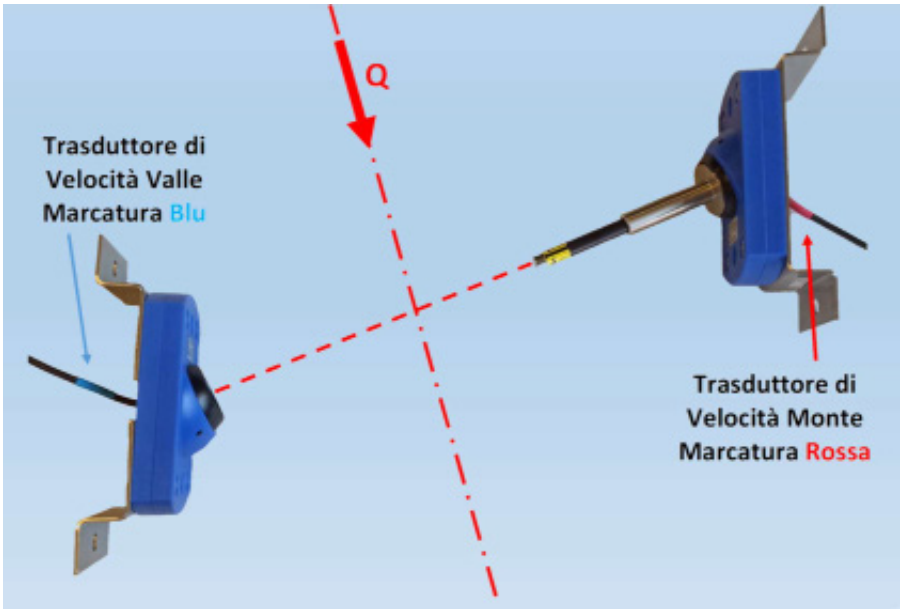
MPCFN

Flow meter

Velocity area for open channels, tunnels or full/partially full pipes with ultrasonic sensors

The MPCFN system is an area-flow meter that is used in combination with an optional level transmitter to measure flow in open channels. The MPCFN consists of an advanced digital signal processing (DSP) computer and up to eight speed transducers. The flow meter uses the transit time difference of ultrasonic sound pulses to measure the flow velocity in the open channel. Ultrasonic pulses are transmitted from upstream to downstream, and vice versa, through the channel at an angle α between the direction of flow and the path of the sound wave. The difference between the transit times of the sonic waves is directly proportional to the speed of the liquid.
The MPCFN can be used in rectangular, circular, trapezoidal or other shaped channels. Since the transducers generate almost no restriction, virtually no pressure drop is generated. The meter's computer-based DSP with Cross Correlation and Fast Fourier Transform (FFT) technology allows the system to operate in the most demanding applications, including those involving liquids with high concentrations of suspended solids and air or components that generate a lot of noise. The MPCFN is also able to provide two independent measurements with a total maximum limit of 4 chord planes (example: 2 sizes each with 2 chord levels).



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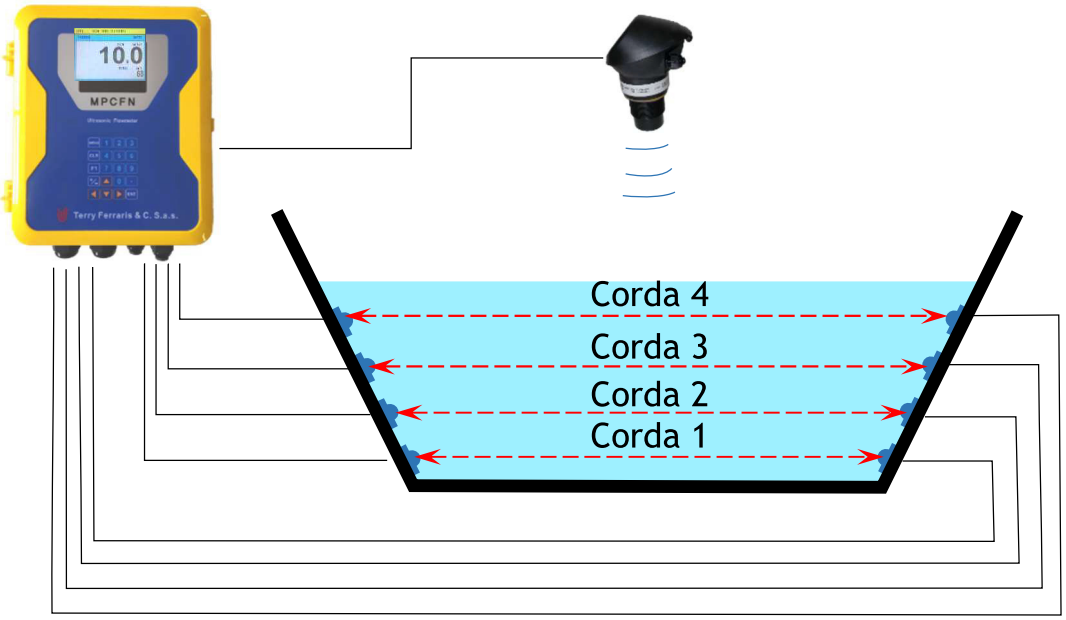

TRANSDUCERS

LTI-M Insertion transducer
Mat.: AISI 304 (transducer body, ball valve)
Mat.: Carbon steel (weld sleeve)

TRSBC Transducer
Mat.: Polyurethane

LTR-L Transducer
Mat.: Nylon

LO Pipe Insert
Mat.: Polyethylene, AISI304

LTO-M Transducer with adjustable angle
Mat.: Nylon

LTO-L Transducer with adjustable angle
Mat.: Nylon

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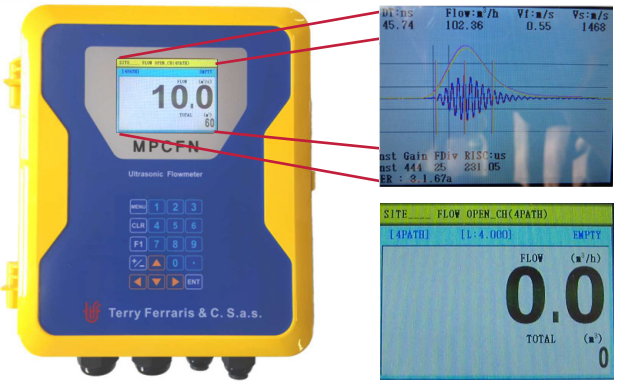
The transit time technique uses a pair of transducers for each acoustic chord, and each transducer sends and receives encoded ultrasonic signals through the fluid. When the fluid flows, the transit time signal in the downstream direction is less than that in the upstream direction: the speed at which the liquid moves is given by the difference between these two times of flight.

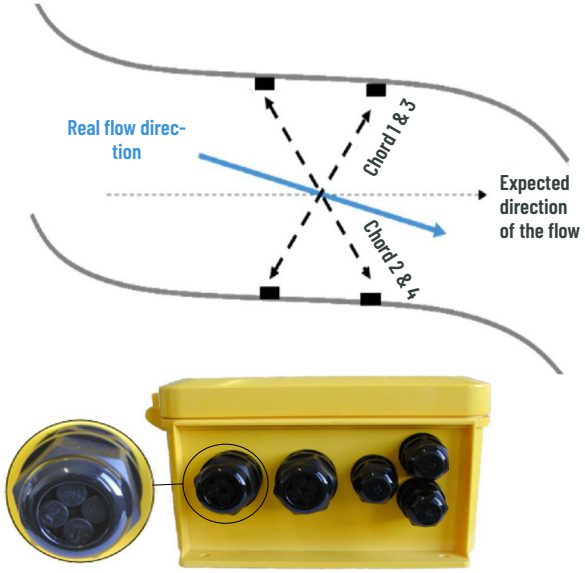
The MPCFN flow meter measures the time-of-flight difference and uses the programmed parameters of the channel/pipeline to determine direction and flow rate.

The mounting position of speed transducers in a channel, or within a pipe, is a function of the straight sections upstream and downstream of the measuring point. Normally upstream straight sections are 5 to 10 widths while downstream stretches are 3 to 5 widths.

Width means the width of a channel or the diameter of a pipe.

In the event that there are not enough straight sections, the acoustic chords can be crossed.





Technical specifications

Measuring principle	In transit time with 4 acoustic chords - Cross Correlation - Fast Fourier Transform - Anti-Round, patented automatic tuning system for determining the best coupling frequency of transducers
MPCFN Electronics	IP65, suitable for wall mounting; Weight: 2.4Kg; N.2 PG21A cable glands for transducer cable entry (4+4); N.3 PG13.5 cable glands
Speed range	0 ÷ ±12m/s
Accuracy	±2%
Sensitivity	± 0.03m/sec
Solution	0.001m/sec
Keyboard	20 (4×5) membrane keys
Display	Backlit colour graphic LCD (128x64) - Display: instantaneous flow rate - totalization - signal shape - Oscilloscope function for diagnostics
Power supply	85 to 264Vac 20W or 24Vdc (22 to 26Vdc) 4W
Outputs	N.2 analogue 4 ÷ 20mA; N.2 relays; RS-232C / RS-485 Modbus
Input	N.2 analogue 4 ÷ 20mA (configurable)
Datalogger	32MB
Electronic Temperature	-20 ÷ +60°C
Transducers	IP68, 4 pairs maximum (8 transducers)
Assembly	suitable for channels, pipes, etc.
Model	LTO-M range 1÷3m; LTO-L range 3÷30m; LTR-M (low profile) range 1÷3m; LTR-L (low profile) range 3÷30m; TRSBC range 3÷33m LTI (insertion) range 0.05÷2m; LO (insertion 4 chords for pipes) range 0.05÷1.2m
Transducers Temperature	0 ÷ +60°C (LTO-M/L, LTR-M/L, LO) -40 ÷ +120°C (LTI)
Cables length	10m standard (max. 200m)

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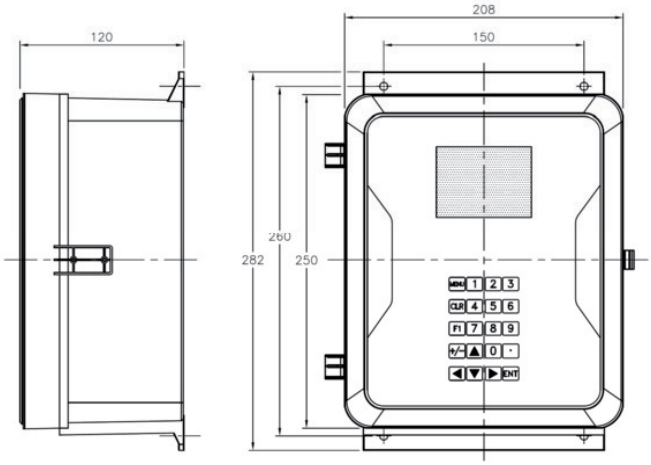
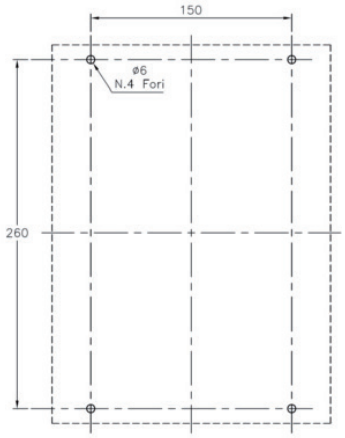
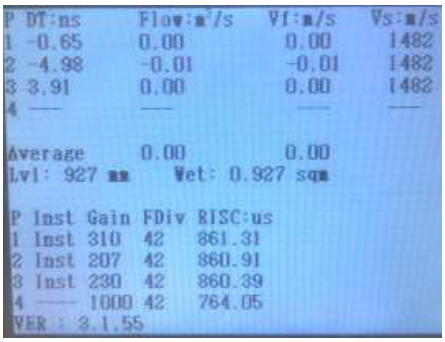
Enclosure and mounting template - Overall dimensions

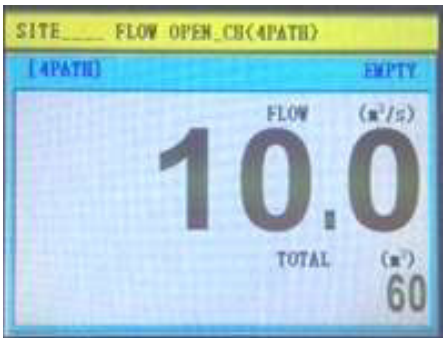


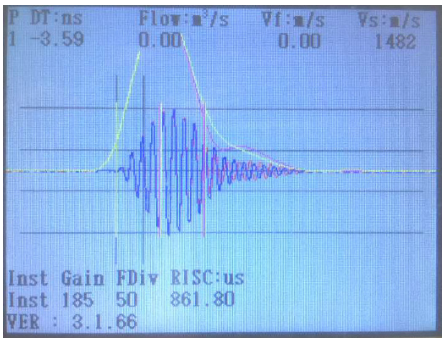
Assembly jig



Graphical display for visualization, calibration and with oscilloscope function for diagnostics



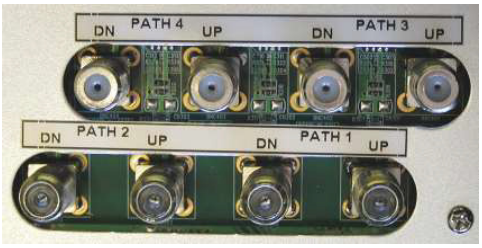


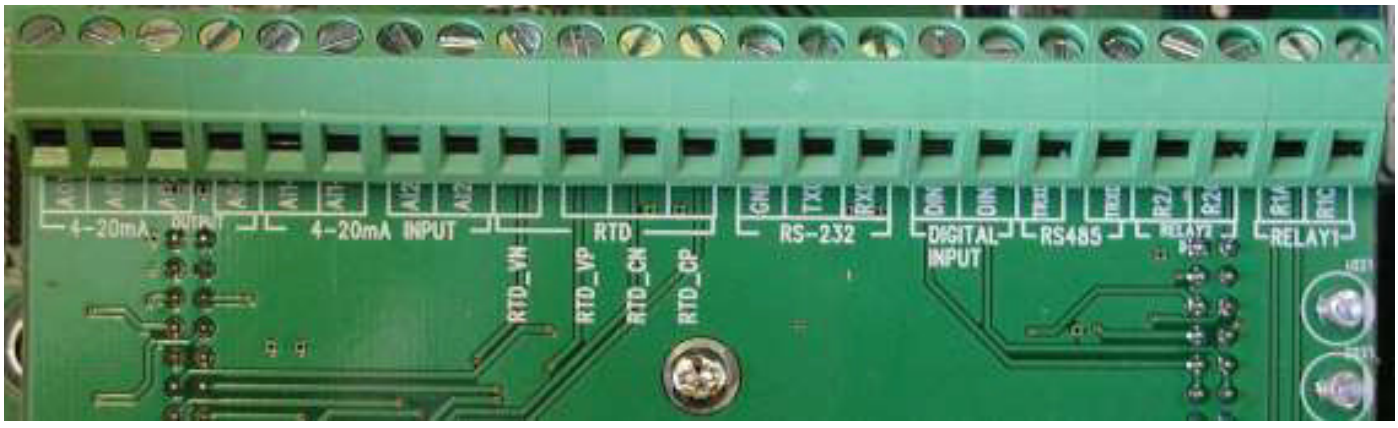


Wiring diagram

A maximum of 4 acoustic chords, 8 speed transducers can be connected to the MPCFN flow meter.

Upstream transducers must be connected to the **UP** connectors, and downstream transducers to the **DN** connectors.





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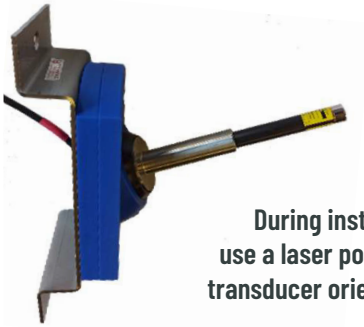
Typical installations: mounting transducers by slides



During installation, use a laser pointer for transducer orientation.

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Theory and applications

The flow rate in a full or partially full pipe is obtained by calculating the amount of water passing through a section of the pipe per unit of time, i.e., in other words, the wetted area multiplied by the average velocity. In the case of partially full pipes, the height of the liquid level in the pipe must also be measured continuously.
The area is easy to calculate, and a precise calculation can be made for a section of a canal or river with a known profile using a level meter that can be immersed or not in contact with the liquid to be measured. However, calculating the average velocity precisely is more problematic, because the velocity of the water varies from point to point and the direction of movement is also subject to considerable variations depending on the operating conditions. Terry Ferraris's phonetic rope system for measuring flow rate is based on water flow velocity measurements using ultrasonic sensors operating at different heights. A computing unit manages the data flow, converts it into flow rate, and records the measurements on a data logger at programmable time intervals, retransmitting them via modem or radio link. The system works on even large pipes, full or partially full, with any type of liquid that does not have too many suspended particles. The measurements obtained have an accuracy of between 2 and 5% (depending on the conditions at the measurement point and the number of phonetic strings used).
The system can be used in environments with temperatures between -20 and 40°C.

Areas of application

The use of the phonic string system is particularly advantageous for managing water resources, aqueducts, flow forecasting, withdrawal management and control, withdrawals for fish farming, outflow control, flood control, discharge control, measurement in irrigation channels, water treatment plants, hydroelectric power stations, differential flow measurement in penstocks and flow in oil pipelines.
Using four devices, it is possible to manage the differential flow from three channels, which can be either inflow or outflow in all possible combinations.
The accuracy of the measurement in accordance with IEC 41/CEI EN60041:1977 standards depends on the number of cables installed.
The best performance is achieved with suspended solids up to 2000ppm with low flora content, air bubbles and limited variations in salinity.

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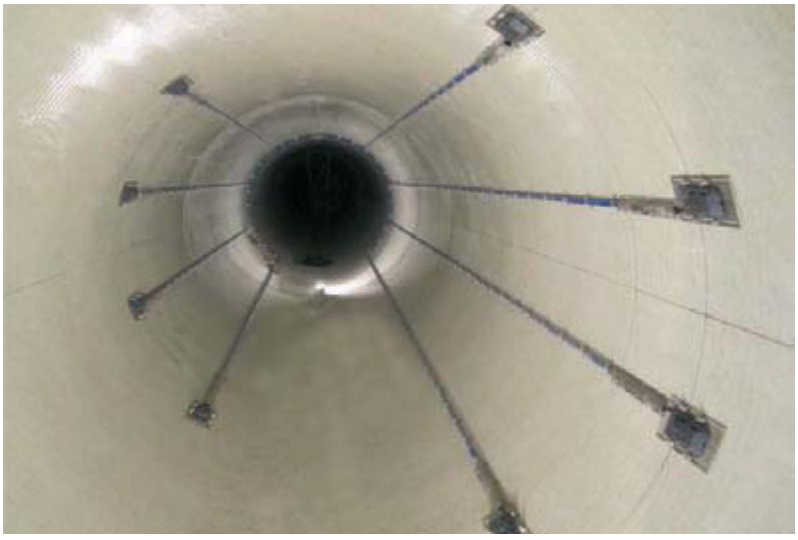
Protection of pressure pipes

The accuracy of phonetic cord flow measurements allows even small differences in water velocity at the inlet and outlet of the penstock to be detected. If a difference in measurement is detected, it means that there is a leak that must be located and eliminated. A small leak can put the penstock at risk, causing landslides over time and/or altering the penstock's structure, with the risk of the penstock itself breaking.

The system is safe and reliable and allows inspections to be carried out or action to be taken before significant damage occurs. Insertion transducers are used to measure velocity/flow rate in penstocks, which can be inspected without interrupting the water flow.
The accuracy of the measurement depends on the number of phonetic strings used.



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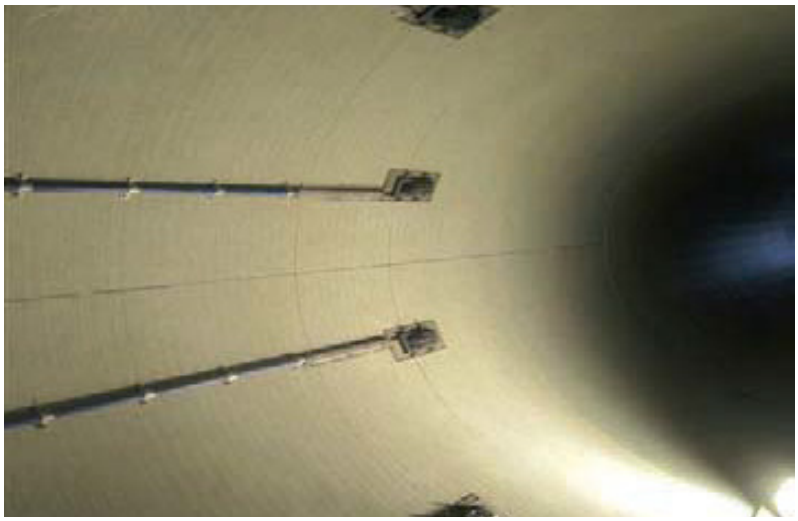

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