

techbrief

Q-Tracker™

Temporary Sewer Flow Monitor

DESCRIPTION

Q-Tracker is a complete, self contained, battery powered flow logging monitor system designed to monitor and log flow in sanitary or storm sewers. The Q-Tracker measures both fluid velocity and depth, internally storing these variables in a data logger. The information can easily be retrieved with the use of a portable PC computer for analysis. Meter installation and removal is possible from outside the manhole making it ideal for temporary site monitoring. The electronics, power supply and communication network are housed within a rugged polypropylene enclosure designed for long-term operation in submerged environments.

OPERATION

Doppler technology delivers very accurate velocity information by measuring the frequency shift between the sending signal and the reflected signal from particles in the flow. Fluid depth is measured by a direct immersion pressure sensor. Both of these transducers are housed in a streamlined probe assembly that is securely positioned at the bottom of the sewer conduit. The unit can be programmed to obtain and log flow data as often as once a minute including velocity, depth and external rain gauge data. Logged data is retrieved via a common RS232 connection using the Q-Tracker software. Further analysis can be done using Q-Tracker for Windows™ or other commercial PC software.

APPLICATIONS

The Q-Tracker is designed for dependable service within the storm and sanitary collection systems for these applications.

- Infiltration and Inflow Analysis
- Industrial Discharge Monitoring
- Combined Sewer Overflow Studies
- Continuous Collection System Management
- Storm Water Flow Monitoring
- Sewer System Evaluation Surveys

CALIBRATION

The Q-Tracker is designed for quick installation and reliable service. Calibration is only required on the depth measurement. This is accomplished quickly and easily through the use of an external field computer, the programming software supplied by Badger Meter, and an external water bucket. The velocity measurement is factory calibrated and does not require field adjustment.

SIZING

The Q-Tracker can be programmed to operate in circular pipes sized from six (6) inches up to one hundred (100) inches.

MAIN FEATURES

- **Sensor unaffected by oil and grease buildup**
- **Simple installation without manhole entry using the optional installation tool**
- **Electronics sealed in waterproof enclosure**
- **Battery powered with standard alkaline lantern batteries**
- **Designed for intrinsically safe operation**
- **Optional rain gauge input**
- **User friendly programming/data retrieval Q-Tracker software**
- **Q-Tracker for Windows™ data analysis software**



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SPECIFICATIONS

VELOCITY AND DEPTH SENSOR

Sensor Enclosure

- Single sensor enclosure housing both the Doppler and the pressure transducers.
- Shaped to minimize hang-up of sewer debris.
- Single cable assembly containing Doppler and pressure transducer wires and tubing. Standard is 25 feet with optional for extension up to 100 feet.

Velocity Measurement

- Doppler operating principle.
- Accuracy $\pm 2\%$ of full scale
- Resolution is ± 0.02 fps.
- Velocity range to 30 feet per second.

Depth Measurement

- Direct immersion pressure sensor.
- Accuracy $\pm 0.25\%$ of full scale.
- Depth range from 0.5 inch to 100 inches.

HYDRAULIC REQUIREMENTS

To produce reliable depth and velocity measurements for the calculation of an accurate flow rate, the Q-Tracker should have a smooth and tranquil approach. This normally relates to field conditions of at least 15 diameters of straight-run pipe, of the same nominal diameter as the measuring section upstream, and free flow conditions downstream. For installations in which the combination of slope and/or velocity head produce super critical flow in the upstream pipe, sufficient energy must be dissipated so that subcritical flow will commence no closer than 10 feet upstream of the entrance to the Q-Tracker.

ELECTRONICS

Enclosure

- Manufactured from corrosion resistant PVC and designed for temporary submersible operation, provided the vent tube is above the water level.
- Size - 9.75" in diameter, 12" in height.
- Weight -15 pounds, including batteries.

Power Requirements

- 12 VDC operation using two (2) standard 6 VDC alkaline lantern type batteries.
- Average 90 day operation sampling velocity and depth at 15 minute intervals.

Processing Components

- System designed for intrinsically safe rating.
- Microprocessor based operation.

Data Logger

- Stores velocity, level and external rain gauge measurements.
- Logging intervals are customer selectable from 1 to 255 minutes, in one minute increments.
- Dual staged logging capability - demand activated.
- 128K battery backed data storage RAM memory with wraparound storage hierarchy.

SOFTWARE

Data Retrieval, Q-Tracker

- Software designed to set up, program, interrogate and download the data from the Q-Tracker.
- Compatible with IBM-PC™ and compatible micro-computers, capable of running under DOS™ 3.0 or later.
- Hardware requirements for the field laptop computer shall be 640 K Byte RAM with a RS-232C interface port. It is recommended that the field computer have an internal hard drive of at least 20 Megabytes.
- Data can be easily converted into an ASCII format, space, comma or tab delimited for file compatibility with most commonly used data bases and spreadsheet programs.

Q-Tracker for Windows™ Data Analysis

- Expanded software package is designed to program and download the Q-Tracker as well as generate reports and graphs, editing, analyzing and appending the data files.
- Q-Tracker for Windows™ software is designed for IBM-PC™, and IBM-PC™ compatible microcomputers, capable of running under the Windows™ 3.1 environment.

SENSOR MOUNTING CONFIGURATIONS

DESCRIPTION

The Mounting brackets for the Q-Tracker sensor are available in two basic configurations; the Spring Mounting band and the "Scissor Jack" expansion band. These bands are designed to be installed inside storm or sanitary sewer lines properly aligning the Q-Tracker sensor. The Spring Mounting band is constructed from stainless steel and is sized for installation in a specific line size. These bands are available from 6 through 18 inches in pipe diameter. The "Scissor Jack" expansion band constructed of stainless steel, is capable of being "built-up" to fit in pipe diameters from 8 through 24 inches.

OPERATION

The Q-Tracker sensor is placed in the sensor clip of the mounting band and the cable is routed along the downstream edge of the band. Cable ties, or common wire, are then threaded through the pre-punched holes in the mounting band to secure the cable. It is recommended that tape be used to wrap the cable to the band minimizing any chance of solids build up and to protect the cable.

“SCISSOR JACK” EXPANSION BAND

The “Scissor Jack” expansion band is designed to be re-used many times in various line sizes from 8 through 24 inches in diameter. The “Scissor Jack” expansion band is supplied as a kit comprised of the base band which includes the spring clip for the sensor, two (2) 2" and four (4) 3" inch ID extension bands, and one (1) "Scissor Jack" assembly. The extension band has a locking mechanism to secure the pieces when they are assembled and the "Scissor Jack" assembly is used to tighten the band to fit the pipe.

GENERAL SPECIFICATIONS

| | |
|--------------------------------|-----------------|
| Maximum Serviceable Line Size: | 24 Inches |
| Minimum Serviceable Line Size: | 8 Inches |
| Material of Construction: | Stainless Steel |
| Number of Components in Kit: | 7 Pieces |

SPRING MOUNTING BAND

The Spring Mounting Band is designed to be used in line sizes from 6 through 18 inches in diameter specific to the application. The spring mounting band is 12 inches in width, has a built-in sensor clip, pre-punched holes to tie down the sensor cable, and top mounted brackets to allow the Q-Stick to be used for installation and removal. The band is manufactured from stainless steel and is capable of many years of operation. The band is flexible allowing for easy insertion into the pipe.

GENERAL SPECIFICATIONS

| | |
|--------------------------------|-----------------|
| Maximum Serviceable Line Size: | 18 Inches |
| Minimum Serviceable Line Size: | 6 Inches |
| Material of Construction: | Stainless Steel |

"Q-STICK" INSTALLATION TOOL

DESCRIPTION

The Q-Stick is a field tool designed to be used in the installation and removal of the Q-Tracker spring mounting bands from outside the manhole. The Q-Stick, in many cases, will eliminate the need to enter the manhole and installation can be accomplished by one person. The Q-Stick is readily field assembled, and by using extensions can install the Q-Tracker mounting bands in storm or sanitary manholes up to 17 feet in depth. The Q-Stick consists of a base pole, main pole, two extension poles, take up wheel assembly, lever handle, and a mechanical finger assembly.

APPLICATION

The Q-Stick is designed to operate with the Q-Tracker spring mounting bands. These bands are sized from 6 through 18 inches and are line dependent in terms of application. The unit should only be used in manholes with depths under 17 feet, fluid velocities not excessive, and not during high flow conditions in which the mounting band is not visible. Care and caution should always be exercised around any manhole and the Q-Stick should not be used around electrical power lines.

GENERAL SPECIFICATIONS

| | |
|------------------------------------|-----------|
| Total Assembled Length: | 21.5 Feet |
| Total Disassembled Length: | 5.5 Feet |
| Maximum Serviceable Manhole Depth: | 17 Feet |
| Weight: | 16 Lbs. |

| | |
|---------------------------|-----------------|
| Material of Construction: | |
| Poles: | Fiberglass |
| Pole Connector: | Aluminum |
| Take up Wheel/Lever: | Aluminum |
| Bolts/Nuts/Washers: | Stainless Steel |

SAMPLE SPECIFICATION

GENERAL

A self contained battery powered sewer flow monitor instrument shall be furnished. The device shall operate on 12 VDC power supplied by two (2) disposable alkaline lantern-type batteries. The unit shall be programmed by an external computer to measure and electronically record flow rate, level, and optional inputted rain gauge. The unit shall be a Badger Meter Q-Tracker™.

DESCRIPTION

The sewer flow monitor shall utilize an ultrasonic Doppler to measure fluid velocity and a pressure transducer to determine fluid level. The Doppler ultrasonic sensor and the pressure transducer shall be housed in a rugged enclosure suitable for operation in a sewer environment. The enclosure housing the electronics and the batteries shall be manufactured from corrosion resistant PVC designed for temporary submersible operation.

ACCURACY

Velocity measured using the Doppler technology will be +/- 2% of full scale with the resolution of +/- 0.02 feet per second with a maximum velocity of 30 fps.

Fluid depth shall be measured with a silicon plate transducer capable of operating to within +/- 0.25% of full scale with the resolution of +/- 0.01 inches over a range of .5 to 100 inches. The depth sensor shall be a direct immersion, solid state transducer that is temperature compensated.

FLOW RATE DETERMINATION

Measured fluid level and velocity shall be converted into flow rate utilizing internally programmed formulas and algorithms. The meter shall be capable of calculating flow with standard weir and/or flume equations, Manning Equation, as well as the Continuity Equation.

PROGRAMMING AND DATA STORAGE

The flow monitor shall require an external IBM™ or IBM™ compatible computer for programming and data retrieval utilizing manufacturer supplied software and connector cable.

The unit shall be capable of measuring and calculating flow in either English or Metric units, customer selectable. All data points shall be time and date stamped. Depth, velocity and optional inputted rain gauge measurements shall be stored in a solid state 128K RAM data logger featuring a wrap-around storage hierarchy. Data, programmed site parameters and on board clock operation must be protected by separate backup lithium batteries rated for ten year life. The monitoring unit shall have all programming and site parameters stored in EEROM such that the unit can be programmed and the lantern batteries removed without loss of the programmed data.

Software provided by the manufacturer shall have the capability to convert the data into an ASCII format. It will operate under a DOS™ 3.0, or later, environment. The software shall have the capability to allow field selectable logging intervals from 1 to 255 minutes in 1 minute increments. It shall also allow the activation of a dual stage logging capability to more accurately monitor peak events.

A separate software package shall be provided that will function as described above as well as having the capability of producing spread sheets and graphs. This software shall operate under Windows™ 3.1.

EXTERNAL CONTACT INPUT

The flow monitor shall allow a tipping bucket rain gauge to be connected into the unit for accumulation of rainfall. The software shall support different size rain gauge inputs (0.1, 0.01, etc.) and shall be capable of receiving information during the sleep mode condition.

SENSOR MOUNTING BANDS

Spring Mounting Band

The manufacturer of the flow monitoring device shall supply hardware to properly secure the sensor into the pipe. This hardware shall be manufactured from 301 stainless steel and designed to be quickly and easily installed into standard sewer manholes and sewer pipes. The spring like mounting bands will not require bolts or additional fixtures in order to adequately secure the band under normal sewer flows. These bands will incorporate a sensor mounting bracket and a means to secure the sensor cable to the mounting band with wire ties. The band shall be designed to allow the use of an optional mounting tool to install and remove the band from outside the manhole. The mounting bands will be supplied (as a set or individually) for installation in sewer line sizes 6, 8, 10, 12, 15 and/or 18 inches.

Scissor Jack Mounting Kit

A scissor jack expansion mounting kit shall be provided for installing the sensor in pipes 8 through 24 inch. It shall be constructed of stainless steel material.

INSTALLATION MOUNTING TOOL

A tool will be supplied by the manufacturer of the monitoring device that will allow for installation and removal of the flow monitoring sensor and its spring mounting band from ground level, outside the manhole, up to depths of 17 feet. This device will allow removal and/or installation of any Badger Meter spring mounting band from 6 through 18 inches. The supplied mounting tool will consist of: base pole, three (3) extension poles, a downhole mechanism, a ratchet lever, and a restraint mechanism. Installation and maintenance manuals will be supplied with each mounting tool.



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