Operation and User Maintenance Manual

FluidScan®

Handheld Lubricant Condition Monitor



SPECTRO INC.

QinetiQ North America

160 Ayer Road Littleton, MA 01460 U.S.A. • Tel. 978.486.0123 • Fax 978.486.0030
email: service@spectroinc.com • web page: www.spectroinc.com

Manual Part No. FL350

This Page is Intentionally Left Blank

Table Of Contents

1.0 INTRODUCTION & SYSTEM DESCRIPTION 1
1.1 INTRODUCTION 1
1.2 DESCRIPTION 2
1.2.1 Theory of Operation 2
1.2.2 Hardware Description 4
1.3 DEFINITIONS 5
1.3.1 Definitions for Instructions 6
1.3.2 Definitions for Terms 6
1.3 SPECIFICATIONS 7

2.0 SET-UP OF THE FLUIDSCAN 9
2.1 FIRST TIME SET-UP 9
2.2 INSTALL & SYNCHRONIZE FluidScan® MANAGER DATABASE SOFTWARE 9
2.2.1 Install FluidScan® Manager Software 10
2.2.2 Synchronize FluidScan® To FluidScan® Manager 12
2.3 SET THE DATE AND TIME 12
2.4 ADD USER TO FluidScan® 13
2.4.1 Add User with FluidScan® Software 13
2.4.2 Add User with FluidScan® Manager Software 15
2.5 ADD DESCRIPTORS ON FluidScan® AND FluidScan® MANAGER 15
2.5.1 Add Descriptor Levels and Descriptors in FluidScan® Manager 16
2.5.1.1 Add Descriptor Levels in FluidScan® Manager 18
2.5.1.2 Add Descriptors in FluidScan® Manager 19
2.5.2 Add Descriptor Levels and Descriptors to the FluidScan® 19
2.5.2.1 Add Descriptor Levels to the FluidScan 19
2.6 METHODS TO ANALYZE IN-SERVICE FLUIDS WITH FluidScan® 22
2.6.1 Standard FluidScan® Method – Quantitative Analysis 24
2.6.2 New User Fluid Method – Quantitative Analysis 25
2.6.3 Subtraction Method – Semi-Quantitative 29
2.6.4 ASTM Method – Trending 30
2.7 ADD ASSETS ON FluidScan® MANAGER AND TO FLUIDSCAN 30
2.7.1 Add Assets to FluidScan® Manager 30
2.7.2 Add Assets to the FluidScan® 32
2.8 ITEMS INCLUDED AND DELIVERED WITH FLUIDSCAN 35

3.0 ROUTINE OPERATIONS 37
3.1 TURNING ON FLUIDSCAN 37
3.2 CELL CLEANLINESS 38
3.3 LOADING THE FLIP-TOP CELL WITH AN OIL SAMPLE 39
3.4 ROUTINE SAMPLE ANALYSIS 40
3.4.1 Measure Asset 40
3.4.2 Measure Fluid 44
3.4.3 Validate Fluid Identity 46
3.5 SYNCHRONIZING FluidScan® WITH FluidScan® MANAGER 48
3.6 BACKING UP, IMPORTING AND EXPORTING THE FluidScan® DATABASE 49

3.6.1 Backup of the FluidScan® Manager Database 49
3.6.2 Device Maintenance 50
3.7 UPDATE A FLUID'S SPECTRUM 51
3.8 CUSTOMIZE SYSTEM FLUID 53
3.9 EDIT FLUID FAMILY DISPLAY FILTER 55

4.0 SOFTWARE DESCRIPTION 57
4.1 FluidScan® SOFTWARE 57
4.1.1 Take Measurement 57
4.1.2 Manage Measurements 58
4.1.3 Options/Setting 59
4.1.4 Logout 61
4.1.5 Shut Down Device 61
4.1.6 About FluidScan® 61
4.2 FluidScan® MANAGER SOFTWARE 62
4.2.1. Measurements 62
4.2.2 Assets 64
4.2.3 Devices 64
4.2.4 Database 65
4.2.5 Tools 65

5.0 USER MAINTENANCE & TROUBLESHOOTING 67
5.1 CLEANING WINDOWS 67
5.1.1 Cleaning the FluidScan® Head CaF2 Window 67
5.1.2 Cleaning the FluidScan® Body CaF2 Window 68
5.2 REPLACING THE FLIP-TOP CELL 69
5.3 REPLACING THE BATTERY 70
5.4 TROUBLESHOOTING 71
5.4.1 Check Fluid Analysis 71

List of Effective Pages

Summary of FluidScan® Manual Versions

Change	*Version*	*Date*	*Description*
First Issue	*beta1*	*5 June 2007*	*Draft1*
2	*beta 2*	*11 June 2007*	Grammatical corrections and some software updates
3	*beta 3*	*12 June 2007*	Corrections from F-M
4	*1.0*	*27 Jan. 2009*	Product Launch Version. Complete re-write to reflect new hardware and software.
5	*1.05*	*2 Feb. 2009*	Corrected FluidScan® Manual installation procedure.
6	*1.06*	*5 Feb. 2009*	Added battery charger caution
7	*1.07*	*10 Feb. 2009*	Added ISO specifics to charger caution and material of windows on page 53 from Kbr to CaF2.
8	*1.1*	*12 May 2009*	Major re-write to include subtraction and explanation of 4 analytical methods. New FluidScan® Manager installation procedure plus numerous software changes.
9	*1.15*	*26 May 2009*	Changed match from 97% to 94% and subtraction to 90% to 94%. Multiple grammatical corrections.
10	*1.2*	*4 July 2009*	Added Validate Fluid Software update for "Validate Fluid Identity". Software update for viewing analyses and multiple properties (trend). Multiple software screen updates and descriptions. Minor corrections.
11	*1.25*	*16 July 2009*	Partial rewrite of Section 2.6 to make it clear that unused oil has to be "new" oil and not in-service or used oil. Minor grammatical corrections. Added FluidScan® registration mark.
12	*1.3*	*22 Sep. 2009*	Changed Match Percentages to Match Scores from 1 to 10.

Total Number of pages in this manual is 80 consisting of the following:

Description	*Page*	*# of Pages*
Covers		*2*
Table of Contents	*i-iv*	*4*
Chapter 1	*1-8*	*8*
Chapter 2	*9-36*	*26*
Chapter 3	*37-56*	*19*
Chapter 4	*57-66*	*10*
Chapter 5	*67-74*	*8*

WARNING: Lubricating oil, including MIL-PRF-7808 and MIL-PRF-23699, frequently contain additives which are poisonous and could be absorbed through the skin. Do not allow oil to remain on skin any longer than necessary.· Oil is a skin irritant and if oil gets on your skin, wash thoroughly. Rubber gloves should be worn whenever lubricating oil is handled. If oil soaks into clothes, change clothes immediately.· Oil gives off fumes that can cause injury to personnel. Use oil in a well-ventilated area.

	**ISO 7000 - 0434**	**Caution, risk or danger! (see Note)**

NOTE: CAUTION, use only supplied charger with FluidScan®:
Elpac Power Systems Model Number FWC1805F, Input 100-240VAC, 47-63Hz, 0.5A, Output 5VDC 3.6A 18W Max.

Chapter 1

Introduction & System Description

1.0 INTRODUCTION & SYSTEM DESCRIPTION

This manual provides the user of the FluidScan® Handheld Lubricant Condition Monitor with basic instructions in operation and user preventive maintenance and troubleshooting. The manual also describes the FluidScan® Manager database software, which is used to synchronize data between the FluidScan® and a personal computer (PC) to archive, retrieve and trend analytical results.

The FluidScan® is available in two colors, yellow and green. They are identical in all other aspects and the part numbers are FLSC1000 for the yellow version and FLSC1001 for the olive drab (green) version.

1.1 INTRODUCTION

The FluidScan, Figure 1.1-1, is a handheld condition based maintenance system that delivers fluid condition assessment based on ASTM International and JOAP[1] standard practices. It protects machinery by determining when a lubricant needs



Figure 1.1-1, FluidScan® Handheld Lubricant Condition Monitor

[1] Department of Defence Joint Oil Analysis Program.

to be changed due to excessive contamination or degradation. FluidScan® detects lubricant degradation and contamination by other fluids (water, glycol, incorrect lubricant) at the point of use by measuring key oil condition parameters in both synthetic and petroleum based lubricants and fluids.

The FluidScan® analyzes lubricants and fluids using infrared spectroscopy, a technique that has found wide acceptance as a primary test for contamination and degradation. It performs the analyses with the same accuracy as laboratory instruments, but does so on-site in a handheld version. The FluidScan® thus reports and stores information on lubricant condition at the point of use. The information stored on the system can be synchronized and downloaded to the FluidScan® Manager, a powerful database that runs on a separate personal computer to store data for archiving, trending, and reporting. FluidScan® Manager is included with the FluidScan, but it is not required for routine operation.

The FluidScan® Lubricant Condition Monitor is applicable to any mechanical system where unexpected down time is unacceptable. It enables operators of power generation equipment, marine vessels, trucks, wind turbines, mining, military vehicles and aircraft, and heavy construction equipment, or any large industrial system to establish predictive maintenance programs based on oil condition rather than on a preset schedule based on time or distance.

The FluidScan® provides immediate on-site analysis of lubricant properties, and accurately warns the user when it is time to change the lubricant due to contamination or degradation. The primary benefits of real-time, on-site analysis include:

- Extended oil change intervals
- No delay in waiting for laboratory analysis
- Reduced operational and maintenance costs
- Reduction of unscheduled maintenance outages
- Prevention of catastrophic failures

The FluidScan® was designed specifically for oil analysis and is optimized for reliable operation in the field.

Its primary features are:

- Small, handheld rugged mid-infrared spectrometer
- Sensitive, comparable to high-end laboratory FTIR spectrometers
- On-site analysis
- Patented optical waveguide technology
- Reliable performance – self-calibrating reference
- Under 1 minute analysis time
- Measures key oil condition parameters including:
  - Total Acid Number (TAN)
  - Total Base Number (TBN)
  - Oxidation
  - Nitration
  - Sulfation
  - Incorrect lubricant
  - Additive depletion
  - Soot
  - Glycol/Antifreeze
  - Water

1.2 DESCRIPTION

This section of the manual describes the theoretical and the physical features of the FluidScan.

1.2.1 Theory of Operation

The FluidScan® lubricant condition monitor is a self-contained handheld analyzer that delivers instant fluid condition assessment to the user based on ASTM Standard Practice E 2412. It eliminates the need for sample preparation and time-consuming cleanup by using a flip-top fluid cell for easy and rapid on-site analysis.

At the core of the FluidScan® is a patented mid-infrared spectrometer with no moving parts, Figure 1.2-1. The spectrometer collects the infrared light transmitted through the fluid in the flip-top cell into a waveguide. The waveguide then carries

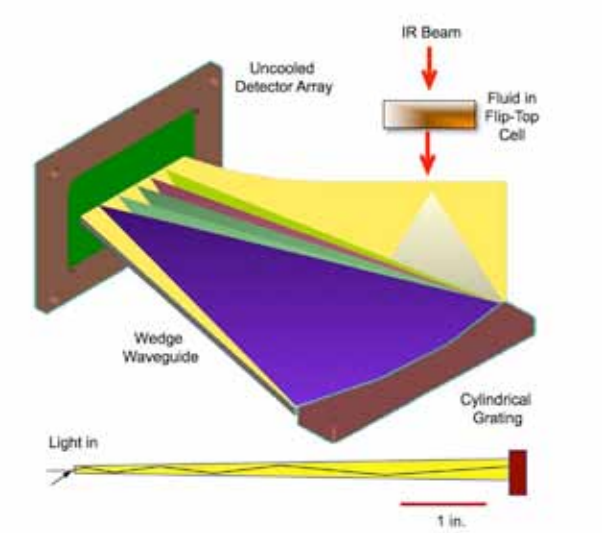


Figure 1.2-1, Schematic Illustration of Monolithic Wedge-Waveguide Infrared Spectrometer

the light to and from a prism-like diffraction grating into a high-performance array detector which collects the infrared spectrum of the fluid. The waveguide allows the infrared signal to be completely confined, minimizing any atmospheric interference and maximizing the efficiency of the spectrometer. This unique technology enables a rugged, highly accurate miniature device that can operate on rechargeable Li-Ion batteries for up to 8 hours.

Key infrared signatures of fluid condition, established by the Joint Oil Analysis Program Technical Support Center (JOAP-TSC), are used to obtain fluid status in real-time. The user loads two drops of sample into the flip-top cell, enters sample information, and initiates an analysis using the FluidScan's intuitive, color user interface and navigation pad. Status and supporting fluid condition parameters are then determined and displayed to the user, and can be stored for trending or exported to a central database. The included FluidScan® Monitor Manager database software provides further data logging, trending, warning and alarm condition alerts.

The FluidScan® is delivered with calibrations for the most common oil types. Contact Spectro Inc. if you are uncertain how to categorize an oil to be analyzed with the FluidScan.

FluidScan's Analytical Capabilities

The FluidScan® is capable of analyzing oil samples by several methods. Similar to FT-IR spectrometers, the FluidScan® will analyze in-service oils using the direct or subtractive methods as described in ASTM International Standard Practice E 2412. The direct method uses no references and merely trends results over time or distance traveled. Variations in results are then indicative of changing physical properties or contamination. The subtractive method requires that clean oil identical to the in-service oil must be analyzed, or a previous analysis of it must be stored in the database. The spectrum from the clean oil is then subtracted from the analysis of the in-service oil and the results are the differences between the two.

The FluidScan, however, has an additional capability to analyze samples and to provide the user with quantitative results using the "Spectral Matching" capability. This is possible because the FluidScan® has stored in its memory algorithms for many of the world's most common lubricant types. These algorithms provide a calibration for most lubricant types so that analytical results are given in physical units as follows:

- *TAN (mg of KOH per g)*
- *TBN (mg of HCL per g)*
- *Oxidation*
- *Nitration*
- *Sulfation*
- *Water (parts per million)*
- *Glycol (percent by weight)*
- *Soot (percent by weight)*
- *Incorrect Fluid (per cent by weight)*
- *Antioxidant Depletion (percent)*
- *Antiwear Depletion (per cent by weight)*

Due to the large number of lubricant types and individual lubricants throughout the world, Spectro Inc. is continuously developing new algorithms for the FluidScan. When a customer has a lubricant that does not already have an algorithm stored in memory, contact Spectro Inc. about the process of creating an additional algorithm. The alternative is to use the direct or subtraction methods as described in ASTM E 2412. See also Section 2.6 for a description of all the FluidScan® methods.

1.2.2 Hardware Description

The various parts and controls of the FluidScan® are shown in Figures 1.2-2 along with a brief description.

1. Sampling Head - Contains the two infrared sources, one for the short-wave band and the other for the long-wave band. The sources are mounted at 90 degrees around the flip-top cell which contains the oil sample for analysis. The sampling head also contains the cradle into which the flip-top cell is opened for the sample "load" position along with a shock absorber used to slowly close the cell after a sample has been inserted.

2. Flip-Top Cell - A patent pending sampling cell into which an oil sample is placed for analysis.

3. Color Display - A 320 x 320 pixel transflective color display to view entries and analytical results.

4. ON/OFF Button - Turns the FluidScan® ON or OFF. To turn OFF the FluidScan, the button must be depressed for 5 seconds. Instrument also turns OFF automatically after 5 minutes of inactivity.

5. Indicator LED - A two-color LED which indicates charge status: off when no charger is plugged in, amber when the unit is charging, and green when the unit is at full charge and still plugged in.

6. Handles - Straps that can be adjusted to securely hold the FluidScan® in your hand.

The routine operation of the FluidScan® is controlled through the use of soft buttons and a directional pad. When pressed, each button generates a keyboard key event.

7. Soft Buttons - Four buttons used to select corresponding instructions displayed in corresponding boxes on the bottom of the color display.



Figure 1.2-2, FluidScan® Top View

8. Directional Pad - Used as a directional pointer with a center mouse "click" button.

Four buttons are implemented as "soft buttons", eight others are used to direct a pointer or communicate up/right/down/left information and one acts as a "click" or "enter" button conventionally associated with a mouse. A region across the bottom of the color display corresponds to the soft buttons. Each of these regions is labeled with a key word that acts as a visual cue as to what the button does. These cues can change depending on the screen.

The FluidScan® has connectors on its communications panel that enable the user to better control the instrument and also to interface with personal computers or a network. The external connections are shown in Figure 1.2-3.

9. Mini-DIN-9 Connector - Not used for routine FluidScan® analyses.

10. USB Client Connector - Used to connect the FluidScan® to a PC and to synchronize data between the FluidScan® and the FluidScan® Manager software.

11. USB Host Connector - Used to connect a keyboard or mouse with a USB female connector.



Figure 1.2-3, FluidScan® End View

12. Ethernet Connector - Used to connect the FluidScan® to a computer network to synchronize data.

13. Battery Charger Connector - Connects the FluidScan® to a battery charger to charge the battery or to operate from an external power source.

14. Serial Number Plates - Plates on the FluidScan® body and sampling head with permanent identification information for the specific FluidScan, Figure 1.2-4.

15. Battery Compartment - Holds the rechargeable Li-Ion battery.

1.3 DEFINITIONS

The following definitions apply to specific instructions throughout this manual and to terms that appear in the text.



Figure 1.2-4, FluidScan® Bottom View

1.3.1 Definitions for Instructions

There are three types of instructions that appear in this manual, Warning, Caution and Note. They are there to protect the user and the FluidScan® and also to emphasize key points or instructions.

WARNING - An operating procedure or practice that may cause injury if not carefully observed or followed.

CAUTION - An operating procedure or practice that may cause damage to the FluidScan® if not carefully observed or followed.

NOTE – An operating procedure or practice that is essential to emphasize.

1.3.2 Definitions for Terms

The following is a list of terms that appear in this manual. A brief definition is provided to describe the term as it is used in the context of the text.

- "Algorithm" - A function applied to a sample and reference spectrum (when using the Subtractive Method) used to generate quantitative values. The algorithm structure contains numbers or text strings that are associated with the function that describe what value the function generates along with upper and lower alarm limits.
- "Asset" - A physical thing from which the oil sample is taken, such an engine, transmission, hydraulic system, etc. An asset is generally identified by a unique serial number.
- ASTM International - Originally known as the American Society for Testing and Materials (ASTM). It is one of the largest voluntary standards development organizations in the world-a trusted source for technical standards for materials, products, systems, and services.
- "Background" - A power spectrum of an empty fluid cell.
- "Dark Counts" - Dark counts the detector recorded when the light source is blocked. This is used when calculating the absorbance spectrum.
- "Descriptor" - Terms used to identify and describe an asset.
- "Direct Method" - One of the two standard spectral interpretation methods. This method applies the algorithm associated with the sample without considering any reference spectra.
- "Directional Pad" - Used as a directional pointer to input data into the FluidScan. The center button is equivalent to the click of a mouse.
- "Flip-Top Cell" - A patented cell on which an oil sample is placed for analysis with the FluidScan®
- "Fluid" - A generic term to describe any liquid sample.
- "Power Spectrum" - A general term referring to an appended spectrum recorded as the signal (in ADC counts) from each element of the array detector twice, once with the long wavelength lamp and once with the short wavelength lamp.
- "Property" - A characteristic of the sample that is being determined (water, soot, AN etc.)
- "Reference" - An absorbance spectrum of a known fluid, usually a new oil.
- "Sample" - The fluid to be analyzed by FluidScan.
- "Soft Button" - Four buttons below the FluidScan® screen that correspond to commands listed on the bottom of the screen.
- "Subtractive Method" - One of the two stan-

dard spectral interpretation methods. This method subtracts the absorbance spectrum of a known reference (such as a new oil) from the sample spectrum prior to applying the algorithm associated with the sample.

- "Transmission" - A power spectrum of the sample used with the "Background" to calculate the absorbance spectrum.

- "User" - A person's name used to log in and to identify the individual performing an analysis with FluidScan.

1.3 SPECIFICATIONS

The FluidScan® is an easy to use lubricant condition monitoring system that was designed to be used on-site and in the field to provide immediate analytical results for oil samples. It can be operated with minimal training as a stand-alone condition monitoring instrument, or in conjunction with the PC based FluidScan® Manager software to store, archive and view data. It requires no user calibration and has the ability to assess oils without comparison to an unused (fresh) oil sample. The FluidScan's primary specifications as listed in Table 1-1.

Table 1-1, FluidScan® Specifications

Item	Specification
Repeatability:	< 3% relative standard deviation within mid-range of measured parameters.
Reproducibility:	< 6% of measured parameters within mid-range of parameters
Meniscus Detection:	Optical (new and used oils)
Measurement Time :	60 seconds, 30 samples per hour including data entry
Calibration:	Not required
Oil Types:	Applicable to commercial and military synthetic or petroleum based fluids.
Sample Volume:	1-2 drops of oil
Consumables:	None
Operating Temperature Range:	-10°C to 50°C
Operating Humidity:	0 to 100%, non condensing
Maximum Operating Altitude:	5,000 meters (16,400 feet)
Battery Life:	6 to 8 hours after a full charge, automatic shut-off to conserve battery
Weight:	1.8 kg (4 lbs)
Dimensions:	17 x 14 x 9 cm (6.5 x 5.5 x 3.5 inches)
Operating System:	Windows® CE
Display:	320 x 320 pixel transflective color screen.
Alarms:	Pass/fail based on limits for each measured parameter.
Flash Memory:	64 MB
Random Access Memory:	64 MB
Data Logging:	Up to 5,000 samples
Synchronization:	To SQL database
Power Requirements:	Rechargeable battery or 100/220 V, 50/60 Hz with charger

This page is intentionally left blank

Chapter 2

Set-up of the FluidScan®

	ISO 7000 - 0434	Caution, risk or danger! (see Note)

NOTE: CAUTION, use only supplied charger with FluidScan® :
Elpac Power Systems Model Number FWC1805F, Input 100-240VAC, 47-63Hz, 0.5A, Output 5VDC 3.6A 18W Max.

2.0 SET-UP OF THE FLUIDSCAN

The FluidScan® is a self-contained analytical instrument capable of analyzing oil samples and storing fixed and variable information in its memory. It can be used by itself, or with a separate PC based data management program to facilitate data storage, archiving and reporting of analytical results.

The FluidScan® requires minimal training for operation. However, there are a few housekeeping functions that must be performed before it is ready to analyze oil samples.

2.1 FIRST TIME SET-UP

The FluidScan® is delivered ready to operate with its operating software installed and with calibrations for the major lubricant families. There are, however, a few functions that the new user must execute in order to get started. The steps include:

- Installing the FluidScan® Manager Database and supporting Software on a stand-alone personal computer (PC) (Section 2.2).
- Set the date and time (Section 2.3).
- Adding Users to the FluidScan® Software (Section 2.4).
- Adding Asset Descriptor Levels and Descriptors (Section 2.5).
- Determine methods to analyze samples (Section 2.6).
- Add Assets (Section 2.7).

First, the FluidScan® Manager software must be installed onto a personal computer. Then your FluidScan® (device) must be synchronized with the database so that it is recognized by the software and details on the descriptors and assets that will be monitored can then be entered into the software.

2.2 INSTALL & SYNCHRONIZE FluidScan® MANAGER DATABASE SOFTWARE

The FluidScan® handheld instrument may be

operated as a stand-alone instrument. A PC is not required for the FluidScan® to be fully functional. However, a PC installed with FluidScan® Manager Database Software makes entering asset information and subsequently managing and maintaining results obtained by FluidScan® much easier. Therefore, using a PC in conjunction with FluidScan® is strongly recommended.

2.2.1 Install FluidScan® Manager Software

The FluidScan® Manager software is included on a CD and is delivered with the FluidScan. The software must be installed on a personal computer operating either on Windows XP or Windows Vista. The installation wizard and the procedure below must be followed to install the software.

The programs on the CD that will be installed are:

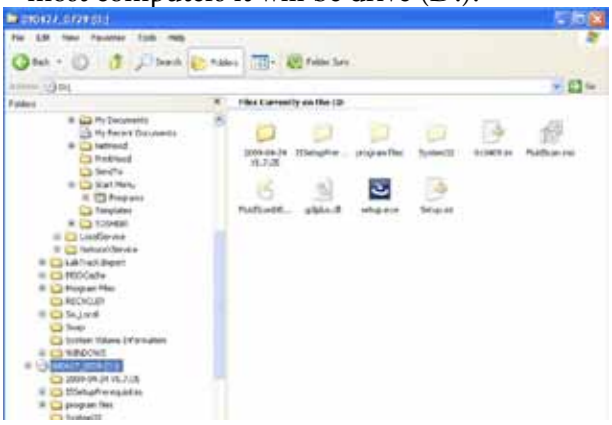
- Active Sync (Async45setup.msi) (Windows XP Only)
- .net Framework (dotnetfx35.exe)
- SQL Server (SSCERuntime-ENU-x86.msi)
- Crystal Reports (CRRedist2008_x86.msi)
- FluidScan® Manager Database
- Mobile Device Console (Vista Only)

To install the software on a PC.

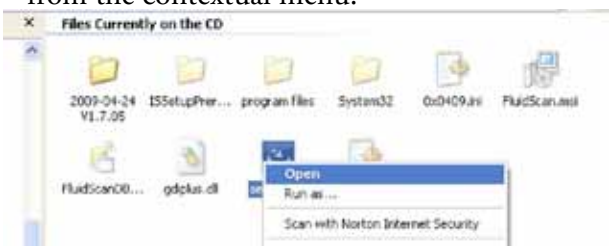
1. Insert the FluidScan® Manager installation CD into the PC.

2. Open Windows Explorer or My Computer.

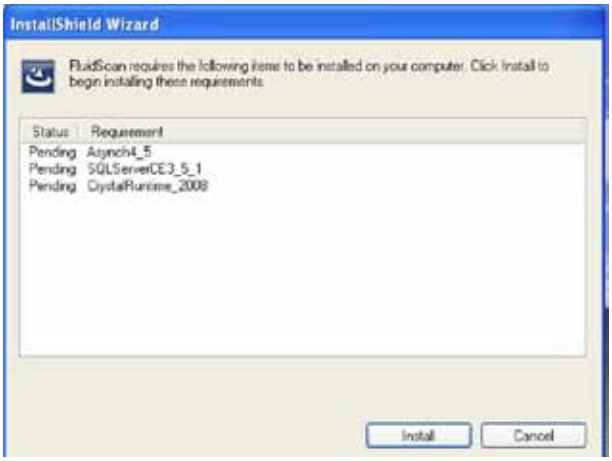
3. Locate and select the FluidScan® CD, on most computers it will be drive (D:).



4. Right-click on **setup.exe** and select **Open** from the contextual menu.

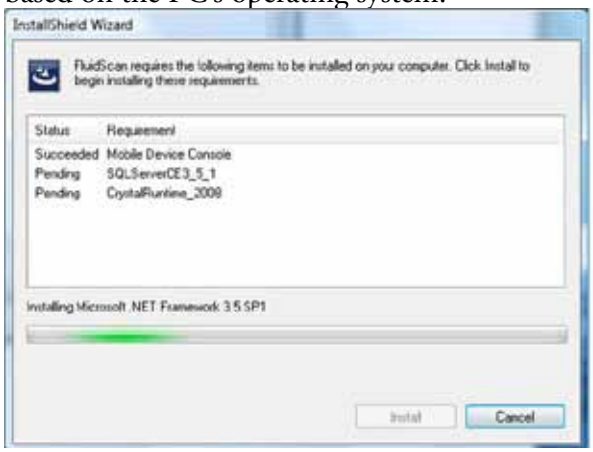


5. The InstallShield Wizard will open. Select **Install** to start the installation wizard.



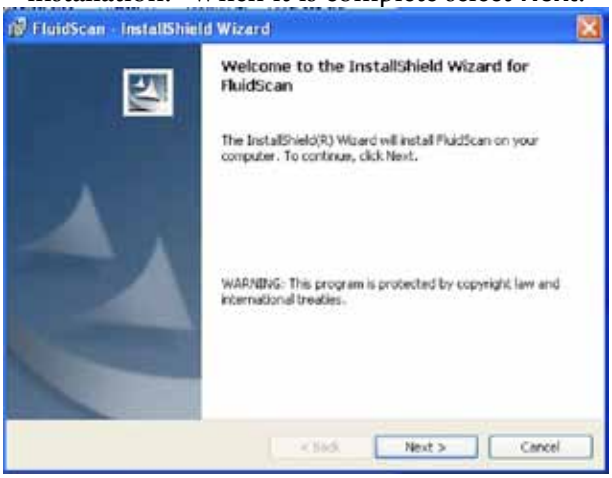
The operating system will check the PC for the presence of required programs and will install only those that are not present.

Note also that Windows Vista requires the installation of Mobile Device Console in place of Active Sync. The installation CD contains both programs and automatically makes the selection based on the PC's operating system.



NOTE: The installation process will take approximately 5 to 10 minutes.

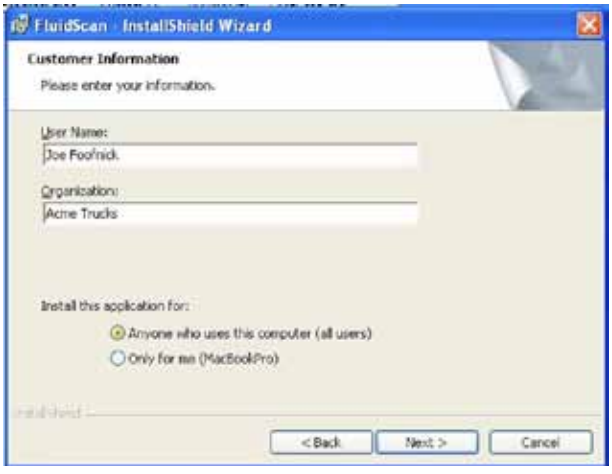
6. A progress bar will show the status of the installation. When it is complete select **Next**.



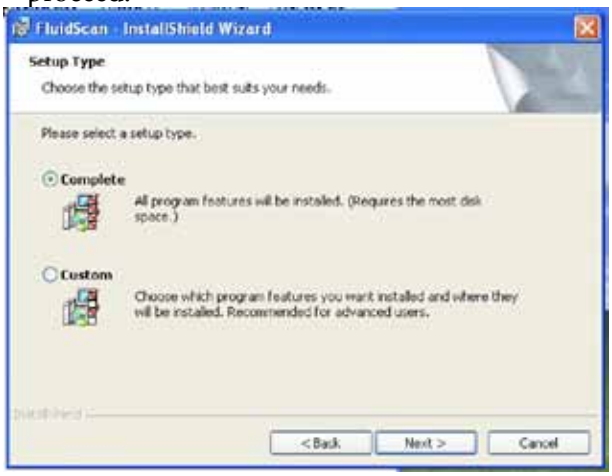
7. Click on the radio button to accept the terms of the license agreement. Select **Next** to proceed.



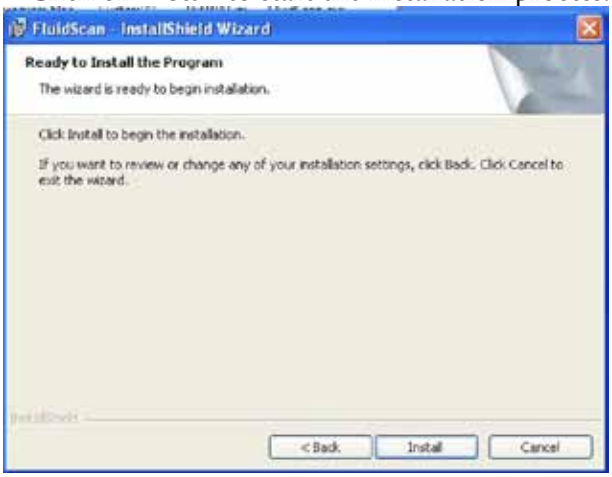
8. Enter a User Name and Organization into the corresponding fields. Select **Next** to proceed.



9. The Setup Type screen appears. Click on the **Complete** radio button and select **Next** to proceed.



10. The InstallShield Wizard is now ready to install the FluidScan® Manager Database. Click on **Install** to start the installation process.



11. A progress bar will show the status of the installation. When it is complete select **Finish**.



12. A shortcut to FluidScan® Manager will be

placed on the PC's desktop for future use. This completes the installation of the FluidScan® Manager software.

2.2.2 Synchronize FluidScan® To FluidScan® Manager

The FluidScan® must be synchronized with FluidScan® Manager before proceeding further in order to transfer the current fluid families from the FluidScan® to the PC based FluidScan® Manager. Data should also be synchronized when changes are made either on the FluidScan® or on FluidScan® Manager.

1. Connect the FluidScan® to your personal computer with the provided cable. Plug one end of the cable into the FluidScan® USB Host Connector and the other end into an open USB port on the personal computer.

2. Turn **ON** FluidScan.

3. Open Microsoft Active Sync on the personal computer.

4. Open the FluidScan® Manager by double-clicking on its icon.

5. On the FluidScan® Manager main menu, select **Synchronize Device** from the "Devices" drop-down menu, Figure 2.2-1.

6. The "Synchronize Device Database" screen opens, Figure 2.2-2. Note that there are two directions in which the systems can be synchronized, either FluidScan® (Device) to FluidScan® Manager, or FluidScan® Manager to FluidScan® (Device).

7. In the future select the appropriate button to copy from one device to the other. However, the first time a synchronization is performed, it must be from the FluidScan® (Device) to FluidScan® Manager.

8. Click on the **Copy Database From Device** button to upload data from the FluidScan® to FluidScan® Manager.

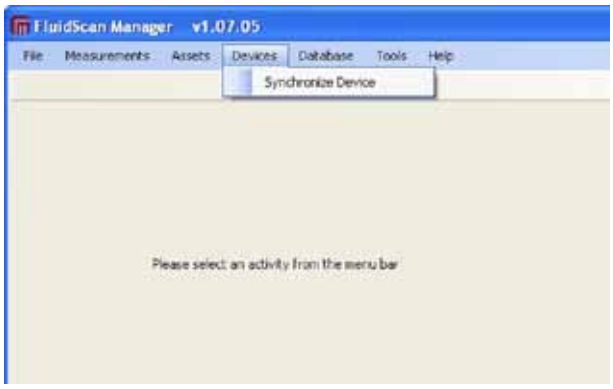


Figure 2.2-1, Select Synchronize Device



Figure 2.2-2, Synchronize Device Database Screen

CAUTION: In FluidScan® Manger, the data you are copying overwrites and replaces the data you are copying to. Before proceeding, verify whether the FluidScan® or the FluidScan® Manager has the most up to date data. This is not a true synchronization procedure where only the most recent files are copied. Future versions of FluidScan® Manager will have an updated synchronization procedure, check the customer support web page at www.spectroinc.com periodically for updates.

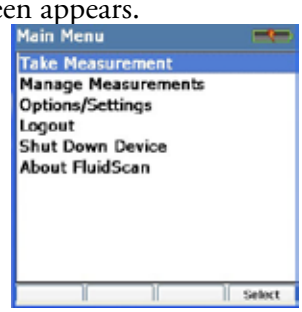
2.3 SET THE DATE AND TIME

The date and time must be set into the FluidScan® when it is first turned On and thereafter if the battery has to be replaced or was allowed to completely deplete.

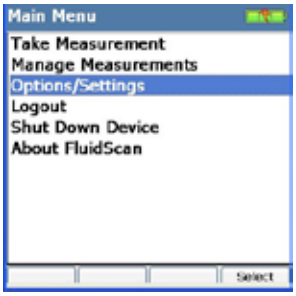
The date and time consists of the Time Zone and Date and Time, both are selected with corresponding soft buttons and changed with the directional pad.

To set the date and time:

1. Turn **ON** FluidScan® by pushing down the ON/OFF button. The FluidScan® software will boot and after about 30 seconds the "Main Menu" screen appears.



2. Using the directional pad scroll down to **Options/Settings**. To make the selection, push the right most soft button under the word **Select** on the bottom of the screen.



3. The "Options/Settings Menu" screen appears. Use the directional pad to scroll down to **User Settings** and press the **Select** soft button.



4. The "User Settings" screen appears. Use the directional pad to scroll down to **Set Date, Time**, press the corresponding soft button to **Select** it.

5. The "Edit Date, Time" screen appears. The default selection is **Time Zone**. Use the up or down directional pad to select the time zone for your part of the world. When the correct time zone is highlighted, press the soft button for **Date/Tim**e.



The cursor will be on the date field. Use the up or down directional pad to set today's date. Move the curser to the right with the directional pad to select the month. Again use the directional pad to select the date. Repeat this process for the year and the time. Press the soft button under **OK** to select the settings for time zone, date and time.

2.4 ADD USER TO FluidScan®

When the FluidScan® is turned ON, the user is required to log in. The user is presented with a list of active users and required to select one from the list. The last user of the instrument is presented as the default choice. However, when the instrument is new, only the default user exists and the FluidScan® will default to the "Main Menu".

The name of the "User", the individual making the analysis with FluidScan, is appended to the analytical data. Each user must set up an account on FluidScan® and login when they use it. Setting up a new user is simple and can be performed on the FluidScan® or on the FluidScan® Manager software. The procedures are described below.

2.4.1 Add User with FluidScan® Software

The steps below take you through the process of adding a new user to FluidScan. The process will describe the use of only the FluidScan® and its input buttons. Note that the process can be made easier by connecting a keyboard and mouse to FluidScan.

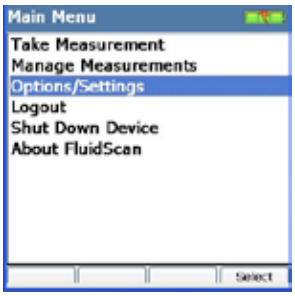
To add a user:

1. Turn **ON** FluidScan® by pushing down the ON/OFF button. The FluidScan® software will boot and after about 30 seconds the "Main

Menu" screen appears.



2. Using the directional pad scroll down to **Options/Settings**. To make the selection, push the right most soft button under the word **Select** on the bottom of the main screen.



3. The "Options/Settings Menu" screen appears. Use the directional pad to scroll down to **Manage Users** and press the **Select** soft button.



4. The "Manage Users" screen appears. **Add User** is the first option, press the corresponding soft button to **Select** it.



5. The "Add User" screen appears. The cursor will be in the "New User Name:" field. Press the soft button under **Edit** to select it.



6. The "New User Name" screen appears.



Note the keyboard on the bottom of the screen. The directional pad is used to select the letters for the user name. The letter or key selected appears in the box above the keyboard and the selection is made when the **Select** soft button is pressed. To start, use the directional pad to select the **Shift** key and press the **Select** soft button, so that the first letter of the user is capitalized. Next, select the remaining letters using the directional pad and the Select soft button to spell the desired name.

7. When the User Name has been spelled out, press the **Done** soft button to select it.

8. The "Add User" screen reappears with the user name filled in and the cursor in the "New User Description" field.



Press the soft button under **Edit** to select it.

NOTE: It is not possible to add a name that pre-exists in the database.

9. The "New User Description" field is an

optional field for situations where it is desirable to further identify the user. Repeat step 6 to add a "New User Description", or press **Cancel** to return to the 'Add User" screen. In the example below, both fields were filled in for the user.



10. To conclude the "Add User" procedure, press the soft button for **Save** to store the information to FluidScan® memory.

2.4.2 Add User with FluidScan® Manager Software

The procedure to add a new user by using the FluidScan® Manager software is more convenient and recommended if several user names are added at one time.

To add a new user to FluidScan® Manger:

1. Open the FluidScan® Manager by double-clicking on its icon.

2. On the main menu, select **Manage Users** from the "Tools" drop-down menu, Figure 2.4-1.

3. The Manage Users screen opens, Figure 2.4-2. Existing users and information relating to them will be displayed in the table at the top of the screen. (The first time the screen is opened. there will not be any existing users

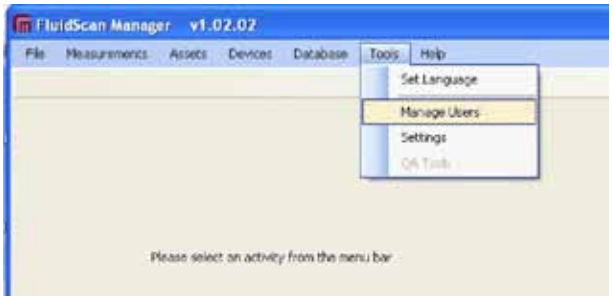


Figure 2.4-1, Select Manage Users

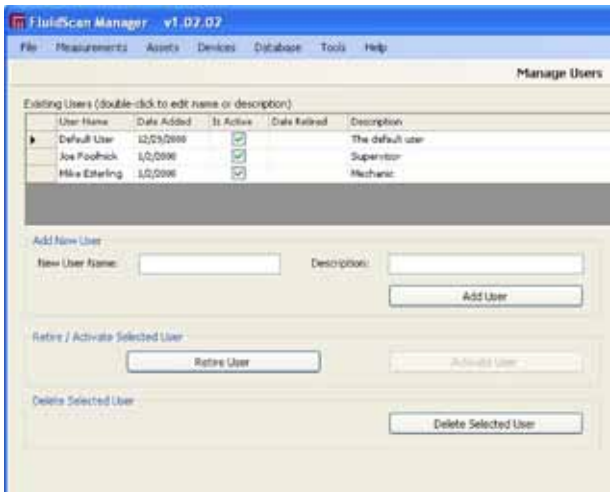


Figure 2.4-2, Manage Users Screen

except for the "Default User"). Note the "Add New User" section near the middle of the screen.

4. Type the name of the user you wish to add into the **New User Name** field.

5. Repeat the process if you wish to add further information into the optional New User **Description** field.

6. Click on the **Add User** button when you are finished with the name and description.

7. The name and description entered will be added to the Existing Users table.

2.5 ADD DESCRIPTORS ON FluidScan® AND FluidScan® MANAGER

Descriptors are the terms used to identify and describe an asset. For example, if an oil sample is taken from the engine of a truck, a descriptor can be used to identify the owner of the truck, another one for the model of the truck, another one for the serial number, another one for the item sampled, and so on. Up to 10 levels of customized descriptors can be used in such a manner to identify an asset.

Descriptors consist of two parts, one is the descriptor "level" and the other is a "descriptor" that

further identifies a level. One way of looking at it is that each level descriptor has a series of sub-descriptors tied to it that further identify an asset. For example, a level may be "manufacturer". Sub-descriptors can then be used to identify the manufacturers of assets from which oil samples are taken, such as Caterpillar, Deutz, Case, Ford, etc.

Descriptor levels must be added to the FluidScan® and the FluidScan® Manager software before any assets can be added and before any samples can be analyzed. This is because the descriptors are tied to the the analysis of an asset and are used to store, retrieve and identify the samples in the database. Descriptor levels can be edited or added, but they cannot be deleted. *For this reason, some thought should be put into the use of descriptors so that they are effective and work well in your application.*

Descriptors can either be added into the FluidScan® Manager database, or into the operating software of the FluidScan. Both methods will be explained in this section of the manual. Which ever method you select, the FluidScan® and the FluidScan® Manager must be synchronized afterwards to make sure both are identical.

The example used to demonstrate the use of descriptors is for a mine with 5 descriptor levels. This mine has two locations that operate a variety of equipment from different manufacturers and oil samples are routinely taken from various assets on the equipment. The mine will use the following 5 descriptor levels and each level will have various descriptors tied to it to further identify the oil sample:

Figure 2.5-1 shows the descriptor levels and descriptors as used in this example. Your application may vary in the specifics, but the concept is identical.

1. **Location** - Since the mine has two operations in two separate locations, this level is used to identify from which of the two mines the sample was taken, the Gold Mine or the Coal Mine.

2. **Equipment** - This level is used to identify from which type of equipment the oil sample is taken. The mine has a variety of equipment and descriptors such as dozer, excavator, tractor scrapers, etc., will be used to identify the equipment.

3. **Model** - This level is used to identify the manufacturer and/or the model number of the equipment. For example, a Caterpillar D5B dozer or a Komatzu PC 3000 shovel.

4. **Subassembly** - In this example, the subassembly is from where the oil sample is taken. Some models of equipment may only have one, but in the case of most mining equipment, there would be an engine, transmission, hydraulic system, etc.

5. **Sampling Port** - This is the point from which the oil sample is actually removed from the subassembly. In most engines, it will be from the sump drain, a filter, or could also be from a valve located in a lubricant flowline that is installed just for the purpose of taking a sample.

The above example will be used to describe how descriptor "levels" and "descriptors" are added to FluidScan® Manager, Section 2.5.1 and FluidScan, Section 2.5.2. Remember that whichever method you select, the FluidScan® and the FluidScan® Manager must be synchronized afterwards to make sure both are identical.

2.5.1 Add Descriptor Levels and Descriptors in FluidScan® Manager

Adding descriptor levels and descriptors into the FluidScan® Manager software is relatively simple and straightforward. The FluidScan® Manager software must be installed on a personal computer as described in Section 2.2. The steps below will demonstrate how descriptor levels and descriptors are added for the example of a mine as explained in Section 2.5.

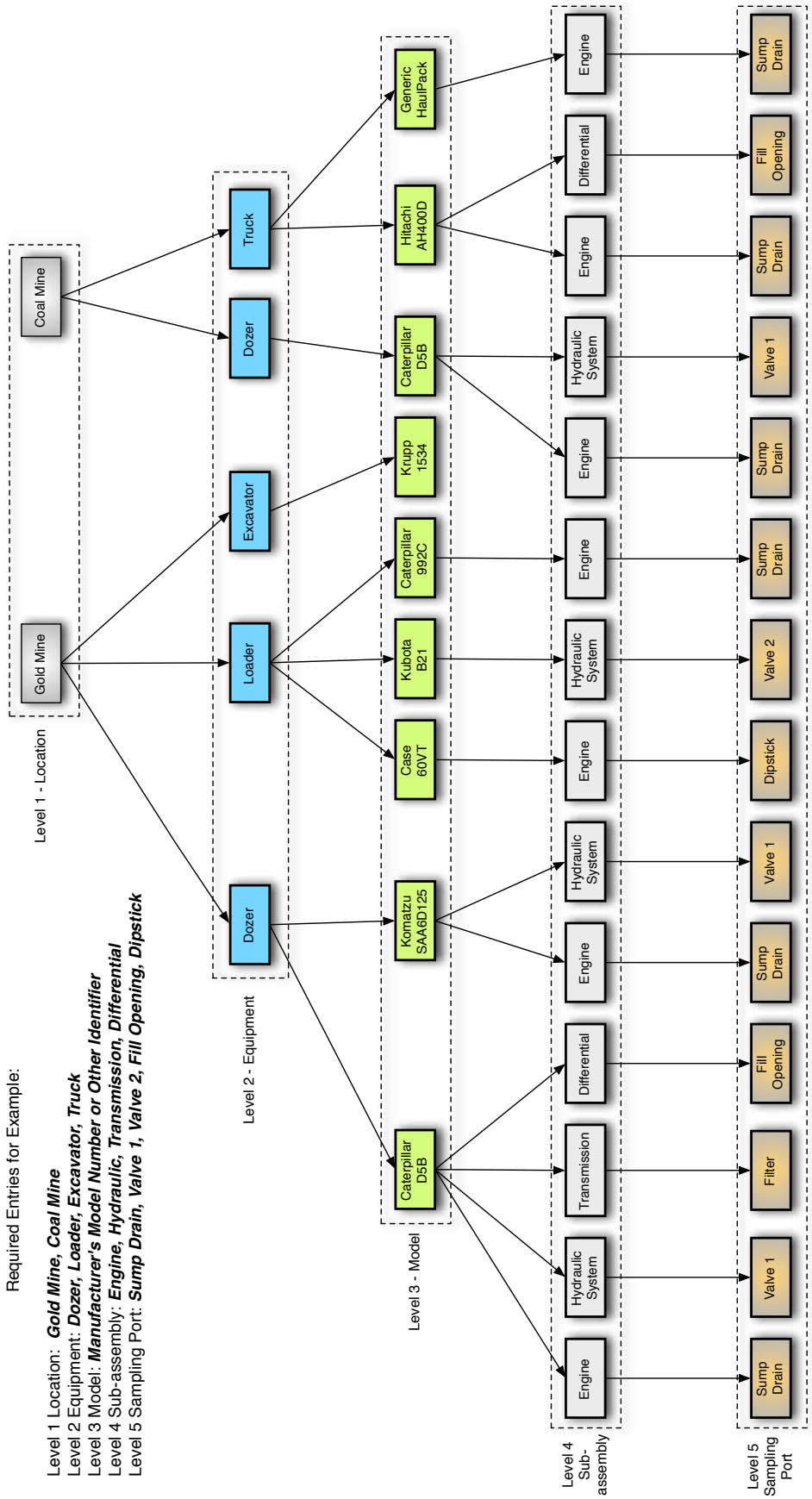


Figure 2.5-1, Decriptor Levels and Descriptor Flow Diagram

2.5.1.1 Add Descriptor Levels in FluidScan® Manager

To add descriptor levels to the FluidScan® Manager:

1. Open the FluidScan® Manager by double-clicking on its icon.

2. Select **Manage Asset Descriptors** from the "Assets" drop-down menu, Figure 2.5-2.

3. Since this is the first time descriptor levels are added, the "Existing Levels:" fields will be empty, Figure 2.5-3. Note the "Add New Level" area below the "Existing Level:" fields. This area has two empty fields, "New Level Number;" and "New Level Name:".

4. To add a level, type the appropriate number into the "New Level Number:" field. In our example, the first level is Number **1**.

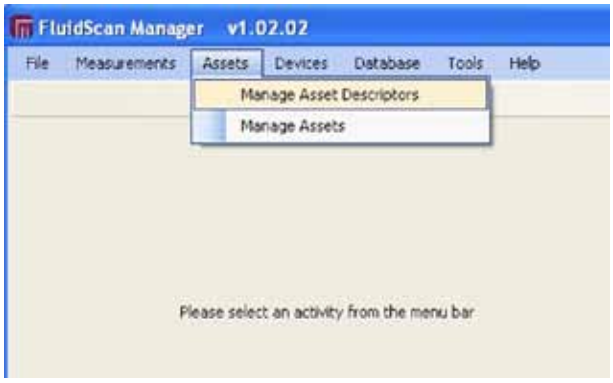


Figure 2.5-2, Manage Asset Descriptors Drop-Down menu

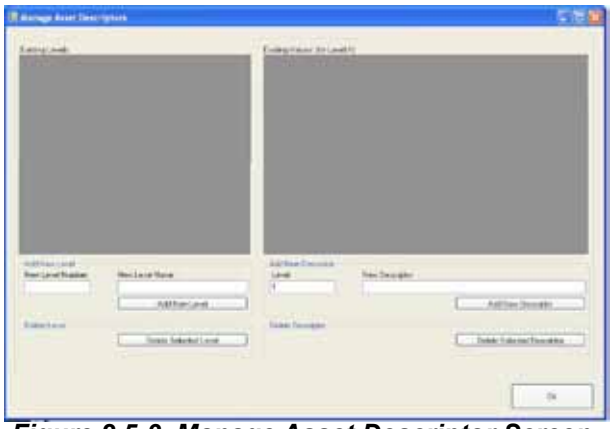
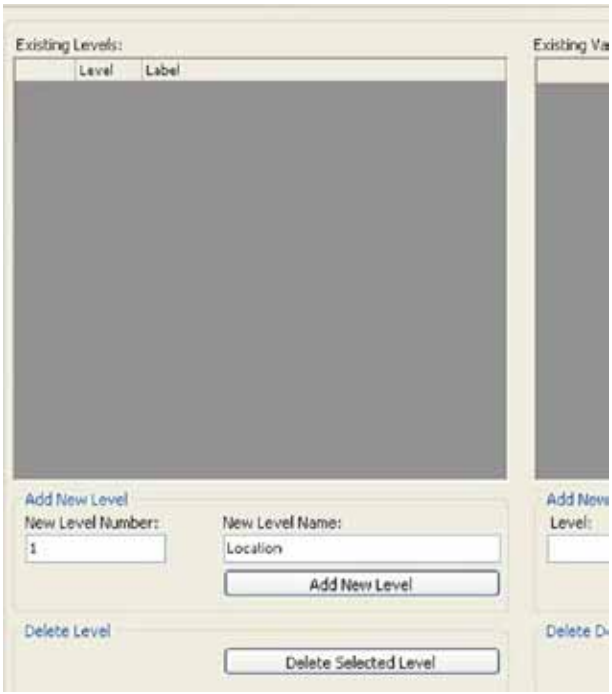


Figure 2.5-3, Manage Asset Descriptor Screen

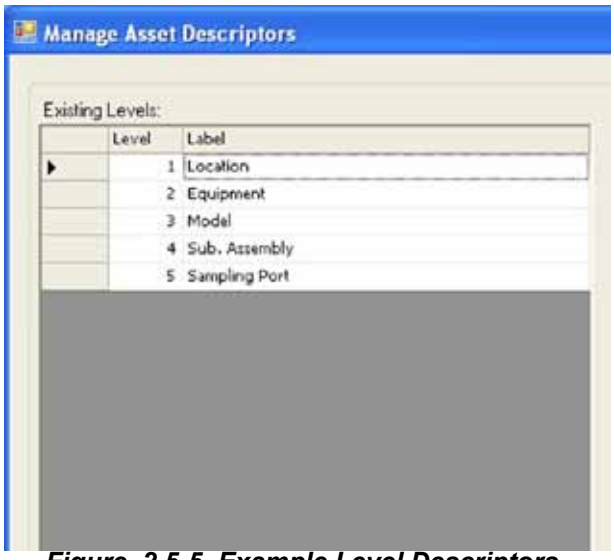
5. Next type the name of that level into the "New Level Name:" field. In our example the name of Level 1 is **Location**, Figure 2.5-4.

6. Click on the **Add New Level Button** to add and save the first level.

7. Repeat steps 4 through 6 until all the levels have been added. For our example, the screen with all entries looks like Figure 2.5-5.



Figure, 2.5-4, Add a Level Descriptor



Figure, 2.5-5, Example Level Descriptors

2.5.1.2 Add Descriptors in FluidScan® Manager

Now that the levels have been entered, descriptors can be added to further describe the selections within the levels.

To add descriptors to levels:

1. If FluidScan® Manager is not already open, start it by clicking on its icon.

2. Select **Manage Asset Descriptors** from the "Assets" drop-down menu, Figure 2.5-2.

3. Select an "Existing Level:" from those just entered by clicking on its name. This activates the "Existing Descriptors: (for Level X) section of the screen. In our example, click on the **Location** level.

4. Note the "Add New Descriptor" area below the "Existing Descriptors: (for Level X) fields. The level number will be entered automatically because the location was selected in the previous step. If it was not done so, type **1** into the Level: field.

5. Type the name of the first location descriptor into the "New Descriptor:" field. In our example, it is **Coal Mine**, Figure 2.5-6.

6. Click on the **Add New Descriptor** button to enter the descriptor.

7. Repeat steps 3 and 4 until all the descriptors have been added for the selected level. For our example, the screen should look like the one in Figure 2.5-7.

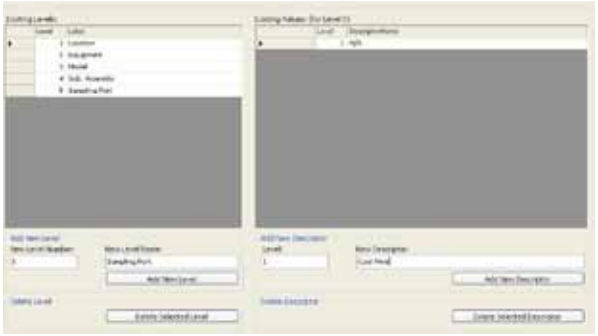




Table 2.5-7, Example of Asset Descriptors

8. Repeat steps 1 through 5 until all the descriptors are added for all the levels.

Additional descriptors can be added to levels at any time. For example, if at some point in time cranes are added to a mine, the descriptor "crane" can be added to the "Equipment" level. Similarly, descriptors can be deleted by selecting its name and clicking on the **Delete Selected Descriptor** button. Deleted descriptors will disappear from the "Existing Descriptors" screen, however, they will still be tied to the data for any analyses that were made with that descriptor.

2.5.2 Add Descriptor Levels and Descriptors to the FluidScan®

Descriptor levels and descriptors can be added into the software of the FluidScan. However, it is not quite as simple as adding them to the FluidScan® Manager software on your PC as described in Section 2.5.1. To assist with entering letters and numbers, a keyboard and mouse can be added by connecting them to the USB port located on the side of the FluidScan. The procedure with a keyboard and mouse is the same except in the steps described below, the extra actions to use the directional pad will be explained.

The steps below will use the example of 5 levels as described in Section 2.5.

2.5.2.1 Add Descriptor Levels to the FluidScan

To add level descriptors to the FluidScan:

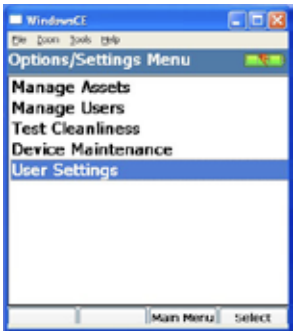
1. Turn **ON** the FluidScan® and log in. The Main Menu will appear.



2. From the "Main Menu", use the directional pad to select **Options/Settings** and press the **Select** soft button.



3. From the "Options/Settings" menu, use the directional pad to select **User Settings** and press the **Select** soft button.



4. From the "User Settings" menu, use the directional pad to select **Edit Descriptor Levels** and press the **Select** soft button.



5. The "Edit Descriptor Levels" figure shown below will appear. If necessary, use the directional pad to select the level you want to enter.



6. Press the **Edit** soft button to bring up the keyboard on the FluidScan® screen.



7. Use the directional pad and the **Select** soft button to spell the name of the level you are entering. Use the **Done** soft button when you are finished and the name you typed will be entered on the screen for the selected level. The next figure shows the first entry of our example of a Gold and a Coal Mine.



8. Use the directional pad to select the next level you want to enter and press the **Edit** soft button to bring up the keyboard on the FluidScan® screen.

9. Use the directional pad and the **Select** soft button to spell the name of the level you are entering. In our example, the next level is "Equipment".



10. Use the **Done** soft button when you are finished and the name you typed will be entered on the screen for the selected level. The figure shows the first two entries of our example.



11. Repeat Steps 7 through 9 until all the levels have been entered. In our example, the final screen after all five levels have been entered will look as shown in the figure.

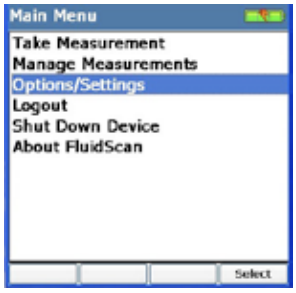


2.5.2.2 Add Descriptors to the FluidScan

Now that the levels have been entered, descriptors can be added to further describe the selections within the levels. To add descriptors to levels in the FluidScan:

1. Turn **ON** the FluidScan® and log in.

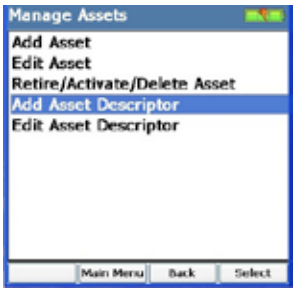
2. From the "Main Menu", use the directional pad to select **Options/Settings** and press the **Select** soft button.



3. On the "Options/Settings" menu, the first selection is "Manage Assets", press the **Select** soft button to select "Manage Assets".



4. From the "Manage Assets" menu, use the directional pad to select **Add Asset Descriptor** and press the **Select** soft button.



5. The next screen will show the levels previously added. In our example, the screen will look like the one below.



6. Select a level using the directional pad and press the **Select** soft button. A screen showing the existing descriptors for that level will appear. Since none have been added, the only one in the field is "N/A".



7. Press the **Edit** soft button to bring up the keyboard on the FluidScan® screen.

8. Use the directional pad and the **Select** soft button to spell the name of the level you are entering. For our example, we selected the

"Location" level and entered Coal Mine.



9. Press the **Done** soft button when you are finished and the name you typed will be entered into the "New Value" field on the bottom of the screen.



10. Press the **Save** soft button and "New Value" will be entered into the "Existing Values" field.

11. Press the **Done** soft button to return to the "Descriptor Levels" screen.



12. Repeat Steps 6 through 9 to add more descriptors. Additional descriptors can be added to a level by selecting it, or descriptors can be added to the next level by selecting it with the directional pad. Add the descriptors for all the established levels.

In our example, the last level was "Sampling Port" and three descriptors were added to this level. An example of the descriptors added to this level is shown below.



Additional descriptors can be added to levels at any time. For example, if at some point in time cranes are added to a mine, the descriptor "Crane" can be added to the "Equipment" level.

Descriptors can be deleted by selecting **Edit Asset Descriptor** from the "Manage Asset" selection. The procedure is similar to the one above, with the exception that a **Delete** button will be available on the "Existing Values" screen. Deleted descriptors will disappear from the "Existing Descriptors" screen. However, they will still be tied to the data for any analyses that were made with that descriptor.

2.6 METHODS TO ANALYZE IN-SERVICE FLUIDS WITH FluidScan®

The FluidScan® is a powerful analytical instrument capable of providing immediate and on-site analyses of fluids. Its detection capabilities can determine lubricant contamination, degradation and cross-contamination at the point of use by measuring key oil condition parameters in both synthetic and petroleum-based lubricants and fluids. Similar to FT-IR spectrometers, the FluidScan® will analyze in-service oils using the direct or subtractive methods as described in ASTM International Standard Practice E 2412. However, the FluidScan® has the additional advantage of also providing quantitative analysis of lubricants by applying "spectral matching" to fluids stored in its library.

NOTE: The method of analysis for an in-service oil sample is determined by and linked to an asset. For this reason, it is recommended that before assets are entered into the database, a user should review the lubricants that are used in these assets to determine the best method of analysis.

This section of the manual describes the four analytical methods that can be applied with the FluidScan® to analyze fluids, Figure 2.6-1. They are:

- **Standard Fluid Scan Method** – This is a quantitative method that provides analytical

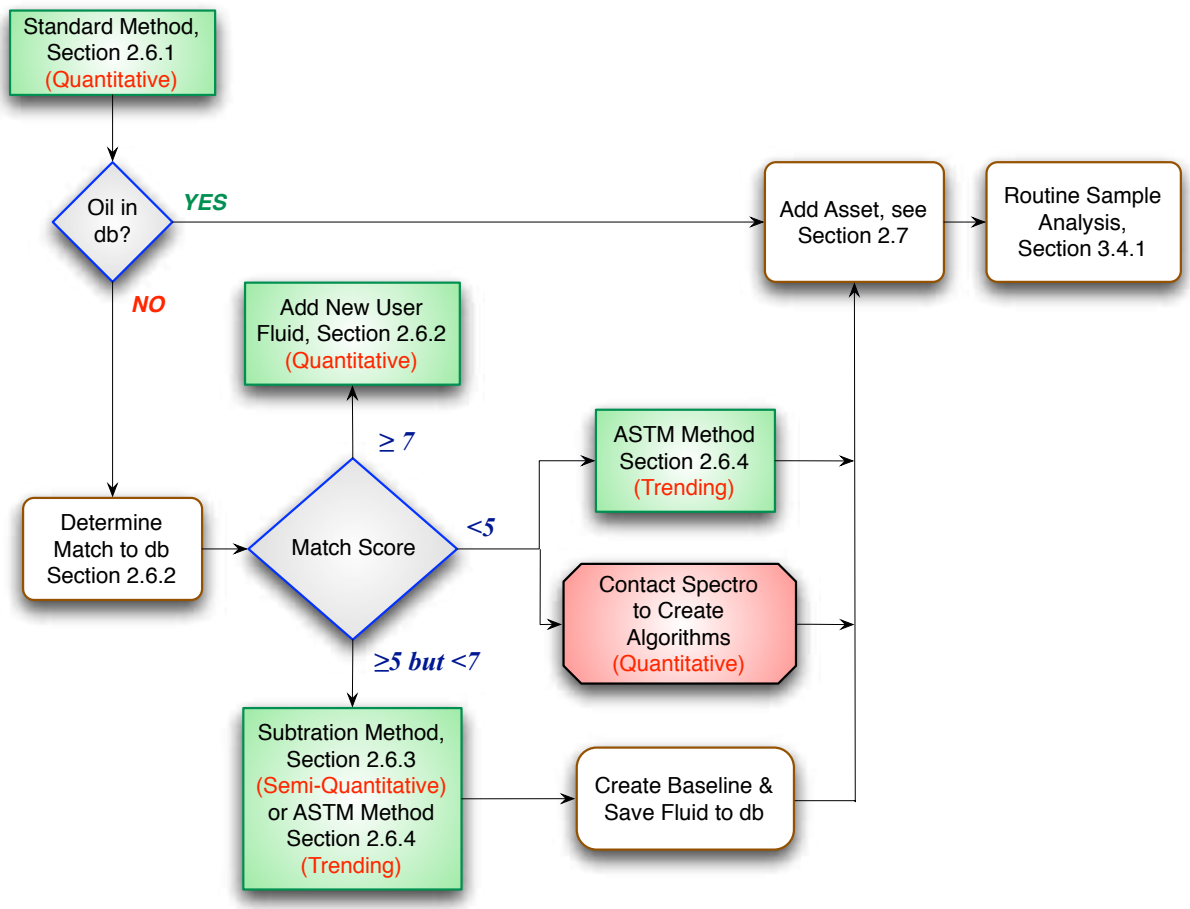


Figure 2.6-1, FluidScan® Methods to Analyze In-Service Oil Samples

results in standard units of measure. It is the preferred method of analysis. It requires that the spectrum of new, unused oil of the type later to be sampled from the asset (machine) to be monitored is stored in the FluidScan® library. See Section 2.6.1

- **New User Fluid Method** - This is also a quantitative method that provides analytical results in standard units of measure. It can be applied to oils that are not already in the FluidScan® library after a spectral score has determined that a new, unused sample of this oil has a greater than 7 (≥7) match score with an oil already in the FluidScan® library. The matching function requires new, unused oil. Matching does not work with an in-service (used) oil sample. After the new, unused oil is matched, the in-service (used) oil may then be measured to give quantitative results. See Section 2.6.2.
- **Subtraction Method** - This is a semi-quantitative method that provides analytical results in standard units of measure. It subtracts the spectrum of a stored, clean reference oil from the spectrum of an in-service oil. It is semi-quantitative because there is no guarantee that the stored spectrum from an oil is devoid of contamination or degradation, see Section 2.6.3.
- **ASTM Method** – This is a trending method based on changes to a fluid over time or distance traveled as described in ASTM E 2412, Standard Practice for Condition Monitoring of Used Lubricants by Trend Analysis Using Fourier Transform Infrared (FT-IR) Spectrometry, see Section 2.6.4.

Some users of the FluidScan® may wish to apply only the ASTM Standard Method for the analysis of in-service lubricants. This would be the case if routine trending of a fluid's properties is the only requirement. In those situations, proceed with Section 2.6.4.

The determination of an analytical method to apply to an asset is straightforward. The Standard Method can be used when a fluid is stored in the database. If not, the New User Fluid Method, Section 2.6.2 can be used to determine how good a new fluid's spectrum matches one or more in the FluidScan® database. The user can then save the new fluid's spectrum and apply either a quantitative (Section 2.6.2) or semi-quantitative method (Section 2.6.3) to in-service fluids based on the match. How well a fluid matches to the FluidScan® database is used to determine which method is best for analyzing the end-user's in-service oil samples.

- If the match is greater than 7 (≥7), the new fluid can be named and stored in the database, Section 2.6.2.
- If the match is between 5 and 7, the fluid can be named and stored in the database and the subtraction method can be used, Section 2.6.3.
- If there is no match or one that is less than or equal to 5 (≤5), the ASTM trending method can be used, Section 2.6.4. Families of fluids for the ASTM Method are in the FluidScan® database.

2.6.1 Standard FluidScan® Method – Quantitative Analysis

Quantitative analysis enables oil properties to be reported in quantifiable units and makes diagnosis easier to understand. End users and customers often like to know results in units they can comprehend. This is possible because the FluidScan® has stored in its memory algorithms for many common lubricant types. These algorithms provide a calibration for most lubricant types so that analytical results are given in physical units as follows:

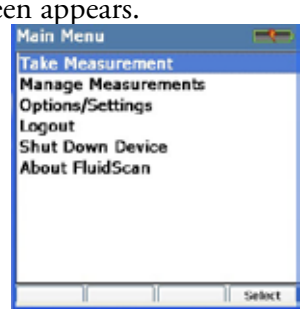
- TAN (mg of KOH per g)
- TBN (mg of KOH per g)
- Water (parts per million)
- Glycol (percent by weight)
- Soot (percent by weight)
- Incorrect Fluid (per cent by weight)
- Antioxidant Depletion (percent remaining)

Due to the large number of lubricant types and individual lubricants throughout the world, Spectro Inc. is continuously developing new algorithms for the FluidScan. When a customer has a lubricant that does not already have an algorithm stored in memory, contact Spectro Inc. about the process of creating an additional algorithm.

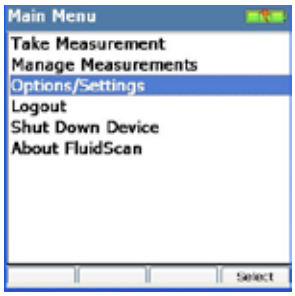
The Standard FluidScan® Method is based on the fact that quantitative analysis is possible with calibrations based on algorithms stored in the FluidScan's memory. If a fluid's calibration algorithms are stored in FluidScan® memory, the Standard FluidScan® Method can be applied to assets that use that fluid. The setup in FluidScan® is simple and straightforward. Algorithms are stored according to "Families" that contain "Fluids" typically associated with that family.

The procedure below describes how to view the families and fluids stored in your FluidScan. To view families of fluids and fluids stored in a FluidScan:

1. Turn **ON** FluidScan® by pushing down the ON/OFF button. The FluidScan® software will boot and after about 30 seconds the "Main Menu" screen appears.



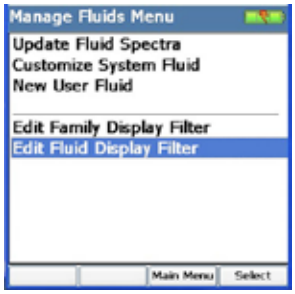
2. Using the directional pad scroll down to **Options/Settings**. To make the selection, push the right most soft button under the word **Select** on the bottom of the main screen.



3. The "Options/Settings Menu" screen appears, . Use the directional pad to scroll down to **Manage Fluids** and press the **Select** soft button.



4. The "Manage Fluids" screen appears. Using the directional pad scroll down to **Edit Fluid Display Filter** and press the **Select** soft button.



5. The next screen displays all the families of fluids with calibration algorithms stored in your FluidScan.



6. To view the fluids in a family, use the directional pad to scroll to the family and press the **Next** soft button. All the fluids in that family will be listed on the screen.



Upon determining that your fluid is in the database, the user can proceed to Section 2.7 to setup an asset that uses that fluid.

NOTE: It is good practice to perform the Spectral Match procedure for New User Fluids described in Section 2.6.2 even if your fluid is in the FluidScan® database. Theoretically, one would assume that a fluid with the same brand and name is identical throughout the world. Practically, however, that is not always the case and formulations might vary depending on external conditions such as the environment in which the fluid is used.

2.6.2 New User Fluid Method – Quantitative Analysis

This method allows the user to add a new fluid to the FluidScan® database if it is similar to one already stored in memory. The new fluid must be a new, unused oil of the type used in the asset being monitored. It cannot be a sample that has already been used.

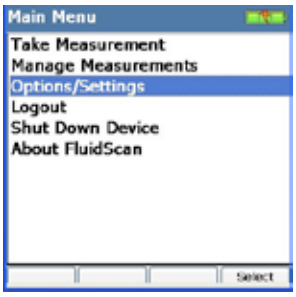
The method determines if a new fluid is similar to one already in memory. It is based on obtaining a match of the new fluid greater than 7 (≥7) to a fluid in the database. The user can then give the new fluid a unique name, select the relevant properties to monitor and if desired, edit the alarm limits.

The procedure to determine a match of new fluids to those in the FluidScan® database is as follows:

1. Turn **ON** FluidScan® by pushing down the ON/OFF button. The FluidScan® software will boot and after about 30 seconds the "Main Menu" screen appears.



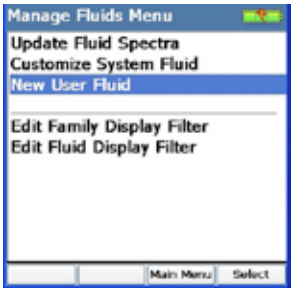
2. Using the directional pad scroll down to **Options/Settings**. To make the selection, push the right most soft button under the word **Select** on the bottom of the main screen.



3. The "Options/Settings Menu" screen appears, . Use the directional pad to scroll down to **Manage Fluids** and press the **Select** soft button.



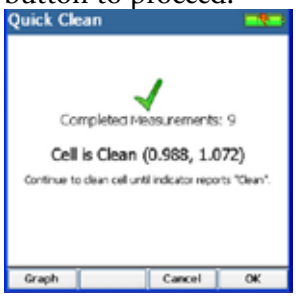
4. The "Manage Fluids" screen appears. Clean the cell and insert it into the "Home" position. Using the directional pad scroll down to **New User Fluid** and press the **Select** soft button.



5. The cell cleanliness test is now initiated and if it is not reported as "Clean", the cell must be cleaned until it is. See also Section 3.2 for cleaning the flip-top cell.



6. When the cell is clean, the screen below will appear to confirm that the FluidScan® is ready for a background measurement. Press the **OK** soft button to proceed.



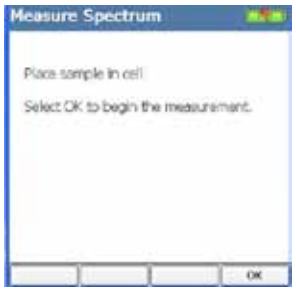
7. The background measurement starts and will take approximately one minute. A progress bar shows the measurement status.



When the background measurement is complete, press the **OK** soft button to proceed.



8. The FluidScan® is now ready to analyze the new fluid to determine a match to the database.



To load a sample in the flip-top cell follow the steps described in Section 3.3 and refer to Figure 3.3-1:

9. Press the **OK** soft button to start the analysis. A progress bar shows the measurement status.



10. The analysis time is approximately one minute. When the analysis is complete, the software compares the absorbance spectrum of the new sample to those in the database. Depending of the size of your database, this process may take several minutes.



11. When the spectrum match software search is complete, the FluidScan will display the matched Fluid Families arranged by score from highest to lowest. An example is shown below.



Note: To see a list of the specific fluids that have matched, select the Fluids soft button. See below.



If more than one fluid matched within a family, the software will select the fluid with he closest match. Using the directional pad, scroll to the best match greater or equal to 7 (≥7). To make the selection, press the Select soft button.

Note: To guarantee accuracy, select a fluid with the best match. The match score must be greater or equal to 7 (≥)7. If the score is gretar or equal to 5 (≥5) but less than 7, the subtraction procedure described in section 2.6.3 can be used to provide semi-quantitative analysis. The ASTM procedure is recommended if the score is below 5. If trending is preferred without quantitative analysis, the ASTM procedure may be used for any fluid even if its score is below 5.

12. A screen appears with the selected family (or fluid) that was selected. Press the OK soft button to confirm the selection.



13. The next screen provide a field for naming the new fluid.



Note the keyboard on the bottom of the screen. The directional pad is used to select the letters for the fluid name. The letter or key selected appears in the box above the keyboard and the selection is made when the **Select** soft button is pressed. To start, use the directional pad to select the **Shift** key and press the **Select** soft button, so that the first letter of the user is capitalized. Next, select the remaining letters using the directional pad and the Select soft button to spell the desired name.

13. When the Fluid Name has been spelled out, press the **Done** soft button to select it. The next screen confirms the new fluid's name and provides an opportunity to edit it. If it is correct, press the **Next** soft button.



14. The properties that can be analyzed and tracked for the new fluid are listed in the next screen. The default is to select all. The directional pad and the **Check** soft button can be used to deselect any property. Press the **Next** soft key to proceed.



15. The alarm limits from the matched fluid are now available to be edited or accepted.



Use the directional pad to select an alarm limit to edit and press the **Next** soft button to accept the alarm limits.

16. The measured properties of your new fluid are now displayed and can be edited if necessary.



NOTE: The measured properties of the fluid that has been analyzed are based on a match to a fluid in the database. Although there is a good match based on the spectrum, it is possible that actual formulations of the fluid differ.

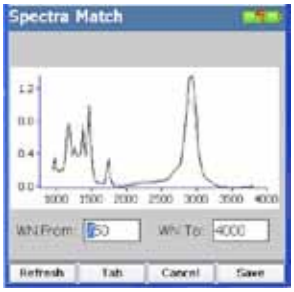
If the actual concentrations of your new fluid's properties are known, the FluidScan® software provides a means to make corrections to improve accuracy. For example, if the measured TAN is 10.1 as shown in the illustration, but the manufacturer's specification sheet for your fluid has a TAN of 8, the TAN for the new fluid can now be edited and changed to 8. The accuracy of future analyses that are made based on your fluid will

thus be improved. Other properties that you wish to edit based on manufacturer's specifications, or other analytical techniques, can be made in the same manner.

In the above example, glycol is reported as 0.4%. At this time, it would be desirable to reset the glycol value to 0.0% since the new, unused oil should not contain any glycol. Likewise, soot is showing a slightly negative value of -0.02%. Soot can be set to 0.0% as well.

Select **Next** if yu are satisfied with the results or **Edit** if you wish to change one or more.

17. The scans of the matched and new fluid appear on the screen.



If you are satisfied with the match, the properties to be measured, the limits, and the new fluid's name, press the **Save** soft button.

18. The next screen confirms that the new fluid has been saved to the FluidScan's memory with the new name and selected properties and alarm limits.



After the new oil has been saved to the fluid library, the user can proceed to Section 2.7 to setup an asset that uses that fluid.

NOTE: Please be aware that even though a New User Fluid has been added to the FluidScan® database, this new New User Fluid is not actively part of the FluidScan® database for the purpose of future fluid matching. For example, a New User Fluid, Oil A, is run and added to one of the Oil Families. Perhaps the end-user receives another batch of Oil A from the supplier. If the end-user runs this new batch of fluid using the New User Fluid routine, the match list will not include Oil A even if the new batch fluid is identical to the original fluid.

This is purposely done to protect the integrity of the FluidScan® database. Should a spectrum be collected with bubbles, a bad background, or from a contaminated sample the quality of the match for the entire database will be compromised. Therefore, it is not possible for the end-user to add new fluids to the library of fluids in the FluidScan® database that participate in the spectral matching function.

If the end-user wishes to check if the new batch of Oil A is the same as the old batch of Oil A, the end-user can apply the Subtraction Method, Section 2.6.3. In this case, the reference fluid is Oil A (as entered previously as a New User Fluid), and the new batch is added as an Asset in the FluidScan® Asset Database. See Section 2.6.3.

2.6.3 Subtraction Method – Semi-Quantitative

This method should be used if the New Fluid Method as performed in Section 2.6.2 results in a match score between 5 and 7. The user can store the spectrum in FluidScan® for use with the subtraction method and give it a unique name, select the relevant properties and, if desired, edit the alarm limits.

The subtraction method requires that the spectrum of a clean oil, identical to the in-service oil is stored in the FluidScan. The spectrum from the new, unused oil is then subtracted from the analysis of the in-service oil and the results are the differences between the two. The resulting absorbance is equal to the amount of the properties in the fluid and can be referenced to an existing cali-

bration curve.

CAUTION: The subtraction method is semi-quantitative as there is no guarantee that the new oil stored in memory for the subtraction reference is clean and devoid of contamination. For example, if the new oil spectrum saved in memory contains 50 PPM of water, that becomes the zero point for water. All analyses of in-service oils from which the reference is subtracted will then have water analyses that have been reduced by that 50 PPM.

To set up a fluid for analysis using the Subtraction Method, perform the New User Fluid Procedure described in Section 2.6.2 in order to determine the degree that the referenced fluid matches a fluid in the FluidScan® database. If the match score is between 5 and 7 continue with steps 11 to 17 to select a match, give it a name, select the properties and, if necessary, edit the limits. The newly named fluid is then saved for use as a reference fluid when future samples are analyzed using the subtraction method.

The Subtraction Method differs from all others in that the method is activated through the selection of the "Calculate Using Subtraction Method" check box when setting up an asset, Sections 2.7.1, Step 6, or Section 2.7.2, Step 7.

The subtraction method can also be used at any time during routine analysis when measuring a fluid by itself when it is not tied to an asset. The Measure Fluid procedure Section 3.4.2 allows the user to select the "Calculate Using Subtraction Method" for an analysis when the sample information is entered.

2.6.4 ASTM Method – Trending

Similar to FT-IR spectrometers, the FluidScan® will analyze in-service oils using the direct or subtractive methods as described in ASTM International Standard Practice E 2412. The direct method uses no references and merely trends results over time or distance traveled. Variations in results are then indicative of changing physical properties or contamination.

When the decision is made to use the ASTM methods based on E 2412, set up the asset as described in Section 2.7 and select the appropriate ASTM fluid from the FluidScan® library.

2.7 ADD ASSETS ON FluidScan® MANAGER AND TO FLUIDSCAN

The FluidScan® measures physical properties of lubricants taken from one or more systems on a piece of equipment. For example, assets may be a bulldozer's engine, transmission and hydraulic system. The measurements taken with the FluidScan® therefore correspond to the descriptor levels of that asset. This way, if for example, an engine is removed from bulldozer A and placed into bulldozer B, the analytical results stay in the same record. An asset is typically identified by a serial number or similar identifier. When the measurement is made, the resulting data will be entered into the analytical history for that asset. For this reason, the asset information and the corresponding descriptors must be in the database so that the measurement can be included into its history.

Information on assets can be entered on the FluidScan, however the process is cumbersome and requires extensive use of the directional pad. It is much easier and efficient to enter the information for assets into the FluidScan® Manager software on your PC and then to synchronize the data with your FluidScan. Both methods to add assets will be described in this section.

2.7.1 Add Assets to FluidScan® Manager

The example of a mine with two locations will be used to describe the procedure of adding assets to the FluidScan® Manager.

1. Open the FluidScan® Manager by double-clicking on its icon.

2. On the main menu, select **Manage Assets** from the "Assets" drop-down menu, Figure 2.7-1.

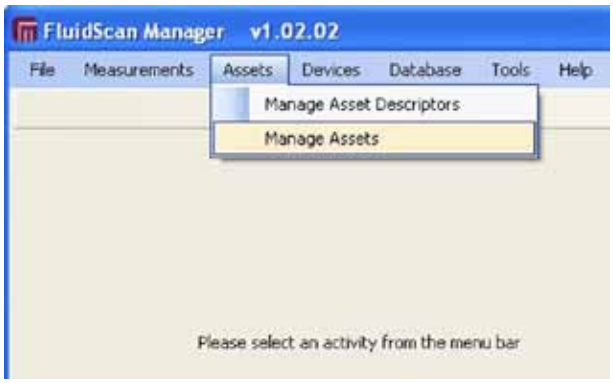


Figure 2.7-1, Manage Assets Drop-Down Menu

3. The Manage Assets screen opens, Figure 2.7-2. There will not be any assets listed the first time this screen is opened, but they will be listed in the "Matching Assets" field as assets are added. Note that the levels entered previously in our example appear on the left hand side with drop-down menus that contain the asset descriptors entered previously.

NOTE: The Manage Assets screen can be used to search for existing assets with the search parameters from the selected level drop-down menus.

4. Click on the Add button on the bottom of the screen to enter information on a new asset.

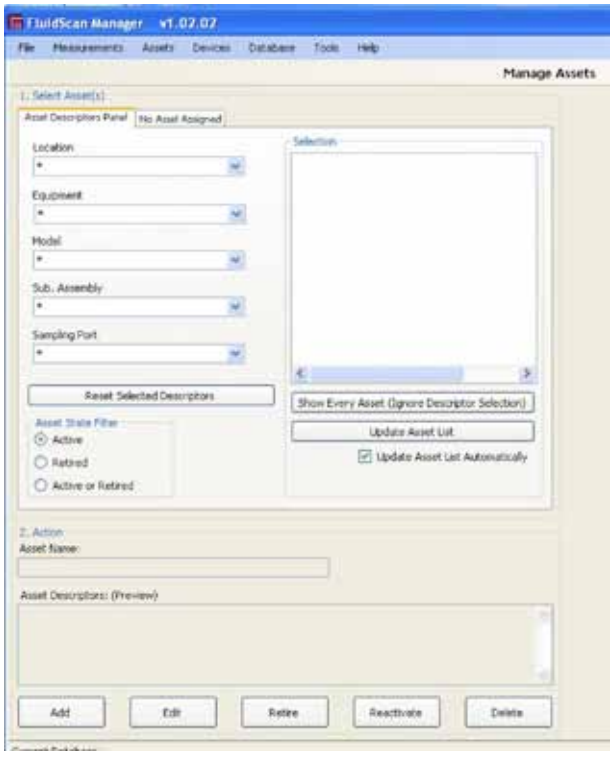


Figure 2.7-2, Manage Assets Screen

5. The screen shown in Figure 2.7-3 will appear (entries made from our example). The "Asset Editor" tab is the default and will be selected. Enter the asset's unique identifier into the **Asset Name** field. In our example, it is a serial number.

6. Select the appropriate descriptors for that asset from the drop-down menus for each level descriptor.

NOTE: If there are more than 4 descriptor levels, the scroll bar to the right of the descriptors is active and must be used to view the remaining levels.

NOTE: If the Subtraction Method as described in Section 2.6.3 is to be used on an assets's fluid, the "Use Spectral Subtraction" box must be selected and checked at this time.

7. The final selection is the fluid (oil) type removed from the asset. Note that there are two tabs. A fluid can be located by its "Family" and then the "Fluid" in that family, or they can be selected from an alphabetical list from the "Fluids Sorted Alphabetically" tab. Select the fluid type by either method.

8. Click on the **OK** button in the lower right hand corner when all the information has been added.

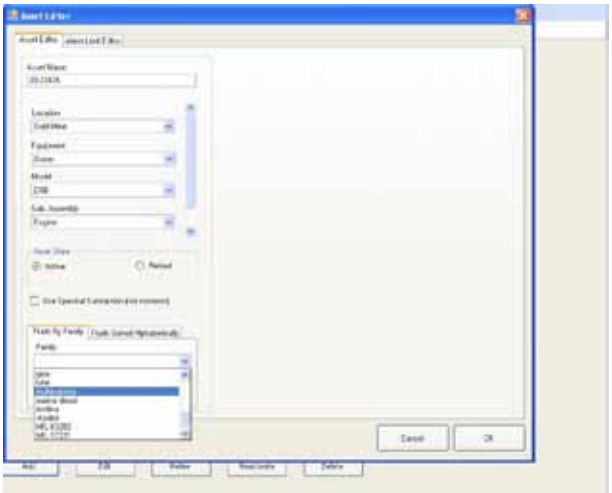


Figure 2.7-3, Manage Asset Editor Screen

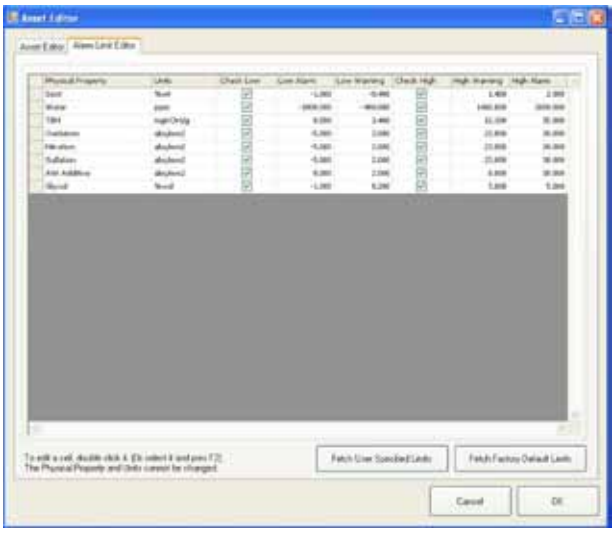
9. Select the "Alarm Limits Editor" tab. Some substances (fluids) are provided with default alarm limits, Figure 2.7-4. They can be accepted or modified at any time by the customer.

10. Read the instructions on the tab to edit the alarm limits. Click on the **OK** button when you are finished.

11. Repeats steps 3 through 10 to add additional assets.

12. The screen shown in Figure 2.7-5 is an example of multiple assets that have been added to the database.

13. Synchronize the FluidScan® Manager with the FluidScan, Section 2.2.2, so that the assets that were added also appear on the FluidScan.



2.7-4, Asset Limit Editor Screen

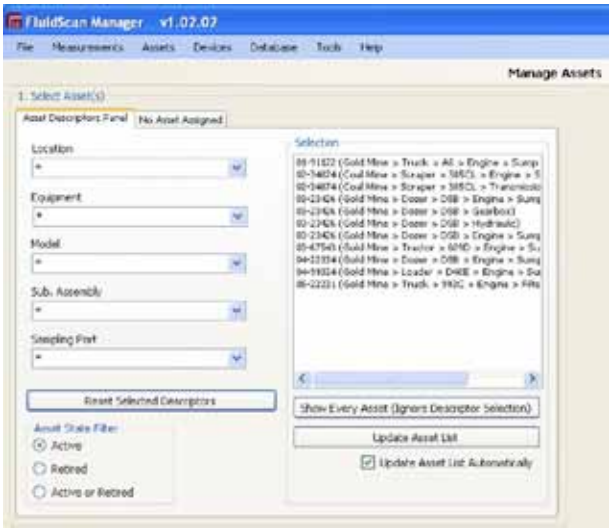


Figure 2.7-5, Existing Asset Example

2.7.2 Add Assets to the FluidScan®

Assets can be added into the software of the FluidScan. However, it is not quite as simple as adding them to the FluidScan® Manager software as described in Section 2.6.1. To assist with entering letters and numbers, a keyboard and mouse can be added by connecting them to the USB port on the side of the FluidScan. The procedure with a keyboard and mouse is the same except in the steps described below, the extra actions to use the directional pad will be explained.

The example of a mine with two locations will be used to describe the procedure of adding assets to the FluidScan.

1. Turn **ON** the FluidScan® and log in.

2. From the "Main Menu", use the directional pad to select **Options/Settings** and press the **Select** soft button.

3. On the "Options/Settings" menu, the first selection is **Manage Assets**, press the **Select** soft button.



4. On the "Manage Assets" menu, the first selection is **Add Asset**, press the **Select** soft button.



5. The next screen has a field into which the name or serial number of the asset can be entered.



Press the **Edit** soft button to bring up the keyboard on the FluidScan® screen.

6. Use the directional pad and the **Select** soft button to spell the name and/or serial number of the asset.

7. Press the **Done** soft button when you are finished and the name you typed will be entered in the "Asset Name/Serial No:" field in the center of the screen as shown in the example.



NOTE: If the Subtraction Method as described in Section 2.6.3 is to be used on an assets's fluid, the "Calculate Using Spectral Subtraction" box must be selected and checked at this time.

8. Press the **Next** soft button to proceed to the descriptors that will be associated with this asset. The first to appear is Level 1 which is "Location" in our example.

9. Use the directional pad to select one of the descriptors for the "Location". In our example, we selected **Mine 1**.

NOTE: Other than the descriptors already entered for the level, it is also possible at this time to add a new descriptor by selecting "Add New" or to temporality identify the level as "N/A" (not applicable).

10. Press the **Select** soft button and the screen will advance to the next descriptor Level.



11. Use the directional pad to select one of the descriptors for the "Equipment". In our example, we selected **Tractor**.

12. Press the **Select** soft button and the screen will advance to the next descriptor Level. In our example, the next level is "Model".



Use the directional pad to select one of the descriptors and press the **Select** soft button.

13. Repeat, for all Levels, the use of the directional pad to select descriptors associated with the asset followed by the **Select** soft button to enter it into the database.

14. When all the descriptors have been se-

lected, the next screen to appear will ask you to "Select the Fluid Family". This is a type of fluid family and not a specific fluid name.



15. Use the directional pad to select the appropriate family for the asset and press the **Next** soft button.

16. If the "Fluid Family" has multiple fluids in the data base, they will appear on the next screen.



Use the directional pad to make a selection followed by pressing the **Next** soft button. In this example, there is only one type of diesel oil.

17. The default limits for the fluid will appear in the next screen. An example is shown below.



These limits can be selected with the directional pad and changed by selecting the **Edit** soft button, or they can be accepted by selecting the **Next** soft button. If you prefer to accept the limits, use the **Next** soft button to jump to step 21, or to edit alarms continue with step 18.

18. To change alarm limits select the property you wish to change using the directional pad followed by the **Edit** soft button. A screen similar to the one below will appear depending on the property selected, in the example it is 'Soot".



19. Use the **Check** soft button to select a limit and the **Tab** soft button to skip through the fields. The fields can be edited and changed by selecting a digit with the directional pad and then by using the up or down directional pad to increase or decrease the number.

NOTE: Analytical results that exceed a limit will appear red on the readout screen and results that exceed the warning limit will appear yellow.

20. Select the **Done** soft button to save the changes and return to the properties screen to edit more properties or to accept all by pressing the **Next** soft button.

21. The "New Asset Summary" screen similar to the example below will appear.



Use the **Back** soft button to make additional changes, or if you are satisfied, use the **Save** soft button to return to the "Manage Assets" screen.

This completes the procedure to add assets to the FluidScan® software.

22. Synchronize the FluidScan® with the FluidScan® Manager, Section 2.2.2, so that the assets that were added also appear on the FluidScan® manager software.

2.8 ITEMS INCLUDED AND DELIVERED WITH FLUIDSCAN

The FluidScan® is delivered in its own transit case, Figure 2.8-1. The case includes the FluidScan® and all of its accessories. A separate sampling starter kit that contains pipettes, sample bottles and cleaning gauze is also supplied .

The items included in the transit case are listed in the table on the net page.

P/N	Description
FL100	FluidScan® Base Spectrometer
FL200	Flip-Top Cell Assembly
FL320	Software CD, FluidScan® Manager (for your PC)
FL305	FluidScan® USB Flash Drive
FL330	FluidScan® Mobility Case
M68270	Cable USB A-B 1.0 meter
FL350	Manual Handheld Lubricant Condition Monitor
P-10719	Universal Battery Charger - Power Supply
FL360	Disposable Non-abrasive Cleaning Pads (pkg/25)
FL310	IR Check Fluid, 10 ml



Figure 2.8-1, Opened FluidScan® Carrying Case

This Page is Intentionally Left Blank

Chapter 3

Routine Operations

WARNING: Lubricating oil, including MIL-PRF-7808 and MIL-PRF-23699, frequently contain additives which are poisonous and could be absorbed through the skin. Do not allow oil to remain on skin any longer than necessary.· Oil is a skin irritant and if oil gets on your skin, wash thoroughly. Rubber gloves should be worn whenever lubricating oil is handled. If oil soaks into clothes, change clothes immediately.· Oil gives off fumes that can cause injury to personnel. Use oil in a well-ventilated area.

3.0 ROUTINE OPERATIONS

The FluidScan® does not require calibration and is always ready to analyze an oil sample. This section of the manual describes how to perform routine sample analysis with the FluidScan, how to synchronize the data with the FluidScan® Manager and how to perform basic data maintenance.

***NOTE:** The Set-up procedure described in Section 2 needs to be performed before any samples can be analyzed.*

CAUTION: Oil can soften paint. If oil drips on painted surface of equipment, wipe up immediately with a clean cloth or paper towel.

3.1 TURNING ON FLUIDSCAN

FluidScan® is turned on by pressing the **ON/OFF** button on the control panel. During the startup booting process, the software will perform diagnostics and initial user tests to ensure that the instrument is in an operational state and will warn the user of possible failure(s). The tests and actions to take based on the results are listed below.

1) Battery Voltage. The unit will compare the current supply voltage against the minimum permissible operating voltage. Should the voltage be below the acceptable minimum, the user will be told of the problem and the instrument shuts down.

2) Temperature. The unit will compare the current operating temperature against the minimum and maximum permissible operating temperatures. Should, the current temperature fall outside of the acceptable range, the user will be warned of the danger. However, the unit will not shut down.

3) Data Base. The unit will check to see if a data base of the appropriate format is present. If a data base is not present or it is of an unusable format, the user is told of the error and the instrument shuts down.

When the FluidScan® has started up successfully, the user is required to Log in. The user is presented with a list of active users and must select one from the list. The last user to operate the instrument is presented as the default choice. If only one active user exists, that user is selected by default without presenting the log in screen. The instrument then proceeds to the "Main Menu".

3.2 CELL CLEANLINESS

In order to provide accurate data, the FluidScan's flip-top cell must be clean and free of any residual sample or foreign material. A cleanliness test is performed automatically prior to an analysis to confirm the cell is clean. A dedicated cleanliness test can also be performed at any time by selecting it through the FluidScan® software.

The routine analysis procedure in Section 3.3 includes a step on cleaning the cell with a clean cloth or gauze after an analysis. This cleaning routine suffices during routine use. However, if a cell is extremely dirty and the cleaning procedure needs to be performed, the steps are listed below.

1. Turn **ON** the FluidScan® and log in. The Main Menu will appear.



2. From the "Main Menu", use the directional pad to select **Options/Settings** and press the **Select** soft button.



Note on Flip Top Cell Cleaning Procedure

The Flip top cell must be cleaned between samples and also before a background measurement is taken. The cell needs to pass the FluidScan® factory cleanliness thresholds before a background is taken. To ensure the most accurate data the cell should be totally free of any residual oil films. Cleaning between samples does not need to be as thorough as the background measurement and a small residual film of oil should not affect the accuracy of the measurements. It is however recommended that the cleaning procedure outlined below remain the same for both backgrounds and for subsequent sample analysis between background measurements.

The cell can be cleaned with either a disposable non-abrasive cleaning pad supplied with the FluidScan® or a clean cotton cloth – both provide suitable material which picks up the oil from the windows and also readily absorbs oil.

The cleaning method that has been proven to provide the easiest and quickest results involves removing the initial oil drop with a swipe of the cleaning material followed by successive swipes with clean areas of the material that do not contain oil. This process should be repeated until no visible residue is left on the window. You will find that more viscous oils like heavy gear oils require more swipes than a less viscous hydraulic oil. This cleaning process is used commonly to clean optical surface with alcohol to remove smudges and debris from lenses. Do not rub the cleaning material back and forth across the window to clean it, as this will leave a residue behind that may cause the cleanliness check to fail.

It is also recommended NOT to use volatile solvents routinely like IPA or Heptane to clean the window. The Flip Top cell is not sealed like a standard flow cell. The solvent vapors left behind will escape into the optical path and absorb IR light that will cause the cell to read dirty even though it maybe perfectly clean and free of oil and solvent.

In some rare cases it maybe necessary to use an oil solvent like Heptane to remove stubborn residue from the window if it cannot be removed using the conventional method. In this case we recommend leaving the Flip Top Cell open to dry for approximately half an hour after it has been cleaned with solvent

3. From the "Options/Settings" menu, use the directional pad to select **Test Cleanliness** and press the **Select** soft button.



4. The system tests cell cleanliness.



5. The system will notify you if the cell is dirty and needs to be cleaned.



6. To clean the cell, grasp the flip-top cell with two fingers and pull straight up from its "home" position.

7. Flip the cell forward and push down lightly until it locks in the "load" position.

8. Open the cell by flipping the top half away from the bottom half. The bottom half will remain locked in the load position.

9. Use one of the disposable non-abrasive cleaning pads supplied with the FluidScan® or a clean cloth or gauze to clean the cell, Figure 3.2-1. Normally a clean cloth or gauze is sufficient to clean a cell. However, after analyzing some very contaminated and degraded fluids, a few drops of the FluidScan® cleaning solution may be required to thoroughly clean the cell.

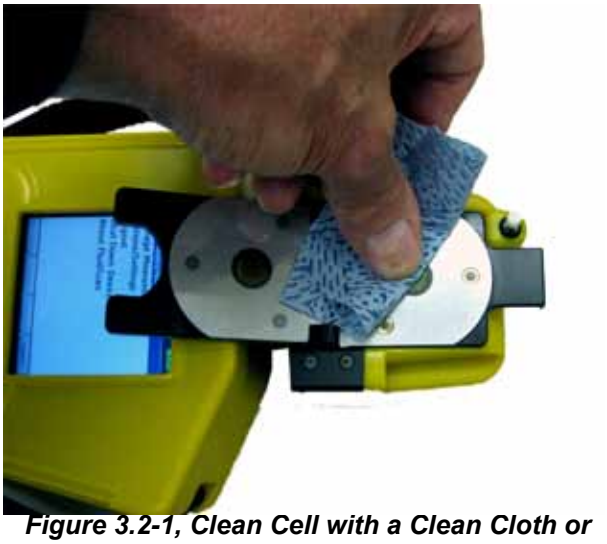


Figure 3.2-1, Clean Cell with a Clean Cloth or Gauze

CAUTION: If a cleaning solution is necessary, use only the FluidScan® cleaning solutions mentioned in the "Note on Flip Top Cell Cleaning Procedure" on page 36..

10. Close the cell and grasp the closed cell and raise it up from the "load" position and lower straight down until it is seated in the "home" position.

11. Repeat the cleaning process if necessary until the cell is reported by the test as "Clean". See also Section 5.1, Cleaning Windows, if the cleanliness test continues to fail.

3.3 LOADING THE FLIP-TOP CELL WITH AN OIL SAMPLE

The FluidScan® uses a unique and patent-pending flip-top cell to analyze fluid samples. The cell's design makes it easy to load a sample and to clean the cell afterwards.

The procedure below describes how to load a sample into the flip-top cell, refer also to Figure 3.3-1.

1. Grasp the flip-top cell with two fingers and pull straight up from its "home" position.

2. Flip the cell forward and push down lightly until it locks in the "load" position.

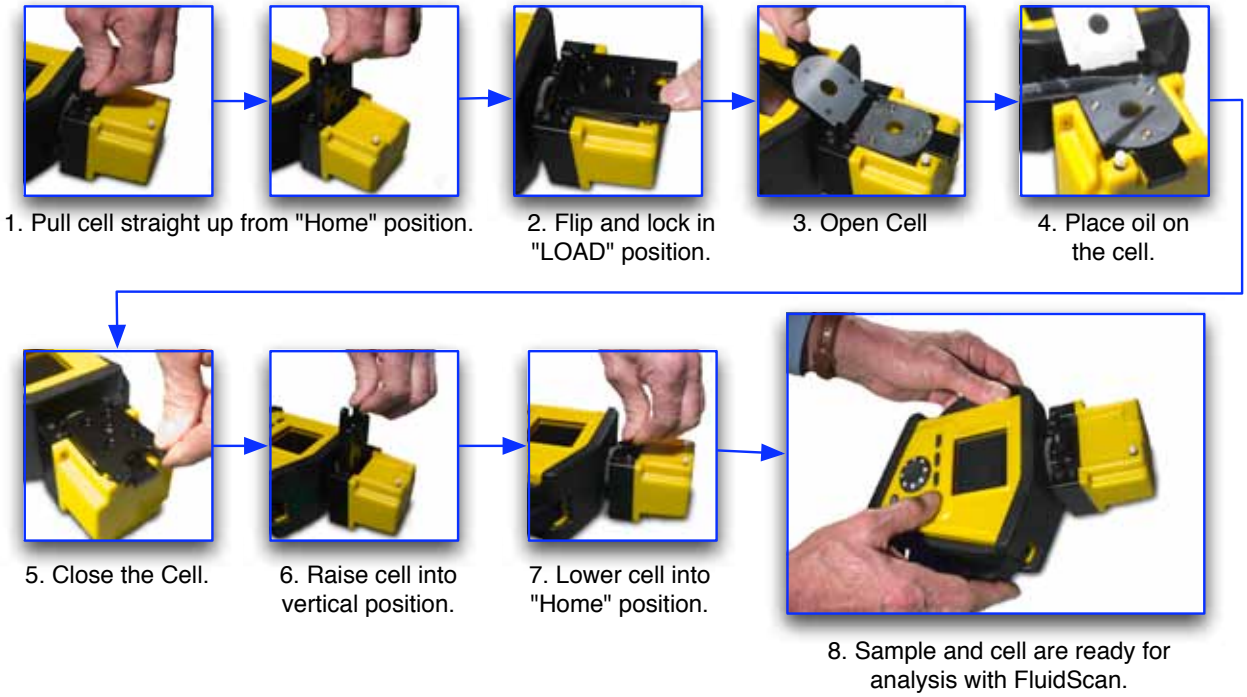


Figure 3.3-1, Loading an Oil Sample into the Flip-Top Cell

3. Open cell by flipping the top half away from the bottom half. The bottom half will remain locked in the load position.

4. With a pipette (or dip-stick), place 1 to 2 drops of oil on the bottom half of the cell to just cover the window.

5. Close the cell by slowly lowering the top half until it rests on the shock absorber.

CAUTION: Do not force the halves together. The cell's shock absorber will slowly lower the top half of the cell onto the bottom. This takes only a few seconds but is extremely important because it eliminates air bubbles.

6. Grasp the closed cell and raise it straight up from the "load" position. While in the raised position, inspect the cell through the windows to confirm that there are no air bubbles present. If there are air bubbles, open the cell, wipe with a clean cloth or gauze pad and repeat step 5.

7. Lower the cell straight down until it is seated in the "home" position.

8. The cell and the sample are now ready for analysis.

9. After the analysis is complete, open the cell as in steps 1 to 3 above and wipe clean with a clean cloth or gauze pad. See also Section 3.2 for Cell Cleanliness. The cell is now ready for the next sample.

3.4 ROUTINE SAMPLE ANALYSIS

The FluidScan® software provides the user with three alternative routines with which to analyze a sample. The normal method is "Measure Asset" which adds the sample's analysis to that asset's descriptor structure. The second method is "Measure Fluid" which can be used to simply analyze a sample without the need to tie it to an assets descriptor structure. The third method is "Validate Fluid Identity" for quality control or to confirm that a suspect fluid is what you believe it to be.

3.4.1 Measure Asset

The "Measure Asset" menu selection provides a means to analyze a sample and to associate that analysis with an existing descriptor structure. As described in Section 2.5, the descriptor structure contains the information needed to process, iden-

tify, and organize the measurement.

The actual sample analysis procedure of the FluidScan® is the same for assets and for fluids, the difference lies only in how the data is stored after the sample is processed. To analyze a sample and to store the data with an asset:

1. Turn **ON** the FluidScan® and log in. The Main Menu will appear.



2. On the "Main Menu", the first selection is **Take Measurement**, press the **Select** soft button.

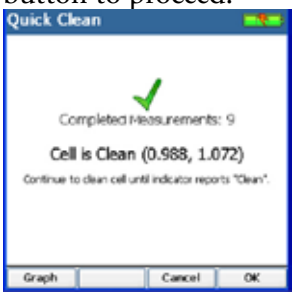
3. On the "Take Measurement" menu, use the first selection, **Measure Asset**, press the **Select** soft button.



4. The cell cleanliness test is now initiated and if it is not reported as "Clean", the cell must be cleaned until it is. See also Section 3.2 for cleaning the flip-top cell.



5. When the cell is clean, the screen below will appear to confirm that the FluidScan® is ready for a background measurement. Press the **OK** soft button to proceed.



6. The background measurement starts and will take approximately one minute. A progress bar shows the measurement status.

Why is there a Background Measurement?

The background measurement is nothing more than an analysis performed with the FluidScan® while the flip-top cell does not contain a sample. In other words, it is the spectrum generated from the components in the optical path that are not associated with an oil sample. When an oil sample is analyzed, the background is subtracted resulting in improved accuracy.

The current background spectrum is lost when the instrument is turned OFF, the operating temperature has changed more than 2°C, or if more than 30 minutes elapsed. The user must always record a background spectrum prior to collecting the first measurement after turning the instrument on.

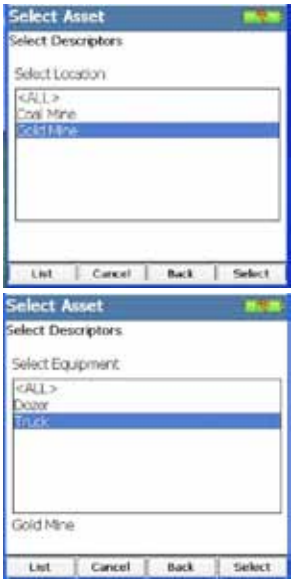
Assuming the background spectrum doesn't change, the same background spectrum can be applied to any sample measurement. However, in order to help ensure that the background spectrum is current, the user is required to record a new background spectrum every so often, or if the temperature change between the current instrument temperature and the temperature at the time the last background was



When the background measurement is complete, press the **OK** soft button to proceed.



7. The software now provides a series of steps so that the sample you are about to analyze is tied to the appropriate asset from which it was taken. The software sequences through the asset descriptor levels that were entered previously and allows the user to select the appropriate one. In the example, we have been using to describe samples from a mine operation, the sequence might look like the one below. Press the **Select** soft button after each selection.







Note that the descriptor levels appear at the bottom of the screen after they have been selected.

8. When all the fixed information on asset descriptors have been selected, the variable on the sample can be entered. It consists of:
a. hours on the lubricant,
b. the date the sample was taken, and
c. the sample ID.



a. For the "Sample ID" field, a unique alphanumeric entry can be made to further identify the sample. Use the Edit soft button and the keyboard on the screen to enter the sample ID. The entry can also be left blank.

b. Next, the date the sample was taken is entered in the same manner as the hours on the lubricant. The current date is the default. To change the date, use the Tab soft button to select the "Sample Date" field and the directional pad to select and change the day, month and/or year. Up and down will increase or decrease the selected number, and the left and right but-

tons will shift between day, month and year.

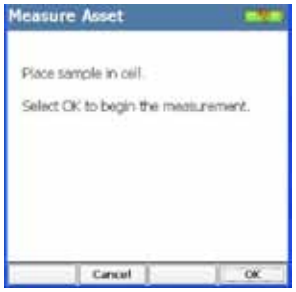
c. Use the tab soft button to select the "Operating Hours" field. The directional button is used to enter the hours on the lubricant. Up and down will increase or decrease the selected number, and the left and right buttons will increase or decrease the selected significant digit. In our example, we are going to enter **313** hours. We thus use the left directional button to move over two significant digits.

The up button is used to enter the number followed by the right directional button to move to the next significant digit and so on.



When the hours have been entered, press **Next** soft button.

9. The FluidScan® is now ready to analyze samples.



To load a sample in the flip-top cell follow the steps described in Section 3.3 and refer to Figure 3.3-1:

10. Press the **OK** soft button to start the analysis. A progress bar shows the measurement status.



11. The analysis time is approximately one minute. When the analysis is complete, the results screen appears. The choices now are to **Spectrum**, **Detail, Discard,** or **Save** the results.



At this point, the analysis is complete with the results shown on the screen. However, it is also possible to further review data by looking at prior analyses if they are stored in the asset record. To do so, select the physical property of interest using the down directional button.



Press the **Detail** soft key to select it. The current analysis plus two previous ones are now displayed on the screen.



Press the **Summary** soft button to return to the previous screen, **Discard** or **Save** the data.

Note: If a physical property has exceeded an alarm limit, it will be shown as in the example below.



3.4.2 Measure Fluid

The "Measure Fluid" feature provides a means to measure the spectrum of a sample when the user does not wish to apply the descriptor structure. In this feature, the user is asked to either select a reference fluid and simply collect a spectrum, or to have the software attempt to identify the reference fluid after recording the spectrum. The user is then able to save the analysis as a single measurement, or assign it to an asset.

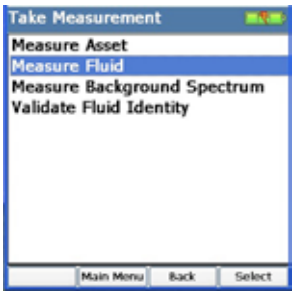
To analyze a fluid:

1. Turn **ON** the FluidScan® and log in. The Main Menu will appear.



2. On the "Main Menu", the first selection is **Take Measurement**, press the **Select** soft button.

3. On the "Take Measurement" menu, the second selection is "Measure Fluid", use the directional button to select **Measure Fluid** press the **Select** soft button.



A sequence of events are now started by the FluidScan® software to verify that it is ready to analyze a sample. First it checks to see if a background measurement is required and then it checks to verify that the cell is clean. The need for a new background measurement is based on temperature change and the time since the last one was performed.

4. When a background measurement is required, the following message appears on the screen. Press the **OK** soft button.

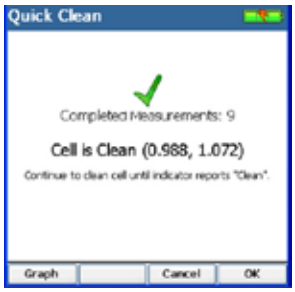


If a background measurement is not required, the cell is checked for cleanliness and if it is clean, the analysis procedure jumps to step 8.

5. The cell cleanliness test is now initiated and if it is not reported as "Clean", the cell must be cleaned. See Section 3.2 for cleaning the flip-top cell.



6. When the cell is clean, the screen below will appear to confirm that the FluidScan® is read for a background measurement. Press the **OK** soft button to proceed.



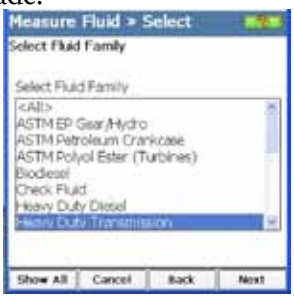
7. The background measurement starts and will take approximately one minute. A progress bar shows the measurement's status.



When the background measurement is complete, press the **OK** soft button to proceed.



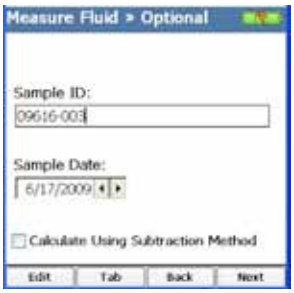
8. The software now provides a series of steps to assist in identifying the fluid. Select a family of fluids by using the directional button and press the **Next** soft button when the selection has been made.



9. A screen with the fluids available in the selected family appears. Select the fluid by using the directional button and press the **Next** soft button when the selection has been made.



10. A screen with a field for a sample identification number or letters is used to identify the fluid and the date it was analyzed. Press the **Edit** soft button to bring up the keyboard and use the directional pad to enter the sample identifier. The date defaults to today's date, leave the subtraction method unchecked, unless the fluid was designated to be analyzed against a reference fluid using the subtraction method.



Press the **Next** soft button to proceed.

NOTE: If the Subtraction Method as described in Section 2.6.3 is to be used on an assets's fluid, the "Calculate Using Spectral Subtraction" box must be selected and checked at this time.

11. The FluidScan® is now ready to analyze samples.



To load a sample in the flip-top cell follow the steps below and refer to Figure 3.3-1:

12. Press the **OK** soft button to start the analy-

sis. A progress bar shows the measurement's status.



15. The analysis time is approximately one minute. When the analysis is complete, the results screen appears. The choices now are to view the **Spectrum**, **Discard** or **Save** the results.



NOTE: If the subtraction method was selected in step 10 (subtraction method check box activated), The results screen will denote this with "(Spectral Subtraction Used) noted on top of the screen.



3.4.3 Validate Fluid Identity

The "Validate Fluid Identity" analytical mode is not used on routine samples as a part of a preventive maintenance program. It is a feature that allows the user to analyze a sample for quality control purposes to confirm that a newly delivered fluid is identical to what was requested, or to determine what an unknown fluid is.

To validate a fluid identity:

1. Turn **ON** the FluidScan® and log in. The Main Menu will appear.



2. On the "Main Menu", the first selection is **Take Measurement**, press the **Select** soft button.

3. On the "Take Measurement" menu, the fourth selection is "Validate Fluid Identity", use the directional button to select **Validate Fluid Identity** and press the **Select** soft button.



A sequence of events are now started by the FluidScan® software to verify that it is ready to analyze a sample. First it checks to see if a background measurement is required and then it checks to verify that the cell is clean. The need for a new background measurement is based on temperature change and the time since the last one was performed.

4. When a background measurement is required, the following message appears on the screen. Press the **OK** soft button.

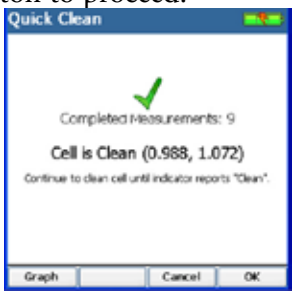


If a background measurement is not required, the cell is checked for cleanliness and if it is clean, the analysis procedure jumps to step 8.

5. The cell cleanliness test is now initiated and if it is not reported as "Clean", the cell must be cleaned. See Section 3.2 for cleaning the flip-top cell.



6. When the cell is clean, the screen below will appear to confirm that the FluidScan® is read for a background measurement. Press the **OK** soft button to proceed.



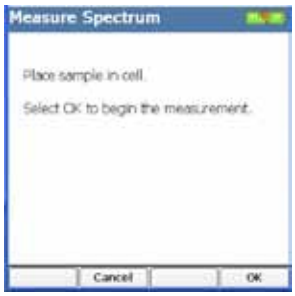
7. The background measurement starts and will take approximately one minute. A progress bar shows the measurement's status.



When the background measurement is complete, press the **OK** soft button to proceed.



8. The FluidScan® is now ready to analyze samples.



To load a sample in the flip-top cell follow the steps described in Section 3.3 and refer to Figure 3.3-1:

9. Press the **OK** soft button to start the analysis. A progress bar shows the measurement status.



10. The analysis time is approximately one minute. When the analysis is complete, the "Select Fluid to Validate" appears. Select the family of fluids by using the directional button and press the **Next** soft button when the selection has been made.



11. A screen with the fluids available in the selected family appears. Select the fluid to validate by using the directional button and press the **Next** soft button when the selection has been made.



The software now determines how close the analyzed fluid matches the fluid you believe it. The score and probability of the match is shown on the next screen.



The match is based on a "Score" as follows:

- *Score 7> - It is highly probable your sample is the selected fluid or equivalent.*
- *Score ≥7 but less than 7 - It is probable your sample is the selected fluid or equivalent.*
- *Score <5 - Your sample is probably not a new, clean sample of the selected fluid.*

The user can now select **OK** if is a good match was obtained, or use the soft buttons to select **Match** or **Back**.

- "Match" will search the database for the closest match to any other fluid.
- "Back" returns you to the fluid selection screens to manually select one to validate the analysis against.

3.5 SYNCHRONIZING FluidScan® WITH FluidScan® MANAGER

Whenever changes are made to either the FluidScan® or to the FluidScan® Manager software, the data should be synchronized so that both contain the same information. For example, if multiple analyses are made in the field using FluidScan, that data should be synchronized by uploading it to the FluidScan® Manager software. Data should therefore be synchronized when changes are made either on the FluidScan® or on FluidScan® Manager.

To synchronize data between FluidScan® and FluidScan® Manager:

1. Connect the FluidScan® to your personal computer with the provided cable. Plug one end of the cable into the FluidScan® USB Host Connector and the other end into an open USB port on the personal computer.

2. Turn **ON** FluidScan.

CAUTION: To avoid damage to the database, the FluidScan® must be at the main menuscreen or at the user logged out screen when synchronizing data.

CAUTION: Do not disconnect the FluidScan® while a synchronize function is in process. It could result in damage to the database and software.

3. Open Microsoft Active Sync on the personal computer.

4. Open the FluidScan® Manager by double-clicking on its icon.

5. On the FluidScan® Manager main menu, select **Synchronize Device** from the "Devices"

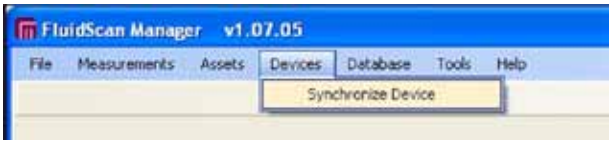


Figure 3.5-1, Select Synchronize Device

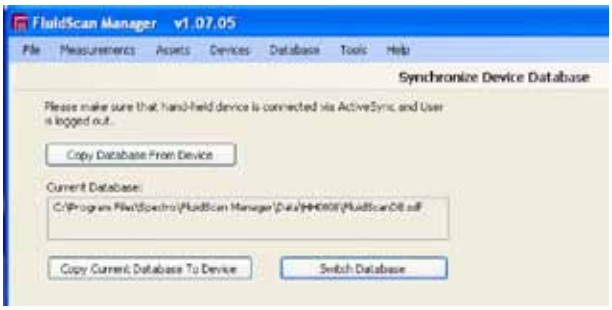


Figure 3.5-2, Synchronize Device Data Screen



Figure 3.5-3, Sync databases Screen

drop-down menu, Figure 3.5-1.

6. The "Synchronize Device Database" screen opens, Figure 3.5-2. Note that there are two directions in which the systems can be synchronized, either FluidScan® (Device) to FluidScan® Manager, or FluidScan® Manager to FluidScan® (Device).

7. Select the appropriate button to copy from one device to the other.

- To copy from FluidScan® to FluidScan® Manager, select **Copy Database From Device**.
- To copy from FluidScan® Manager to FluidScan, select **Copy Current Database to Device**.

CAUTION: In FluidScan® Manger, the data you are copying overwrites and replaces the data you are copying to. Before proceeding, verify whether the FluidScan® or the FluidScan® Manager has the most up to date data. It is not a true synchronization procedure where only the most recent files are copied. Future versions of FluidScan® Manager will have an updated synchronization procedure, check the customer support web page at www.spectroinc.com periodically for updates.

The third option on the "Sync Devices" screen is the Switch Data base option which provides a means to synchronize the FluidScan® Manager with other FluidScans or databases. Note however that only one database at a time can be synchronized. The screen has two options, to synchronize devices or to synchronize with another database. When the Synchronize Devices button is selected, all the FluidScans that were at one time synchronized with FluidScan® Manager will appear in a drop down menu, Figure 3.5-3.

The Other database option provides an alternative to synchronize FluidScan® Manager with another database stored on the same personal computer or another computer on the same network. When **Other Database** is selected, use the **Browse** button to locate the database.

3.6 BACKING UP, IMPORTING AND EXPORTING THE FluidScan® DATABASE

It is always good practice to backup your computer's database. The same is true for the FluidScan® database.

This section describes how to backup databases on FluidScan® Manger and also on FluidScan. The ability to import and export data is also described.

3.6.1 Backup of the FluidScan® Manager Database

Before backing up the database, make sure that

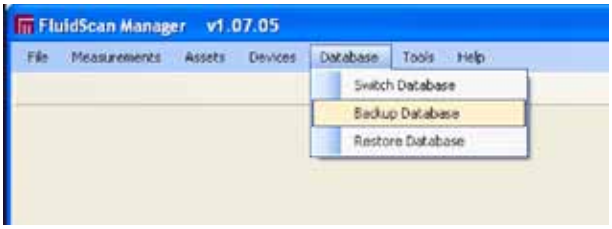




Figure 3.6-2, Backup Database Screen

it is up-to-date. If not, synchronize the data between the FluidScan® and the FluidScan® Manager.

To backup the FluidScan® Manager Database:

1. Open the FluidScan® Manager by double-clicking on its icon.

2. Select **Backup Database** from the "Database" drop-down menu, Figure 3.6-1.

3. The "Backup Database" screen opens, Figure 3.6-2. Use the **Browse** button to select the location where you wish to backup the database.

4. Click on the **OK** button to backup the database.

Note that the "Database"drop-down menu is also used to **Switch Databases, Restore Database** from a backup, or to **Clear All User Data From Database.**

3.6.2 Device Maintenance

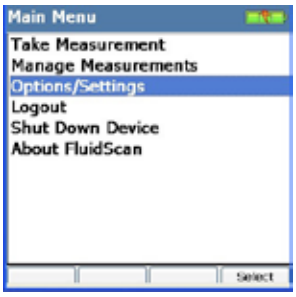
The term "Device Maintenance" as applied in this section refers to software maintenance on the FluidScan. The maintenance includes updating software and exporting or importing data. These functions are important because they are used to install new operating software updates as they become available, export data to another memory device or to import data such as new fluid families.

The "Device Maintenance" options are available through the "Main Menu" on FluidScan.

1. Turn **ON** FluidScan® by pushing down the ON/OFF button. The FluidScan® software will boot and after about 30 seconds the "Main Menu" screen appears.



2. Using the directional pad scroll down to **Options/Settings**. To make the selection, push the right most soft button under the word **Select** on the bottom of the main screen.



3. The "Options/Settings Menu" screen appears. Use the directional pad to scroll down to **Device Maintenance** and press the **Select** soft button.



Figure 3.6-3, USB Memory Drive Inserted in USB Host Connector



4. The "Device Maintenance" selections appear. They are Update Software, Export Data, Import Data and Compact Database.



The first three selections are based on a USB memory drive installed in FluidScan's USB Host connector, Figure 3.6-3

- **Update Software** - this function is used to install updated versions of the FluidScan® operating software and also updated fluid families. A specific file to load as an update can be selected using the directional pad.
- **Export Database** - this function is used to export a database as a backup, to transfer to another FluidScan, etc.
- **Import Database** - this function is used to restore the database from a backup or to install a database from another FluidScan.
- **Compact Database** - this function cleans and defragments the FluidScan's database. The process takes about 20 seconds and should be performed whenever there is a lot of data activity between the FluidScan® and its database.

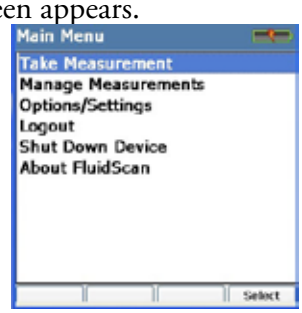
5. Select the "Device Maintenance" function you wish to perform and use the soft buttons to select the appropriate action.

3.7 UPDATE A FLUID'S SPECTRUM

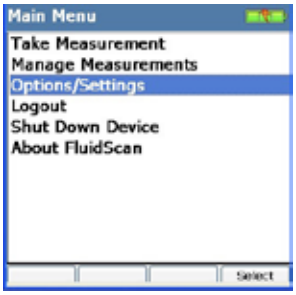
It is not uncommon that a petroleum company may change a fluid's formulation. In addition, some fluids may have the same name, but in different parts of the world, the formulation differs to accommodate climate and/or operating conditions. The FluidScan® is delivered with a library of fluid spectra pre-installed, however, the user does have the option to update them as necessary.

The spectra update procedure is simple. The steps include selecting the existing fluid in the FluidScan's memory, followed by an analysis of the new and unused fluid to obtain an updated spectra. To update the spectrum for a specific fluid:

1. Turn **ON** FluidScan® by pushing down the ON/OFF button. The FluidScan® software will boot and after about 30 seconds the "Main Menu" screen appears.



2. Using the directional pad scroll down to **Options/Settings**. To make the selection, push the right most soft button under the word **Select** on the bottom of the main screen.



3. The "Options/Settings Menu" screen appears. Use the directional pad to scroll to **Manage Fluids** and press the **Select** soft button.



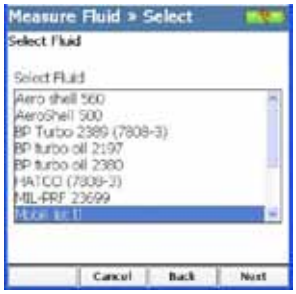
4. The "Manage Fluids Menu" screen appears. **Update Fluid Spectra** is the first available selection. Press the **Select** soft button to proceed.



5. The "Select Fluid Family"screen appears. Use the directional pad to scroll down to appropriate family for the fluid you wish to update and press the **Select** soft button. In this example we are selecting the "Gas Turbine" family.



6. The "Select Fluid" screen appears. Use the directional pad to scroll down to the fluid you wish to update and press the **Select** soft button. In this example we are selecting the "Mobile Jet II".



7. The cell cleanliness test is now initiated and if it is not reported as "Clean", the cell must be cleaned until it is. See also Section 3.2 for cleaning the flip-top cell.



8. When the cell is clean, the screen below will appear to confirm that the FluidScan® is ready for a background measurement. Press the **OK** soft button to proceed.



9. The background measurement starts and will take approximately one minute. A progress bar shows the measurement status.



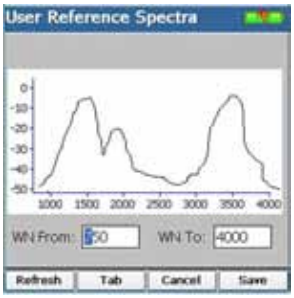
When the background measurement is complete, press the **OK** soft button to proceed.

10. Place a sample of the fluid you wish to analyze into the flip-top cell. See also section 3.3 for instructions on loading the cell.

11. Press the **OK** soft button to start the analysis. A progress bar shows the measurement's status.



12. When the analysis is complete, the spectra for the analyzed fluid appears on the screen. The analysis can now be cancelled and repeated, or store in memory to replace the old spectra buy pressing the **Save** soft button.

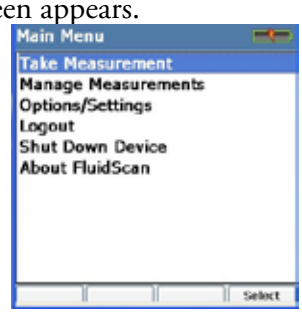


3.8 CUSTOMIZE SYSTEM FLUID

This feature allows the user to clone a fluid that is in the FluidScan's memory. The custom fluid is analyzed to create a reference spectrum, given a unique name, properties from the fluid in memory are selected, and alarm limits can be customized or accepted as is. The algorithms of the selected fluid to clone will be used for the custom fluid. This feature provides a means for the user to create alarm limits that are associated with a fluid and not an asset.

To customize a system fluid:

1. Turn **ON** FluidScan® by pushing down the ON/OFF button. The FluidScan® software will boot and after about 30 seconds the "Main Menu" screen appears.



2. Using the directional pad scroll down to **Options/Settings**. To make the selection, push the right most soft button under the word **Select** on the bottom of the main screen.



3. The "Options/Settings Menu" screen appears. Use the directional pad to scroll down to **Manage Fluids** and press the **Select** soft button.



4. The "Manage Fluids Menu" screen appears. Use the directional pad to select **Customize System Fluid** and press the **Select** soft button to proceed.



5. The cell cleanliness test is now initiated and if it is not reported as "Clean", the cell must be cleaned until it is. See also Section 3.2 for cleaning the flip-top cell.



6. When the cell is clean, the screen below will appear to confirm that the FluidScan® is ready for a background measurement. Press the **OK** soft button to proceed.



7. The background measurement starts and will take approximately one minute. A progress bar shows the measurement status.



When the background measurement is complete, press the **OK** soft button to proceed.

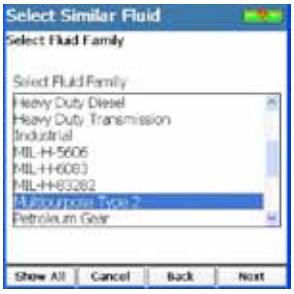
8. Place a sample of the fluid you wish to analyze into the flip-top cell. See also section 3.3 for instructions on loading the cell.



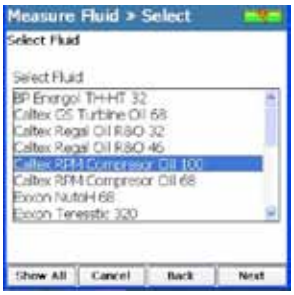
9. Press the **OK** soft button to start the analysis. A progress bar shows the measurement's status.



10. The fluid to be cloned and used for its algorithms can now be selected. Use the directional pad to scroll to the fluid family and press the **Next** soft button to select it.



11. From the fluids available in the family, select the one to be cloned by scrolling to it with the directional pad. Press the **Next** soft button to select it.



12. A screen with a field for the cloned fluid's name appears. Press the **Edit** soft button to bring up the keyboard and use the directional pad to enter a unique name for the new cloned fluid..



13. When a unique name has been entered, press the **Done** soft button to proceed.



Press the **Next** soft button to accept the new fluid's name.

14. The properties that can be analyzed and tracked for the new fluid are listed in the next screen. The default is to select all. The the di-

rectional pad and the **Check** soft button can be used to deselect any property. Press the **Next** soft key to proceed.

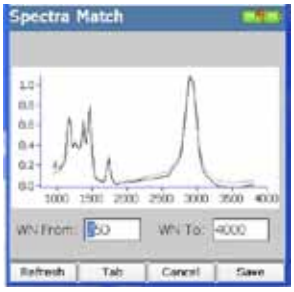


15. The alarm limits from the matched fluid are now available to be edited or accepted.



Use the directional pad to select an edit an alarm limit, and press the **Next** soft button to accept the alarm limits.

16. The scans of the cloned and new fluid appear on the screen.



If you are satisfied with the match, the properties to be measured, the limits, and the custom fluid's name, press the **Save** soft button.

17. A next screen confirms that the new fluid has been saved to the FluidScan's memory with the new name and selected properties and alarm limits.



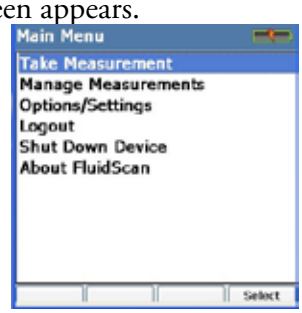
3.9 EDIT FLUID FAMILY DISPLAY FILTER

The edit family and fluid display option provides a means to simplify these screen when not all the available fluids are routinely used. The unwanted fluids will be hidden from the view, but still available if needed in the future.

NOTE: Filtered fluids are not removed from the FluidScan' memory. They can be unfiltered at any time. It is also possible to select* Show All *to see all available families and fluids whenever a step call for a fluid to be selected.

To hide fluid families and fluids is a two step process. First you deselect the families of fluids that are not used at your facility. Next you can deselect any fluids in a family that are not used:

1. Turn **ON** FluidScan® by pushing down the ON/OFF button. The FluidScan® software will boot and after about 30 seconds the "Main Menu" screen appears.



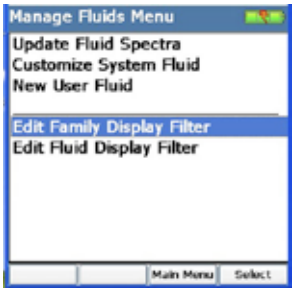
2. Using the directional pad scroll down to **Options/Settings**. To make the selection, push the right most soft button under the word **Select** on the bottom of the main screen.



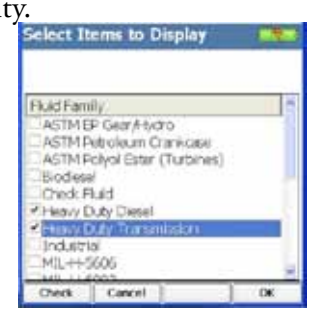
3. The "Options/Settings Menu" screen appears. Use the directional pad to scroll down to **Manage Fluids** and press the **Select** soft button.



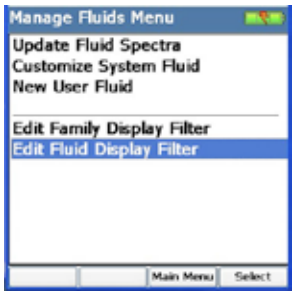
4. The "Manage Fluids Menu" screen appears. Use the directional pad to select **Edit Family Display Filte**r and press the **Select** soft button to proceed.



5. It is now possible to select the families that will be displayed and available for use. Use the directional pad and **Check** soft button to deselect families of fluids that are not used at your facility.



6. Press the **OK** soft button to proceed to return to the "Manage Fluids Menu" screen. Use the directional pad to select **Edit Fluid Display Filte**r and press the **Select** soft button to proceed.



7. The available fluid families, less the ones that have been deselected, are now available in case fluids within the family are to be deselected. (In our example, all but two families have been deselected).



8. Use the directional pad to select a family that you wish to filter further. Use the directional pad and **Check** soft button to deselect fluids from the family that are not used at your facility.



9. Repeat the process for each family of fluids that you wish to filter. Press the **OK** soft button when you are finished and press the **Main Menu** soft button to return to the main menu.

Chapter 4

Software Description

4.0 SOFTWARE DESCRIPTION

The FluidScan® operating software and FluidScan® Manager software is described in these sections of the manual. Many software features that are used in routine operation of the FluidScan® are covered in previous sections and in great detail. This chapter will cover those features that are not covered and typically are used only occasionally and for non-routine operations.

4.1 FluidScan® SOFTWARE

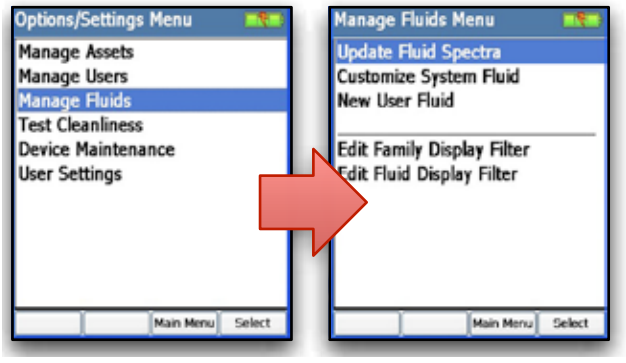
FluidScan® can be used by itself and data can be downloaded into FluidScan® Manager. After logging in, everything starts from the "Main Menu". Here the user has the following options:

- **Take Measurement,** Section 4.1.1
- **Manage Measurements,** Section 4.1.2
- **Options/Settings,** Section 4.1.3
- **Logout,** Section 4.1.4
- **Shut Down Device,** Section 4.1.5
- **About FluidScan,** Section 4.1.6

Each of these options will be explained in the next few sections.

4.1.1 Take Measurement

"Take Measurement" is the first item on the main menu because it is the one used most often. It has some sub-menus that are available by pressing the **Select** soft button.



The sub-menus of "Take Measurement" are:

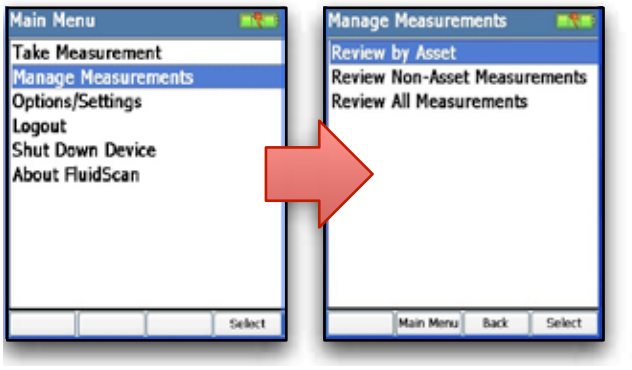
- **Measure Asset** - This selection is made when the user is ready to analyze an oil sample taken from an asset. When selected, it takes the user through the steps of identifying the asset with its descriptors and the actual sample analysis procedure. The steps are described in

detail in Section 3.4.1

- **Measure Fluid** - This selection is made when the user is ready to analyze a sample without first tying it to its descriptors. This option is frequently used when there is a need to quickly analyze a sample and to view the analytical results. When selected, it takes the user through the fluid families and the actual sample analysis procedure. The steps are described in detail in Section 3.4.2.
- **Measure Background Spectrum** - This selection allows the user to perform a background analysis by itself. A background analysis is required by the FluidScan® periodically and is based on time and temperature change. The Asset and Fluid Measurement procedures automatically default to a background analysis if the time and/or temperature criteria have been exceeded.
- **Validate Fluid Identity** - This selection allows the user to analyze a sample for quality control purposes to confirm that a newly delivered fluid is identical to what was requested, or to determine what an unknown fluid is based on those stored in the FluidScan® database. The steps are described in detail in Section 3.4.3

4.1.2 Manage Measurements

The "Manage Measurements" menu selection provides the user with alternative methods to review analytical results in the FluidScan® database.



The sub-menus of "Manage Measurements" are:

- **Review by Asset** - This selection allows the user to view the analytical results of a specific asset based on a selection of the descriptors. When an asset has been selected, all the analyses in the FluidScan's memory will be available for further review.



The directional keypad followed by the **Select** soft button can be used to select any of the available analyses.



The directional keypad can then be used to highlight and select any of the measured physical properties.



Selecting the Detail soft button brings the last three analyses to the screen. The limits for the physical property will also be displayed if an analysis exceeded it.



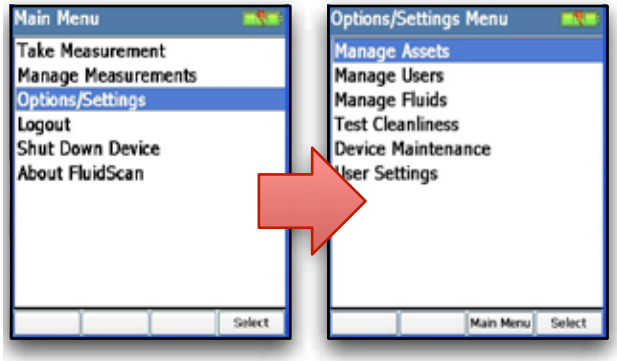
- **Review Non-Asset Measurements** - This selection allows the user to review analyses that were not tied to an asset in the database, frequently these are stand-alone analyses of

fluids.

- **Review All Measurements** - This selection allows the user to review a measurement from a list of all those available in the database.

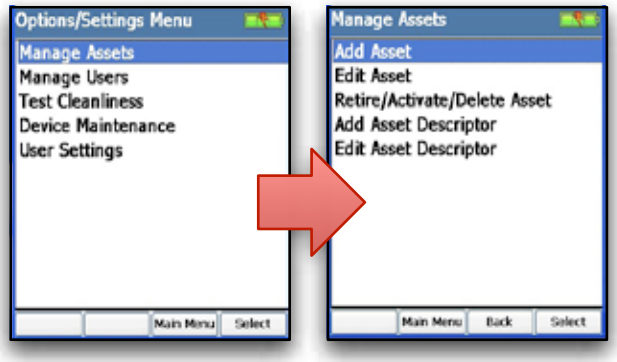
4.1.3 Options/Setting

The "Options/Settings" menu selection provides the user with a variety of housekeeping functions that include management of the database and the instrument.

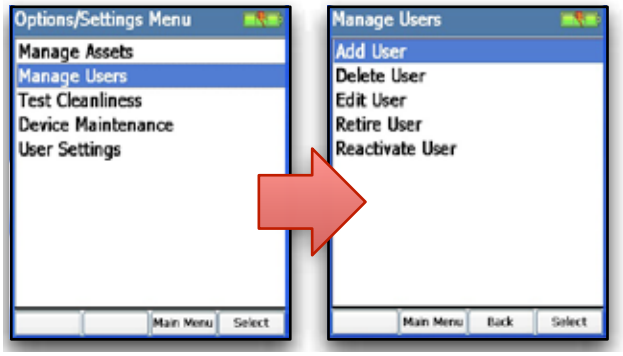


The sub-menus of "Options/Settings are:

- **Manage Assets** - This selection allows the user to add, edit, activate and retire assets and to add or edit descriptors. The sub-menus are straight forward and self explanatory. The user simply needs to use the soft buttons and the directional pad to perform any of the available options.

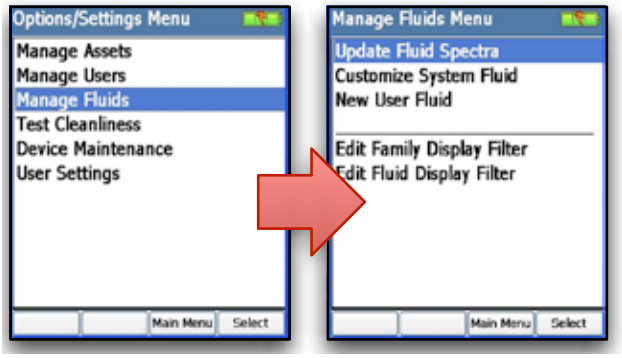


- **Manage Users** - This selection allows the user to add, edit, activate and retire users. The sub-menus are straight forward and self explanatory. The user simply needs to use the soft buttons and the directional pad to perform any of the available options.



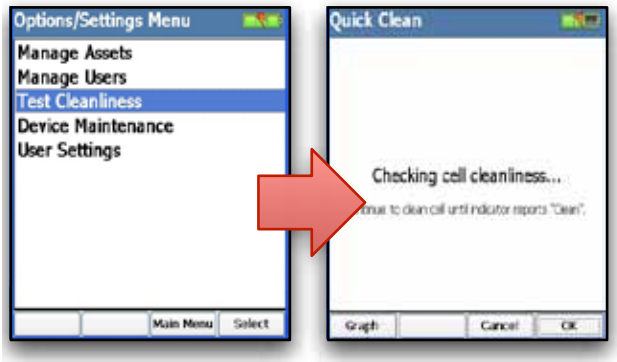
- **Manage Fluids** - This selection allows the user to update,customize and filter fluids that are in memory.

- Update Fluid Spectra is a useful feature to update a spectra when for example, the formulation of a fluid changes, see Section 3.7 for a detailed explanation of this feature.
- Customize System Fluid - This feature allows the user to clone a fluid that is in the FluidScan's memory. The custom fluid is analyzed to create a reference spectrum, given a unique name, properties from the fluid in memory are selected, and alarm limits can be customized or accepted as is, see Section 3.8.
- New User Fluid - This selection allows the user to add a new fluid to the database if the match to another fluid already in the database is greater than 94%, see Section 2.6.
- Edit Family/Fluid Display Filter - The edit family and fluid display option provides a means to simplify these screen when not all the available fluids are routinely used. The unwanted fluids will be hidden from the view, but still available if needed in the future.

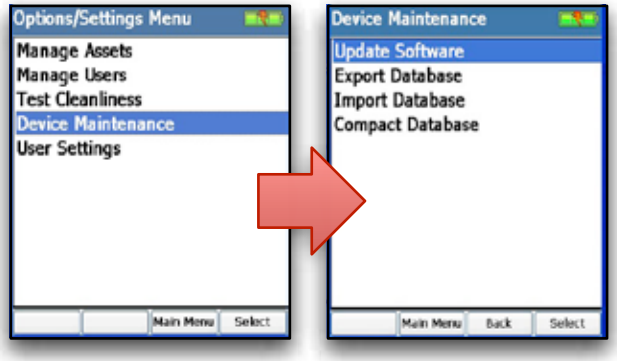


- **Test Cleanliness** - This selection allows the user to check and clean the flip-top cell at any time. This is the same test that is performed

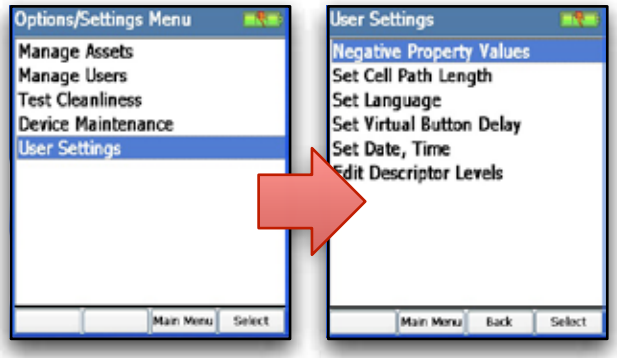
before the analysis of an asset or a fluid.



- **Device Maintenance** - This selection allows the user to update the FluidScan® software, to export or import files and to defragment and compact the database. The sub-menus would be used in conjunction with a USB memory stick installed into the USB connector as described in Section 3.6.2.

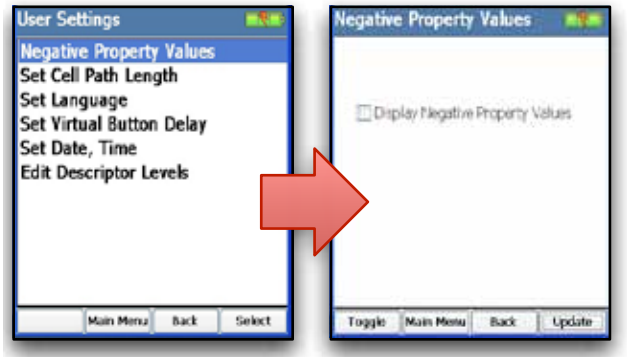


- **User Settings** - The final sub-menu of the "Options/Settings" selection provides the user with a means to input data that typically will not change after a selection has been made.



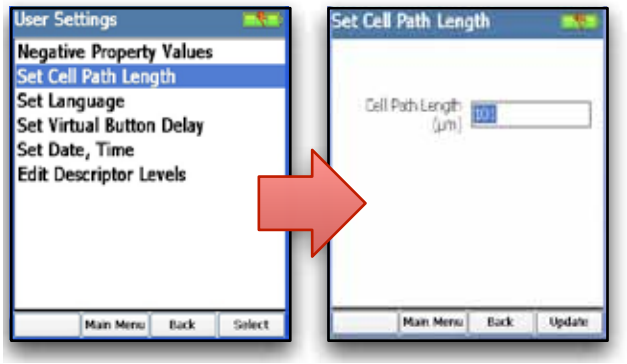
The available sub-menus available in "User Settings" are:

- **Negative Property Values** - This option provides a means to either view negative number or to have all negative number displayed as zero.



The selection can be made with the **Toggle** soft button to either select or de-select the feature. This feature is typically not selected so that only positive values appear for analyses. Negative values are possible because in very clean fluids with physical property values close to zero, the detection limit for the property may be greater than the concentration present.

-**Set Cell Path Length** - The cell path length is set into the FluidScan® software at the factory. The setting only has to be changed if the cell is replaced. A cell's path length is etched on the cell near its hinge. The directional pad is used to increase or decrease the path length.



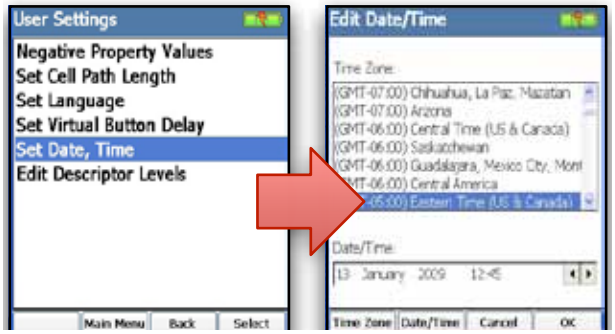
-**Set Language** - The default language for the FluidScan® software is English. Initially it will also be available in Spanish with other languages to be added in the future. To change the language, use the directional pad and **Select** soft button.



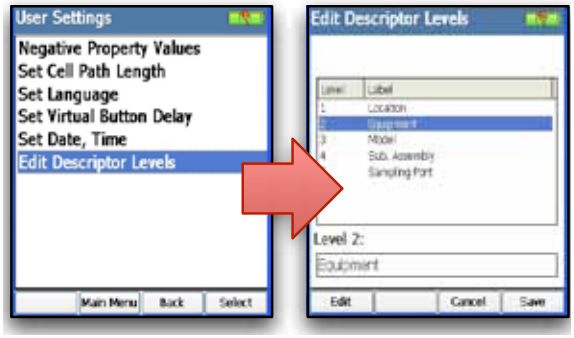
- **Set Virtual Button Delay** - This option allows the user to change the feel and sensitivity of the soft buttons. In most instances, the default value does not have to be changed.



- **Set Date and Time** - The date and time will not change as long as the FluidScan® has power from its battery or charger. It must be set when the FluidScan® is first turned **ON** or after the battery has been replaced. The date and time consists of the Time Zone and Date and Time, both are selected with corresponding soft buttons and changed with the directional pad. See also Section 2.3 for instructions to set the date and time.

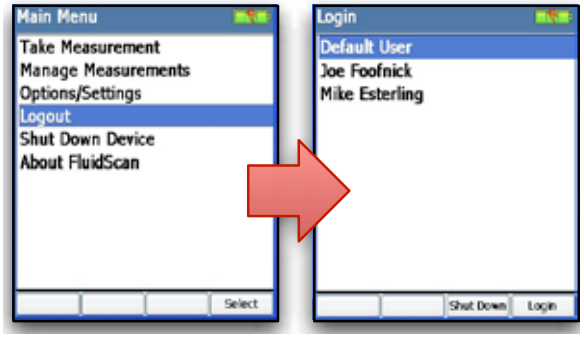


- **Edit Descriptor Levels** - The names of descriptors can be changed with this option. When the option has been selected, the existing descriptors appear on the next screen. The names of a descriptor can be changed by selecting it with the directional pad followed by the **Edit** soft button.



4.1.4 Logout

The Logout selection from the "Main Menu" provides a quick path for a user to **Logout**, and **Shut Down** the device or to have another user **Login**.



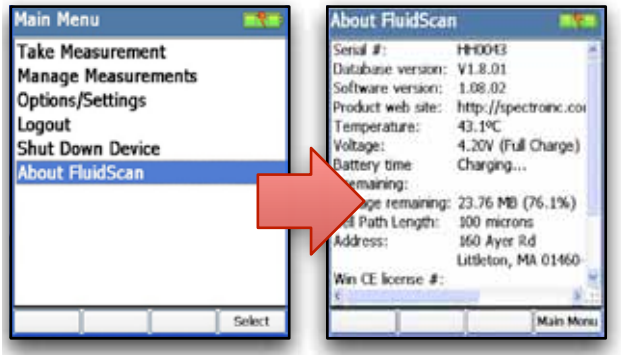
4.1.5 Shut Down Device

The Shut Down Device selection from the "Main Menu" provides a quick path to shut down and turn OFF the FluidScan. The user is asked to confirm or cancel the selection by using either the **Shut Down** or **Cancel** soft buttons.



4.1.6 About FluidScan®

The About FluidScan® selection from the "Main Menu" provides the user with detailed information about the FluidScan.



When the option is selected, information on the following is provided. :

- Serial #
- Database version
- Software version
- Windows CE license #
- Product web site (for software updates and general information)
- Temperature (internal temperature of FluidScan)
- Voltage (voltage status of the battery)
- Battery time remaining
- Storage remaining
- Cell path length
- Address (Spectro Inc. address)
- Algorithm collection # (use to determine current number when updates are available)
- Service contact
- Copyright #
- Win Ce license#

4.2 FluidScan® MANAGER SOFTWARE

The FluidScan® Manager database software is used to synchronize data with the FluidScan® and to archive, retrieve, and trend results. The FluidScan® can be operated without this software, but the software enables data to be stored in a central location. Users who prefer not to use FluidScan® Manager, can use the FluidScan's "Device Maintenance" menus to export data to a spreadsheet or other database.

The FluidScan® Manager software must be installed on a personal computer. The software is on a CD and is provided along with your FluidScan. The installation procedure is detailed in Section 2.2 of this manual.

After the software has been installed, double-click on the FluidScan® Manager icon to start the program.

When the program has been started, Figure 4.2-1, note that there are drop-down menus on top of the screen. The primary drop-down menus are:

- Measurements
- Assets
- Devices
- Database
- Tools

4.2.1. Measurements

The "Measurements" drop-down menu has only one selection, **View Measurements**. When it is selected, The measurements screen as shown in Figure 4.2-2 appears.

This software option has four sections and provides the user with the capability to:

1. Select Assets
2. Select Measurements to View
3. Measurement Details (analytical results)
4. Analysis (export or report results)

Assets to view can be selected by using descriptors to narrow down the selection process. To select a descriptor, use the drop down menu associated with the descriptor level. The "*" in a field denotes that no descriptor is selected.

Figure 4.2-2 currently shows all the assets in our example, but if we select **Gold Mine** in the location field, the matching assets will be narrowed down in Section 2 as shown in Figure 4.2-3.

It is now possible to click on any of the assets in the "Matching Assets" field to view measurements

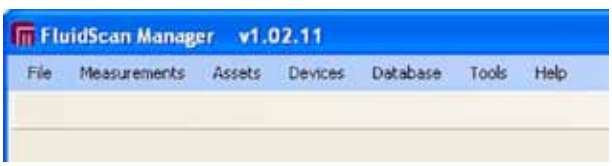


Figure 4.2-1, Drop-Down Menus in FluidScan® Manager

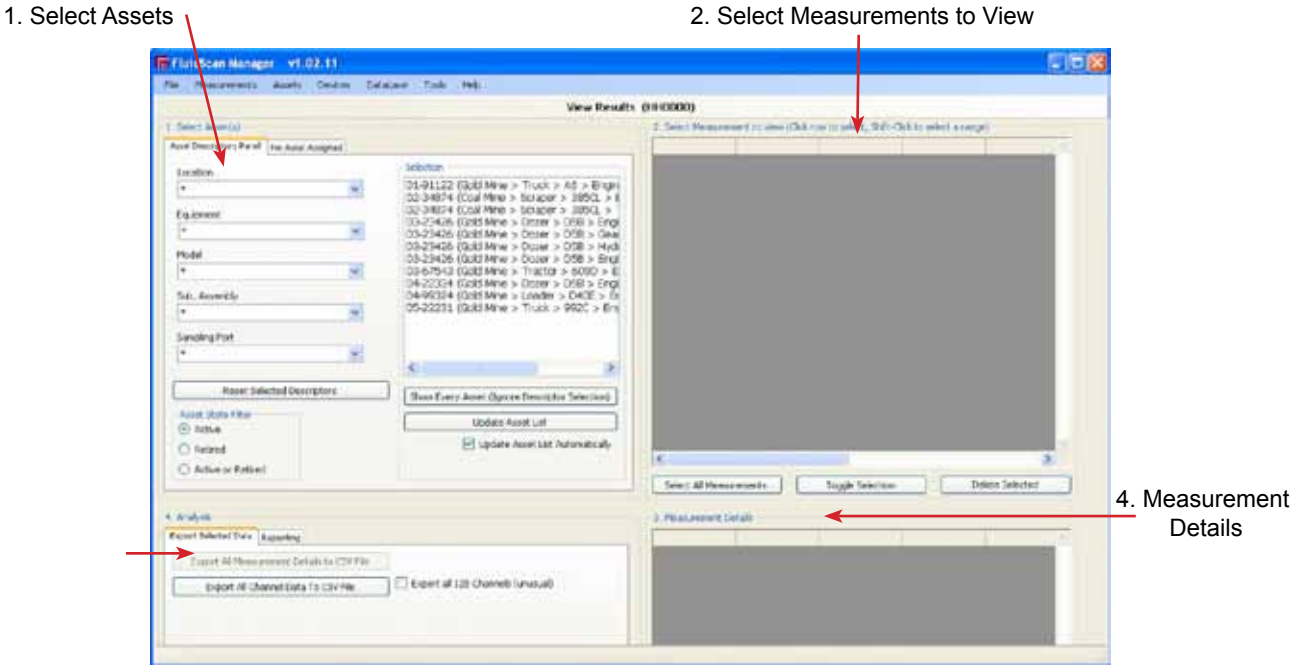


Figure 4.2-2, Measurements Screen

that are stored for it in the database. For example, if we select the first matching asset (the dozer) and click on it, Section 3 of the screen shows that three measurements are in the database for this asset, Figure 4.2-4. The measurements are sorted with the most recent on top. The three buttons beneath the measurements can be used to select all analyses, switch between them, or delete one or more analyses.

When a measurement is selected, the analytical results are shown in Section 3, "Measurement Details" (bottom of Figure 4.2-4).

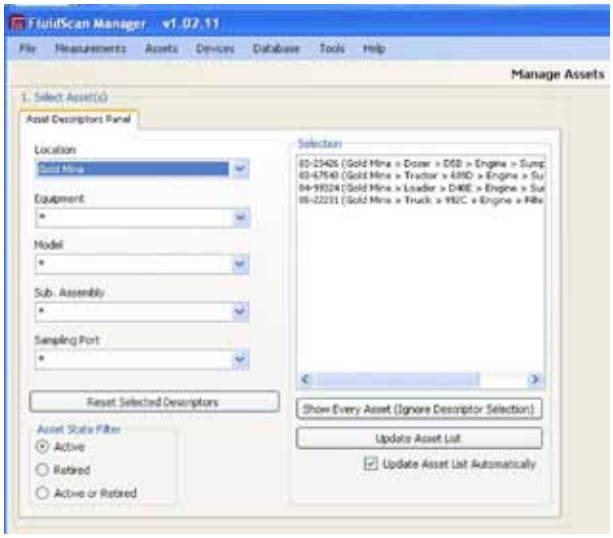


Figure 4.2-3, Assets Selected for Gold Mine Location

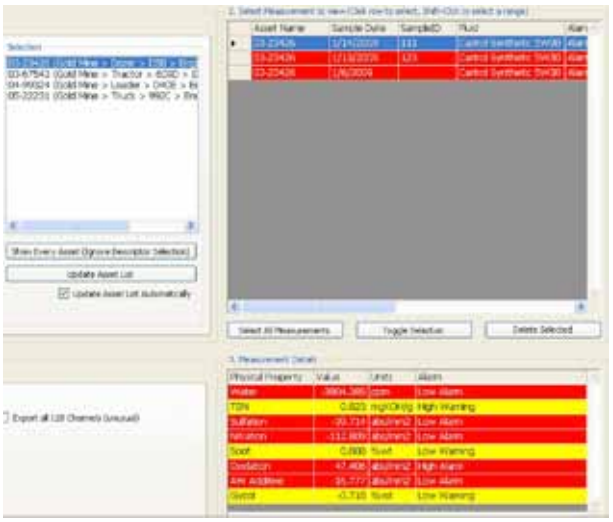


Figure 4.2-4, Available Measurements and Details

Section 4, Analysis, has two tabs, "Export Data" and "Reporting".

The "Export Data" tab has two buttons that provide a means to export the reported analytical results to a CSV file, or to export all the analytical data from the analysis spectrum to a CSV file.

The "Reporting" tab provides options to print reports with trends or individual analyses, Figure 4.2-5. To create a trend, select the date range fol-

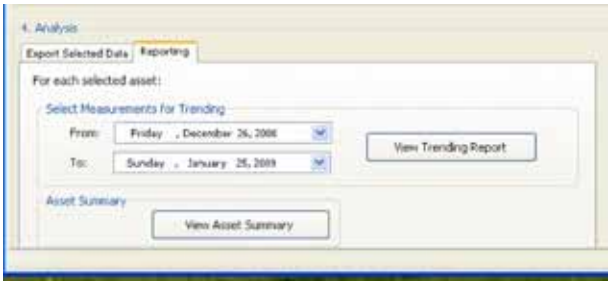


Figure 4.2--5, Reporting Tab

lowed by selecting the **View Trending Report** button. A sample report is shown in Figure 4.2-6. Note that the report has multiple pages, in this example, two physical properties are trended per page. The other alternative report is an asset summary. To create an asset summary report select the asset in Section 2 of the screen followed by selecting the **View Asset Summary** button on the "Reporting" tab. A sample asset summary report is shown in Figure 4.2-7.

Both report alternatives have an option to save the report to memory, and/or to print a paper copy. To save the report, select **Save Report**. In the pop-up window that appears, select the location where you wish to save the report and give it a name. Select **Save** to save it to memory. To print a copy of the report, select **Print Report** and on the pop-up window that appears, select the printer to which you wish to send the report.

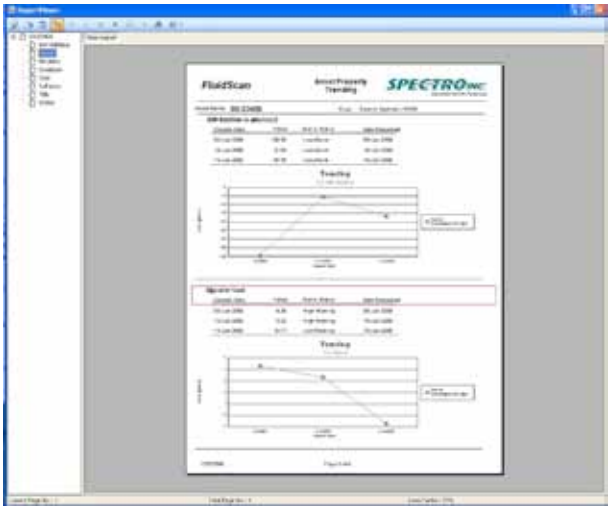


Figure 4.2-6, Example of a Trend Report



Figure 4.2-7, Example of an Asset Summary Report

4.2.2 Assets

The "Assets" drop-down menu has two selections, **Manage Asset Descriptors** and **Manage Assets.** Both of these selections are described in detail in Sections 2.5 and 2.6 of this manual.

4.2.3 Devices

The "Devices" drop-down menu has only one selection, **Synchronize Devices**. When it is selected, the Synchronize Device Database screen as shown in Figure 4.2-8 appears.

The Devices screen provides the user with three alternative synchronization methods, Copy Database From Device, Copy Current Database To Device and Switch Database. The Copy Database From Device and Copy Current Database To Device provide a means to overwrite and copy the data base either from the FluidScan® to FluidScan® Manager or the other way around as explained in detail in Section 2.2.2 of this manual.

CAUTION: To avoid damage to the database, the FluidScan® must be at the main menu screen or at the user logged out screen when synchronizing data.

CAUTION: Do not disconnect the FluidScan® while a synchronize function is in process. It could result in damage to the database and software.

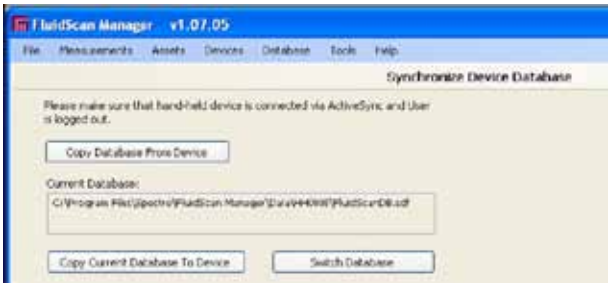


Figure 4.2-8, Synchronize Devices Screen

The Switch Data base option provides a means to synchronize the FluidScan® Manager with other FluidScans. Note however that only one database at a time can be synchronized. The screen has two options, to synchronize devices or to synchronize with another database. When the Synchronize Devices button is selected, all the FluidScans that were at one time synchronized with FluidScan® Manager will appear in a drop down menu, Figure 4.2-9.

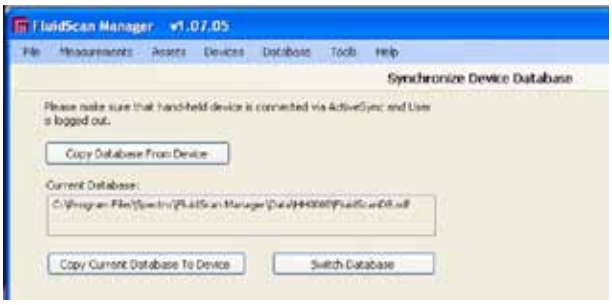
The Other database option provides an alternative to synchronize FluidScan® Manager with another database stored on the same personal computer or another computer on the same network. When **Other Database** is selected, use the **Browse** button to locate the database.

4.2.4 Database

The "Database" drop-down menu has three selections: **Switch Database, Backup Database,** and **Restore Database.** The first two selections, Switch and Backup Database are described in detail in Sections 4.2.3 and 3.6 of this manual.

The Restore database, as the name implies, provides the user with a means to restore a database from a backup file. When the option is selected, the screen shown in Figure 4.2-10 appears.

The Restore From synchronize devices option provides a means to restore the FluidScan® Manager database with other FluidScans or databases. Note however that only one database at a time can be restored.



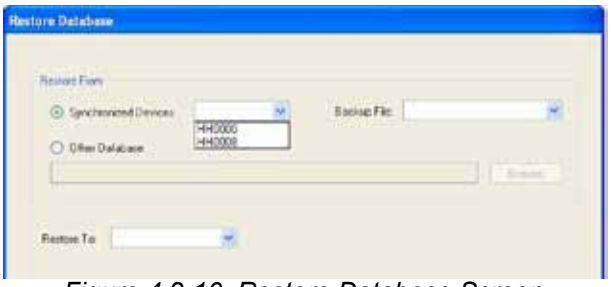


Figure 4.2-10, Restore Database Screen

The screen has two options, from which to restore data; from another FluidScan® or another database. When the Synchronize Devices button is selected, all the FluidScans that were at one time synchronized with FluidScan® Manager will appear in a drop down menu, Figure 4.2-10.

The Other database option provides an alternative to synchronize FluidScan® Manager with another database stored on the same personal computer or another computer on the same network. When **Other Database** is selected, use the **Browse** button to locate the database.

4.2.5 Tools

The "Tools" drop-down menu has two selections, **Set Language,** and **Manage Users.** The Set Language option will allow users to change the language used by FluidScan® Manager. Currently only English is available, however, other languages will be forthcoming. The Manage Users option provides a means to add, retire, or delete users of the FluidScan. This option is described in detail in Section 2.4.1 of this manual.

This Page is Intentionally Left Blank

Chapter 5

User Maintenance & Troubleshooting

5.0 USER MAINTENANCE & TROUBLESHOOTING

This section of the manual describes recommended preventive maintenance procedures for the user of the FluidScan®® to keep the instrument in optimum operating condition. Troubleshooting tables are also provided to assist the user in determining the source of a possible problem and how to remedy it.

5.1 CLEANING WINDOWS

In routine operation, prior to the analysis of a sample, the FluidScan®® software checks for cell cleanliness and notifies the user when it is dirty and needs to be cleaned, see also Section 3.2. Occasionally the cell cleanliness test will continue to fail even after the cell is repeatedly cleaned. When this happens, the most likely cause is dirt or oil on one of the CaF_2 (Calcium Fluoride) windows.

The most likely window to be dirty is the one on the FluidScan®® head. This window should be cleaned first and if the cleanliness test continues to fail, then the window on the FluidScan®® body must also be cleaned. The procedure for cleaning both windows follows in the next two sections.

5.1.1 Cleaning the FluidScan®® Head CaF2 Window

The CaF_2 window on the FluidScan®®'s head should be cleaned periodically depending on the number of samples analyzed and the environment in which it is used. It should also be cleaned if the cell cleaning test fails repeatedly, even after the cell has ben cleaned. To clean this window the flip-top cell must be moved out of the way.

1. Lift the flip-top cell straight up from its "home" position and flip it into the "load" position, Figure 5.1-1.

2. Turn the FluidScan®® over so that the bottom is facing up.

3. Use a Q-tip to gently clean the surface of the



Figure 5.1-1, Flip-Top Cell in the "Load" Position

window on the FluidScan® head, Figure 5.1-2.

4. If necessary, moisten the Q-tip with a little isopropyl alcohol and repeat the cleaning process.

5. Lift the cell from the "load" position and reinsert it into the "home" position.

6 Perform a cell cleanliness test, Section 3.2 to confirm that the window cleaning process was successful. If the test passes the FluidScan® is ready to analyze samples, if not proceed with the cleaning process of the window on the FluidScan® body, Section 5.1.2.

5.1.2 Cleaning the FluidScan® Body CaF2 Window

The window on the FluidScan® body should also be cleaned periodically depending on the number of samples analyzed and the environment in which it is used. It also must be cleaned when the cleanliness test fails after the window on the head has been cleaned.

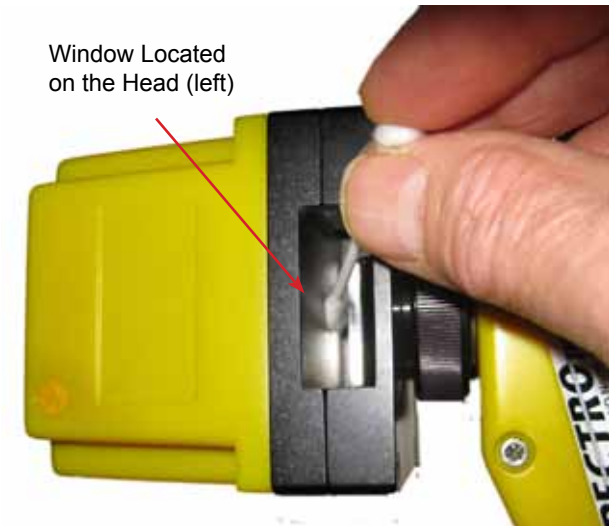


Figure 5.1-2, Clean Window on Head with a Q-tip

1. To gain access to the window on the FluidScan® body, remove the head by turning the retainer ring on the head mount, Figure 5.1-3. Pull the head away from the body when all the threads are exposed.

2. Use a Q-tip to gently clean the surface of the window on the FluidScan® body, Figure 5.1-4.

3. If necessary, moisten the Q-tip with a little reagent grade isopropyl alcohol and repeat the cleaning process.

CAUTION: Use only the FluidScan® cleaning solution available from Spectro Inc. or 99% anhydrous isopropyl alcohol (reagent grade).

4. Reassemble the FluidScan® by attaching the head to the body and tightening the retainer ring.



Figure 5.1-3, Remove Head from FluidScan® Body



Figure 5.1-4, Clean Window on Body with a Q-tip

5. Perform a cell cleanliness test, Section 3.2 to confirm that the window cleaning process was successful. If the test passes the FluidScan® is ready to analyze samples, if not, repeat the cleaning process starting with the flip-top cell and the two CaF_2 windows.

5.2 REPLACING THE FLIP-TOP CELL

The flip-top cell design is rugged and should last many years with routine use. It is, however, possible that it becomes damaged at some point or most likely, that one of the windows breaks or becomes scratched.

The flip-top cell is easy to replace. It can be replaced after a retainer plate has been removed to allow it to slide out of its holder.

1. Remove the two screws that hold the cell retainer plate with a 0.05 inch Allen wrench, Figure 5.2-1.

2. Set aside the screws and retainer plate and lift the cell straight up and out of its holder, Figure 5.2-2.

3. Before installing a replacement cell, note its path length and write it on a piece of paper. The path length is etched near the hinge of the cell and should be a number close to 100.

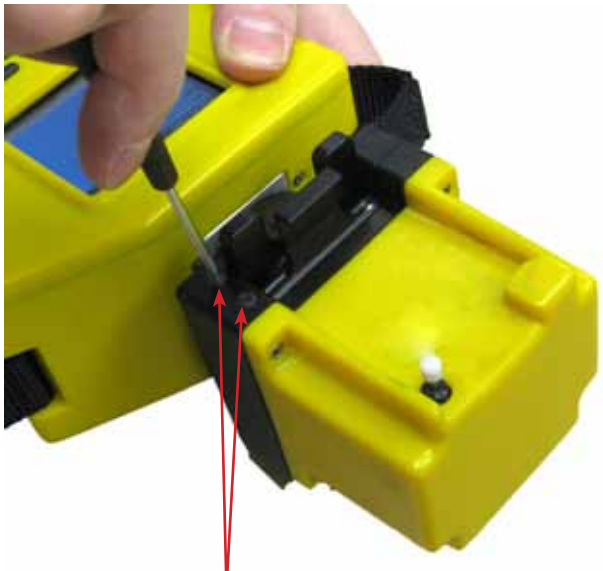


Figure 5.2-1, Remove, Screws and Retainer Plate



Figure 5.2-2, Lift Cell Straight Up to Remove from Holder

4. Install the replacement cell by sliding it straight into the holder.

5. Reinstall the retainer plate and tighten with the two screws.

The path length of the replacement cell needs to be entered into the software.

1. Turn **ON** the FluidScan® and login.

2. From the "Main Menu", use the directional pad to scroll to **Options/Settings** and press the **Select** soft button.



3. On the "Options/Settings" menu, use the directional pad to scroll to **User Settings** and press the **Select** soft button.



4. On the "User Settings" menu, use the directional pad to scroll to **Set Cell Path Length** and press the **Select** soft button.



5. Enter the replacement cell path length with the up or down directional pad.



6. To complete the process, press the **Update** soft button when you are finished and then press the **Main Menu** soft button..

5.3 REPLACING THE BATTERY

The FluidScan® uses a Li-Ion rechargeable battery that is ideal for portable instruments because these batteries have one of the best energy-to-weight ratios, no memory effect, and a slow loss of charge when not in use. With time the battery may need to be replaced.

CAUTION: Observe your local and federal regulations regarding the proper disposal procedure for Li-Ion batteries.

To replace the FluidScan® battery:

1. Turn **OFF** the FluidScan®.

2. If the FluidScan® is wearing a protective "boot" (rubberized cover), it must be removed.
- Remove the handles which are attached to each side with velcro.
- Remove the head by turning the retainer ring on the head mount, Figure 5.1-3. Pull the head away from the body when all the threads are exposed.
- Carefully peel off the rubber boot and set it aside.

3. Turn over the FluidScan® so that the bottom



Figure 5.3-1, Remove the 4 Screws from Battery Compartment Cover



Figure 5.3-2, Battery Compartment with Cover

is exposed.

4. Remove the four screws that hold the battery cover with a 0.05 inch Allen wrench, Figure 5.3-1.

5. Remove the cover to expose the battery and its connector, Figure 5.3-2.

6. Remove the battery from the compartment and carefully pull the battery connector straight up to remove it from its socket, Figure 5.3-3.

7. A replacement can now be installed using the reverse procedure.

8. Replacement batteries are shipped fully charged, however, it is good practice to charge the battery for at least 30 minutes with the FluidScan® turned OFF.



Figure 5.3-3, Disconnect and Remove Battery

5.4 TROUBLESHOOTING

This section of the manual provides hints and procedures to be used in an effort to troubleshoot problems in order to come up with a cause and corrective action.

5.4.1 Check Fluid Analysis

A check fluid can be used on the FluidScan® to confirm that it is operating as expected. A check fluid, FL 310, is delivered with the FluidScan®. It can be analyzed whenever a user suspects that there may be something wrong with the FluidScan®'s performance.

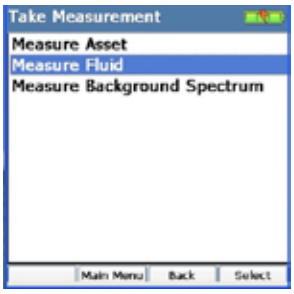
The check fluid is analyzed the same as any other fluid.

1. Turn **ON** the FluidScan® and log in. The Main Menu will appear.



2. On the "Main Menu", the first selection is **Take Measurement**, press the **Select** soft button.

3. On the "Take Measurement" menu, use the first selection is **Measure Fluid**, press the **Select** soft button.



A sequence of events are now started by the FluidScan® software to verify that it is ready to analyze a sample. First it checks to see if a background measurement is required and then it checks to verify that the cell is clean. The need for a new

background measurement is based on temperature change and the time since the last one was performed.

4. When a background measurement is required, the following message appears on the screen. Press the **OK** soft button.



If a background measurement is not required, the cell is checked for cleanliness and if it is clean, the analysis procedure jumps to step 8.

5. The cell cleanliness test is now initiated and if it is not reported as "Clean", the cell must be cleaned. See Section 3.2 for cleaning the flip-top cell.



6. When the cell is clean, the screen below will appear to confirm that the FluidScan® is read for a background measurement. Press the **OK** soft button to proceed.



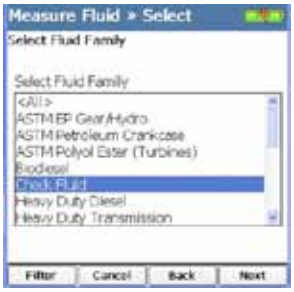
7. The background measurement starts and will take approximately one minute. A progress bar shows the measurement's status.



When the background measurement is complete, press the **OK** soft button to proceed.



8. A screen with the fluid families available in the FluidScan®'s memory appears. Select the **Check Fluid family** by using the directional button and press the **Next** soft button when the selection has been made.

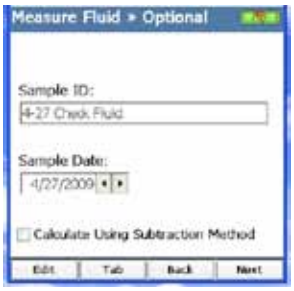


9. A screen with the fluids available in the selected Check Fluid family appears. Select the **Check Fluid** by using the directional button and press the **Next**.



10. A screen with a field for a sample identification number or letters is used to identify the check fluid and the date it was analyzed. Press the **Edit** soft button to bring up the keyboard and use the directional pad to enter the sample identifier. The date defaults to today's date,leave

the subtraction method unchecked.



Press the **Next** soft button to proceed.

11. The FluidScan® is now ready to analyze the check fluid.

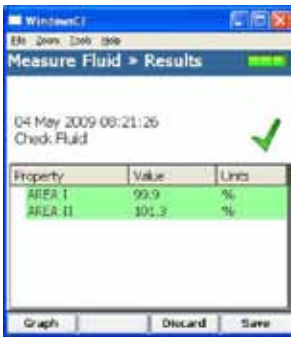


To load a sample in the flip-top cell follow the steps below and refer to Figure 3.3-1:

12. Press the **OK** soft button to start the analysis. A progress bar shows the measurement's status.



13. The analysis time is approximately one minute. When the analysis is complete the results screen appears.



The check fluid passes successfully if the values for the properties in AREA I and II are between 94% and 106%. A successful check fluid analysis will also have the two areas shaded in green, whereas a failed check fluid analysis would be in red. The choices now are to **Save**, **Discard** or **Graph** the results. It is good practice to save the analysis for reference if a future test fails.

If the check fluid test fails, clean the flip top cell and repeat the test. If it fails a second time, contact Spectro Inc.

This Page is Intentionally Left Blank