EMCO FLOW SYSTEMS

Sono-Trak® Doppler

Ultrasonic Flow Meter

The ***Sono-Trak***® Doppler ultrasonic flow meter is a non-invasive, ultrasonic flow metering system. Based on the principles of the Doppler effect, it calculates flow velocity by sensing and measuring the frequency shift in motion from reflective materials within a liquid.

Benefits

- Non-invasive design
- Low-cost, simple installation
- Fits pipe sizes from 1 to 100" (25 to 2540 mm) outside diameter
- Rugged and maintenance-free —no moving parts
- No pressure drop and no costly process shutdowns
- Reliable and accurate flow readings—typically provides ±2.0% full scale accuracy and ±0.1% repeatability

Features

- Automatic gain control—as flow profile changes so does the electronics signal
- Noise immunity to variable frequency drive (VFD)
- User-friendly, easy-to-program display with on-screen prompting and keyboard entry
- Digital signal—allows for cable lengths up to 5000' (1524 m)
- AC or DC operation
- Fixed and portable units available

Overview

The ***Sono-Trak***® Doppler flow meter uses advanced signal processing technology that dramatically increases the accuracy of flow rate measurement. Its accuracy ratings are typically ±2.0% of full-scale accuracy, and repeatability is ±0.1% of reading.

This flow metering system uses two transducers mounted side by side, operating as ultrasonic signal transmitters and receivers. The measurement is obstructionless and produces no associated pressure drops. With no moving parts to wear over time, the ***Sono-Trak***® Doppler flow meter is virtually maintenance-free and is available in both fixed and portable units.

Suitable Fluids

The ***Sono-Trak***® Doppler flow meter is suitable for fluids containing suspended particles or bubbles with at least 35 parts per million (ppm) at 40 µ or larger, and a minimum of at least 0.2% density difference from liquid medium.

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Applications

- The ***Sono-Trak***® Doppler flow meter easily measures most all liquids containing particles or air bubbles. Some materials well suited for measurement include:
- Agricultural water
- Abrasives
- Asphalts
- Concrete
- Drudge flows
- Drilling mud
- Large contaminates
- Extremely viscous substances
- Grout
- Hazardous wastes
- Municipal sludge and wastes
- Paper pulp
- Rendering products
- Reservoirs and runoffs
- Rivers and streams
- Sludge
- Slurries
- Suspended solids

Installation Considerations

The ***Sono-Trak***® Doppler flow meter is available in fixed and portable units. The fixed unit consists of:

- *Electronics enclosure*
- *Digitizer*
- *Two transducers and 25′ cable (7.6 m)*
- *Tiedown kit*
- *Sonic coupling gel*
- *User manual*

In addition, portable units include:

- *12 V, 2.2 AH battery*
- *110 VAC battery charger*
- *Tote handle and side latch*
- *Field transport case*

Custom cable lengths of up to 5000′ (1524 m) are available.

Doppler Placement

The ideal placement of the ***Sono-Trak***® Doppler flow meter is within 20 diameters of straight run upstream and 10 diameters of straight run downstream between the meter and any disturbance of the flow; however, the meter has worked with straight runs of as little as 5 diameters upstream and 2 diameters downstream.

Piping Conditions

- *The **Sono-Trak**® Doppler flow meter fits pipe diameters from 1 to 100″ (25 to 2540 mm).*
- *Pipes should be cleaned with all paint and scale removed.*
- *Horizontal pipe mounting is recommended.*

Clamp-on mounting

The ***Sono-Trak***® Doppler flow meter is configured with clamp-on transducers. When installed, the transducers sense fluid flow through a pipe and send this information to the system electronics. The electronics then convert, transmit, and display the received data.

External clamp-on sensors are ideal for smooth, clean pipe surfaces and are installed without shutting down flow. When clamp-mounting the flow meter, attach the sensors side by side in a position approximately 7 to 11 o'clock on the outside of the pipe. Use stainless straps, nylon belts, or bungee straps and a steel chain to secure the clamps in place.

Use only a sonic coupling medium to transmit the energy from the transducer crystals through the pipe wall and into the flow to be measured. Any type of non-fibrous grease or gel will suffice.

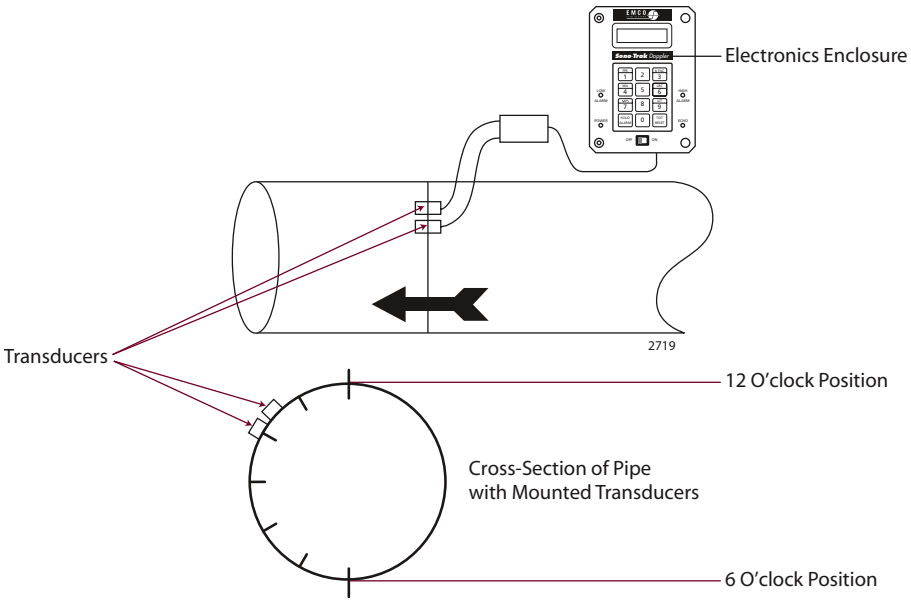


Figure 1 Mount the transducers side by side between 7 and 11 o'clock

Figure 2 Secure the transducers in place

Cabling

The standard cable length between the electronics enclosure and the transducers is 25' (7.6 m). Custom cable lengths up to 5000' (1524 m) are available.

Display Module

A user-friendly, easy-to-read display provides continuous, real-time flow rate, velocity, and totalization measurements in user-selectable engineering units. On-screen prompting and a full-function, 32-character, dual-line, alphanumeric keypad entry make programming effortless.

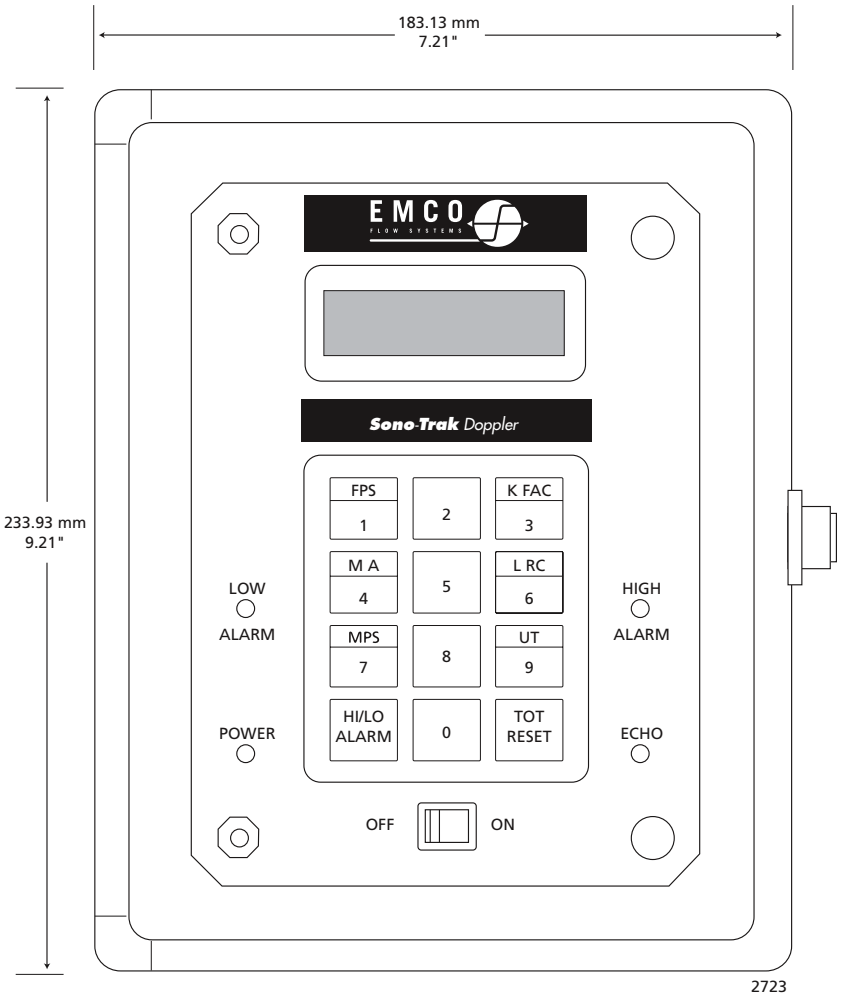
The display reads pulse, voltage, and analog rates, and it includes built-in high/low limit alarms, 4 to 20 mA signals, and an echo light to indicate whether the signal is producing accurate readings.

Specifications

Fluid Conditions		
Measured Fluid	Homogenous liquids with Newtonian flow profiles (sludges, slurries, sewage, wastewater, and other fluids containing suspended particles)	
State of Flow	Axis-symmetric flow in pipe filled with fluid	
Fluid Type	Liquids containing suspended particles of at least 35 ppm at 40 µ at 0.2% density of undissolved solids or air bubbles	
Measurable Fluid Temperature Range	-40 to 300°F (-40 to 149°C)	
Velocity Range	0.1 to 40 fps (0.04 to 12.19 mps)	
Flow Sensitivity	0.05 fps (0.02 mps)	
Piping Conditions		
Pipe Diameter Range	Volumetric indication	1 to 100" (25 to 2540 mm) diameter
Pipe	Including, but not limited to, carbon steel, stainless steel, ductile iron, cast iron, FRP, PVC, fiberglass, Teflon®, and most concrete-lined or coated pipes	
Pipe Lining	Including, but not limited to, tar, epoxy, mortar, rubber, Teflon®, PVC, and glass	
Measurement Accuracy		
Accuracy *Note: Accuracy is a function of flow profile.*	Typically ±1% to ±3% of full scale, based on straight run of piping of 20 diameters upstream and 10 diameters downstream	
	±3% to ±5% of full scale based on straight run of 10 diameters upstream and 5 diameters downstream	
	±5% to ±10% of full scale based on straight run of 5 diameters upstream and 3 diameters downstream	
Linearity	±0.5% of full scale	
Repeatability	±0.1% of full scale	
Response Time	≤ 1 sec	
Electronics Enclosure		
Dimensions	9.21" (H) x 7.21" (W) x 5.09" (D) (285 mm x 183 mm x 129 mm)	
Weight	12 lb (5.45 kg)	
Materials	Flame-retardant, fiberglass-reinforced polyester with lockable latch, gray in color	
Environmental Rating	NEMA 4X (IP65)	
Ambient Temperature Range	-13 to 132°F (-25 to 55°C)	
Ambient Humidity	< 100% RH	

Transducers		
Dimensions	Transducer heads	4.85" (L) x 1.33" (W) x 1.35" (D) (123 mm x 33.8 mm x 34.3 mm)
	Digitizer	4.45" (L) x 2.50" (W) x 1.10" (D) (113 mm x 63.5 mm x 28 mm)
Weight	2.3 lb (1 kg)	
Housing Material	Cast aluminum	
Mounting	Mount to the outside of pipe by means of stainless straps, nylon belts, or bungee and steel chain	
Crystal Wedge Material	Epoxy resin (all transducer models)	
Environmental Rating	NEMA 6 (IP67)	
Ambient Temperature Range	-4 to 130°F (-20 to 54°C)	
Ambient Humidity	< 100% RH	
Transducer Cable		
Standard Cable	25' (7.6 m), 2 twisted pairs, 24 AWG, belfoil shield *Note: Custom cable lengths are available.*	
Maximum cable length	5000' (1524 m)	
Power		
Fixed Units	110 VAC or 220 VAC at 50/60 Hz (AC line voltage selectable via internal selector switch)	
	12 VDC (DC operation enabled by internal selector switch)	
Portable Units	Internal gel-cell, 8-hour continuous operation; built-in battery Recharge time is 12 hours using the external power adapter/charger or DC auto cigarette lighter.	
Power Adapter/Charger	Standard adapter	115 VAC, 50/60 Hz (± 10%) input delivering 12 VDC, 500 mA output
	Optional adapter	230 VAC, 50/60 Hz (± 10%) input delivering 12 VDC, 500 mA output
Power Consumption	10 W typical	
Analog Output Signal	4 to 20 mA DC, 700 Ω maximum load resistance, internally fused, active output	
Alarm Output	When on AC power	15 VDC = Active alarm
		High alarm switched +15 VDC, 500 mA
		Low alarm switched +15 VDC, 500 mA
	When on battery power	12 VDC = Active alarm
		High alarm switched +12.0 VDC, 500 mA
		Low alarm switched +12.0 VDC, 500 mA
Power Failure Backup	An internal super-capacitor allows the electronics assembly to retain all parameter information and current totalizer value for up to ten days.	

Standard Interface		
LCD Display	2-line, 16 characters per line, high resolution	
LED Indicators	Yellow	Echo signal received
	Red	High alarm or low alarm activated
	Green	Power available
Keypad	12 keys, tactile feedback *Note: Keypad lockout is available through internal switch.*	
Display Panel	Rate selection	
	Totalizer selection	
	K factor selection	
	Analog output set	
	Low-flow cutoff set	
	Update time (damping) set	
	High/low alarm set	
	Fps or mps selection	
	Totalizer reset	
Output Setting Function	4 to 20 mA output scaling (set in velocity from keypad)	
Alarm Setting Function	High and low alarm set points (entered in velocity from keypad)	
Rate Indication	4-digit LCD, velocity or volume (user selectable)	
	English units	Feet per second (fps), gallons per minute (gpm), cubic feet per second, and million gallons per day *Note: Gallons refers to U.S. gallons.*
	Metric units	Meters per second (mps), liters per second (lps), and cubic meters per second
Totalizer Indication	11-digit LCD	
	English units	Gallons, cubic feet, acre feet, and millions of gallons *Note: Gallons refers to U.S. gallons.*
	Metric units	Liters and cubic meters
Update Time (Damping)	0 to 99 sec, entered from keypad	
Low-Flow Cutoff	0 to 2.5 fps (0 to 0.76 mps), entered from keypad	
K Factor	A value of 1 to 256, entered from the keypad depending upon sensor type; default is 90 Hz (correction factor)	
Totalizer Reset	Totalizer can be manually reset to zero from the keypad.	



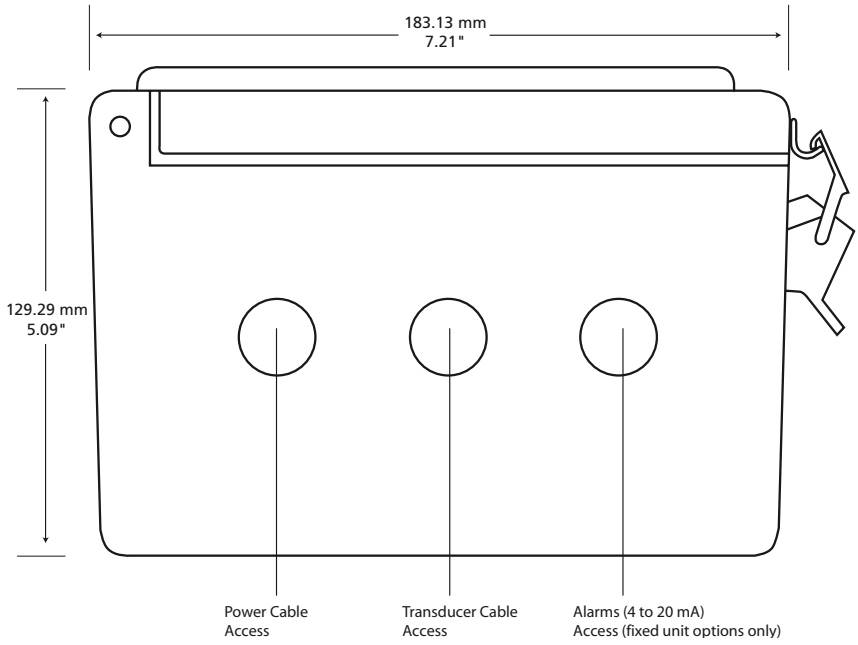


Figure 4-1 Dimensions

Fixed and Portable Models

The ***Sono-Trak***® Doppler flow meter is available in fixed, wall-mounted models or portable models.

Fixed *Sono-Trak*® Doppler Inclusions	
C5F Model Part Number 3153140-001	1 set of electronics in a NEMA 4X case with an LCD display
	2 transducers with 25' (7.6 m) of cable
	Transducer tiedown kit
	Sonic coupling gel
	Operating manual
Portable *Sono-Trak*® Doppler Inclusions	
C5P Model Part Number 3153141-001	1 set of electronics in a NEMA 4X case with an LCD display
	2 transducers with 25' (7.6 m) cable
	Transducer tiedown kit
	Sonic coupling gel
	Operating manual
	12 V, 2.2 AH battery
	120 VAC battery charger
	NEMA enclosure with tote handle and side latch
	Field transport case

The complete EMCO product line for liquid, gas, and steam applications includes industrial inline vortex, industrial insertion vortex and turbine, commercial vortex, electromagnetic, and clamp-on ultrasonic flow products.

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