



MARSH-McBIRNEY, INC.

# Installation & Operation



## Using the Flo-Tote™ 3 Flowmeter System

- ✓ Flo-Tote™ 3 Open Channel Sensor Model 3000
- ✓ Flo-Logger™ - Model 1000-1
- ✓ Flo-Station™ - Model 1000-2

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**Patent Notice**

This equipment is manufactured in the U.S.A. under one or more of the following U.S. patents: 4015471, 4083246, 4459848, 4549434, 4688432, 4455870, 4669308, 4821580, 5313842, 5385056 and 5811688. Other Patents pending.

**P/N 105005301, Rev A, 04/03.**

## **WARRANTY STATEMENT**

Manufacturer warrants all products of its manufacture to be free from defects in workmanship and material under normal use and service. This warranty extends for a period of twelve (12) months, from date of shipment, unless altered by mutual agreement between the Purchaser and Manufacturer prior to the shipment of the product. If this product is believed to be defective, Purchaser shall notify Manufacturer and will return the product to the Manufacturer, postage paid, within twelve (12) months, after date of shipment by the Manufacturer. If the Purchaser believes the return of the product to be impractical, Manufacturer shall have the option, but will not be required, to inspect the product wherever located. In any event, if the Purchaser requests the Manufacturer visit their location, the Purchaser agrees to pay the non-warranty expenses of travel, lodging, and subsistence for the field service response. If the product is found by the Manufacturer's inspection to be defective in workmanship or material, the defective part or parts will either be repaired or replaced, at Manufacturer's election, free of charge. Warranty repairs will be returned to Purchaser, transportation prepaid to any point in the United States. If inspection by the Manufacturer of such product does not disclose any defect of workmanship or material, Manufacturer's regular service repair charges and freight charges will apply.

The exceptions to the above warranty period include the Multi-Mag electromagnetic averaging sensors (except high temperature and 3 inch sensor models); the Model 2000 open channel sensors; the 1-inch full pipe sensors and the 2-inch full pipe sensors which are covered under a sixty (60) month warranty period.

The Flo-Tote 3 Flowmeter 24-Hour Service Turnaround applies only during the original (12) month warranty period (DOMESTIC ORDERS ONLY).

This warranty statement does not apply to any products sold or provided, that are not manufactured by Marsh-McBirney, Inc. These products may be covered by the original manufacturer's written warranty.

**THE FOREGOING WARRANTY IS MANUFACTURER'S SOLE WARRANTY, AND ALL OTHER WARRANTIES, EXPRESS, IMPLIED OR STATUTORY INCLUDING AND IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ARE NEGATED AND EXCLUDED. THE FOREGOING WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, GUARANTEES, REPRESENTATIONS, OBLIGATIONS OR LIABILITIES ON THE PART OF THE MANUFACTURER.**

Purchaser's sole remedy and Manufacturer's sole obligation for alleged product failure, whether under warranty claim or otherwise, shall be the aforementioned obligation of Manufacturer to repair or replace products returned within the above stated warranty periods. The Manufacturer shall not be liable for, and the Purchaser assumes and agrees to indemnify and save harmless the Manufacturer in respect to, any loss or damage that may arise through the use by the Purchaser, or others of any of the Manufacturer's products.

## Safety warnings

When installing, operating, and maintaining Marsh-McBirney equipment where hazards may be present, you must protect yourself by wearing Personal Protective Equipment (PPE) and be trained to enter confined spaces. Examples of confined spaces are manholes, pumping stations, pipelines, pits, septic tanks, sewage digesters, vaults, degreasers, storage tanks, boilers, and furnaces.

You must follow all state and local laws, as well as Occupational Health and Safety Administration (OSHA) regulations concerning Personal Protective Equipment, confined-space entry, and exposure to blood borne pathogens. Specific requirements can be found in the OSHA section of the Code of Federal Regulations: *29 CFR, 1910.132 - 1910.140, Personal Protective Equipment; CFR Title 29, Part 1910.146, Permit-Required Confined-Spaces; and 29 CFR, 1910.1030, Blood borne Pathogens.*

### ***IMPORTANT NOTICE!***

Enclosed Documentation for Intrinsically Safe (IS) operation must be read prior to equipment installation.

### ***WARNING!***

**Never enter a confined space without first testing the air at the top, middle, and bottom of the space.** The air may be toxic, oxygen deficient, or explosive. Do not trust your senses to determine if the air is safe. You cannot see or smell many toxic gases.

### ***WARNING!***

**Never enter a confined space without the proper safety equipment.** You may need a respirator, gas detector, tripod, lifeline, and other safety equipment.

### ***WARNING!***

**Never enter a confined space without standby/rescue personnel within earshot.** Standby/rescue personnel must know what action to take in case of an emergency.

**WARNING!**

***Always protect yourself when handling equipment that has been exposed to biological hazards: wear disposable latex examination gloves, goggles, aprons, waders, and other required Personal Protection Equipment.***

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# Chapter 1

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## Before You Start

In this chapter you will find out about this manual, how to register your equipment, what you must know about safety, where to go for further information, and the sensor installation procedure.

### Registering your Flo-Tote 3 Flowmeter

Take a moment to register your Flowmeter using the registration card that came with your documentation. As a registered user, you will receive notices of new and upgraded Marsh-McBirney products.

### What you need

To use the Flo-Tote 3 Flowmeter, you need a Windows based laptop computer that can run Flo-Ware software. Your laptop computer must have:



#### Hardware Requirements

Pentium class processor or equal running at least 90 MHz. 16 MB RAM or higher (depends on operating system requirements). Video adapter card capable of running in 800 x 600 mode in at least 16 bit (65,000) colors.



#### Software Requirements

Windows 95, 98, Me, NT, 2000, XP, or Pocket PC 2002 (Flo-Ware FX only) operating system. Microsoft Internet Explorer 5.0 or higher recommended.

# What you must know

## About safety

Before installing a Flo-Tote 3 Flowmeter, you must be trained to enter confined spaces. If you haven't already, please read "*Safety warnings*" on page 4.

## About the open channel

Before ordering a Flo-Tote 3 Flowmeter, you need to know the diameter inside the open channel. The diameter determines which sensor insertion hardware you require, as well as the proper length of cable.

## About Flo-Ware software

Before using Flo-Ware software, you must know how to perform standard operations common to most Windows programs. If you are comfortable using another Windows program, you already know enough to use Flo-Ware. Refer to Flo-Ware for Flo-Tote 3 Flowmeter Software Manual for step-by-step software instructions.

# Where to go for information

**For information about the Flo-Tote 3 System, refer to these documents:**

Flo-Ware for Flo-Tote 3 Flowmeter Software Manual

Flo-Tote 3 Flowmeter System, Installation and Operations Manual, P/N 105005301

Sensor Installation Manual for Open Channels P/N 100BAND.

# Chapter 2

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## About the Flo-Tote 3 Flowmeter

### What is the Flo-Tote 3 Flowmeter?

The flowmeter system consists of:

- Model 3000 Flo-Tote 3 Electromagnetic Level/Velocity Sensor
- Model 1000-1 Flo-Logger (portable mount-short term monitoring) and/or
- Model 1000-2 Flo-Station (permanent mount-long term monitoring).
- RS-232 serial communications cable (for connecting the Flo-Logger/Flo-Station to your laptop computer).
- Flo-Ware or Flo-Ware FX software running on your laptop/desktop computer/Pocket PC.

### Flo-Tote 3 Flowmeter Features

The original Flo-Tote Open Channel Flowmeter has been the industry standard for over two decades. Thousands of users worldwide have verified Flo-Tote's accuracy. Now, the revolutionary NEW Flo-Tote 3 Flowmeter is available with customer requested features while utilizing the same proven electromagnetic sensor technology.

#### **New Features Include:**

- Disconnectable sensor
- 24 Hour Service Turnaround (Minimal Down Time)
- Field Replaceable Sensor (No Calibration Needed-No Down Time)
- Sensor Interchangeability (Flo-Tote 3 and Flo-Dar Flowmeters)
- Extended Battery Life
- Portable and Permanent Models available

- Lightweight (7.5 lbs/3.4 kg) for Easy Handling (Half the weight of Flo-Tote II)
- Increased Signal Intensity for Greasing Applications
- Flow Temperature Measurement

## Construction

The Flo-Logger is a sealed watertight (IP68) PVC enclosure.

The Flo-Station is a Polystyrene (NEMA 4X, IP66/67-7) enclosure.

## Power Source

The Flo-Logger is powered by (2) 6-volt lantern batteries. Each Flo-Logger contains a 5-year lithium memory battery (serviceable only by Marsh-McBirney) that allows the unit to retain collected data when the primary battery is removed.

The Flo-Station is a +12 VDC powered unit.

# How does the Flo-Tote 3 Flowmeter work?

Each Flo-Tote 3 Flowmeter System has a Flo-Tote 3 sensor that measures the velocity and level of conductive liquids in an open channel or closed conduit. Using these measurements and the area of the channel, Flo-Ware/Flo-Ware FX software calculates *flow*.

Flow is calculated using the equation:

**Flow = Average Velocity x Area.**

Data is sent from the Flo-Tote 3 electromagnetic sensor to a Flo-Logger or Flo-Station via a cable. Flow data is transferred from the Flo-Logger to a laptop/desktop/Pocket PC computer via a communications cable. Flow data from the Flo-Station is output via 4-20 mA outputs.

## Which software works with the Flo-Tote 3 System?

Here's a list of the software that works with the Flo-Tote 3 Flowmeter:

- Flo-Ware Software. This program, designed for use on a laptop/desktop computer, allows you to collect and analyze flow data.
- Flo-Ware FX Software. This program, designed for use on a Pocket PC, allows you to collect and analyze flow data and is available from Savannah Environmental at (800) 632-0232/(301) 694-4766/  
fax (301) 694-2994/email: support@savenv.com.

*Refer to Flo-Ware for Flo-Tote 3 Flowmeter Software Manual for step-by-step software instructions.*

# Who should use the Flo-Tote 3 Flowmeter?

Anyone who needs to measure the flow in an open channel should use the Flo-Tote 3 Flowmeter. This includes technicians and engineers who work for:

- Municipal water treatment facilities.
- Engineering firms that design, maintain, or upgrade fresh water, sewer, or storm water systems.
- Utilities.
- Manufacturing Facilities.

## Flo-Tote 3 Flowmeter Applications:

- Perform Inflow & Infiltration (I&I) studies.
- Perform Water Distribution/Leak Isolation Studies.
- Evaluate existing sewer systems and storm water systems.
- Monitor flow from towns and cities.
- Monitor sewer overflow into streams and rivers.
- Monitor industrial flow from factories.
- Check efficiency of pump stations.
- Check accuracy of existing flowmeters.

# Why use the Flo-Tote 3 Flowmeter?

The Flo-Tote 3 Flowmeter is:

- Accurate. The Flo-Tote 3 flowmeter uses the most accurate method of calculating flow, based on the Continuity equation  $\text{Flow} = \text{Average Velocity} \times \text{Area}$ . Verification of the Flo-Tote 3 specifications by an independent flow laboratory assures you of our commitment to accuracy. Thousands of users worldwide have verified Flo-Tote's accuracy.
- Portable (Flo-Logger). You can move the Flo-Logger to different sites quickly and easily. This means you can get an accurate flow measurement at each of your sites, without having to purchase a flowmeter for each location. The Flo-Logger uses (2) standard, 6-volt lantern batteries.
- Permanent (Flo-Station) The four programmable 4-20 mA outputs provide a convenient way to transfer real-time flow data to SCADA and other data collection systems, control systems and display devices.
- Reliable. The Flo-Tote 3 Flowmeter even operates under surcharge conditions. The Flo-Tote 3 sensor contains no moving parts, which makes it more reliable than other sensors.
- Adaptable. The Flo-Tote 3 Flowmeter adapts to a wide range of pipe sizes and shapes, eliminating the need for costly weirs or flumes.

# Site checklist

Here is a checklist of items you will need at the flow monitoring site.

<b>Site Checklist</b>	
<ul style="list-style-type: none"> <li>✓ Laptop/Desktop/Pocket PC computer (FULLY CHARGED, WITH WINDOWS AND FLO-WARE /FLO-WARE FX INSTALLED).</li> <li>✓ Blank, formatted 3.5" diskettes.</li> <li>✓ RS-232 serial communications cable.</li> <li>✓ Flo-Logger/Flo-Station and Flo-Tote 3 sensor.</li> <li>✓ Batteries for Flo-Logger.</li> <li>✓ Sensor installation hardware (VARIES ACCORDING TO SITE)</li> </ul>	<ul style="list-style-type: none"> <li>✓ Flo-Mate Model 2000 portable velocity meter (RECOMMENDED BUT NOT REQUIRED; USED FOR SITE CALIBRATION).</li> <li>✓ Desiccant cartridge (MUST BE BLUE).</li> <li>✓ Neoprene tape.</li> <li>✓ Electrical tape.</li> <li>✓ Plastic bucket.</li> <li>✓ Ruler, yardstick, and metal tape measure.</li> <li>✓ Clean, dry rags.</li> <li>✓ Marsh-McBirney instructional documentation.</li> <li>✓ All required safety equipment. (VARIES ACCORDING TO SITE).</li> </ul>

# Chapter 3

## Flo-Ware Software



Flo-Ware/Flo-Ware FX communications program allows for viewing of real time data, site instrument adjustment and data retrieval.

*Refer to Flo-Ware for Flo-Tote 3 Flowmeter Software Instruction Manual for step-by-step software instructions.*

### Flo-Ware Features at a glance:

- **General**

- Windows 32 bit (Windows 95, 98, Me, NT, 2000, XP)
- Modular design supports instrument "plug in" drivers
- Multiple document interface
- Foreign language support
- Network provisions

- **Communications**

- Site Setup
- Setup site attributes
- Tracks setups
- Calibration support
- Read Meter
- Upload instrument data
- Instrument vital signs
- Real Time
- On-Site system diagnostics
- Realtime reporting of data
- Spectrum analysis, vital signs where applicable

View Data  
Table view of stored data  
Supports sorting  
Preferences

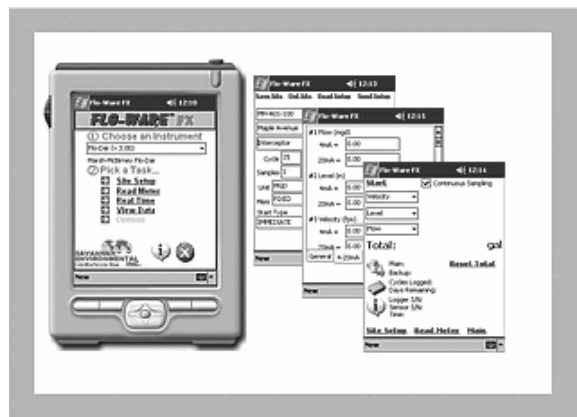
- **Reporting**

User defined file dates/times  
User defined data intervals  
File appending  
Import different file types into same project (i.e., flow, rainfall)  
Custom theme support  
Full color, presentation quality charts  
Scatter plots  
Pre-formatted text reports  
Text report designer  
Data Editing  
Single point editing  
Find/Replace  
Advanced data reconstruction workspace  
Point & click relationship builder  
Repair data with error in it  
Save relationship tables for future use

## Flo-Ware FX Software

Move over laptop computers, notebook computers, and blind data transfer units. Flo-Ware FX has arrived in the palm of your hand. This instrument management system operates on the new Pocket PC 2002

operating system, inside an inexpensive Pocket PC. You can think of Pocket PC 2002 as the popular Windows® XP operating system on a crash diet. While it “looks and feels” like Windows® XP, it does not have any of the overhead associated with it. The Pocket PCs sport a touch screen, zero boot-up time, and extended battery life (up to 20 hours of use), making this system the perfect companion for you in the field. In the office, Pocket PC 2002 will automatically



synchronize with your desktop PC allowing you to seamlessly transfer files to and from your Pocket PC to your desktop PC.

Flo-Ware FX picks up where other systems fall short. From site setup, reading meters, viewing real-time data, and viewing stored flowmeter data, Flo-Ware FX does it all. Something a data transfer unit (DTU) couldn't even think of! Flo-Ware FX packs most of the punch of a notebook computer without any of the shortcomings (i.e., low battery life, unreadable screen in daylight, high cost, low reliability, etc.) In the time it takes to boot-up a notebook computer, you can read data from your instrument to the Pocket PC and be well on your way to the next site of the day.

Flo-Ware FX is very modular and is designed to operate directly with other compliant instruments. As you purchase various compliant products, you can simply install the supplied instrument module onto your Pocket PC. Flo-Ware FX will automatically detect the module and make it available for you to use. This gives you a common interface, minimal learning curve, and a scaleable program that will grow with your monitoring needs well into the future.

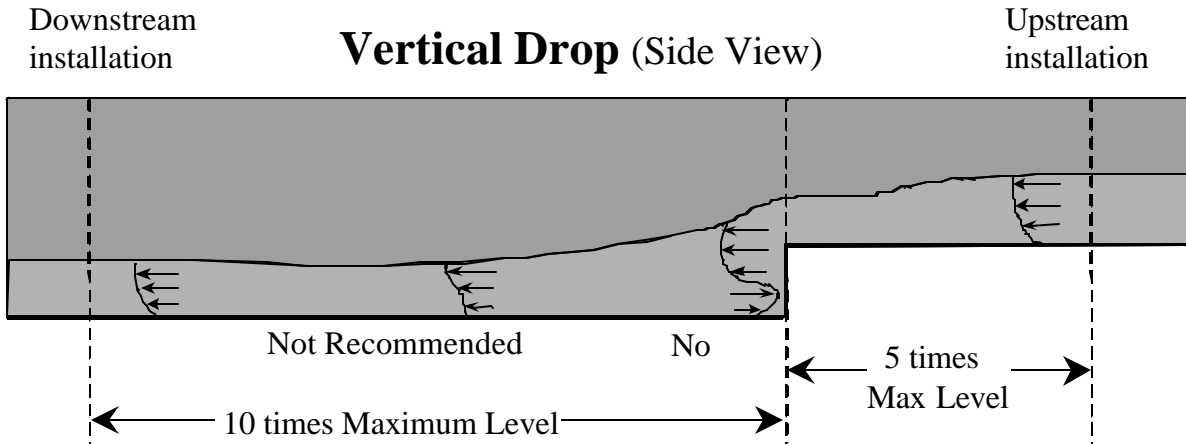
## **Flo-Ware FX Features at a glance:**

- Hardware available off the shelf at your local computer dealer
- Long Battery Life
- Excellent Readability in Direct Sunlight
- Fits in Your Shirt Pocket
- Zero Boot-Up Time
- Seamlessly connects with your desktop PC for data transfer
- Directly compatible with Flo-Ware for Windows and associated instruments
- Less expensive than a notebook computer
- 10 times more powerful & useful than blind data transfer units (DTU's)



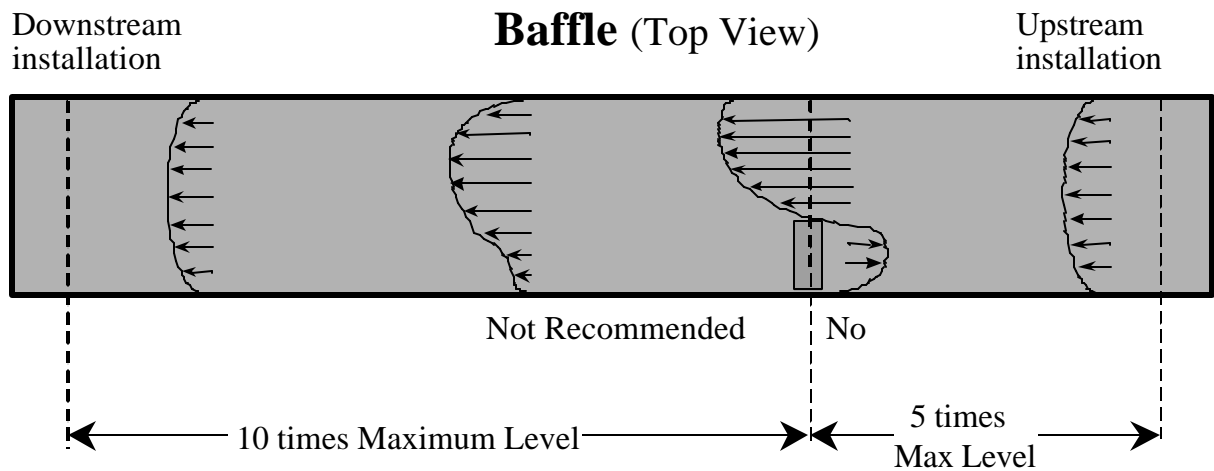
# Vertical drops

The sensor should not be placed in a manhole near a vertical drop in the channel. The manhole must be at least five times the pipe diameter (or maximum level) upstream from the vertical drop, or ten times the pipe diameter downstream.



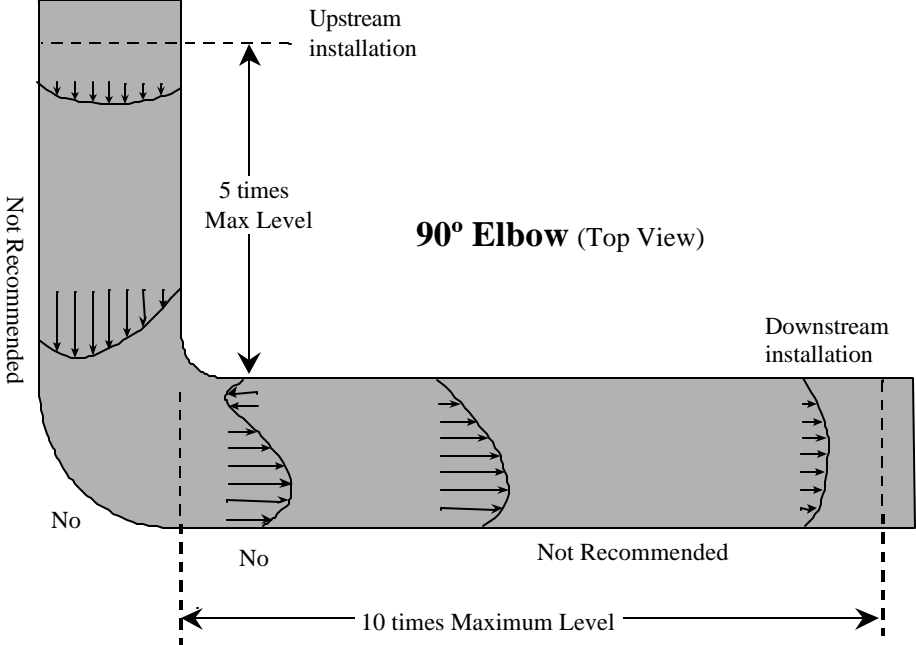
# Baffles

The sensor should not be placed in a manhole near a baffle (or other obstruction) in the channel. The manhole must be at least five times the pipe diameter (or maximum level) upstream from the obstruction, or ten times the pipe diameter downstream.



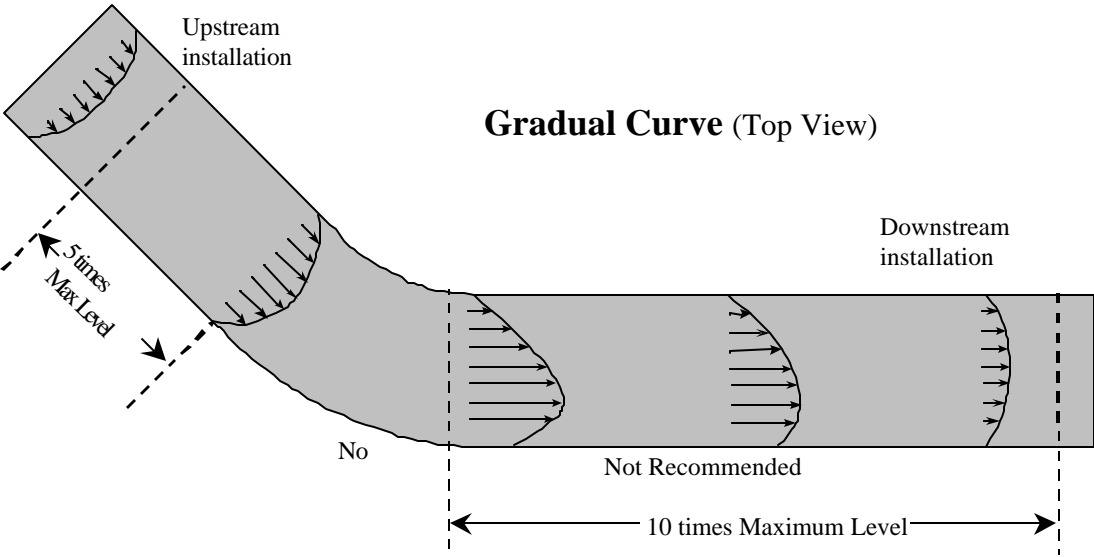
# Elbows

If the sensor needs to be installed in a manhole near a curve or elbow, it should be at least five times the pipe diameter (or maximum level) upstream, or ten times the pipe diameter downstream of the bend.



# Gradual curves

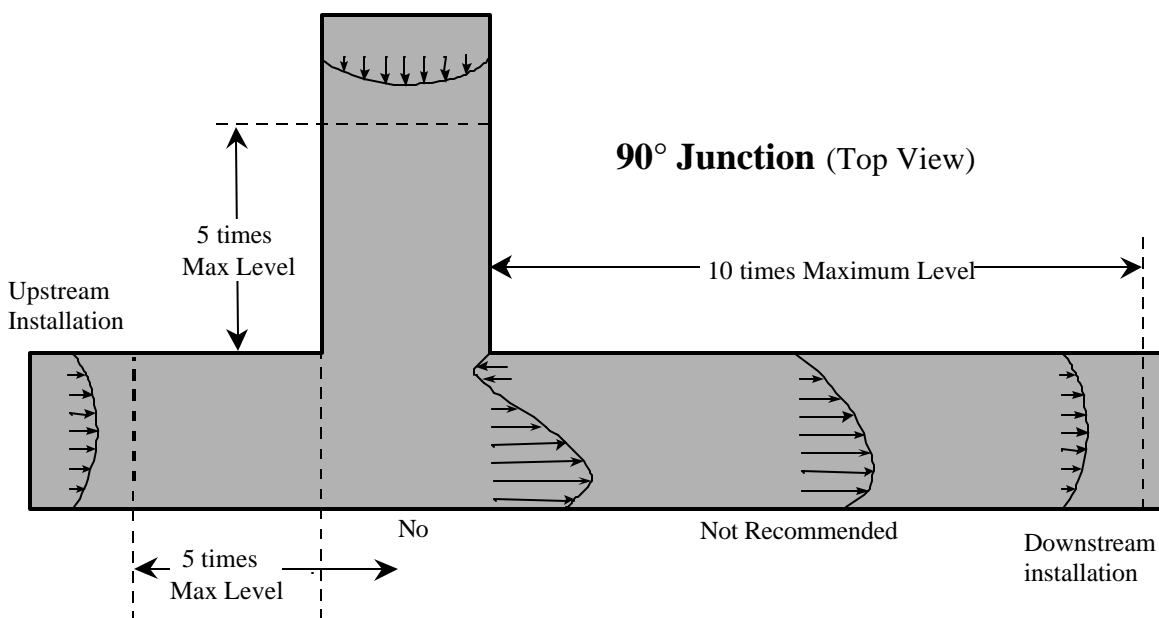
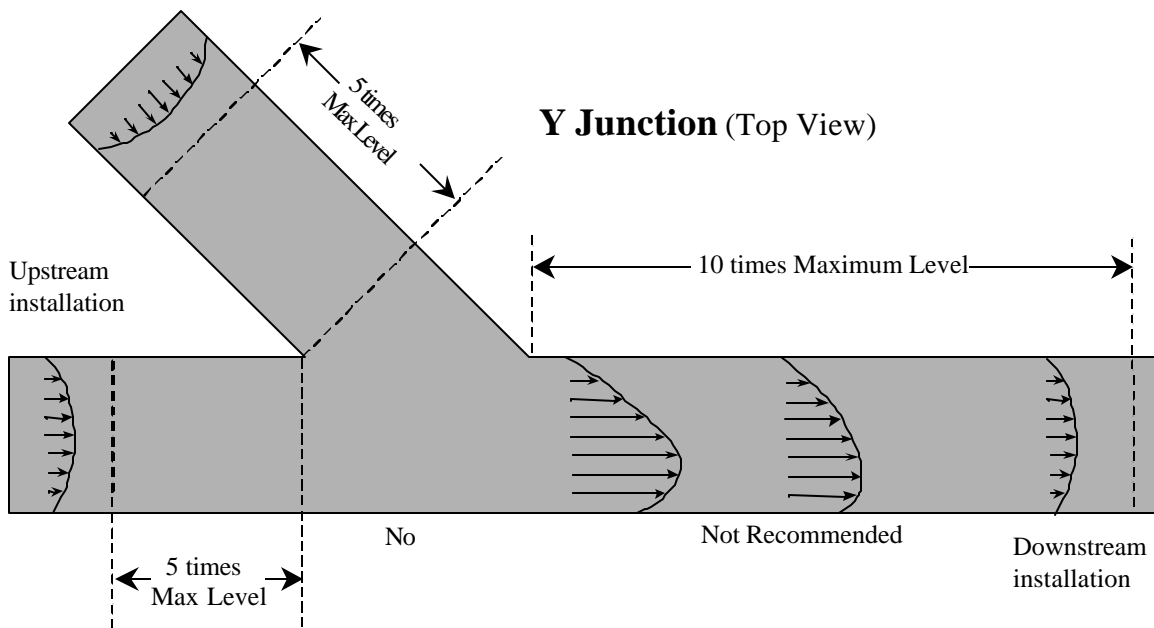
If the sensor needs to be installed in a manhole near a curve or elbow, it should be at least five times the pipe diameter (or maximum level) upstream, or ten times the pipe diameter downstream of the bend.



# Pipe junctions

Locate the sensor in a manhole away from any pipe junctions. If the flow in both pipes coming into the junction is approximately equal, make sure the manhole is at least five times the pipe diameter (or maximum level) upstream, or ten times the pipe diameter downstream from the junction.

Use the pipe diameter (or maximum level) of the pipe below which the sensor is installed. If the flow in one pipe or channel is significantly higher than in the other, install the sensor on the wall closest to the low flow channel.



# Chapter 5

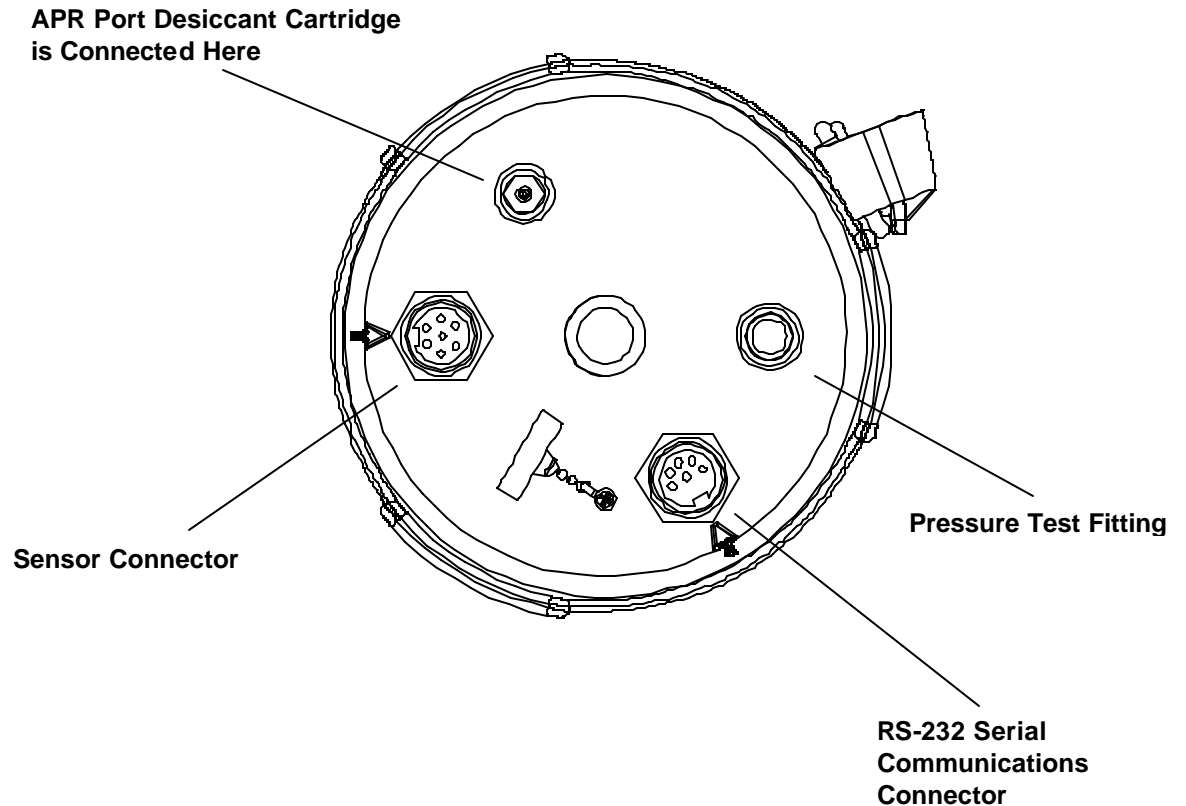
## Flo-Logger/Flo-Station Installation

### Flo-Logger Model 1000-1 Installation

#### Connecting the Monitor and Installing the Batteries and Desiccant Cartridge

##### Sensor Connections

Connect the sensor cable to the sensor connector located on the bottom of the Flo-Logger. If the sensor end of the cable is not already connected to the sensor, it should be connected now.

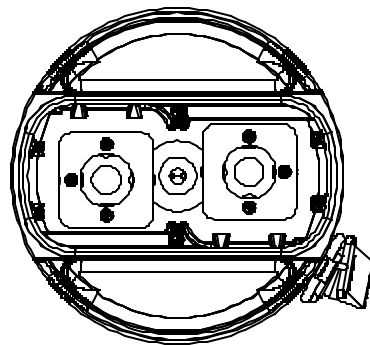


# Desiccant Cartridge

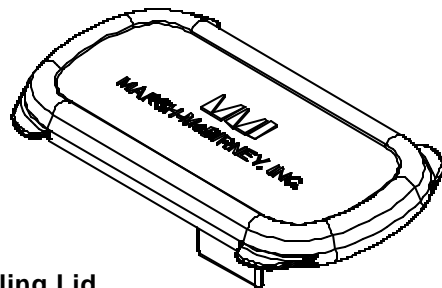
Make sure a fresh desiccant cartridge is attached to the atmospheric pressure reference (APR) port located on the bottom of the Flo-Logger housing. The desiccant cartridge protects the APR tube from moisture and debris affecting the accuracy of the surcharge level pressure transducer. Whenever a desiccant cartridge turns mostly pink, it should be replaced with a fresh (blue) cartridge. If desired, two cartridges may be used in series for long lasting protection. Desiccant cartridges (Part #55032) may be purchased from MMI.

# Battery Installation

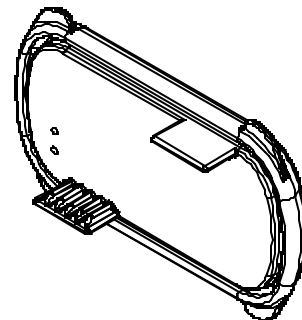
The Flo-Logger is powered by two 6-volt lantern batteries (use alkaline type batteries only). **Recommended batteries include Procell PC908, Duracell MN908 and Energizer Industrial EN529.** Remove the battery compartment sealing lid and install fresh batteries into the battery compartment, springs first. Compress each battery until its bottom can fit under the ledge on the side of the battery compartment. This holds tension on the battery springs and ensures good contact.



**Battery Compartment  
Top View**



**Sealing Lid  
Top View**

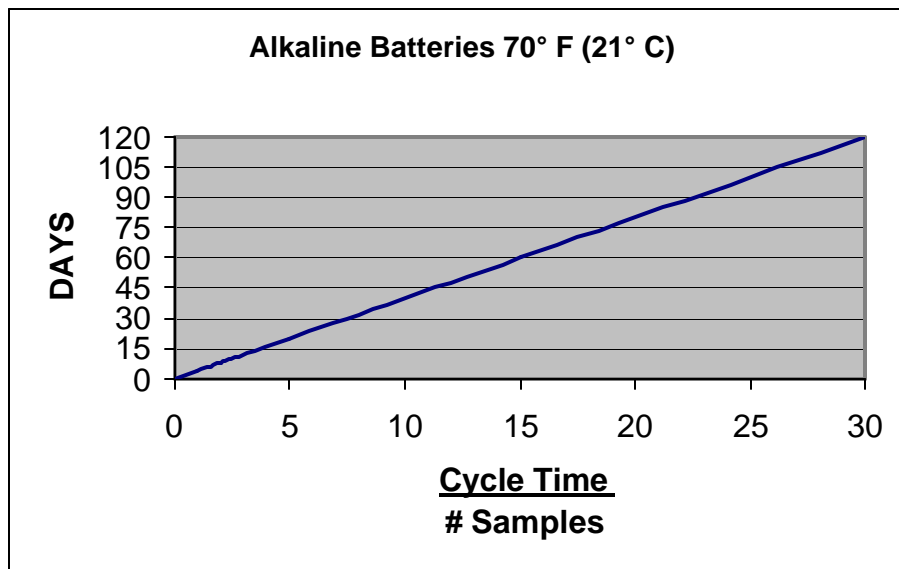


**Sealing Lid  
Bottom View**

Re-install the sealing lid. Make sure there is no dirt or debris on the sealing groove of the lid. Clean if necessary. The securing tabs fit between the battery and inside compartment wall to keep the bottom of the battery secured under the battery retaining ledge during operation. Press firmly around the top of the lid to ensure a good seal.

# Battery Life

How long the batteries last will depend on how often the flowmeter is taking samples. Typical battery life is 10 weeks based on a 15 minute data collection interval. Stored data is maintained by a separate lithium battery when the main batteries are either depleted or removed from the portable flow monitor.



# Lithium Battery

The internal lithium data back-up battery should be serviced every five years. Contact the MMI Customer Service Department for details on how to return the Flo-Logger for service.

## RS-232 Serial Communications Cable

A laptop/desktop computer or Pocket PC with Flo-Ware/Flo-Ware FX software installed must be connected via a communication cable to the Flo-Logger to set up and collect data from the meter. The communications cable is included with the Flo-Ware software package. Extra cables may be purchased by registered Flo-Ware users. The RS-232 Serial Communications Connector is located on the bottom of the Flo-Logger housing. The protective cover should remain in place whenever the communication cable is not connected.

**Note:** Communications cable **CANNOT** be used with Comm Port 2. Comm Ports 1 and 3-8 **CAN** be used.

# Setting Up the Flowmeter for Your Site

Note: Flo-Ware Software with Flo-Tote 3 File Driver is required to set up the flowmeter.

Flo-Ware/Flo-Ware FX software with the Flo-Tote 3 file driver is used to configure your Flo-Tote 3 Flowmeter to a particular metering site, transfer stored data from the flowmeter to your computer system, view the operation of your meter in real time and to run reports and graphs based on the collected data.

Detailed instructions for using Flo-Ware software are contained in the Flo-Ware for Flo-Tote 3 Software Instruction Manual found on your Flo-Ware Resource CD. Instructions are also accessible directly from the Flo-Ware program via the Help function. Additional information can be found via the Flo-Ware website at [www.savenv.com](http://www.savenv.com).

The sensor offset and site specific information such as pipe shape, site coefficient, pipe ID and sediment level obtained during sensor installation will need to be entered into the site set-up section of the Flo-Ware software.

## Securing the Flo-Logger

- 1** Secure the Flo-Logger with the nylon strap to a suitable structure such as a manhole ladder rung.
- 2** Ensure the unit is secure.
- 3** To reduce the chance of debris snagging on the sensor cable, coil any excess cable and secure out of the way.

# Flo-Station Model 1000-2 Installation

The Flo-Station controls and transmits flow data from the Flo-Tote 3 sensor. A portable computer/Pocket PC and Flo-Ware software is used to set up the flowmeter for the particular monitoring site and can also serve as a powerful data retrieval and reporting system. The four programmable 4-20 mA outputs provide a convenient way to transfer real-time flow data to SCADA and other data collection systems, control systems and display devices.

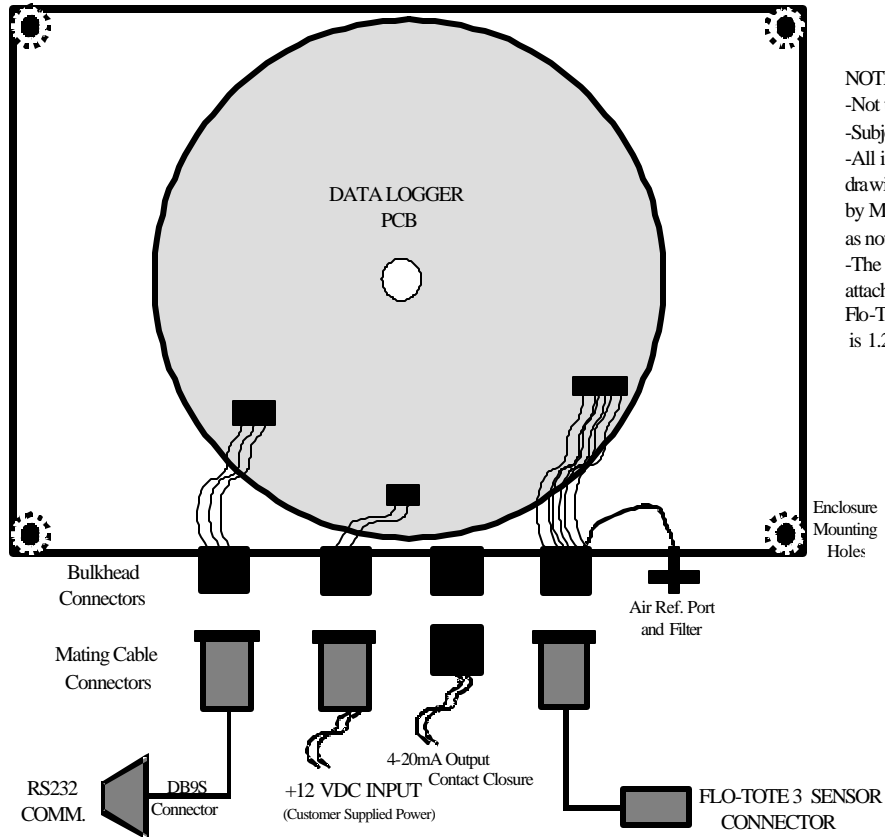
## Securing the Flo-Station

- 1** #10 or #8 screws or bolts may be used to secure the Flo-Station to a flat surface. Drill a 6 by 8 inch (153 x 203 mm) hole pattern where the monitor is to be mounted.
- 2** Pull up and turn to remove the four cover screws from the cover of the Flo-Station. Note the cover is sealed and should be left in place.
- 3** Insert the mounting screws or bolts through the four holes at the corners and secure the Flo-Station to the flat surface.
- 4** Re-install the cover screws.

# Wiring Diagram

## FLO-STATION MODEL 1000-2 FLO-TOTE 3

Enclosure:  
Polystyrene with cover  
9"W x 7"H x 4"D  
22.8 x 17.7 x 10.1 cm



NOTES:  
-Not to Scale  
-Subject to Change  
-All items on this drawing supplied by MMI except as noted  
-The connector that attaches to the Flo-Tote 3 sensor is 1.2" diameter.

# Sensor Connection

Connect the sensor cable to the sensor connector located on the Flo-Station housing.

# Power Connections

The Flo-Tote 3 Flowmeter comes with a 3 ft. power cable. The red wire is +12 VDC. The black wire is the power common. A longer customer supplied cable can be substituted if desired.

## Power Connector Hook-Up (5 Pin Bendix)

+12 VDC in	A	Red
N/C	B	
N/C	C	
Power Common	D	Black
N/C	E	

## 4-20 mA Output Connector

The Flo-Tote 3 Flowmeter comes with a 10 ft., 4 to 20 mA output cable. A longer customer supplied cable can be substituted if desired.

## Output Connector Hook-Up (15 Pin Bendix)

4 to 20 mA	#3 (+)	C	Blue	} Velocity
4 to 20 mA	#3 (-)	D	Brown	
4 to 20 mA	#2 (+)	E	Black	} Level
4 to 20 mA	#2 (-)	F	White	
4 to 20 mA	#1 (+)	G	Red	} Flow
4 to 20 mA	#1 (-)	H	Green	
4 to 20 mA	#4(+)	A	Yellow	} Surcharge Level
4 to 20 mA	#4 (-)	B	Orange	

## Optional Contact Closure Cable

+ Bat	K	Red
- Ground	L	Black
Contact Closure Arm	M	Green
Contact Closure Wipe	N	White

# Desiccant Cartridge

The Flo-Station should be mounted in a relatively dry environment such as a control room or other suitable space. A hydrophobic filter is attached to the APR port and should be all that is required in most applications.

If the Flo-Station is installed in a high moisture environment such as a pit, make sure a fresh desiccant cartridge is attached to the atmospheric pressure reference (APR) port located on the bottom of the Flo-Station housing. Leave the filter in place and attach the desiccant cartridge to the filter. The desiccant cartridge protects the APR tube from moisture and debris affecting the accuracy of the surcharge level pressure transducer. Whenever a desiccant cartridge turns mostly pink, it should be replaced with a fresh (blue) cartridge. If desired, two cartridges may be used in series for long-lasting protection. Desiccant cartridges Part #55032 may be purchased from Marsh-McBirney.

## Spare parts - Flo-Tote 3 Flowmeter System

Part Number	Description
105005301	Flo-Tote 3 Flowmeter Operations Manual
100BAND	Open Channel Sensor Installation and Profiling Guide
3000-1	Flo-Tote 3 Sensor 30 Ft Cable
3000-2	Flo-Tote 3 Sensor 60 Ft Cable
3000-3	Flo-Tote 3 Sensor 100 Ft Cable
3000-4	Flo-Tote 3 Sensor (Length As Required – 1000 Ft Max)
55032	Desiccant Assembly
750000201	Q-Stick Sensor/Band Installation Tool
245000501	Q-Stick Replacement Pole Only
55031SS	Profiling Adapter
115000101	Rechargeable Battery – 6 Volt Lantern
800004001	Battery Charger – For 6 Volt Lantern Battery 110V AC
800007201	Suspension Cable
420001001	Suspension Strap

# Chapter 6

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## Installing the Flo-Tote 3 Model 3000 Sensor

*Refer to Open Channel Sensor Installation Manual P/N 100BAND for step-by-step installation instructions for the Flo-Tote 3 Sensor.*

# Chapter 7

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## Maintaining the Flo-Tote 3 Flowmeter

*See Open Channel Sensor Installation Manual P/N 100BAND for detailed Flo-Tote 3 Sensor Maintenance Instructions.*

### Flo-Logger/Flo-Station Cleaning Instructions

#### Flo-Logger Cleaning

The Flo-Logger should be cleaned on a periodic basis depending on usage. Use a mild detergent and water only on the exterior. Check the case for cracks or damage.

#### Flo-Station Cleaning

The Flo-Station should be cleaned on a periodic basis depending on its environment. Use a damp cloth only. Do not submerge or douse with water.

#### Lithium Battery Check (Flo-Logger and Flo-Station)

The back-up lithium battery life should be checked every six months. Battery life can be checked using the Flo-Ware software.

## Desiccant Replacement (Flo-Logger Only)

Locate the Air Pressure Reference (APR) port on the bottom of the Flo-Logger case. The desiccant cartridge is connected to the APR tube connected to this port.

If the current desiccant is pink, replace it with a blue desiccant. If desired, you can plug two cartridges in series for longer-lasting protection.

If a blue desiccant is not available do not remove the pink desiccant.

## Lantern (6-Volt) Battery Replacement (Flo-Logger Only)

Remove old batteries. Check the battery compartment for damage. Use a dry clean cloth and wipe off any dirt or moisture from the battery contacts. Do not use sandpaper on the battery terminal contacts. Use a non-residual contact cleaner for the battery contacts. Insert two new batteries ensuring that the battery terminals make proper contact.

Always collect flow data prior to battery removal.

Only use recommended alkaline batteries. Do not use carbon-zinc batteries.

## Returning the Flowmeter for Service

Under normal operating conditions the Flo-Tote 3 Flowmeter System should not need to be returned for repair or calibration.

If the monitor unit, sensor unit or both need to be returned to the factory for repair, please do the following:

- 1** Identify the Sensor Model Number (3000) and Electronics Model Number (1000-1 *or* 1000-2).
- 2** Identify the Serial Numbers of the Flo-Tote 3 Sensor and the Flo-Logger (Model 1000-1) *or* Flo-Station (Model 1000-2).
- 3** Record the Reason for Return.
- 4** Call the Customer Service Department (800-368-2723/301-874-5599) and get a Return Materials Authorization (RMA) number.
- 5** Ship the equipment in the original packaging, if possible.

**NOTE**

Do not ship manuals, computer cables, mounting bands, batteries or other parts with your unit (unless required for repair), as they may not be returned.

- 6** Please make sure the equipment is free from foreign debris and is dry prior to shipping.
- 7** Write the RMA number on the shipping label.
- 8** Ensure all return shipments are insured.
- 9** Address all shipments to:

Marsh-McBirney, Inc.  
4539 Metropolitan Court  
Frederick, MD 21704-9452  
Attn: RMA# XXX

# Specifications

## **Flo-Tote 3 Sensor Model 3000**

### **Material**

Standard: Polyurethane exposed to flow.

Dimensions: 5 <sup>3</sup>/<sub>16</sub>" L x 1 <sup>3</sup>/<sub>4</sub>" W x 1 <sup>1</sup>/<sub>8</sub>" H  
(13.1 cm x 4.4 cm x 2.8 cm)

Weight: 2.5 lbs. (1.1 kg) with 30 Ft. Cable

Operating Temperature Range: 32° to 113° F (0° to 45° C)

Storage Temperature: -4° to 125° F (-20° to 51° C)

### **Velocity Measurement**

Method: Electromagnetic (Faraday's Law)

Range: -5 to +20 ft/s (-1.5 to +6.1 m/s)

Accuracy: ±2% of reading, ± 0.05 zero stability at 0 to +10 ft/s  
(0 to 3.04 m/s)

Zero Stability: ±0.05 ft/s (±15.2 mm/s)

Resolution: 0.01 ft/s (3.05 mm/s)

### **Level Measurement**

Method: Submerged pressure transducer

Range: Standard 0.4 to 138 inches. (10 mm to 3.5 m)

Contact factory for extended ranges.

Accuracy: ± 1% reading, ± 0.03 feet, zero stability for 0 to 10  
ft/sec.

(0 to 3.04 m/s)

Includes non-linearity, hysteresis and velocity  
effects.

Zero Stability: ± 0.03 ft. (.009 m)

Resolution: 0.1 inch (2.5 mm)

Over Range Protection: 2 X range

### **Flow Measurement**

Method: Conversion of water level and pipe size to fluid area.

Conversion of local velocity reading to mean  
velocity. Multiplication of fluid area by mean  
velocity to equal flow rate.

Conversion Accuracy: ±5.0% of reading. Assumes pipe is 10 to  
90% full and with a level greater than 2 inches  
(5.08 cm)

### **Temperature Measurement:**

Method: 1 wire digital thermometer

Range: 14° to 185° F (-10° to 85° C)

Accuracy: ±3.5° F/C

### **Sensor Cable**

Material: Polyurethane jacketed

Standard Length: 30 feet (9.1 m)

Optional Lengths: 60, 100 feet (18.2 m, 30.4 m) or length as needed

*Contact MMI for Sensor Installation Hardware Ordering  
Information (sold separately).*

*Contact MMI for Flo-Logger/Flo-Station Options/Accessories List*

## **Flo-Logger Model 1000-1 (Portable Installations)**

### **Data Storage**

64K (16K cycles of velocity/level data)

### **Local Terminal**

RS232C at 19.2K baud

### **Power Requirements**

12 VDC (Two six volt lantern batteries are supplied standard.)

### **Battery Life**

16 weeks typical at a sample interval of 15 minutes using  
recommended batteries.

### **Housing**

Sealed watertight (IP68) PVC enclosure

Length: 13.85" (35.179 cm)

Diameter: 7.75" (19.685 cm)

Weight: 7.5 lbs. (3.4 kg) (including batteries)

### **Temperature**

Operating Temperature Range: 14° F to 125° F (-10° C to 51° C)

Storage Temperature Range: -4° F to 125° F (-20° C to 51° C)

### **Sensor/Logger Disconnect**

Both the sensor and the logger have waterproof (IP68)  
connectors for easy separation from the interconnecting cable.

## **Flo-Station Model 1000-2 (Permanent Installations)**

### **Data Storage**

64K (16K cycles of velocity/level data)

### **Local Terminal**

RS232C at 19.2K baud

### **4-20 mA Outputs**

Four 4-20 mA outputs standard. (4) programmable,  
isolated outputs capable of driving 650 ohms each.

### **Contact Closure (Optional)**

One form C dry contact closure

### **Power Requirements**

+12 VDC @ 220 mA with all four 4-20mA outputs @ 20mA

### **Housing**

Material: Polystyrene (NEMA 4X, IP66/67-7)

Dimensions: 9" W x 7" H x 4" D (22.8 cm x 17.7 cm x 10.1 cm)

Weight: 7.5 lbs. (3.4 kg)

### **Temperature**

Operating Temperature Range: 14° F to 122° F (-10° C to 50° C)

Storage Temperature Range: -4° F to 122° F (-20° C to 50° C)

## **Software – Flo-Tote 3 Flowmeter System**

### **Set-Up/Data Retrieval/Reporting**

Flo-Ware/Flo-Ware FX for Windows software (sold separately) is  
the user on-site set-up, data management and report generation  
software for the Flo-Tote 3 Flowmeter System. It is compatible  
with computers (desktop/portable/Pocket PC) utilizing Windows  
95/98/2000/Me/NT/XP and Pocket PC 2002. Flo-Ware for Windows  
software can retrieve data from both Flo-Tote 3 and Flo-Dar Model  
464/460 Flowmeters.

# Ordering Information

The Flo-Tote 3 incorporates an Electromagnetic Velocity Sensor and Pressure Depth Transducer for use in Open Channel Applications. It is available with a Portable Flo-Logger (battery powered data logger), or a Permanent Flo-Station (DC powered electronics). Flo-Logger is submersible and operates on two six volt batteries. The Flo-Station requires 12VDC power supply. Flo-Logger and Flo-Station require Flo-Ware software. Instruction manuals included. Mounting Hardware is sold separately.

**Applications:** Portable/Permanent flow monitoring in partially full pipes, rectangular channels, or any defined conduit. For use in sewage, water or any conductive liquid.

<b>SENSORS</b>	
<b>Model 3000-</b>	
Sensor, Flo-Tote 3 w/ 30 ft. cable	890005401
Sensor, Flo-Tote 3 w/ 60 ft. cable	890005402
Sensor, Flo-Tote 3 w/ 100 ft. cable	890005403
Sensor, Flo-Tote 3 w/ cable length as needed (Maximum length 1000 feet)	890005404
<b>Sensor Mounting Hardware is sold separately, see "Open Channel Mounting Hardware"</b>	
<b>ELECTRONICS</b>	
<b>Model 1000</b>	
Logger, Flo-Logger - Portable battery powered data logger	8900046XX-1
Flo- Station, W/O display Includes qty. (4) 4to20mA outputs - DC powered (12VDC power supply required)	8900050XX-2
Power Supply, DC - None	
Power Supply - DC, 12 VDC @500mA without enclosure - Used with DC Flo-Station above	800014101
Power Supply - DC, 12 VDC @500mA with its own enclosure - Used with DC Flo-Station above	800014001
<b>Contact Closure - Flo-Station Only</b>	
Software, Flo-Ware required to Operate Flo Logger (Includes computer communication cable)	Model T200-120
Software, Flo-Ware required to Operate Flo-Station only (Includes computer communication cable)	Model T200-120
<b>ACCESSORIES &amp; SPARES</b>	
Annual Certification Agreement- Includes Sensor and Electronics (Return to factory Only)	103008801
1 Year Extended Warranty-Includes Sensor and Electronics (Return to Factory Only)	103008901
2 Year Extended Warranty Includes Sensor and Electronics (Return to Factory Only)	103008902
3 Year Extended Warranty Includes Sensor and Electronics (Return to Factory Only)	103008903
Spare Instructional Manual Flo-Tote 3 (includes Flo-Logger and Flo-Station information)	105005301
Spare Open Channel Sensor Installation & Profiling Manual	100 BAND
Profiling Adapter - Allows sensor to be mounted on pole for profiling flow channel	55031SS
Rechargeable Battery - 6 Volt Lantern (Flo-Logger only, requires 2)	115000101
Battery Charger - Used for recharging 6 volt batteries 110V AC	800004001
Desiccant Replacement Cartridge (Flo-Logger Only)	55032
Suspension Cable – Stainless Steel to hang Flo-Logger to manhole step (Spare)	800007201
Suspension Strap - Fabric to hang Flo-Logger to manhole step (Spare)	420001001
Odd Shaped Table - Configures software for user's specified conduit	Odd Shape SPC
Q-Stick Insertion Tool - Allows street level installation in pipe sizes 6" to 18"	750000201
Q-Stick Replacement Pole Only	245000501

# Glossary

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0.2, 0.4, 0.8 of depth method	A method of velocity profiling in which velocity is measured at 20%, 40%, and 80% of the depth of the channel. See also velocity profiling.
APR port	Air Pressure Reference port located on the bottom of the Flo-Tote 3 sensor. <i>See also desiccant cartridge.</i>
Band, mounting	The hardware that holds the sensor in the channel. There are several types of bands.
Base mounting strap	A strap that holds the Flo-Tote 3 sensor on the mounting band. See also sensor and band.
Battery cap	Cap on top of Flo-Logger that protects batteries.
“Bucket Test”	The process of checking the Flo-Tote 3 sensor’s level and velocity in a bucket of water. See also Level Zero number and Velocity Zero number.
Cycle time	How often the Flo-Logger turns on and allows the Flo-Tote 3 sensor to measure flow conditions.
Desiccant cartridge	A device connected to the Flo-Logger via an Air Pressure Reference (APR) tube. The purpose of the cartridge is to keep moisture out of the APR tube. See also APR port. Desiccant can also be used with Flo-Station.
Download	To send setup information from a computer (laptop/desktop/Pocket PC) to the Flo-Logger/Flo-Station.
Flo-Logger	Portable monitoring flow data collection device (Model 1000-1) for the Flo-Tote 3 Flowmeter.
Flo-Station	Permanent monitoring flow data collection device (Model 1000-2) for the Flo-Tote 3 Flowmeter.
Flo-Tote 3 Sensor	The electromagnetic area/velocity sensor (Model 3000) for the Flo-Tote 3 Flowmeter system.
Flo-Ware/Flo-Ware FX	Software designed to work with the Flo-Tote 3 Flowmeter system.
Flow Rate	The quantity of liquid moving through a channel during a certain time. Flow is often measured in millions of gallons per day (MGD) or gallons per minute (GPM).
Flow Total	The total volume of flow for a given time period.
Flowmeter	A device for measuring flow.
Flume	A section of a channel specially designed to measure flow. A flume’s area or slope (or both) is different from that of the channel, causing increased velocity and a change in level.

I & I study	A study in which the amount of inflow and infiltration into a channel is measured. See also inflow and infiltration.
Infiltration	Water seeping into a pipe at a joint, crack, or break. See also I & I study.
Inflow	Water flowing into an open channel. See also I & I study and open channel.
Level	The height of liquid in a channel, as measured in inches.
Level offset number	The difference between the actual level and sensed level in the channel. The built-in Level Offset is 0.4 inches, since the sensor's level port does not rest directly on the channel's bottom. <i>See also level port.</i>
Level port	The part of the sensor that measures level.
Level-offset mounting	A technique of mounting the sensor so that it is above silt in the channel.
Level Zero number	A number calculated by Flo-Ware that verifies a Flo-Tote 3 sensor's ability to measure the correct level. <i>See also "bucket test."</i>
On time	In the Flo-Logger/Flo-Station, the length of time during each cycle that the Flo-Tote 3 sensor is actively measuring velocity and level. <i>See also cycle time.</i>
Open channel	A pipe, canal, gutter, or ditch that is open to human access. Example: wastewater channel inside a manhole.
Rain event	A rain storm that causes extra water to flow into a channel quickly. This extra water causes a sharp increase in velocity or level, resulting in an increase in flow.
Realtime	In Flo-Ware, the immediate display of level, velocity, and flow rate as they are calculated/measured.
Sensor	An electromagnetic sensor with no-moving parts that is installed in a pipe to measure velocity, level, conductivity, temperature or other flow parameters.
Serial communications cable	The RS-232 cable that connects a Flo-Logger/Flo-Station to the serial communications port of a computer. <i>See also serial communications port.</i>
Site calibration	The process of calibrating the Flo-Tote 3 Flowmeter for a particular site in order to obtain the most accurate flow measurement. <i>See also Site Calibration Coefficient.</i>
Surcharge	A condition in which liquid rises above normal levels and spills out of a channel.
Suspension cable	The strap on the Flo-Logger that allows it to hang from a hook or ladder rung.
Upload	To collect data or setup information from the Flo-Tote 3 Flowmeter.
Velocity	The speed and direction of liquid flowing through a channel.
Velocity electrodes	The part of the Flo-Tote 3 sensor that measures velocity.

Velocity profiling	The process of measuring the velocity at several locations in a channel in order to obtain the average velocity for the channel. <i>See also 0.2, 0.4, 0.8 of depth method.</i>
Velocity Zero number	A number (between $0 \pm 0.05$ feet per second) that verifies the Flo-Tote 3 sensor's ability to measure the correct velocity. <i>See also "bucket test."</i>
Weir	A dam in a channel specially designed to measure flow by raising the water level.



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