MODEL: HYDROSENSE 2410

OIL IN WATER MONITOR

USER MANUAL (REV: 5.0)

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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: *(Specify at the time of order)*	100 -130VAC* ***OR*** 207 - 253VAC* 50/60 Hz, 200 VA max, OPTIONAL: 24 VDC @ 3.5 A max *Operational Range
User Interface:	
Display	Four line LCD with simultaneous display in PPM, Cal Location, current temperature, and bar graph
Communication Interface:	RS-485 Modbus, optional HART or Fieldbus Foundation module for uni-directional communication of ppm.
Relays / Analog Outputs:	
Relay Outputs	4 independent SPDT, 10 amp (7 amp if used in Class I, Div 2 applications), dry contacts with LED panel indication 2 setpoint alarm relays (R1 & R2): user settable alarm points and delay time (0-99 seconds delay on) 1 maintenance alarm relay (R3) 1 Lamp or controller failure alarm relay (R4)
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)
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:	CAN/CSA-C22.2 No. 0-M91 CAN/CSA-C22.2 No. 94-M91 C22.2 No. 142-M1987 C22.2 No. 213-M1987 (Hazardous Location : Class I, Division 2, Groups A, B, C and D) UL 50 (11th Ed.) 1995 UL 916 (Third Ed) March 2006 UL 1604 (Third Ed) Feb 2004 (Use in Class I and II, Division 2; Class III Hazardous (Classified) Locations) CE ABS Design Assessment IMO MEPC.107(49) (conditional to site monitoring requirements) ** (USCG certified)

* UL certified at 120 ±10% VAC and 230 ±10% VAC
** The HydroSense 2410 has been third party tested and certified that it is in compliance with the IMO MEPC.107 (49) guidelines. The MEPC 107(49) guidelines require that the site must log and retain data for 18 months. A sample stream by-pass alarm must also be installed and logged. To meet the IMO MEPC. 107(49), the site must consider these requirements. A kit is available from Arjay Engineering if these conditions are not met at site.

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
- Isolated inputs
- Continuous On-Line monitoring
- Instantaneous readings
- Multi-point automatic or manual calibration
- Temperature and light degradation compensation
- 4 relays (SPDT 10A 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 120VAC, 50/60Hz, 220VAC, 50/60Hz or 24 VDC as ordered.

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.

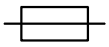
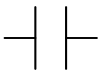
14) A RS-485 Modbus output is provided. This can be used to link to computers and other equipment. Optional HART and Fieldbus Foundation are available.

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.

17)

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 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.

3) 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.

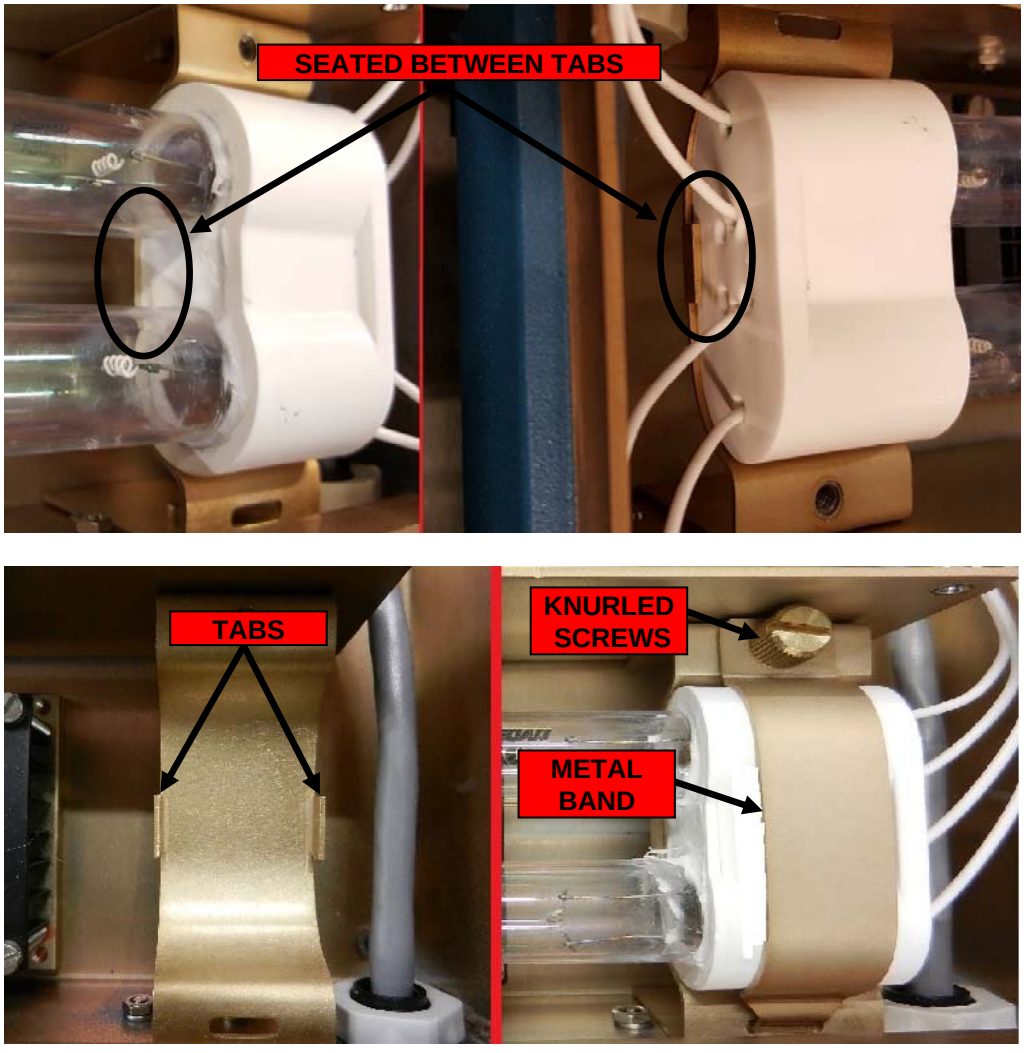


Figure 1 – SECURE LAMP INSIDE THE LAMP BOX

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

5) 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.

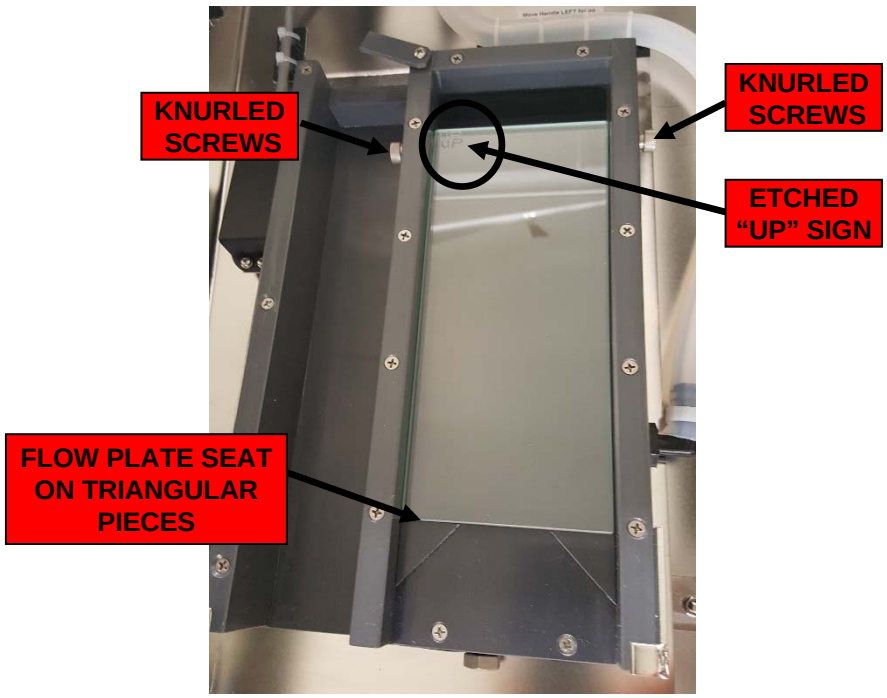


Figure 2 – FLOW PLATE SECURE AGAINST TRAY

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

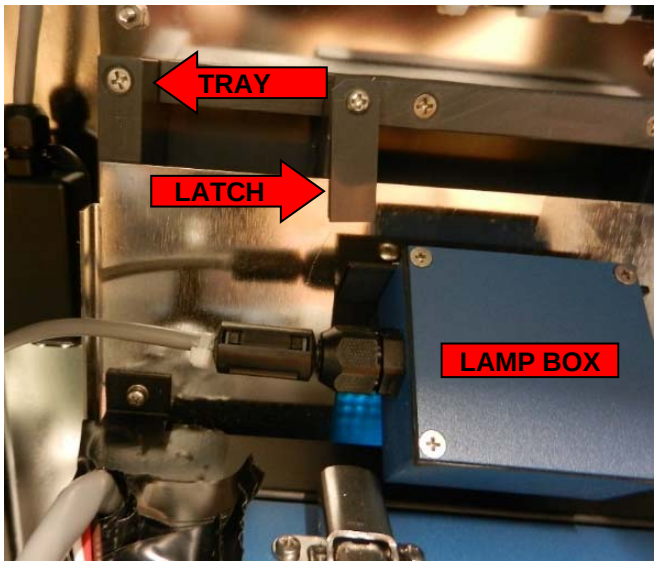


Figure 3 – BLUE LAMP BOX SECURE AGAINST TRAY

7) 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.

8) 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.

9) Confirm that the tray and flow plate are securely in place. Slowly open the inlet water source to allow a steady and even flow over flow plate. Once the flow connections are verified and operational, turn the water source off to continue with the electrical installation.

See video on Arjay Enginnering Ltd. website (www.arjayeng.com) for more information in using HS2410 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:


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.

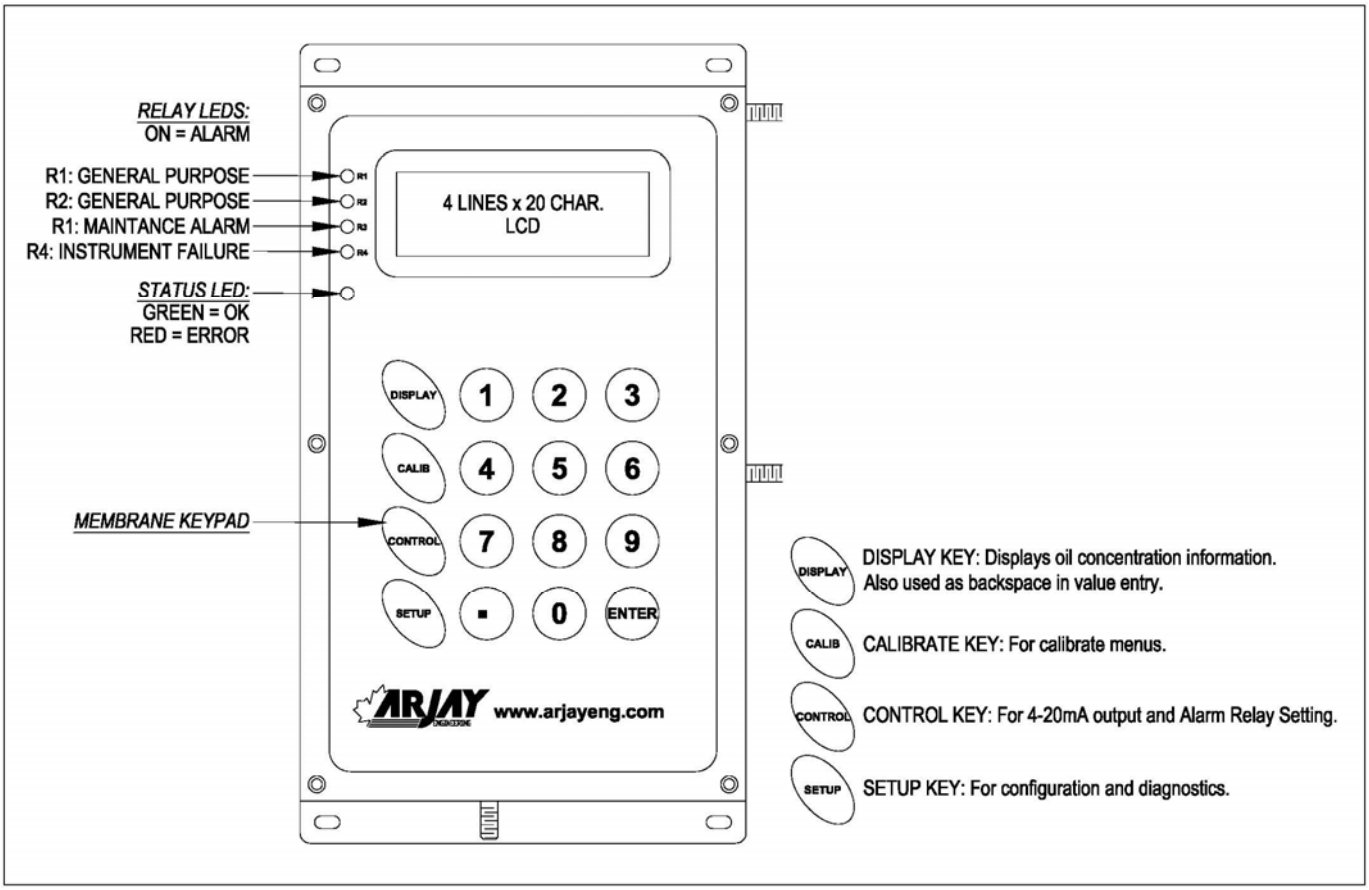


Figure 4 - USER INTERFACE

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.

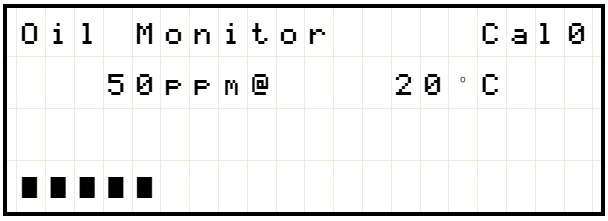
If the entered value is out of the allowed limits, the system displays the limiting value for 2 seconds. For example, if the alarm time delay value is entered as 5000 seconds, then **MAX. 99** is displayed for 2 seconds, and then entry is allowed again. The current value is not changed unless the entered 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> 5-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 8.1.4 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 1st line on right corner shows calibration location (Cal0 – Cal9). The unit can save 10 different calibration curves (in each curve up to 5 points can be entered).

The 2nd line shows the oil concentration value in PPM and current temperature of sample chamber.

The 3rd line is blank.

The 4th line displays a bar graph of the oil concentration as a percent of the Output Full Scale. The bar graph resolution is 5%.

The Status Indicator (see figure 4.0) should be green. If this is red, the LCD displays the System Error. See the troubleshooting guide for details.

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 lamp failure (R4).

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

5.1.1 SETPOINTS

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 RELAY TIME DELAY

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

The relays may be disabled from operating for maintenance purposes. Confirm the relays are activated in the lower right corner of the display in the RELAY SETTINGS menu. If the display reads ON (in the lower right corner), the relays are activated. Press <3> to enable the relays or press <4> to disable the relays.

The control functions are now entered. Press <CALIB> to calibrate or <DISPLAY> to return to the main display.

5.2 OPERATING RANGE - mA OUTPUT SETTINGS

Determine the desired operating range of the instrument. This will reflect the 0 to 100% OUTPUT display on the main menu, and the 4 to 20 mA output range of the instrument. For example, if the operating range of the process is 0 to 30 PPM, a range of 0 to 50 PPM may be desirable. The display will show 0-50 PPM equal to 0-100%. 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 4-20 mA Settings. 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). Key in the desired value and press **<ENTER>**.

5.2.1 Confirm 4-20 mA OUTPUT direction

The display will require a confirmation if the 4-20 mA signal is to be direct acting (4-20 mA = 0-100%), or if inverse acting is required (20-4 mA = 0-100%). The lower left display will read mA: DIR. If this is required, press **<ENTER>**. If inverse is required, press **<1>**.

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

For Calibration, the Hydrosense 2410 can accept up to 5 sample points to draw a calibration curve. A calibration curve is used because some samples may not be linear as concentrations increase.

6.2.1 AUTOMATIC CALIBRATION <1-AUTO>

Press <CALIB> key, enter password at the prompt, then 1-AUTO.

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 2410. 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 2410.

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 2410.

Press <ENTER> to input ppm value of the 2nd point. 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.

Press <0> to finish calibration OR Press <ENTER> to continue to third calibration and repeat the above procedure for each additional 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.

6.2.2 MANUAL CALIBRATION WITH LABORATORY RESULTS

When the lab results have been returned, press the <CALIB> key, enter the password at the prompt, then press <2> for Manual Calibration.

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).

Press <ENTER> to procced to 2nd point value.

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.

Press <ENTER> to continue calibration and repeat the above procedure for each sample.

Press <0> to finish calibration, then press <DISPLAY> to main display menu.

THIS COMPLETES THE MANUAL CALIBRATION.

6.2.3 GAIN SETTING

The FLR signal gain is typically factory set and should only be modified if directed by an Arjay Engineering representative. The procedure to change the gain is as follows:

Press the <CALIB> key, enter the password at the prompt, then press <4> to Set Gain.

Enter the new gain value then press <ENTER>. Note: the actual gain set may differ than the desired value due to the resolution of the gain setting circuitry. The actual gain will be displayed if the gain setting menu is re-entered.
Press <DISPLAY> to main display menu.

6.2.4 LIGHT REFERENCE AND TEMPERATURE SETTING

With automatic calibration, the light reference and temperature are automatically recorded (REF @ CAL, TEMP @ CAL). The procedure to change these values is as follows:

Press the <CALIB> key, enter the password at the prompt, then press <3> to ManRef.

Enter the new REF @ CAL value at grab sample time, then press <ENTER>.

Enter the new TEMP @ CAL value, then Press <ENTER>.

Press <DISPLAY> to main display menu.

6.2.5 CHANGE CALIBRATION LOCATION

There are 10 calibration locations in Hydrosense 2410 (Cal 0 – Cal 9). Each location can have up to 5 points to draw a calibration curve. The procedure to change calibration location is as follows:

Press the <CALIB> key, enter the password at the prompt, then press <5> to Sel Cal.

Enter the location number (0-9), then press <DISPLAY> to main display menu.

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

There are a number of diagnostic screens to monitor the performance of the unit.

7.1 AMPLIFIED SIGNAL <1>

Press the <SETUP> key then Press <1> for AmpSig.

This screen displays the FLR (Sample Fluorescence) and the REF (Lamp Reference) signal values AFTER amplification. 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 bottom line shows the REF value and temperature value at calibration.

7.2 UNAMPLIFIED SIGNAL <2>

Press the <SETUP> key then Press <2> for UnAmpSig.

This screen displays the FLR value (the difference between the ON and OFF values) BEFORE amplification. This is a calculated value based on the measured amplified signal and the gain value.

The Total Gain, Fixed Gain and Pot (Adjustable Gain) values are also displayed on the same screen.

7.3 DIAGNOSTICS <3>

Press the <SETUP> key then Press <3> for Diags.

The screen displays the currently applied temperature compensation correction on fluorescence and lamp reference values.

In addition to the above information, the mA output can be forced to either 4 or 20mA regardless of the ppm value. Forcing the mA value is useful to check the response or performance of external equipment such as chart recorders or control devices.

7.4 MIN/MAX <4>

Press the <SETUP> key then Press <4> for Min/Max.

This screen displays the FLR and REF minimum and maximum values for the last 10 seconds as well as their difference. These figures give an indication of the reading stability.

7.5 SETTING <5>

Press the <SETUP> key then Press <5> >, enter the password at the prompt, then press <ENTER> for Settings.

7.5.1 mA TRIM <1>

Press <1> for mA Trim. This procedure trims the mA output for maximum accuracy by compensating for the mA output circuitry tolerances.

Important: 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.

7.5.2 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.

7.5.3 UNITS <3>

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

7.5.4 PASSWORD <4>

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

7.5.5 MODBUS ADDRESS <5>

Press <5> for Modbus address. The Modbus address is used only for network applications and is usually factory set. 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 ERROR WILL RESULT. ENTER THE DESIRED TAG NUMBER.

Enter the desire modbus address, press <ENTER> to Settings Menu.

8.0 TROUBLESHOOTING

<table>
<tr><th>CONDITION</th><th colspan="2">DO THIS</th></tr>
<tr><td rowspan="5">Display Menu show:
ERROR
Check Lamp
R3 & R4 are ON and Status LED is red</td><td colspan="2">The controller is not receiving signals from receiver and lamp. Check Wiring.
If wiring checks out, call Arjay Technical Support and record the following data.
Press <SETUP>, then press <1> for AMPSIG, and recording the following data:</td></tr>
<tr><td>REF on</td><td>off</td></tr>
<tr><td>FLR on</td><td>off</td></tr>
<tr><td>REF:</td><td>FLR:</td></tr>
<tr><td colspan="2">REF@cal</td></tr>
<tr><td>R3 is ON</td><td colspan="2">Reboot the unit. If R3 is still ON, recalibrate the unit.</td></tr>
<tr><td>R4 is ON</td><td colspan="2">Replace the Lamp</td></tr>
<tr><td rowspan="8">PPM reading is erratic or unstable</td><td colspan="2">Check the flow evenly over the flow tile.
Make sure the HS2410 was proper calibrated.</td></tr>
<tr><td colspan="2">Procedures to check and record calibration data:
Press <CALIB>, then press <2> for Manual
Press <ENTER> for cal point 1 and record data:</td></tr>
<tr><td colspan="2">Cal Point 1</td></tr>
<tr><td>Oil (ppm):</td><td>FLR:</td></tr>
<tr><td colspan="2">Press <ENTER> a couple of times to continue for cal point 2 and record data:</td></tr>
<tr><td colspan="2">Cal Point 2</td></tr>
<tr><td>Oil (ppm):</td><td>FLR:</td></tr>
<tr><td colspan="2">Press <ENTER> to continue if have more calibration points, or press<0> to exit.</td></tr>
</table>

9.0 CONTROLLER SETTING SHEET

PARAMETER	DESCRIPTION	FACTORY SETTING	USER SETTING
REF at Calibration	To compensate for fluorescence light source degradation, the lamp light intensity value is captured during calibration and is subsequently used to compensate the fluorescence signal. This captured reference value may be viewed in the Calibrate menu. NOTE: altering the “REF at Cal” value will alter the unit calibration, and should only be done under Arjay authorization.		
Zero	Oil PPM value for zero scale mA output (4 mA).	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 N samples. Higher values provide more stable readings (Max. 1000)	960	
Gain	Adjustable gain on the unamplified FLR SIGNAL. Should only be modified if directed by an Arjay Representative	same as fixed gain	

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

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. See section 3.3 for moere detail information. 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

WARRANTY STATEMENT

with options for: Extended Warranty by Purchase
Extended Warranty by Start-Up Service
New Home Warranty Act

Seller's Express Warranty. Seller warrants the Purchased Items to be free from defects in materials and workmanship under normal use and service for a period of one year from time of purchase. Seller further warrants that it will perform the Services in a professional and workmanlike manner. Buyer agrees that it has the sole responsibility for the proper selection, application, installation, and/or use of the Purchased Items and for instructions to ultimate users, if any, concerning use, application, periodic maintenance, and cautions regarding the Purchased Items. Buyer agrees that the warranties provided herein shall not apply to any Purchased Item which: (1) has been repaired or altered outside of Seller's factory in any way so as, in Seller's judgment, to affect such Purchased Item's reliability; (2) has been subject to misuse, negligence, or accident; (3) has been operated other than in accordance with the applicable printed instructions provided by Seller; or (4) has been subject to wear of wetted or reactive parts caused by Buyer's application of the Purchased Items.

Seller's Exclusive Obligations Under Warranty. Seller may, at its option, repair or replace, or refund the purchase price of Purchased Items which shall be returned to Seller, no later than one month after the expiration of the applicable warranty period in the manner set forth in this clause, and which Seller's examination shall disclose to Seller's satisfaction to be defective as specified in the warranty clause hereof.

All such Purchased Items shall be returned to Seller at Oakville, Canada; freight, duty and brokerage prepaid, accompanied, or preceded by a particularized statement of the claimed defect. Under such circumstances and if confirmed warranty applicable by Seller, Seller shall bear the cost of repair or replacement and the risk of loss while the Purchased Items are in Seller's possession at Seller's plant. Seller will return warranty product to Buyer prepaid by a freight method of Sellers discretion. SELLER'S OPTION TO REPAIR, REPLACE, OR REFUND THE PURCHASE PRICE FOR PURCHASED ITEMS IS BUYER'S EXCLUSIVE REMEDY AGAINST SELLER WITH RESPECT TO THE PURCHASED ITEMS. SELLER SHALL NOT BE LIABLE TO BUYER, ITS AGENTS, EMPLOYEES, OFFICERS, OR DIRECTORS, FOR ANY CONSEQUENTIAL OR INCIDENTAL DAMAGES, LOSS OF REVENUE OR PROFIT, OR ANY OTHER INDIRECT DAMAGES RELATED TO THE PURCHASED ITEMS OR SERVICES.

Fee based extension:
For an additional fee, the standard factory warranty can be extended. To initiate this process please contact an Arjay Representative to determine price and time allotment.

Start-up Services extension:
The basic factory warranty of one year will be extended if the Arjay Start-up services are purchased along with the instruments on the original order. An additional one year of warranty will apply in addition to the standard one year warranty supplied. Carbon Monoxide sensors cells are included in this extended warranty. All other consumable gas sensor cells are excluded from this additional warranty.

New Home Warranty Act extension:
If the Arjay Start-up services are purchased along with the instruments on the original order and the instrument is further maintained and calibrated a minimum of once per year during the warranty period by an Arjay Authorized Service company, an additional two years of warranty will apply in addition to the standard one year warranty supplied. This warranty extends to Arjay supplied equipment and includes carbon monoxide sensing cells. All other consumable gas sensor cells are excluded from this additional warranty.

Arjay Engineering Ltd.
arjayeng.com