



**FluoroCheck 2000
Oil-in-Water Monitor**

Style A for Crude Hydrocarbon Use

User Manual

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1 FluoroCheck Function and Description

The FluoroCheck 2000 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.

Please note: Fluorescent emission output is not strictly linear, and it can be affected by numerous variables. If the procedures in this manual are followed closely, accurate concentration measurements can be made with a high degree of reliability.

The FluoroCheck 2000 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 indicative to a specific application.
- > Following the procedures outlined in this manual and using procedures as indicated by the EPA for sample preparation will provide highly accurate measurements specific to your application.

Remember that this instrument is based on light measurements relative to it's calibration by the user. Determine the degree of accuracy desired and follow procedures consistently for best results.

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.

Specifications

Power Requirements	Frequency: 47 – 63 Hz Line Voltage: 90 – 260 VAC Power Consumption: 15 W	
User Interface:	2 line x 16 characters Backlit LCD, Membrane keypad	
Communication Port:	RS232C, 9 pin male serial connector, 1200 baud, 8 data bits, 1 stop bit, no parity	
Dimensions:	12 x 15.9 x 34.3 cm (h x w d)	
Weight:	1.7 kg (3.75 lbs)	
Operating Environment	Indoor Use: 15-40 deg. C Relative humidity: $\leq 80\%$ for 15 – 31 °C Decreasing linearly to 50% for 31 – 40 °C Altitude: ≤ 2000 m	
Light Source	Type: Mercury lamp Excitation Wavelength: 365 nm \pm 7 nm at Full Width Half Maximum Expected Life: 5000 hours	
Emission Filter	Type: Interference filter Emission Wavelength: 460 nm \pm 15 nm at Full Width Half Maximum	
Fuse Values (internal)	F3.15 A, 250 V, Microfuse (2) on PCB; F 2 A, 250 V, 5 x 20 mm on power module	
Safety Specifications	Safety	UL3101-1 CSA 22.2 No. 1010-1 EN61010
	Emissions	FCC Part 15 Class A EN55011 Class A
	Immunity	EN50082-1
	Listed by ETL Testing Lab CE Marked	

- Note** This declaration of conformity is only valid for this instrument when it is:
- used in approved locations, and
 - used as delivered from Arjay Engineering except for alterations described in the User Manual



Important Information

- > Hexane, Pentane 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 removing the bottom panel or cleaning the instrument.
- > Place the instrument so that the back vents are not obstructed.
- > Use and store the instrument away from direct sunlight and away from areas where the instrument may become wet.
- > Allow 15 minutes for warm up each time it is switched on.
- > Wipe the cuvet exterior before placing it into the well. Take care not spill any liquid into the well. Always orientate the cuvet holder with the dot facing toward you.
- > Reliable results depend on measurement accuracy and consistency. Always use a Dispensing Pipette for solvent measurements.
- > The optical surfaces must remain clean in order to measure fluorescence accurately. Periodically clean the optical surfaces as described in the care and maintenance section.
- > 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.

Instrument power up

Mains Power

1. Plug one end of the power cord into the receptacle on the back of the unit marked MAINS. Plug the other end to a suitable grounded power outlet.
2. Turn the mains power switch beside the power receptacle to on (I).
3. See section 3 for complete operating instructions.

Serial port connector

The RS232C serial port is a DB9 9-pin male connector. The type of serial cable required depends on the type of device - DTE or DCE - that it is connected to. The FluoroCheck is configured as a DTE device, so a connection to another DTE device requires a null modem serial cable. If the data is delivered to a DCE device (receives signals at pin 2 and transmits signals at pin 3) such as a printer, then a regular serial cable is required.

FluoroCheck RS232C signal and pin number assignments

Pin 2	Transmit
Pin 3	Receive
Pin 5	Ground
Other pins	not connected

The FluoroCheck requires these settings in the device receiving the data:

Baud rate	1200
Data bits	8
Stop bit	1
Start bit	1
Parity	none

2 Fluorometry Principles and Extraction Method Overview

Fluorescence measurement

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

Aromatic hydrocarbons, when subjected to a specific wavelength, will fluoresce at a predictable wavelength that is selective to these compounds. In the cuvet well of the instrument, the sample is exposed to UV light (365 nm) from a mercury lamp. This light excites the hydrocarbons, causing light to be emitted 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. Thus, the measured fluorescence is a direct indicator of the hydrocarbon concentration. The aromatic hydrocarbon concentration is used as a proportional indication of total hydrocarbons, which is then displayed in ppm.

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

Fluorometers measure fluorescence in relative rather than absolute units. After zeroing with a "blank" (hexane, pentane or other extraction agent), always initiate the monitor by calibrating the instrument to display the known concentration of a solution or standard.

Extraction Method Overview

To provide the instrument with a stable sample for reading, the hydrocarbons are first extracted from the water sample. One such technique is known as Solvent Extraction.

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.

This approach to hydrocarbon extraction is confirmed in EPA Method 1664 Rev.A.

System operation overview (a quick guide)

All menu options are described in detail in Section 3. Users familiar with sample preparation and this instrument can refer to the following steps or the laminated Quick Reference card for an abbreviated guide to measure the concentration of an unknown sample.

The following is based on the unit settings being previously set-up by the user.

Initial Calibration

1. Prepare or acquire a hydrocarbon contaminated water sample to be used for calibration. Use a sample with a ppm value that provides a suitable range for the instrument. For instance, if typical samples range from 0 to 50 ppm, a calibration standard of 40 ppm would be appropriate.

2. To calibrate the instrument:

Press **1> Read**. Set the zero by inserting a cuvet containing solvent only. Always insert the round cuvet so that the dot on the holder is toward the front. Close the lid. Press **<ZERO>**. After "0" is displayed, remove the cuvet. Add a solvent extracted sample to a cuvet. Insert the cuvet into the well and press **<CALIB>**. Enter the value of the concentration (in ppm), close the lid, and press **<ENTER>**.

3. You must now determine the value of the **Calibration Reference Standard Cuvet** for the above calibration. This will allow frequent re-calibrations and checks without having to use prepared samples. Insert the supplied Calibration Standard Cuvet. Always direct the divot marking towards the front. Close the lid and record the reading for future daily calibrations. This value is specific to this calibration and site only. It is not indicative of other hydrocarbon contaminants and sites.

Leave the instrument powered on at all times if the unit is to be used frequently. Turning the power switch off will remove the calibration parameters from memory. Re-calibration will be necessary on power up. A Calibration Reference Standard Cuvet is provided for this purpose. The Standard does not replace the required initial calibration using a site prepared sample. Periodic re-calibrations using actual prepared or analyzed samples should be done.

When leaving the instrument on for extended periods, select the AUTO LAMP SHUT-OFF feature in the main program. This puts the lamp into standby mode if not used within a one hour period.

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 of water and perform the solvent extraction technique to separate out the solvent and oil. Do not remove the extracted oil sample yet.

(To comply with EPA Method 1664 Rev.A, and where solubles are desired to be measured: if the pH is suspected above 2, add about 1 ml of HCL to the 10 ml water sample and shake to acidify the water prior to the hexane extraction procedure. Discard a portion of the water mixture to prepare for the extraction with 10 m)).
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 instrument. Close the lid. The sample will read automatically. Press **<ENTER>** to re-read the concentration.

**Important FluoroCheck measurement notes**

- > Accurate measurements of water and solvent are critical. Be consistent.
- > Consistent shaking for the prescribed time is important to the extraction process.
- > Turn the lamp on 15 minutes before use to allow the lamp and sample compartment temperature to stabilize.
- > Zero the unit with a Zero Blank of solvent frequently.
- > Always orientate the cuvet holder the same way.
- > Clean the cuvetts with a low-lint tissue prior to inserting.
- > Always close the lid for readings and after use.
- > Repeat the measurement of each sample concentration to verify that the results are reproducible.

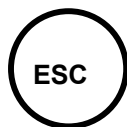
3 Detailed Operating Instructions

This section describes the instrument operation. Once familiar with the operations, enter the Set Up menu and select your desired function for each feature.

The keypad is used to select setup options and to zero and calibrate the instrument. The LCD display shows each current menu option.

Numeric Keys 0-9

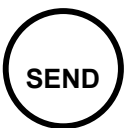
Use the numeric keypad to enter a calibration standard value or to choose menu options.



The <ESC> (escape) key displays the Main Menu.



The <ENTER> key registers numeric values, advances to the next screen or initiates a fluorescence measurement.



The <SEND> key sends sample ID number and displayed reading to the serial communication port.



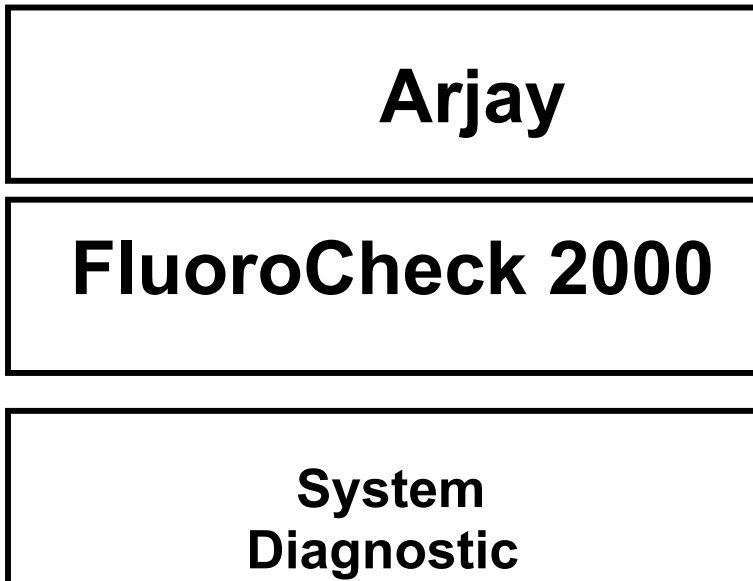
The <CALIB> key calibrates the instrument based on the standard solution provided.



The <ZERO> key sets the hexane "background".

Power up and program flow

Turn the mains power switch beside the power cord receptacle to on (I) to activate a self diagnostic cycle, which requires about 2 minutes. This cycle identifies the model, tests all circuits, turns the UV lamp on, and displays the Main Menu when the instrument is ready.



A series of screens report which components are being tested as the program runs through the system diagnostics. Finally, a 20-second countdown appears as the system warms up. The Main Menu appears when the instrument is ready to receive input.

1> Read 2> Setup > Test
--

Press <ESC> anytime to return to this screen. The following three sections describe all options in the Main Menu. You may wish to set operator preferences (see the section titled "Main menu option 2> Setup") before working through the 1> Read section, which prepares the instrument to measure fluorescence.

Main menu option 1>Read

The read option prepares the instrument to measure fluorescence. This function can be accomplished with either Prompt **off**, which is the default setting and does not guide the operator at each step, or the operator can choose Prompt **On**, which describes each step of the measurement. (Select from the **2> Setup** menu). The display for each option is fully described in the following two pages.

Once you are familiar with the instrument you will probably choose prompt **off** for routine measurements.

Prompt Off

Prompt **Off** is the default setting. In this mode the operator is not prompted to zero every solution or to calibrate the instrument.

Note: Pressing the enter key at every step is not required in the Prompt Off mode.

LCD Message

Action Required

Concentration

Displays concentration in chosen units.

To zero the instrument: Add only solvent solution to the cuvet and place it into the cuvet well. Close the lid and press **<ZERO>**.

Computing zero...

Concentration

Displays concentration in chosen units.

To calibrate the instrument: Add the appropriate prepared sample or standard. Place the cuvet in the well, close the lid, and press **<CALIB>**.

Enter standard conc.

Enter the concentration of the standard. Press **<ENTER>**.

Calibrating...

Concentration

Displays concentration in the chosen units.

To measure concentration: Remove the cuvet. Add a solvent extracted sample to a fresh cuvet. Place the cuvet into the well, close the lid, and the measurement is displayed.

Concentration

Displays concentration in the chosen units.

Press **<ENTER>** to re-read the sample concentration.

Prompt On

If prompt **On** is selected, each step displays as follows. Press the indicated key or press **<ENTER>** to continue.

LCD message Action required

If you select <2> Setup for instrument calibration:

Place assay blank in well Add only solvent into a cuvet. Place the cuvet in the well. Close the lid. Press **<ENTER>**.

Press ZERO The assay (solvent blank) background is determined and subtracted. Press **<ZERO>**.

Computing zero...

Add calibration standard Remove the cuvet. Add a prepared concentration standard to a cuvet. Place cuvet into well, close the lid and press **<ENTER>**.

Press CALIB Sets the instrument to display concentration based on the standard. Press **<CALIB>**.

Enter std. conc. Enter the prepared concentration value. Press **<ENTER>**.

Remove standard Remove cuvet. Press **<ENTER>**.

If you select <1> Read for a sample measurement:

Place assay blank in well Add only solvent into a cuvet. Place the cuvet in the well. Close the lid. Press **<ENTER>**.

Concentration Displays concentration

Press ZERO The solvent background offset is determined. Press **<ZERO>**.

Computing zero...

Add unknown sample Remove the cuvet. Add an extracted sample to a fresh cuvet. Place cuvet into well, close the lid and press **<ENTER>**.

Concentration Displays concentration in chosen units. Press **<ENTER>**

1>Read 2>Calib Choose <1> to measure next sample

3>ESC Choose <2> to re-calibrate the unit

Choose <ESC> to return to the Main Menu

Main menu option 2> Setup

Select **2>** from the Main Menu to access the Setup menu, which accepts operator preferences.

1> Prompt	2>Units
3>Send	4>More

Each submenu is described below. Press **<ESC>** at any time to return to the Main Menu. Press the number associated with the parameter of interest to access the following submenus.

Prompt	
1>Off	2>On

1> Prompt off displays only measurements and minimal instructions.

2> Prompt On guides the user through calibration and measurements, step by step.

Units	
1>ppm	2>none

1> Sets units to display ppm.

2> No units are displayed.

After a brief pause, the Setup menu displays.

1>Manual send
2>Auto send

1> The Manual send option sets the software to that measurements and the corresponding ID numbers are transmitted to the serial port only when **<SEND>** is pressed.

2> The Auto send option conveys this data automatically after each measurement. (see printer connection guidelines)

After a brief pause, the Setup menu displays.

**5>Autoshut 6>ID#
7>Language**

Press **>4** in the Setup menu for thses additional options:

**Lamp auto-shut
1>Off 2>On**

1> Lamp auto-shut Off causes the lamp to stay on until the instrument is switched off. That is, the automatic shut-off is disabled.

2> Lamp auto-shut On causes the lamp to automatically shut off after one hour of no keypad activity. This option is recommended because it extends lamp life.

After a brief pause, the Setup menu displays.

**Please enter ID
Number 0**

This option allows the operator to specify a starting ID number. Each subsequent sample will then be assigned an ID number, incremented by 1, from this starting point.

Input the starting point sample number. Press **<ENTER>**. To turn off sample number, enter 0. After a brief pause, the screen returns to options 5 to 7 in the Setup menu. (Press **<ESC>** for the Main Menu.)

**1> Engl 2>Deutch
3> Franc 4>Espan**

Enter the number corresponding to the desired language. After a brief pause, the screen returns to options 5-7 in the Setup menu. (Press **<ESC>** for the main menu.)

Main menu option 3> Test

Use the test menu to isolate the cause of a malfunction. Press **<ESC>** to return to the main menu. The four options are

1> Data	2> Lamp
3> Info	4> Diagnos

1> The **Data** option displays voltage (mV) signals from the sample (Sig.) and the lamp reference (Ref.).

2> The **Lamp** option switches the lamp off if it is on, or on if it is off.

3> The **Info** option identifies the initial UV lamp reference signal (mV), the firmware version, the PC board version, the date of manufacture, and the serial number.

4> The **Diagnos** option initiates a comprehensive system diagnostic routine. The operator is required to press all 15 keys on the keypad and open and close the lid when prompted. If a component is found faulty, an error message displays the failure source.

Error and other messages

Turning lamp on This message reports that the lamp is being switched on. Wait 15 minutes to allow the lamp to stabilize before taking measurements. When this message displays, the lamp was either inadvertently switched off or the auto-shut function switched it off after an hour of no keypad activity.

Zero first, using a blank sample The unit was not first zeroed during calibration. Insert a blank cuvet of solvent and press **<ZERO>**.

Blank>sample Zero and re-calib Blank value is higher than the sample value. Zero using blank solvent and recalibrate.

Re-calib using lower value The entered calibration value is too high. Recalibrate with standard solution. Use a lower factor if not using actual standard calibration.

Failed Diagnostic test failed. Call the Arjay Technical Service Department.

FluoroCheck communication with other devices

Communication between the FluoroCheck and another device such as a printer or an IBM-compatible computer is limited to an ASCII "dump". No error checking (such as CRC) or protocols for attention (such as ACK or NAK) are available. Also, no XON or XOFF procedure is required.

To connect the communication facility, plug the appropriate cable (see page 1-5) into the FluoroCheck serial port and the device. Select **2>setup**, then **3>Send** to choose either Auto send (which transfers each sample ID number and measurement automatically) or Manual send (which requires the operator to press **<SEND>** to transfer each reading to the device).

Software options

If the data flow is channeled to a computer, data can be captured by Terminal software included with Microsoft Windows. To use the Windows Terminal program:

1. 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.
2. Click *cancel* on the **Location Information** pop-up and continue to proceed with the program initialization.
3. If required, under the **Connection Description** pop-up, enter a file name for the connection and choose an icon from the provided list.
4. Again, you may have to click *cancel* on the **Local Information** pop-up.
5. Finally, in the **Connect To** pop-up, select the COM port that is connected to the FluoroCheck cable. Then set the baud rate at 1200, Data bits at 8, Stop bits at 1, Parity at None and Flow control at None. Click OK.

The program is ready to receive data.

4

Care and Maintenance

To clean the exterior, wipe the unit with a damp cloth. Never use abrasive cleansers or solvents. The only user-serviceable component is the optical block. The optical block assembly is described in the cleaning section below.

Optical block

Clean the optical block periodically, depending on the frequency of use, or if solution spills into the cuvet well.

Important

- > Turn the mains power off and unplug the power cord.
- > The optical surfaces are easily scratched. Handle with extreme care and polish gently.
- > Wear gloves when servicing the optical block. This protects both the technician from hazardous materials that may have been spilled and protects the optical surfaces from fingerprints.
- > Use only isopropanol on a clean soft cloth to clean the optical surfaces.

Optical block disassembly

- 1 Turn the mains power off and unplug the power cord. Spread a soft cloth over the work area and turn the unit upside down onto the padded surface. Wear gloves, both to protect yourself and the optical surfaces.
- 2 Locate the the thumb screw near the front of the unit and unscrew. (The captive screw stays attached to the block). Lift the optical block assembly straight up.
- 3 Hold the optical block assembly so that the ground plate (with the thumb screw) faces up and the optical block is cradled in your palm. (In this position no components will be damaged if they slide out of their slots during disassembly). Unscrew the phillips (star) screw near the thumbscrew. Lift the ground plate and remove the glass cover in front of the excitation aperture. Keep the optical block in this position for steps 4 and 5.
- 4 The stainless steel reference mirror does not contact solution, so it requires little maintenance. If it requires cleaning, insert a hook (such as a paper clip) in the hole where the mirror bends and pull the mirror out.

- 5 The sample mirror, which covers two sides of the cuvet well, slides out when gently nudged from the bottom. Turn the block over (right side up) and collect the mirror. Handle with care.
- 6 Remove the reference and emission filter seal rings and place on a soft cloth. The emission filter should slide out easily. If required, press the filter from behind with a cotton swab.
- 7 Cleaning. Clean the cuvet well with cotton swabs. Dampen a soft cloth with alcohol and wipe each optical surface. If required, gently polish with a dry soft cloth. Remove all particles. Allow to air dry. All surfaces must be completely clean for accurate measurements.

Optical block assembly

- 1 If the reference mirror was removed, choose the best surface to face the reference beam. Slide the mirror into the slot until it stops. The mirror self aligns.
- 2 Hold the block in your palm as in step 3 above, slide the glass over the excitation aperture slot, and seat the ground plate onto the optical block. Secure with the phillips screw.
- 3 Carefully slide the sample mirror into the cuvet well. The mirror must fit flush with the top of the block.
- 4 Install the emission filter so that the arrow points away from the block. Install both seal rings.
5. Inspect the assembly, If necessary, wipe the surface until clean. Slide the assembled optical block into the instrument and secure with the thumb screw.

5 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.
- > Place the unit so that the back vents are not blocked.
- > Take care not to spill any liquid into the cuvet well.

Fluorescence values drift

- > Sample solutions must be 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.
- > 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 point of pipette extract from the sample bottle.

Readings negative or lower than expected

- > Use a freshly prepared solvent 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 5 minutes and allow the sample to stand still for several minutes prior to extraction.

Error and other messages

One dot remains in the left corner

A series of dots across the display indicate that the instrument is stabilizing a measurement. If one dot remains in the left corner, no stable reading was determined. Wipe the cuvet and repeat the measurement procedure.

Turning lamp on

The lamp was inadvertently turned off or the auto shut function switched the lamp off after one hour of no keypad activity. This message reports that the lamp is being turned on. Wait 15 minutes before taking measurements to allow the lamp to stabilize.

Zero first, using a blank sample

The solvent solution was not "blanked". Zero the instrument: place the blank solvent solution into the cuvet and press **<ZERO>**.

Blank>sample, Zero and re-calib

Blank value is higher than the sample value. Zero using "blank" solvent solution and recalibrate.

Re-calib using lower value

The entered calibration value is too high. Recalibrate with standard solution. Use a lower factor if not using the actual standard calibration.

Failed

The diagnostic test failed. Call the Arjay Engineering Technical Service Department.

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 your local Arjay representative.

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