Document Number:
XE-FTA5PM-R0A

FRC
A Safe Fleet Brand

INSIGHT

PORTABLE FLOWTESTER
Flow and Pressure Test Set
MODELS:
FTA500 GPM/PSI
FTA510 LPM/kPa, FTA520 LPM/Bar

Tube shown with Pressure Sensor and optional Pitot Pick-up installed.

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INTRODUCTION

Overview

The **INSIGHT Portable FlowTester** with pressure meter is an instrument that will measure flow rate and pressure directly without using charts or doing calculations. The tester is designed around a digital meter with a paddlewheel type flow sensor and pressure sensor mounted in a flow tube. The flow tester program allows for up to six different calibration schemes to be set in memory. This enables the operator to press a button and use the same portable tester with different size flow tubes.

The **Portable FlowTester** consists of a Pelican case into which a panel is mounted containing an **INSIGHT** digital meter, a power switch, low battery indicator, and cable connections. The Pelican case also contains a rechargeable battery and an AC charger/ power supply. A cutout in the front panel allows for the storage of cables.

The **INSIGHT** digital meter has a 4-digit LED display with daylight bright digits 0.56 inch high. The meter electronics are self contained and program features are accessed via push buttons on the front of the module. Flow rate and pressure information is provided by a paddlewheel type flow sensor and pressure sensor mounted in a flow tube. This information is processed and shown on the digital display. An optional Pitot pressure pick-up is available to be used with the pressure sensor for reading higher flow rates.

The **Portable FlowTester** can be powered by its internal rechargeable 12 volt battery, a 120/240 VAC source, or an external 12/24 VDC source (with optional cable). The battery charging unit is mounted inside the box. To charge the internal battery plug the cable into the AC CHARGER input on the front panel and connect the other end to a 120/240 VAC electrical outlet.

Note: The **Portable FlowTester** must be ordered from the factory set for 240 VAC and 24 VDC operation.

All controls, indicators, and input connections are located on the front panel.

Features

Field Programmable

Multiple Flow Rate Calibration Points

Uses Multiple Diameter Flow Tubes

High and Low Flow Warnings

Optional Pitot Pick-up

Specifications

Display Module

Supply Voltage:	9 - 30 VDC
Supply Current:	0.5 Amp

Flow Tube

Material:	Aluminum	
Sizes Available:	1.5" Tube w/2.5" Couplings	(13 - 320 GPM)
	2.0" Tube w/2.5" Couplings	(21 - 520 GPM)
	2.5" Tube w/2.5" Couplings	(30 - 850 GPM)
	3.0" Tube w/NPT Threads	(40- 1380 GPM)
	4.0" Tube w/NPT Threads	(80 - 2300 GPM)

Note: GPM rating is at 0 PSI back pressure (no obstruction at end of tube).

Flow Sensor

Type:	Paddlewheel
Sensor Material:	Acetal (Delrin) with Stainless Steel (316) Shaft
Excitation Voltage:	5 VDC

Pressure Sensor

Model Number:	XE-PRO31PT3
Pressure Range:	0 - 300 PSI
Proof Pressure:	800 PSI
Excitation Voltage:	5 VDC
Output Voltage:	0.5 - 4.75 VDC (See Table 1)

Table 1. Pressure Sensor Output Voltage

PRESSURE	VOLTAGE
0	0.5
100	1.917
150	2.625
200	3.33
250	4.04
300	4.75

GENERAL DESCRIPTION

Components

The **INSIGHT Portable FlowTester** consists of the following components:

Case

Digital Flow and Pressure Display Module

Battery and Charger

Flow Tube(s)

Paddlewheel Flow Sensor and Sensor Housing Assembly

Pressure Sensor (Pitot Pick-up Optional)

Cables

Case

Mounted inside the Pelican case is a panel that has a digital flowmeter display module, power switch, low battery indicator, and input cable connectors installed. The case also houses a rechargeable battery and an AC charger/power supply. A slot cutout in the front panel allows for the storage of cables. All controls and indicators are located on the front panel. (Refer to Controls and Indicators.)

Digital Flow and Pressure Display Module

The module contains a digital display, two buttons and an LED. It houses the electronics and programs that are used to operate the portable tester. The programs are accessed and inputs are made by using two buttons on the front of the display module.

Battery and Charger

The battery and charger used in the tester is a maintenance free, sealed lead acid battery. If any problems occur with any of the charging circuits, or if it is found during a test that the battery is not charged, it is possible to power the unit directly from either a 120/240 VAC or a 12/24 VDC source. (Refer to Power section.)

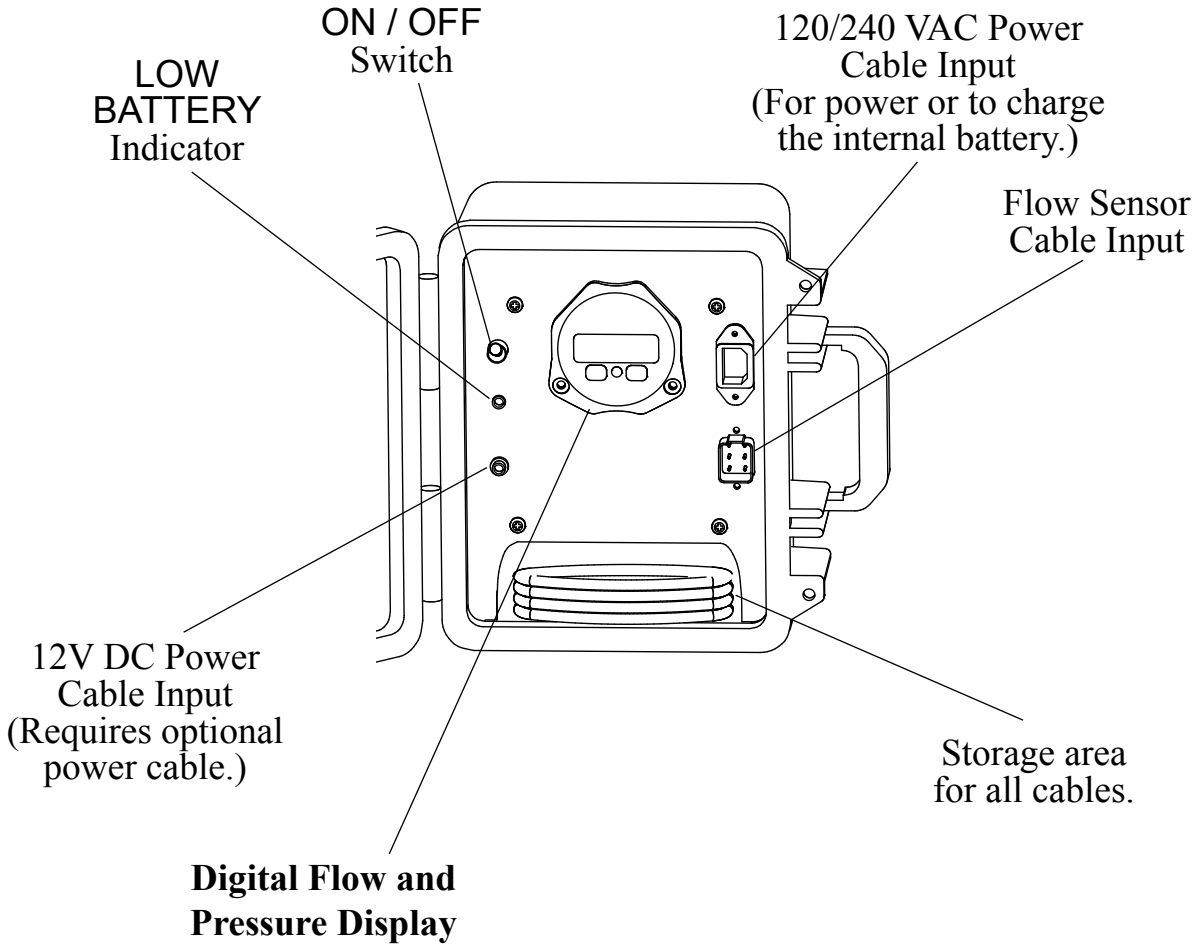
Note: The **Portable FlowTester** must be ordered from the factory set for 240 VAC and 24 VDC operation.

Flow Tube(s)

The tester can store in memory calibration data for up to six flow tubes. Each flow tube will have a mount for a paddlewheel flow sensor.

Paddlewheel Flow Sensor and Pressure Sensor

The sensors provide input signals to the display module that are proportional to the flow rate and pressure in the tube. They are mounted in the discharge end of the tube. The electrical connectors are waterproof and molded into the sensor housings.



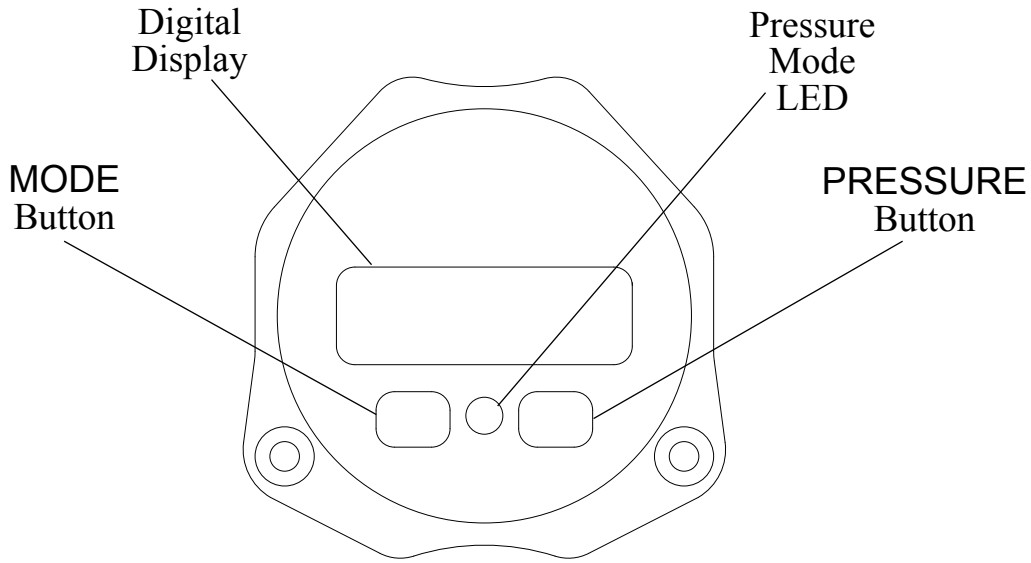


Figure 1. Controls and Indicators

TYPICAL APPLICATIONS

Hydrant Total Flow Test

A direct reading of flow in Gallons Per Minute (GPM) can be obtained by connecting the **Portable FlowTester** to a discharge, flow water and record the flow displayed. The tester can also be used (employing some simple math) to find the total output of a hydrant. This can be accomplished by recording the differences in flow out of one discharge as other ports on the hydrant are opened.

The hydrant test method described below assumes the use of a Tester with a 2.5" flow tube. If a different size tube is used, the mathematical calculations below would need to be adjusted.

The **Portable FlowTester** may be connected to the 2.5" hydrant port in order to obtain individual hydrant flow measurements. Other ports may be opened as desired. To conduct this test, proceed as follows:

1. Connect the flow tube to a 2.5" port. (Adapters are not supplied.)
2. Open the hydrant valve and record the flow reading.
3. Shut off the hydrant and remove the other 2.5" cap.
4. Open the hydrant valve and record the flow reading.

Note: This reading will be lower than the first reading as the water is now being discharged from two ports.

5. If the hydrant has a steamer port, open that and record the flow as above.

If more than one port is opened, the total actual flow will be higher than the displayed flow, but it will be in proportion to the opened port areas. The actual flow can be determined by multiplying the displayed flow by a **K factor** such that:

Total Actual Flow = Displayed Flow x K

Use the values for **K** in Table 2 to determine actual estimated flow.

Table 2. Values for K With a 2.5" Flow Tube

PORTS OPENED	K
One 2.5" port with 2.5" flowmeter attached	1.00
Two 2.5" ports, one with 2.5" flowmeter attached	2.00
One 2.5" with 2.5" flowmeter attached and one 4.5" LDH	4.24
Two 2.5", one with 2.5" flowmeter attached and one 4.5" LDH	5.24

For different size flow tubes the value for K that is used to determine total flow out of the hydrant will be different than those shown in Table 2. Use the following formula to determine new value for K.

$$\text{Constant } \mathbf{K} = \frac{\text{Total Flow Area}}{\text{Area of Flow Tube Opening}}$$

Total Flow Area = Finding the sum of the areas of all open discharges.

(Area of a circle is πr^2)

K factor are used as multipliers to determine total flow out of a hydrant when the portable flow tester is hooked up to only one port of the hydrant, but water is flowing out of more than one.

Water Distribution System Test

This test is used to determine the flow rate available at a particular location at the desired mains residual pressures. This is the available flow rate of the distribution grid, at that location, with one or more hydrants being used simultaneously.

In performing these tests, follow the recommendations outlined in the FIRE FLOW TESTS section of "FIRE SERVICE HYDRAULICS" second edition. Also consult the "FIRE PROTECTION HANDBOOK" 15th edition of the NFPA.

Generally the procedure is as follows:

1. Select two adjacent hydrants, one to be the flow hydrant and the other to be the static hydrant.
2. Assign a man to each hydrant. Attach a cap, complete with a pressure gauge to one of the 2.5 inch (65mm) outlets on the static hydrant. Connect the Portable Flow Tester to one of the 2.5 inch (65mm) outlets on the flow hydrant;
3. Ensure that all port caps are shut tight. Open the static hydrant and bleed off the air through the pet cock on the gauge. Close the pet cock and record the static pressure;
4. Open the flow hydrant fully. When the pressure gauge on the static hydrant holds steady, record the residual pressure at the static hydrant and the flow rate displayed by the Portable Flow Tester at the flow hydrant.
5. If the residual pressure at the static hydrant has dropped more than 10 PSI from the no flow pressure measurement, no additional testing is required in order to obtain the local grid characteristics.
6. If the residual pressure drop was less than 10 PSI additional ports or hydrants may be need to be opened. If additional ports are opened refer to Hydrant Total Flow Test Section to figure out the total flow.

Calculation of Results

The test results may now be used to calculate the total flow in the local distribution system (mains) at the recommended minimum value of 20 PSI.

The Hazen-Williams equation is used to calculate total maximum allowable flow at the minimum desired pressure.

$$Q_R = Q_F \times \frac{H_R^{0.54}}{H_F^{0.54}}$$

Where:

$\boldsymbol{Q_R}$ = The total flow in GPM at the desired residual pressure (generally 20 PSI)

$\boldsymbol{Q_F}$ = The test flow of the flow hydrant

$\boldsymbol{H_F}$ = The loss of pressure in PSI at the static hydrant

Values of **H** ($\mathbf{H_R}$ or $\mathbf{H_F}$) to the 0.54 power.

To obtain H_F subtract the residual pressure on the static hydrant from the static pressure at no flow.

H_R = Pressure drop in PSI to the desired residual pressure.

To obtain H_R subtract the desired residual pressure (generally = 20 PSI) from the static hydrant pressure at no flow.

Raise H_R and H_F to the 0.54 power using a calculator.

A simple substitution of the values in the equation will yield Q_R, the maximum available flow at the desired residual pressure.

In interpreting the results of these tests, it should be remembered that they show the strength of the distribution system and do not necessarily indicate the degree of adequacy of the entire water system. In this connection it is important to check the facilities supplying the distribution system and determine the length of time the discharges indicated by the tests can be maintained.

Use of Test Results

The information developed from a set of flow tests, if properly used, can be of considerable help to both the fire and water departments of a municipality. Because the quantities of water available at various locations are known, chief officers of the fire department should be able to deploy the pumpers responding to a fire in a given area to the best advantage. They will know the strong points of the distribution system where the supply is sufficient for numerous pumpers, as well as the weak spots where not more than one or two pumpers can be used effectively.

Since test results will reveal the weak points in a water distribution system, they can be used by the water department to determine where and to what extent improvements are needed. They are also helpful in providing data which can be used in estimating the supply available for extensions into newly developing areas.

When tests are repeated after a number of years at the same location and under similar conditions, a comparison of the results may show decreased quantities available because of tuberculation of mains, increased consumption, or both. If such warnings are needed, the necessary steps can be taken to provide additional distribution capacity before the available quantities become seriously inadequate. In a similar manner, repeated tests can be used to determine the increased quantities that may be available in areas where improvements have been made.

In reviewing flow tests results and comparing them with results obtained by other methods of analysis, it is often found that certain sections of a distribution system are not delivering their full capacity. This indicates that there are either restrictions somewhere in the mains or that one or more valves may be inadvertently closed. It points out the need for a physical check on the mains and valves in the vicinity of the test. Many closed valves in distribution systems have been located as a result of fire flow tests.

Water Distribution System Test Example

Test data obtained:

a. Static pressure = 78 PSI

b. Residual pressure at the static hydrant during the flow test = 50 PSI

c. Tester reading with one additional 2.5" port opened = 455 GPM.

d. The Tester has a 2.5" discharge opening and a flow area of 4.9 sq. inches. The flow area of the other openings flowed can be obtained by using the following equation.

$A = 0.785 \times D^2$ where D is the inside diameter of the opening in inches.

A hydrant with a 2.5" opening has an area of 4.9 sq. inch and a steamer port with a diameter of 4.5 inches has an area of l5.9 sq. inch. The Tester has a choke area of 4.9 inch, therefore with a 2.5" port opened in addition to the one the Tester is mounted on then the test flow (Q_f) equals:

$$\text{Test flow } (Q_f) = \frac{\text{Flow Reading (FR)} \times \text{Total Flow Area}}{\text{Area of the PFPM}}$$

$$\text{Test flow } (Q_f) = \frac{FR \times (4.9 + 15.9)}{(4.9)} = FR \times 4.24$$

e. Selected minimum residual pressure in the mains = 20 PSI.

CALCULATIONS

a. Test flow (Q_f) = 4.24 x 455 GPM = 1929 GPM

b. H_f = pressure drop during test = 78-50 = 28 PSI

c. H_r = pressure drop to desired residual pressure = 78-20 = 58 PSI

d. Total flow (Q_r) = $\dfrac{Q_f \times H_r^{0.54}}{H_f^{0.54}}$

Then $Q_r = \dfrac{1929 \times 58^{0.54}}{28^{0.54}}$ (where $58^{0.54} = 8.96$ and $28^{0.54} = 6.05$)

$$Q_r = \frac{1929 \times 8.96}{6.05} = 2857 \text{ GPM}$$

Pump Test

The **Portable FlowTester** can be used to test pumpers not only from draft but also from the tank or from a hydrant. It is extremely valuable to know not only that a pumper can pass the service test, but remember it is necessary to know your capabilities on the fire ground.

Make sure the pump can supply the preconnected lines with enough water from the tank, if that is how they are expected to be used. For in-line pump testing, attach the portable flow tester to the hydrant and run a typical hose layout. Next, extend standard fire fighting lines, open valves and flow water. Monitor the flow rate.

For the service type of test, connect three lines into a common manifold. On the discharge of the manifold connect a short length of hose leading into the portable flow tester. Attach another length of hose on the discharge side and connect this to a deck gun or monitor. If the monitor incorporates a sufficient straight length, with an integral stream straightener, then the tester may be attached on to the discharge end of the monitor in lieu of the nozzle.

Test the pumper according to the certification pressure, RPM, and volume or pressure pump settings. To do that, set the RPM and then adjust the pump pressure by adjusting the discharge valves. Correct the RPM if it has changed and readjust the pressure if that has changed. When at the correct pressure and RPM point, note the flow rate. The flow should meet the pumper rating at that pressure and RPM.

Nozzle Test

Attach a hose to the inlet of the flow tube and the nozzle to be tested on the discharge of the flow tube. The nozzle may be either a smooth bore type or automatic. Flow the nozzle at various pressures and note the flow and pressure displayed on the readout. This test will provide a vivid depiction of the nozzle pressure/flow relationship.

Training

Use the **Portable FlowTester** in training sessions to show firemen the effects of pressure and flow on hose handling, reach of stream, and the effects of a kinked hose etc., as pumper pressure and nozzle sizes are changed.

Install the flow tube in the line behind the nozzle, preferably not directly on to the discharge port of the pumper. Both the nozzleman and the pump operator vary their valves. It is now possible to monitor the flow rate and thus determine the optimum flow for various situations. This will be a graphic presentation of interaction of pressure, flow, and nozzles, particularly in cases where automatic nozzles are used.

Calibrate a Vehicle Mounted Flowmeter

1. Connect the portable flow tester flow tube to the pump suction port. (Refer to Figure 2.)
2. Lay a 2 1/2" hose from the discharge to be tested to the flow tube making sure there is no kink in the hose.
3. With the pump engaged open the discharge gate slowly all the way.
4. Control the flow with the suction port valve and by changing the RPM if needed.
5. Read the displayed flow on the tester flowmeter.

Note: Refer to the vehicle flowmeter manufacturer's instructions to determine how to adjust the calibration of the vehicle mounted flowmeter.

6. Have an assistant calibrate the vehicle flowmeter to match the reading on the tester flowmeter.

FLOW RATE MEASURING INFORMATION

• The location of the flow sensor in the plumbing system is critical. The flow at and around the sensor must be laminar, or smooth, to ensure accurate flow rate measurement. There must be enough straight pipe run before the flow sensor location to allow the stream to stabilize into a uniform flow.

• Plumbing systems are always unique and may cause small deviations in the factory flowmeter calibrations. It is recommended to check flowmeter calibration after installation.

• Flowmeters should be checked from time to time for accuracy and recalibrated as necessary. Calibrate at the most frequently used flow rate or use the guidelines provided by NFPA 1901. (Refer to Table 3.)

• Plumbing components upstream of a flow sensor that tend to increase stream turbulence may cause erroneous flow rate readings. Typical components would include a valve, flange or elbow, sudden or multiple bends in the piping, or an increase in pipe diameter. In these cases it may be require that a short length of hose (perhaps a 10 foot section) be installed upstream of the portable flow tester flow tube to stabilize the flow. (The hose diameter must be the same as the flow tube diameter.)

Table 3. Flowmeter Calibration Flow for Each Pipe Size

Note: (Reference NFPA 1901) Each flowmeter shall be calibrated to an accuracy of ±5 percent when flowing the amount of water shown for the pipe size in which it is mounted.

Pipe Size		Flow	
Inch	mm	GPM	LPM
1	25	40	150
1.5	38	90	340
2	52	160	600
2.5	65	250	950
3	75	375	1400
4	100	625	2400
5	125	1000	4000
6	150	1440	5500

POWER

Internal Battery

IMPORTANT : Before using the **Portable FlowTester** for the first time, the battery must be charged for at least six (6) hours.

The **Portable FlowTester** is powered by a rechargeable battery and must be charged regularly. A fully charged battery will provide approximately six hours of operating time. When the tester is not in use, the ON/OFF switch should be left in the OFF position. The LOW BATTERY WHEN LIT indicator will illuminate when the battery needs to be charged.

Charging

Note: The **Portable FlowTester** must be ordered from the factory set for 240 VAC and 24 VDC operation.

A charger is mounted inside the box. A 120/240 VAC power cable is supplied to power the charger. To charge the internal battery plug the cable into the AC CHARGER input on the front panel and connect the other end to a standard AC electrical outlet.

The battery must be charged with the ON/OFF switch in the OFF position.

Replacing the Battery

The battery used in the tester is a 12 VDC, 3.4 Ah, maintenance free, sealed lead acid battery. The battery should last 3 to 4 years depending on use.

(To install a battery do these steps in reverse.) To remove the battery:

1. Remove the four retaining screws on the bottom of the flow tester case.
2. Open the cover and lift out the front panel.
3. Remove the two screws holding the battery to the front panel.
4. Remove the wires form the battery terminals.

Alternate Power Sources

If any problems occur with any of the charging circuits, or if it is found during a test that the battery is not charged, it is possible to power the tester directly from either a 120/240 VAC or a 12/24 VDC source.

The tester will operate normally and can be used to perform flow tests when connected to an AC power source. Plug the AC Power Cable into the AC CHARGER input on the front panel and connect the other end to a standard AC electrical outlet. The flow tester will work from the internal DC power supply.

A 12/24 VDC power source (car or truck battery) can also be used to power the flow tester. Plug the optional DC Power Cable into the EXTERNAL POWER DC VOLTAGE input on the front panel and connect the other end to a DC source.

Caution: Care should be taken not to drop the flow tube. Dropping the flow tube could result in damage the exterior of the tube or the flow sensor.

Note: Before using the **Portable FlowTester** for the first time, it must be charged for at least six (6) hours.

The battery used in the tester is a maintenance free, sealed, lead acid battery. If any problems occur with any of the charging circuits, or if it is found during a test that the battery is not charged, it is possible to power the unit directly from either a 120/240 VAC or a 12/24 VDC source. (Refer to Power section.)

It is recommended that the calibration of the meter be checked once annually or if the operator feels that the reading might be erroneous.

Program Features

See Programming section for more detailed information.

High and Low Flow Warning (Codes 315 and 316)

When the flow rate is above the programmed high flow value a flashing -HI- will show in the digital display. When the flow rate is below the programmed low flow value a flashing -LO- will show in the digital display.

Flow Test

Set-up

Note: FRC does not provide adapters for connecting flow tubes. Use appropriate adapters as necessary.

1. Ensure the tester battery is charged or connect it to an alternate power source.

Note: The flow sensor is positioned at the discharge end of the flow tube.

2. Attach a water source to the intake side of the flow tube. Best results will be obtained by a short run (perhaps 10 feet) of relatively straight hose from the source to the flow tube.
3. On the discharge side of the flow tube attach a hose, a nozzle, a quarter turn ball valve, or leave free depending on the type of test.
4. Connect the sensor cable between flow tube sensors and the sensor input on the front panel of the tester.
5. Place **ON/OFF** switch to **ON** the display will flash the calibration/tube size program. After 3 seconds the display will switch to show 0 GPM.
6. Press **MODE** button to display the current sensor/tube size program.
7. If the sensor/tube size program is correct, press and hold **MODE** button until the display begins to flash, release the button and proceed with the flow tests.
8. If the sensor/tube size program is not correct, select the correct program.

Select Sensor/Tube Size

Note: The sensor/tube size programs must be pre-entered into memory and calibrated. (Refer to Programming section.) If a sensor/tube size had been entered but not calibrated it can not be selected. (Refer to Calibration section.)

1. Press **MODE** button to display the current sensor/tube size program.
2. Each time the **MODE** button is pressed the display will show the next available program.
3. When the desired program is shown in the display, press and hold **MODE** button until the display begins to flash.
4. Release **MODE** button to select the sensor/tube size program.
5. Proceed with the flow tests.

Pressure Display Modes

Flow rate is shown in the display on power on. The display will operate in three modes to show pressure.

1. To display pressure momentarily:

   Press the **P** button momentarily.

2. To display pressure continuously:

   Press and hold the **P** button until pressure is displayed. Press the **P** button again to cancel and return to flow display.

3. To alternately display pressure and flow:

   Press the **P** button twice (double click). Press the **P** button again to cancel return to flow display.

PROGRAMMING

The program access mode is selected and inputs are made by using the two buttons on the front of the display module. The digital display will show stored data and operator inputs. (Refer to Figure 2.)

Note: When entering codes in the program access mode there is a time out feature that requires an operator input be made every three seconds. If an input is not detected at a button within three seconds the program will return to normal operation.

Inputs

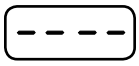
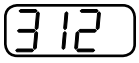
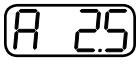
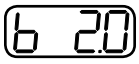
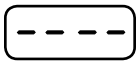
The two buttons on the front of the display module allow the operator to gain access to stored data and program functions.

The **MODE** button is used to display and select the calibration/tube size program.

Both the **MODE** and **P** buttons are used to enter a program code.

Once a program code is entered the **MODE** button is used to select the digit to be changed and the **P** button is used to change the digit or option choice.

PROGRAM ACCESS MODE DISPLAYS

Mode Selected:		Ready for program code to be entered.
Entering Code:		Ready for first digit of code to be entered.
Code Entered:		Valid three digit code.
Automatic:		Programmed value or option is shown.
Change Option:		New program value or option is selected.
Exit Mode:		Ready for another program code to be entered or return to normal operation.
Error Code:		Shows if an invalid program code has been entered.

Note: Refer to Program Access Mode for detailed information.

Figure 2. Typical Programming Displays

Program Access Mode

To gain access to the program features a three digit program code must be entered. Review the Program Code Descriptions or refer to Table 3. Program Code Quick Reference for the proper three digit code.

Note: There is a time out feature that will return the program to normal operation in three seconds if input is not detected at the buttons.

Select Program Access Mode

Turn on power. Press the **MODE** button and hold it until the display shows four dashes. The program access mode is ready for a three digit program code to be input.

Enter Program Code

Note: There is a time out feature that will return the program to normal operation in three seconds if input is not detected at the buttons.

1. Select the Program Access Mode (four dashes are shown in the display).
2. Press the **MODE** button. The display will show the number 100 and the first digit 1 will flash. Each time the **MODE** button is pressed the number will scroll up by 1. Set the first digit to the number desired.
3. Press the **P** button. The second digit shown in the display will flash. Each time the **P** button is pressed the number will scroll up by 1. Set the second digit to the number desired.
4. Press the **MODE** button. The third digit shown in the display will flash. Each time the **MODE** button is pressed the number will scroll up by 1. Set the third digit to the number desired.

When a valid three digit program code is entered the display will show a program value or an option. If an invalid code is entered the display will show an error code.

Note: When a valid code has been entered and the display shows a programed value or an option, the time out feature is disabled.

Change Values or Options

Press the **MODE** button to select the digit that is to be changed. The digit will flash. Press the **P** button to change the digit or the option choice.

Exit Program Access Mode

Press both the **MODE** and **P** buttons and hold them until four dashes are shown in the display. Release the buttons and enter a new code or after 3 seconds the program will time out and return to normal operation.

Program Code Descriptions

When a valid three digit program code has been entered a program value or option will show in the display. The **MODE** and **P** buttons are used change the data.

The **MODE** button will select the digit that is to be changed. The digit will flash.

The **P** button will change the digit that is flashing or change the option choice.

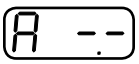
Table 3 provides a quick reference of the program codes.

Table 4. Program Code Quick Reference

CODE	FEATURE	OPTIONS
312	Sensor/Tube Size	A,B,c,d,E,F (with tube size)
315	High FLow Warning	0 to 9999 (0 = disabled)
316	Low FLow Warning	0 to 9999 (0 = disabled)
321	Flow Calibration	Calibrate at one flow rate
322	Flow Calibration	Calibrate at two to ten flow rates
E202	Invalid Code Entered	Re-enter code
E204	No Flow Sensor Signal	Check water flow and wiring
E206	Invalid Calibration Point	Select different point
E208	Memory Failure	Contact FRC

- Refer to Program Code Descriptions for detailed information.
- There is a timeout feature that will return the program to normal operation in three seconds if input is not detected at the buttons.
- When a valid code has been entered and a programed value or option is shown in the display, the timeout feature is disabled.

Code 312 Sensor/Tube Size

Factory programmed value:  (–.– = Tube Size)

Options: A, B, C, D, E, F (With Any Tube Size)

This code will allow the flow tester to be programmed for up to six different sensor/tube sizes. Each is identified with a sensor identifying letter (A thru F) and the tube size. The sensor/tube sizes are entered into memory by setting the program slot and doing the calibration procedure. Once the tester is programmed the operator presses the mode button to select a different sensor/tube size. (**Note:** Tube can refer to pipes, fittings, or other fixtures that the flow sensor may be mounted in.)

Note: Tube size is in inches or millimeters depending on code 313 setting.

Code 315 High Flow Warning

Factory programmed value:0 (High flow warning is disabled.)

Options: 0001 to 9999

This code will allow the high flow warning to be set. When the flow rate is above the high flow warning program value, the flow display will alternately flash between the flow rate and -HI-.

Code 316 Low Flow Warning

Factory programmed value:0 (Low flow warning is disabled.)

Options: 0001 to 9999

This code will allow the low flow rate warning to be set. When the flow rate is below the low flow warning program value, the flow display will alternately flash between the flow rate and -LO- .

Code 321 Flow Calibration (Single Point)

Factory programmed value: Precalibrated to Pipe Size

Options: 1 Calibration Point

Refer to Calibration section.

Code 322 Flow Calibration (Multiple Point)

Factory programmed value: No Values Entered

Options: 2 to 10 Calibration Points

This code allows for the display to be calibrated at multiple flow rates. This function should be used when the flow sensor is installed in a difficult plumbing location where flow is not linear. It corrects for nonlinear flow to provide an accurate flow rate display.

Refer to Calibration section.

Error Code E202

An invalid program code has been entered. Re-enter program code when the digital display resets.

Error Code E204

There is no signal from the sensor. This code will only be displayed when in a calibration mode. Troubleshoot the sensor and the associated wiring.

Error Code E206

A selected calibration point is to close to the previous point. (There is less than 5% difference between two calibration points.) Select a different point to continue with the calibration procedure.

Error Code E208

There is a failure with the internal memory of the module. Contact FRC if this error code is displayed.

Exit Program Access Mode

Press both the **MODE** and **P** buttons and hold them there until four dashes are shown in the display. Release the buttons and after 3 seconds the program will return to normal operation.

Enter Sensor/Tube Size

The **Portable FlowTester** program allows for up to six different sensor/tube sizes to be set in memory. Each is identified with a sensor identifying letter (A thru F) and the tube size.

Note: Tube can refer to pipes, fittings, or other fixtures that the flow sensor may be mounted in.

The tester is programmed and calibrated at the factory for the sensor(s) and tube(s) it is shipped with.

A sensor/tube size is programmed into memory by selecting an identifying letter (A thru F) for the sensor, entering the tube size, and doing the calibration procedure. The calibration procedure must be done for each sensor/tube size. If a sensor/tube size had been entered but not calibrated it can not be selected when performing flow test.

1. Place **ON/OFF** switch to **ON** the display will flash the sensor/tube size program. After 3 seconds the meter will switch to show 0 GPM.
2. Enter code 312.

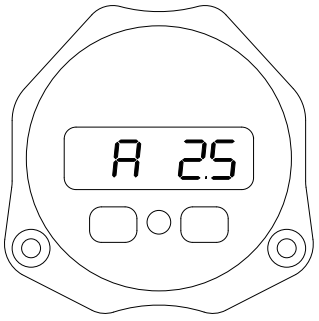
   Result: The display will show the default sensor/tube size.
3. Press the **MODE** button to select the digit that is to be changed. The digit will flash.
4. Press the **P** button to change the digit.
5. Enter the identification letter and tube size. (Unused slots are set at 0.0.)
6. Press both the **MODE** and **P** buttons and hold them until four dashes are shown in the display. Release the buttons and enter a new code or after 3 seconds the program will time out and return to normal operation.

Note: All additions or changes in this program require calibration.

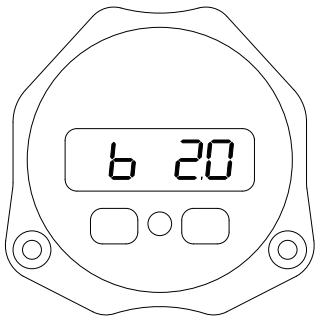
7. Perform the calibration procedure for the sensor/tube size.

There are six Sensor/Tube Size program slots. They are identified by a letter and the tube size. Each program is calibrated to be used with a specific sensor and tube. The tube size will be displayed in inches or millimeters depending on code 313 setting.

The display format is as follows:
1st - A x.x
2nd - b x.x
3rd - c x.x
4th - d x.x
5th - E x.x
6th - F x.x
(x.x = Tube Size)



Sensor A with
2.5" Tube



Sensor B with
2.0" Tube

Figure 3. Sensor/Tube Size Program Displays

CALIBRATION

The **Portable FlowTester** is programmed and calibrated at the factory for the tube(s) that it is shipped with. Each new sensor/tube size program that is entered needs to be calibrated.

It is recommended that the tester be checked for accuracy annually and recalibrated as necessary. The calibration must be checked for all sensor/tube size programs that are stored in memory.

To calibrate the digital flowmeter use a precalibrated water flow test kit or a Pitot gauge as a reference.

Notes:

Fully charge the battery before calibrating.

Ensure the flow sensor paddlewheel is clean and the spins freely.

Review the Programming section for details on using the Program Access Mode.

Flow Calibration, Single Point (Code 321)

Calibrate at the most frequently used flow rate or use the guidelines provided by NFPA 1901. (Refer to Table 3.)

1. Enter code 321.

   Result: The digital display will show the default sensor/tube size program.

2. Press the **P** button to change the sensor/tube size program.

3. Press both the **MODE** and **P** buttons and hold them until 0 is shown in the display. Release the buttons.

4. Flow water through the tube at the flow rate selected for the calibration point. Ensure a constant pressure is maintained to obtain a steady flow rate.

5. Adjust the tester displayed flow rate to match the reference flow rate.

   Use the **MODE** button to select the digit that is to be changed. The digit will flash.

   Use the **P** button to change the value of the flashing digit.

6. Press both the **MODE** and **P** buttons and hold them until four dashes are shown in the display. Release the buttons and enter a new code or after 3 seconds the program will time out and return to normal operation.

7. Vary the water flow through the discharge and ensure the displayed flow rate matches the reference. If there are differences at other flow rates the multiple point flow calibration may be necessary.

Flow Calibration, Multiple Point (Code 322)

This function allows for the tester to be calibrated at multiple flow rates. It corrects for nonlinear flow to provide an accurate flow rate display.

Select flow rates to calibrate (up to 10 calibration points) that are within the most commonly used flow range.

Note: There must be at least a 5% difference between each calibration point. If a selected calibration point is too close to the previous point an E206 error code will show on the display.

1. Enter code 322.

   Result: The digital display will show the default sensor/tube size program

2. Press the **P** button to change the sensor/tube size program. Repeatedly pressing the **P** button will result in cycling through pipe 'A' through 'F' and then back to pipe 'A'. Select the pipe being calibrated.

3. Press both the **MODE** and **P** buttons and hold them until **Pt1** is shown in the display. Release the buttons.

   Result: The flowmeter program is ready to set the first calibration point.

4. Flow water through the tube at the flow rate selected for the calibration point. Ensure a constant pressure is maintained to obtain a steady flow rate.

5. Press the **MODE** button.

   Result: The display will show a flow rate with the last digit flashing.

6. Adjust the displayed flow rate to match the reference flow rate.

   Use the **MODE** button to select the digit that is to be changed. The digit will flash.

   Use the **P** button to change the value of the flashing digit.

7. Press the **MODE** button. While holding down the **MODE** button, press and release the **P** button. Then release the **MODE** button last. (If the buttons are pressed too long the program will exit the calibration mode.)

   Result: The display will show **Pt2** (or the next calibration point).

8. Repeat steps 4 through 7 for each flow rate to be calibrated.

9. To exit the calibration program:

   Press the **MODE** button first, and then the **P** button. Hold both until four dashes are shown in the display. Release both buttons and enter a new code, or after 3 seconds the program will time out and return to normal operation.

FLOW SENSOR MAINTENANCE

It is recommended that the flow sensor be cleaned during the yearly calibration check.

Depending on the environment that the flow tube is used in, it is possible that mud, grass, algae, or other materials may collect on the paddlewheel of the flow sensor and require it to be cleaned from time to time.

Remove the flow sensor and clean the it with a mild soap and clean water. Make sure the paddlewheel spins freely.

Remove Flow Sensor

1. Remove retaining nut.
2. Slide flow sensor out of sensor housing.

Install Flow Sensor

1. Insert flow sensor into sensor housing. Align flat spot on sensor rim with alignment tab and make sure O-Ring is in groove.

Note: The retainer cap only needs to be hand tightened. There is an inside lip that will stop the cap from turning when it makes contact with the alignment tab. This provides the correct pressure to make the seal at the O-Ring. Make sure the flow sensor does not disengage from the alignment tab and rotate.

2. Install retainer cap and hand tighten.

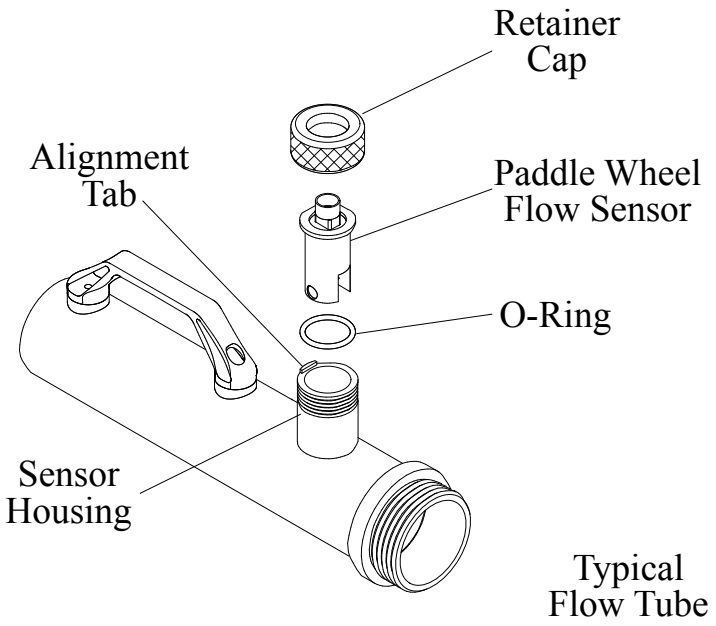


Figure 4. Flow Sensor Maintenance

PARTS LIST

Index	FRC Part No.	Description
1	FTA500-XXX	Portable FlowTester (GPM/PSI)
	FTA510-XXX	Portable FlowTester (LPM/kPa)
	FTA520-XXX	Portable FlowTester (LPM/Bar)
		XXX = Tube Diameter
	XE-FTPWRUSA-C	. Power Cable, Type K, 120 VAC
2	ZBT-172-ND	. Battery, Rechargeable, 12 VDC
3	XE-FM015FT1-M	Flow Tube, 1.5-in w/2.5 Couplings
	XE-FM020FT1-M	Flow Tube, 2.0-in w/2.5 Couplings
	XE-FM025FT1-M	Flow Tube, 2.5-in w/2.5 Couplings
	XE-FM030FT1-M	Flow Tube, 3.0-in w/NPT Threads
	XE-FM040FT1-M	Flow Tube, 4.0-in w/NPT Threads
4	XE-MF15P-S	. Sensor, Paddlewheel Flow
5	XE-PRO31PT2-S	. Sensor, Pressure
6	XE-FTF156	. . Pitot Pressure Pick-up
7	XE-FTIPFPM-C	. Cable, Flow and Pressure Sensors
8	XE-FTC12V-A	DC Power Cable (Optional)

Flow tube is shown with the optional Pitot pressure pick-up installed.

Figure 5. Parts List

DANGER

PERSONAL RESPONSIBILITY CODE

The member companies of FEMSA that provide emergency response equipment and services want responders to know and understand the following:

1. Firefighting and Emergency Response are inherently dangerous activities requiring proper training in their hazards and the use of extreme caution at all times.
2. It is your responsibility to read and understand any user's instructions, including purpose and limitations, provided with any piece of equipment you may be called upon to use.
3. It is your responsibility to know that you have been properly trained in Firefighting and/or Emergency Response and in the use, precautions, and care of any equipment you may be called upon to use.
4. It is your responsibility to be in proper physical condition and to maintain the personal skill level required to operate any equipment you may be called upon to use.
5. It is your responsibility to know that your equipment is in operable condition and has been maintained in accordance with the manufacturer's instructions.
6. Failure to follow these guidelines may result in death, burns or other severe injury.

FEMSA

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