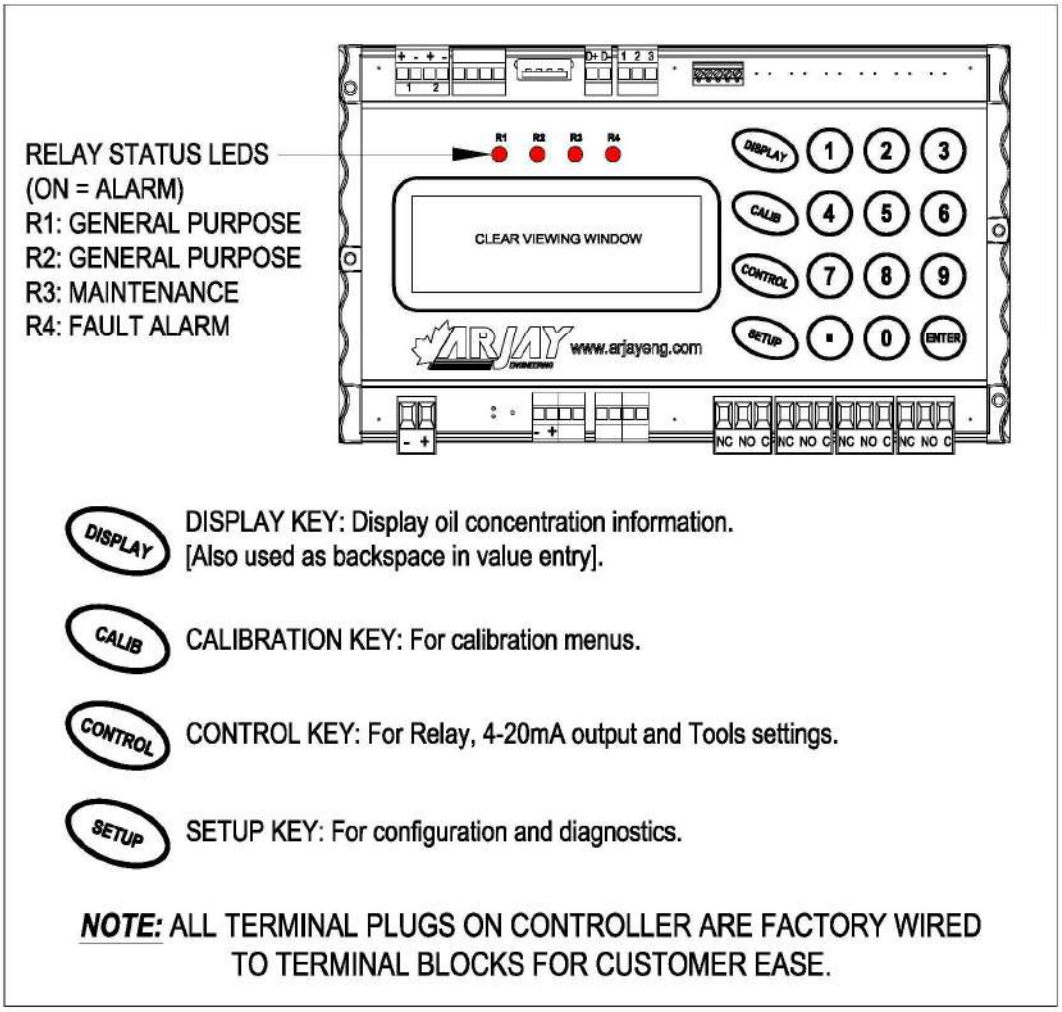


Figure 4 - USER INTERFACE

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, in which case the DISPLAY menu is entered.

The decimal point is the dot (■) key.

Values may be entered with any number of decimal places.

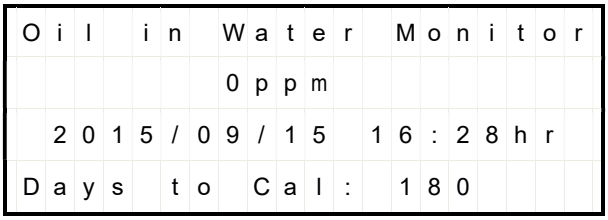
If the entered value is out of the allowed limits, the system displays the limiting value for 2 seconds. For example, if the alarm time delay value is entered as 5000 seconds, then **MAX. 99** is displayed for 2 seconds, and then entry is allowed again. The current value is not changed unless the entered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

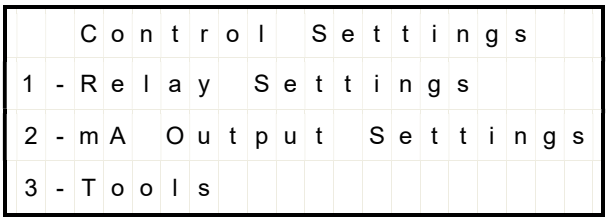
The 3rd line shows the current date and time

The 4th line displays the amount of days left until next calibration.

The main power supplies in upper chamber should also show a Green power light.

5.0 CONTROL SETUP (<CONTROL> KEY)

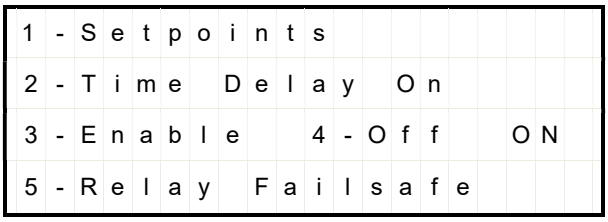
To access the control setup settings, you will require a password. The password is “2000”.



5.1 RELAY SETTINGS <1>

Four relay alarm points are available for remote alarm. Of these, two are general-purpose alarm relays with user settable alarm points, dead band (differential alarm points), and time delay. The remaining two relays are to indicate Maintenace alarm (R3) and Fault alarm (R4).

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 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 PPM concentration is fluctuating at the alarm level. Similarly, enter the high and low alarm points for the second relay R2 if it is to be used. 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 Enter On delay in the Relay Setting Menu. 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 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 Yes 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 PPM. 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>.**

				S	e	t		m	A		O	u	t	p	u	t			
1	=	m	A		Z	e	r	o	/	S	p	a	n		S	e	t	u	p
O	u	t	:	4	-	2	0	m	A			2	=	0	-	2	0	m	A
m	A	=	D	I	R							3	=	I	N	V			

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 INDIRECT <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 CALIBRATION SETUP (<CALIB> KEY)

NOTICE	**To access the calibration settings, you will require a password. The password is '2000'.**
NOTICE	**Calibration must be performed after installation and any lamp replacement.**
NOTICE	**Allow a minimum of 24 hours of power up prior to calibration to allow the lamp 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. At least two points of entry at different contaminant levels are required. These levels may initially be unknown for calibration purposes and entered in manual calibration at a later date after laboratory results are returned. One of these points may be clean process water (0 PPM hydrocarbons).

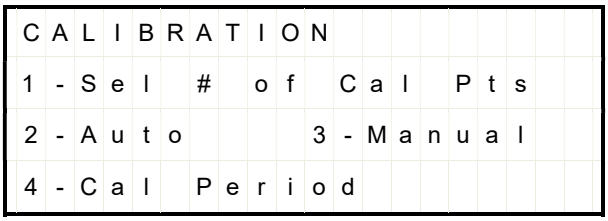
Prepared samples may be used for calibration and testing although variations in personal blending techniques, the source of the hydrocarbon and background water, the container used, and the retention time prior to use will all play a part in the concentration reliability and repeatability.

6.1 BEFORE CALIBRATION

Open the sample chamber door. Lift the Lamp Blue Box off the tray and place it on the door brackets. Check that the flow plate is resting securely in place against the tray. The flow plate has a special reflective core and MUST be placed in the tray with the etched "UP" side facing out (toward you).

Slowly open the process stream valve to allow a steady and even flow over the flow plate. Check that the outfall is draining well and water is not building up in the drain tray. Verify that the flow plate is evenly and completely covered with the flowing water. The sample flow may not initially cover the whole flow plate by itself. Stir up the flow plate by rubbing the flow plate so the water sheens evenly and completely across the flow plate as it flows. Place the Lamp Blue Box back against the tray and secure it with the retaining latch. Close the chamber door. Make sure the Sample Chamber Door is closed tightly. The door MUST be closed to eliminate any background light interference during and after calibrations.

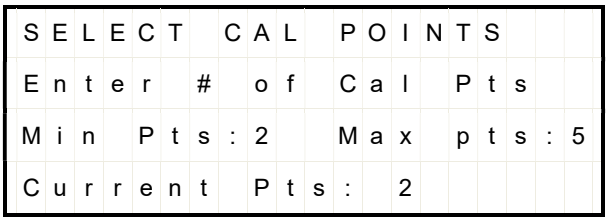
6.2 CALIBRATION



6.2.1 SELECT # OF CALIBRATION POINTS <1>

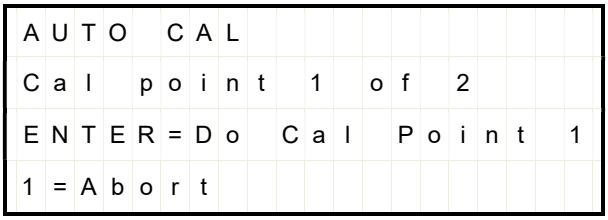
Press the <CALIB> , enter the password at the prompt then Press <1> for SEL # of cal points. The fourth line shows the current selection. Enter # of points if change is required then press <ENTER>.

For Calibration, the Hydrosense 4410-LMP 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 because some samples may not be linear as concentrations increase.



6.2.2 AUTOMATIC CALIBRATION

Press <2> for automatic calibration.



Press <ENTER> to proceed to 1st calibration. Normally, the 1st point is clean process water (0.0 ppm). Manually put the handle of the 3 way valve to the “up” position and let the clean process water flow through the Hydrosense 4410-LMP. Enter the ppm value (0.0). Once the reading (FLR rdng) has stabilized, press <ENTER> key. The display will now proceed to the second point.

A different concentration of contaminated water is required. If the process stream has a different concentration than 0 ppm, put the handle of the 3 way valve to “down” position to allow the process stream to flow through the Hydrosense 4410-LMP.
If the concentration of process stream is close to 0.0 ppm, a prepared sample (refer to Section 10.0) and a sample pump will be used. Disconnect the inlet of clean water and connect the prepared sample into the inlet. Pump the prepared sample through the Hydrosense 4410-LMP.

Enter the known or unknown* ppm value of stream concentration (i.e., 30.0 PPM). Once the reading (FLR rdng) 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 grab sample take off valve at the same time. After finishing turn back the valve to close position. Send the sample for lab analysis promptly. Record the FLR signal value on the bottom line of the display. The laboratory ppm value and corresponding FLR reading (FLR rdng) will be entered in manual calibration at a later date.

If more then 2 calibration points are entered in Section 6.2.1 then display will proceed to the 3rd point. Repeat the above procedure for each concentration level. A minimum of two inputs is required.

THIS COMPLETES THE CALIBRATION IF KNOWN VALUES WERE ENTERED. If random unknown values were entered, the laboratory results will need to be entered in manual cal (see Section 6.2.3) to correct the values of the samples.

6.2.3 MANUAL CALIBRATION WITH LABORATORY RESULTS

When the lab results have been returned, press the <CALIB> key, enter the password at the prompt, then press <3> 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 ppm value will be displayed. If a grab sample was taken for this point, key in the lab value of sample in PPM and press <ENTER>. Otherwise, Just press <ENTER>. The unit will prompt you to enter a FLR value in mV. This was recorded for you when you first took the grab sample. Press <ENTER> to accept this and proceed to 2nd calibration point (2nd point).

Key in the lab result in PPM of Sample # 2 if a grab sample was taken and press <ENTER>. Otherwise, Just press <ENTER>. The unit will again prompt you to enter a FLR value that corresponds to your sample. Press <ENTER> to accept this value and proceed to 3rd calibration point.

Repeat the above procedure for each sample. If only two calibration points were selected (Section 6.2.1) then display will show “Calibration OK” and returns to main calibration menu.

THIS COMPLETES THE MANUAL CALIBRATION.

6.2.4 LIGHT REFERENCE AND TEMPERATURE SETTING

With automatic and manual calibration, the light reference and temperature are automatically recorded (REF @ CAL, TEMP @ CAL). These recordings are shown in SETUP menu. Press <SETUP>, then <2> for Diagnostics then <2> for Calibration data.

Reference at Cal is used to monitor lamp aging and send a maintenance alarm (R3) that re-calibration is required and/or a new lamp is required.

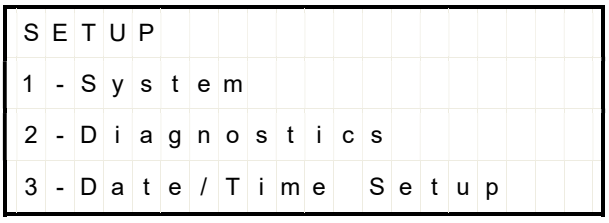
6.2.5 CHANGE CALIBRATION LOCATION

There is an option to have up to 10 calibration locations in Hydrosense 4410-LMP (Cal 1 – Cal 9). Each location can have up to 5 calbration points to draw a calibration curve. Consult factory if this feature is required.

6.2.6 CALIBRATION PERIOD

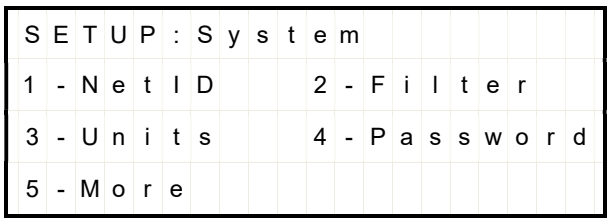
The 4410-LMP controller has a calibration reminder feature. The factory setting is 180 days from last preformed calibration. At this time the main display will show “Calibration Due”. Press <1> to change the amount of days from last calibration or <2> to exit.

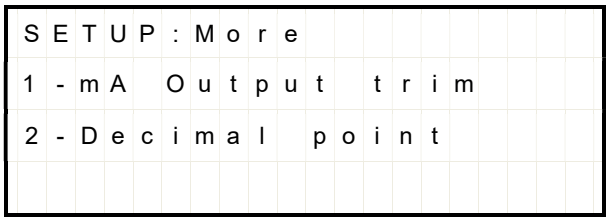
7.0 SETUP (OPERATION AND DIAGNOSTICS) (<SETUP> KEY)



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.

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 1000. The default value is 960. Note: R3 maintenance alarm may come on while filter is recalculating.

7.1.3 UNITS <3>

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

7.1.4 PASSWORD <4>

Press <4> for password. Enter the new password at the prompt, then press <ENTER>.

7.1.5 MORE <5>

For further options Press <5>.

7.1.6 mA OUTPUT TRIM <1>

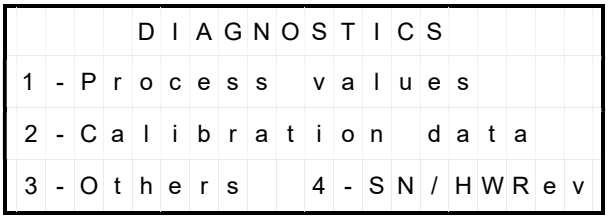
Press <1> for mA Trim. This procedure trims the mA output for maximum accuracy by compensating for the mA output circuitry tolerances. THIS PROCEDURE IS PERFORMED AT THE FACTORY AND IS TO BE PERFORMED BY AUTHORIZED PERSONNEL ONLY. IF IMPROPERLY DONE, THE ACCURACY OF THE MA OUTPUT CAN BE IMPAIRED.

7.1.7 DECIMAL POINTS <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 Setup menu.

7.2 DIAGNOSTICS <2>

There are a number of diagnostic screens to monitor the performance of the unit. Press the <SETUP> key then Press <2> for diagnostics.



7.2.1 PROCESS VALUES <1>

Press <1> for Process values. This screen displays the FLR (Sample Fluorescence) and the REF (Lamp Reference) signal values. The values when the lamp is ON as well as OFF for both the FLR and the REF are displayed as well as the respective difference between the ON and OFF values. 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 REF value (lamp reference) and FLR (sample fluorescence). The 4th line shows the current temperature (T1) of the bottom chamber.

7.2.2 CALIBRATION DATA <2>

Press <2> for calibration data values. This section will show each calibration point as well as reference and temperature at calibration. Press Enter to exit or to proceed to next set of calibration points (if more then 2 is selected).

7.2.3 OTHERS

Press <3> for other diagnostic data values. The screen displays the current temperature compensation correction on fluorescence and lamp reference values as well as the last calibration date. There is no temperature compenstation between the temperature range of 22-26°C.

7.2.4 SN / HWREV <4>

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

7.3 DATE / TIME SETUP <3>

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

8.0 TROUBLESHOOTING

DISPLAY MESSAGE	ALARM STATUS	DO THESE STEPS
Lamp ERROR	R4 LED On	• REF signal is less than 400mV. • Check that TX cable is connected properly. • Check that blue lamp box door is closed. • Replace UV lamp (A00114). • Check if UV lamp has been installed and connected to lamp driver board after shipment.
Receiver ERROR	R4 LED On	• Check that RX cable is connected properly. • Receiver board (A00427B) may need to be replaced.
Code: 01	R3 LED On	• Reference value is 50% less intensity from original calibration • Recalibrate or prepare to replace lamp (A00114).
Code: 02	R3 LED On	• FLR signal is less than the calibrated offset value (Factory defaulted at 80% of original value). Note: If lamp error and code 2 is on at the same time then follow lamp ERROR troubleshooting steps.
Code: 03	R3 LED On	• Check temperature sensor (T1) is reading accurately in diagnostic menu (this is the internal temperature of lower chamber). • Check that the temperature sensor is wired properly. • Replace temperature sensor A00772.
Calibration Due Code: 04	R3 LED On	• Calibration is Due • Re-Calibrate unit and calibration due date will reset itself.
PPM reading is erratic or unstable	N/A	• Check that the process is flowing evenly over the flow plate. Make sure the HS4410-LMP was proper calibrated. • Check for HIGH suspended solids in process. • Make sure UV lamp is properly seated in cradle between 2 tabs (see figure 1 for detail). • Make sure the flow plate is properly seated in PVC tray.
	N/A	Record calibration data in Diagnostics: 1. Calibration Data: • Press <SETUP>, then press <2> for Diagnostic. • Press <2> for calibration data. • Record information on screen. 2. Process Values • Press <SETUP>, then press <2> for Diagnostic. • Press <1> for Process values. • Record REF and FLR from line 1, 2 and 3. 3. Report recorded information from step 1 & 2 above to Arjay: Arjay@arjayeng.com.

9.0 CONTROLLER SETTING SHEET

PARAMETER	DESCRIPTION	FACTORY SETTING	USER SETTING
REF at Calibration	To monitor for fluorescence light source degradation, the lamp light intensity value is captured during calibration and this captured reference value may be viewed in the Calibration DATA under Diagnostic Menu.		
Zero	Oil PPM value for zero scale mA output (4 mA) or (0mA).	0.0ppm	
Span	Oil PPM value for full-scale mA output. (20 mA)	100.0ppm	
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.	10 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.	20 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. 1000)	960	
Failsafe	Relays energized under normal conditions	ON	

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 lamp replacemnt.**

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 alarm (R3) feature 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.

A flow plate is used for all applications and is shipped as the standard with the unit. Film build-up of algae and silt will not affect the operation of the unit unless it accumulates oil from contaminated water to a point at which the unit acknowledges and reads this oil. It is suggested that routine maintenance be scheduled to verify that this build-up is not extreme and the flow plate is cleaned as necessary.

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

The first is a BUMP TEST. To confirm that the unit is responding to the contaminant, a higher or lower concentration than normal may be manually inserted into the stream at the actual process or at the sample chamber.

Divert the 3 way valve and provide clean water or a different concentration sample into the flow. Observe that the reading increases or decreases and alarms accordingly.

A second test is a FLUORESCENCE ACCURACY TEST. The clear flow plate provided with the unit can be used to confirm the response to fluorescence of the unit. After a calibration has been completed, lift the Lamp box to access the flow plate. Turn off the inlet water and flip the flow plate with the etched “UP” now facing down. Leave the water off. Secure the lamp box back in position and close the chamber door. Read and record the display in PPM for future reference . Periodically, or in conjunction with the BUMP TEST, insert this flow plate upside down and confirm that the reading is within 5% of the initial reading. If the unit is not within specification, re-calibration of the unit should be initiated. IMPORTANT: Each time the unit is re-calibrated, the flow plate should be inserted upside down and the new reading recorded.

NOTICE	**After bump test is preformed the glass flow plate must be place in the “UP” position for normal operation.**

It is recommended that the above tests be done initially with a high frequency to record a history of the unit stability. The frequency can be reduced to a level comfortable to the application and customer. A one month minimum check is recommended in conjunction with a flow plate cleaning.

A third test is an actual CALIBRATED SAMPLE TEST. Since the two above tests confirm both a response to a calibrated sample flow plate and the contaminant, using an actual sample may only be necessary in applications where precise data records and monitoring is required. To test the accuracy and calibration of the unit, have a sample analyzed by a lab and compare it to the observed reading. The lab procedures must be the same as the ones used for calibration.

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

11.2 FLOW PLATE CLEANING

The unit is designed for quick and easy cleaning. Remove the Blue Lamp Box and place on the chamber door to access the flow plate. Wipe the flow plate with a clean damp cloth. The flow plate may be removed for cleaning if desired. Do not use soap as this may cause an inaccurate reading if not rinsed completely. One suggestion would be to use windex brand class cleaner with “anti-fog” to clean the flow plate. For persistent stains use Muriatic acid (18%) or Isopropyl Alcohol. Replace the flow plate. Verify an even water flow across the flow plate. Place the Blue Lamp Box back on the Tray and secure it with the retaining latch. Close the door snugly.

11.3 LAMP REPLACEMENT

Power off the unit. Allow 15 minutes for the lamp to cool. Open the chamber door. Open the Blue lamp Box lid to view the lamp. The lamp is connected to a socket and the unit is held down with the single knurled screw. Undo the screw and carefully lift the lamp up. Remove the lamp from the socket (unscrew the connectors mounting block) and insert the new lamp. (Note: the socket has a polarity to direct you). Secure the new lamp into place with the metal band and knurled screw. Close the lid. A calibration must be performed after a 24 hour warmup of new lamp.

See video on Arjay Enginnering Ltd. website (www.arjayeng.com) for more information in using Oil in Water Montior.

11.4 SPARE PARTS LIST

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

Arjay Part No.	***Desciption***
A00114	UV Lamp
A00142B	Flow Plate