CALDON® ULTRASONICS

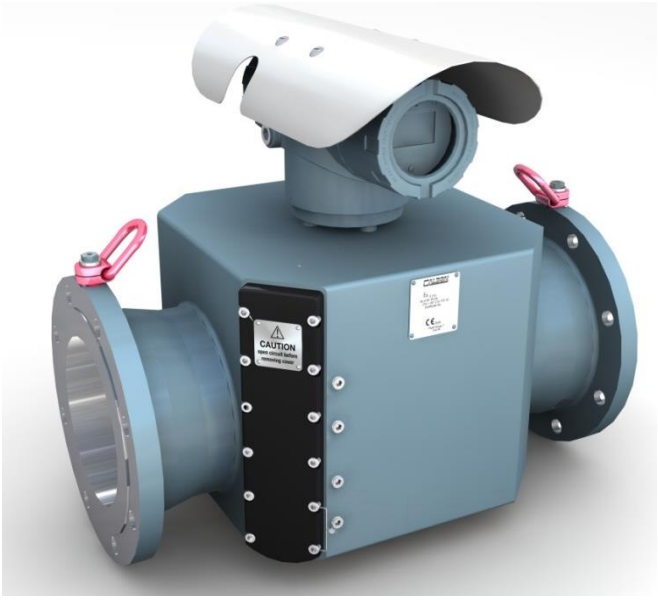
LEFM Link – 2G

PC Interface Software

User Manual



G2 Transmitters



G3 Transmitters

Manual No. IB0910 Rev. 05

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The Caldon LEFMLink 2G software is diagnostic software intended as a user diagnostic tool for the LEFM2xxCi liquid flow meters (220Ci, 240Ci, and 280Ci as well as the 280Fi and 2010 flow meters), LEFM3xxCi gas flow meters and the SoundTrack pipeline interface detectors.

Note: This version of software has been updated to work with the new G3 transmitters that were introduced in 2015. The electronics prior to 2016 is referred to as the G2 electronics.

It is recommended that before performing system verification and repair procedures, personnel receive general training from Cameron. Contact Cameron for information on training programs.

Cameron is a manufacturer of high quality instrumentation and control products, selling direct from a Pittsburgh based factory to customers in the U.S. and through agents and representatives abroad. A complete range of support services are offered. For additional information or assistance on the application, operation or servicing the LEFM 2xx and 3xx Series Meter or SoundTrack family, write or call, or visit www.c-a-m.com/flo.

Table Of Contents

Section 1 1

Introduction 1
System Requirements 1

Section 2 3

Installation and Hardware Setup 3
Software Installation 3
Hardware Configuration 5

Section 3 9

User Interface Overview 9
Software Architecture 9
Main Screen Overview 11

Section 4 16

Downloading and Uploading Configurations 16
Logging Into G3 Transmitters 16
Download Setup Files 17
Upload Setup File from Device 20

Section 5 23

User Manuals 23

Section 6 25

Task Operation 25
Data Logging 25
Update Scaling 28
Setting Transmitter Time 32
Resetting Transmitter Totalizers 33
Re-Initializing Velocity Profile 34
Waveform Viewing 35

Section 7 39

Menu Items 39
Signal Diagnostics 39
Calculation Diagnostics 41
G2 Only -Transducers 42
G2 Only Echo Paths 43
Trending 44
Health Audit 45

Section 8 46

Section 9 51

Tools 51
Viewing Modbus Registers 51
Output Forcing 52
Zeroing Meter 53
Communications 54

Section 1

Introduction

The LEFMLink 2G is the second generation of software used as a PC diagnostic tool for the LEFM 2xxCi and 3xxCi series flow meters and the SoundTrack pipeline interface detectors. This manual covers the use of the software to diagnose problems, update the input and output scaling, and configuration of these devices.

Note: This version of software has been updated to work with the new G3 transmitters that were introduced in 2015. The electronics prior to 2016 is referred to as the G2 electronics.

This manual assumes the user understands the troubleshooting techniques covered in the IOM manuals and/or has been trained by Cameron personnel on these techniques. This manual also assumes that the user is familiar with the use of Windows and PC computers.

System Requirements

PC (preferably a laptop) installed with Windows XP or later operating system with at least one free serial communications (COM) port or an Ethernet port.

Section 2

Installation and Hardware Setup

Software Installation

LEFMLink 2G is packaged as an installation program. The installation program, LEFMLink 2G Setup.exe, can be run directly from the 101A729 CD. Run the executable by double – clicking on the icon.



The following screen will open to start the installation process; click "Next >" to install LEFMLink 2G on the computer.

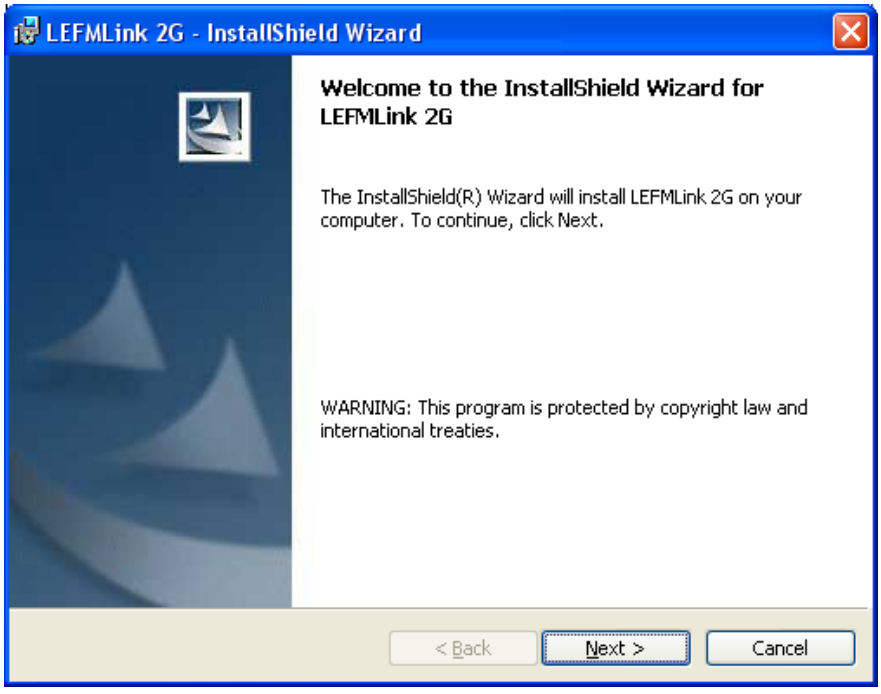


Figure 2-1: Install Program

Enter user information and click “Next >” to continue.

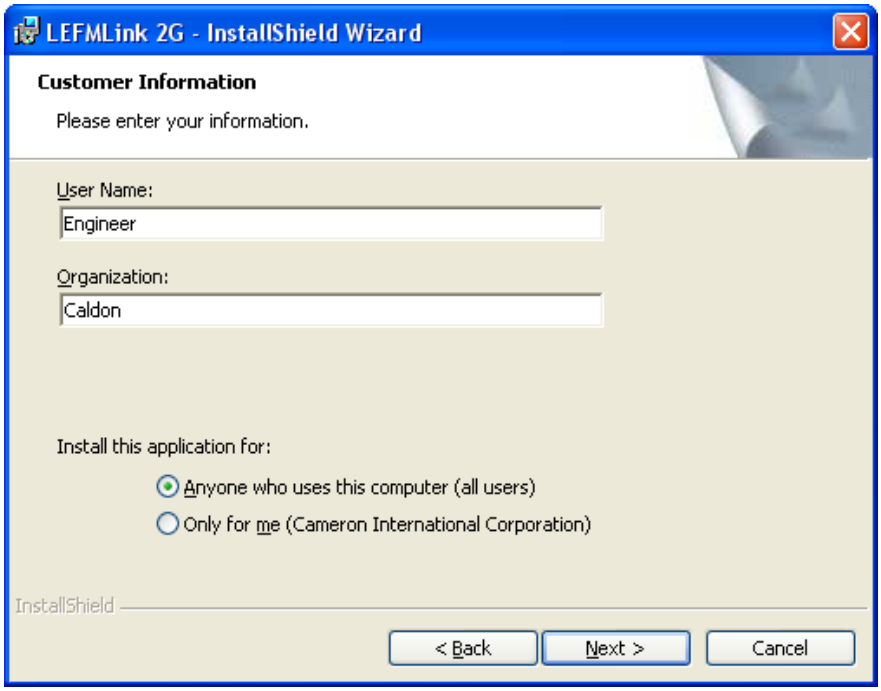


Figure 2-2: Enter User Information

The default directory is C:\Program Files\Cameron\ModWorXPro, Click “Install” to install LEFMLink 2G to the specified location.

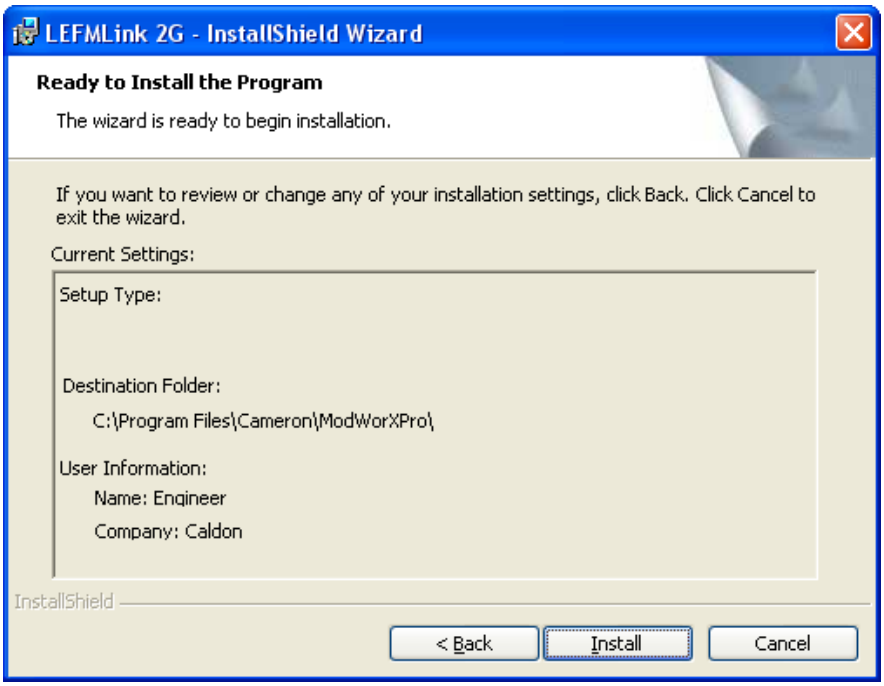


Figure 2-3: Ready to Install

Click on Finish to exit the installation program and launch LEFMLink 2G (see Section 3).

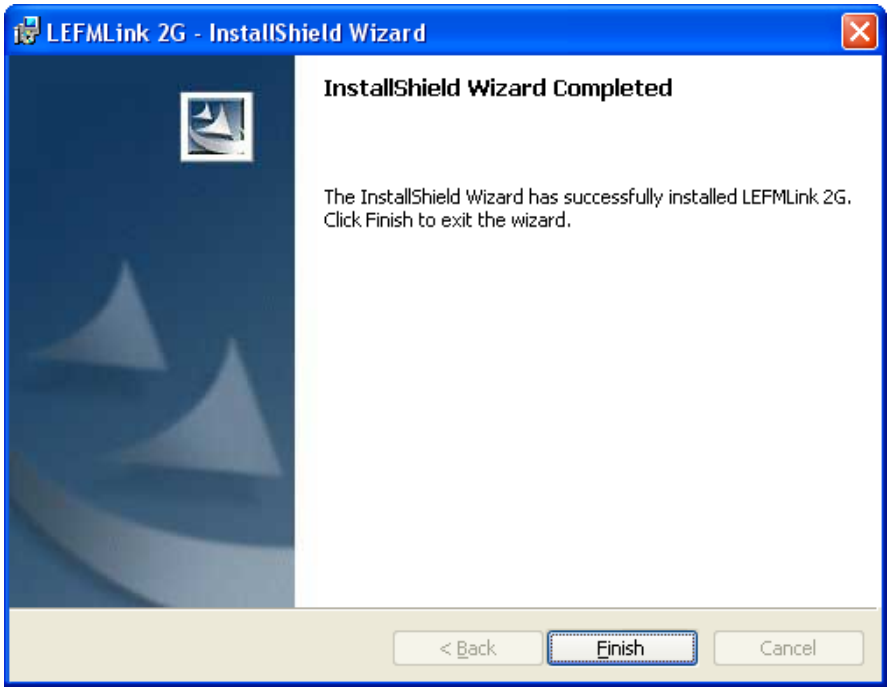


Figure 2-4: Installation Complete

Hardware Configuration

Serial Connections

Connect the serial interface cable between an available COM port on the PC and terminal blocks on the transmitter (for example, on the G2 transmitter use TB-2 pins 1 to 5 or TB-2 pins 6 to 10). Please see the operation manual for the model transmitter being used.

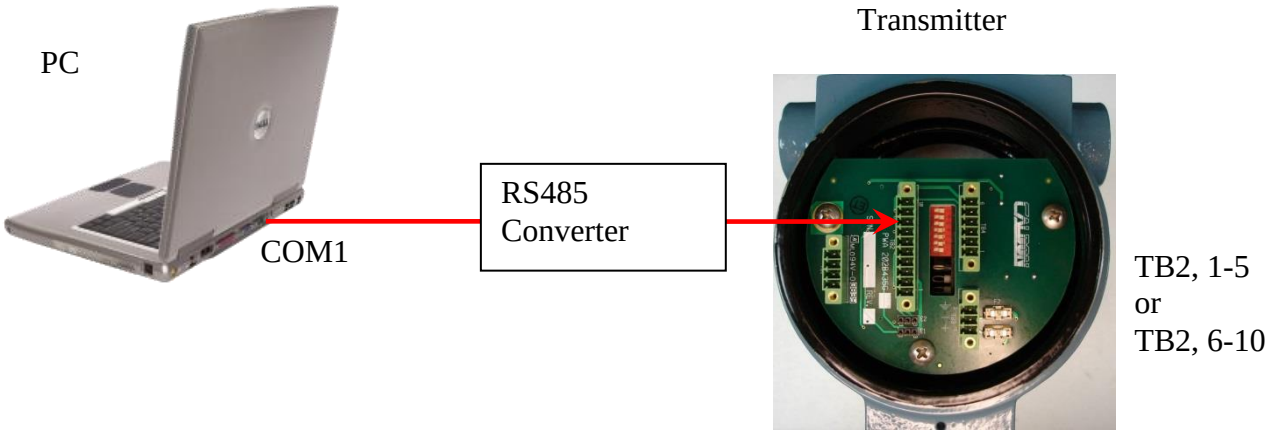


Figure 2-5: Hardware Example Connection to Hazardous Area Electronics (G2 shown)

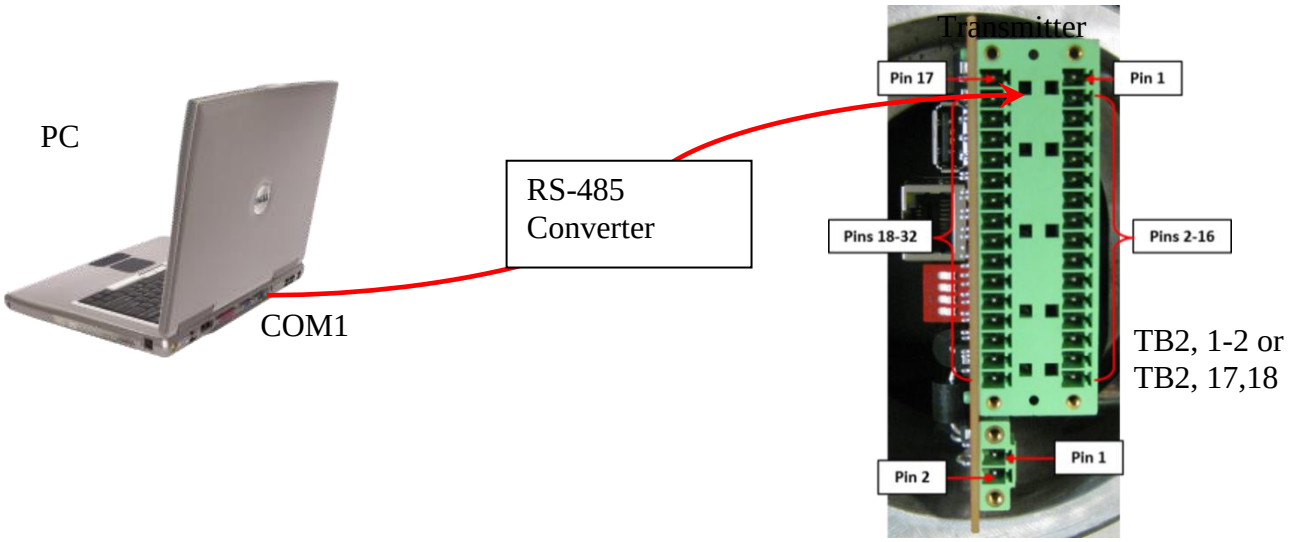


Figure 2-6: Hardware Example Connection to Hazardous Area Electronics (G3 shown)

Start LEFMLink 2G according to Section 3.

For G2 transmitters - LEFMLink 2G default communicates at 9600 baud to Modbus Slave Address 1[1] For G2 transmitters with Ethernet converters the default baud rate is 38400 slave address 1.

For G3 transmitter the typical baud rate is 19,200 baud with slave address 1. On the G3 transmitter the serial settings and IP addresses are displayed on the device display on startup.

If the communications matches the configuration of the Cameron equipment then LEFMLink 2G will display data similar to that shown in Figure 2-7 and LEFMLink 2G is ready for further use.

If the communication are faulty – then the LEFMink 2G will remain on the communication page. If it does connect – but then fails, then the LEFMLink 2G screen will show a communication failure, like Figure 2-8. In either case, further steps are necessary to connect. One or more of the following are likely:

- The Cameron hardware device has different communications settings; see Section 3 for instructions on changing the communication settings to match the device configuration.
- The comm port is in use by another program. This can happen for example when programs such as HotSync or ActiveSync for a PDA are enabled. Close down the conflicting program to establish connection, or select a different COM port if available.
- The cable is damaged.

[1] Note: The default value on a given PC will be equal to that last used by the software. The software remembers the communication settings used.

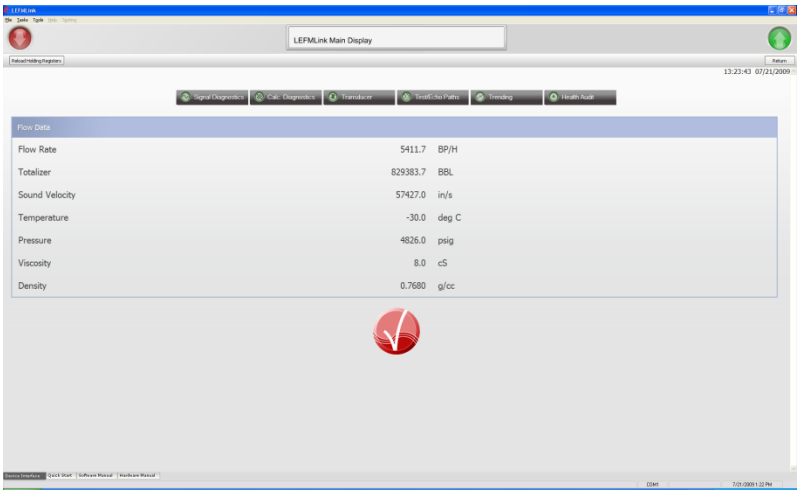


Figure 2-7: LEFMLink 2G Communicating with Transmitter

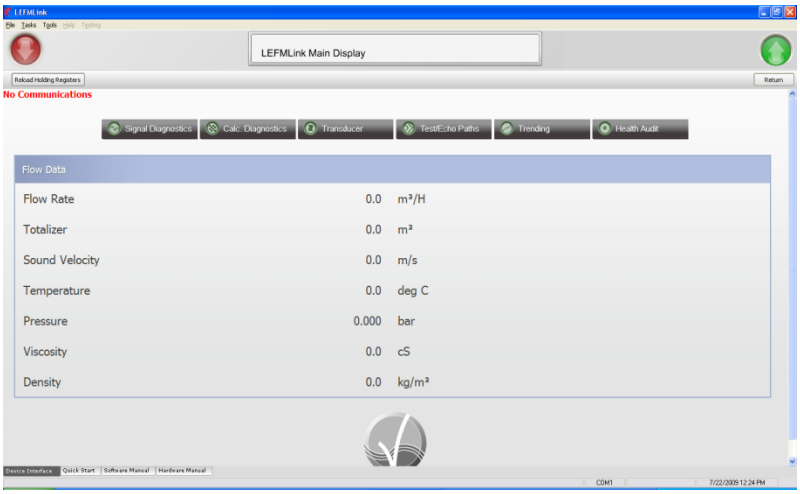


Figure 2-8: LEFMLink 2G with No Communication with Transmitter

Ethernet Connections

For G2 transmitters refer to IB1218 - LEFM 2xxCi and 3xxCi Transmitter Webserver Interface Software for instructions on verifying that the serial to Modbus TCP converter built into the unit is configured correctly and communicating with the CTC prior to attempting to connect to the meter using LEFMLink 2G.

For G3 transmitters the copper and fiber modes are mutually exclusive. Refer to the transmitter model number for mode the boards are configured for.

Connect the meter to the network and configure the PC such that it can communicate on the same network. Contact your system administrator for assistance in establishing the setting on both the PC and the meter to establish a connection.

Section 3

User Interface Overview

The user interface is similar for all Cameron measurement devices, with some product specific differences. Common features will be described first, followed by product specific features as applicable.

Software Architecture

Once entering through a brief "splash" screen (where LEFMLink 2G has an animated start), the software goes to a connect screen (Figure 3-1). The main screen (Figure 3-4) is the anchor to the architecture. From this screen user manuals can be launched (PDF files), tasks can be executed and data can be collected.

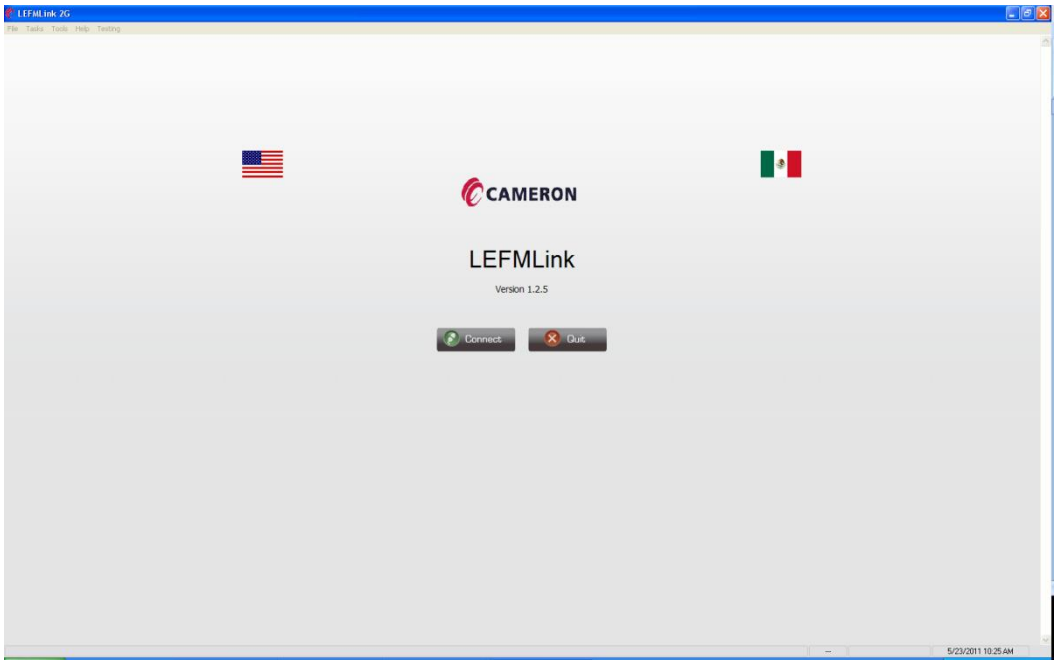


Figure 3-1: LEFMLink 2G Initial Connection Screen

From the connect screen, simply click on connect. The software will launch the communications screen to let the user select the appropriate communications (Figure 3-2 and 3-3).

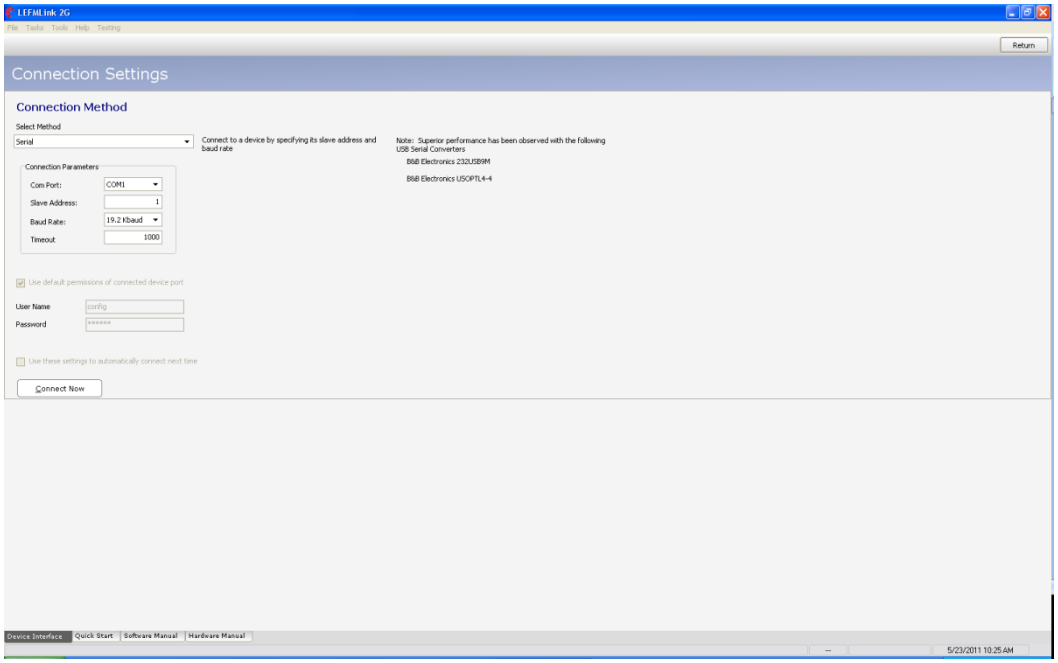


Figure 3-2: LEFMLink 2G Serial Communications Screen

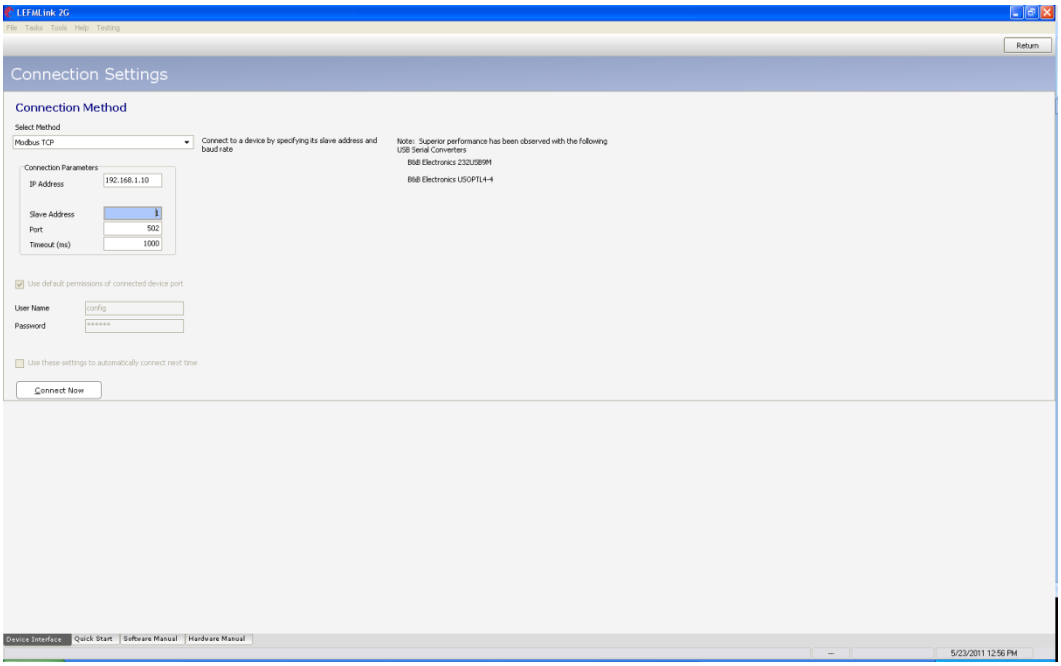


Figure 3-3: LEFMLink 2G Modbus TCP Communications Screen

On some small screens, i.e. Netbooks, the “Connect Now” button may not be visible, press Alt+c to activate.

The main screen of LEFMLink 2G contains an overview of the meter status and measurements. Figure 3-4 shows the main screen and highlights the major areas of that screen.

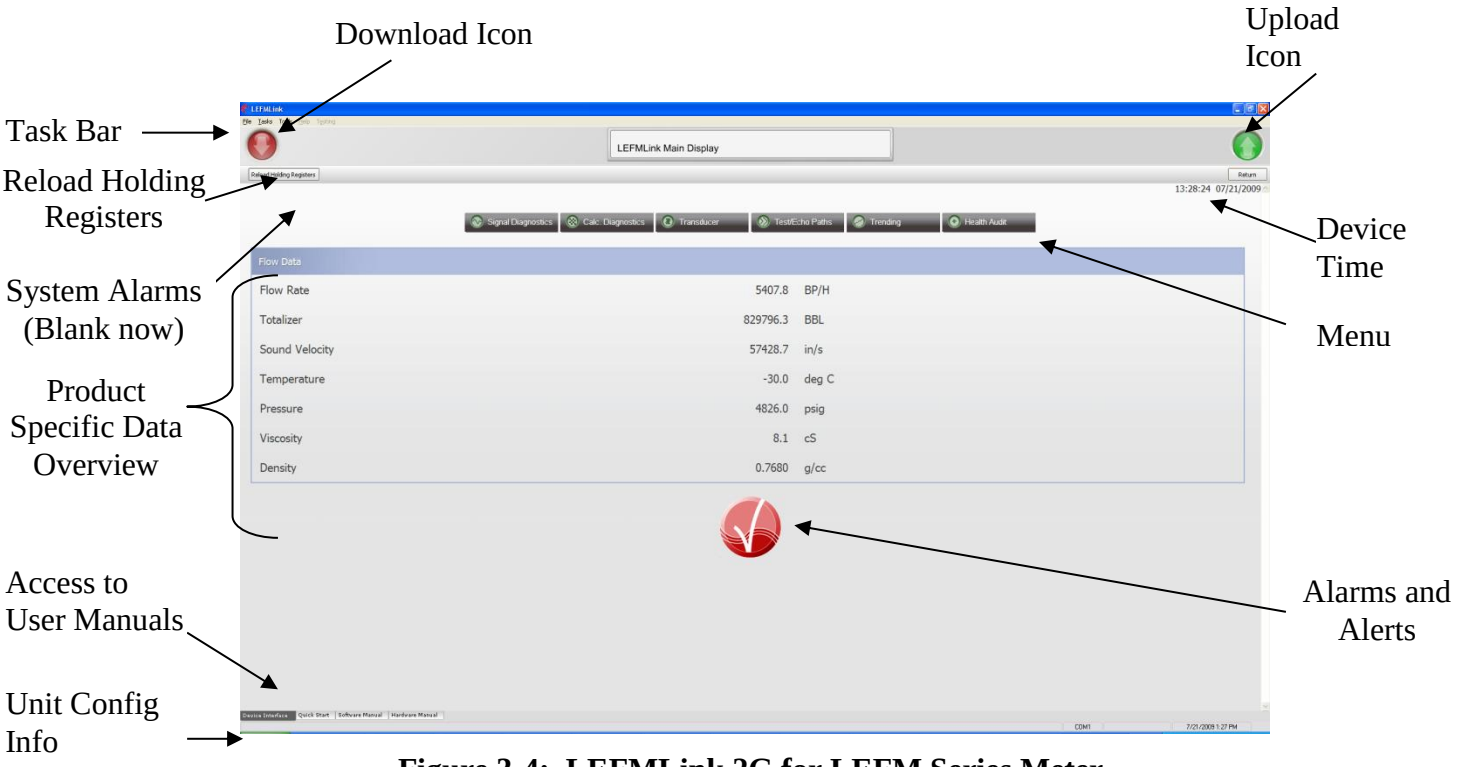


Figure 3-4: LEFMLink 2G for LEFM Series Meter

The following subsections give introductory explanations of the main screen operation.

Main Screen Overview

Task Bar

The task bar is used to access the other functions within LEFMLink 2G. The task bar is only accessible from the main screen. Below is a summary of the main task functions. Each task item will be detailed in a later section.

File Commands

- Exiting Program

Tasks (See Section 6)

- Data Logging – Start and Stop data logging; choose directory path and name of log
- Analog Input/Output Scaling – Change Analog Input, Analog Output, and Pulse Output Scaling as well as the communication settings on the Transmitter.

- Analog Input RTD Scaling
- Set Transmitter Time
- Reset Transmitter Totalizers
- Re-Initialize Velocity Profile
- Path Triggering

Tools (See Section 8)

- View Modbus Registers (tool to see and write to any Modbus register)
- Output forcing – Force values to analog and frequency output for loop calibration purposes.
- Zero Meter (Special site procedures required)
- Communications (Change Meter Baud Rate and Slave ID)

If a task item cannot be executed under the current conditions it is grayed out (for example device does not have an RTD, the task is "grayed out". Task items are normally all active when on the main screen, but are grayed out if operating on one of the lower screens.

Reloading Holding Registers

LEFMLink 2G displays its units based on the transmitter's units. However, the units are read only when LEFMLink 2G connects for the first time. If the user were to change the units, then hitting this action button lets LEFMLink 2G re-read the registers and update its text appropriately[2].

Downloading and Uploading Icons

LEFMLink 2G has special icons for sending configuration files to a transmitter (downloading – icon is a red "down" arrow) and for reading configuration files from a transmitter (uploading – icon is a green "up" arrow). There is a user manual section on these tasks.

Device Time

The transmitter has its own real time clock. The time and date of this clock can be observed on the main screen. If necessary, this device time can be changed to the PC time.

Access to User Manuals (See Section 5)

These tabs are used to access the user manuals associated with the product.

[2] LEFMLink does re-load the holding registers periodically, however, if the user knows that the units have changed, then reloading manually is recommended.

Menu (See Section 7)

The menu is used to access the other screens and operations performed by LEFMLink 2G. Once within a menu screen, the task bar items become inaccessible until return to the main screen. Below is a summary of menu operations. Each task item will be detailed in a later section.

- Signal Diagnostics
- Calculation Diagnostics
- Transducers
- Test/Echo Paths
- Trending
- Health Audit

System Alarms

This section contains status information for the device. One of the following messages can be displayed:

```
No Setup
No GSS
BAD Checksum
No Communications
```

`No Setup` appears if the system has not been configured or the setup was cleared.

`No GSS` appears if the system is configured to use a GSS (Global Synchronization Signal) and none is present.

`BAD Checksum` appears if the system memory self diagnostics fail.

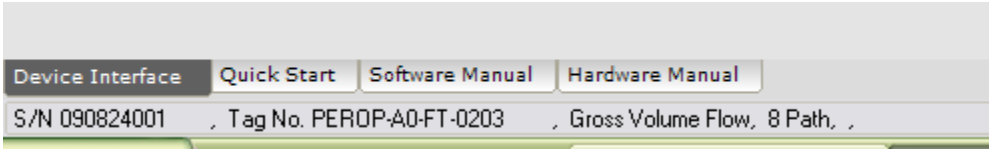
`No Communications` appears if the system is not transmitting with device

Lower Status Bar (Unit Configuration Info)

On the lower status bar information about the unit currently connected is shown. This may include:

The left side of the bar has configuration data from the transmitter.

- Unit Serial Number
- Unit Tag Number
- Flow Type (Gross Volume, Net Volume, Mass)
- Number of Paths
- Fluid Type



The right side has information about the connection settings.

- Communications Port
- Baud Rate
- Slave ID

Product Specific Data Overview

The main screen for the LEFM 2xx/3xx Series Flow Meters displays the following:

- Flow – Current Flow Rate in the programmed units of the transmitter
- Totalizer – Total Volume since last reset in flow units
- Sound Velocity – Fluid Sound Velocity
- Temperature – Meter Body Temperature input
- Pressure – Optional Fluid Pressure input (default zero if not installed)
- Viscosity – Calculated Fluid Viscosity
- Density – Calculated Fluid Density

Alarms and Alerts Log

This icon shows the system status. A color red indicates some out of specification condition. Clicking on this icon opens a status summary page.

Lists of Alarms and their time tags

List can be cleared of old alarms.

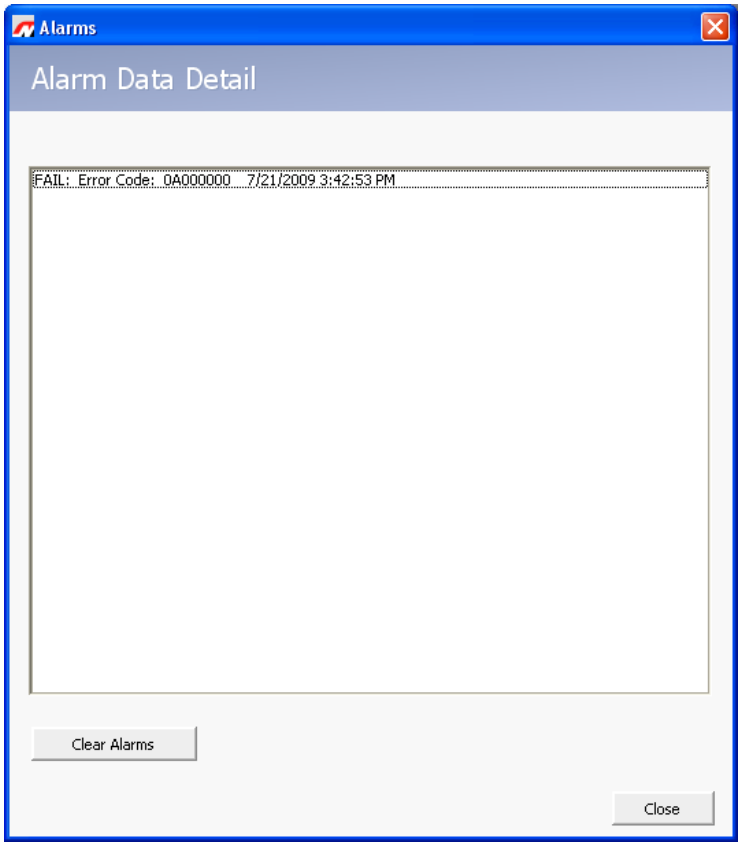


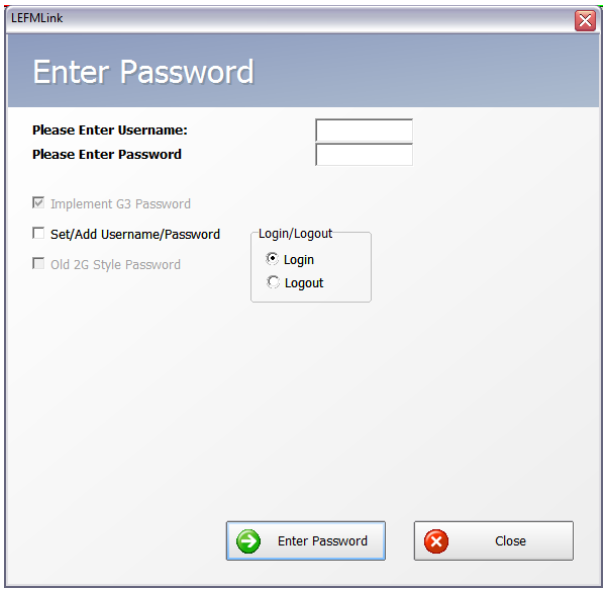
Figure 3-5: LEFMLink 2G Alarm Log

Section 4

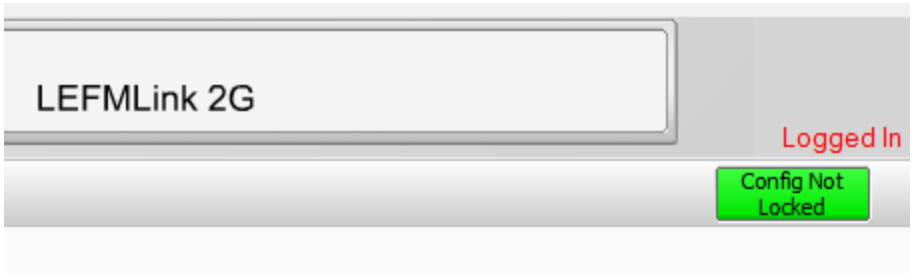
Downloading and Uploading Configurations

Logging Into G3 Transmitters

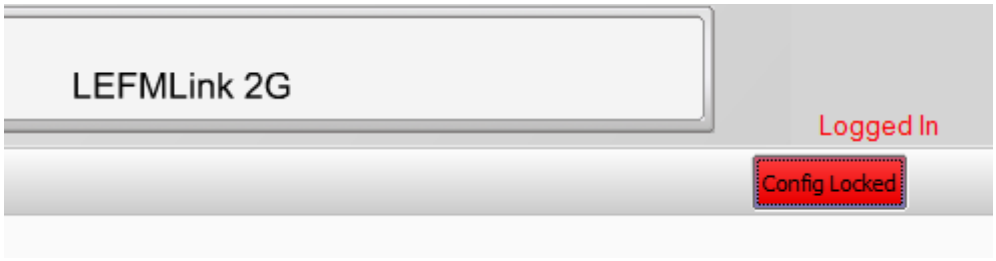
The G3 transmitter has a user name and password that must be entered in order to send a setup file. To proceed, on the menu bar hit – TASKS – "Login/Logout/Add User". The following display will appear.



Enter the know user name and password for your transmitter. After entering the password, then the on the main screen – "click" on the green Config Not Locked Icon.



After a couple of seconds – the icon will change to the red Config Locked icon, this indicated that the current user has control of the configuration database and can make and commit changes.



Download Setup Files



WARNING

The icon Download configuration file to device command sends a new setup to the transmitter. To download a setup file to the device, select the red down arrow on the main screen. This procedure may change settings that affect the flow measurement value.

Figure 4-1 shows the Setup Files dialog box.



Figure 4-1: Setup Files Dialog Box before Configuration File is Selected

Password Set- G2 Electronics only

For any command that changes the configuration of the electronics, a Password Set command is required. Different commands and functions will be available to the user depending on the level of the password entered. A 4 digit numeric user password is required.

These passwords are defined in the configuration file and the Administration level password is required to change it from the default value.

The default values are:

Level 1 – Analog Scaling/Setting Time and Resetting Totalizers

User Number	Password
1	1111
2	2222
3	3333
4	4444
5	5555

Level 2 – All entries to devices

User Number	Password
Administrator	1234

Note: User passwords can be changed by sending a calibration file. Be aware of values in the calibration files.

Note: If the Electronics has not been configured and is showing No Setup then the master password of 16286 must be used for the initial download. After that the password sent from the cal file will be used.

Send Setup File



Sending the incorrect setup file will adversely affect the operation of the device. The setup file (*.cal) contains device specific parameters that have been defined at the factory. Consult Cameron before sending a new setup. If the device has a valid setup, perform an upload (See next section) before proceeding to change the current settings.

The "Select Setup File" opens a file-open dialog box (Figure 4-2). Select the appropriate *.cal file for the connected device. Click "Open" to send the selected setup file to the device.

After the setup is downloaded the meter will reset. The reset process takes about 30 seconds, during which the transmitter's main screen will go blank for a short period of time.

For G3 transmitters – LEFMLink 2G will remain logged in after sending a setup – but it will have released the LOCK to the device. Any future changes will require lock to be re-set.

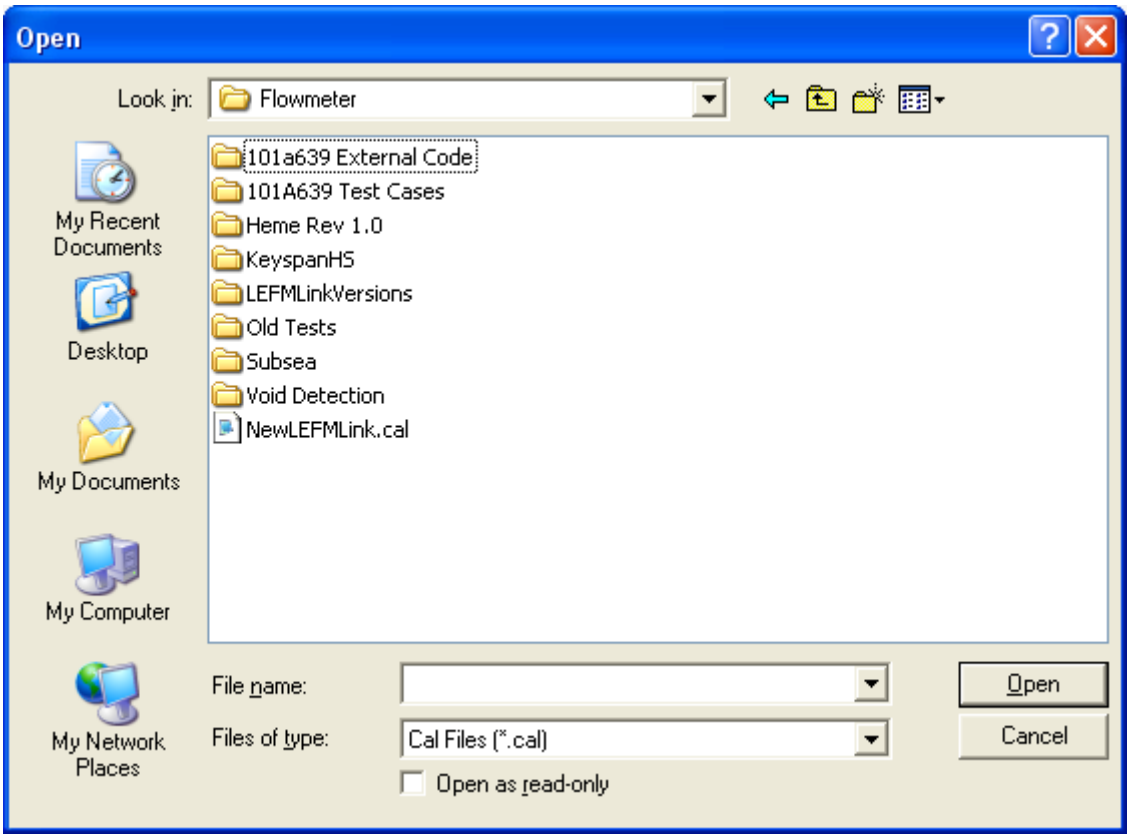


Figure 4-2: Send Setup File Dialog

Upload Setup File from Device

Figure 4-3 shows the Setup Files dialog box.

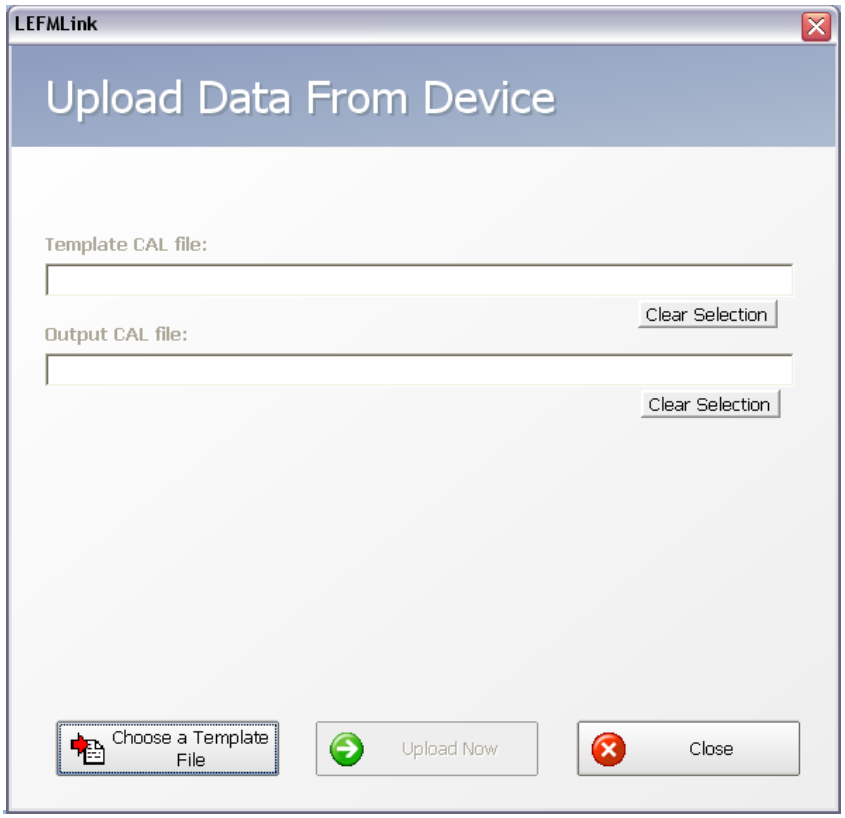


Figure 4-3: Setup Files Dialog Box before Upload Template is Selected

There is a two step process for uploading the current device configuration (*.cal) to the computer. The first step is to select a valid template. A template is a setup file (*.cal) containing a Modbus mapping of the configuration parameters (typically all) pertaining to the revision of the firmware controlling the transmitter.

Click on “Choose a Template File” and the Open Template dialog box appears (Figure 4-4). The setup file supplied with the device is the best template; however, default templates are also provided with LEFMLink 2G.

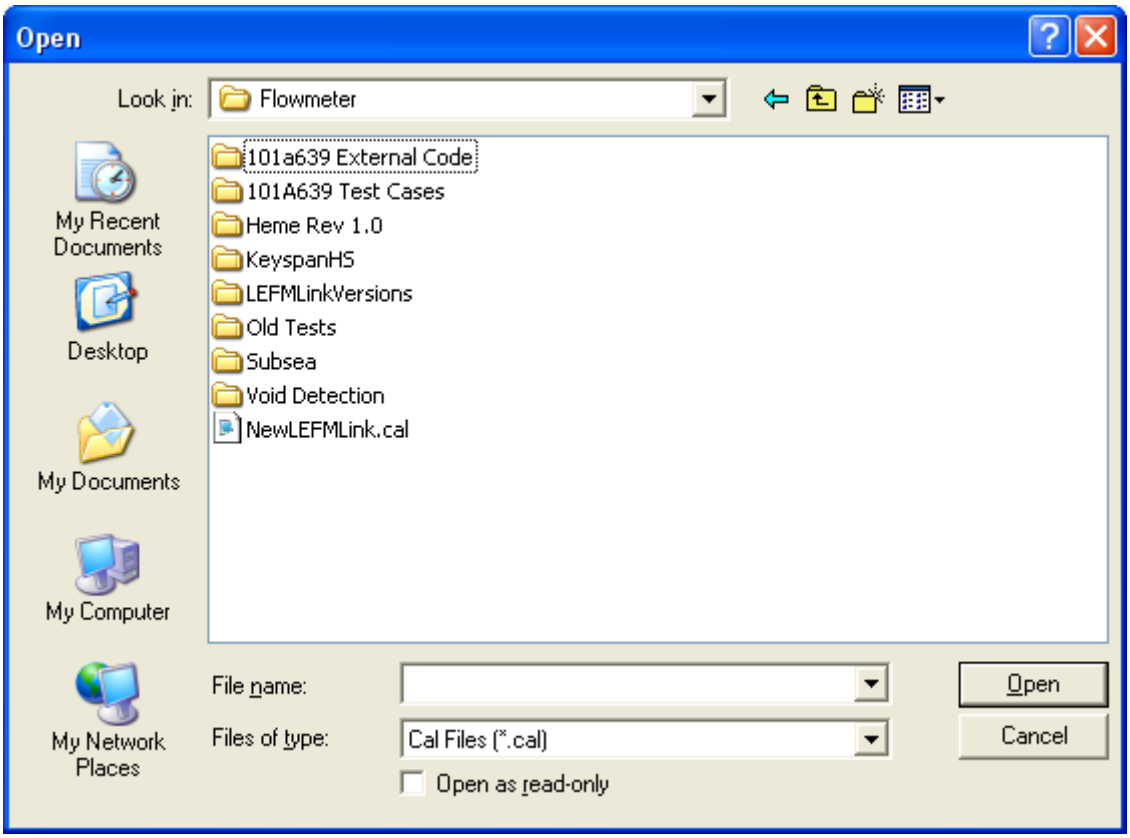


Figure 4-4: Select Upload Template Dialog

After a template is loaded, the "Select Output File" button becomes active[3]. Selecting the "Select Output File" button launches another Open dialog box (Figure 4-5). Enter/type a new name (Please do not use the same name as the file supplied by Cameron) and click "Open".

Now click on the "Upload Now" button, which is no longer grayed out. This uploads the configuration parameters of the hardware device to the selected output filename in the format of the upload template.

The uploaded file can be re-sent as a setup file[4].

[3] This button replaces the "Choose Template File" button as seen in Figure 4-3.
[4] Please confirm passwords, since passwords cannot be uploaded from the device.

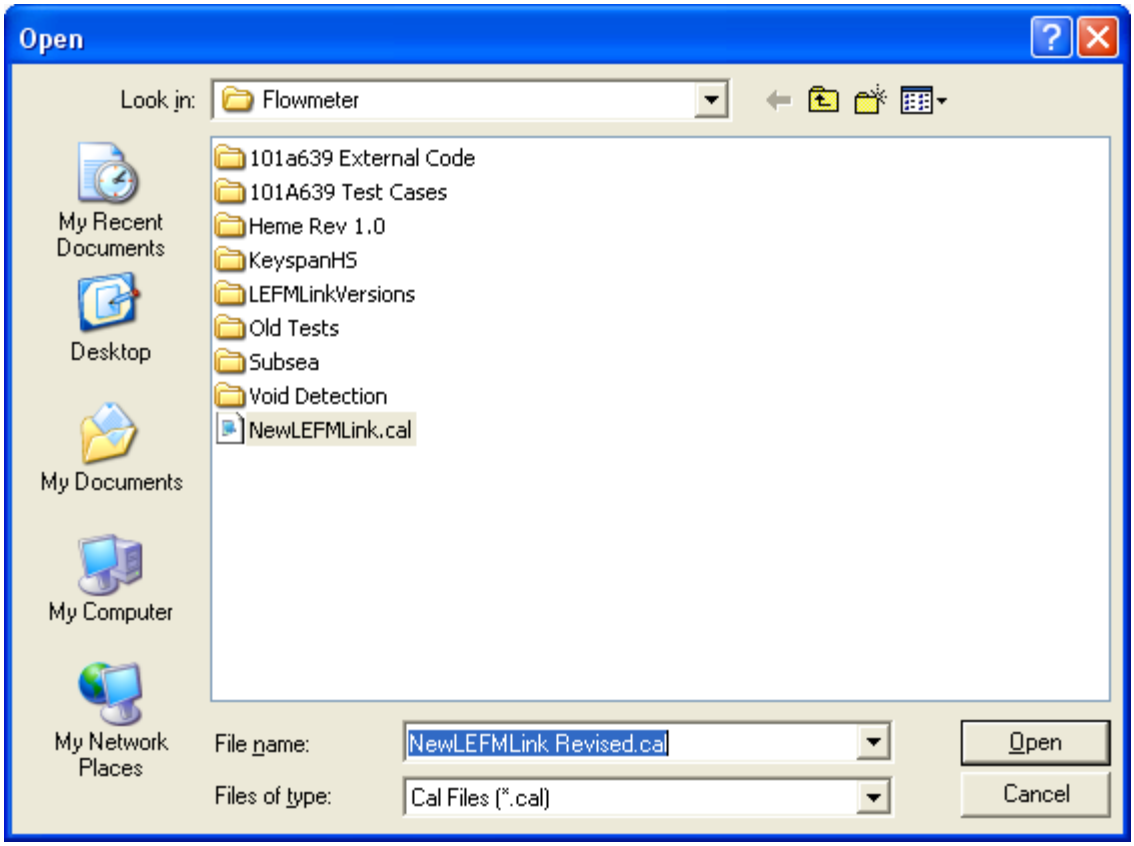


Figure 4-5: Upload Setup from Device File Selection/Naming Dialog Box

Section 5

User Manuals

LEFMLink 2G has the user manuals embedded in the product directories. To access these manuals, click on the labeled "tabs" on the bottom of the main screen.

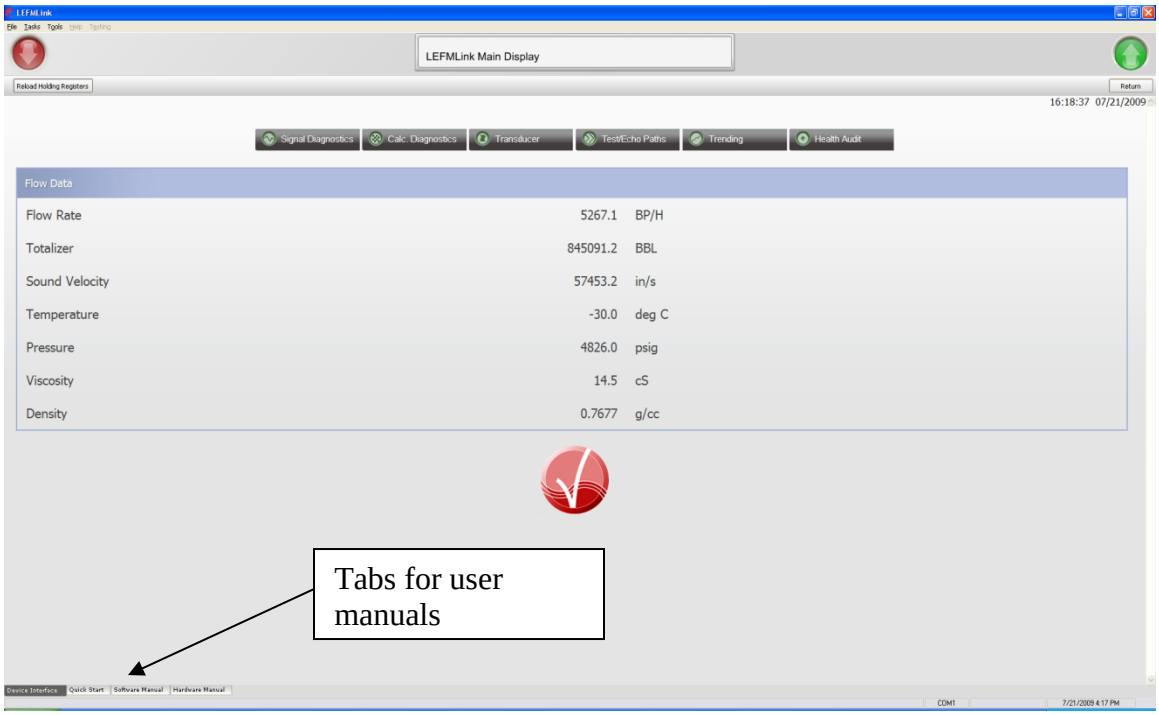


Figure 5-1: Main Screen

There are 3 types of manuals embedded.

- Quick Start – This LEFMLink 2G operation manual
- Gas 3xxCi Manual
- Liquid 2xxCi Manual



Figure 5-2: Example of User Manual Access

Section 6

Task Operation

The following sections explain the operation of the tasks found under the "Tasks" pull down menu. The tasks that can be performed are:

- Data Logging – Start and Stop data logging; choose directory path and name of log
- Analog Input/Output Scaling – Change Analog Input, Analog Output, and Pulse Output Scaling as well as the communication settings on the Transmitter.
- Analog Input RTD Scaling
- Set Transmitter Time
- Reset Transmitter Totalizers
- Re-Initialize Velocity Profile
- Path Triggering

Data Logging

Note: do not access data logging from this location to collect a log for a gas meter. See section 8.

The logging feature of LEFMLink 2G has two basic options, real time and event based logging.

The first option is to make a single continuous file, logging at the Log Frequency interval. This file will be closed daily and a new file started.

To access this feature select Tasks -> Data Logging.

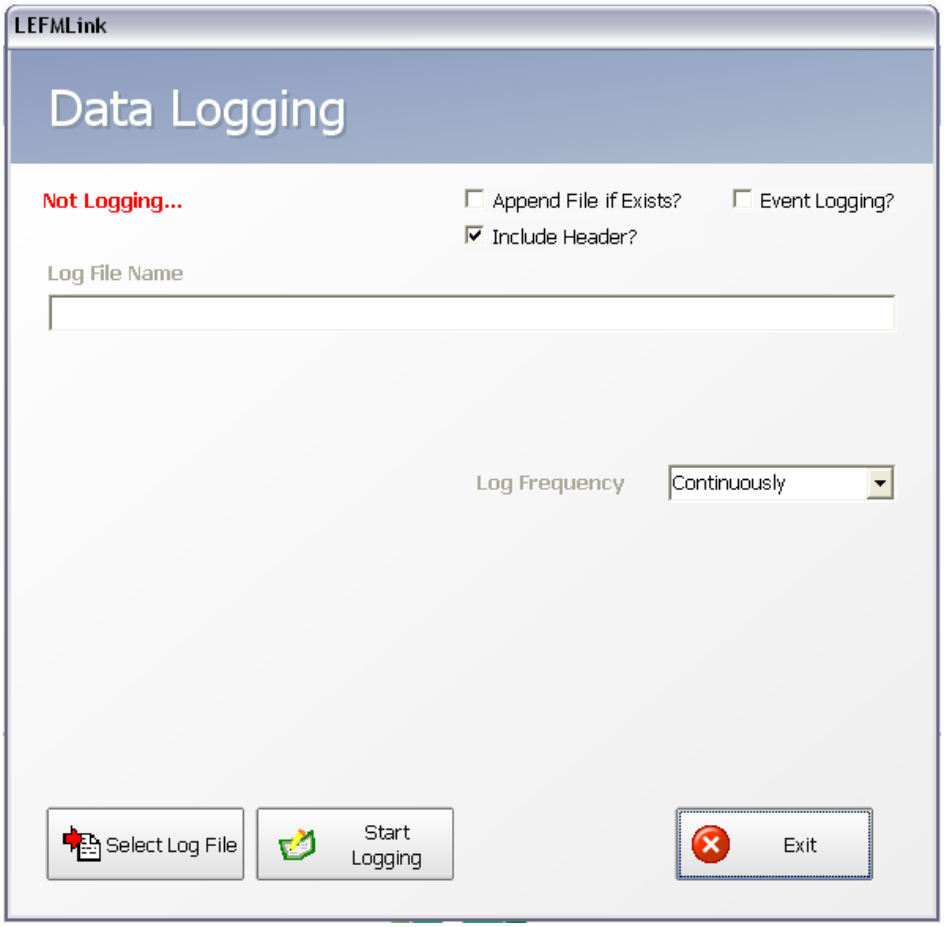


Figure 6-1: Logging Dialog Box

The Data Logging dialog box will be displayed.

Ensure the "Event Logging?" check box is not checked.

If adding data to an existing file check the "Append File if Exists?" check box.

If descriptive headers are required then check the "Include Header?" check box.

Click on the "Select Log File" button and select the file name and location for the log file. A default file name based on the date and time will be suggested but can be changed if desired.

Click on Start Logging to begin data logging. At this point you can exit the data logging dialog box and continue to view data in LEFMLink. Data Logging will show in the header in Red while logging is under way.

To stop datalog click on Tasks -> Stop Logging in the menu or if the datalog dialog is still active click on the Stop Logging button in the dialog box.

For G2 electronics only:
The second option, “Event Logging”, generates a log file at a transmitter specified number of occurrences, such as after 100 events have occurred. An event is defined as any change in the alarm/alert state of the meter. So for example, if a path were to go into alert and then subsequently clear the alarm, the transmitter records two events (going into alert and exiting alert). Each logged event is a complete data set of the meter. These logged events are used to help troubleshooting the meter when conditions are intermittent.

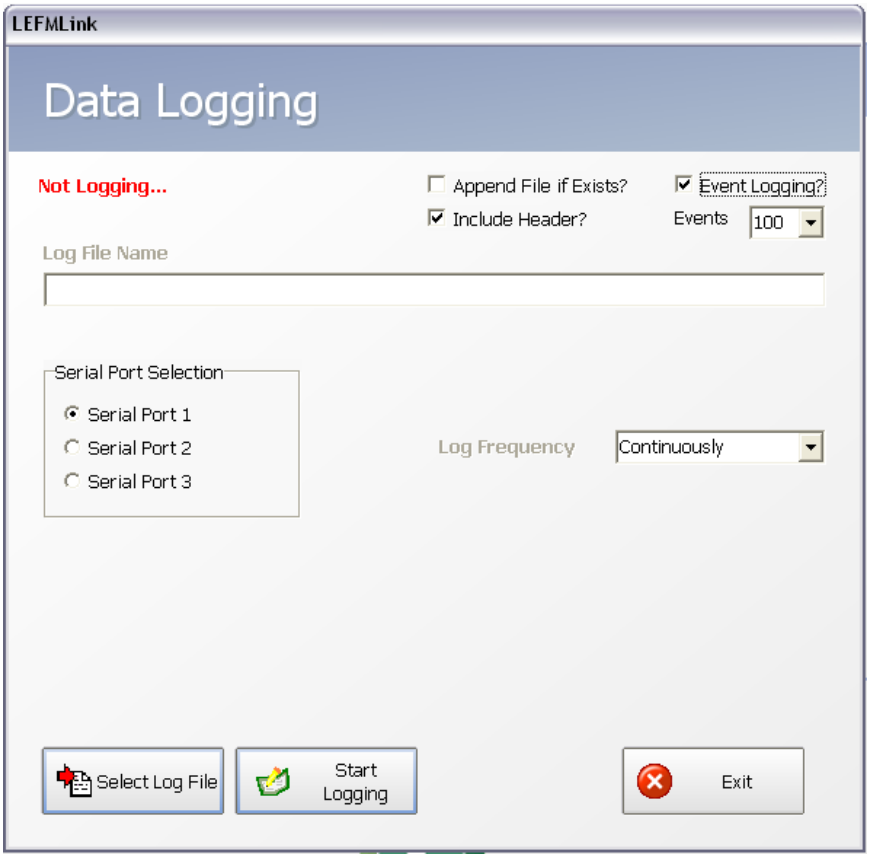


Figure 6-2: Event Logging Dialog Box

Setup for Event logging is similar to standard datalogs with two important exceptions.

First check the “Event Logging?” check box and select the number of events. By default leave it at 100 events, if fewer events are stored in the meter then real time data will be saved for those records.
Second, select the serial port on the meter LEFMLink is connected to.

WARNING

Event Logging causes the Flow Meter to report the historic events on the serial port selected. Incorrect serial port selection can cause the historical events to be transmitted to a plant or flow computer instead of LEFMLink causing erroneous readings on those systems!

Update Scaling

The update scaling menu is used to change the Input and Output Scaling of the device. A valid password must be entered in order to change scaling.

G3 - RTD/Analog I/O Scaling

WARNING

Scaling the analog inputs can change the flow measurement calculation of the device. Contact appropriate site personnel prior to any analog input adjustments.

"Analog Input Scaling" is used to configure the analog inputs into the transmitter. Signal conditioning circuits are used to convert the incoming signals either RTD ohms or input current 4 – 20 mA.

The procedure is the same – enter a lower bound that is input to the electronics and calibrate; then enter an upper bound and calibrate. After setting the input value to the electronics terminals – let the transmitter average a bit before saving the calibration (about 15 seconds).

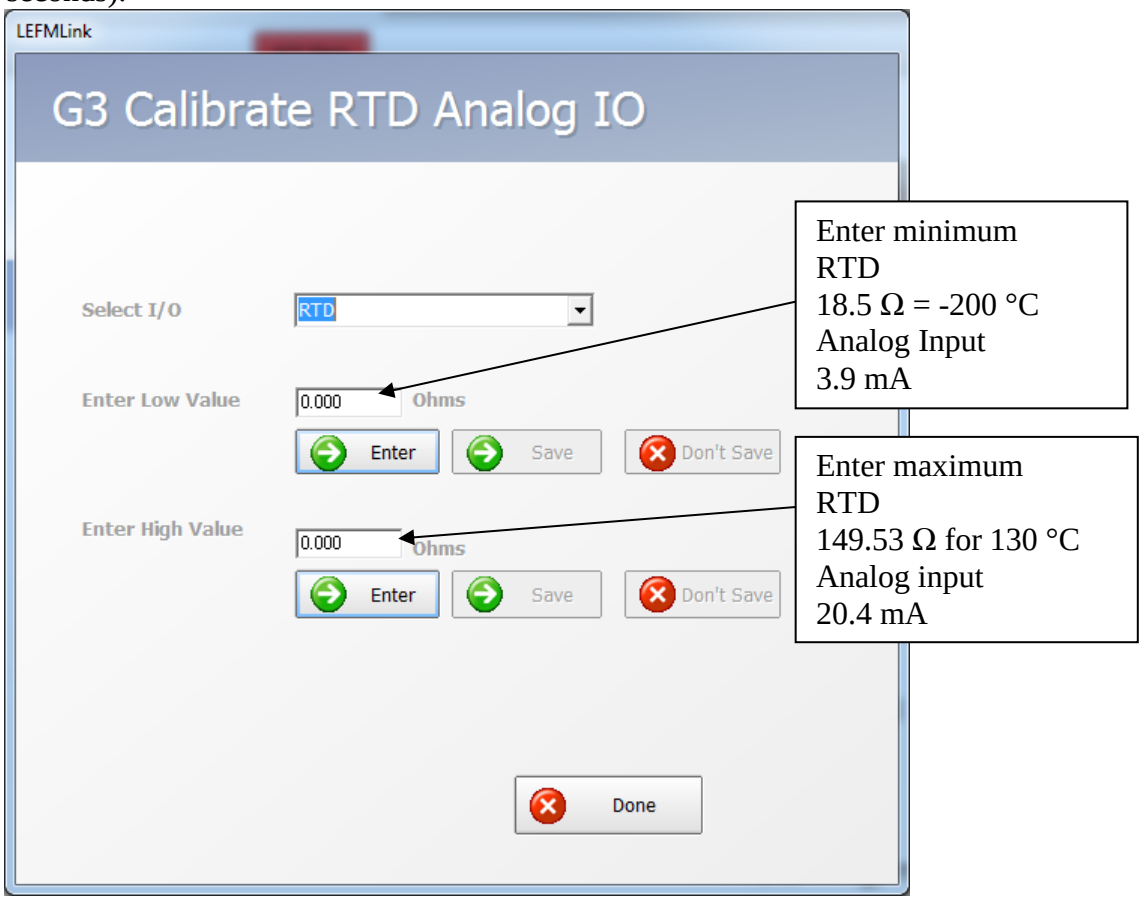


Figure 6-3: RTD/Analog Input Scaling Dialog (RTD shown)

Analog Input Scaling-G2

WARNING

Scaling the analog inputs will change the flow measurement calculation of the device. Contact appropriate site personnel prior to any analog input adjustments.

"Analog Input Scaling" is used to configure the analog inputs into the transmitter. Signal conditioning circuits are used to convert the incoming current signal to 0 – 5 Volts. The values for both Volts and Engineering Units are shown on this screen.

Below that are the current scaling values mapped to the 0 – 5 Volt input range. New scaling minimum and maximum engineering values may be entered into the New Min and Max edit boxes. After the new values are entered click "Accept". When you are finished changing values click "Done".

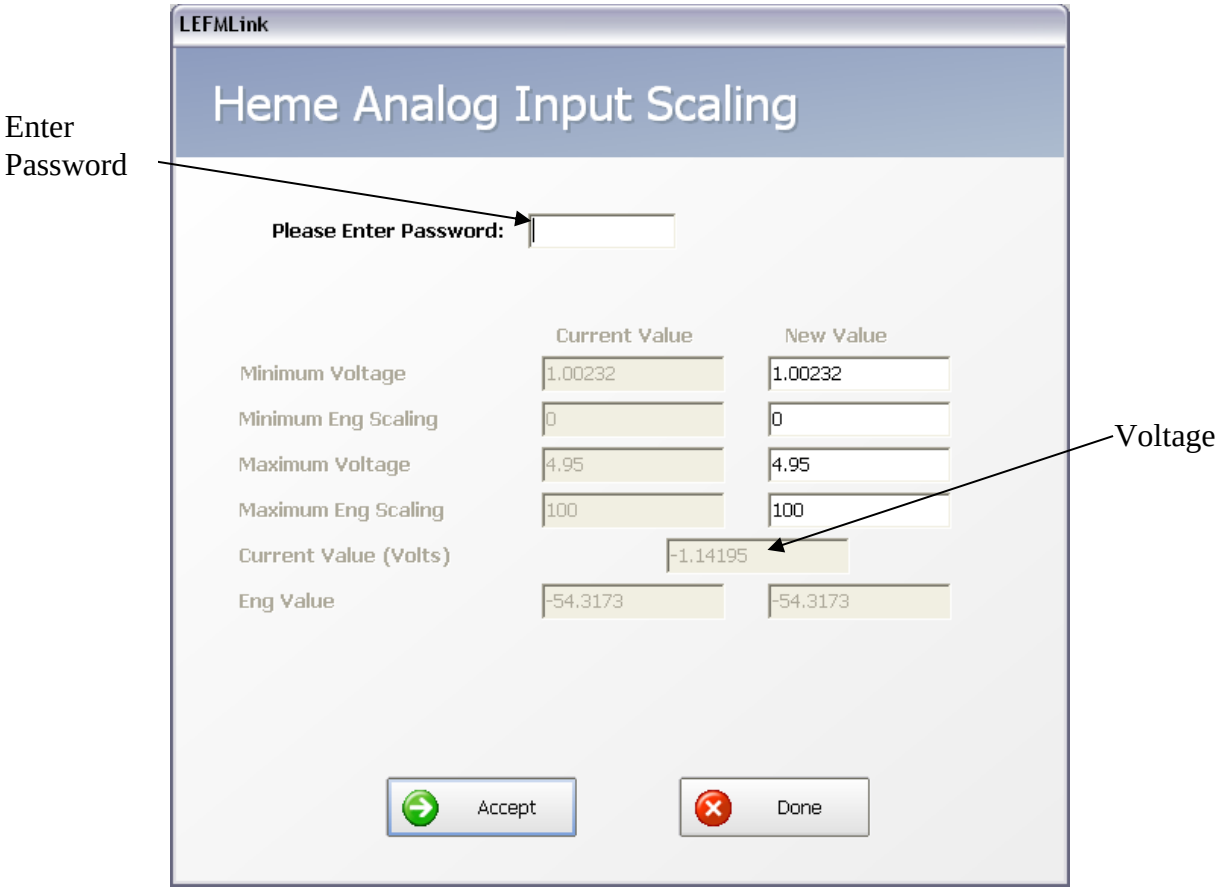


Figure 6-3: Analog Input Scaling Dialog

Scale Analog RTD Inputs- G2

WARNING

Scaling the analog inputs will change the flow measurement calculation of the device. Contact appropriate site personnel prior to any analog input adjustments.

"Scale Analog RTD Input" is used to configure the analog RTD input into the transmitter. Signal conditioning circuits are used to convert the incoming current resistance signal to 0 – 5 Volts. The display shows the RTD values in volts, ohms and temperature.

To simplify scaling, an offset and a slope have been given to the user. It is preferred that these values be adjusted. After the new values are entered click "Accept". When you are finished changing values click "Done".

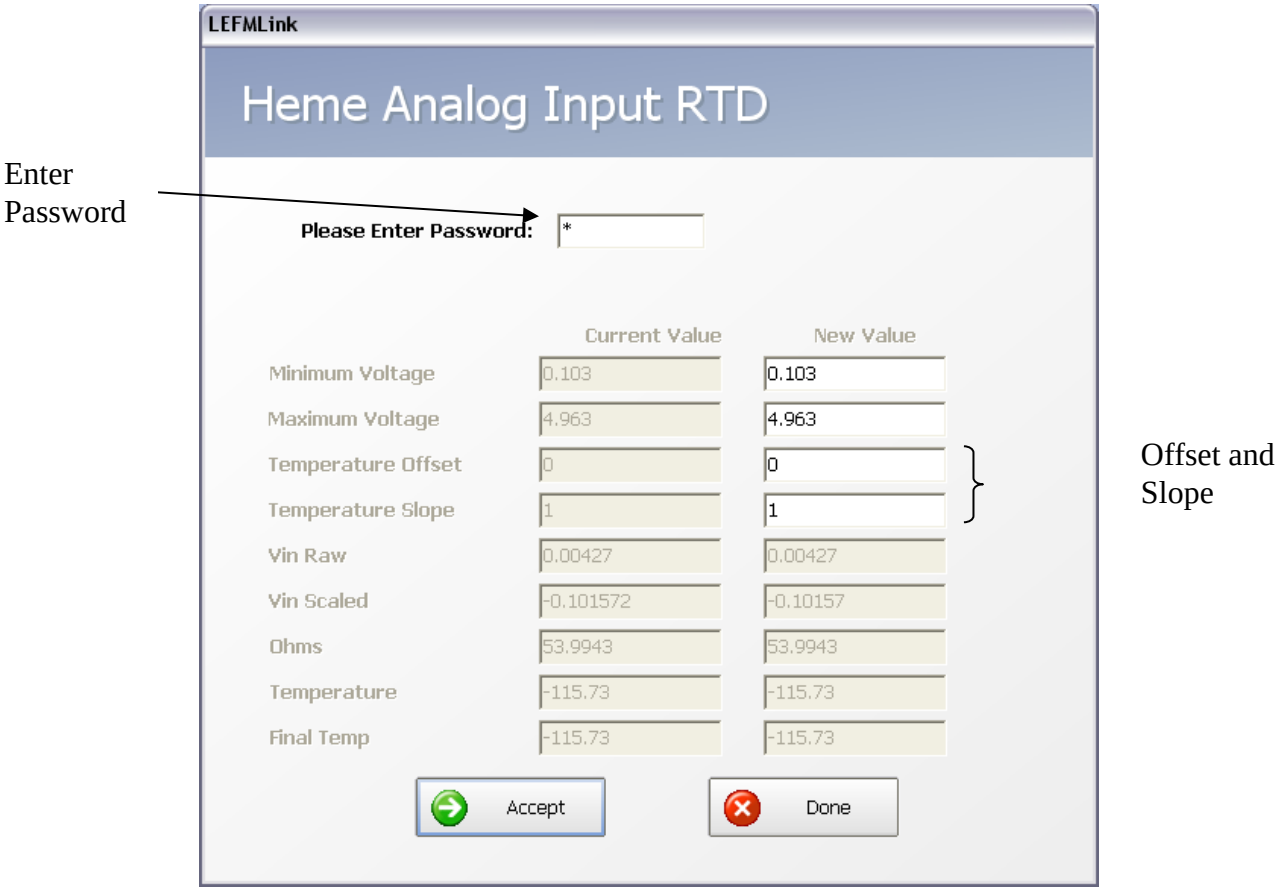
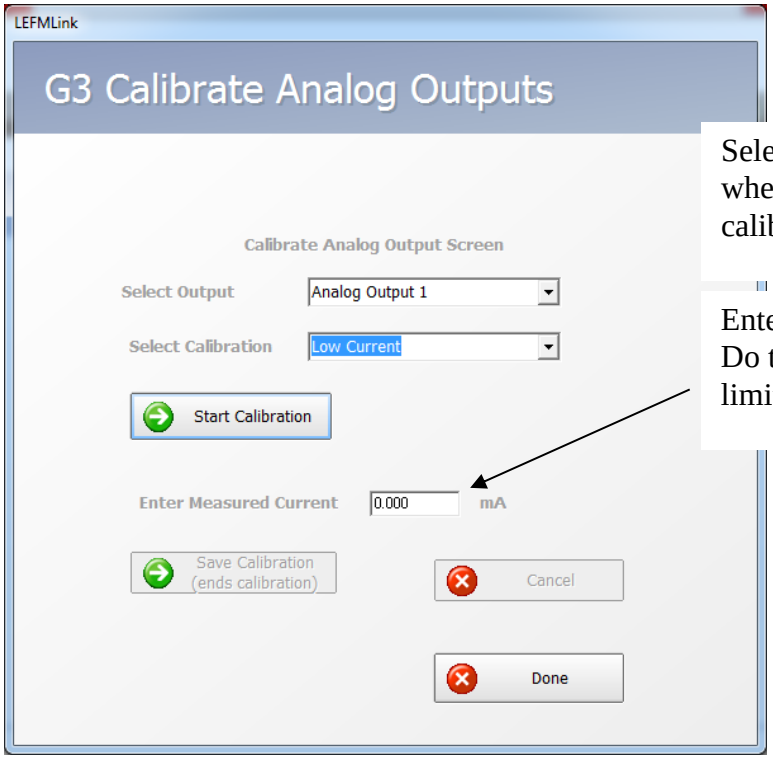


Figure 6-4: Analog Input Scaling Dialog

Scale Analog Outputs –G3

WARNING

Scaling the analog outputs will change the flow measurement indication as observed by some plant devices. Contact appropriate site personnel prior to any analog output adjustments.



Select which output and whether it is a high or low calibration

Enter measured current
Do the low and high current limits

Scale Analog Outputs –G2

WARNING

Scaling the analog outputs will change the flow measurement indication as observed by some plant devices. Contact appropriate site personnel prior to any analog output adjustments.

"Scale Analog Outputs" is used to configure the analog outputs from the transmitter. Signal conditioning circuits are used to convert the outgoing signal from 0 – 5 Volts to 0 to 20 mA. The transmitter has been factory programmed to operate with the signal conditioner modules specific to your device.

The Analog Output Scaling window displays the current value of the selected output in Engineering Units and percent full scale. The window displays the value scaled to engineering values. The units displayed on the Analog Output Scaling screen are consistent with those on the main screen. New values may be entered into the edit boxes.

After the new values are entered click “Accept”. When you are finished changing values click “Done”.

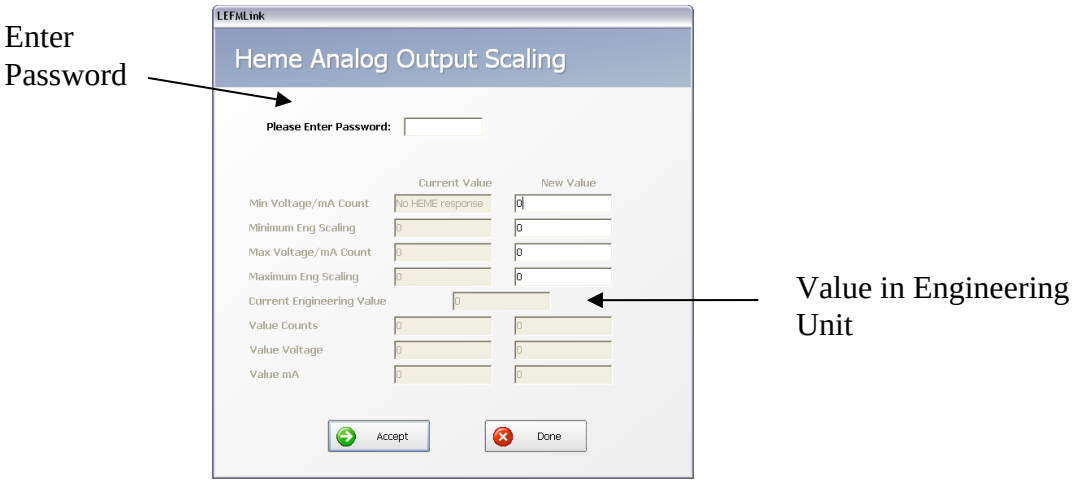


Figure 6-5: Analog Output Scaling Dialog

Setting Transmitter Time

The transmitter has a battery backed up clock with non-volatile memory that tracks time. However, when the device is at the factory, it is set to factory local time. Therefore, the delivered meter will need its time updated (if required by the site) and occasionally updated for clock drift. The screen that is launched to update the time is shown below.

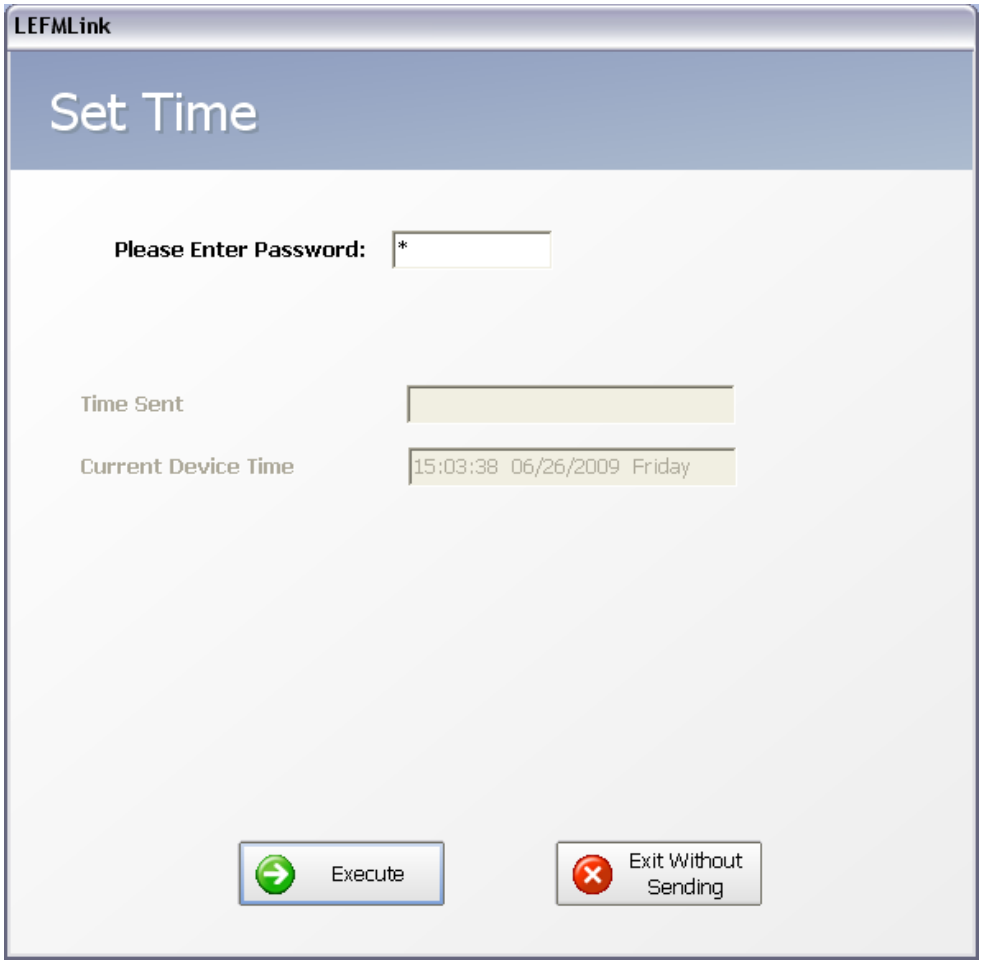


Figure 6-6: Setting Transmitter Time

This task is password protected but any level user can change the time. The program sends the PC time, so confirm that the PC time is appropriate.

Resetting Transmitter Totalizers

The transmitter has non-volatile memory that preserves the totalizer values during times of lost power. However, if the totalizers need to be reset (set to "0"), this task launches the following screen.



Figure 6-7: Resetting Totalizers

This task is password protected but any level user can reset the totalizers.

Re-Initializing Velocity Profile

The transmitter has non-volatile memory that preserves the best estimate of the velocity profiles during times of lost power. However, if these estimates need to be re-initialized (set to default values in the software configuration files), this task launches the following screen.

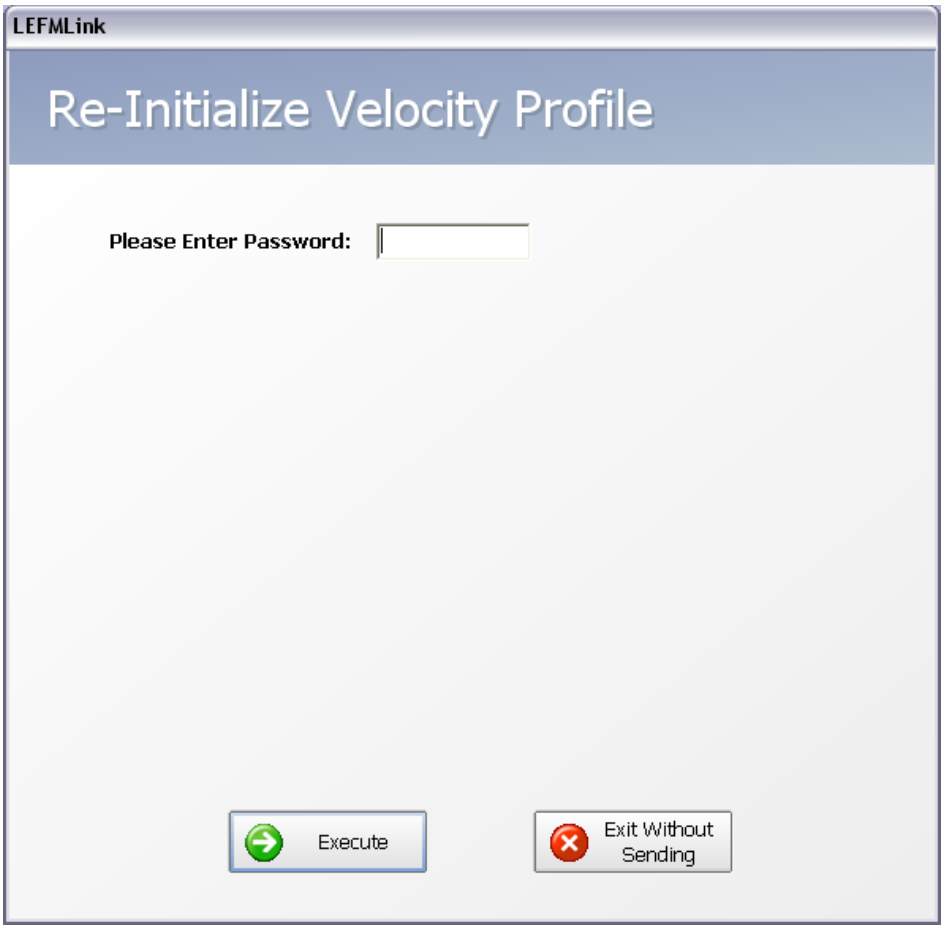


Figure 6-8: Re-Initializing Velocity Profile Values

This task is password protected but any level user can re-initialize the velocity profile.

Waveform Viewing

This screen allows the user to get an indication of the waveform being used by the meter for all paths.

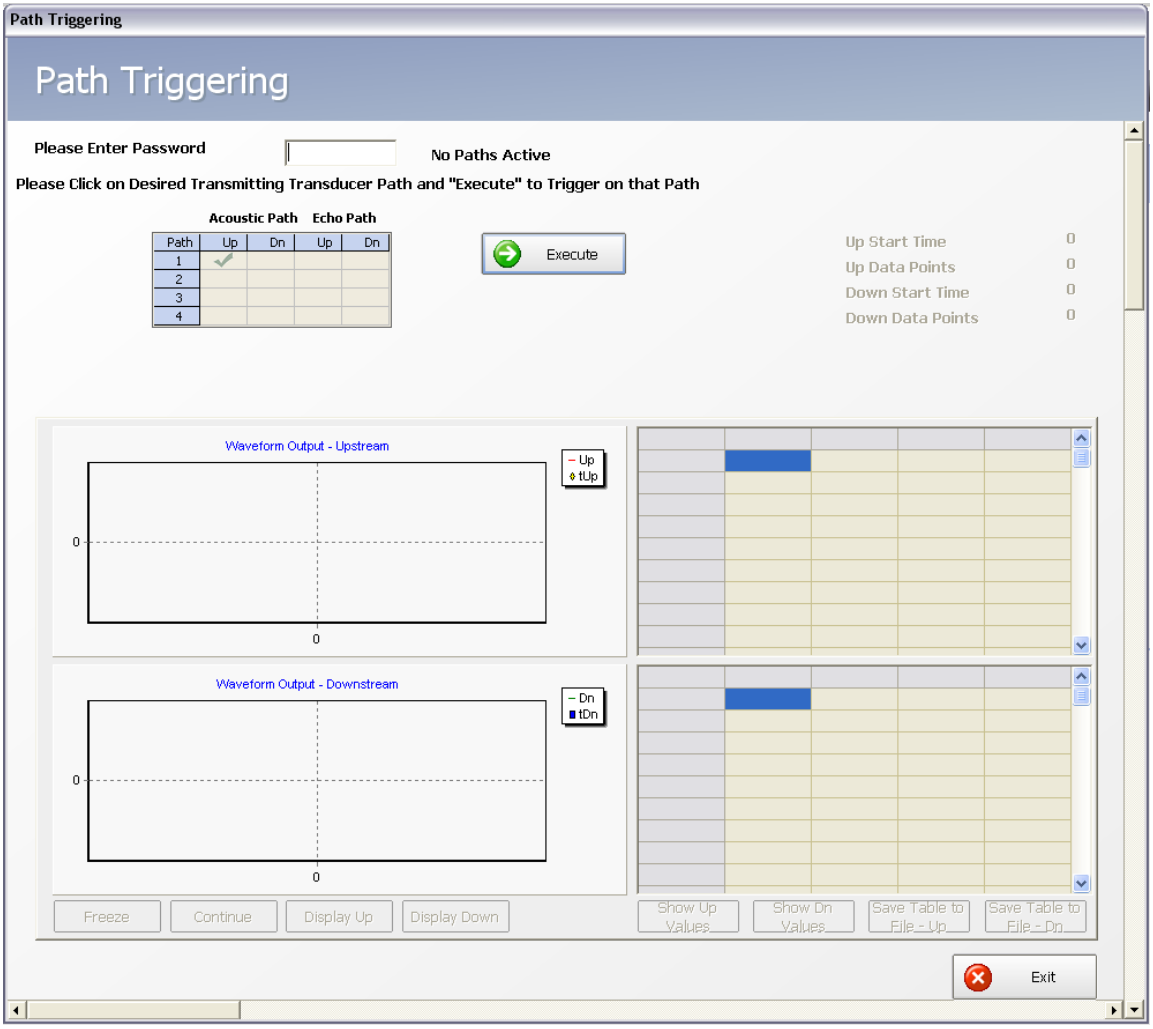


Figure 6-9: Path Triggering Dialog on Startup

G2 - First enter the administrator level password (1234 by default).

G3 – Login with Lock as described earlier in this document.

Click on the desired path in the matrix. If a scope is to be used select between acoustic Path Up and Down and Echo Path Up and Down. For an on screen waveform only the acoustic paths are displayed and up and down can be displayed simultaneously.

Click Execute to send the selected path to the meter.



Figure 6-10: Waveform Buttons Enabled

At this point the controls for the waveform display are enabled. Click “Display Up” and “Display Down” to show the waveforms on the screen. Click “Show Up Values” and “Show Do Values” to show tabulated data on the screen. To save a table click on the respective “Save Table to File” button.

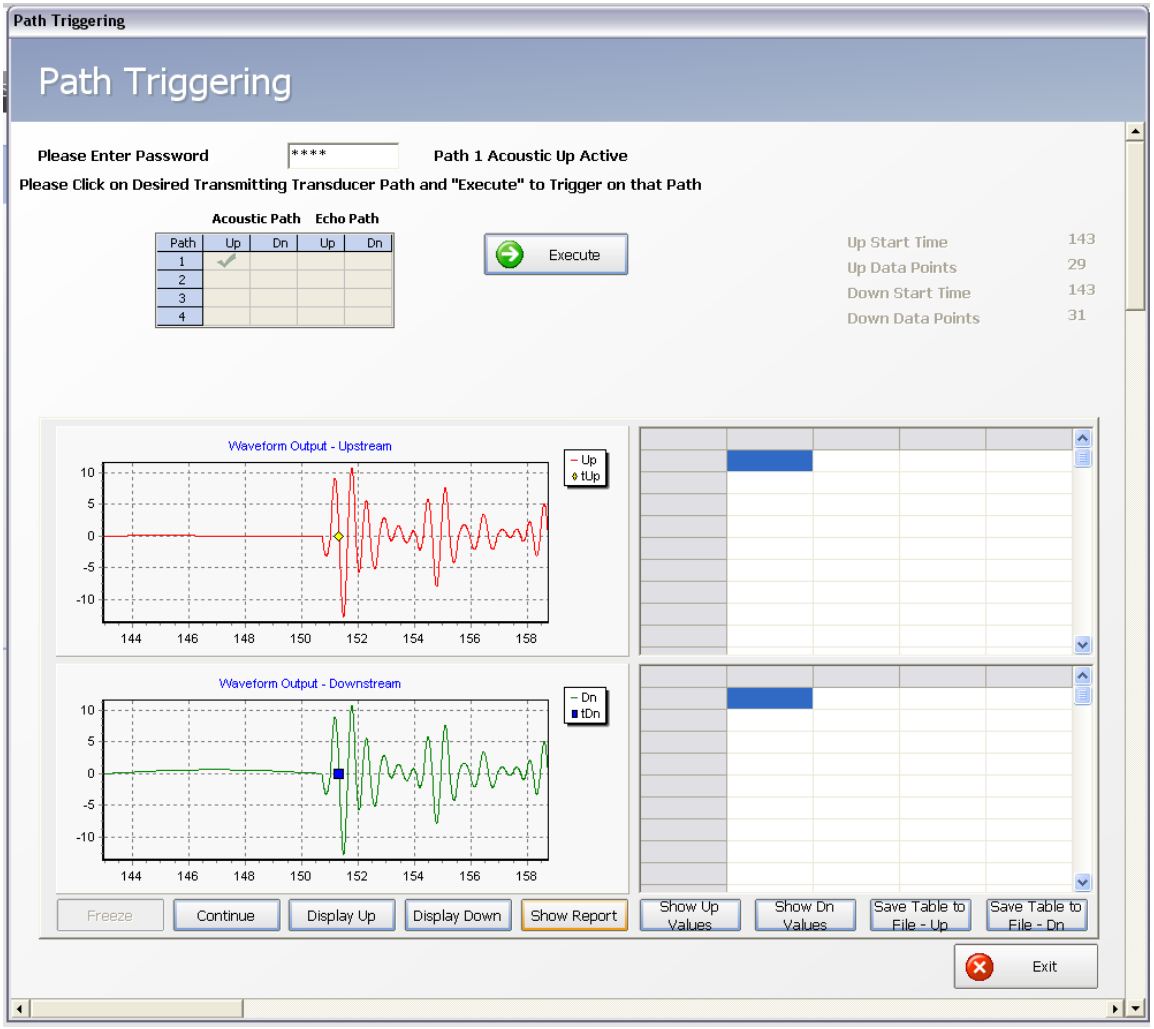


Figure 6-11: Waveform Displayed

Once the desired waveform is displayed on the screen you can stop updating by click on the "Freeze" button. The "Show Report" button becomes enabled and by clicking on it you get a report of the current waveform. This can be printed or saved to disk.

Click "Continue" to gather more data.

To change the selected path click on the desired path and Click "Execute" again.

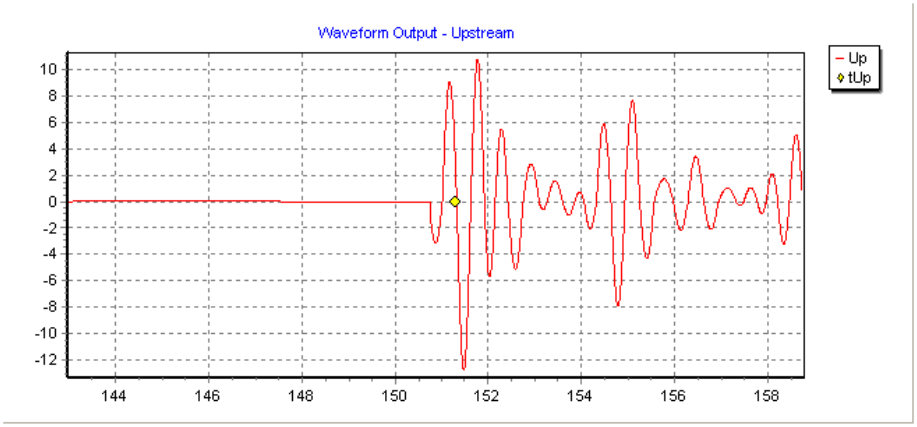
To exit the screen click "Freeze" and then click "Exit". On screens with limited resolution it may be necessary to scroll down to see the exit button.

S/N: 110503001 Tag No.: Computer Time: 2011/05/20 08:29:09

Setup Time: 5/20/2011 8:25:00 AM, Revision: 101A639 Rev 08.02.01, Checksum: B233, Setup ID: 8

Meter Type: Gross Volume Flow, 4 Path, Chordal, Oil

Acoustic Path 1 Up



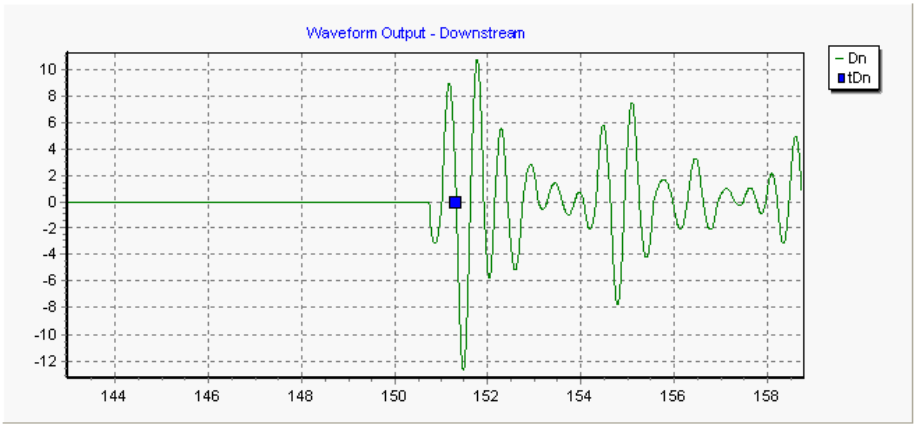
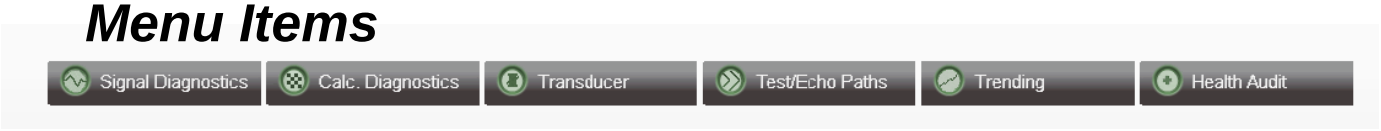


Figure 6-12: Waveform Report

Section 7

Menu Items



Each of the menu buttons will launch a screen as described below.

Signal Diagnostics



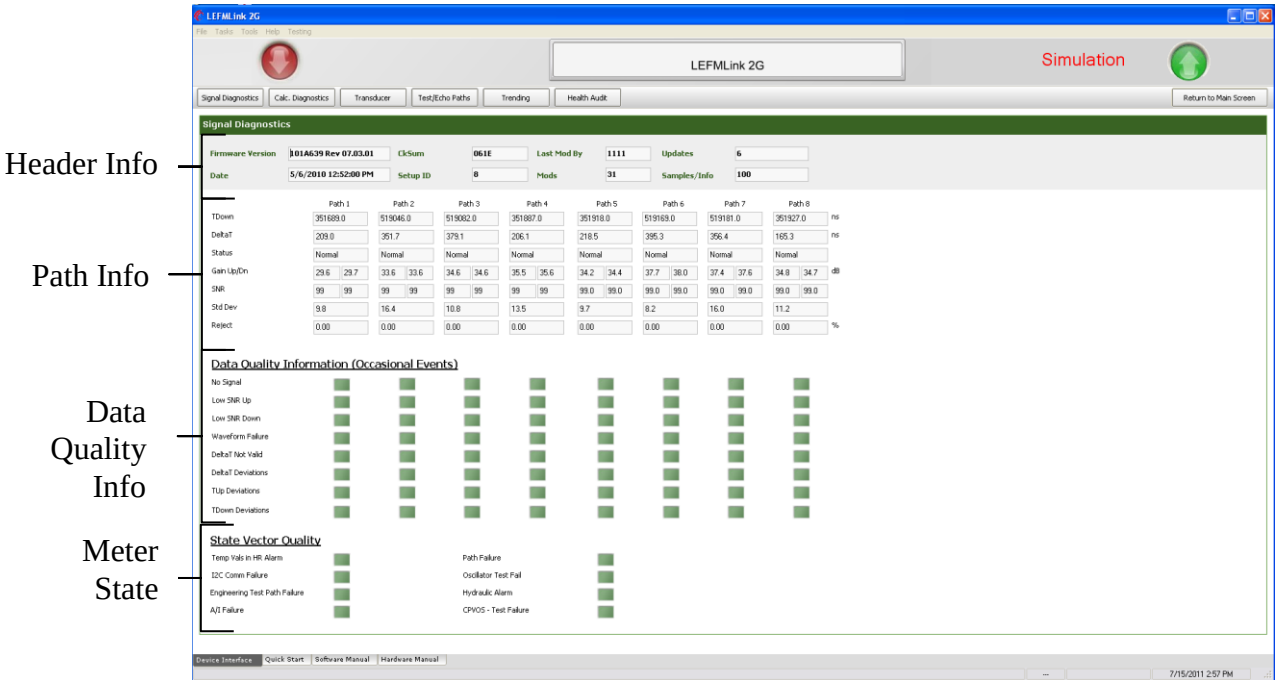


Figure 7-1: LEFM 200 Series Signal Diagnostic Screen

Figure 7-1 shows the Signal Diagnostic Screen. The data on this screen is grouped into paths. The transmitter supports up to 8 paths. Each path represents an acoustic measurement in the meter. The LEFM240C contains 4 paths and the LEFM220C contains 2 paths.

Header Info

The following is a description of the items on that screen:

- Updates – Total number of data requests made by LEFMLink 2G that have been acknowledged by the transmitter. This value typically increments by one (1) every five (5) seconds.
- Samples/Info – The number of acoustic measurement scans during the last update period.
- Setup ID – Configuration ID of the device
- FW – Firmware Version (revision level).
- Checksum of the transmitter's configuration
- Time/Date of the transmitter's real time clock
- Last Mod By – Index of the user (1 through 5 and 6 is the administrator)
- Mods – Number of revisions to the configuration (since software was installed)

Path Info

- TDown – Acoustic transit time (nanoseconds) for each path.
- DeltaT – Difference between upstream and downstream transit time (nanoseconds) for each path.
- Status – Path Status; Normal, Reject, VOS (Sound Velocity Error) for each path.
- Gain Up & Dn – Pulse Catch Gain in dB, normally between 40 and 88 dB.
- SNR – Signal to Noise Ratio; ratio of acoustic signal amplitude to baseline noise.
- Standard Deviation– Measure of signal stability; calculates the normalized variance of delta T (expressed in % - max is limited to 100%, particularly for zero flow, when the standard deviation is greater than the measurement).
- Reject – Percent Data Rejected, normally less than 5%.

Data Quality Info (For information only)

- No Signal – Acoustic signal not received
- Tup Deviations – Transit time in the upstream direction disagreed with statistical average by more than acceptable limit.
- Tdown Deviations – Transit time in the downstream direction disagreed with statistical average by more than acceptable limit.
- DeltaT Deviations – Differences in transit time (between upstream/downstream) disagreed with statistical average by more than acceptable limit.
- Waveform Failure– Received waveform failed the cross correlation test.
- SNR Up/Dn – Waveform did not exceed noise be sufficient margin
- DeltaT invalid – Measurements did not agree with device ranges.

Calculation Diagnostics

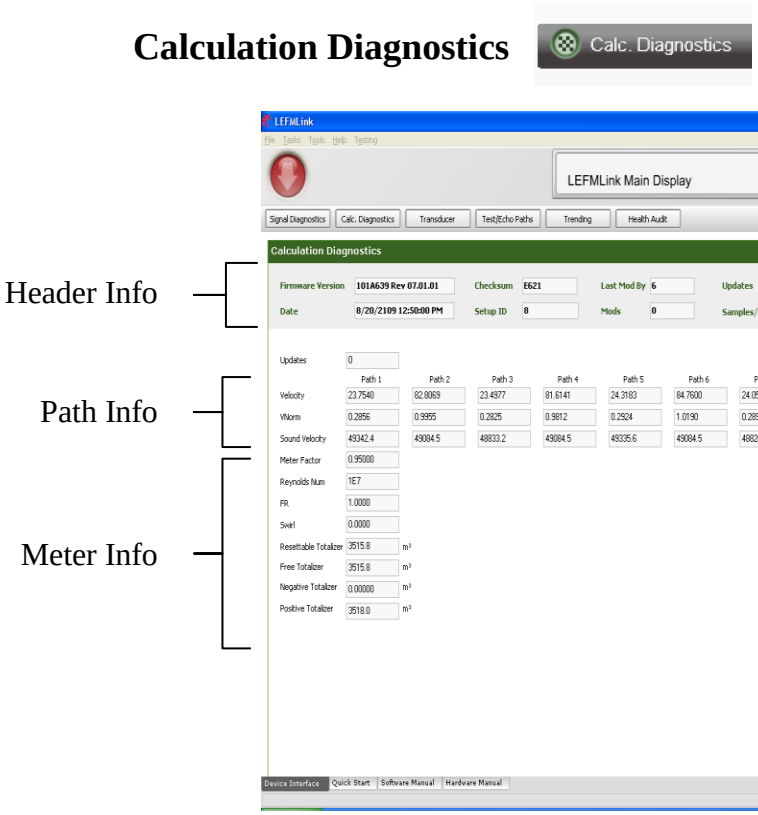


Figure 7-2: Calculation Diagnostics

The calculation diagnostics page shows velocity profile, profile factor, Reynolds Number, totalizer information, and setup information. Descriptions of the different fields follow:

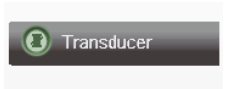
Note: The header information is not repeated in this section.

Path Information

- Velocity – Axial fluid velocity calculated by each path.
- VNorm – normalized velocity of each path to the meter average.
- Sound Velocity – The speed of sound calculated per path.

Meter Information

- Totalizer values
  - Resettable,
  - Non-resettable (Free),
  - Positive only,
  - Negative only
- Meter Factor – Velocity profile correction factor used by the meter.
- Reynolds Number – Calculated Reynolds Number.
- FR – Flatness Ratio (ratio of outside path velocity to inside path velocity – 240 and 280 products only)
- Swirl – Swirl ratio normalized to axial velocity

G2 Only -Transducers 

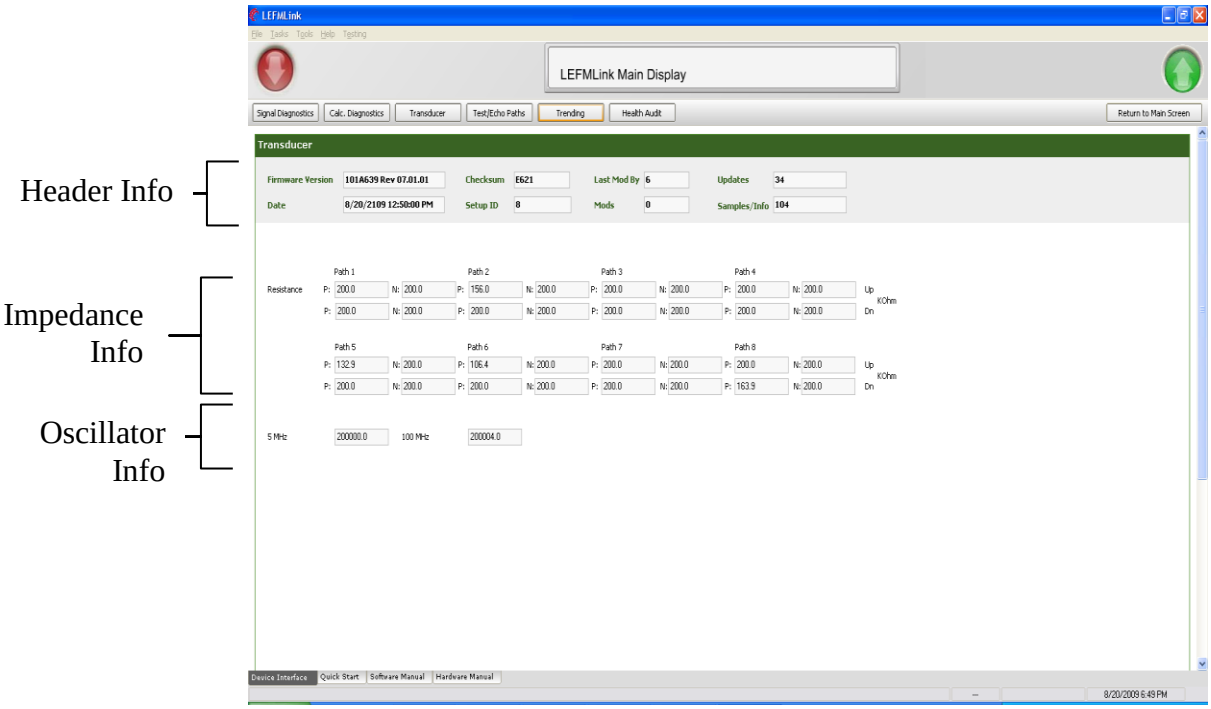


Figure 7-3: Transducers Screen

The transducer diagnostics page shows the impedance check of the transducers/cables and electronic oscillator test results. Descriptions of the different fields follow:

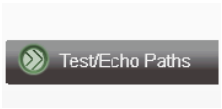
Impedance Information (Paths listed Up /Down)

- Positive to Shield – Normal ~ 200 Kohms
- Negative to Shield – Normal ~ 200 Kohms

Oscillator Comparisons

- Values from the 5 MHz and 100 MHz oscillators are displayed. If they vary by more than 0.01%, then an alarm is set within the transmitter and output to LEFMLink 2G.

G2 Only Echo Paths



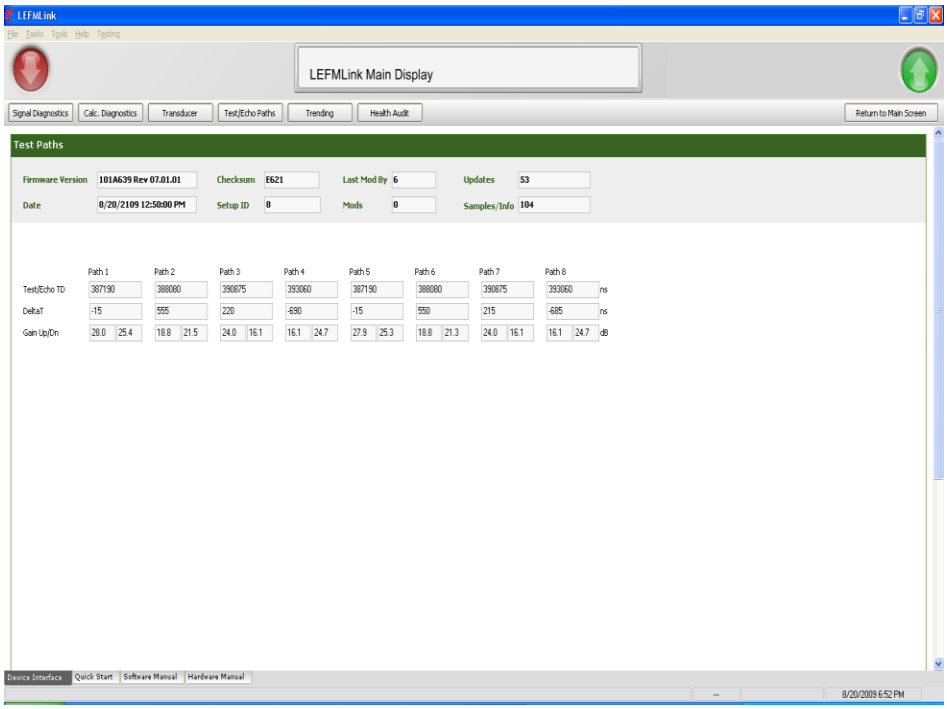


Figure 7-4: Echo Paths Screen

Each transducer is tested in an echo mode. This information is used to diagnose transducer performance and acoustic attenuation. Descriptions of the different fields follow:

Note: The header information is not repeated in this section.

Echo Path Information

- EPTD – Pulse Echo T Down, the time for the ultrasonic pulse to return to the sending transducer.
- EPDT – Pulse Echo Delta T, the difference in time between the two echo pulses.
- EP Gain Up & Dn – Pulse Echo Gains in dB, between 40 and 88 dB.

Trending



Flow Speed of Sound Deviation Velocity Profile

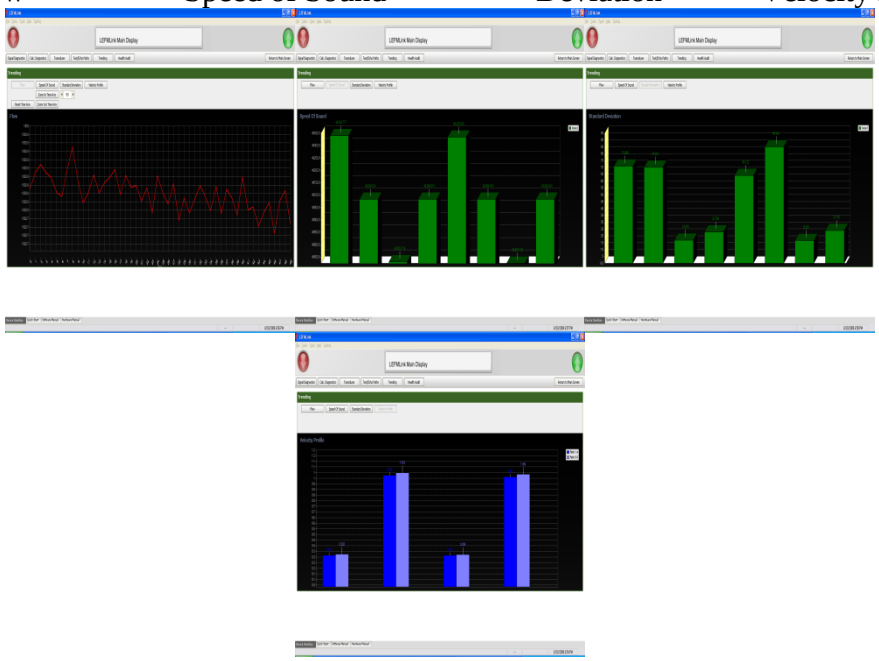
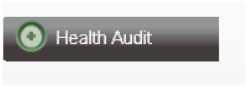


Figure 7-5: Trending Graphs

The per path flow, speed of sound, Delta T Deviation, and velocity profile graphs are shown in Figure 7-5. These graphs can be used to diagnose problems with the fluid hydraulics in the line.

Health Audit



The health audit is a one page summary screen. It plots the health of the meter by displaying the Gains, SNRs, velocity profile, statistics and hydraulic parameters in a graphical format.

In each graph, paths that are out of specification (either against a limit or against comparison to a reference point) are plotted in red. Further, comparison data (for example from the calibration of the meter or another date) can be plotted alongside the live data. To do a comparison, upload the appropriate "*.csv" file using the file manager tool, accessed via the "Open Compare File" button on this page. If a comparison file is not selected, only live data will be shown. The "Preview Report" button allows the user to save that data and to print the report.

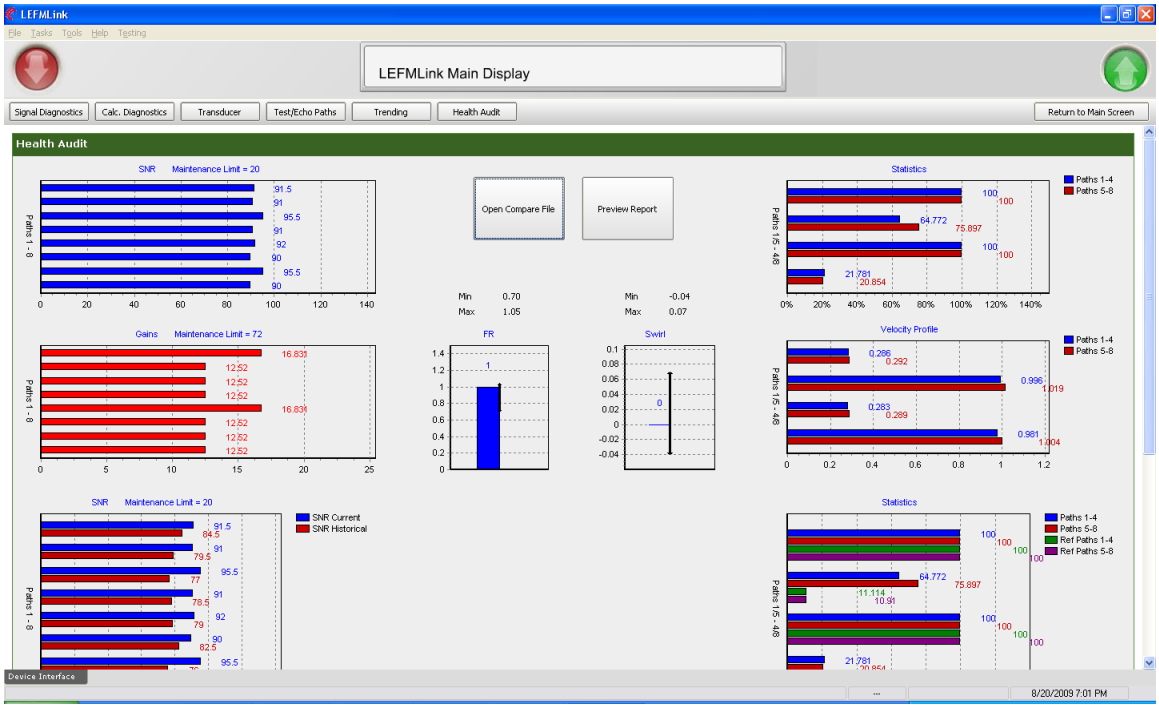


Figure 7-6: Health Audit Summary

(Note: Scrolling on the Screen is Necessary)

Section 8

Detailed Diagnostics Tab

This section describes the detailed diagnostic/acoustic data specific to the LEFM 3xxCi ultrasonic gas flowmeter and G3 electronics (of any type of software). The following pages describe the data accessible using the LEFMLink 2G software, and contained within the detailed diagnostics tab. Once you have connected to the meter using LEFMLink 2G (sections 2 and 3 describe the software setup and connection process) the Front Page should look identical to the below picture.



Figure 8-1 Main LEFMLink 2G screen with Gas Tab enabled

Function Discussion

The transmitter performs all control and timing for the generation and measurement of acoustic pulses. Acoustic processing is performed by specialized proprietary boards that are designed to achieve high sampling rates, provide stable ultrasonic signals, and eliminate zero drift. The circuit boards within the transmitter are programmed to perform the following functions:

- Step through the ultrasonic path cycles
- Provide gain control for each ultrasonic path
- Compute flow
- Generate pulse outputs and analog outputs

The following pages outline and describe how the LEFMLink 2G presents the data gathered and calculated by the transmitter to the user for trouble shooting and meter diagnostics.

Menu Items

The following screen capture depicts 380Ci gas tab.

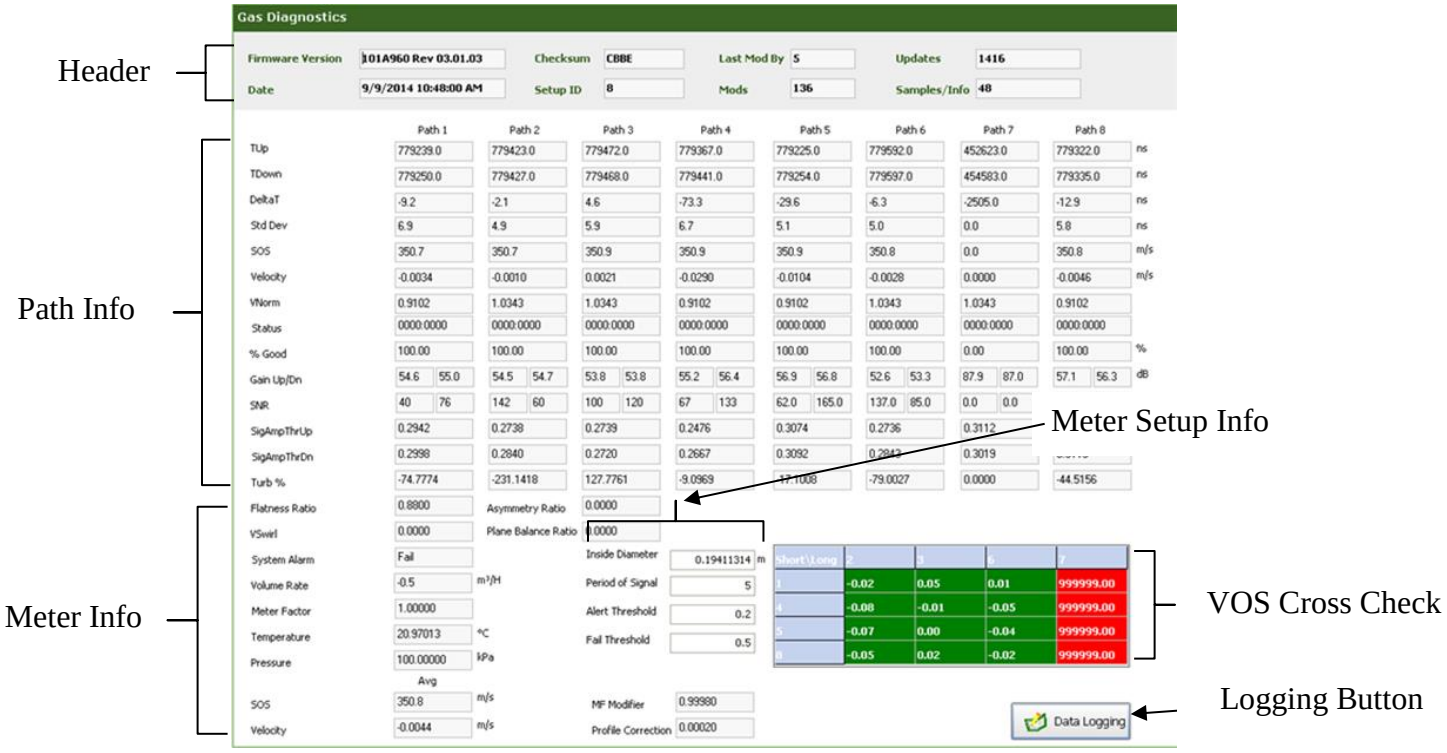


Figure 8-2 Gas Diagnostics tab navigated to from the front page

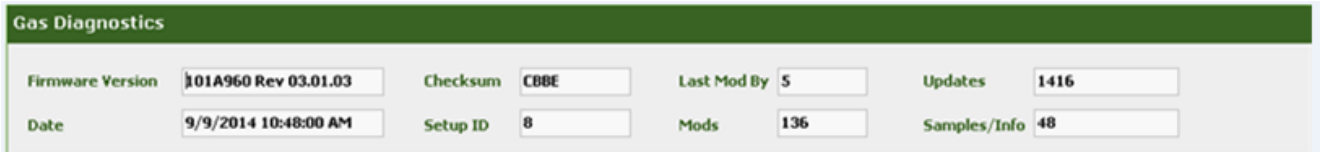


Figure 8-3 Header

Header Info

- Updates – Total number of data requests made by LEFMLink 2G that have been acknowledged by the transmitter. This value typically increments by one (1) every five (5) seconds.
- Samples/Info – The number of acoustic measurement scans during the last update period.
- Setup ID – Configuration ID of the device
- Firmware Version –Firmware identification and revision level.
- Checksum of the transmitter's configuration
- Time/Date of the transmitter's real time clock
- Last Mod By – Index of the user (1 through 5 and 6 is the administrator)
- Mods – Number of revisions to the configuration (since software was installed)

	Path 1	Path 2	Path 3	Path 4	Path 5	Path 6	Path 7	Path 8	
TUp	779239.0	779423.0	779472.0	779367.0	779225.0	779592.0	452623.0	779322.0	ns
TDown	779250.0	779427.0	779468.0	779441.0	779254.0	779597.0	454583.0	779335.0	ns
DeltaT	-9.2	-2.1	4.6	-73.3	-29.6	-6.3	-2505.0	-12.9	ns
Std Dev	6.9	4.9	5.9	6.7	5.1	5.0	0.0	5.8	ns
SOS	350.7	350.7	350.9	350.9	350.9	350.8	0.0	350.8	m/s
Velocity	-0.0034	-0.0010	0.0021	-0.0290	-0.0104	-0.0028	0.0000	-0.0046	m/s
VNorm	0.9102	1.0343	1.0343	0.9102	0.9102	1.0343	1.0343	0.9102	
Status	0000:0000	0000:0000	0000:0000	0000:0000	0000:0000	0000:0000	0000:0000	0000:0000	
% Good	100.00	100.00	100.00	100.00	100.00	100.00	0.00	100.00	%
Gain Up/Dn	54.6 55.0	54.5 54.7	53.8 53.8	55.2 56.4	56.9 56.8	52.6 53.3	87.9 87.0	57.1 56.3	dB
SNR	40 76	142 60	100 120	67 133	62.0 165.0	137.0 85.0	0.0 0.0	55.0 59.0	
SigAmpThrUp	0.2942	0.2738	0.2739	0.2476	0.3074	0.2736	0.3112	0.3598	
SigAmpThrDn	0.2998	0.2840	0.2720	0.2667	0.3092	0.2843	0.3019	0.3113	
Turb %	-74.7774	-231.1418	127.7761	-9.0969	-17.1008	-79.0027	0.0000	-44.5156	

Figure 8-4 LEFMLink detailed information

Path Info

- TUp– Acoustic transit time (nanoseconds) for each path, ending at the upstream transducer.
- TDown – Acoustic transit time (nanoseconds) for each path, ending at the downstream transducer.
- DeltaT – Difference between upstream and downstream transit time (nanoseconds) for each path.

- Std Dev– Measure of signal stability; calculates the standard deviation of delta T (nanoseconds).
- SOS– Calculated speed of sound in the fluid.
- Velocity – Fluid velocity calculated by each path.
- VNorm – normalized velocity of each path to the meter average.
- Status – Path Status; Normal, Reject, VOS (Sound Velocity Error) for each path.
- % Good – Percent Data Accepted, normally greater than 95%.
- Gain Up & Dn – Pulse Catch Gain in dB, normally less than 70 dB.
- SNR – Signal to Noise Ratio; ratio of acoustic signal amplitude to baseline noise.
- SigAmpThrUp – Ratio of first positive signal peak to signal max in upstream direction.
- SigAmpThrDn – Ratio of first positive signal peak to signal max in downstream direction.
- Turb% – Calculates the standard deviation of delta t normalized to delta t and expressed as a percentage.



Figure 8-5 LEFMLink 2G Meter information

Meter Information

- Flatness Ratio – Ratio of outside path velocity to inside path velocity .
- Swirl – Swirl ratio normalized to axial velocity.
- System Alarm– Provides overall system status.
- Volume Rate– Current meter volumetric flow rate.
- Meter Factor – Calculated meter factor used to correct the flow measurement.
- Temperature– Current meter body temperature.
- Pressure– Current meter pressure. (If used)
- SOS– Meter average calculated speed of sound in the fluid.
- Velocity– Meter average calculated fluid velocity.

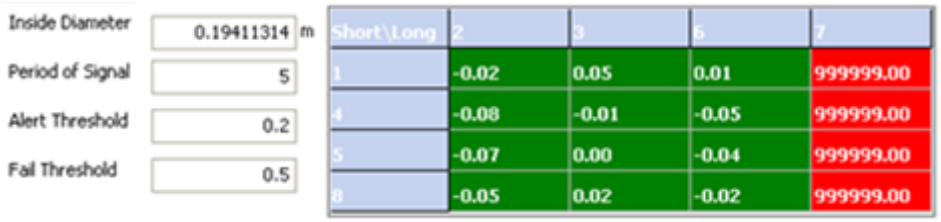


Figure 8-6 VOS Cross check and Meter Setup descriptions for LEFMLink 2G

VOS Cross Check

The VOS Cross Check is calculated using the following equation:

VOS Cross Check = InsideDiameter*(VOS_long_path - VOS_short_path) / (PeriodOfSignal*VOS_long_path*VOS_short_path)

The results of the VOS cross check are shown numerically in LEFMLink 2G, as well as color coded (green = pass, yellow = alert, and red = fail). Pass fail criteria are user defined within the LEFMLink 2G interface software.

Meter Setup Info

- Inside Diameter – The inside diameter of the meter.
- Period of Signal – The period of the signal, typically 5 µs for 200 kHz transducers.
- Alert Threshold– User defined VOS cross check value in terms of signal periods.
- Fail Threshold– User defined VOS cross check value in terms of signal periods.

Data Logging

The data logging function is available within the “Gas Tab”, and functions in the same manner as is described in section 6 of this manual. Please refer to section 6 for data logging instruction.

Section 9

Tools

Each of the tools launches a screen described in the following sections. These tools include:

- Viewing Modbus Registers (tool to see and write to any Modbus register)
- Output forcing – Force values to analog and frequency output for loop calibration purposes.
- Zeroing Meter (Special site procedures required)

Viewing Modbus Registers

Occasionally, test values may be entered into the device (Holding registers) and specific values may be read from the device. LEFMLink 2G has a tool for that task. The tool is shown below.

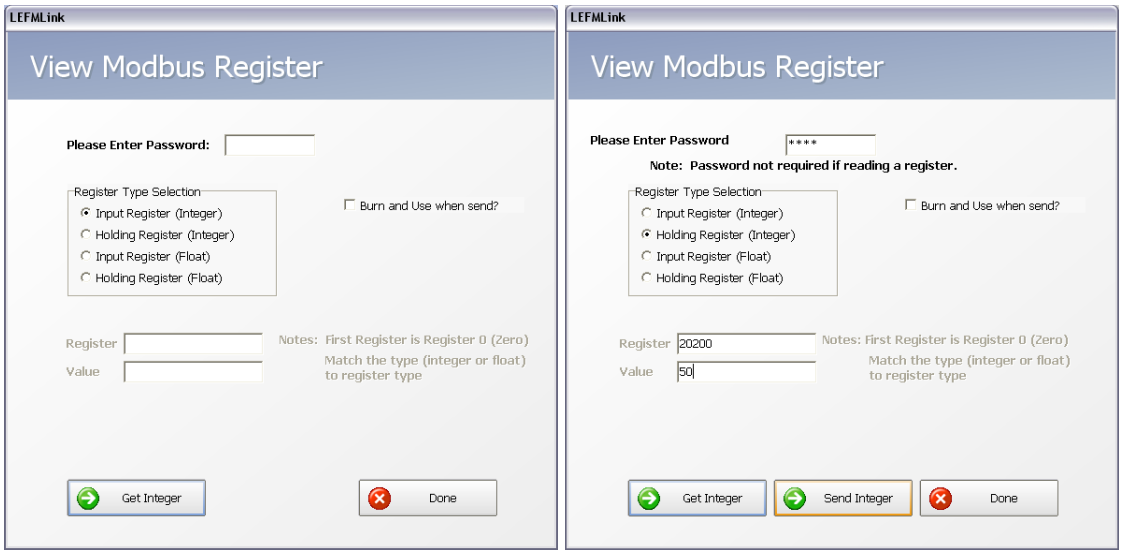


Figure 9-1: Modbus Register Viewing Changing
(Input Registers on Left and Holding Registers on Right)

Note: Holding registers are password protected as discussed in Section 3.

Output Forcing

WARNING

Scaling the analog outputs will change the flow measurement observed by the site. Contact appropriate site personnel prior to any analog output forcing tests. While the transmitter will show the outputs forced on the display, coordination with the site is crucial.

During installation, device scaling and troubleshooting, the ability to set the analog outputs (current or pulse) to an arbitrary value – irrespective of the true indication can be a useful tool. This tool launches the following screen.

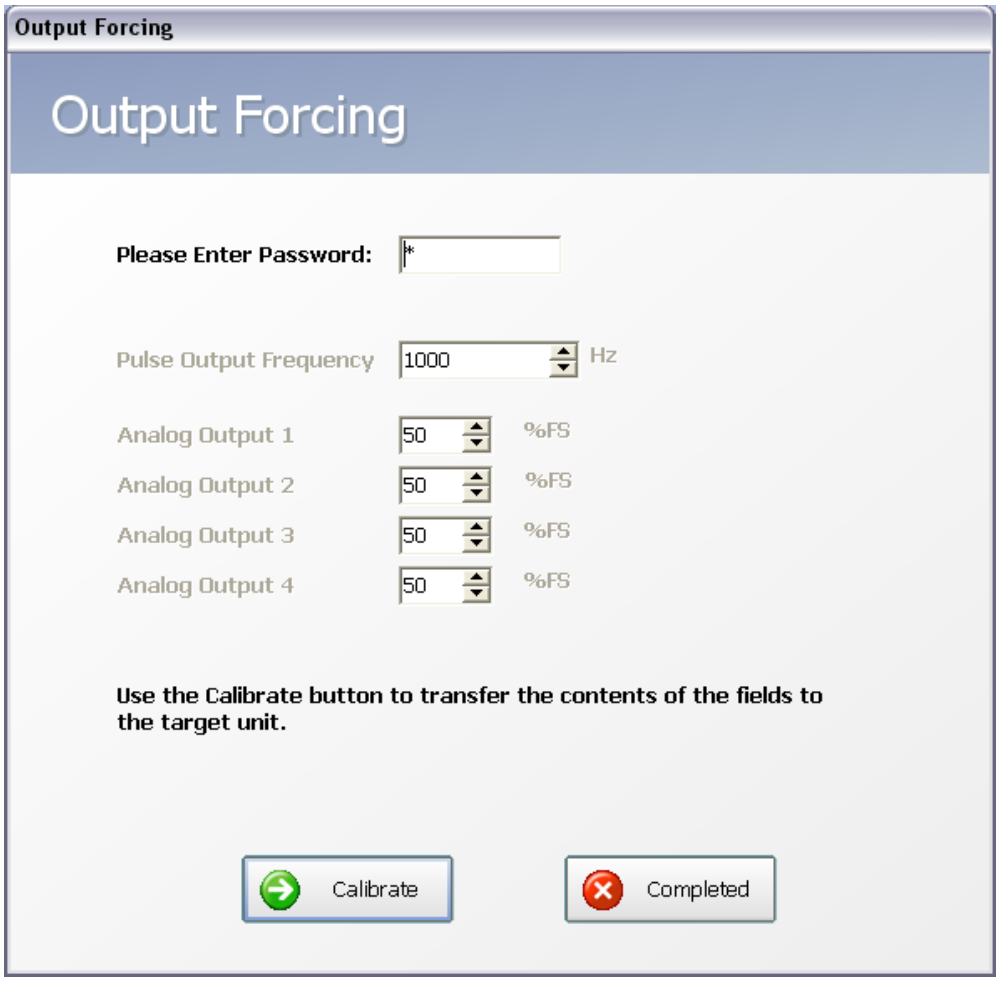


Figure 9-2: Output Forcing

Zeroing Meter

WARNING

Zeroing the meter will change the flow measurement observed by the site. Contact appropriate site personnel prior to any zeroing steps are performed.

During installation, periodic calibration and troubleshooting, the meter may be zeroed. This step requires exceptional diligence. If the flow through the meter is not truly zero – then an offset can be embedded into the device.

Proper site procedures are required to isolate flow through the meter and verify flow is zero and that the meter operations are acceptable.



Figure 9-3: Zeroing Meter

Communications

G2 Only - The user has the ability to explicitly change just the slave address and the baud rate on the device.



Figure 9-4: Set Device Comms

After changing the communications parameters on the device, the user can then change LEFMLink's communications parameters to match.

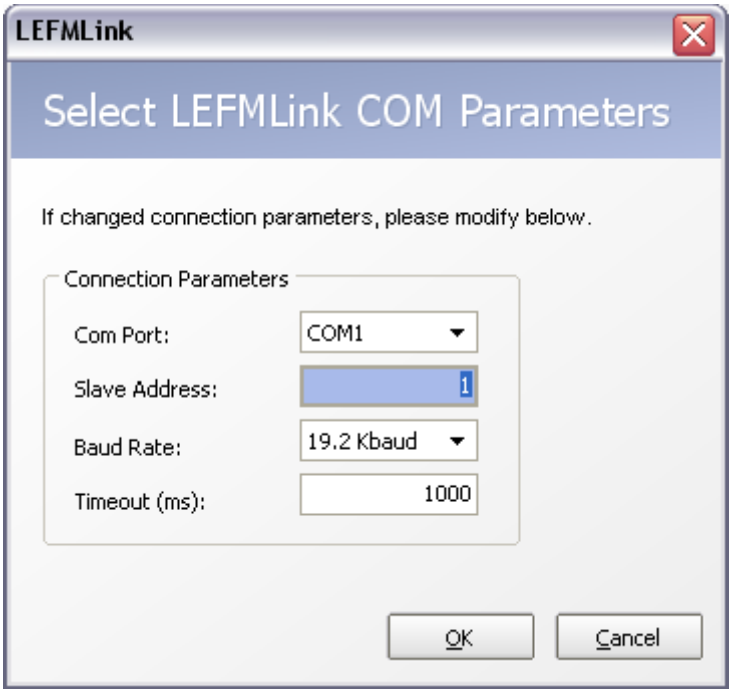


Figure 9-5: Select LEFMLink COM Parameters

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