

Fox Thermal Instruments, Inc.

THERMAL MASS FLOW METER & TEMPERATURE TRANSMITTER



Notice

This publication must be read in its entirety before performing any operation. Failure to understand and follow these instructions could result in serious personal injury and/or damage to the equipment. Should this equipment require repair or adjustment beyond the procedures given herein, contact the factory at:

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Fox FT3 Manuals:

- Model FT3 Instruction Manual
- Fox FT3 RS485 Modbus Manual
- Fox FT3 HART Manual
- Calibration Validation User's Guide

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Introduction

Introduction

Introduction

Thank you for purchasing the Model FT3 Thermal Gas Mass Flow meter and Temperature Transmitter from Fox Thermal Instruments. The Model FT3 is one of the most technically advanced flow meters in the world. Extensive engineering effort has been invested to deliver advanced features, accuracy measurement performance and outstanding reliability.

The new FT3 View software allows users to easily display data and configure the FT3 to their specific application parameters. Then, log flow/temperature data to an Excel file. The software can also activate the new Calibration Validation diagnostic function using the CAL-V™ and Zero CAL-CHECK™ tests.

This Manual contains the installation and operation instructions for the meter.

This manual is divided into the following sections: Introduction, Installation, Operation, Glossary and Index.

Installation

Installation

Installation

Open the back section of the IP68 FT3 housing, then connect the unit via a USB (type A, mini cable) to a PC. If the PC is connected to the Internet and running Windows 7™, the PC will try to automatically load the VCP driver. If the driver does not load automatically, download the VCP driver at: <http://www.ftdichip.com/Drivers/VCP.htm>



Note: The latest version of the FT3 View™ software is available for download at <http://www.foxthermalinstruments.com/products/ft3view.php> (see Fig. 2.1)

Fig. 2.1: Online Download Location for FT3 View™ Software

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FT3 View™ Software Tool

The FT3 View™ application software is a program that runs on a PC and communicates with a Fox FT3 Therm Meter.

- Quick access to all configuration parameters with pop-up windows and pull down menus
- Selection of measurement units, flow and temperature ranges, alarm settings and more
- Display of alarm codes
- Storage of meter configurations to a file that can be archived
- View raw data that can be used to diagnose or troubleshoot your meter
- Data Logging to a Microsoft® Excel spreadsheet
- CAL-V™ Calibration Validation [Certificate](#)
- Zero CAL-CHECK™ Calibration Validation [Certificate](#)

Get a Free Quote
Use our configurator to choose the right meter for your application. Submit the configuration and get a quote within 1 business day.
[Click to get a Free Quote >>](#)

FT3 View™ Software (for XP/Win7) ←

[FT3 View™ Data Sheet](#)
[FT3 View™ Instruction Manual](#) (Instructions for downloading and using the FT3 View™ Software)
[FT3 View™ Software \(for XP/Win7\)](#) ←

Configuration and Data Logging Application

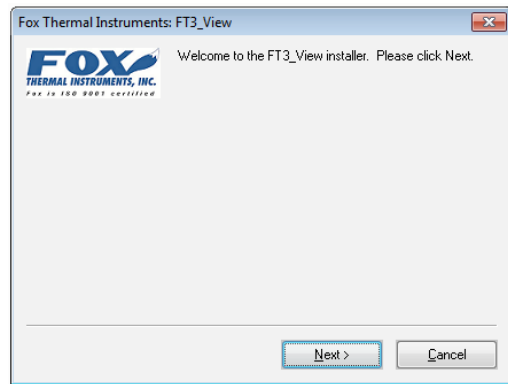
QUALITY SYSTEM
FM Approvals
REGISTRATION

CLICK HERE TO VIEW THE
FOX ISO 9001:2008

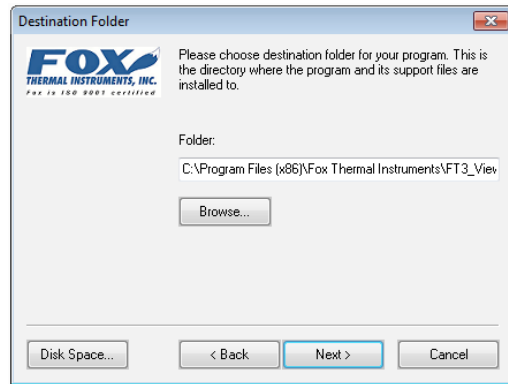
Installation

Installation

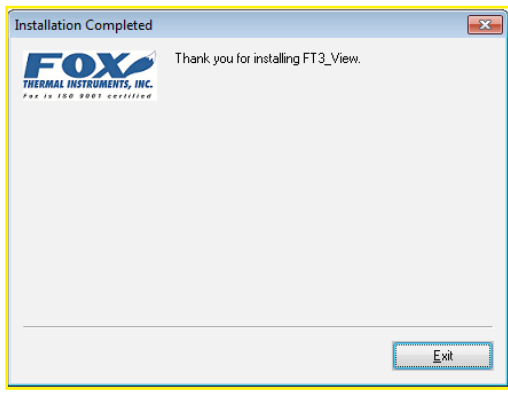
To install the FT3 View program, run the "FT3View_V#.##-setup.exe" file that is located in the downloaded file.



After clicking "Next" the screen will show:



Select the folder in which you wish to install FT3 View™, then click "Next".



When the program is done installing, you may exit, then restart your computer.

INSTALLATION

Installation

COM Port Selection

Com Port Selection

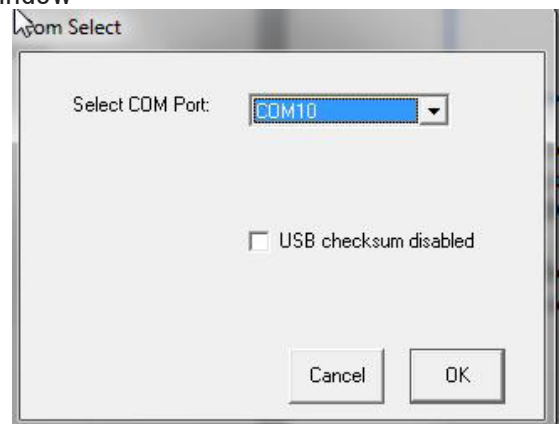
Upon opening FT3 View for the first time, Windows will assign a "virtual COM port". To determine which Com port number has been assigned, go to Control Panel/Device Manager and click on COM port. The Com port number should be displayed under the USB symbol.

When prompted, enter the assigned COM port by using the drop down menu and press **OK**.

Note: The FT3 Meter must be plugged into the computer in order for the system to register it.

Note: The program will automatically remember this Com port when calling up the program again.

Fig. 2.1: COM Port Selection Window



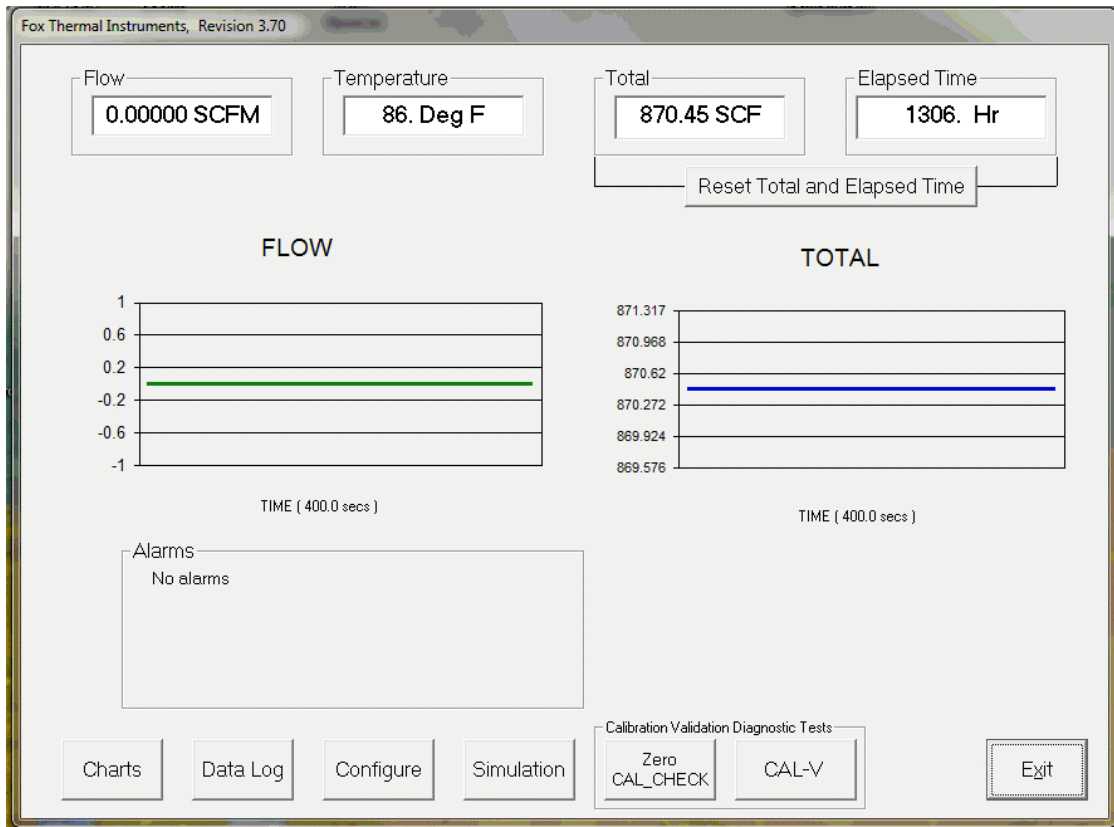
Operation: Main Screen

Main Screen

Main Screen

The image below depicts the main screen that appears upon entering FT3 View.

Fig. 3.1: FT3 View Main Screen



Note: Data on the screen is refreshed every second.

Charts Button

This calls up two charts that can be configured for either temperature or flow. Each chart can be individually enlarged and rescaled from the original default settings. For more information on how to change the charts settings, refer to "Operation: Chart Settings" on page 10.

Note: It can be set for either automatic or manual scaling.

Data Log

This function allows all selected data to be logged to an Excel file at the



Operation: Main Screen

Main Screen specified sample time. All readings are time/date stamped. For more information on using the Data Logger function, refer to "Operation: Data Logger" on page 19.

Configure

This allows the operator to go in and set the application parameters. This can be done either via the FT3 View™ software or manually via the instrument's display. For more information on configuring application parameters, refer to "Operation: Configure" on page 12.

Simulation

This function can be used to verify that all the flow meter outputs are working properly. Probably the easiest way to perform this check is to enter a specific temperature/flow rate. The corresponding analog outputs can be verified using a DMM and using a watch for the pulse. Refer to Page 20 for more information on how to use the Simulation function.

Zero CAL-CHECK™

The Zero CAL-CHECK™ calibration validation test can be performed while the unit is still in the pipe (if a no flow condition can be established) or out of the pipe when zero flow cannot be established. Zero CAL-CHECK™ does the following:

- Checks for build-up on sensor that could affect calibration
- Further validates the zero stability of the meter
- Checks thermal conductivity (heat transfer) repeatability of the sensor

The Zero CAL-CHECK™ calibration validation test is explained in greater detail on p. 26.

CAL-V™

The CAL-V™ calibration validation test can be performed while the unit is still in the pipe - and under normal flow conditions. CAL-V™ verifies that the sensor and meter electronics meet the operation specifications and the meter is accurate. The CAL-V™ calibration validation test is explained in greater detail on Page 22.

Alarms

The unit can be configured for high/low alarms for either flow or temperature. The "alarms window" displays any alarms or warnings.

Exit

Exit the application

Operation: Chart Settings

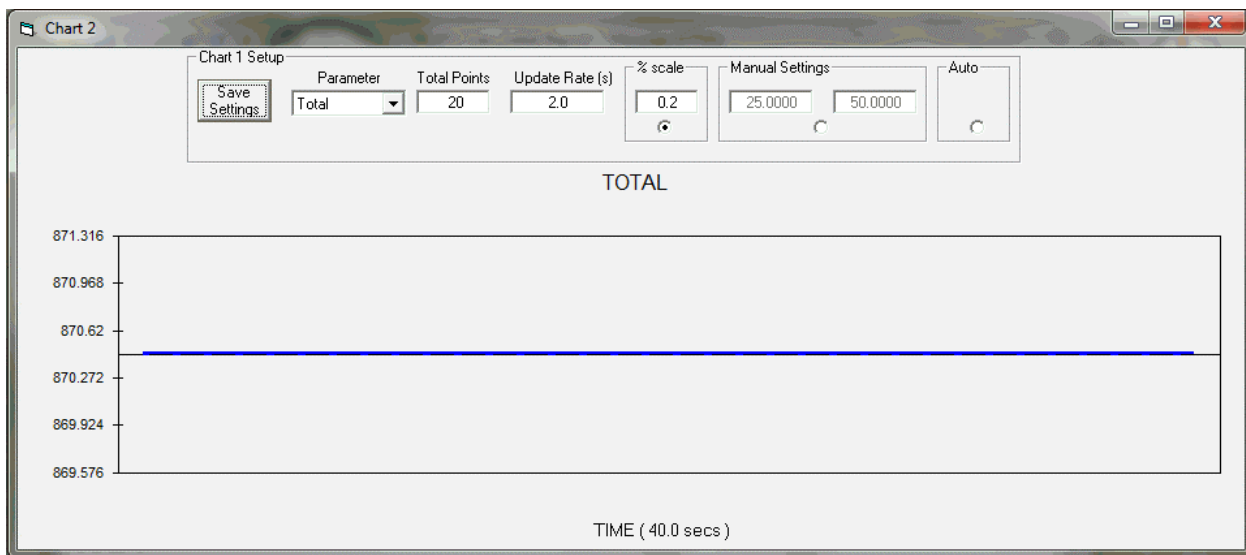
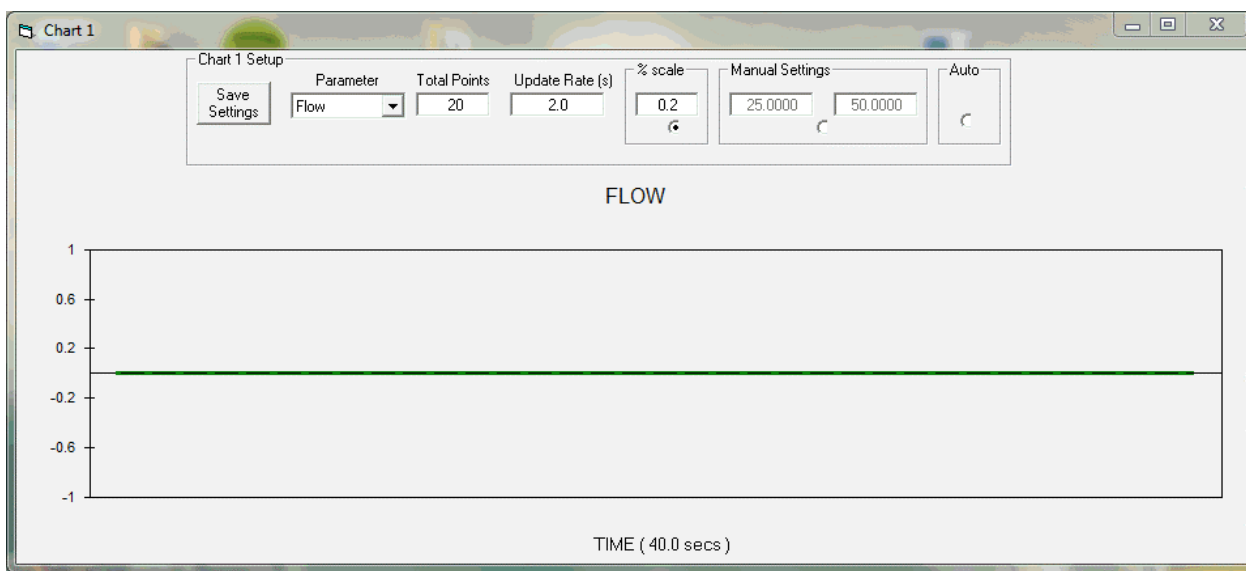
OPERATION

Charts Settings

Charts Settings

From the main menu screen, click on "Charts". Two charts, one for flow and the other for temperature, will appear side-by-side.

Fig. 3.2: Chart Settings Window - Charts 1 and 2



Each chart can be selected for flow, temperature or total flow and scaled in one of three ways: a plus/minus percent scale, inputting min/max values manually, or real-time automatic scaling.

Operation: Chart Settings

Charts Settings

Save Setting

The user can save any new chart settings on the main page window. These settings can then be closed by clicking on the "X" at the top right corner of the window.

Parameters

All meter operating parameters can easily be selected for charting: flow, temperature or total flow.

Total Points

The total points specifies the number of points plotted on the graph. Older data is automatically disregarded.

Update Rate

The update rate controls the data refresh rate.

Percent (%) Scale

This sets the scale to a plus/minus specified percentage from the initial measured value. Typically, the minimum/maximum is scaled at plus/minus 10% of that initial value.

Manual Chart Setting

The Manual mode allows a user to input min/max values for chart scaling. When entering new values, press enter for them to take effect.

Automatic Chart Setting

Automatic mode lets the program adjust the scaling on a real-time basis based on the entire range of values.

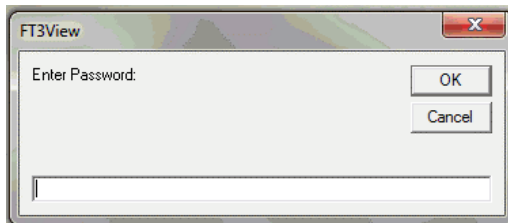
Operation: Configure

Configure

Configure

From the main menu, click on the "Configure" button and enter the requested password for either Level I (1234) or Level II (9111) access.

Fig. 3.3: Password Window

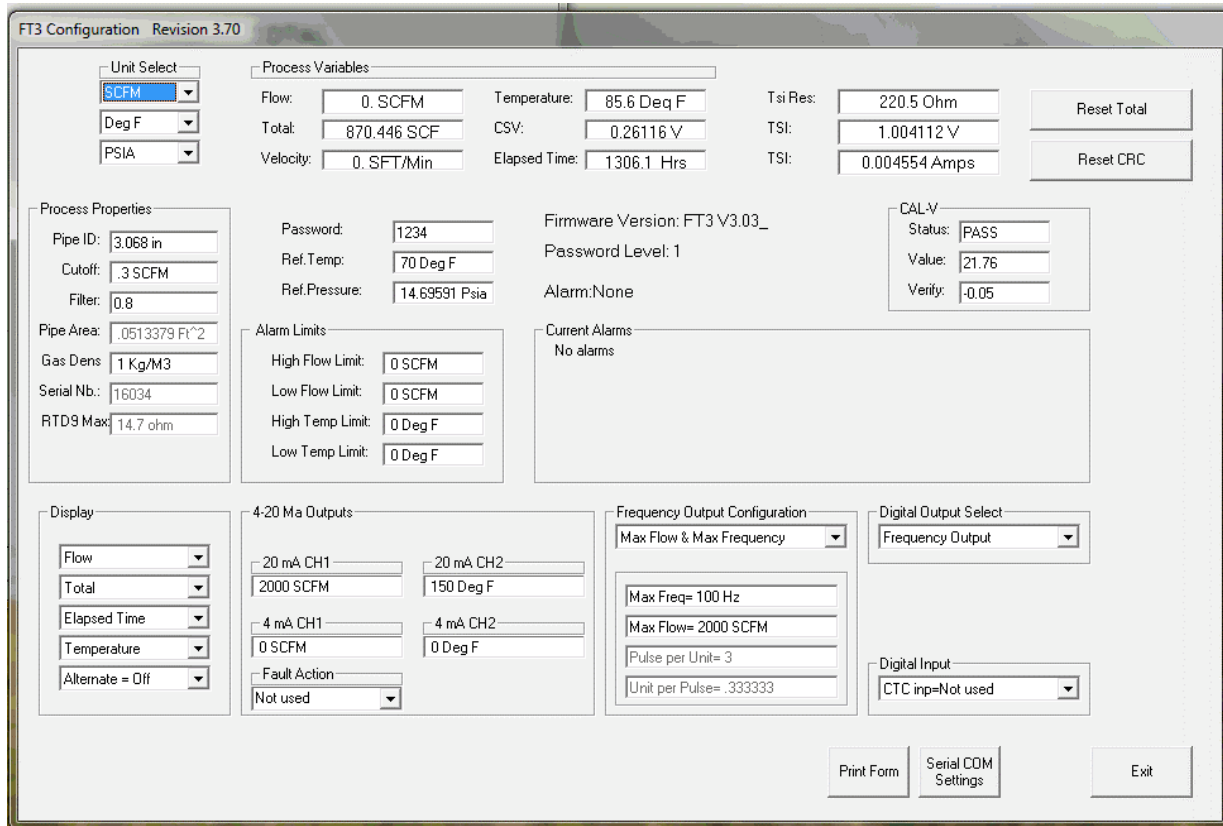


Note: Most users will only need access to the Level I screen to do basic setting of units, alarms and output scaling.



Level I Configuration

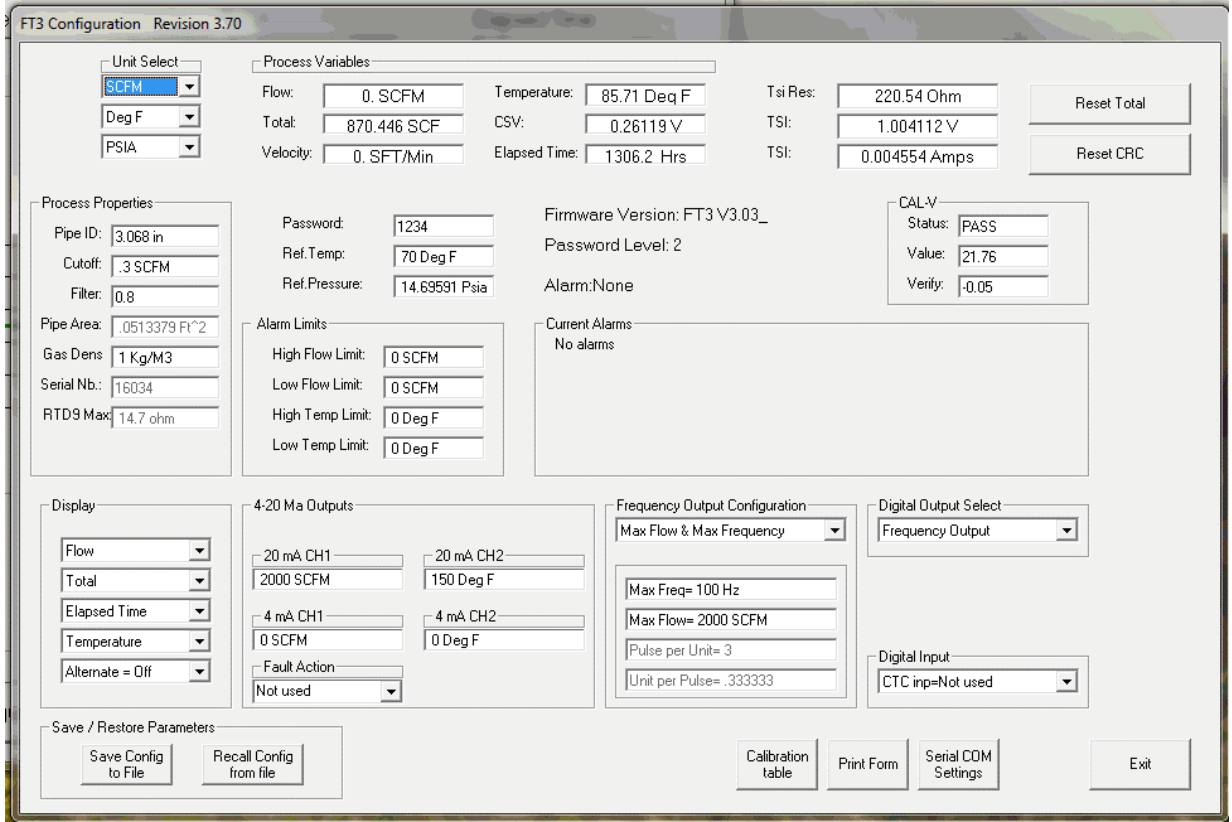
Fig. 3.4: Level I Configuration Screen



Operation: Configure

Level II Configuration

Fig. 3.5: Level II Configuration Screen



Warning: The Level II configuration screen allows access to the instrument calibration table. Users should be careful when making changes to some settings within this screen.

Unit Select

Unit Select

The "Unit Select" section is used to change the desired units in the flow rate, temperature and reference pressure parameters.

Process Properties

Process Properties

Pipe Inner Diameter (ID): The pipe inner diameter can be entered in either inches or millimeters. Once entered, the program will automatically recalculate the pipe cross-sectional area for the velocity/flow calculations. A precise ID is required to ensure accurate flow measurement.

Operation: Configure

Process Properties

Process Properties (cont'd):

Cut-off: A gas flow rate at - or below - the cut-off setting will cause the meter to read zero.

Filter: Changing this value will increase or decrease the damping of the flow rate reading. Decrease the setting to increase damping. The default setting is 0.8 (see FT3 Manual for more details).

Pipe Area: This value can be entered directly - or it is automatically calculated by entering the pipe ID above.

Note: The ID unit is inches/mm, while the pipe area is in square feet/meters.

Gas Density: The gas density is required only when the selected output is mass units - either pounds or kilograms.

Serial Number: Serial number of the meter (factory set).

RTD9 Max: The FT3 probe contains two sensing elements: a PowerPro™ and a precision RTD. The PowerPro™ sensor has a maximum resistance (measured in ohms) that corresponds to the maximum temperature/current at which it can operate, before it shuts down (factory set).

Display

Display

With the top four drop-down boxes, the user can choose the data to display. By selecting "Alternate", the screen automatically switches between the data screens.

Alarm Limits

Alarm Limits

Users can set both high/low alarms for both flow and temperature. When a limit is reached, an alarm message is displayed. In addition, if the meter's digital output is activated, breaching the alarm limit automatically activates a discrete output to control an external buzzer, light or some other way to alert the operator.

Analog 4 to 20 mA

Analog 4 to 20 mA

The FT3 has dual analog 4 to 20 mA outputs. Channel 1 is for flow and Channel 2 is configurable for either flow or temperature. Though the FT3 will already be scaled for the specific application coming from the factory,



Operation: Configure

FT3 View™ allows the operator to easily re-scale the 4 to 20 mA outputs as needed.

Digital Output Select

Digital Output Select

This selection enables the FT3 to operate the digital output in either pulses (counts) or as an alarm discrete output.

If the pulses (counts) output is selected, it can be programmed in three different ways via the pull-down menu "Frequency Output Configuration".

- Maximum flow and maximum frequency
- Pulses per Unit
- Units per Pulse

Digital Input

Digital Input

The digital input selection can be used to reset the flow totalizer function or to switch the meter from calibration curve 1 to curve 2.

Note: The FT3 must be originally configured for two gas calibration curves at the factory to use curve switching.



Process Variables

Process Variables

Flow: Current flow rate in selected units

Total: Cumulative mass or volume flow in selected units

Velocity: Flow velocity

Temperature: Gas temperature (Fahrenheit or Celsius)

CSV: Current sense voltage

Elapsed Time: Time since the Totalizer was reset

Tsi_resistance: Calculated resistance of the 200 ohm RTD element

TSI voltage: Measured voltage across the 200 ohm RTD element

TSI amperage: Calculated current going through the 200 ohm RTD element

Reference Conditions

Reference Conditions

Reference temperature and pressure are the standard (or normal) temperature and pressure (STP) for which the flow rate is calculated.

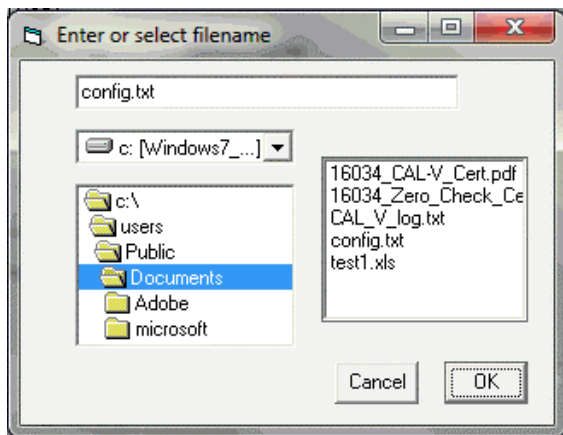
Operation: Configure

Save Current Configuration

Save Current Configuration to File

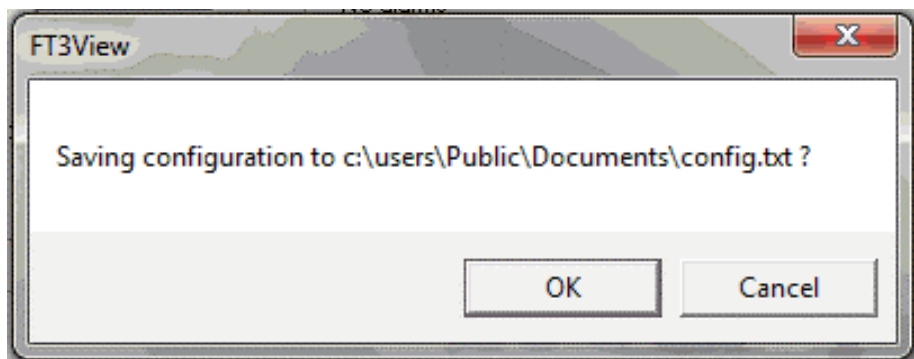
The current configuration parameters are saved to a text file.

Fig. 3.6: Save Current Configuration to File Window



Select an existing file to overwrite or a new file name and then press **OK**. A confirmation window will be shown.

Fig. 3.7: Confirmation of Saved Configuration Window



Recall Configuration

Recall Configuration to File

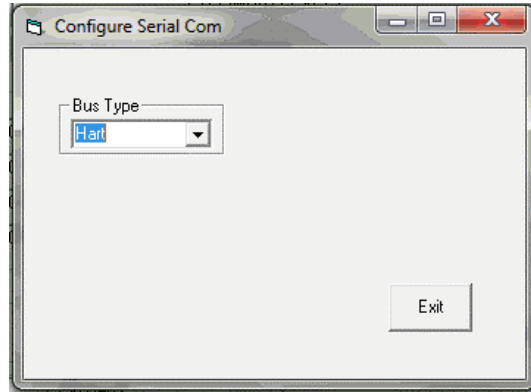
This allows the operator to recall an existing FT3 configuration file.

Operation: Configure

Serial COM Settings **Serial COM Settings**

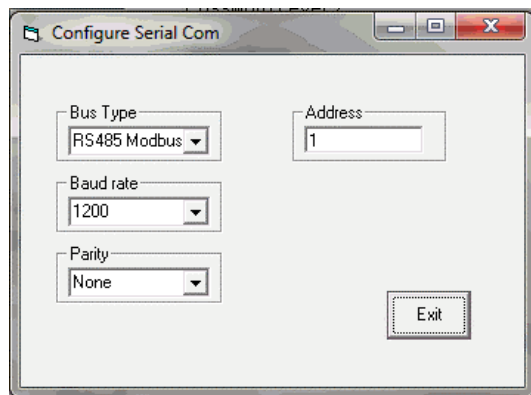
Use this function to set the serial communication settings for any of the optional FT3 bus communication boards.

Fig. 3.8: Select Serial Communication Window



The node address for the FT3 on a HART network is set through the HART protocol using either a hand-held communicator or a HART master.

Fig. 3.9: Modbus RS485 Settings Screen



Note: The baud rate and parity selector and the network address will be shown for Modbus RS485.



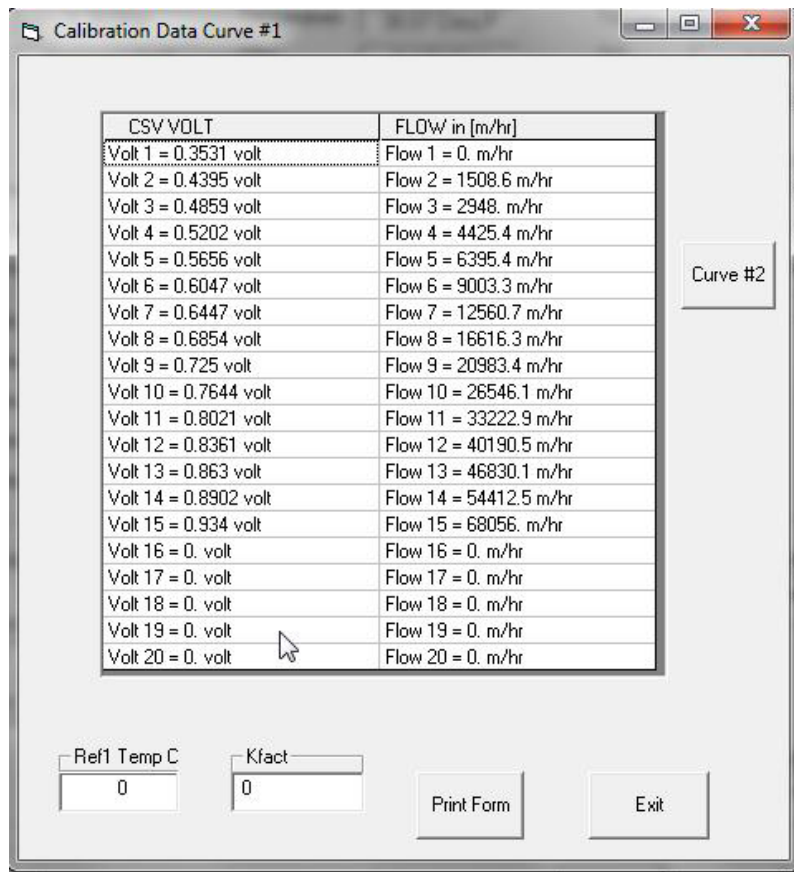
Operation: Configure

Calibration Table

Calibration Table

This allows access to the calibration table(s) stored in the memory of the meter.

Fig. 3.10: Calibration Data Curve Window



The calibration table contains the Current Sense Voltage (CSV) read directly from the meter's bridge circuit, plus the corresponding gas flow velocity (meters per hour). Reference 1 is the temperature at which the table calculations are based. To access a second curve, click the "Curve #2" button.

OPERATION

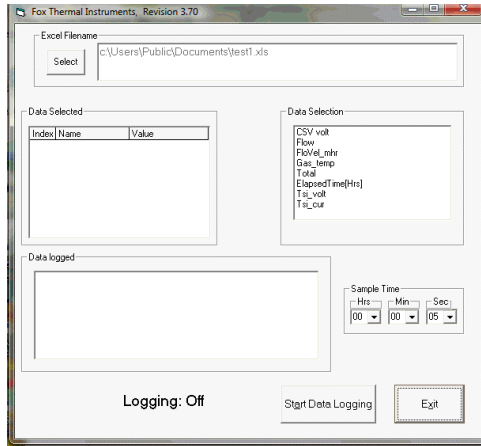
Operation: Data Logger

Data Logger

Data Logger

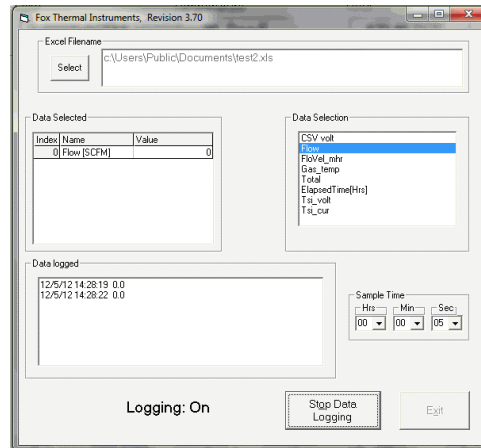
The Data Logger screen can be accessed from the main screen. Clicking the "Data Logger" function will prompt the user for a password. Enter a Level I or Level II password and the Data Logger window will appear.

Fig. 3.11: Data Logger Window - Logging Turned Off



Select the sample time from the drop down menu, and then select the required data from the Data Selection list. Select or create a name for the Excel file and then press the "Start Data Logging" button.

Fig. 3.12: Data Logger Window - Logging Turned On



When "Start Data Logging" is pressed, the data is recorded in the specified Excel file - and also displayed in the Data Logged window. Pressing "Stop Data Logging" ends data acquisition.

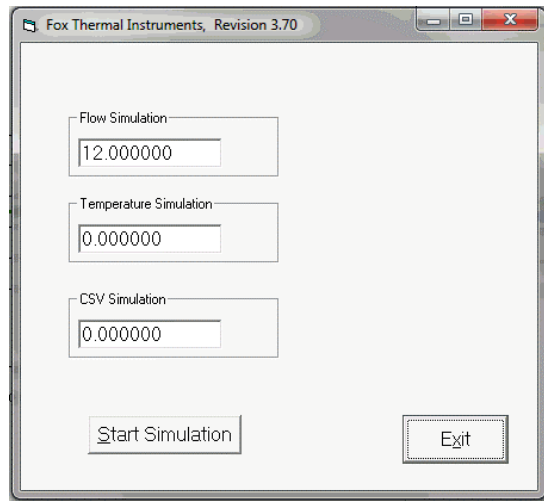
Operation: Simulation Mode

Simulation Mode

Simulation Mode

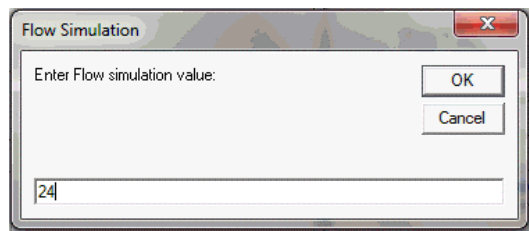
After clicking on "Simulation", a password will be requested. Enter the password and then the Simulation screen will be shown.

Fig. 3.13: Simulation Mode Window



The simulation mode simulates flow rate, temperature and/or CSV. Click on the required data and enter a value. Simulation mode allows users to verify the analog outputs, digital outputs and totalizer at simulated flow rates and temperature.

Fig. 3.14: Entering a Simulation Value



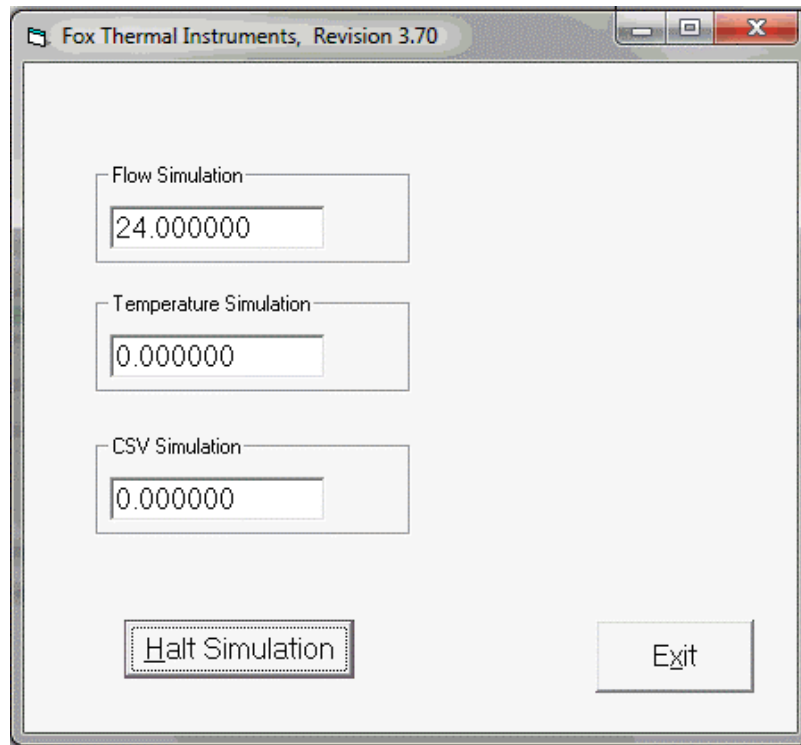
Enter the value, click **OK** and press "Start Simulation".

OPERATION

Operation: Simulation Mode

Simulation Mode

Fig. 3.15: Simulation Running



In Simulation mode, all FT3 outputs and the Totalizer respond as if in normal measurement mode. Click "Halt Simulation" to end.

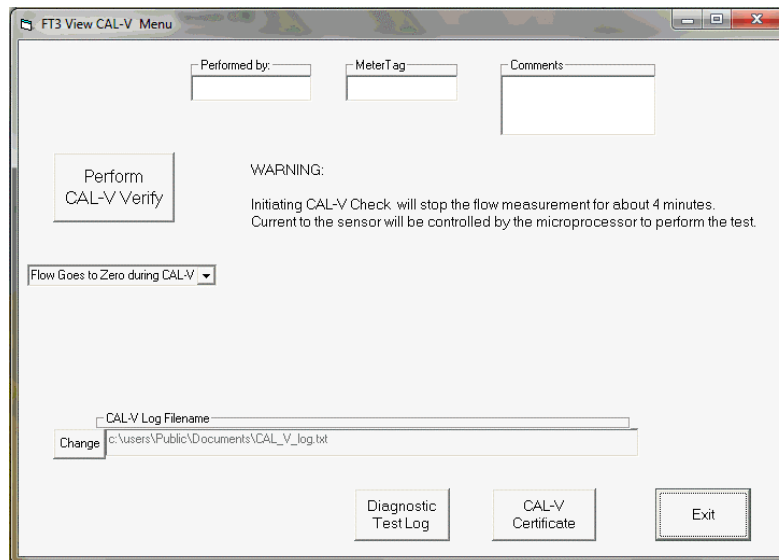
Operation: CAL-V™

CAL-V™

CAL-V™

CAL-V™ is performed to verify the proper operation of the FT3 Fox meter. From the Main Menu, click on the "CAL-V" button to access the CAL-V Menu Window.

Fig. 3.16: CAL-V™ Menu Window



On the CAL-V™ Menu, there are fields to enter information about the person performing the test, meter tag information, and any other important information may be entered into the comments area.

A drop-down menu allows the user to choose between these two options:

- Flow goes to Zero during CAL-V™
- Flow holds the last value during CAL-V™

The user can also specify a particular folder name and location for the data to be stored in a log to access test results at later times.

Please note that the test will take about four minutes. The flow measurement will stop and go to zero for this period unless the "hold last value" option has been chosen.

When ready to start, click the "Perform CAL-V Verify" button.

Operation: CAL-V™

CAL-V™

Fig. 3.17: CAL-V™ Confirmation Window

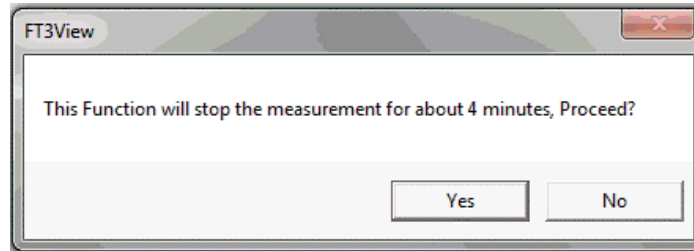
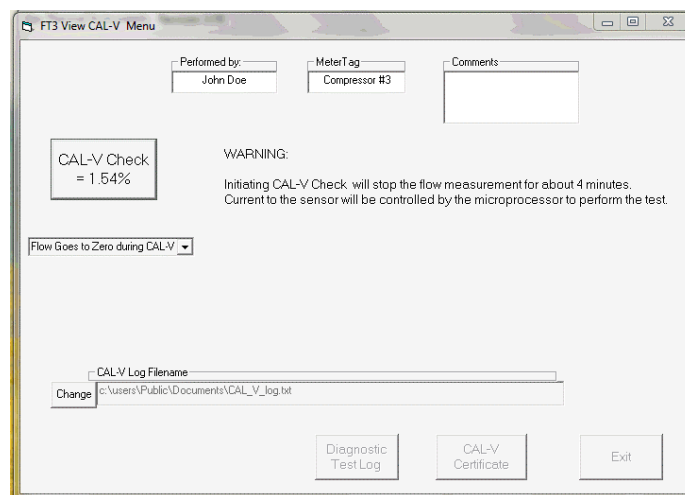
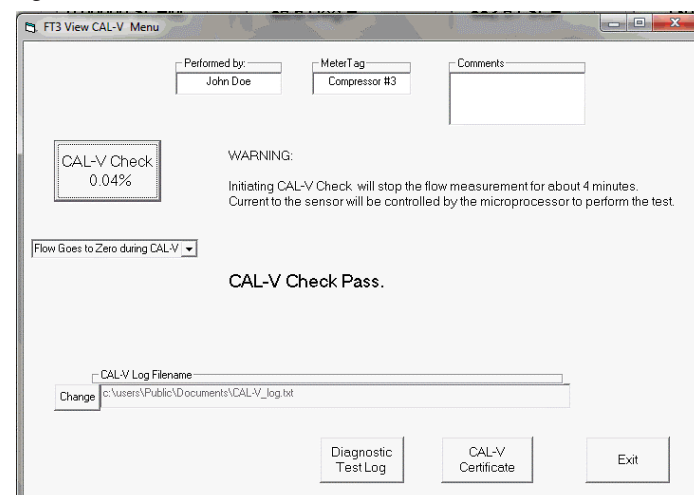


Fig. 3.18: Running a CAL-V™ Test



The CAL-V™ test window will display the current calculated value as the microprocessor adjusts current to the sensor. At the end of the test, a Pass/Fail message will be displayed.

Fig. 3.19: CAL-V™ Check Results Window




Operation: CAL-V™ Certificate

CAL-V™ Certificate

CAL-V Certificate

The "CAL-V™ Certificate" button will display the latest certification. When performing CAL-V™, all the data is logged into a CAL-V™ log file with all pertinent data, including the serial number. You can choose to create multiple logs by changing the file name and location on the CAL-V window. A laptop can be used to perform the CAL-V™ on a different FT3 meter. When a CAL-V™ certificate is requested, the program will search the log file for the specific serial number and will display only the last check performed.

Fig. 3.20: CAL-V™ Certificate



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CAL-V™ CERTIFICATE
CALIBRATION VALIDATION

CAL-V™ Performed on:	December 05 2012	14:36:02	CAL-V™ Results:	PASS
Firmware Version:	FT3 V3.03_		CAL-V™ Value:	21.76
Fox Meter Serial Number:	16034		CAL-V™ Verify:	0.00%
Tag #/Meter location:	Compressor #3			
Test performed by:	John Doe			
Additional Comments:				

Calibration Table Stored in Flow Meter

Compare the below Calibration Table to the original Calibration Certificate

Data Point	Input Volts	NMPH at 0 C 760 mmHg
1	0.28000	0.00
2	0.41000	3229.74
3	0.46000	6983.77
4	0.49000	10744.46
5	0.53000	17159.82
6	0.56000	23925.25
7	0.58000	31408.13
8	0.61000	40764.05
9	0.64000	53590.99
10	0.67000	69975.49
11	0.69000	88456.75
12	0.72000	104941.60
13	0.74000	127601.30
14	0.76000	152711.00
15	0.79000	181160.50
16	0.00000	0.00
17	0.00000	0.00
18	0.00000	0.00
19	0.00000	0.00
20	0.00000	0.00

CAL-V™ is an in-situ calibration routine that validates the flow meter's calibration accuracy by testing the functionality of the sensor and its associated signal processing circuitry.

At the conclusion of the test, the meter will display a pass/fail message and the CAL-V™ data.

A "pass" result confirms the meter is measuring accurately.

1. The CAL-V™ test is valid for checking the calibration accuracy of flow meters installed in the application for which it was calibrated, including the gas/gas mixture, calibration range and pipe size shown on the Calibration Certificate.
2. For applications with temperature exceeding 250°F (121°C), CAL-V™ test results may vary.

Operation: Diagnostic Tests Log

Diagnostics Tests Log

Diagnostic Tests Log

The Diagnostic Tests Log button allows the operator to view a log of previous CAL-V™ checks that have been run on the meter. Be sure to access the correct log by choosing the correct file name in the CAL-V Log Filename box.

Fig. 3.21: CAL-V™ Log

Ser. NB	Date	Time	TYPE	Value	Ref	Verify	PASS/FAIL	Temp	Perform by:	TAG	Comments
16034	December 05 2012	14:53:36	CAL-V CHECK	-----	21.76	0.04%	CAL-V CHK PASS	-----	John Doe		Compressor #3

Exit

Operation: Zero CAL-CHECK™

Zero CAL-CHECK™

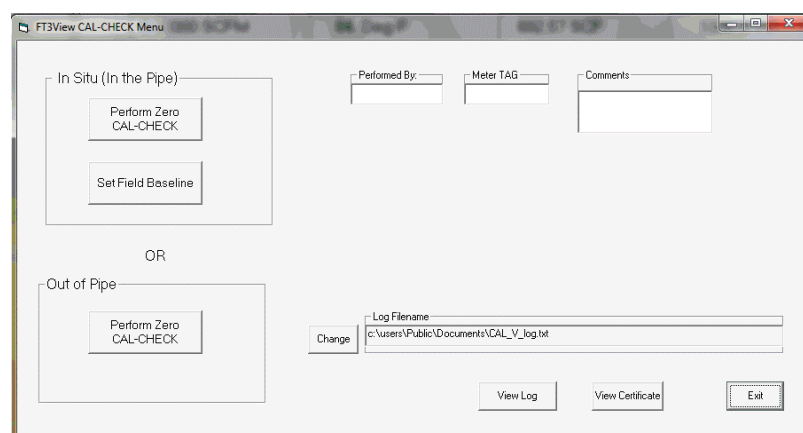
Zero CAL-CHECK™

Zero CAL-CHECK™ is performed to verify the following:

- Checks for build-up on sensor that could affect calibration
- Further validates the zero stability of the meter
- Checks thermal conductivity (heat transfer) repeatability of the sensor

From the Main Screen, click on the "Zero CAL_CHECK" button to access the Zero CAL-CHECK Test Menu Window.

Fig. 3.22: Zero CAL-CHECK™ Test Menu Window



On the Zero CAL-CHECK™ Menu, there are fields to enter information about the person performing the test, meter tag information, and any other important information may be entered into the comments area.

Two test options are available when performing a Zero CAL-CHECK™ test:

- In-Situ (In the Pipe): use only if zero flow can be established
- Out of Pipe: use when zero flow cannot be established

Note: If you are unsure of which test is best for your configuration, please refer to the Calibration Validation User's Guide for more information.

Warning: Before performing the In-Situ (In the Pipe) test **for the first time**, the "Field Baseline" must be set. Any test performed after the first time does not require the Field Baseline to be set. See Calibration Validation User's Guide for more information.

Choose the appropriate test option based on your ability to achieve a "zero flow" - or "no flow" - condition in the pipe. You may also use the In-Situ (In



Operation: Zero CAL-CHECK™

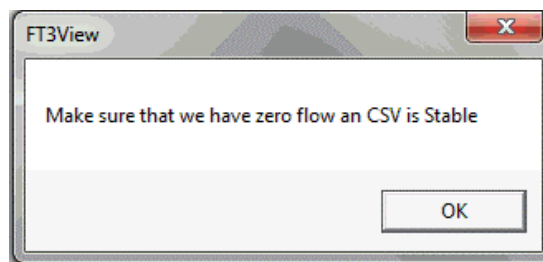
Zero CAL-CHECK™ the Pipe) test if you are using a Fox Packing Gland Assembly to removed the meter from the flow.

The user can also specify a particular folder name and location for the data to be stored in a log to access test results at later times.

Please note that the test will take about five minutes.

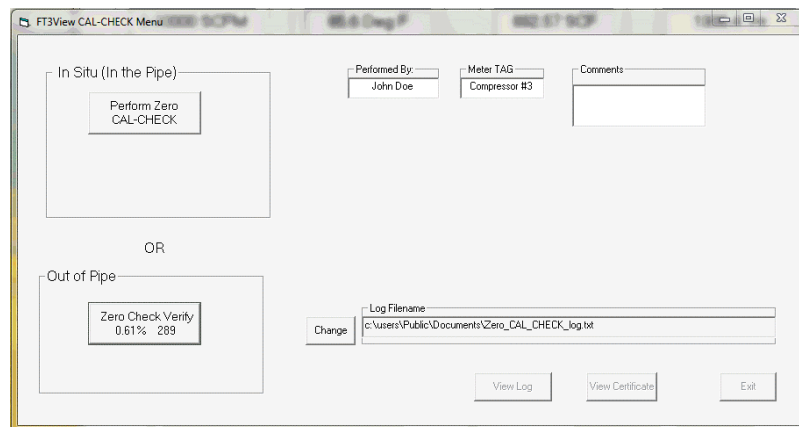
When ready to start, click the appropriate "Perform Zero CAL-CHECK" button.

Fig. 3.23: Stable Conditions Confirmation Window



During the test, the Zero CAL-CHECK™ button will display the current calculated value and a countdown timer of seconds left on the test.

Fig. 3.24: Running a Zero CAL-CHECK™ Test (Out of Pipe Example)

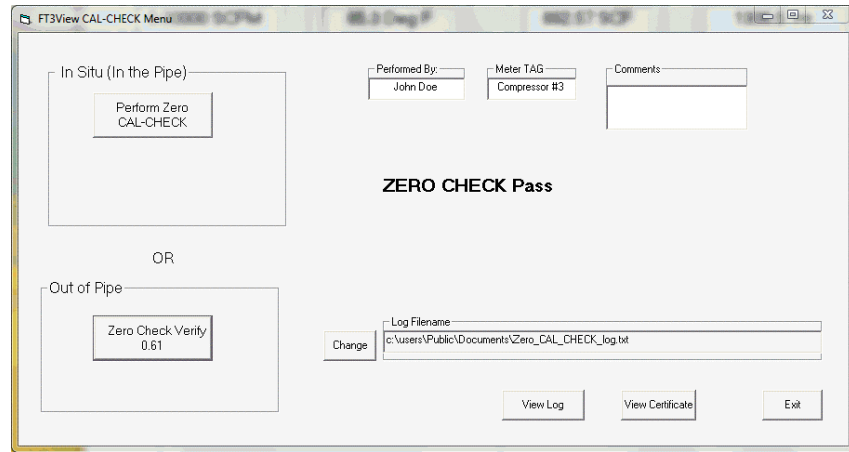


As with the CAL-V test, a Pass/Fail message for the Zero CAL-CHECK™ test will be displayed at the test conclusion.

Operation: Zero CAL-CHECK™ Certificate

Zero CAL-CHECK™ Results

Fig. 3.25: Zero CAL-CHECK™ Results Window

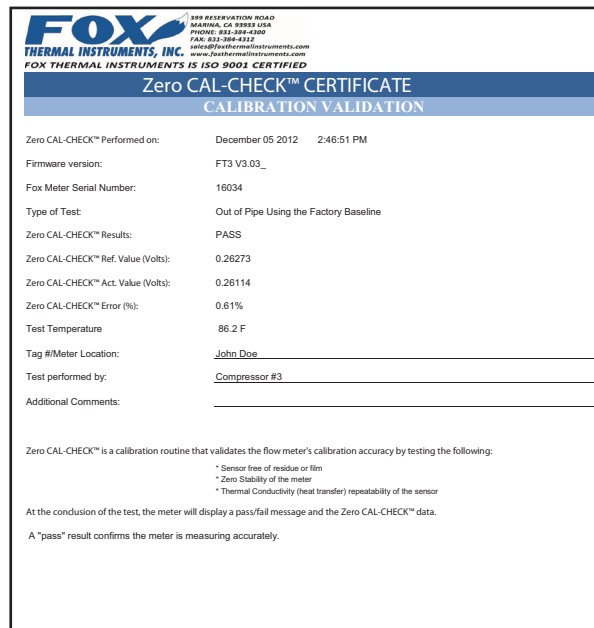


Zero CAL-CHECK™ Certificate

Zero CAL-CHECK™ Certificate

The Zero CAL-CHECK™ Certificate function displays the latest certification. When performing a Zero CAL-CHECK™ test, all the data is logged into a log file with all pertinent data, including the serial number. A laptop can be used to perform the Zero CAL-CHECK™ test on a different FT3 meter. When a Zero CAL-CHECK™ certificate is requested, the program will search the log file for the specific serial number and will display only the last check performed.

Fig. 3.26: Zero CAL-CHECK™ Certificate



Operation: Zero CAL-CHECK™ Log

Zero CAL-CHECK™
Log

Zero CAL-CHECK™ Log

The "View Log" button allows the operator to view a log of previous Zero CAL-CHECK™ tests that have been run on the meter.

Fig. 3.27: Zero CAL-CHECK™ Log

Ser.No	Date	Time	TYPE	Value	Ref	Verify	PASS/FAIL	Temp	Perform by:	TAG	Comments
16034	December 05 2012	14:46:51	ZERO OUT-PIPE CHK	0.26114	0.26273	0.61%	ZRO CHK PASS	86.2 F	John Doe	Compressor #3	

Definitions

Glossary of Terms and Definitions



COM
CSV
DMM
ID
mA
PC
RTD
STP
TSI

Communication
Current Sense Voltage
Digital Multimeter
Inner Diameter
Milliamps
Personal Computer
Resistance Temperature Detector
Standard Temperature and Pressure
Temperature Sense Current

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Information



Caution



Wiring



Definition of Terms



Troubleshooting Tips