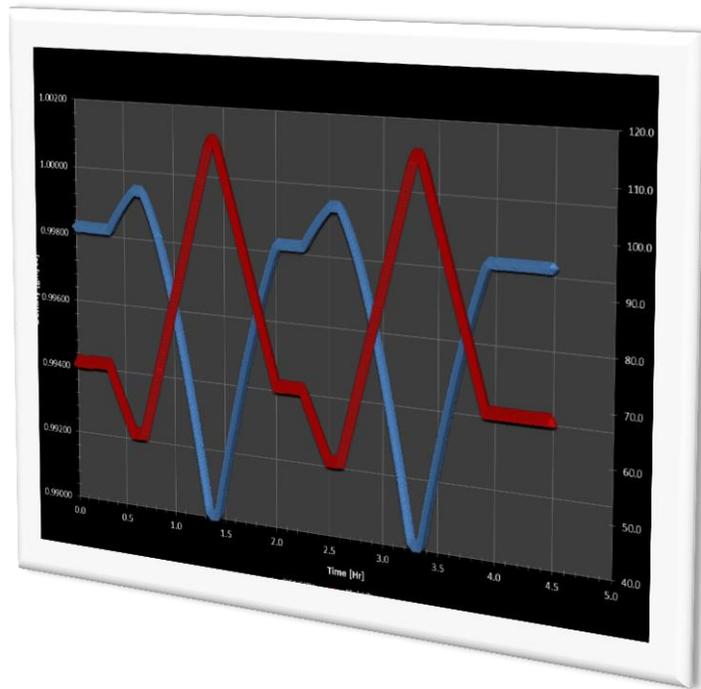

DENSI-TRAX SOFTWARE USER'S GUIDE



COMMUNICATION & INTEGRATION SOFTWARE FOR THE DENSITRAK®
LIQUID DENSITOMETER

THIS MANUAL CONTAINS VALUABLE INFORMATION – DO NOT DISCARD

AFT P/N 101210-E



OVERVIEW

We sincerely **THANK YOU** for your purchase of an ANALYTICAL FLOW TECHNOLOGIES DENSITRAK® D625 Density Meter (Henceforth, D625). DENSI-Trax software is a tool for use with the DENSITRAK® Liquid Density Meter and provides the following functions:

- ✓ CONFIGURE THE INPUT AND OUTPUT (I/O) SETTINGS
- ✓ MODIFY THE 4-20 mA SPAN for DENSITY
- ✓ CONFIGURE THE TWO INDEPENDENT N/O OR N/C ALARM CONTACTS
- ✓ CONFIGURE THE CALIBRATION COEFFICIENTS INSIDE THE PROCESSOR
- ✓ APPLY A **DENSITY CORRECTION FACTOR** TO THE DENSITY OUTPUT
- ✓ MONITOR/RECORD LIVE DATA FOR DENSITY, TEMPERATURE, ETC
- ✓ USE AS A DATA LOGGER TO RECORD METER DATA TO A "COMMA SEPARATED VALUE" TEXT FILE

Carefully read this manual prior to installation and operation of this software in order to ensure proper operation of the Liquid Densitometer.

Do NOT discard this manual - Always keep it in a place where you can access it for quick reference. If you lose or require additional copies of this manual refer to the ANALYTICAL FLOW TECHNOLOGIES (AFT) website (www.densitrak.com) for a downloadable PDF version.

Carefully read the DENSITRAK® LIQUID DENSITY METER OPERATION MANUAL prior to use of the DENSI-Trax Software.

INFORMATION CONTAINED IN THIS PUBLICATION REGARDING DEVICE APPLICATIONS AND THE LIKE IS PROVIDED ONLY FOR YOUR CONVENIENCE AND MAY BE SUPERSEDED BY UPDATES. IT IS YOUR RESPONSIBILITY TO ENSURE THAT YOUR APPLICATION MEETS WITH YOUR SPECIFICATIONS. ANALYTICAL FLOW TECHNOLOGIES MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WHETHER EXPRESS OR IMPLIED, WRITTEN OR ORAL, STATUTORY OR OTHERWISE, RELATED TO THE INFORMATION, INCLUDING BUT NOT LIMITED TO ITS CONDITION, QUALITY, PERFORMANCE, MERCHANTABILITY OR FITNESS FOR PURPOSE. ANALYTICAL FLOW TECHNOLOGIES DISCLAIMS ALL LIABILITY ARISING FROM THIS INFORMATION AND ITS USE.

NOTICE TO CUSTOMERS

All documentation becomes dated, and this manual is no exception. AFT products and documentation are constantly evolving to meet customer needs, so some actual dialogs and/or product descriptions may differ from those in this document. Please refer to our web site (www.densitrak.com) to obtain the latest documentation available.

Documents are identified with a part number and revision number. This number is located on the bottom of each page. The numbering convention for the part number is "XXXXXX-Y", where "XXXXXX" is the part number and "Y" is the revision level of the document.

This instrument is not user serviceable. For technical assistance, contact the Sales organization from which you purchased the product.

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SYSTEM REQUIREMENTS

- WINDOWS® Based Computer (7/Vista/XP compatible)
- USB Port
- USB Cable (included)
- RS232 COM Port and Cable (if applicable)
- DENSI-Trax Software CD-ROM (included)
- DENSITRAK® Windows® Drivers (included)
- DENSITRAK® Liquid Density Meter with SPUD 800 Density Processor

CHAPTER 1: THEORY OF OPERATION

The liquid density meter uses the spring mass principle for measuring the fluid density. A portion of the measurement tube is energized (transmit sensor) to vibrate and to maintain its natural resonant frequency by using an electrical feedback driving system. A change in the vibrating mass, (as a result of change in the fluid density) shifts the resonant frequency which is interpreted by the receive sensor. The signal is then output to the density processing unit via the rear mount electrical connector.

The Signal Processing Unit for Density – SPUD – is the brain of the entire electronics package. The SPUD reads live analog signals for frequency, temperature and pressure (if applicable) and uses these values along with unique Calibration Coefficients in order to calculate a fully compensated live fluid density output value.

CHAPTER 2: INTRODUCTION

An overview of the DENSI-Trax Communicator / Configurator / Data Logger system is given.

The DENSI-Trax Communicator / Configurator / Data Logger is a simple software application on a Windows® platform. The DENSI-Trax Communicator / Configurator / Data Logger is an integral part of the DENSITRAK® densitometer product line. The application usage can vary from coefficient configuration, input and output structure and also as a real-time data logger with a real-time plot screen.

One of the biggest features of this software is its ability to show historic data and trends. Data can be transferred directly into reports, spreadsheets or analysis programs. Data can be examined and archived on any Windows® compatible machine and can be printed out in various formats as required. This data is very useful when contacting the AFT engineers for customer support.

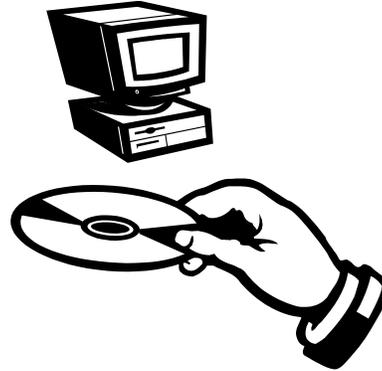
This instrument has two independent scalable outputs so it can measure live fluid density and temperature simultaneously.

Communication options include USB, RS232, and RS485 (2-wire) protocols.

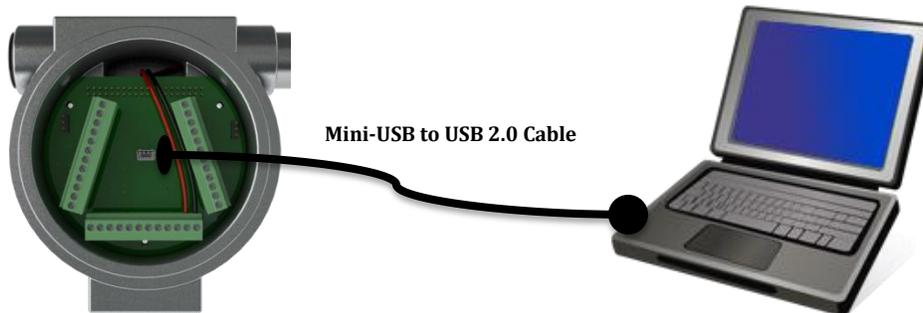
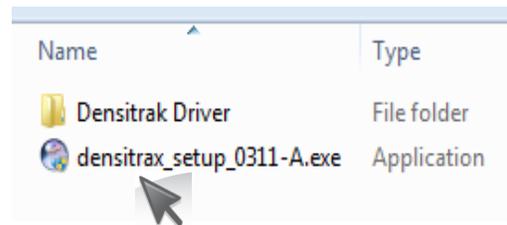
CHAPTER 3: INSTALLATION

To install the DENSI-Trax Software:

1. First acquire the latest DENSI-Trax installation executable file (densitrax_setup_REV-X.exe, where REV-X represents the version of DENSI-Trax Software) from either the Analytical Flow Technologies web site (www.densitrak.com) or the DENSI-TRAX CD-ROM (P/N 101211).



2. RUN (double-click) the DENSI-Trax Setup Executable file
 - You may need to navigate to the DRIVE/FOLDER where the EXECUTABLE file is located
 - Select YES if prompted to allow unknown publisher to make changes to your computer
 - Follow the On-Screen prompts to complete installation of the software
3. Connect the DENSI-TRAK® Liquid Density Meter to your Computer
 - Use the USB Communication Cable provided to attach the meter to the computer
 - Connect Power (+24 V_{DC}) to the DENSI-TRAK® Densitometer
 - **Refer to the DENSI-TRAK® User's Manual for Power Input Connections**
4. Install the WINDOWS® Driver
 - **Browse to the CD Folder where the DENSI-TRAK Driver is located**



The software can also communicate with the Density Meter via RS232
Refer to the DENSI-TRAK USER'S MANUAL for COMMUNICATIONS CONNECTIONS

You are now ready to run the DENSI-Trax Communicator / Configurator / Data Logger Windows®-Based software.

CHAPTER 4: SOFTWARE OVERVIEW

The DENSI-Trax Communicator / Configurator / Data Logger software is a very easy to use graphical user interface program designed specifically for the DENSITRAK® Liquid Densitometer.

The software consists of seven screens each identified by a specific tab on the top of the software screen. The screen tabs are identified as the following along with a list of functions performed by that screen:

1. MAIN
 - ✓ Select COM Port and protocol
 - ✓ Select DENSITRAK® Model
 - ✓ View Model Details (Serial number, Model number, Calibration date, etc.)
 - ✓ Password-Protected Access Level
2. INPUT
 - ✓ Configure all meter input units
 - ✓ Configure meter analog input values (4 – 20 mA scaling)
 - ✓ Enable EXTERNAL TEMPERATURE PROBE OPTION
3. OUTPUT
 - ✓ Enable or Disable analog OUTPUT 1 and/or OUTPUT 2
 - ✓ Configure output units
 - ✓ Configure meter analog output values (4 – 20 mA scaling)
 - ✓ Enable a FIXED OUTPUT VALUE – useful for Calibration & troubleshooting
 - ✓ 4-20mA Output calibration (FACTORY ONLY)
 - ✓ Enable and Configure ALARM 1 & 2
4. DENSITY
 - ✓ Program the processor with the Calibration Coefficients
 - ✓ Perform a K_0 offset FIELD CALIBRATION
5. SAMPLING
 - ✓ Set number of samples for averaging (Factory Only)
6. METER PROVING
 - ✓ Allows the end-user to apply a *DENSITY CORRECTION FACTOR (DCF)* or *DENSITY METER FACTOR (DMF)* to the live density output value
 - ✓ REFER to API Chapter 14.6 for details on determining a **DCF / DMF**
7. LCD DISPLAY
 - ✓ Allows user to choose the LOCAL LCD DISPLAY units for Density, Temperature and Pressure
8. DISPLAY/RECORD
 - ✓ User can select various variables such as Density, Temperature, Frequency, Output and Pressure to MONITOR real-time
 - ✓ User can also select which variables (and unit) to record to a text file (csv)
 - ✓ Input the sample rate in seconds

There is also a FILE Pull-down menu which allows the user to SAVE THE METER CONFIGURATION and store it on a hard drive, removable drive or disk.

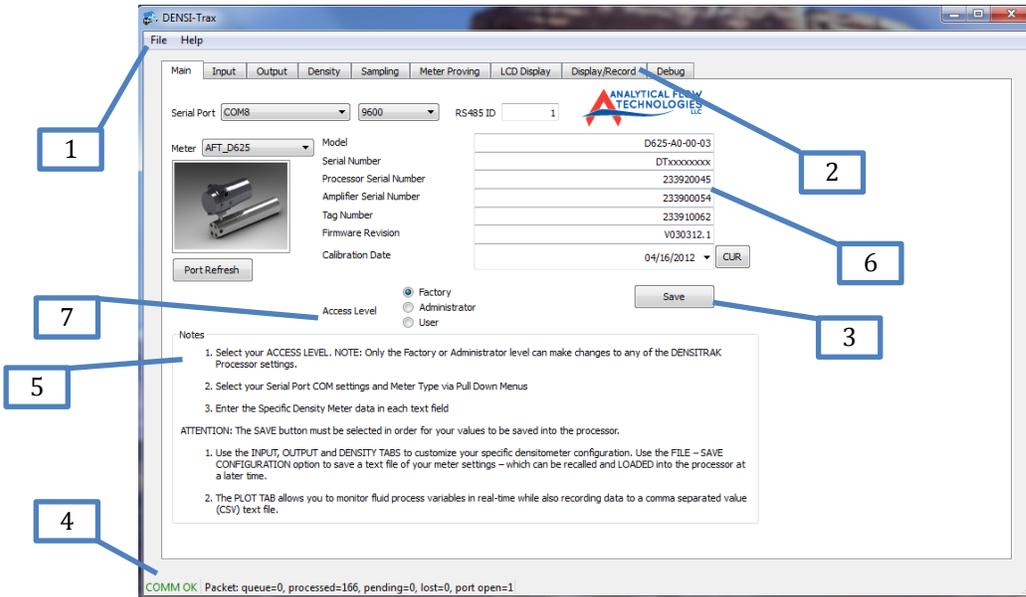
The user can also LOAD a CONFIGURATION FILE from a disk or flash drive.

Each screen contains a SAVE Button – and this button must be selected whenever any changes are made to the values which the user wants to write to the processor on the DENSITRAK® meter.

The next section highlights the important components on the DENSI-Trax GUI interface.

THE GUI SCREEN COMPONENTS

The above diagram is a representation of the Graphical User-Interface. The numbered balloons refer to



various features of the interface and are described below. These are the major components for each TAB Screen.

- ① Software Menus
 - ② SCREEN TABS
 - ③ SCREEN **SAVE** BUTTON (The SAVE button writes any variable changes into the processor memory)
 - ④ COMMUNICATION STATUS Indicator
 - ⑤ TAB-Specific NOTES area
 - ⑥ Text Entry Boxes
 - ⑦ Password-Protected Access Level Selection
- ✓ **FACTORY Password:** AFT2010
 - ✓ **Administrator Password:** AftAdmin

CHAPTER 5: SOFTWARE OPERATION

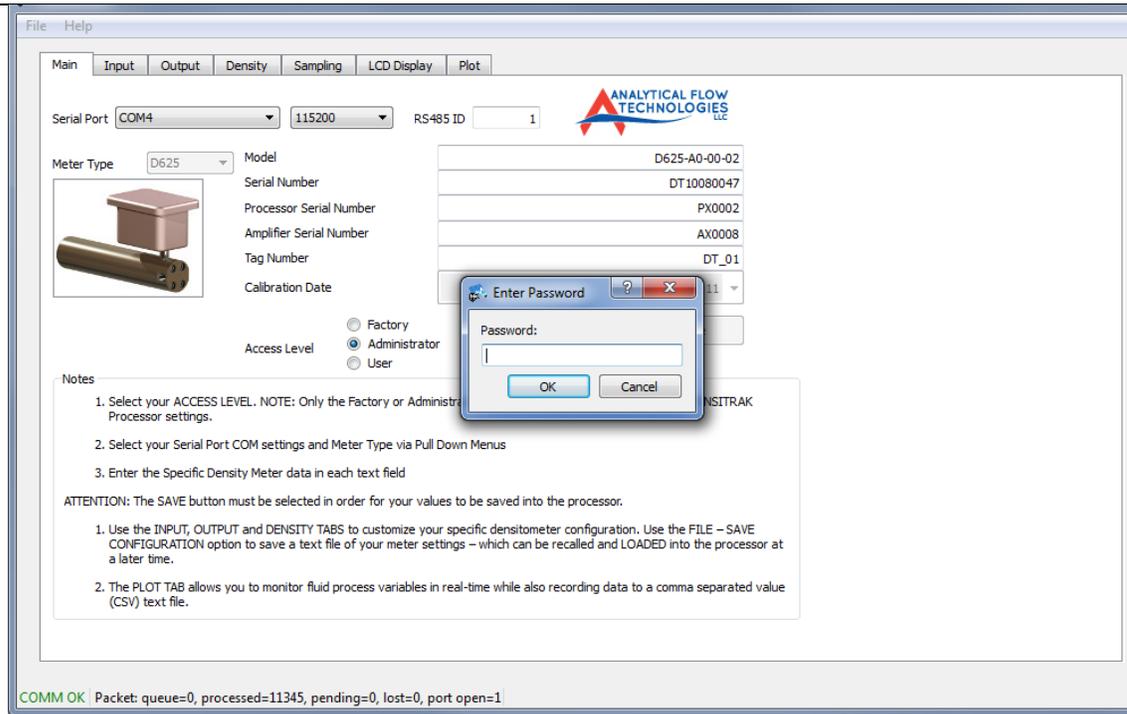
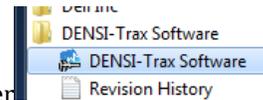
After you've completed the software installation and meter setup outlined in Chapter 3 you are now ready to LAUNCH the software and communicate with the DENSITRAK® density meter.

LAUNCHING THE SOFTWARE

2. Connect the COMPUTER to the DENSITRAK® meter via USB, or RS232 COM Cable
3. Supply power (+24 V_{DC}) to the DENSITRAK® meter
4. Launch the DENSI-Trax Software

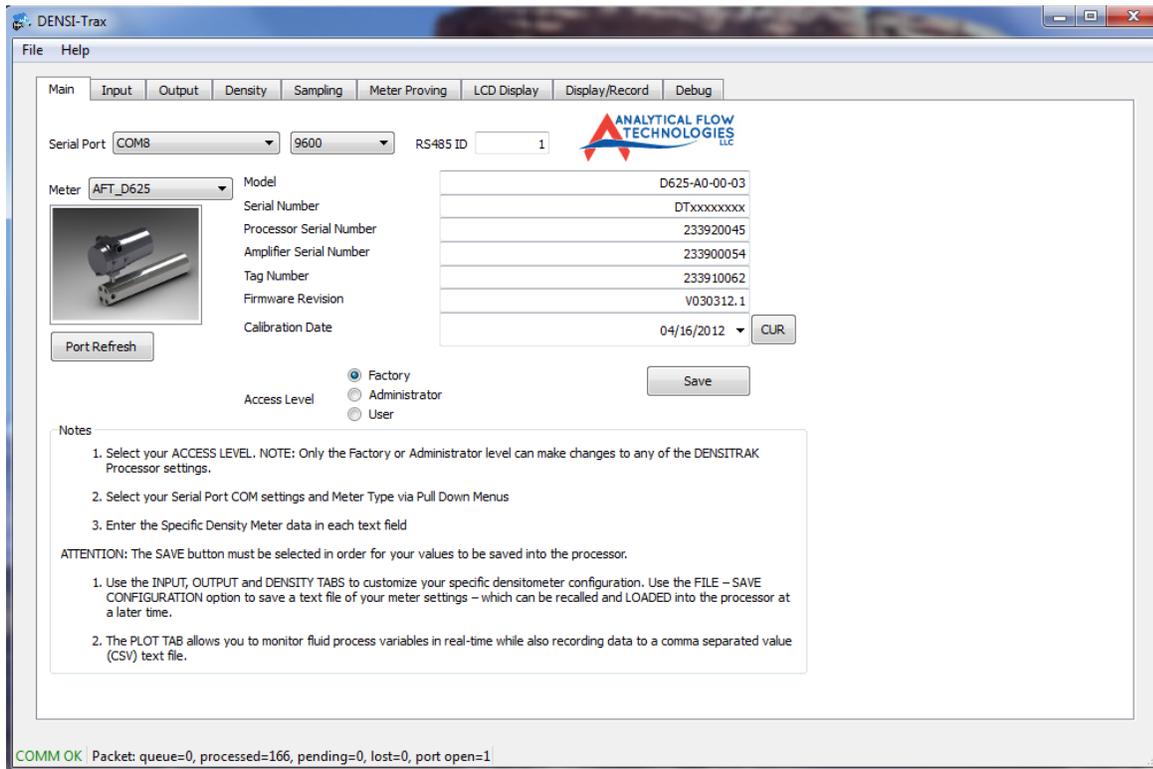
✓ Use the DESKTOP shortcut icon 

✓ Or use the START MENU and Select the DENSI-Trax Software Folder



5. Verify that the **COMM OK** is present in the COM STATUS Indicator after program starts
 - ✓ You may need to CLOSE the Program and Re-Launch if **COMM OK** is not present after selecting the correct COM Port
 - ✓ You may need to install the DENSITRAK DRIVER if using the USB port on your computer
6. Select user ACCESS LEVEL
7. Enter PASSWORD when prompted. PASSWORDS ARE CASE-SENSITIVE
 - ✓ **FACTORY Password:** AFT2010
 - ✓ **Administrator Password:** AftAdmin
8. You are now able to interact with the METER and configure the settings for INPUT, OUTPUT, PLOT, DATA Logging and ALARM settings

MAIN SCREEN



The MAIN screen allows the user to select and verify that the software is communicating with the DENSITRAK® Density Meter. The values in the Text Entry Boxes are programmed into the SPUD processor at the Factory. The user can read the meter Model, Serial Number, Circuit Board serial numbers, Firmware Revision and the last date of calibration. The user can also select “EXT METER” if the electronics are being used with a commercially available densitometer such as a UGC or Emerson/MicroMotion.

ONLY the FACTORY Access level has clearance to modify the meter data on this screen.

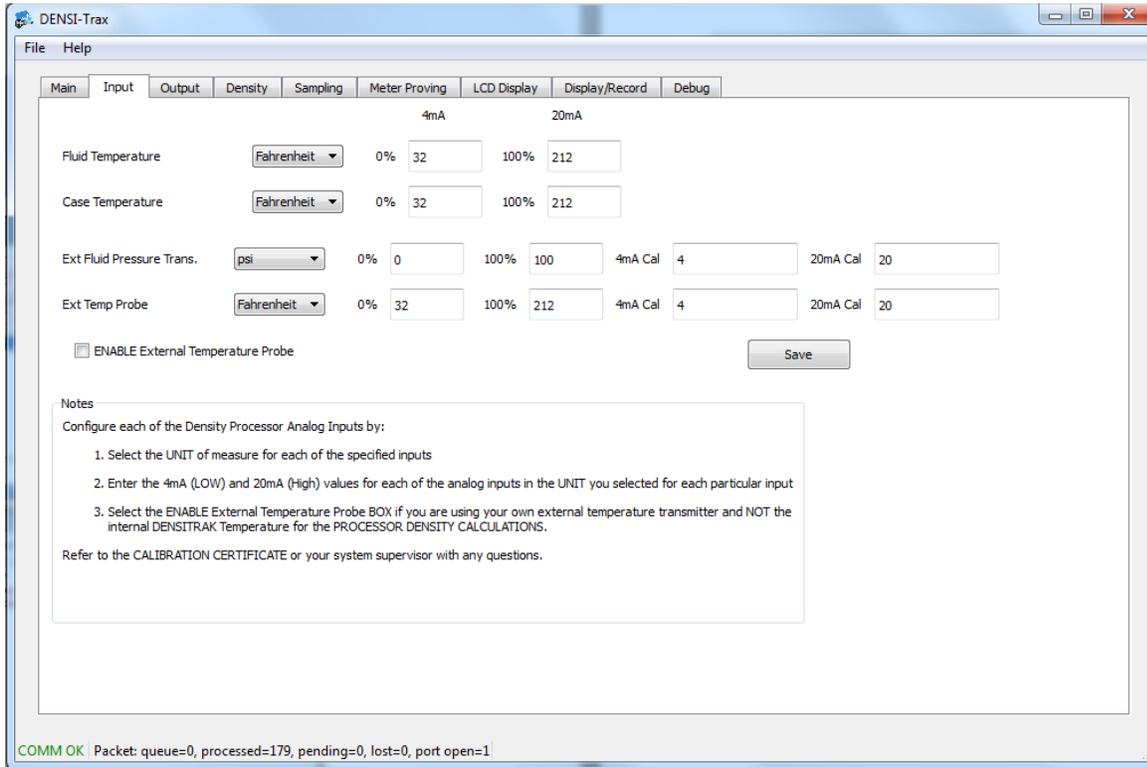
DENSI-TRAX ACCESS LEVEL PASSWORDS

The software has three different levels of access which are designed to limit the level of configuration power available to each user. The three levels are:

FACTORY	<ul style="list-style-type: none"> ▪ Full Access to Modify all variables and settings ▪ PASSWORD: AFT2010
ADMINISTRATOR	<ul style="list-style-type: none"> ▪ Access to all variables except the “DEBUG” screen and Calibration Date and model selection ▪ PASSWORD: AftAdmin
USER	<ul style="list-style-type: none"> ▪ PLOT and DATA LOGGER FUNCTIONS ONLY ▪ PASSWORD: Not Applicable

NOTE: All processor settings/values on each of the SCREEN TABS can be found on the CALIBRATION CERTIFICATE assigned to each density meter.

INPUT SCREEN



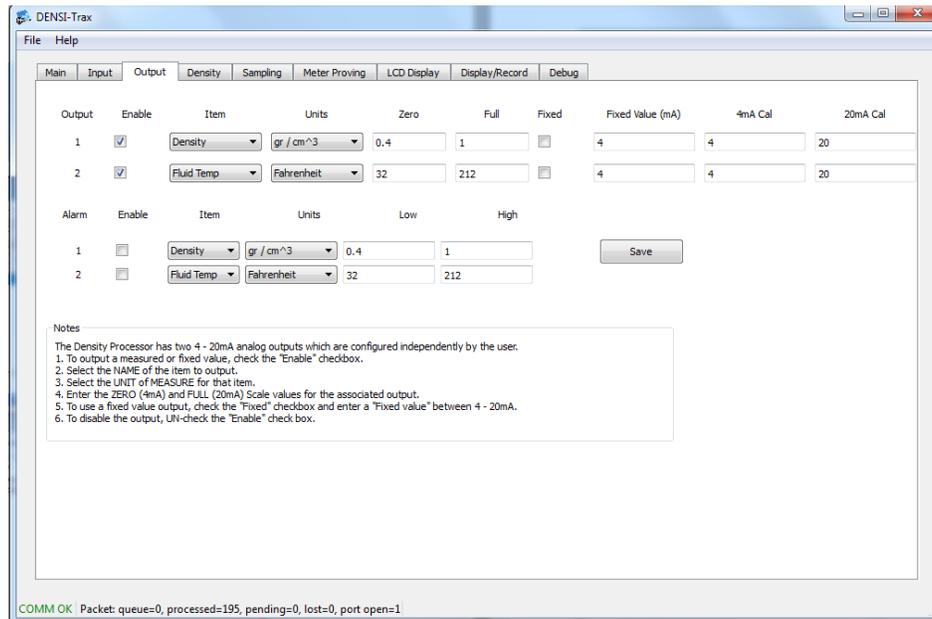
The INPUT screen allows the user to configure the meter inputs for:

- ✓ Fluid Temperature
 - The DENSITRAK® meter has a built in RTD which measures live fluid temperature. The temperature is used by the density processor to compensate for temperature influences on the fluid density.
 - Default input scaling is 32°F - 212°F (0°C - 100°C)
 - Optional input scaling is -58°F - 302°F (-50°C - 150°C)
- ✓ Case Temperature
 - Case Temperature is set at the factory – ONLY APPLICABLE for DENSITRAK® SVT and 1AA0 models
- ✓ EXTERNAL FLUID Pressure TRANSMITTER
 - The customer has the option of connecting an external pressure transmitter 4-20mA signal to the meter to compensate for the effects of pressure on fluid density
 - Scale the input values according to your model pressure transmitter
 - Refer to the DENSITRAK® Manual for Pressure Transmitter connections
- ✓ EXTERNAL FLUID Temperature Probe
 - If the customer has a thermowell with an analog 4-20mA output installed in their system they can use that device for temperature compensated density calculations by enabling the check box and scaling the input appropriately



The user must select the **SAVE** button in order for any changes to be made in the density processor

OUTPUT SCREEN



The OUTPUT Screen is for configuring the TWO INDEPENDENT ANALOG 4-20mA output signals provided by the Density Processor. It also allows the end-user to set ALARM CONDITIONS for both analog outputs

ANALOG OUTPUT CONFIGURATION

1. Select either ENABLE () or DISABLE () for analog 4-20mA Outputs 1 & 2
2. Use the ITEM Pull-Down Menu to select the measured variable you want to output (Density, Specific Gravity, Temperature, API Gravity, Pressure – if applicable)
3. Use the UNITS Pull-Down Menu to select which **UNIT** you prefer for the output variable
4. Enter the ZERO (4mA) and FULL (20mA) scale values for the selected output variable
5. The User can also ENABLE () a FIXED mA output value.
 - a. Enable the check box and input a Fixed mA value between 4mA and 20mA
 - b. Convenient tool for troubleshooting output problems or calibrating PLC's, etc.
6. 4mA and 20mA calibration is performed at the factory.
7. The **SAVE** button must be selected to apply any changes made to the default values

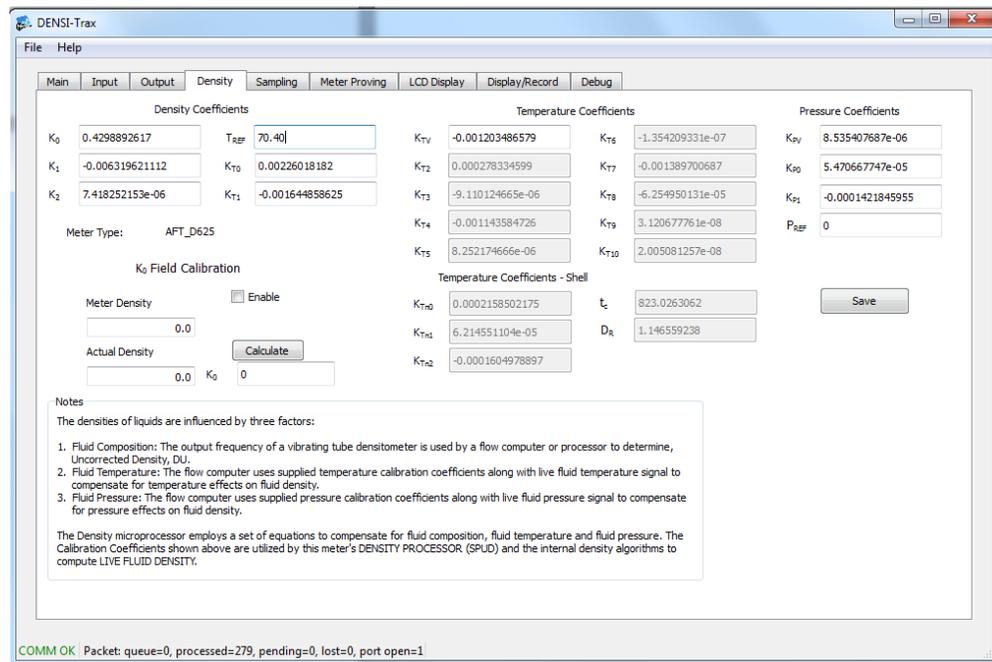
ANALOG OUTPUT ALARM CONFIGURATION

The DENSITRAK® Electronics package provides a pair of NORMALLY OPEN (N/O), and NORMALLY CLOSED (N/C) contacts for each of the analog outputs configured above.

1. Select either ENABLE () or DISABLE () for Alarms 1 & 2
2. Use the ITEM Pull-Down Menu to match the variable for Output 1 & 2 respectively. Alarm 1 should match Output 1 variable, and Alarm 2 should match Output 2 variable
3. Use the UNITS Pull-Down Menu to match the units of the output variable
4. Enter the LOW ALARM and HIGH ALARM values
5. The N/O and N/C contacts on the customer interface board will “switch” when in an Alarm condition

DENSITY SCREEN

This screen is where the **FACTORY CALIBRATION COEFFICIENTS** are programmed into the density processor. The density processor utilizes multiple algorithms to calculate density, and the calibration coefficients provide unique values for each specific meter to compensate for fluid composition, fluid temperature and fluid pressure (if applicable).



The calibration coefficients can **ONLY** be entered when logged in as a **FACTORY** or **ADMINISTRATOR**. The coefficients are determined at the factory and entered into the density processor after calibration is completed. The Coefficient values should match the Calibration Coefficients on the laminated Calibration Certificate that accompanies each meter.

K₀ OFFSET FIELD CALIBRATION

The **ANALYTICAL FLOW TECHNOLOGIES D625** meter is calibrated at the factory with many various fluids and various flow rates – however, there may be occasions where field calibration (adjustment of the K₀ density coefficient) is applicable. Many factors influence whether an adjustment of the K₀ density coefficient is required, such as:

- ✓ Process pipeline flow rates
- ✓ Noise or vibration in the process pipeline
- ✓ Temperature differential

If the density meter is **CONSISTENTLY** displaying a density output reading that is slightly above or below the **ACTUAL** density of the fluid flowing through the pipe a simple adjustment of the K₀ density coefficient can be performed so that the meter is calibrated to the actual fluid density.

The K_0 density coefficient can be found on the Calibration Certificate that was included with your density meter. The K_0 density coefficient can also be read (and displayed) by the selecting the DENSITY tab in the DENSI-Trax Windows ® Software.



When comparing (proving) density readings of any fluids – the fluid metering conditions (temperature, composition and pressure) for both devices must be identical

FIELD CALIBRATION EXAMPLE:

An example of a K_0 adjustment might be as follows:

Distilled Water at 68°F (and minimal pressure) flowing through the meter reads (outputs) 0.99865 gr/cm³ on the meter, but we know (from tables, or hydrometer, pycnometer, etc.) that distilled water has a density of 0.99740 gr/cm³ at 68°F. This means that the meter has an error offset of +0.00125 gr/cm³ at 68°F.

We can correct that error by simply adjusting the K_0 density coefficient by the amount of the error offset, and then entering the new K_0 density coefficient into the density processor or flow computer. The DENSI-Trax software has this feature built in. For this example, the user would simply:

1. ENABLE () the Field Calibration CHECK BOX
2. ENTER the meter value of 0.99865 into the box below METER DENSITY
3. ENTER the actual density value of 0.99740 into the box below ACTUAL DENSITY
4. SELECT the CALCULATE Button
 - ✓ Observe the new K_0 value created in the box below the CALCULATE button
5. SELECT the SAVE Button
6. The new K_0 value is now programmed into the density processor and the actual density and meter density should be nearly identical

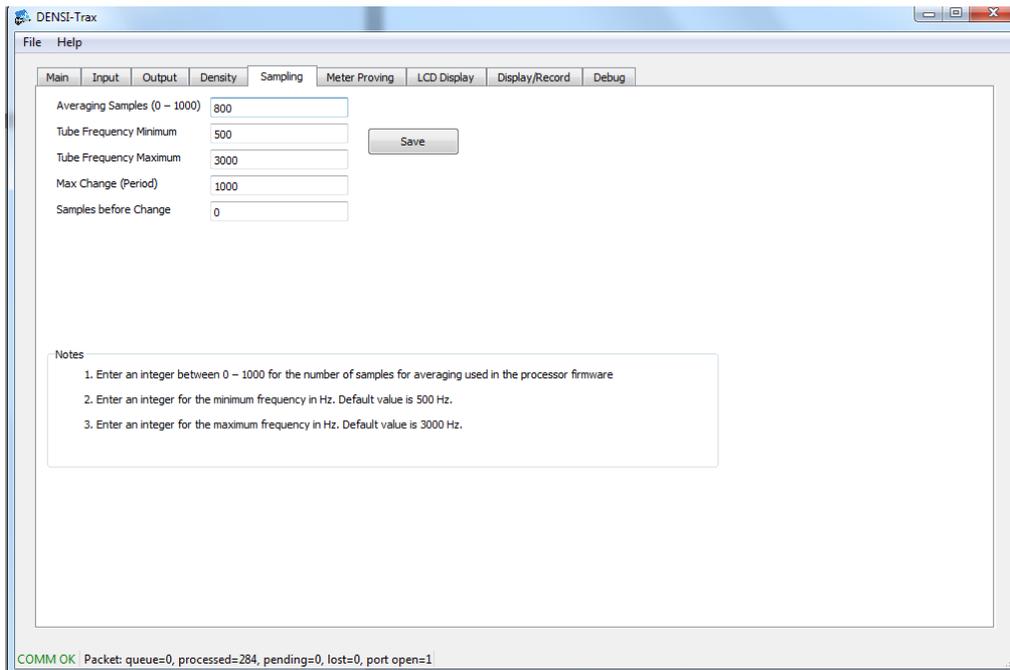
CONTACT ANALYTICAL FLOW TECHNOLOGIES ENGINEERS WITH ANY QUESTIONS CONCERNING YOUR SPECIFIC APPLICATION.

SAMPLING SCREEN

The SAMPLING SCREEN is for factory use only. All values are programmed at the factory.

The DEFAULT Sampling Screen Values are shown in the screen below.

THESE VALUES SHOULD NOT BE MODIFIED BY THE END-USER



METER PROVING SCREEN

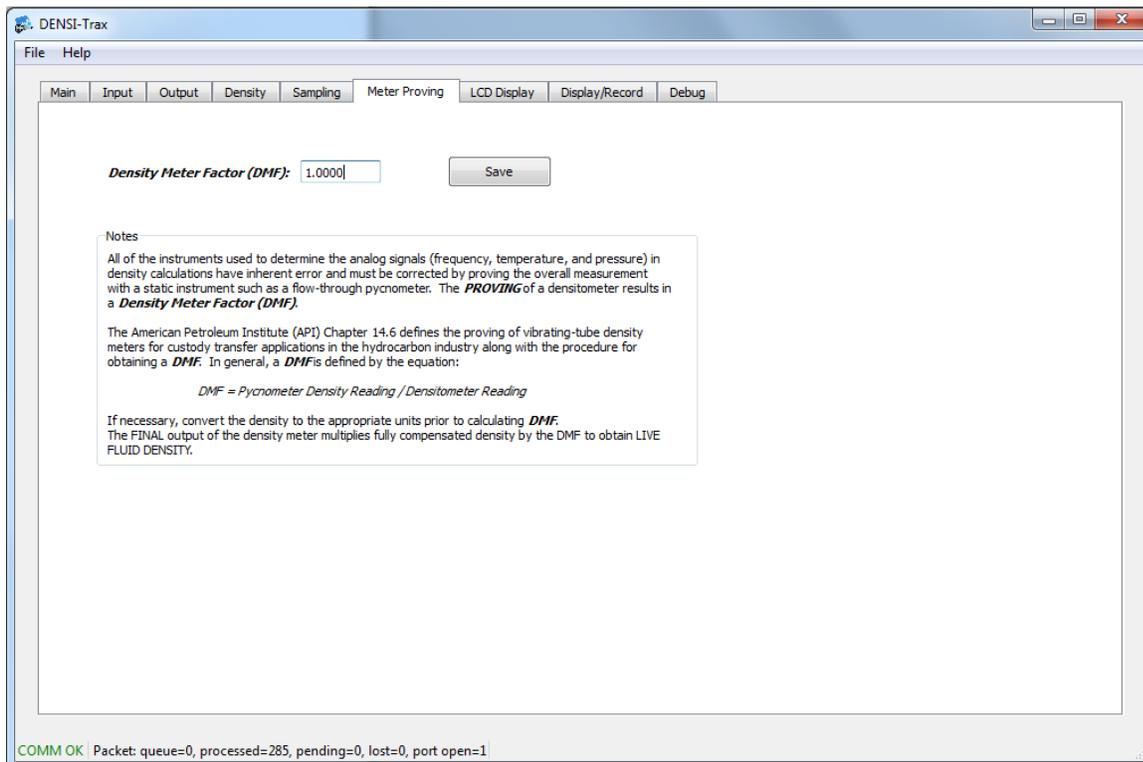
All of the instruments used to determine the analog signals (frequency, temperature, and pressure) in density calculations have inherent error and must be corrected by proving the overall measurement with a static instrument such as a flow-through pycnometer. The PROVING of a densitometer results in a **DENSITY METER FACTOR (DMF)** or **DENSITY CORRECTION FACTOR (DCF)**.

The American Petroleum Institute (API) Chapter 14.6 defines the proving of vibrating-tube density meters for custody transfer applications in the hydrocarbon industry along with the procedure for obtaining a **DMF**. In general, a **DMF** is defined by the equation:

$$DMF = DCF = \frac{\text{Pycnometer Density Reading}}{\text{Densitometer Reading}}$$

If necessary, convert the density to the appropriate units prior to calculating a **DMF**.

The FINAL output of the density meter multiplies fully compensated density by the **DMF** to obtain the **LIVE FLUID DENSITY** output of the meter via the 4-20mA signal.



To apply a **DMF / DCF** to the densitometer 4-20mA output:

1. Calculate the **DMF / DCF** according to the formula
2. Enter the **DMF / DCF** value into the text box on this screen
3. Apply the **SAVE** button

All CALCULATED DENSITY CALCULATIONS WILL NOW BE MULTIPLIED BY THIS VALUE PRIOR TO OUTPUT

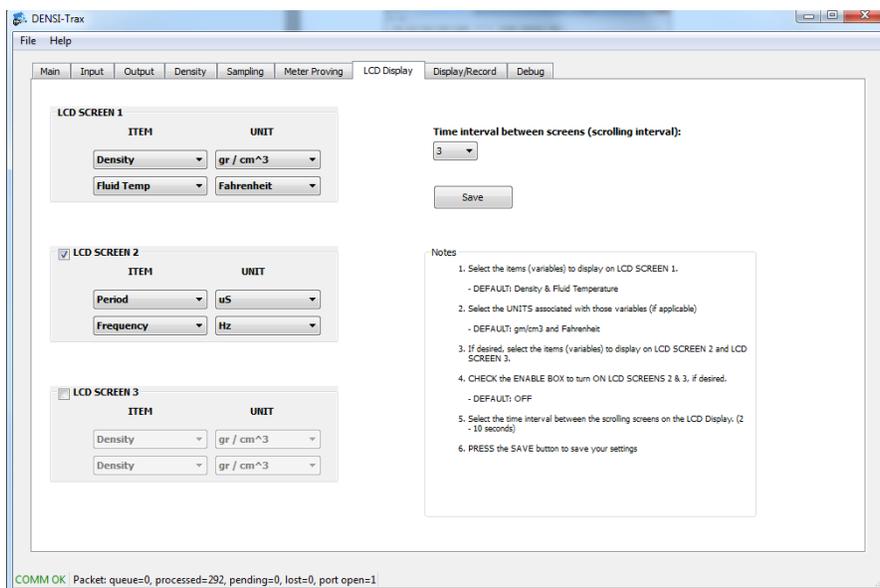
LCD DISPLAY SCREEN

The integrated 2-line LCD (VFD) Display on the DENSITRAK® Densitometer has the ability to rotate through three different screens. The end-user can customize the variables and units for each of the screens. To modify the LCD Screen:

- A. Select the VARIABLE & UNITS for **SCREEN 1**
- B. ENABLE () the LCD **SCREEN 2** check box and select the VARIABLE & UNITS
- C. ENABLE () or DISABLE () the LCD **SCREEN 3** check box and select the VARIABLE & UNITS
- D. Use the PULL-DOWN MENU to select the time interval (in seconds) for the scrolling screens
- E. Select the **SAVE** to enable your changes

The user can modify the units for DENSITY, TEMPERATURE and PRESSURE by using the PULL-DOWN Menu for each variable. The units of choice are:

1. DENSITY
 - ✓ Grams per cubic centimeter gm/cm³
 - ✓ Kilograms per cubic meter kg/m³
 - ✓ Pounds(mass) per cubic foot lb/ft³
 - ✓ Pounds(mass) per gallon lb/gal
 - ✓ ounces (mass) per gallon oz/gal
 - ✓ Pounds(mass) per cubic inch lb/in³
2. SPECIFIC GRAVITY @ 60°F (unit-less measurement of density)
3. TEMPERATURE
 - ✓ Fahrenheit °F
 - ✓ Celsius °C
4. PRESSURE
 - ✓ Bar
 - ✓ Pounds per square inch PSI
 - ✓ Atmospheres atm
 - ✓ kilopascal kPa

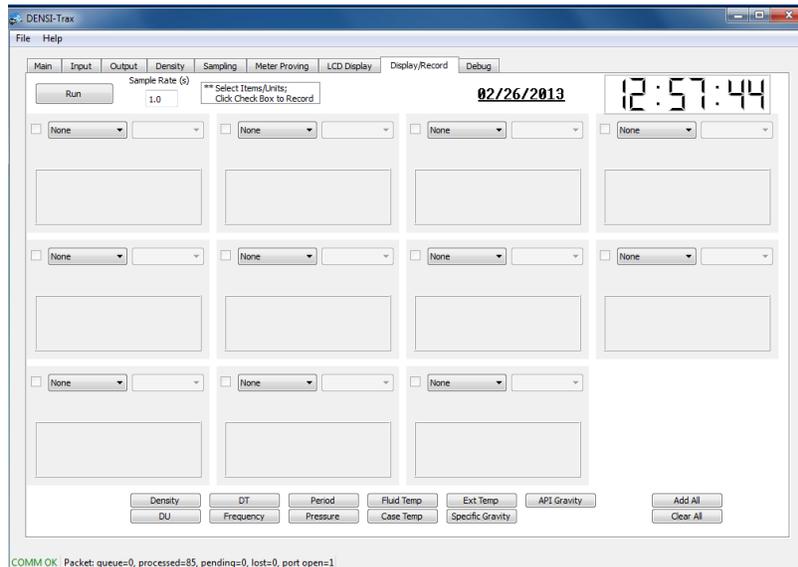


The default values are indicated in the screen above

DISPLAY/RECORD SCREEN

The DISPLAY/RECORD Tab provides the user with the option of recording live data to the screen and/or to a text (.csv) file. It also allows the user to select the sample rate time interval and unit for each of the variables.

Computer Time is shown at the upper right hand corner of the screen.



To RECORD and PLOT live data from the density processor the user only needs to select () the appropriate VARIABLE CHECK BOXES. To RECORD the data the check box next () to the variable name must be selected.

1. Enter SAMPLE RATE (in seconds) in the provided cell (default value is 1.0 seconds)
2. Select the variables you want to MONITOR live by using the Pull-DOWN menu or by selecting the variables listed at the bottom of the screen
3. Select the variables to RECORD to a data file by selecting the Check Box ()
4. Select the RUN button
5. IF RECORDING DATA to a text file you will be PROMPTED to name the text file.
 - a. Browse to the folder you want to save the file
 - b. Enter the name of the File
 - c. Select SAVE
6. The meter will record and monitor data at the sampling rate interval you entered in step 1.
7. Select STOP when you want to stop recording or plotting live data

DEBUG SCREEN

This screen is for FACTORY USE ONLY.



CONTACT INFORMATION

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Fax: 888-774-8321

Web: www.densitrak.com

APPENDIX I: CONVERSION FACTORS

DENSITY

Convert From	Convert To	Unit	Multiplication Factor
Grams per Cubic Centimeter gr/cm ³	Kilograms per cubic meter	kg/m ³	1000.00
	Ounces per gallon	oz/gal	133.5265
	Pounds per cubic foot	lb/ft ³	62.42796
	Pounds per cubic inch	lb/in ³	0.03612729
Pounds per cubic foot lb/ft ³	Grams per Cubic Centimeter	gr/cm ³	0.01601846
	Kilograms per Cubic meter	kg/m ³	16.01846
	Ounces per gallon	oz/gal	2.138889
	Pounds per cubic inch	lb/in ³	0.0005787037

PRESSURE

Convert From	Convert To	Unit	Multiplication Factor
Bar	Pounds per square inch	PSI	14.50377
	Atmosphere	atm	0.9869233
	Kilopascal	kPa	100
	Megapascal	MPa	0.1
	Inches of Mercury		29.52999
Pounds per square inch PSI	Atmosphere	atm	0.06804596
	Kilopascal	kPa	6.894757
	Megapascal	MPa	0.006894757
	Inches of Mercury		2.036021
	Bar		0.06894757



 FLOW RATE

Convert From	Convert To	Unit	Multiplication Factor
Gallons per minute GPM	Gallons per hour	GPH	60
	Liters per hour	l/hr	227.1247
	Liters per Minute	l/min	3.785412
	Cubic meters per hour	m ³ /hr	0.2271247
	Cubic meters per minute	m ³ /min	0.003785412
	Barrels (US) per minute	BPM	0.0317460
	Barrels (US) per hour	BPH	1.90476
Barrels per hour BPH	Gallons per hour	GPH	31.5000
	Liters per hour	l/hr	119.240
	Liters per Minute	l/min	1.98734
	Cubic meters per hour	m ³ /hr	0.119240
	Cubic meters per minute	m ³ /min	0.00198734
	Barrels (US) per minute	BPM	0.0166667
	Gallons per minute	GPM	0.525000

 TEMPERATURE

$$^{\circ}\text{F} = (^{\circ}\text{C} \times 1.8) + 32$$

$$^{\circ}\text{C} = (^{\circ}\text{F} - 32) / 1.8$$



APPENDIX II: SOFTWARE PASSWORDS

All passwords are case-sensitive.

1. FACTORY level password: AFT2010
2. ADMINISTRATOR level password: AftAdmin
3. USER level password: None Required

APPENDIX III: DENSITRAK® FIRMWARE UPDATE

The integrated firmware in the DENSITRAK® Signal Processing Unit for Density (SPUD) can be updated by the end-user at any time with the most recent firmware available on the Analytical Flow Technologies website: www.densitrak.com. The DENSITRAK® electronics incorporates a MICROCHIP PIC32 processor which can be updated with the MICROCHIP HID Bootloader program.

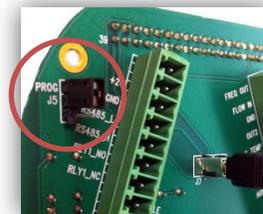
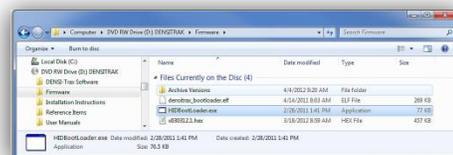
The Equipment necessary to update the SPUD firmware is:

- ✓ USB Cable (provided with the DENSITRAK Density Meter)
- ✓ Windows®-based computer with USB Port
- ✓ Original factory-issued Calibration Certificate
- ✓ **Microchip HID Bootloader Program** (included on the Analytical Flow Technologies CD-ROM or via the website)
- ✓ DENSITRAK Densitometer and 24 V_{DC} power supply
- ✓ The latest Firmware **HEX** file (*v030312.1.hex for example*)

FIRMWARE UPDATE PROCEDURE

NOTE: Updating the FIRMWARE will erase all of the factory programmed INPUT / OUTPUT and CONFIGURATION settings in the densitometer Signal Processing Unit. PRIOR to updating the firmware, the customer should make note of all of the current processor settings. The customer must also have the original Calibration Certificate in order to reprogram the firmware with the specific settings applicable to that meter.

1. Connect the DENSITRAK meter that is to be updated to the computer via USB cable
2. Open the DENSI-Trax Software program
3. Make notes of all the current INPUT/OUTPUT/Configuration settings of the DENSITRAK Processor
 - ✓ Also refer to the meter's laminated Calibration Certificate
 - ✓ Use the FORM in APPENDIX IV for recording the current settings in the meter processor
4. Close the DENSI-Trax Software program and shut down (remove power) the DENSITRAK meter
5. Insert the Analytical Flow Technologies reference CD-ROM into the PC
6. Browse to the **FIRMWARE – HIDBootLoader.exe** file on the CD-ROM and copy it to your computer
7. Download the latest **HEX** file to your computer. The file is available on the CD-ROM or from the website. (www.densitrak.com/downloads/)
8. Ensure that the POWER is OFF to the DENSITOMETER
9. Install the J5 jumper as shown in the image at right (top two pins)
10. Attach the USB cable from the DENSITOMETER to the Computer
11. APPLY POWER (Turn ON) to the DENSITOMETER



12. Launch the Microchip **HIDBootLoader.exe** Program



13. If the densitometer is powered on the J5 jumper is installed correctly, the HIDBootLoader screen should appear similar to the image at right

14. Select the **"Open Hex File"**



15. Browse to the location that you saved the most recent HEX file

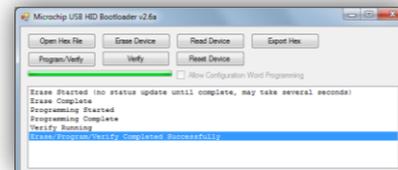
16. Select **OPEN** file



17. Select **Program/Verify**

18. Confirm that the DENSITRAK processor was updated correctly the **Erase/Program/Verify Completed Successfully** message appears in the text window

19. Close the HIDBootLoader PROGRAM 



20. Turn OFF Power to the DENSITOMETER

21. Remove the J5 Jumper and replace in its default position (bottom two pins)

22. Turn ON Power to the DENSITOMETER

- ✓ Watch the LCD Display on the DENSITOMETER when applying power and confirm that the screen indicates **"COLD START"** then firmware revision (i.e. v030113.1)

23. Launch the DENSI-Trax Software Program

24. Log-In as the **FACTORY** level (Password: **AFT2010**)

25. Using the SAVED CONFIGURATION .xml File, Factory Calibration Certificate and/or the notes you made in Step 3 above, Re-Program each of the **MAIN, INPUT, OUTPUT, DENSITY, and LCD DISPLAY Screens** in the software.

- ✓ YOU MUST SELECT THE **SAVE** BUTTON ON EACH SCREEN FOR THE SETTINGS TO BE PROGRAMMED TO THE DENSITRAK PROCESSOR

26. For the **SAMPLING Screen** enter the following values:

- ✓ Averaging Samples (0-1000) 800
- ✓ Tube Frequency Minimum 500
- ✓ Tube Frequency Maximum 3000
- ✓ Max Change (Period) 1000
- ✓ Samples before Change 0

27. Your DENSITRAK DENSITOMETER is now programmed with the latest firmware



APPENDIX IV: PROCESSOR SETTINGS FORM

MAIN SCREEN

Meter Type	Tag Number
Model	Firmware Rev UPDATES AUTOMATICALLY
Processor S/N	Calibration Date
Amplifier S/N	

INPUT SCREEN

Fluid Temp Unit	4mA Value	20mA Value
Case Temp Unit	4mA Value	20mA Value
Ext Fluid Press Unit	4mA Value	20mA Value
Ext Temp Probe Unit	4mA Value	20mA Value

Enable External Temperature Probe

OUTPUT SCREEN

Output	Enable	Item	Unit	ZERO	FULL	FIXED	Fixed Value	4mA CAL	20mA CAL
1	<input type="checkbox"/>					<input type="checkbox"/>			
2	<input type="checkbox"/>					<input type="checkbox"/>			
Alarm	Enable	Item	Unit	LOW	HIGH				
1	<input type="checkbox"/>								
2	<input type="checkbox"/>								

DENSITY SCREEN

K ₀	T _{ref}	K _{Tv}	K _{T6}	K _{Pv}
K ₁	K _{T0}	K _{T2}	K _{T7}	K _{P0}
K ₂	K _{T1}	K _{T3}	K _{T8}	K _{P1}
		K _{T4}	K _{T9}	P _{ref}
		K _{T5}	K _{T10}	

K₀ Field Calibration Enable

Meter Density	K _{Tn0}	t _c
Actual Density	K _{Tn1}	D _R
	K _{Tn2}	

SAMPLING SCREEN

Averaging Samples (0-1000)	800
Tube Frequency Minimum	500
Tube Frequency Maximum	3000
Max Change (Period)	1000
Samples before Change	0

METER PROVING SCREEN

Density Meter Factor (DMF): _____

LCD DISPLAY SCREEN

LCD SCREEN 1		LCD SCREEN 2		LCD SCREEN 3	
Item	Unit	Item	Unit	Item	Unit
Time Interval between Screens (scrolling interval) _____					

