



SIEMENS

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# Intro to Electromagnetic flow meter

## Niels Chr Christensen

## SITRANS F M electromagnetic flowmeters

The SITRANS F M program offers a complete range of magnetic flow meters for any application of conductive fluids.

The SITRANS F M program consists of three different flow meter types:

**Traditional pulsed DC magnetic flow meters** Mag5000/6000

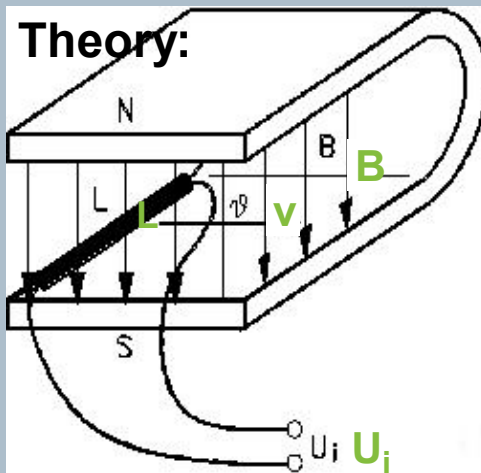
**Advanced high strength AC magnetic flow meters** Tansmag2

**Battery driven water meters** Mag 8000

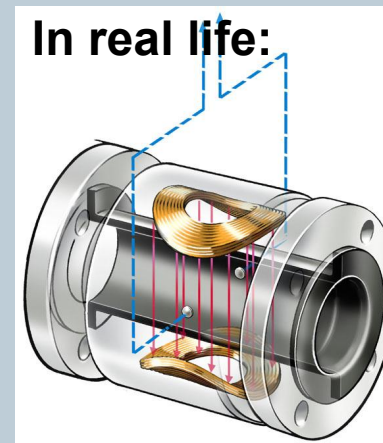


## Working principle

... is based on Faraday's law:  $U_i = L * B * v$



When an electrical conductor of length  $L$  is moved at velocity  $v$ , vertical to the lines of flux through a magnetic field of strength  $B$ , the voltage  $U_i$  is induced at the ends of the conductor.



In a MAG meter;  $L$  (inner diameter) and  $B$  (strength of magnet) are known.

Therefore, when you measure  $U_i$  on the electrodes you can calculate the velocity directly by dividing  $U_i$  by the constants  $L * B$

That is; the electrode signal,  $U_i$ , is directly proportional to the fluid  $v$  velocity.

## Working principle

FM Magnetic flowmeters can only measure:

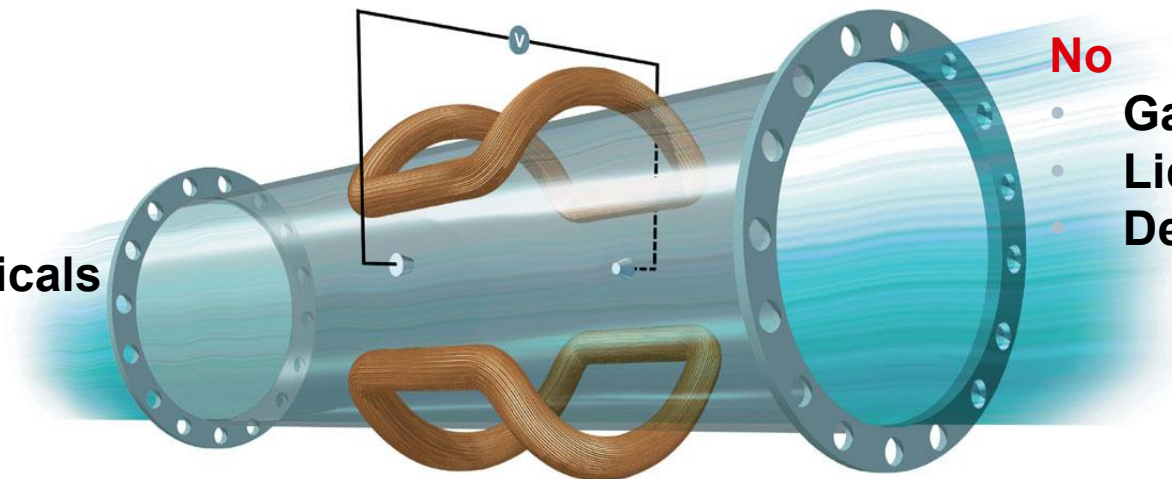
**Fluids with electrical conductivity**

Compact installation:  
Liquids with an electrical conductivity  $\geq 5 \mu\text{S/cm}$ .

**Some examples:**

**Yes**

- **Water**
- **Milk**
- **Chemicals**



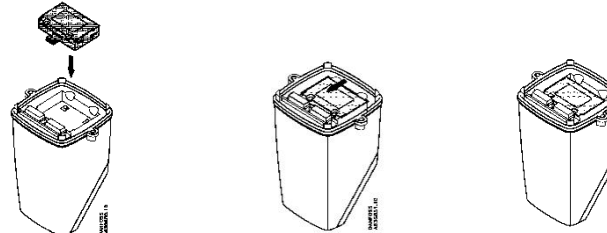
# Add-on modules for MAG 6000/6000I

## Available modules:

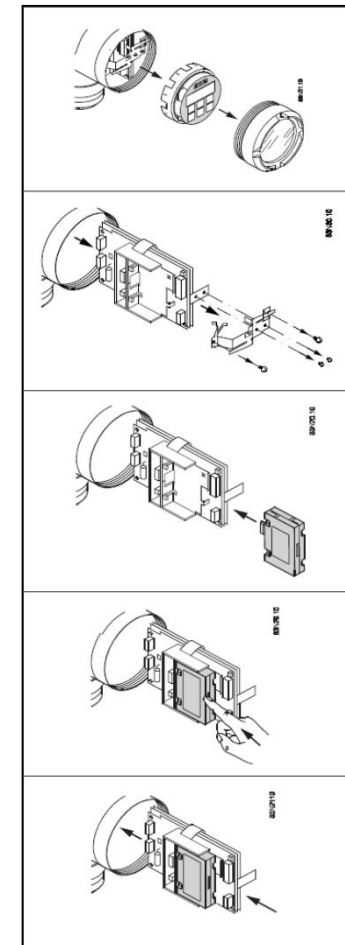
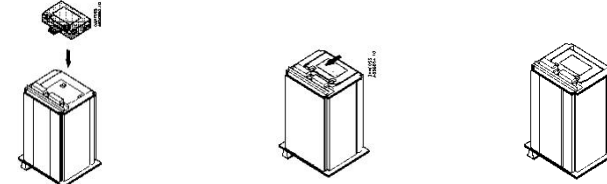
- HART
- PROFIBUS PA -3
- PROFIBUS DP - 3
- MODBUS RTU
- FF



### MAG 6000 – polyamide enclosure



### MAG 6000 – 19" rack



# Check of electrode noise

Click to start



## Go to Service Menu

Password 1000

Go to Service Menu

Step1. Choose excitation

Frequency OFF

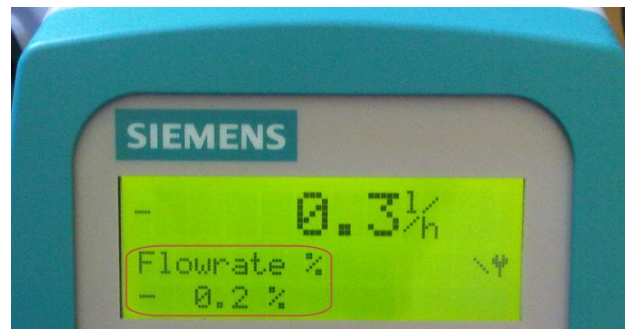
Step2. Put cut off to 0,0%

Please go two steps back for below display indication.

what indicate the display mark with red

the below picture indicate -0,2%

Click to start



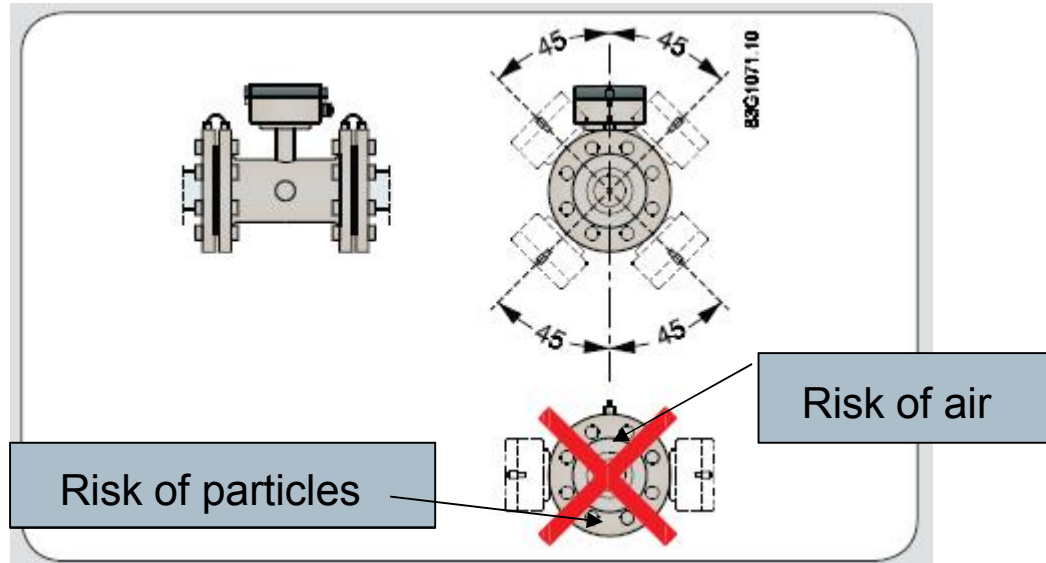
The option is only available up to SW 4.04

From the SW 4.07 the flow velocity is available.

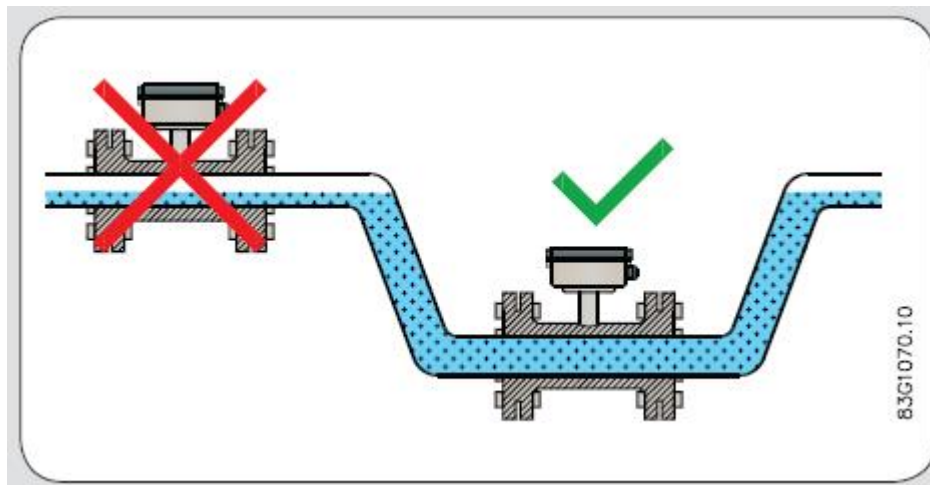
Short circuit 82/83 – common mode noise  
Short circuit 82/83/0 – internal insulation noise

# Installation

## Horizontal pipes

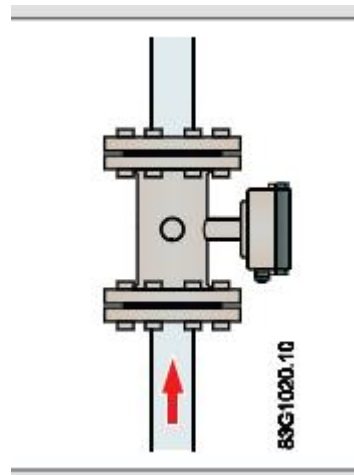


Partly filled pipe

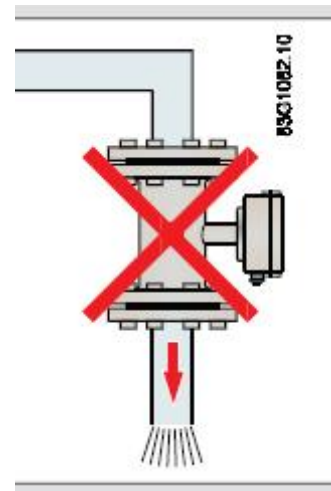


# Installation

## Vertical pipes



Flow in upward direction

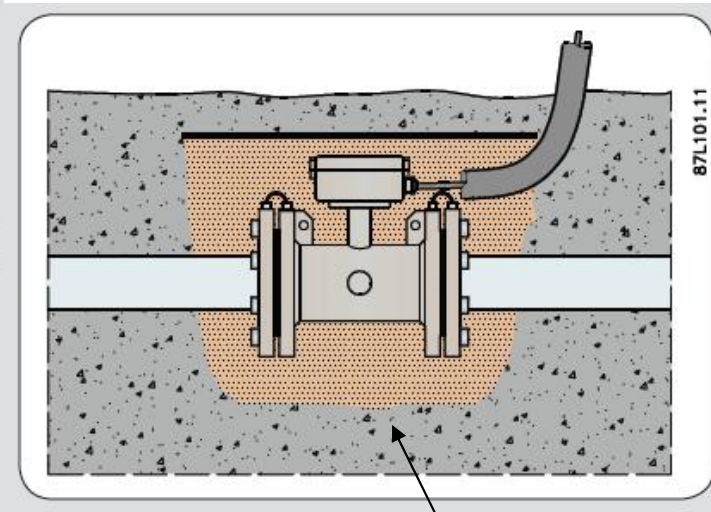
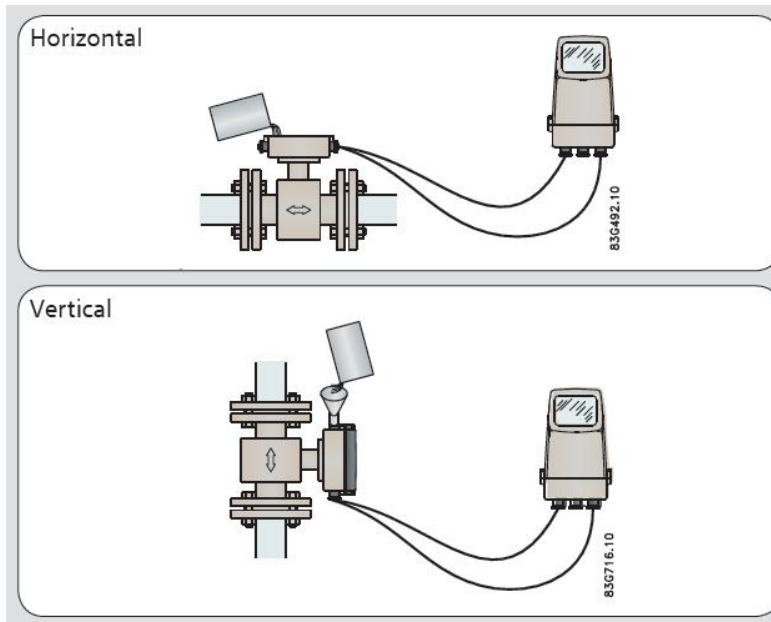




# Installing MAG 3100 and MAG 5100 W

Update to IP68

Direct burial



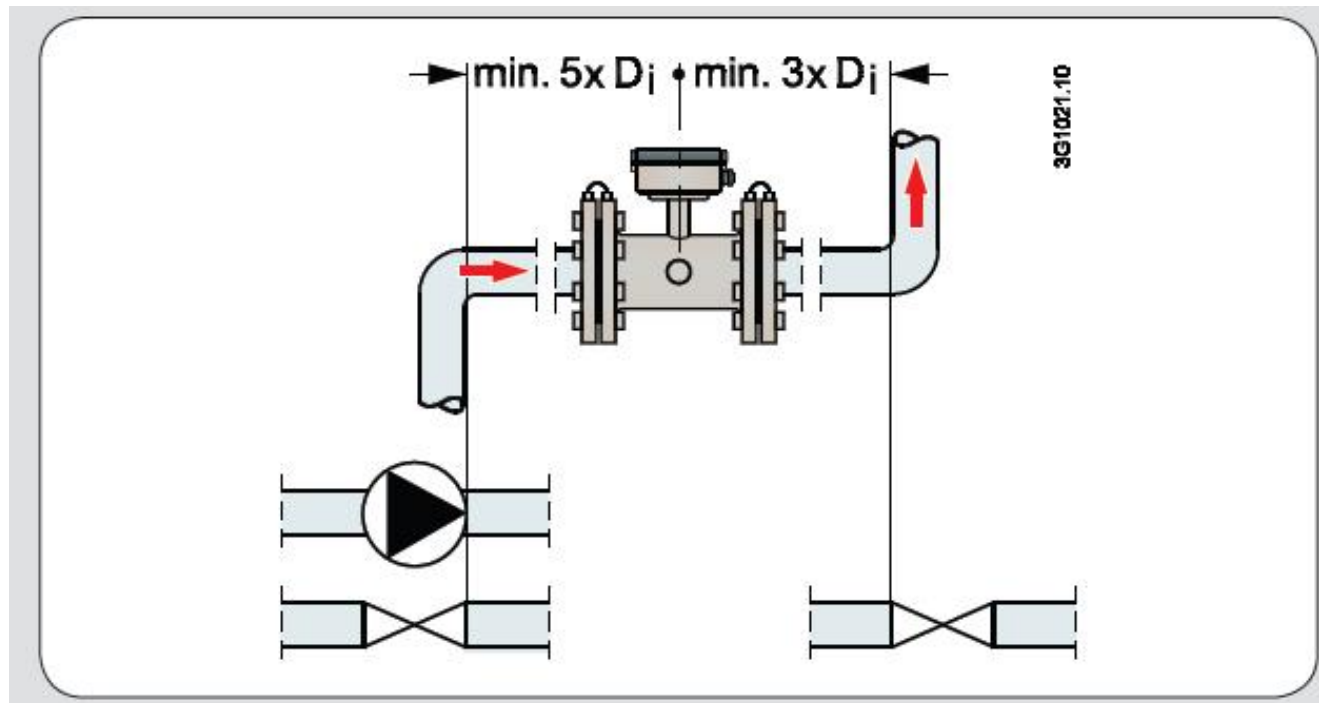
Pea Gravel



IP68 Potting kit

## Selecting a suitable location

Choose a location that provides at least 5 x diameter before and 3 x diameter after the sensor.



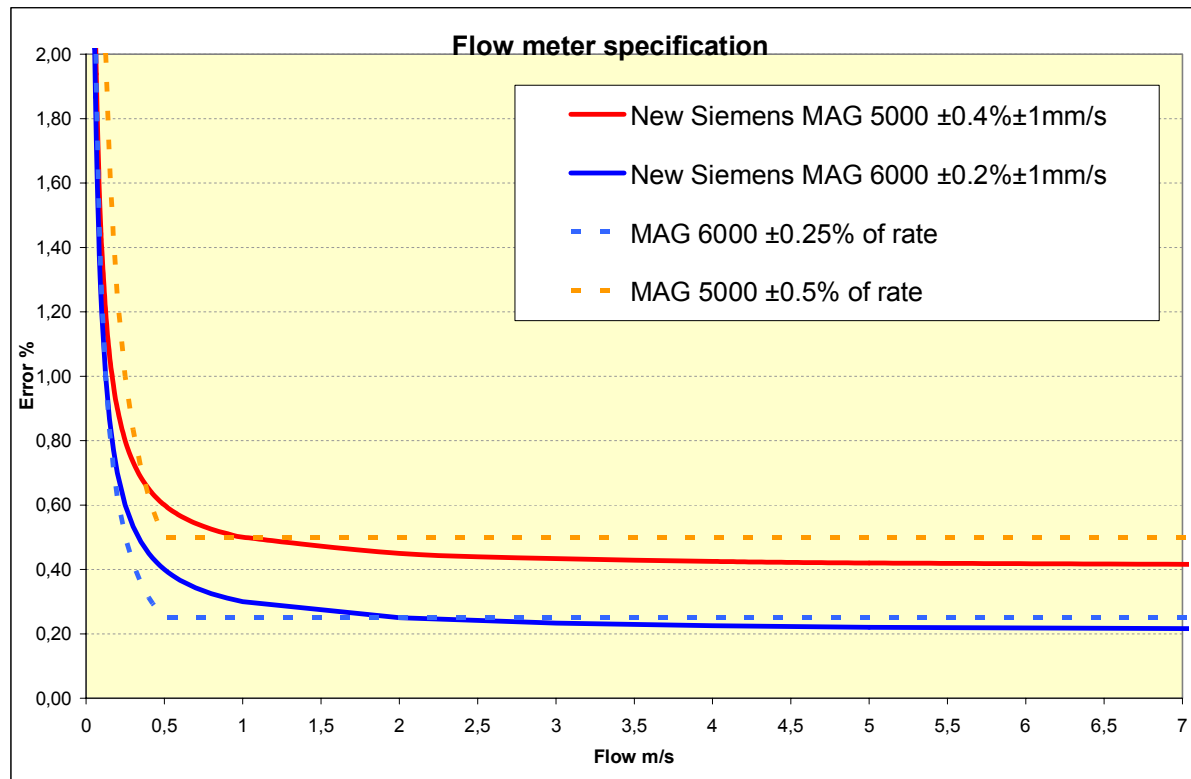
# SITRANS F M MAG 5000/ MAG 6000

## Accurate flowmeters from Siemens

**Max. measuring error (incl. sensor and zero point)**

MAG 5000 0.4 % ± 1mm/s (changed from 0.5% of rate)

MAG 6000 0.2 % ± 1mm/s (changed from 0.25 % of rate)

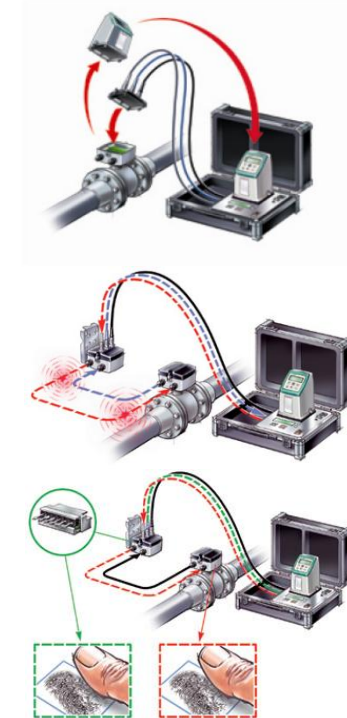


Repeatability: 0.1%

## Working principle

In situ verification of a complete flowmeter

- Transmitter test of gain, linearity, offset and output
- Sensor test of insulation and magnetism
- Insulation test of interconnecting cable installation
- Verify against the original wet calibration parameters held as “fingerprints” in the SENSORPROM<sup>®</sup> unit



***Is straightforward to use,  
a full automatic verification in only 15 minutes  
and no need for special equipment***

## Sensorprom concept

Each flow meter has its own identity stored in the SENSORPROM.

The information consists of:

- **Calibration data**
- **“Fingerprint” – magnetism properties**
- **Setup and programming data**



The individual calibration and fingerprint data are factory pre-programmed, whereas the setup data are customer individual.

This individual and unit unique information ensures a cost effective, easy and error free installation.

**Sensorprom**

*MAG 3100*

*MAG 3100 P*

*MAG 5100 W*

*MAG 1100*

*MAG 1100 F*



# Verification certificate

## SIEMENS MAGFLO® Verification Certificate

<b>Customer:</b>		<b>MAGFLO® Identification:</b>	
Name	_____	TAG No./Name	0 _____
Address	_____	Sensor Code No.	083G4054 _____
	_____	Sensor Serial No.	089904T361 _____
Phone	_____	Transmitter Code No.	083F5003 _____
Email	_____	Transmitter Serial No.	567022N520 _____
		Location	_____

<b>Results:</b>	<b>Verification file name or No.</b>	File #1 _____
	<b>Transmitter</b>	Passed _____
	<b>Sensor</b> Insulation	Passed _____
	Magnetic Circuit	Passed _____

Velocity	Current Output			Frequency Output		
	Theoretical	Actual	Deviation	Theoretical	Actual	Deviation
0.5m/s	4.800mA	4.801mA	0.08%	0.500kHz	0.500kHz	-0.01%
1.0m/s	5.600mA	5.600mA	-0.02%	1.000kHz	1.000kHz	0.01%
3.0m/s	8.800mA	8.796mA	-0.09%	3.000kHz	3.000kHz	0.01%

Current Output 4-20mA      Frequency Output 0-10kHz

<b>Transmitter Settings:</b>		<b>Sensor Details:</b>		
<b>Basic</b>	Qmax	50.0000 m³/h _____	Size	DN 80 3 IN _____
	Flow Direction	Positiv _____	Cal. Factor	1.0 _____
	Low flow Cut-off	1.50% _____	Correction Factor	1.0 _____
	Empty Pipe	OFF _____	Excitation Freq.	6.25Hz _____
<b>Output</b>	Current Output	OFF _____	<b>Verificator Details (083F5060)</b>	
	Time Constant	N/A _____	Serial No.	017807N242 _____
	Relay Output	Error Level _____	Device No.	83462 _____
	Digital Output	Pulse _____	Software Version	1.40 _____
	Frequency Range	N/A _____	PC-Software Version	5.00 _____
	Time Constant	N/A _____	Cal. date	2006.01.01 _____
	Volume/pulse	1 m³/p _____	ReCal. date	2006.01.01 _____
	Pulse width	N/A _____		
	Pulse polarity	N/A _____		
	Totalizer 1 value before test	0.00000 m³ _____		
	Totalizer 1 value after test	0.56992 m³ _____		
	Totalizer 2 value before test	0.00000 m³ _____		
	Totalizer 2 value after test	0.56992 m³ _____		
	Operating time in days	3 _____		

<b>Comments</b>

These tests verify that the flowmeter is functioning within 2% deviation of the original test parameters.  
Verification is traceable to National and International Standards.

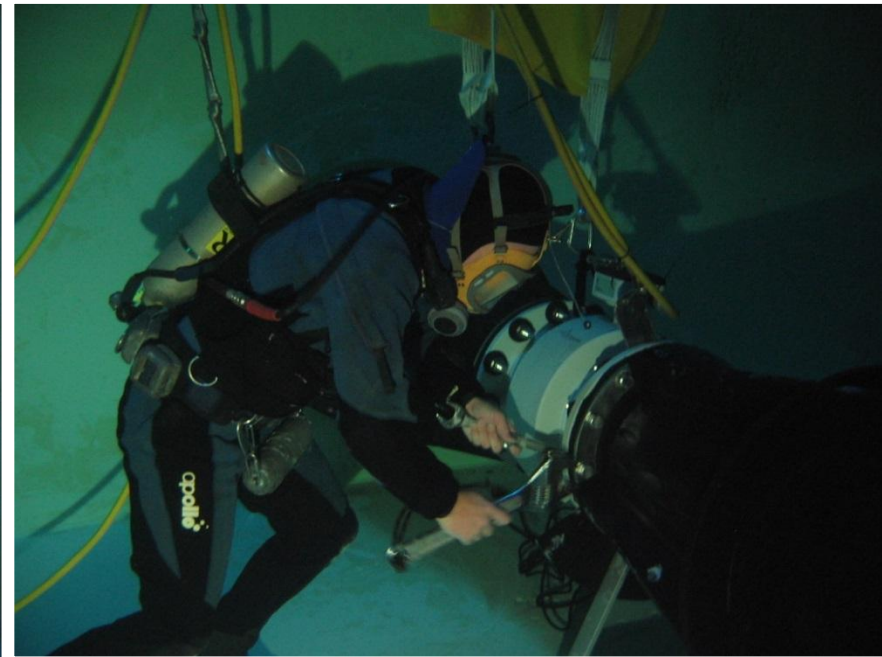
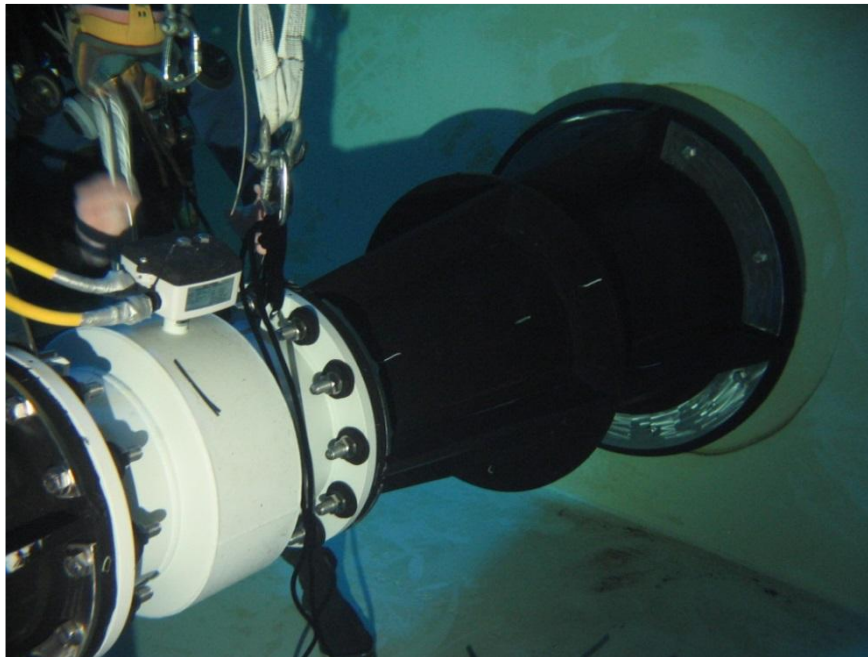
Date and signature \_\_\_\_\_

2006.01.01

# Applications

Sydney Water, Australia – water both inside and outside the meter

SIEMENS



# Applications MAG 3100 Uranium mining in Kazakhstan





# SITRANS F M MAG 8000

## Battery-operated electromagnetic water meter

- Low-powered transmitter on volume-produced sensor program (same sensor with different calibration)
- Unique 6 years operation on internal battery pack
- Default IP 68 (10m) / Nema 6P encapsulation rating
- Developed after OIML R 49 – global water meter spec., conforms with European CEN EN 14154 and ISO 4064
- Dedicated functions – leakage, tariff and data logger



Internal 3-year life battery pack for Irrigation



Internal 6-year life battery pack



External 10-year life battery pack



Mains power supply



Mains power with up to 3 years battery back-up



# SITRANS F M MAG 8000 - Advanced functions Introduction



SITRANS F M MAG 8000 provide several functionalities that help customers detect, prevent, analyse and use application information for billing purposes.

Access to this information is via the FlowTool or the SIMATIC PDM using the IrDA interface on the MAG 8000.

# SITRANS F M MAG 8000 - Advanced functions

## Leakage detection

### Function

- The leakage program helps to predict a leakage rising over time.
- Leakage is monitored on flow rate or volume.
- A leakage alarm is enabled if the measured value continually exceeds a leakage limit over a longer time.
- The leakage limit is defined as a fixed value or the lowest measured value inside the leakage period with a fixed limit add on.
- The possible leakage value is measured 24 hours in a defined leakage time window.
- An additional leakage day counter is include to see the active periods before a leakage alarm is activated.
- The leakage alarm can be reset manually.



# SITRANS F M MAG 8000

## Typical Applications - MAG 8000 Compact IP68

Company: MID Kent Water

Location: United Kingdom

Task: Water Supply



# SITRANS F M MAG 8000

## Benefits

- Precise Metering
  - Easy to install
  - Superior measurement
  - Ownership - Long lasting performance
  - Intelligent Information – Easy to access
- ✓ Precision
  - ✓ Intelligent
  - ✓ Communication
  - ✓ Ownership

The water meter of choice for water supply and metering



# SITRANS F M MAG 8000 Installed base



# Siemens Flow Instruments

- The production facilities for MAG flow meters



Configuration Center



**Thank you very much**



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**[www.Siemens.com/flow](http://www.Siemens.com/flow)**