Magnetic flowmeters

- Product family introduction
- Principle of operation
- Product review
- Applications
- Key product features
Siemens offers a comprehensive selection of electromagnetic flow meters

- Water & waste water
- Chemical
- Food & beverage
- Mining
- Aggregates
- Cement
- Pharmaceutical
- Paper & pulp
- Power & utilities

Modular pulsed DC magnetic flow meter program
How it works…

- Based on Faraday’s law of Electromagnetic Induction, a voltage \( (U_i) \) is induced at the ends of an electrical conductor \( (L) \) when it’s moved (velocity \( v \)) perpendicularly to the lines of flux of a magnetic field \( (B) \).

\[
U_i = L \times B \times v
\]

\( U_i = \) Induced voltage
\( L = \) Inner pipe diameter \( = k_1 \)
\( B = \) Magnetic field strength \( = k_2 \)
\( v = \) velocity of conductor
\( k = k_1 \times k_2 \)

\( U_i = k \times v \), the electrode signal is directly proportional to the fluid velocity.
**Voltage** = \( L \times B \times v \)

**Q** = **V** \( \times A \)

Simply stated...

*The faster water flows through the magnetic field, the greater the voltage created*
Voltage = L x B x v
Q = V x A
Simply stated…
The faster water flows through the magnetic field, the greater the voltage.
**SITRANS F M**

**Product family**
- MAG 1100 F
- MAG 1100
- MAG 1100 with adaptors
- MAG 6000
- MAG 6000 with adaptors

**Principle of operation**
- Wall mount junction box

**Product overview**
- MAG 6000 I (Exd)
- MAG 6000/Ex safety barrier IP 66 / Nema 4
- MAG 5000/6000 19" panel mt IP 20 / Nema 2
- MAG 6000 Cleaning IP 66 / Nema 4

**Application**
- Wall mount junction box

**Key features**
- Greater flexibility
- Compact or remote
- One type transmitter for all sizes
- Industry specific transmitters and sensors
- Streamlined product range
- Flexible logistics handling
- Quick reaction to changing customer demands – even after ordering - delivery

**In brief: competitiveness**
SITRANS F M

Product family

MAG 1100
- Flangeless wafer design
- Corrosion resistant
- Highly resistant liner and electrodes

MAG 1100 F
- Specially design for food & beverage and pharmaceutical industry
- Sanitary connections
- No performance issues when solids are present
- Unaffected by viscoscity and temperature changes

MAG 5100 W
- A sensor for all water and wastewater applications
- Coned design
- Suitable for burial and constant flooding
- Complies with drinking water and custody transfer approvals

MAG 3100 P
- Sensor for process and chemicals industries
- PFA/PTFE liner and Hastelloy electrodes
- Designed to withstand harsh environments with strong chemicals, high temperature and pressure

MAG 3100
- Wide range of sizes and supports special request construction
- Liners and measuring electrodes capable of withstanding the most extreme processes
- Fully welded construction

Flow seminar

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What makes Siemens SITRANS F M simply better?

<table>
<thead>
<tr>
<th>Product family</th>
<th>Principle of operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greater flexibility</td>
<td></td>
</tr>
<tr>
<td>Compact or remote installation using the same transmitter and sensor</td>
<td></td>
</tr>
<tr>
<td>USM II communication platform for easy integration with all systems</td>
<td></td>
</tr>
</tbody>
</table>

| Easier to commission |
| SENSORPROM memory unit enables instant measurement from the measurement from power-up |
| User settings automatically stored in the SENSORPROM |

| Easier to service |
| Transmitter replacement requires no re-programming. |
| SENSORPROM automatically updates all settings after initialization |
| Comprehensive self-diagnostic for error indication and logging |

| Room for Growth |
| Plug & play communication modules: Profibus PA & DP, HART, Modbus RTU, Foundation Fieldbus |
| Add-on communication modules allow future upgrades |

1. Plug & Play Communication Module
2. SENSORPROM M memory unit
<table>
<thead>
<tr>
<th>Sensor</th>
<th>MAG 1100</th>
<th>MAG 1100 F</th>
<th>MAG 3100</th>
<th>MAG 3100 P</th>
<th>MAG 5100 W</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size DN</td>
<td>2–100 mm / 1/12”– 4”</td>
<td>10–100 mm / 3/8”– 4”</td>
<td>15–2000 mm / 1/2”–78”</td>
<td>DN 15–300 / 1/2”– 12”</td>
<td>25–1200 mm / 1”– 78”</td>
</tr>
<tr>
<td>Pressure rating max.</td>
<td></td>
<td></td>
<td>PN 100 / Max 1450 psi* / ANSI 150 &amp; 300 / AWWA D / AS 2129 / AS 4087</td>
<td>PN 40 / Max 580 psi / ANSI 150</td>
<td>PN 10 &amp; 16 / ANSI 150 / AWWA D / AS 4087</td>
</tr>
<tr>
<td>Liner material</td>
<td>Ceramic</td>
<td>PFA</td>
<td>Neoprene, EPDM, Ebonite LINATEX, PTFE</td>
<td>PTFE, PFA</td>
<td>Ebonite, NBR, EPDM</td>
</tr>
<tr>
<td>Electrode material</td>
<td>Platinum</td>
<td>Hastelloy C</td>
<td>316 SS, Hastelloy C, Titanium,</td>
<td>Hastelloy C276</td>
<td>Hastelloy C276</td>
</tr>
<tr>
<td>Approvals</td>
<td>ATEX II 2GD</td>
<td>ATEX II 2GD, 3A, EHEDG design, FDA</td>
<td>ATEX II 2GD</td>
<td>ATEX II 2GD</td>
<td>Drinking Water WRAS; NSF 61; DVGW; Belgaqua; ACS</td>
</tr>
<tr>
<td>Custody transfer approval</td>
<td>Cold water pattern approval - PTB. Heat meter pattern approval - OIML R 75</td>
<td>Cold water pattern approval - PTB. Hot water pattern approval - PTB. Other media than water - OIML R 117</td>
<td>Cold water pattern approval - DANAK TS 22.36.001, PTB. Heat meter pattern approval - OIML R 75. Hot water pattern approval - PTB. Other media than water - OIML R 117</td>
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<td>Cold water pattern approval - MI-001, OIML R 49, PTB</td>
</tr>
</tbody>
</table>

* PN 40 / Max 580 psi

** ANSI 150 & 300 / AWWA D / AS 2129 / AS 4087

* OIML R 75.
## Transmitters

<table>
<thead>
<tr>
<th>Transmitters</th>
<th>Mag 5000 / 5000CT</th>
<th>Mag 6000 / 6000CT</th>
<th>Mag 6000i</th>
<th>Mag6000i (Exd)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enclosure</td>
<td>IP67 / NEMA 4X or IP20/66 / NEMA 2/4 Polyamide</td>
<td>IP67 / NEMA 4X die-cast aluminium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max measuring error</td>
<td>0.40 % of rate</td>
<td>0.20 % of rate</td>
<td>0.20 % of rate</td>
<td>0.20 % of rate</td>
</tr>
<tr>
<td>Display</td>
<td>3-line alpha numeric LCD with backlight</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inputs &amp; outputs</td>
<td>1 digital input, 1 current output, 1 pulse/frequency output, 1 relay output</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication</td>
<td>HART</td>
<td>HART; Profibus PA/DP: Modbus RTU: Foundation Fieldbus: Devicenet</td>
<td>HART; Profibus PA</td>
<td></td>
</tr>
<tr>
<td>Batch function</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Approvals</td>
<td>FM/CSA Class 1, Div 2</td>
<td></td>
<td></td>
<td>ATEX II 2GD</td>
</tr>
<tr>
<td>Custody transfer approval</td>
<td>Cold water pattern approval - MI-001, OIML R 49, PTB</td>
<td>Cold water pattern approval - MI-001, OIML R 49, DANAK TS 22.36.001, PTB. Heat meter pattern approval - OIML R 75. Hot water pattern approval - PTB. Other media than water - OIML R 117</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Guaranteed performance

- Compact or remote installation
- Superior signal resolution for optimized turn down ratio
- Digital signal processing with unlimited possibilities
- User configurable operation menu with password protection
- Multiple functional output for process control
- Self-diagnostics for error detection and logging
- Batch control
- Multi-lingual display and keypad interface
- Custody transfer approved
- Electrode cleaning accessory option
Calibration Report:

1. Every sensor is wet calibrated
2. Shipped with every sensor is the actual calibration report.
3. ”4 point” – 2 flow rates, 2 times each.
4. Accredited calibration lab.
5. Replacements available for lost certs..
### SITRANS F M

**MAG 1100 & MAG 1100F (Food)**

<table>
<thead>
<tr>
<th>Product family</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>1/2” to 4”</td>
</tr>
<tr>
<td>Liner</td>
<td>Ceramic or PFA</td>
</tr>
<tr>
<td>Electrodes</td>
<td>Platinum or Hastelloy C</td>
</tr>
<tr>
<td>Accuracy</td>
<td>0.5% (PFA)</td>
</tr>
<tr>
<td></td>
<td>0.25% (ceramic / MAG 6000)</td>
</tr>
</tbody>
</table>

**Product overview**

<table>
<thead>
<tr>
<th>Enclosure</th>
<th>NEMA 4x &amp; NEMA 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approvals</td>
<td>3A</td>
</tr>
</tbody>
</table>

**Application**

<table>
<thead>
<tr>
<th>Fittings</th>
<th>MAG1100: Studs and nuts included</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MAG1100F: Tri-Clamp or Tri-Clover (optional)</td>
</tr>
</tbody>
</table>
## MAG 3100 / 3100P

### Product family
- **Size**: 1/2" to 80"
- **Measuring range**: up to 500,000 GPM
- **Liner**: Neoprene, Ebonite, EPDM, PTFE, Linatex, Tantalum
- **Electrodes**: Stainless 316 Ti, Hastelloy, Titanium, or Platinum
- **Temperature**\(^*\): -40 to +356 °F
- **Maximum pressure**\(^*\): 1500 psi
- **Accuracy**: 0.25% of actual flow w/MAG 6000
- **Enclosure (sensor)**: NEMA 4x & NEMA 6 (NEMA 6P optional w/sub. kit)
- **Approvals**: FM Class 1, Div. 2,

\(^*\)Dependent on flanges and liner

### Application
- Process and Chemical industry
- Short delivery time (5 days)
- Competitive pricing for the MAG 3100 P
- High Temperature for “FREE”
- Verificator compatible

### Key features
**Sizes**: PFA: 1", 2", 3", 4"

PTFE: ½", 1", 1 ½", 2", 2 ½", 3", 4", 5", 6", 8", 10", 12"

**Liner material**: PTFE 130 °C (266 °F) and PFA 150 °C (300 °F)

**Electrode material**: Hastelloy

**Flanges and Pressure rating**: EN flanges PN10, PN16, PN40, ANSI 150

**Approvals**: FM, UL C-tick, conforms to CE, PED and ATEX

**Transmitters**: MAG 5000 / 6000 and MAG 6000 I / MAG 6000 Ex d
MAG 5100W (Water & Wastewater)

- **Size**: 1” to 78”
- **Liner**: New hard rubber liner
- **Electrodes**: Hastelloy
- **Flanges**: ANSI 150# or AWWA
- **Accuracy**: 0.20% with MAG 6000
- **Enclosure**: NEMA 4x & NEMA 6 (6P optional)
- **Approvals**: NSF 61 (drinking water)
All Sitrans f m MAGFLO meters are calibrated on approved calibration rigs (ISO 9001, DANAK, UKAS, PTB, CT, EN 45001, CE, NIST)

In-situ MAGFLO verification – three simple steps

Transmission test
Cross-talk test
Boost test

MAGFLO Verification Certificate

SENSORPROM
- Sensor information and identification
- Calibration parameter
- Fingerprint

In-situ verification
- No interruption of flow
- Full installation test
- Fully automated verification in less than 15 minutes
The New MAG 8000W Battery-Powered Magmeter

- 0.5% accuracy
- 6-year battery life (ext. pack up to 10 years)
- For water distribution, leak detection, revenue & billing, irrigation, etc.
- Built-in data-logger (by day, week, or month)
- IrDA with USB download connection to Laptop
- 2-pulse outputs for volume, alarm, or call-up
- Allows tamper-evident seals
- Stainless Steel construction, lid protects display, rated NEMA 4X and NEMA 6P
- Evident seals for CT use
- Modbus RTU Optional Communications
**Transmag 2**

**Pulsed AC Field MAGFLO meter**
Goes beyond where conventional DC MAG’s stop

**Applications**
- High concentration pulp stock
- Heavy mining slurries
- Mining slurries with magnetic particles/minerals

**Product family**

**Principle of operation**

**Product overview**

**Application**

**Key features**

**Pulsed AC-technology**
- More than 10 times stronger magnetic field signal
- High excitation frequency
- Stable zero-point
- Fast responding and stable flow signal

**Compensation coil**
- Second coil circuit to compensate for magnetic particles & main power supply fluctuations
# SITRANS F M

## Conductive Liquids
- Tap Water
- Ground water
- Wastewater
- Sodium Chloride (salt)
- Acid solutions
- Sodium Hydroxide
- Lime Solutions
- Black Liquor
- Pulp Stock
- Hydrogen Peroxide
- Ammonium
- Latex Paint
- Beer, Wine
- Fruit Juices
- Some polymers

## Non Conductive Liquids
- Animal Fats and oils
- Vegetable oils
- Gasoline
- Acetone
- Deionized Water
- Benzene
- Carbon Tetrachloride
- Enamel Paint
- Monomers
- Sugar solutions
- Some polymers
Applications

- **Chemicals:** Acids, alkaline solutions, solvents, cooling liquids (glycol), additives
- **Pharmaceutical/Health Care:** Acids, solvents, coating liquids, lotions, creams
- **Food:** Water, beer, wine, spirits, milk, yogurt, soft cheese, juices, molasses, Sugar and salt solutions, blood, sausage pulp
- **Metal Industry:** Pump control, cooling water, circulated water
- **Effluent:** Effluent raw sludge, purified sludge, neutralization chemicals, milk of lime, flocculants, polymers
- **Drinking Water:** Supply water, reservoir and pumping stations, consumption
- **Wood Chip:** Measurement and dosing of glue, pulp stock
- **Textiles:** Water, chemicals, dyes, bleaching agents
- **Photography:** Emulsions
- **Power Station:** Differential measurement of cooling circuits, heat quantity measurement
- **Animal Feed:** Water, molasses, liquid feed
Robust Construction; The fully welded body has no joints in Robust that will allow the ingress of water.

IP68 Rating; By use of the submersible kit, 085U0220 the flowmeter can be made fully IP68 to 10 meters depth.

Superior Paint Finish; Suitable for all but the most extreme environments the excellent bonding prevents corrosion from propagating from surface flaws.

Economics; It is usually far cheaper to be able to install a flowmeter without having to construct purpose made chambers.

Fully Bonded Lining; No opportunity for water ingress between the lining and the inner tube.

Flexibility; Provides the opportunity to install flowmeter in positions not originally planned.

Remote Verification; Access to the meter tube not required for verification to take place.

Applications

IP68 MAG3100’s with EPDM liner
Submersion Kit – NEMA 6P

Submersion Kit FDK-085U0220:
- Compatible with all sensors
- Add to wired sensor in the field for flood or condensation protection.
- Increases enclosure rating to NEMA 6P – 10m continuous submersion.

- Clear material – wiring can be viewed.
- Self healing/repairing – terminals can be probed and will reseal.
- Non-permanent – can be removed for repair/rewiring.
These are optimal – when in a tight spot, sacrifice the downstream lengths first.
Installation Tips

Keep the pipe full!
With partially full pipes or pipes with free outlet, the flowmeter should be located in a U-tube. The sensor must always be full of liquid.
Installation Tips

Keep the pipe full!
Installation at the highest point in the system
Installation in vertical pipes with free outlet (some back pressure is recommended)
Installation Tips

Position B
Electrodes reading across the flow profile

Position A
Electrodes reading in one plane of the flow profile
Magnetic flowmeters

- Sizes from 1/12” – 78” (84”)
- Variety of Styles and configurations
- Integrated sensor prom
- Verificator
- Food grade meters
- 0.2% - 0.4% accuracy
- Service menu
- Field upgradeable communication modules (Mag 6000)
- Every meter is wet calibrated and supplied with an NIST certificate
- Submersible kits providing protection up to NEMA 6P
- 3100 series Mag meters available with custom lay lengths