



**FluoroCheck II**  
**Oil-in-Water Monitor**  
**Style A/B**  
**For Crude and Refined Hydrocarbon Use**

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## 1.0 FluoroCheck Function and Description

The FluoroCheck II Style A/B is a filter fluorescence photometer with a fixed excitation bandpass source (365 nm) and an emission bandpass filter (460 nm). It is designed specifically for the quantitation of low ppm concentration measurements of aromatic hydrocarbons (oil) in water.

The FluoroCheck II has many applications of use and will provide varying degrees of accuracy depending on it's set up.

- A general off-site calibration allows field screening for hydrocarbons in water.
- A site specific calibration will provide more accurate ppm values that target the type of compounds representative to a specific application.
- Following the procedures outlined in this manual and using procedures as indicated by the EPA or ISO for sample preparation will provide highly accurate measurements specific to your application.

Determine the degree of accuracy desired and follow procedures consistently for best results.

### 1.1 Unpacking

Unwrap all packages carefully and compare contents with the packing list, making sure all items arrived. If any part is missing, contact your local sales office. Inspect all components for damage that may have occurred while the unit was in transit. If any part appears damaged, contact the carrier immediately. Be sure to keep all packing material for damage claims or for repacking should it become necessary to return the unit.

## 1.2 Specifications

Base Unit	
Power Requirements	12 VDC, 0.5 A
Power Supply Unit	Input: 100-240 VAC, 47-63 Hz, 0.5 A Output: 12 VDC 1.5A
User Interface	4 line x 16 characters Backlit LCD, Membrane keypad
Communication Port	RS232, 9 pin Female serial connector, 9600 baud, 8 data bits, 1 stop bit, even
Measuring Range	0-100 ppm
Instrument Accuracy	±0.1 ppm  The accuracy is based on oil type, calibration and operating consistency
Calibration Memory	a library of up to 10 different calibrations
Calibration Curve	up to five concentration entry points per calibration
Operating Environment	Indoor Use: 15-40 deg. C  Relative humidity: ≤ 80% for 15 – 31 °C Decreasing linearly to 50% for 31 – 40 °C Altitude: ≤ 2000 m
Light Source	UV LED Excitation Wavelength: 365 nm
Expected Life	10000 hours
Excitation Filter	Excitation wavelength: 350 ± 20 nm at Full Width Half Maximum
Emission Filter	Emission Wavelength: 450 nm ± 40 nm at Full Width Half Maximum
Dimensions:	280 mm x 168 mm x 110 mm High
Weight:	1 kg (2.4 lbs)
Power Supply Safety Specifications	UL, CSA, CE

### 1.3 Important Information

- Hexane, Pentane, and other solvents and samples can be hazardous.
- Wear gloves when handling.
- Disposal must comply with all applicable regulations.
- Never dispose of by pouring into a drain.
- Always unplug the instrument before opening the panel or cleaning the instrument.
- Use and store the instrument away from direct sunlight and away from areas where the instrument may become wet.
- Wipe the cuvet exterior before placing it into the well. Take care not to spill any liquid into the well. Always orientate the cuvet holder with the dot matching the dot on the instrument.
- Reliable results depend on measurement accuracy and consistency. Always use a Dispensing Pipette for solvent measurements.
- If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.
- Only accessories and parts approved or supplied by Arjay Engineering may be used for operating, maintaining, and servicing this product.

**Caution: Avoid direct contact with a UV LED that is powered on. Always power the unit off before servicing or maintaining this instrument.**

### 1.4 Instrument Power Up

1. Plug the 12 VDC jack of the power supply into the receptacle on the back of the unit marked power input. Plug the other end to a suitable grounded power outlet.
2. Turn the power switch beside the power receptacle to on (I).
3. See section 3.0 for detailed Instrument Function Description.
4. See section 4.0 for Instrument Calibration and Use.

## 2.0 Fluorometry Principles and Extraction Method Overview

### 2.1 Fluorescence Measurement

The fluorescence principle is based on the science that certain compounds can be subjected to a specific wavelength of light (excitation) and can re-emit this light energy at one, or more, higher wavelengths (emission). These emission wavelengths are registered as peaks.

Aromatic hydrocarbons, when subjected to a specific wavelength, will fluoresce at a predictable wavelength. This is considered its signature wavelength. When the solvent extracted sample is inserted into the cuvet well of the instrument, the sample is exposed to UV light (365 nm) from a LED light source. This light excites the hydrocarbon molecules, which then emit energy at peaks of approximately 460 nm. An emission filter in front of the photodetector allows only fluorescence at 460 nm +/- to register, minimizing background interference caused by other wavelengths. Through the instrument calibration and Arjay processor, the measured fluorescence provides a direct indication of the hydrocarbon concentration.

The ratio of aromatics to total oil is registered through a customer site calibration or Arjay factory calibration to provide a ppm display of total oil.

Since different oil types may yield a different fluorescent intensity at similar concentrations, an instrument calibration is made specific to the application.

The FluoroCheck II allows a library of up to 10 different calibrations to be entered. As such, multiple oil types, sites, or applications can be named and stored in the memory.

### 2.2 Solvent Extraction Method Overview

The FluoroCheck II is designed to operate using solvent extracted samples. The solvent extraction approach is a method used in EPA Method 1664 Rev A and ISO-9377-2 procedures to define the hydrocarbons to be measured. By following the extraction procedure, the FluoroCheck II correlates well with these procedures.

#### **A typical extraction procedure is as follows:**

1. Take a 100 ml water sample. A jar etched with markings is provided.
2. Add 10 ml of solvent into the jar. (Using the bottle dispenser will provide consistent measurements.)
3. Shake vigorously for 2 minutes. Use a timer or electric shaker for consistent extractions.
4. Allow the sample to stand for 2 minutes. The solvent will rise to the surface. Stir the solvent layer with the pipet to break any bubble emulsion.
5. Use a disposable pipet and remove some solvent sample from the middle of the solvent surface layer.
6. Insert the extracted sample into the measuring cuvet to about 3/4 full. Wipe the cuvet of any fingerprints or grease.

Sample preservation and release of solubles is increased by keeping the sample below pH 2. This is indicated in EPA Method 1664 Rev A and ISO-9377-2. If this is desirable, add 10 ml of HCL to the 100 ml water sample and shake to acidify the water prior to the extraction procedure. If this method is to be used, this should be performed for the initial calibration and for all ensuing sample tests.

A solvent such as Hexane or Pentane attracts and bonds to hydrocarbons. When the solvent is added to a water sample and shaken vigorously, the hydrocarbon molecules will attract to the solvent. When left to stand, the solvent then separates from the water to the surface and will bring the hydrocarbons with it. The upper solvent sample layer is tested in the instrument. Since the unit was originally zeroed using solvent, any added fluorescence is a direct result of the hydrocarbons now in the solvent sample. By filtering the fluorescence to the signature excitation and emission wavelengths of oil, a ppm indication can be determined.

## 2.3 Instrument operation overview (a quick guide)

The FluoroCheck II kit is supplied with two types of sample cuvetts. The 10 mm x 10 mm square cuvetts are for use with refined and light oil testing. These oils typically yield lower fluorescence energy and the large cuvetts provide a greater instrument response. The small round cuvetts (microserts) are for use with crude oils. Crude and heavy oils are strong fluorescours. The small cuvetts provide the fluorescence required for routine measurements.

When calibrating, use the appropriate cuvet that will be used for routine testing. After calibration, the same cuvet type must be used for each sample.

The solvent extraction procedure provides the instrument with a stable and clean sample for reading. The FluoroCheck will accept a calibration using a water sample without a solvent extraction. Since this sample may introduce interference from solids or other contaminants, this approach should only be used for sample screening purposes to identify the possible presence of a hydrocarbon.

All menu options are described in detail in Section 3.0. Users familiar with sample preparation and this instrument can refer to the following steps.

The Fluorocheck II can store up to 10 different types of oil or site calibration data. After the first calibration the user does not need to calibrate the instrument after powering on the instrument, but a 'ZERO' should be performed to compensate the instrument for normal UV LED and electronic drift.

**Calibration Reference Standard** A personal ppm value must be assigned to the Reference Standard that will represent your calibration and oil type. This will allow frequent re-calibrations and checks without having to use prepared samples. After the initial calibration insert the supplied Calibration Reference Standard. Always match the dots on the cuvet and measuring block. Close the lid and record the reading. For future calibrations and checks, this standard can be inserted to confirm the ppm value and re-calibrate if necessary. This value is specific to this calibration and site only. It is not indicative of other hydrocarbon contaminants and sites.

Periodic re-calibrations using actual prepared or analyzed samples may be desired to maintain a good correlation against local laboratory results.

The following is assuming that the instrument setup and initial calibration (see section 4.1) have been completed

### To measure a sample:

**Always wipe the cuvet with a clean tissue prior to placement into the holder to remove any contaminants from handling.**

1. Take a grab sample of water and perform the solvent extraction technique to separate out oil. Do not remove the extracted oil sample yet.
2. Set the zero by inserting a 'blank' cuvet containing solvent only. Press <ZERO>.
3. After "0" is displayed, remove the cuvet. Using the pipet, put some extracted sample into a fresh cuvet and insert this into the testing well. Close the lid. The sample will read automatically.

**Note:** You only need to do a 'Zero' once after powering on the instrument, although periodic re-zeroing will improve results.

## 3.0 Instrument Functions

Note: This section offers a functional overview of the unit. It is recommended to have the unit and a power source available to you while you review this section.

### 3.1 Keypad Review

The keypad is used to select the initial setup options and to zero and calibrate the instrument. The following keys are available for use.

**Numeric and alpha-Keys <0>-<9>** Use the numeric keypad to enter a calibration standard value or to choose menu options.

The **<DISPLAY>** key exits any menu to return to the normal operating PPM display. While entering numeric values in the menus, the **<DISPLAY>** key will reverse an entry to allow a correction.

The **<CAL>** key enters the menu to select the calibration from the stored calibration locations list or perform a new calibration.

The **<SETUP>** key accesses the user-selected functions including diagnostics, units, and Lamp sleep (Auto off) mode.

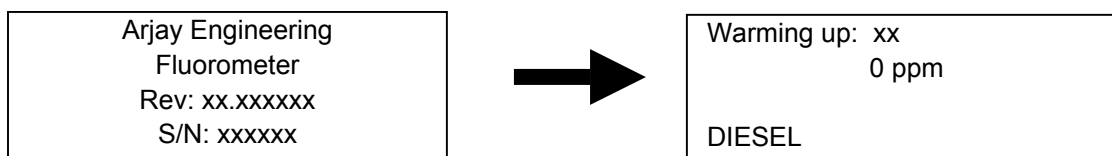
The **<ENTER>** key registers numeric values or advances to the next screen.

The **<ZERO>** key compensates the normal UV LED and electronic drift.

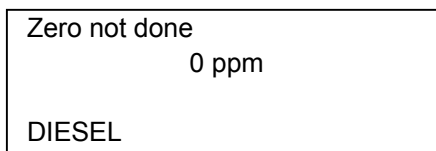
The **< . >** key represents a decimal point for numeric entries.

### 3.2 Power Up

**Plug in** the power supply to an AC source. **Plug in** the DC jack into the back of the Fluorocheck II and turn the power switch to on (**I**). A screen will momentarily flash with the Hardware and Software version. A countdown will begin to allow the LED to warm up and stabilize.



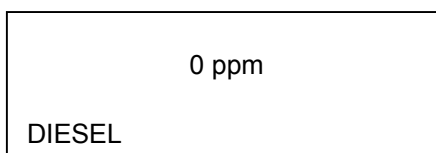
When complete the display will read similar to:



### 3.3 Main Keystroke

#### 3.3.1 <DISPLAY>

**When in other menus, you can press the <DISPLAY> key** to bring the instrument to the measuring display mode (similar to the following display). Since the unit continuously sees a fluorescence response from the sensor, a ppm reading will be indicated whether or not a sample is in place. If at any time the user wishes to exit from another menu, pressing the DISPLAY will return the instrument to this normal operating display function.



This is the normal display that will be used by the operator for the routine measurement of samples.

The second line indicates the current concentration of the sample.

The fourth line indicates the current calibration – oil type or site location (eg. DIESEL)

### 3.3.2 <SETUP> Key

**Press the <SETUP> key**, then enter the password if prompted and press <ENTER>. The factory set password is 2000. This screen offers a menu of diagnostics and user selectable operation settings. These are configured when first receiving the instrument and may be changed at any time.

```

                SETTINGS
1 - Auto Off   2 - Units
3 - Diags
Rev: xxx-xxxxxxx
  
```

**Press <1> for Auto Off.** This causes the LED to automatically shut off after a preset time (seconds) if there no activity.

```

                SETTINGS
Inactivity time
In sec for lamp off
xxxx
  
```

Enter the time value in seconds, and press <ENTER>

**Press <2> for Units.** The concentration reading will typically be displayed in ppm. From this menu, the user may also select different units:

1 – ppm ; 2- mg/L; 3 – FLR (raw fluorescence value)

The unit does not convert from one type of units to another after calibration. During calibration, concentration values must be entered using the display units indicated.

**Press <3> for Diagnostics** This will display the unamplified (raw) fluorescence reading that the sensor is receiving and LED current.

```

                SETTINGS: DIAGS
DIESEL
Detector:      xxx.x mV
LED mA: 10.0
  
```

### 3.3.3 <CAL> (calibrate) Key

**Press the <CALIB> key** then enter the password if prompted and press <ENTER>. The factory set password is 2000. This will allow you to choose the calibration location from the stored calibration locations list, or perform a new calibration.

```

                CALIBRATION
1 – Select from list
2 – Perform new cal
Current:      xxxxxx
  
```

The present Calibration location is indicated.

**Press <1> for Select from list** This provides a menu of factory calibrations and user site calibration locations:

0 = diesel  
1 = crude  
2 = gasoline

3 = transformer oil

4-9 = user stored calibrations

Note: The factory calibrations are based on factory sourced oils. Actual oils at your site may indicate a different response. The factory calibrations should only be used as an indication of oil presence and not an actual value.

Press <0> to <9> to select the calibration location from the stored calibration locations list, and then press <ENTER> to the main display screen.

**Press <2> for Perform new Cal** This will allow the user perform a new calibration into the menu. Detailed calibration procedures are reviewed in Section 4.0 Instrument Calibration and Use.

### 3.3.4 <ZERO> Key

When the FluoroCheck II is first turned on and routinely throughout the day, a ZERO should be performed to compensate the unit for normal UV LED and electronic drift. This is a fast and easy procedure.

Insert a cuvet containing clean extraction solvent only. Fill the cuvet to about 3/4 full. Insert the cuvet in the testing well and always match the dots on the cuvet and testing well. Close the lid and wait for the mV reading to stabilize, then press <ENTER> to accept.

## 3.4 Communication

The RS232 serial port of FluoroCheck II is a DB9-pin female connector. Connect the serial port of FluoroCheck II to computer serial port. The FluoroCheck II requires these settings in the device receiving the data:

Baud rate	9600
Data bits	8
Stop bit	1
Start bit	1
Parity	Even

In the computer, under the standard windows setup, the **Hyper Terminal** program resides in the **Communications** file under **Accessories**. Click on the **Hyper Terminal** icon to open the program. Cancel "Connection Description", then open the file named Fluorocheck2 Hyper Terminal Emulator" (see attached CD).

From the FluoroCheck II main display menu (only from this screen). Press the <ENTER> key. A data report will be transmitted from the FluoroCheck II to the Hyper terminal windows of computer.

## 4.0 Instrument Calibration and Use

### 4.1 Initial Calibration

The Fluorocheck II uses a UV LED that is driven by current. The more current, the brighter the LED. Different oil types yield different fluorescence energy. Refined and light oil yield lower fluorescence energy and need more UV light. The crude and heavy oils have higher fluorescence energy and need less UV light. The current for the UV LED can be set from 0-25 mA. Normally, 1 mA current for crude oil and 10 mA for refined oil are used.

The FluoroCheck II kit is supplied with two types of sample cuvetts. The 10 mm x 10 mm square cuvetts are for use with refined and light oil that yield lower fluorescence energy. Therefore the large cuvetts are used to provide a greater instrument response. The small round cuvetts (microserts) are for use with crude oils. Crude and heavy oils are strong fluorescours. The small cuvetts provide the fluorescence required for routine measurements.

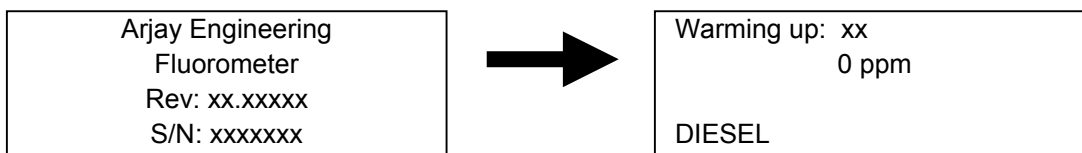
Determine the mA current to be used if a site specific calibration is to be done. If a site specific calibration is to be done, up to 4 prepared known samples can be used or unknown samples can be used and sent to lab for analysis immediately following the calibration procedure. Use samples with a ppm value that provides a suitable range for the instrument. For instance, if typical samples range from 0 to 50 ppm, calibration values of 10 ppm to 40 ppm would be appropriate. If samples of 10 ppm are more common, calibration samples of 5 ppm to 15 ppm would be more appropriate. One sample is acceptable. Multiple sample concentrations will increase accuracy.

Using an actual contaminated water sample for calibration will provide the most reliable calibration. Prepared sample standards may not be indicative of actual process conditions of oil type, oil dispersion, and background contaminants. Prepared samples may be unstable and retention of oil injected into the water can be difficult. If preparing a standard, use glass containers only (plastic containers draw oil out of the water). Use a carrying agent, such as acetone, to help disperse the oil into the water prior to the extraction.

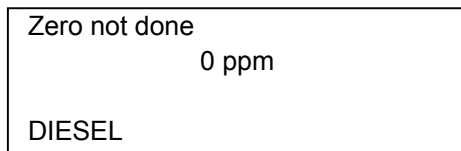
#### To Calibrate the instrument:

Determine the appropriate cuvet type: square for refined oil, round for crude oil. Determine the appropriate LED current: normally set 10 mA for refined oil, set 1 mA for crude oil.

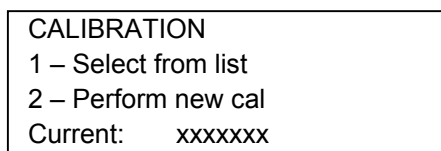
Power on the instrument. The screen will indicate a lamp warming count down. .



When warming up is complete, the screen display will be similar to



Press the <CAL> key, then enter the password at the prompt. The factory set password is 2000. Press <ENTER> key to advance to the following calibration menu.



The FluoroCheck II can save calibration data for up to 10 different oil types or site locations. For each group calibration, up to 5 points can be entered.

**Press <2> to perform new calibration**, and the display goes to the following calibration menu:

```
NEW CALIBRATION
For: Cal 4
Press 0-9 then enter
```

If the current calibration oil type or location is correct, the press <ENTER>. If not, select <4> to <9> for the desired calibration location, the press <ENTER>. Locations 0-3 are reserved for Factory Calibrations and cannot be changed. The screen will display the following calibration entry menu:

```
NEW CALIBRATION
For: Cal 4
1 – Auto      2 – Manual
3 – LED power: xx.x mA
```

1 – Auto will calibrate the unit based on the user presently having contaminated water samples ready (the ppm value may be known or unknown).

2 – Manual will allow you to view and change the ppm and mv values that were entered during the Auto calibration mode. This is used to correct temporary ppm values after the laboratory results are received.

3 – LED power: This is used to change the LED current. Press <3> , press <ENTER> to continue, then enter the current mA value, press <ENTER> go back the calibration menu.

Press <1> for **Auto**.

```
AUTO CAL: Cal 4
Enter = Do Cal point 1
0 = Calibration done
1 st pt: Must be 0 ppm
```

The first calibration point must be 0 ppm. Press <Enter> to proceed.

Insert a cuvet containing clean extraction solvent only. Fill the cuvet to about 3/4 full. Always insert the cuvet with the dot matching the dot in the measuring block. Close the lid. Wait a few seconds for the reading to stabilize and then Press <ENTER>.

The display will now prompt to enter Cal point 2. Press <Enter> to continue calibration.

Prepare an extraction of one of the contaminated samples as per section 2.2. Insert the sample cuvet into the testing well and close the lid. Wait a few seconds for the reading to stabilize. Enter the value of the concentration (in ppm), and press <ENTER>. If the ppm value is not known, enter a random ppm value of the expected concentration. This will be corrected later. If an unknown ppm sample was used, immediately send a sample of the same contaminated water (not extracted) to a local laboratory for analysis.

The display will now prompt to enter Cal point 3. If another sample is available to increase the points on the calibration curve, press <ENTER> to continue and repeat the above procedures for each sample.

If no more sample points are to be entered press <0> for Calibration Done.

**Calibration is complete. Press the <DISPLAY> key to exit the Calibration Menu.**

**If you entered an unknown ppm value:** When the actual ppm value is determined, follow the following procedure to correct the random ppm value you entered.

Press the <CAL> key, enter the password then press <ENTER>

Press <2> for Perform new Cal

Confirm the Calibration Location, then press <ENTER>.

**Press <2> for Manual**

These are now the values held in memory from your random calibration.

Press <ENTER> to view the First Point 0 ppm.

Press <ENTER> to accept the First Point FLR reading.

Press <ENTER> to view the 2<sup>nd</sup> ppm value entered. Key in the correct value received from the laboratory.  
Press <ENTER>.

Press <ENTER> to accept the Second Point FLR reading.

Follow this procedure for any further calibration points entered or press <0> for Calibration done.

**Calibration is now complete. Press the <DISPLAY> key to exit the Calibration Menu.**

You must now determine the value of the Reference Standard. Reference A is for crude oil and Reference B is for refined oil. This will allow frequent re-calibrations and checks without having to use prepared samples. Insert the supplied Reference Standard into the testing well. Always match the dots on the cuvet holder and testing well. Close the lid and record the reading for future calibrations. This value is specific to this calibration and site only. It is not indicative of other hydrocarbon contaminants and sites.

Periodic re-calibrations using actual prepared or analyzed samples may be desired to maintain a good correlation against local laboratory results.

## 4.2 Measure a sample

If the present oil type or calibration location is not indicated, follow the steps below and choose the desired one.

**Press the <CAL> key, enter the password if prompted and press <ENTER>. The factory set password is 2000.**

**Press <1> to select the saved calibration data.**

- 0 = diesel
- 1 = crude oil
- 2 = gasoline
- 3 = transformer oil
- 4 ~ 9 = user stored calibrations

Press <0> to <9> to select the calibration location from the stored calibration data list, and the press <ENTER> to the main display menu.

### To measure a sample

Always wipe the cuvet with a clean tissue prior to placement into the well, to remove any contaminants from handling.

1. Take a grab sample and perform the solvent extraction method (see section 2.2) to separate out the solvent and oil. Do not remove the extracted oil sample yet.
2. Insert a 'blank' cuvet containing solvent only into the testing well. Press <ZERO> key, wait for the mV reading to stabilize then press <ENTER> key.
3. Using the pipet, put some extracted sample (from step 1) into a fresh cuvet and insert this into the well. Close the lid. The instrument will automatically read the ppm value.

Note: You only need to do a 'Zero' once after powering on the instrument, although periodic re-zeroing will improve results.

### 4.3 Important Measurement Notes

1. Accurate measurements of water and solvent are critical. Be consistent.
2. Consistent shaking for the prescribed time is important to the extraction process.
3. Zero the unit with a Zero cuvet of solvent.
4. Always orientate the cuvet holder with the dots matching.
5. Clean the cuvetts with a low-lint tissue prior to inserting.
6. Repeat the measurement of each sample concentration to verify that the results are reproducible.

### 4.4 Photo Guide to prepare a sample



A sample with volume markings can be used for grab samples. Fill to 100 ml.



A solvent dispenser will give consistent and safe extractions. Add 10 ml solvent.



A countdown timer will provide consistent mixing. Shake for 2 minutes.



Let extracted sample stand for 2 minutes. Stir the solvent layer with the pipet to break any bubble emulsion.



Remove some solvent from the middle of the solvent layer with disposable pipet



Fill a cuvet 3/4 full with the solvent.



If using a round cuvet place it in the cuvet holder.



Place the cuvet into testing well with the dots matching.



Close the lid and read the ppm.

## 5.0 TROUBLESHOOTING

### Always be sure to:

- Operate the unit in a location isolated from equipment that radiates high-frequency electromagnetic interference.
- Operate the unit away from direct sunlight.
- Take care not to spill any liquid into the testing well.

### 5.1 Symptoms

#### Fluorescence values drift

- Sample solutions must be at a stable and ambient temperature for consistent readings. (Fluorescence decreases as temperature increases).
- Protect test samples and the Calibration Standard from light to prevent photobleaching.
- Take readings immediately after sample preparation. Oil will deteriorate over time.
- If air bubbles are present, the reading will first drift upward as the light is scattered by the bubbles until they move out of the beam range or dissipate.
- If particulates are present, the reading may suddenly rise as a particulate drifts in the light path, then drop as it moves out of the beam range.

#### Wide fluctuations in fluorescence or ppm values

- Wipe the outside of the cuvet before placing it into the sample chamber.
- Use consistent measurement techniques, timing of the solvent mix, and a consistent point in the solvent layer that you extract from the sample bottle.

#### Readings negative or lower than expected

- Use a freshly prepared sample at ambient temperatures to set the zero and for all subsequent measurements.

#### Readings are higher than expected

- Fluorescent enhancement may result from high levels of detergents or background contaminants. When preparing the sample be sure to consistently shake the sample for 2 minutes and allow the sample to stand still for 2 minutes prior to extraction.

### 5.2 Maintenance, Error and Other Messages

#### Warming up .... Please Wait

- The unit has been turned on or the LED Sleep mode had been activated. This message reports that the LED is being turned on.

#### Zero not Done

- The Instrument requires the 'Zero', see section 3.3.4 for detail.

#### No change in signal

- During calibration, two identical ppm values were attempted to be entered for different sample concentrations, or different ppm values were attempted to be entered for the same sample concentration

#### Overrng: Lower LED mA

- The mV reading is too high, you need to lower LED current and recalibrate the instrument.

## 6.0 CUSTOMER SERVICE INFORMATION

Arjay Engineering offers complete technical support for all our products. If you have any questions about how to use this product, or would like to arrange to repair it, please call, fax, or e-mail Arjay or your local Arjay representative.

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