



MemoLog

STATIONARY ULTRASONIC
TRANSIT TIME FLOWMETER

Measurement, data acquisition and transmission system of flow and pressure for water networks with long battery life

With MemoLog, BM Tecnologie Industriali developed and introduced in Full Pipe Water Flow Measurement Market a revolutionary **ALL IN ONE** flow meter.

MemoLog is an ultrasonic flowmeter that uses both ultrasonic clamp-on sensors and insertion sensors, it is supplied by 24 VDC and it could be supplied by a rechargeable battery too, type LiFePO4 40 Ah lasting up to one year.

It acquires data on an external 4GB pen drive: the acquired data, together with the alarms and the diagnostics can be sent remotely through a built-in GSM / GPRS modem.

The IP65 protection grade of the main unit and the IP68 protection grade of the sensors complete the excellent performances of this flow meter.

The advanced configuration menu can guide in a few steps, through a display and a keyboard or using software HydroFlux, even a few experienced operator about how to use MemoLog.

A sophisticated diagnostic system, with a smart user interface, allows the user to understand quickly if the measurement is correct and, if not, to identify the problems.

The software HydroFlux was developed for the advanced management of the acquired data, it allows the creation of master data, tables and graphs, it could be able to make the budget in a water district and identify the water losses, it imports and exports the data.

- Main Characteristics**
- ✓ Flow and Pressure measurement
 - ✓ Protection IP65
 - ✓ Power supply: 12...36 VDC
Battery powered: life: up to 1 year, expandable up to 3 years.
 - ✓ Compact and easy to install
 - ✓ Digital and analog input
 - ✓ Data acquisition on internal memory and USB Pen Drive
 - ✓ Data transmission via GPRS/GSM/SMS to a remote system
 - ✓ Software "HydroFlux" for data management and configuration

- Main Applications**
- ✓ Virtual Water Districts
 - ✓ Water Losses in Aqueduct
 - ✓ Check Fire System
 - ✓ Calibration of Numerical Models
 - ✓ Measurement campaigns on Long and Short Periods in Aqueduct
 - ✓ Water Balance
 - ✓ Pumping Station Control
 - ✓ Waste Water Treatment Plants
 - ✓ Hydroelectric Power Stations
 - ✓ Industrial Process Monitoring

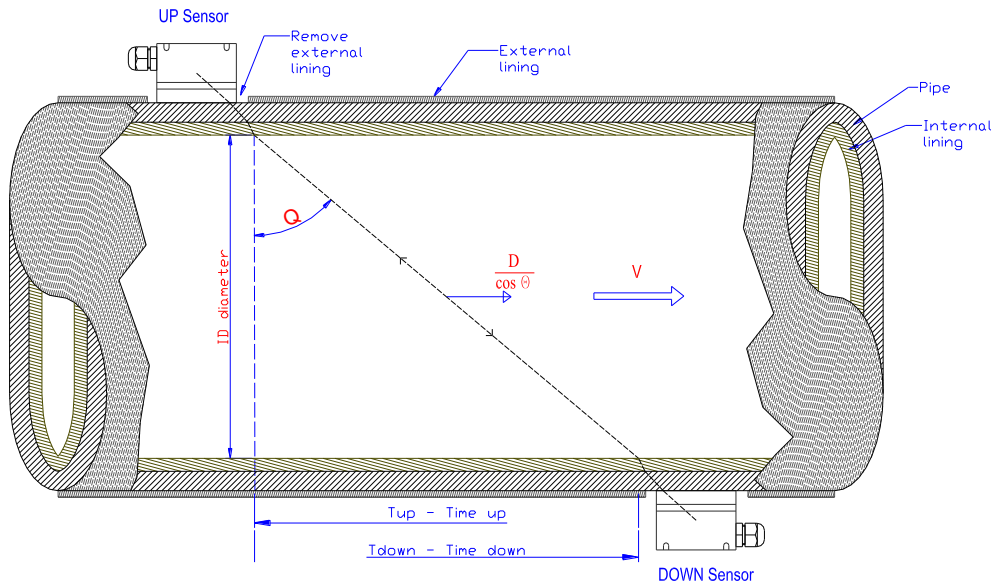
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The device measures flow rate by calculating the spreading time of an ultrasonic wave in a liquid, going upstream and downstream into a pipe.

When the ultrasonic wave spreads in a liquid, the flow will cause a changing in the spreading time depending on downstream or upstream current.

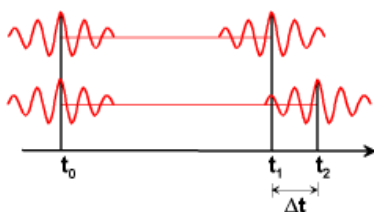
The ultrasonic wave going towards the same directions of the flow increases the spreading speed, while the ultrasonic wave going towards the opposite side of the flow decreases the spreading speed.

If the difference between the two spreading times is accurately measured, it would be possible to calculate the flow speed.



The measures are taken by 2 sensors in direct contact with the pipe's external surface. One sensor is placed on the upper side of the pipe's external surface (UP SENSOR), one sensor is placed on the lower side of the pipe's external surface (DOWN SENSOR). The sensors positions could look like a "Z" or like a "V", a "N" or a "W", if the pipe has a small diameter (in the previous sketch, the sensors are "Z" mounted).

The difference between the transmitted and received signals upstream and downstream is calculated as follows:



$$(1) T_{up} = \frac{M * D}{Co + VSIN\theta} \quad (2) T_{down} = \frac{M * D}{Co - VSIN\theta}$$

$$(3) V = \frac{M * D}{SIN2\theta} * \frac{\Delta T}{T_{up} * T_{down}}$$

Where:

M = Spreading time

Tup = Positive spreading time

D = Pipe's internal diameter

Tdown = Negative spreading time

θ = Pipe's internal diameter

Co = Sound spread speed through the fluid in static conditions

The Δt value is the difference of the spreading time into a homogenous fluid without gas bubbles.

The equation (3) for calculating the average speed "V" could be used for all the types of fluids in ideal working conditions. The fluid speed measuring is in fact conditioned by different factors which decrease the precision: for example the deposits on the inner walls of the pipes change the measuring principle of the transit time flow meter.

It is possible to adjust the zero point of the device: if the fluid is in static conditions, this operation makes the repeatability precision increase until reaching values near to 1%.



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Technical Features

ELECTRONIC UNIT	
I/O	
Flow sensor inputs	Inputs for ultrasonic transit time sensors
Digitals Inputs	4 opto-isolated digital inputs 0-24V: - 1 alarm input - 1 totalizer input for external pulse flow meter - 1 input for starting acquisition by external event - 1 input for direct transition from intermittent to continuous acquisition
Pressure sensor input	1 analog input 0÷10V
Serial port	RS232
POWER SUPPLY	
Internal Battery	LiFePOH - 40Ah
External Power Supply	Low tension: 11÷24V AC/DC High tension by AC/DC converter: 90..240V _{AC} ~ 60/50Hz
Consumption	Max in transmission: 150mA @ 13,2V Min. in low power 0,39mA @ 13,2V
ACQUISITION DATA MEMORY	
USB Pen Drive	4GB
REAL TIME CLOCK	
Real Time Clock	Buffered with internal battery
MODEM and SIM CARD	
Bandwidth	QuadBand GSM: 900/1800 e 850/1900 MHz
Functions	SMS, GSM, GPRS
Standard	Compatible with controls AT standard 07.07 e 07.05
SIM Holder	External access
Antenna	Magnetic base, omnidirectional with 1,5 m cable
DISPLAY e KEYBOARD	
Number of characters	2 lines x 20 columns, Backlit with adjustable contrast
Menu languages	Italian and English (Chinese, German, French, Spanish, Portuguese under development)
No. of keys	12 alphanumeric keys, 8 function keys
ENVIRONMENTAL	
Temperature	-10°C ~ +50°C (14°F ~ 104°F)
Protection	IP65
MECHANICAL	
Case/Material	Black Case - PA66 loaded
Size and weight	L178 x W75 x H250 mm - 1 Kg (batteries included)
COMPLIANCE STANDARDS C€	
Compatibility / Electromagnetic Immunity	EN 61000-6-2: 2005



FLOW MEASUREMENT	
Performances	Accuracy: $\pm 1.0\%$ (after calibration) Linearity: 0.5% Repeatability: $\pm 0.2\% \sim 0.5\%$ m/s
PIPES	
Material	Carbon steel, INOX, cast iron, ductile iron, copper, PVC, aluminum, cement, fiberglass and most other materials. The flow can be measured on pipes with an inner lining by selecting the liner material and thickness in an appropriate menu.
Internal diameter	15...6000 mm
Hydraulic conditions	The upstream straight section must be greater than 10 diameters, the downstream section should be greater than 5 diameters
MEASURABLE FLUIDS	
Type	Drinking water, sea water, kerosene, gasoline, fuel oil, oil, propane -45 °C, butane 0 °C ... any liquid that is able to propagate ultrasound
Suspended solids	Up to 20000 ppm (mg/l) with a few air bubbles
Temperature	-20°C~ +90°C
ULTRASONIC TRANSIT-TIME SENSORS	
Type	<p>Clamp-on outside of pipes:</p> <ul style="list-style-type: none"> • TTS100-TS2-NG for DN15..100 mm • TTS100-TM1-NG for DN50..1000 mm • TTS100-TL1-NG for DN300..6000 mm <p>Temperature: -30°C~ +90°C</p> <p>Insertion type:</p> <ul style="list-style-type: none"> • TTS100-B(45)-1-NG-1" for DN50..6000 and pipe thickness up to 30 mm • TTS100-B(45)-2-NG-1" for DN50..6000 and pipe thickness up to 85 mm <p>Temperature: -20°C~ +90°C- Max pressure: 20 Bar</p>
Mounting methods	"N", "W": pipes DN \leq 32 mm "V": pipes DN40..600 mm "Z": pipes DN \geq 600 mm
Cable length	5 m extendable with 5 m extensions (Max. 200 m)
Protection	IP68
MEASURING UNITS	
Metric	m ³ , l, USGal, UKGal, millionUSGal, cubic feet, barrels oil US, barrels oil UK / sec, min, hours, days

PRESSURE MEASUREMENT	
Nominal Range	0..0,10 - 0,25 - 0,40 - 0,60 - 1,00 - 1,60 - 0..2,50 - 4,00 - 6,00 - 10,0 - 16,0 - 25,0 - 40,0 - 60,0 - 100,0 Bar (user selectable)
Accuracy	0,5% with a range up to 0,6 Bar - 0,35 % with a range over 0,6 Bar
Temperature	-25°C~ +125°C
Protection	IP68
Cable length	5 m (incremental length at step of 5 m) - Max. 200 m
Measuring unit	Bar, PSI



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BASIC EQUIPMENT MemoLog		
Quantity	Description	Code
1	Transit time flowmeter, type: MemoLog USB Case - RS232 - Modem GSM/GPRS - Internal memory 262144 records - 1 analog input - 4 digital inputs	000033799
1	Couple of clamp-on transit time sensors, type: TTS100-TS2-NG For pipes DN15..100 - Temp. Max.: 90°C - Velocity Range: +/- 16 m/sec With exit cable (0,25 m) and rapid connector IP68	000033779
1	Couple of clamp-on transit time sensors, type: TTS100-TM1-NG For pipes DN50..1000 - Temp. Max.: 90°C - Velocity Range: +/- 16 m/sec With exit cable (0,25 m) and rapid connectors IP68	000033780
1	Pack of acoustic coupling gel, type: TGA-TTFM	000028162
1	Antenna GSM 900/1800, magnetic base, type: ABM-1,5-PTTFM2000 With 1,5 m cable and IP68 connector	000033798

1	Configuration and data management Software: "HydroFlux"	000033867
1	User manual	000033868

PRESSURE SENSOR MemoLog	
Description	Code
Piezoresistive pressure transmitter, type: TPR 331-xxxx-005-PTTFM2000 0..0,10 Bar	000033800
0..0,25 Bar	000033801
0..0,40 Bar	000033802
0..0,60 Bar	000033803
0..1,00 Bar	000033804
0..1,60 Bar	000033805
0..2,50 Bar	000033806
0..4,00 Bar	000033807
0..6,00 Bar	000033808
0..10,0 Bar	000033809
0..16,0 Bar	000033810
0..25,0 Bar	000033811
0..40,0 Bar	000033812
0..60,0 Bar	000033813
0..100,0 Bar	000033814



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ACCESSORIES FOR MemoLog	
Description	Code
External battery for MemoLog, type: EPB-40Ah-PTTFM2000 Protection IP67 – Capacity: 40 Ah	000033785
External battery for MemoLog, type: EPB-80Ah-PTTFM2000 Protection IP67 – Capacity: 80 Ah	000033786
Battery Chrger for MemoLof, type BCH-40AH Input 110-240 VAC	000033287
Couples of rail guide mounting system in stainless steel for clamp-on sensors installation: RGMS-TS2/TM1-NG-FIX-2 For pipes > DN250	000033869
Junction Box for external digital inputs PTTFM2000, type: JB-4DI-PTTFM2000 With 2 mt cable connector	000033870
Kit of mounting chains for clamp-on sensors installation, type: CMS-CLAMP-3000-PTTFM2000 For pipes up to 3 mt diameter	000033871
Kit of mounting chains for clamp-on sensors installation, type: CMS-CLAMP-6000-PTTFM2000 For pipes up to 6 mt diameter	000033872

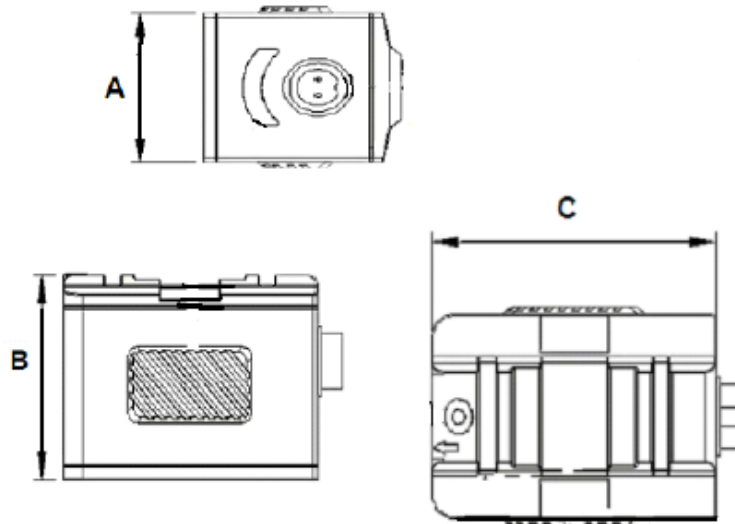
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250 mm

178 mm

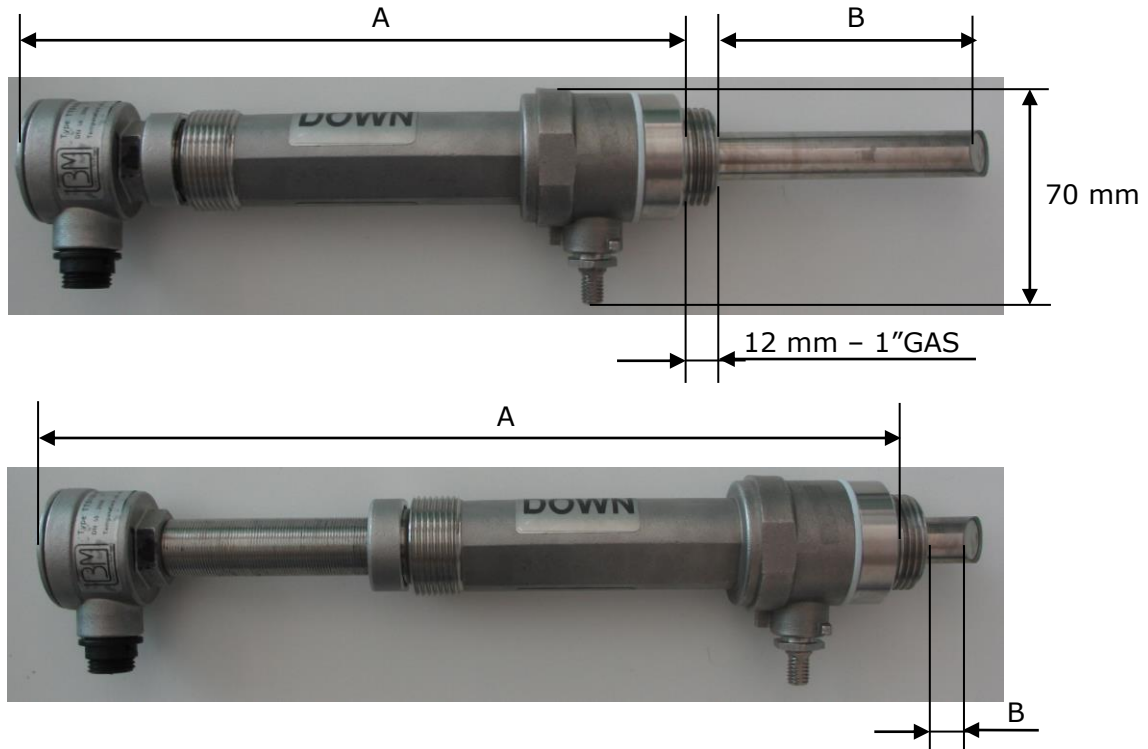
CLAMP-ON SENSORS



Sensor Type	A	B	C
TS2-NG-PTTFM 2000	28 mm	25 mm	45 mm
TM1-NG-PTTFM 2000	39 mm	44 mm	64 mm
TL1-NG-PTTFM 2000	53 mm	54 mm	97 mm

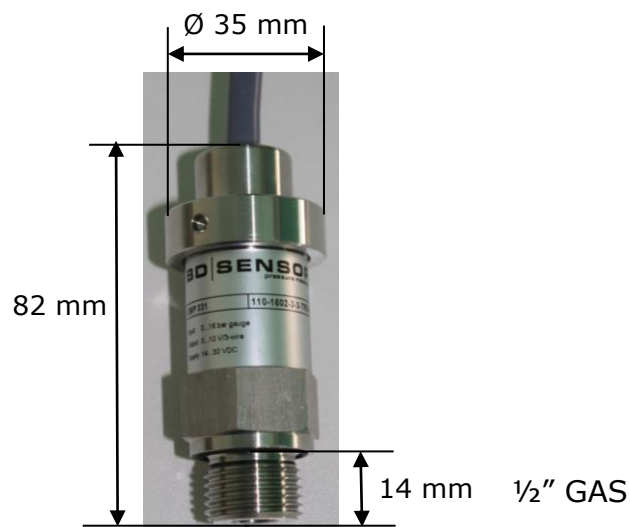
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INSERTION SENSORS



Sensor	Insertion	A	B
TTS100-B(45)-1-NG-1"	Minimum	160 mm	8 mm
	Maximum	137 mm	30 mm
TTS100-B(45)-2-NG-1"	Minimum	295 mm	8 mm
	Maximum	220 mm	85 mm

PRESSURE SENSOR





Software

HydroFlux

Software to manage the data downloaded from MemoLog

Data displayed in tables and charts

Water balance for leaks detection.

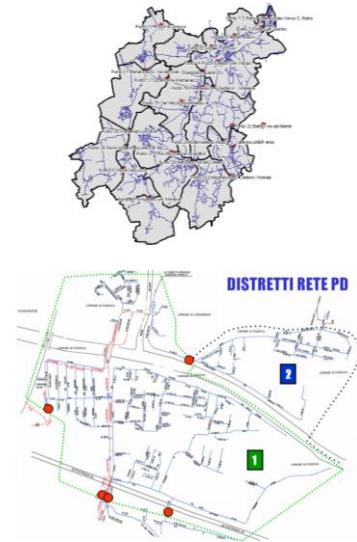
General description

HydroFlux is a software developed for the configuration, the download and the import of data from MemoLog and their following automatic analysis to detect, for example, the losses in a water network.

You can create measurement stations to which bind the data downloaded from an MemoLog and create district metered areas that can be identified by different measuring stations.

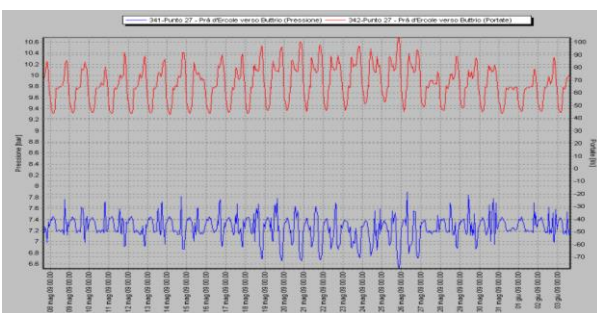
The advanced processing and management of ingoing and outgoing flow data of the water districts identifies any losses in water networks by measuring the minimum night flow. It is possible to display the data in tables or charts, for a simultaneous visualization of their trends.

Districts organization

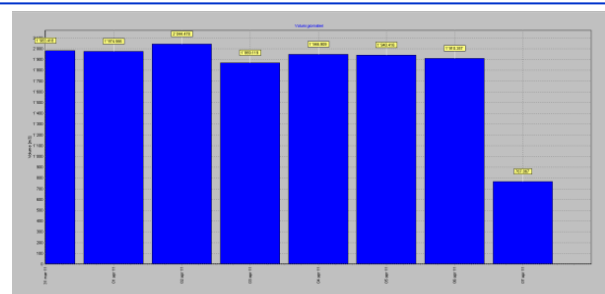


Data visualization

Data/Ora	Portata	Pressione UP	DN	Qualità	VEL.	NET	POS	NEG	TOT GL.	TOM/TOS
05/05/2011 17:08:00	0	24		3				0	10059	
05/05/2011 17:09:00	0	24		3				0	10059	
05/05/2011 17:10:00	0	24		3				0	10059	
05/05/2011 17:13:00	3952	24		3				0	10059	
05/05/2011 17:14:00	4125	24		3				0	10059	
05/05/2011 17:15:00	4125	24		3				0	10059	
05/05/2011 17:16:00	4254	24		3				0	10059	
05/05/2011 17:17:00	4231	24		3				0	10059	
05/05/2011 17:18:00	4231	24		3				0	10059	
05/05/2011 17:19:00	4288	24		3				0	10059	
05/05/2011 17:20:00	4288	24		3				0	10059	



Volumes



Minimum Night Flow

