



SITRANS FM

Electromagnetic Flowmeters

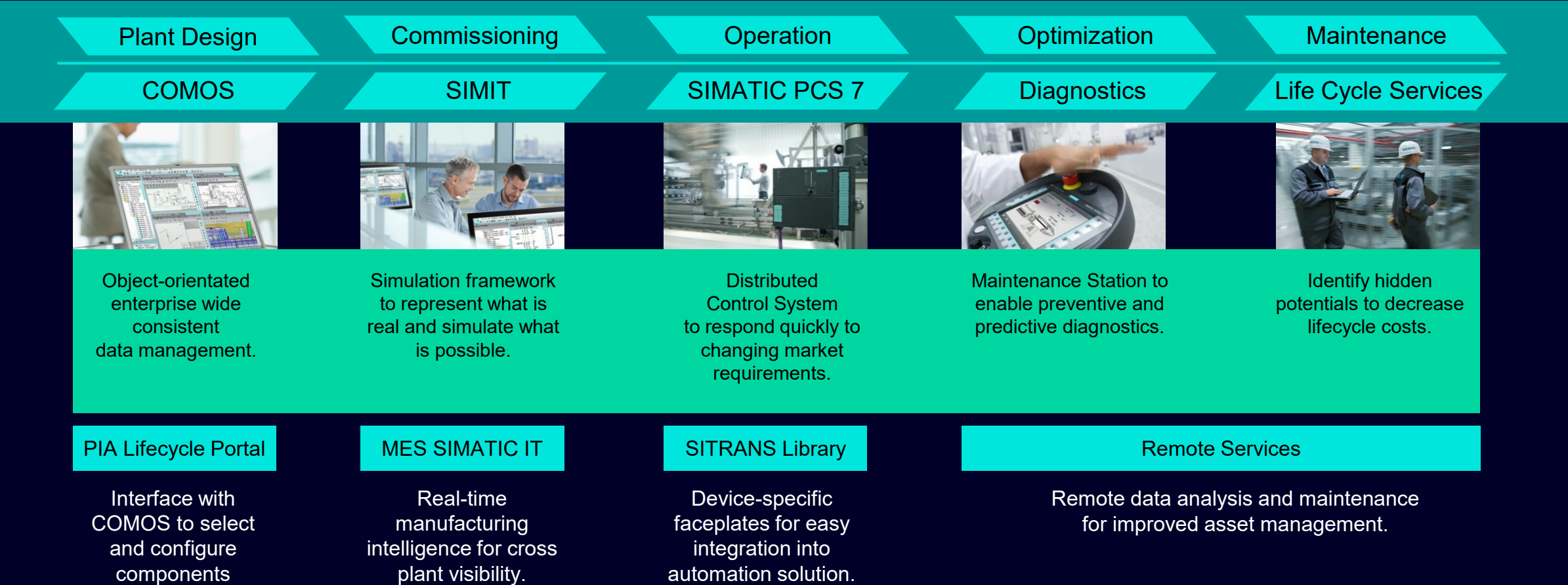
[siemens.com/sitransfm](https://www.siemens.com/sitransfm)

Agenda



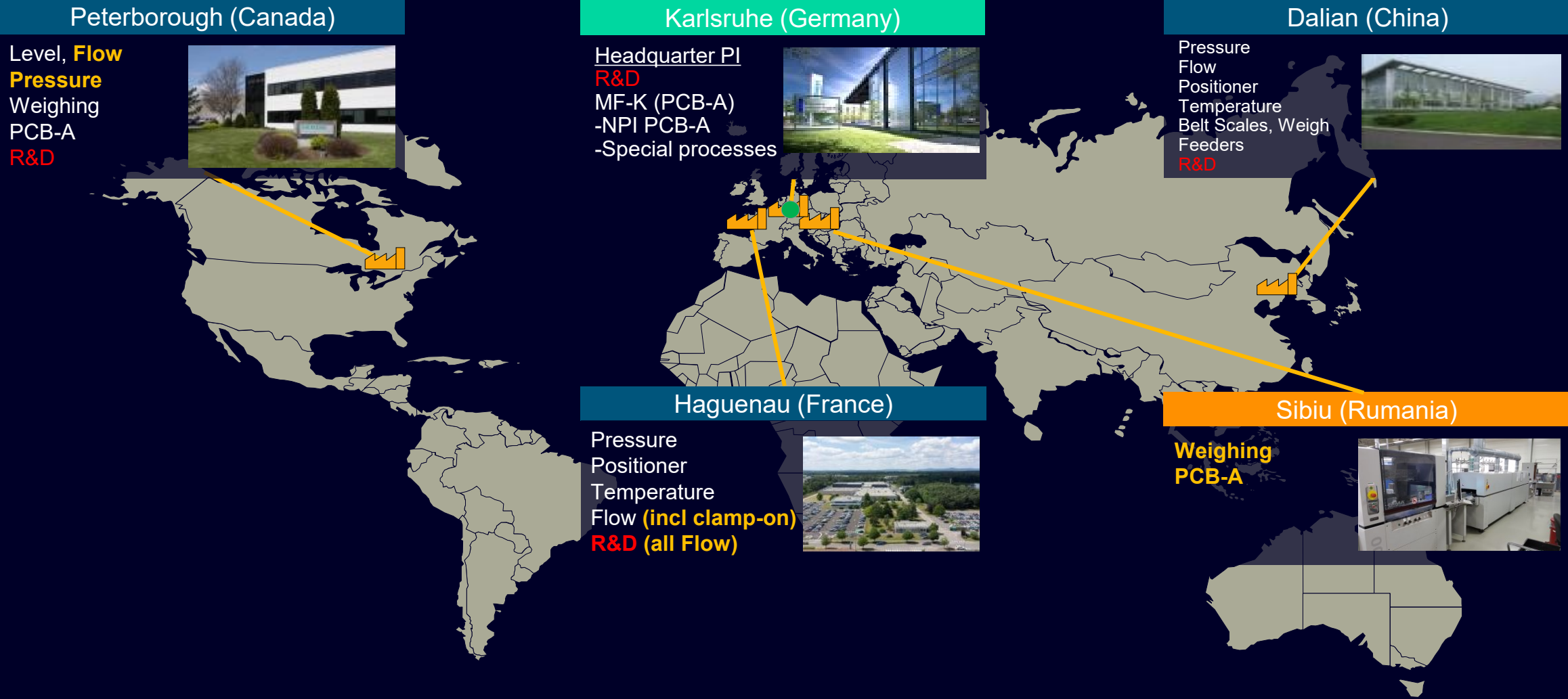
- Introduction of Siemens Process Instrumentation 2
- Product description 11
- MAG 5100W 25
- MAG 8000 33
- MAG 3100 46
- MAG 1100 57
- TransMag 2 (MAG 911E) 66

Customer benefits along the entire lifecycle of the plant using our tools



Field Instruments Global Operations – next to our customer

Reduce delivery time and maintain proximity to our customer base



Production facility in Europe

Lead-factory Haguenau, France

Production of SITRANS P, SITRANS T, SIPART PS2 and SITRANS F (F M & F US) series

Highlights

- More than 500,000 products produced each year
- Specialized in process instrumentation and automation for 40 years
- Production, testing, maintenance and state-of-the-art calibration on site



Flow: Highest safety level and cleanliness especially for your sensitive processes or drinking water customers

1. Flowmeter design:

Siemens flowmeters have an optimum flow performance. This impedes the growth of biofilms and constitutes a considerable advantage compared to mechanical turbine meters.

2. High standards of hygiene:

Siemens guarantees effective disinfection of the water used for calibration.

3. High-tech disinfection:

Legionella and *Pseudomonas* are securely inactivated during the calibration of our flowmeters. This ensures a high hygienic standard for our customers.



Disinfection
dosing

Zero Defect Culture

Implement quality – manage quality

Operations

- Standardized Siemens production system
- Lead factory concept
- Lean manufacturing

Quality

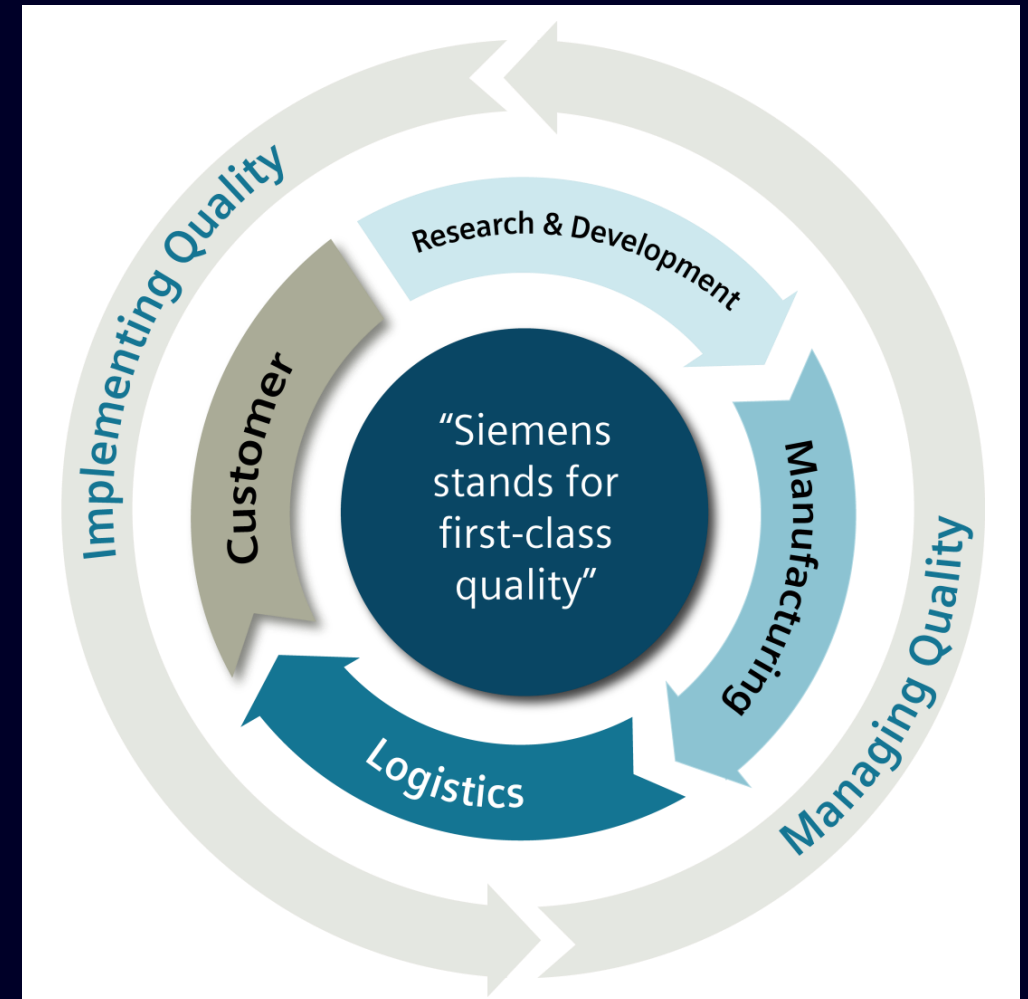
- Quality standards in processes and projects – Zero Defect Culture
- Strict quality reporting
- Project quality manager

Logistics

- Optimized supply performance
- Quick Ship program

Service

- World wide experienced service organization
- Application support via Tech-line in the headquarter



Agenda



- Introduction 2
- **Product description, MAG-Inductive Principle** 11
- MAG 5100W 25
- MAG 8000 33
- MAG 3100 46
- MAG 1100 57
- TransMag 2 66

SITRANS FM program offers a complete range of magnetic flowmeters for conductive fluids

The SITRANS FM program consists of three different flowmeter types:



Standard

- Traditional pulsed DC magnetic flowmeters:
MAG 3100,
MAG 5100W,
MAG 1100



Advanced

- Advanced high-strength AC magnetic flowmeters:
MAG911E



Battery driven

- Battery driven water meters:
MAG8000

We have an instrument for all applications, including real challenges such as:
remote, high solid content and slurries

Product data overview	MAG 1100	MAG 3100	MAG 5100W	MAG 8000	MAG911E
Drinking Water	X	X	X	X	
Wastewater	X	X	X		
Chemicals	X	X			
Food and Beverage	X		X		
Pulp and Paper		X			X
Light Slurries		X	X		X
Heavy Slurries					X
Wireless Applications*				X	

*RTU3030C secures wireless access in combination with all MAG-Meters

MAG Field of Applications:

from high to very low conductivity, from liquid to paste

Standard electromagnetic flowmeter measures homogeneous and conductive liquids.

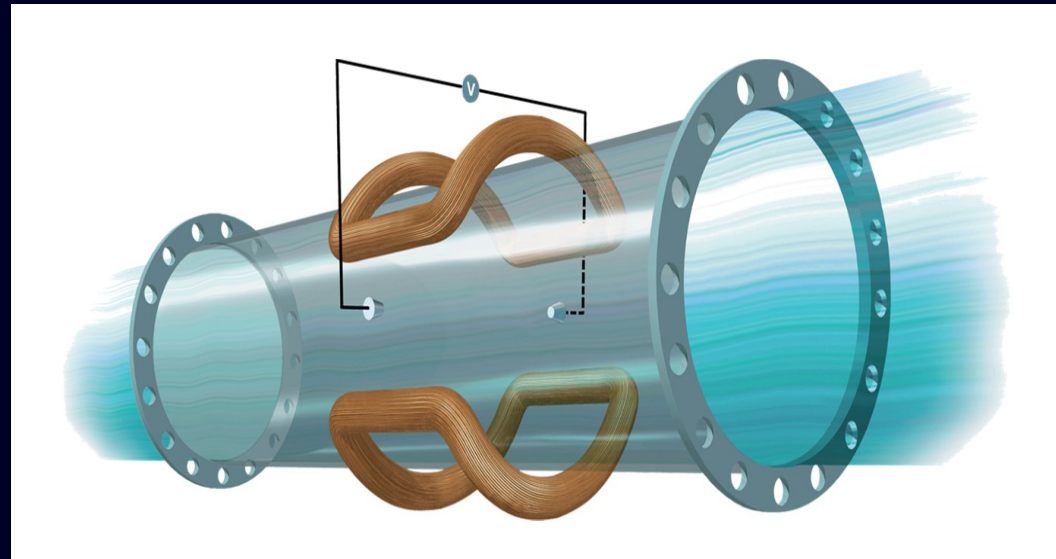
- MAG 5100, MAG 3100, MAG8000, MAG 1100 > 5 μ S

Transmag (AC-meter) handles challenging conditions

- Transmag FM911 > 1 μ S/cm and heavy slurries (~70% solids)

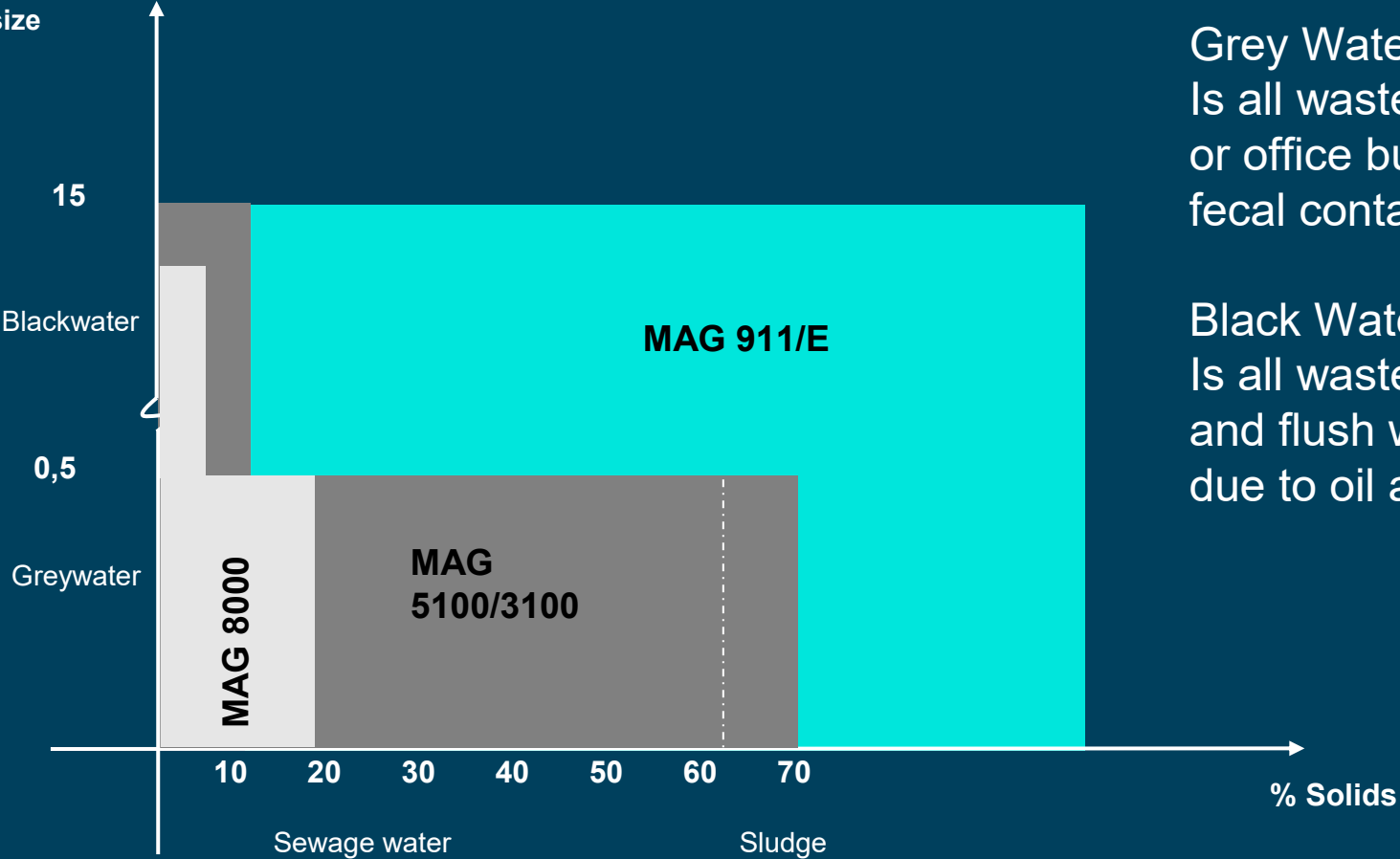
Examples

Drinking water	✓
Treated water	✓
Irrigation	✓
Wastewater	✓
Liquids including solids	✓



Example Instrument selection for wastewater covering full range of applications

Particle size (mm)

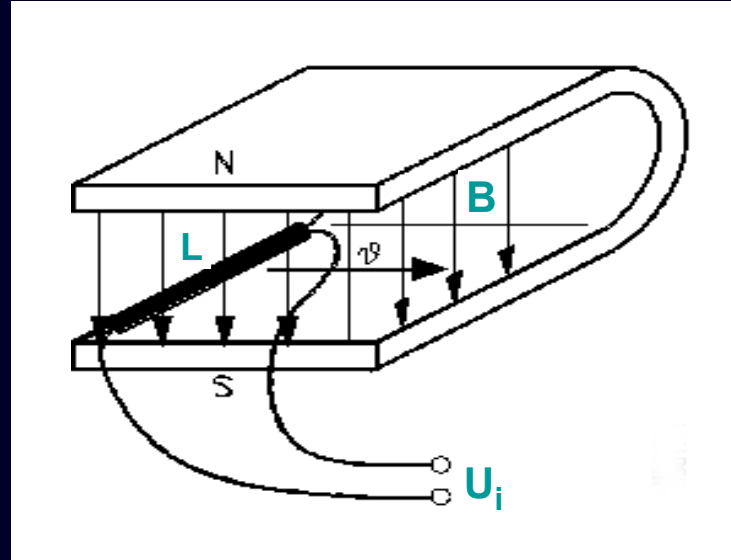
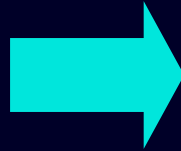
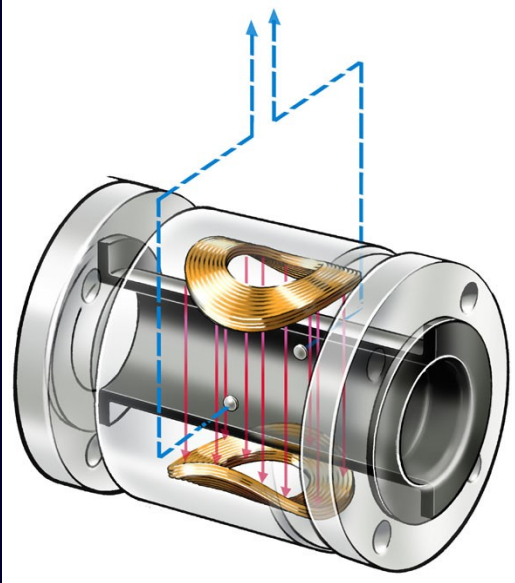


Grey Water (Sullage):
Is all wastewater generated in households or office buildings from streams without fecal contamination

Black Water:
Is all wastewater containing feces, urine and flush water from toilets and kitchens due to oil and fat

SITRANS FM:

flow measurement via electromagnetic induction principle



$$U_i = L \times B \times v$$

Explanation:

Voltage U_i is induced at the electrical conductor with a length L , moving at a speed of v , perpendicular to the flow lines through a magnetic field with a strength of B .

Metrology of MAG – In theory:

How a MAG-meter is classified, proper dimension, low flow properties

MAG flowmeters are calibrated and then verified using a verification ratio $R = Q3/Q1$

Q1: Minimum flow

Q2: Transition flow

Q3: Nominal flow

Q4: Maximum flow

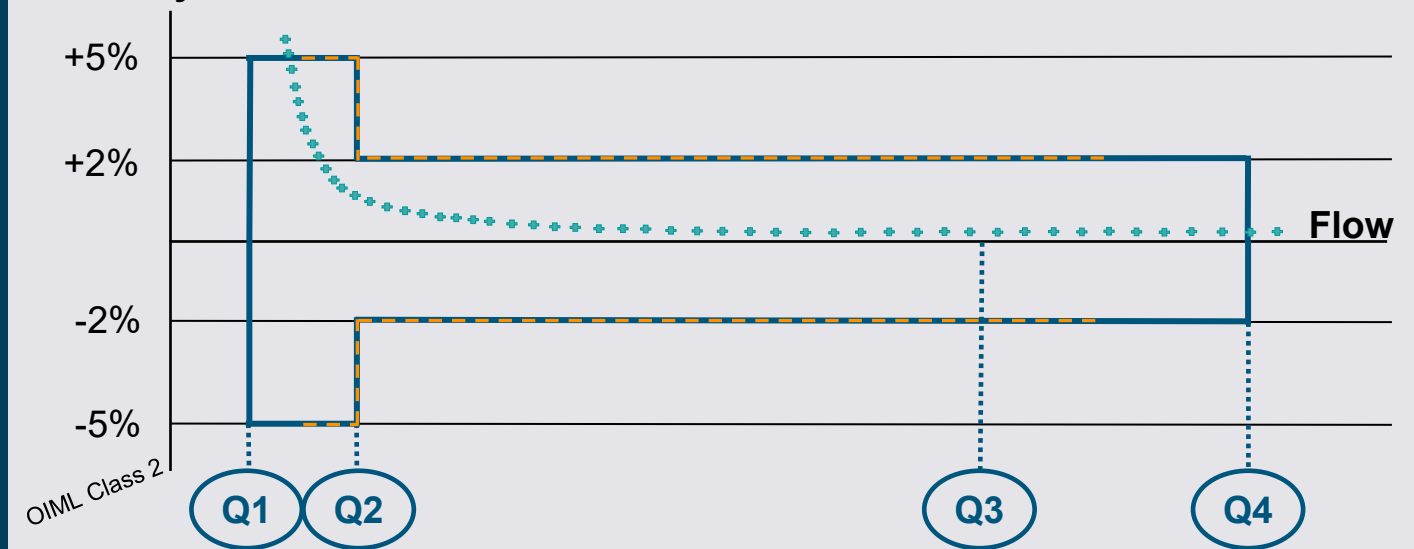
- $Q2 = 1.6 \times Q1$
- $Q4 = 1.25 \times Q3$

⇒ Primitive verification
(except manufacturing)

⇒ MID = OIML Class 2

Tolerance channel – Maximum permissible measurement error

Accuracy

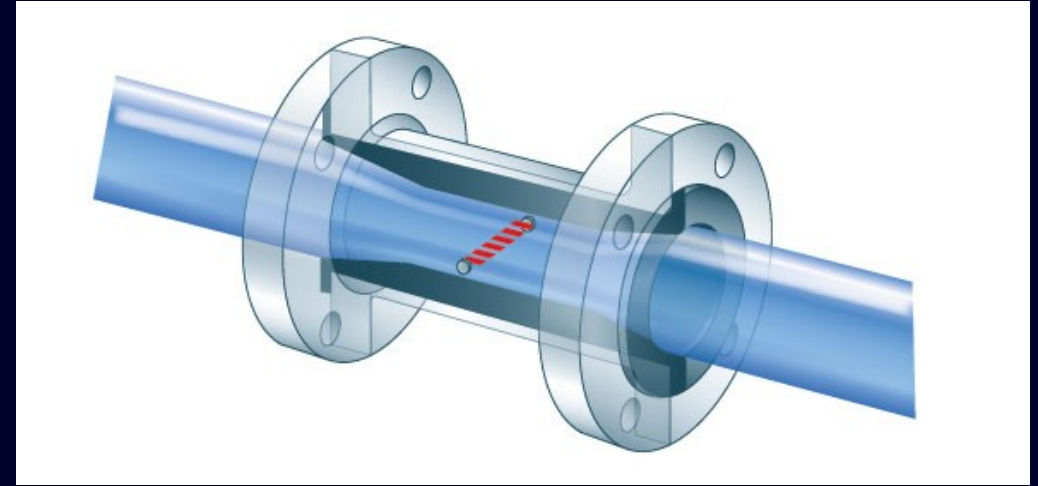


» Organisation Internationale de Métrologie Légale (OIML) «
International Organization of Legal Metrology
(founded 1955 in Paris)

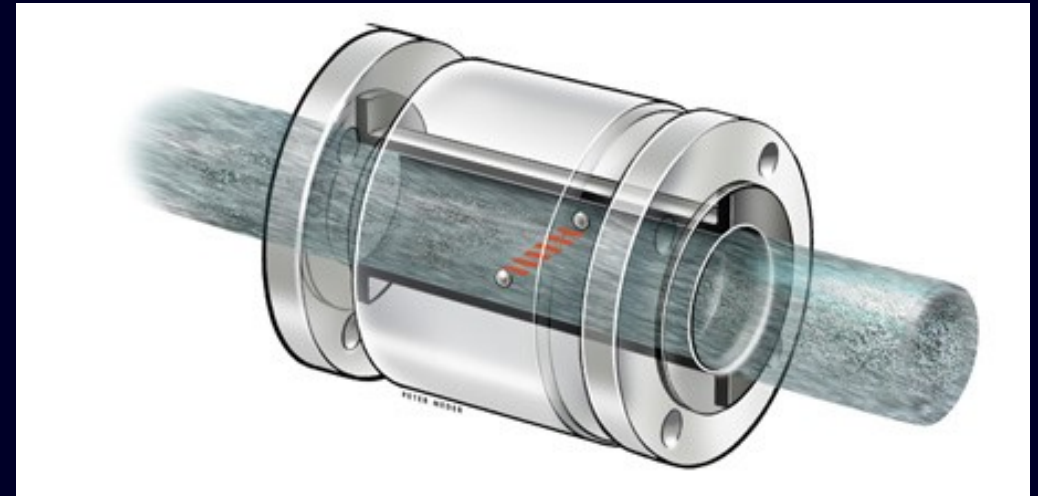
SITRANS F M MAG:

Effortless undisturbed measurement without moving parts in the flow

Slightly conical for better low flow detection with negligible pressure loss















No moving parts, meaning no influence of particles in the water – allowing for high repeatability of the measured value with maximum accuracy $\pm 0.2\%$



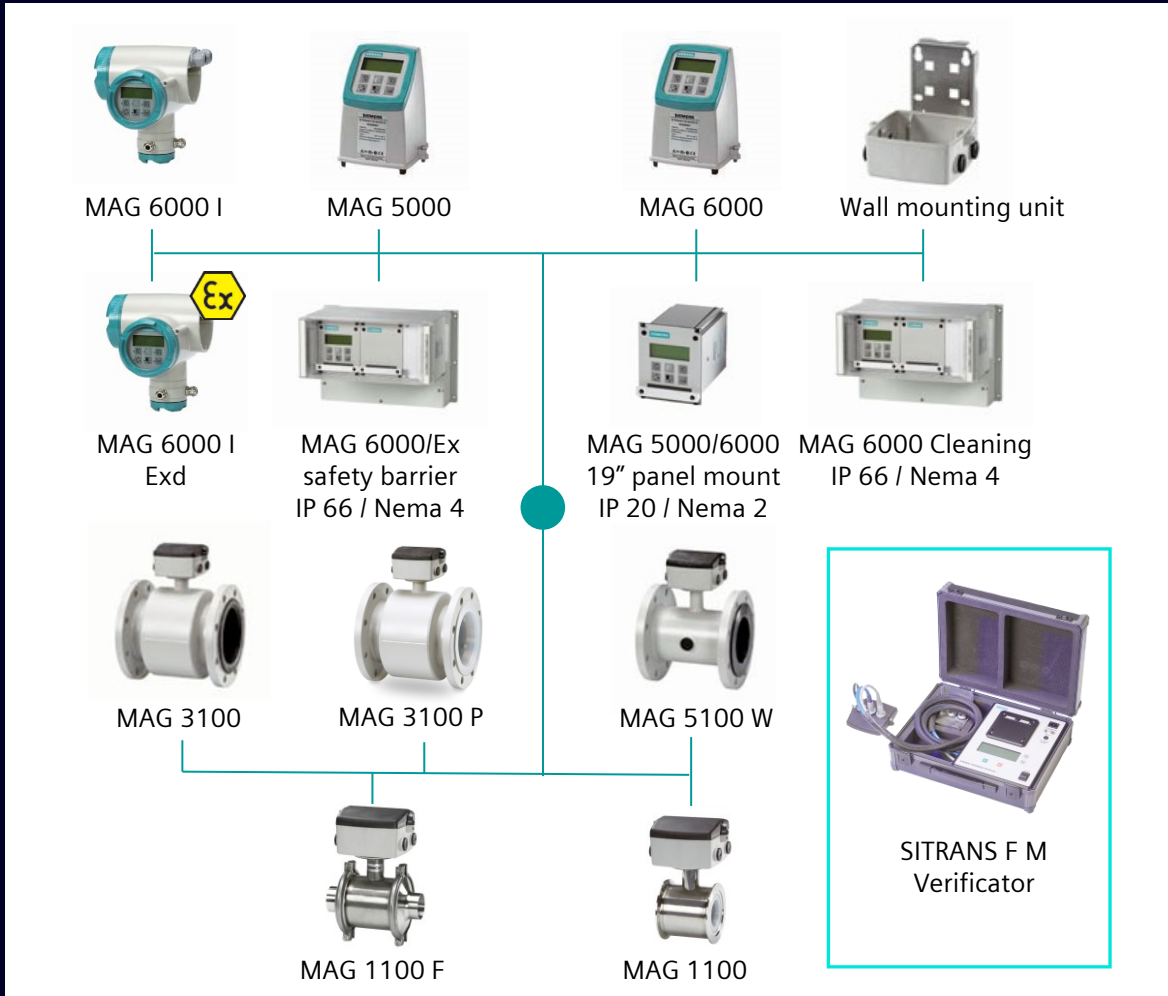
Pros and Cons:

Magnetic vs. mechanical flowmeters

	Electromagnetic flowmeters		Mechanical flowmeters	
Metrology	Stability: no moving parts		Mechanical wear results in deviation	
Variance	Configuration: compact & separate <ul style="list-style-type: none"> • Sensor: IP 68 – submersible • Transmitter: IP68 		Compact system only	
Pressure loss	Virtually no pressure drop		Mechanics in water flow	
Measuring direction	Bidirectional		Unidirectional	
External influences	Not affected by: <ul style="list-style-type: none"> • Water hammer • Critical operating states • Suspended solids • Flow reversal 		Affected by all mentioned factors	
Power	<ul style="list-style-type: none"> • Requires battery or mains 		No energy source required	

Portfolio

SITRANS F M product portfolio – Sensible, flexible, reliable



Battery-driven electromagnetic water meter



MAG 8000

High-power AC electromagnetic flowmeter









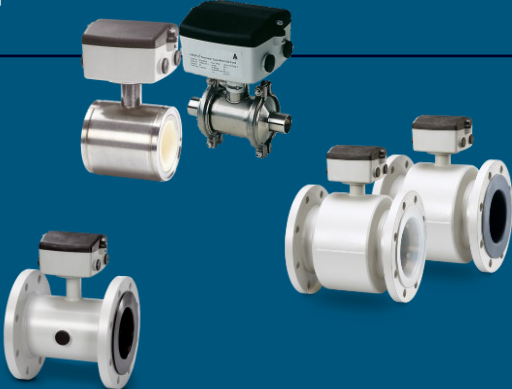

Transmag 2/911

Why choose SITRANS F M?

- 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

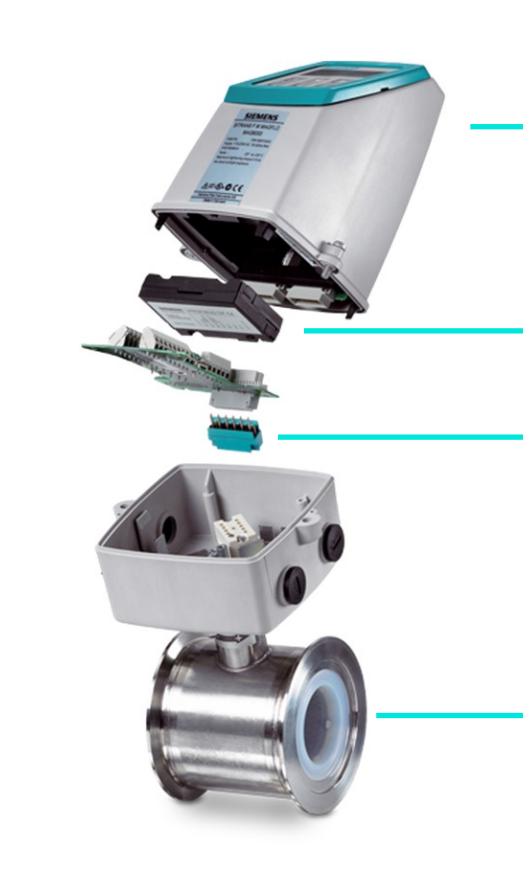
Portfolio

SITRANS F M product portfolio Compact and Remote – Accurate, flexible, reliable

	MAG5000	MAG6000	MAG6000I	MAG6000	Transmag2	MAG8000	
			 Ex de				
	7ME6910	7ME6920	7ME6930	7ME6920	7ME5034	7ME6810	
Accuracy	0,4 %	0,2%	0,2%	0,2%	0,5%	0,2% / 0,4%	
Min. Conductivity (compact mount)	≥ 5 µS/cm				≥ 1 µS/cm	≥ 20 µS/cm	
Sensor	MAG 1100 / 1100HT / 1100F					911/E	
	MAG 3100 / 3100HT / 3100P						
	MAG 5100W						

Example:
Compact mounting, modular system

MAG6000 transmitter with MAG sensor



Transmitter

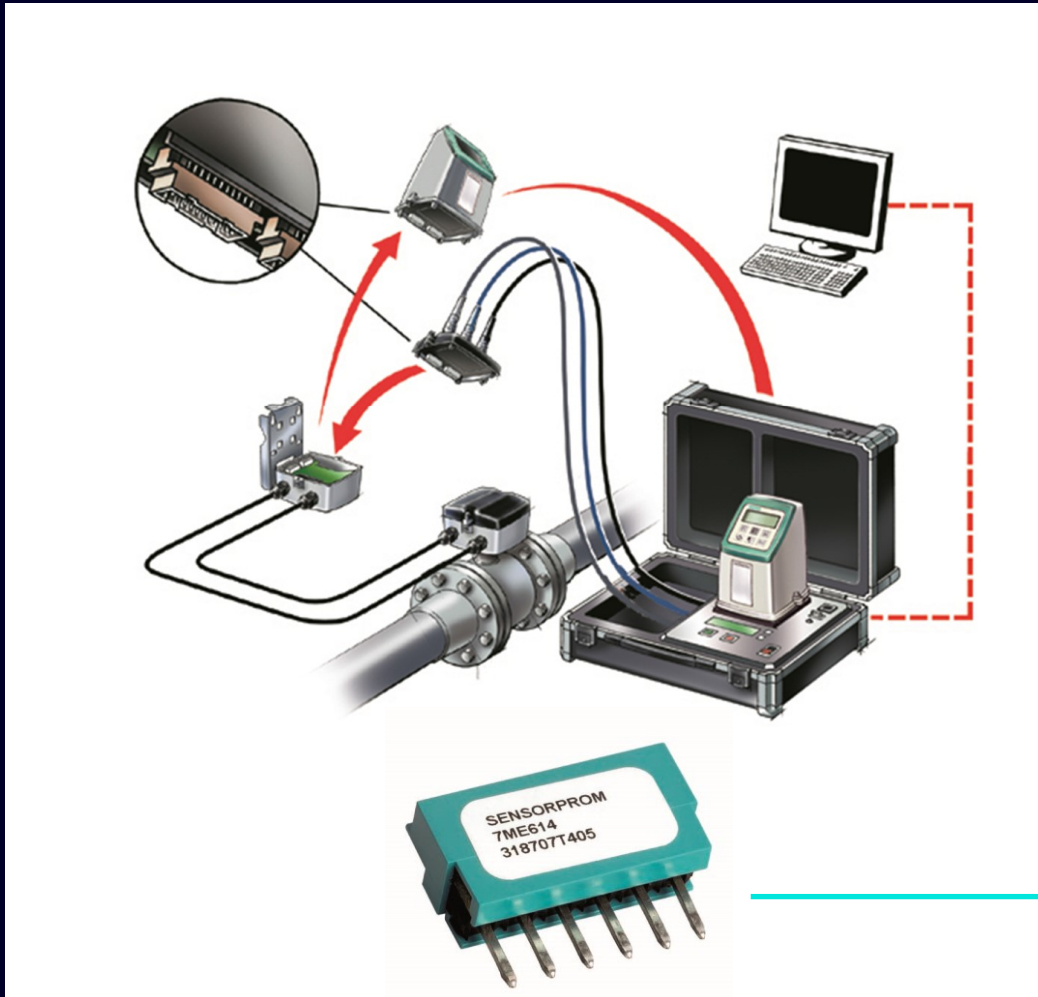
Communication module

SENSORPROM-memory unit

MAG 1100F sensor

System / value-added topics Verificator:

Confidence in your measurement with SITRANS F M



Verificator

- Avoid recalibration and interruption of process
 - Verify the correct product quality
 - Save money and resources through accurate dosing of the required quantities
- *Typical application:*
- Siemens sales companies
 - Large customers
 - New installations
 - Service teams

Sensorprom

- Each flow meter has its own identity stored in the SENSORPROM. The information consists of:
- Calibration data
- “Fingerprint” – magnetism properties
- Setup and programming data

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Simple, flexible solutions

SITRANS F M MAG 5100 W

with MAG 5000/6000

Target industries / applications – MAG 5100W

Dedicated and cost-effective sensor for all water processes



Clean water

- Potable water delivery
- Irrigation
- Home delivery
- Bulk flow
- Billing
- Raw water
- Leak detection

Waste-water

- Bulk flow
- Raw water
- Gray water
- Sludge
- Cake

HVAC & Marine

- Water flow for balancing
- Water flow for chiller loading
- Energy flow for chiller
- Performance monitoring
- Ballast water treatment

Top highlights

Perfect choice for water / wastewater industry



Feature / Function	Benefit
<ul style="list-style-type: none"> • Coned liner design • Cost-effective solution 	<ul style="list-style-type: none"> • Increased low flow accuracy for leak detection • Proven 2% accuracy with zero upstream and zero downstream straight runs
<ul style="list-style-type: none"> • Extensive quick-ship program 	<ul style="list-style-type: none"> • 5 day delivery time on standard product configurations
<ul style="list-style-type: none"> • Built-in grounding electrodes 	<ul style="list-style-type: none"> • No need for external grounding protection
<ul style="list-style-type: none"> • Widely approved drinking water and custody transfer approvals * 	<ul style="list-style-type: none"> • Approved for drinking water and custody transfer applications
<ul style="list-style-type: none"> • Sensor enclosure rated to: <ul style="list-style-type: none"> • IP 67 • IP 68 with submersible kit 	<ul style="list-style-type: none"> • Suitable for direct burial and constant flooding

*) Drinking water: NSF61, WRAS, ACS, DVGW W270 Custody transfer: OILM R49, MI-001, PTB K7.2 (Germany)

Introduction – SITRANS F M

Measuring conductive fluids with the best

The SITRANS FM MAG 5100 W flowmeter, featuring high durability liners and electrodes, is a cost-effective solution for all water applications, including groundwater, drinking water, wastewater, sewage and sludge.



Features	Advantage	Benefits
Affordability	High accuracy for a competitive price	High value for the money
User-friendly interface	Simplifies programming and customization of setup	Saves time at start-up
Robust construction	Durable performance in tough conditions	Long service life results in reduced cost of ownership
Broad breadth of products	Select the right instrument for the application	<ul style="list-style-type: none"> Prevents costly errors caused by incorrectly applied meters Ability to work with one supplier reduces purchase costs
Verificator	Verificator compatible – Independently verifies performance of sensor, transmitter and installation (including cable) without process interruption	Saves time and money: <ul style="list-style-type: none"> No need to remove sensor to verify Avoid costly errors or fines resulting from incorrect flow readings

SITRANS F M simply better for your applications:

Easier to commission



The sensorprom memory enables instant measurement from power-up

Accuracy



Why accept uncertainties – approved flowmeter calibration by Siemens means you don't have to

Reliability



We calibrate all flowmeters in our own EN 45001 approved laboratories

Room for growth



Plug & play communication modules allow future upgrades

Easier to service



Comprehensive self-diagnostics for error indication and logging

Greater flexibility



Compact or remote installation using the same transmitter and sensor



Product data – MAG 5000 and 6000

Guaranteed performance

	MAG 5000	MAG 6000
Enclosures	IP67 / NEMA 4X or IP20/66 / NEMA 2/4 Polyamide	
Max Measuring Error	0.4% of rate	0.2% of rate
Display	3-line alpha numeric LCD with backlight, 10 languages	
Inputs and Outputs	1 digital input, 1 current output, 1 pulse/frequency output, 1 relay output	
Communication	HART	HART, Profibus PA/DP, Modbus RTU, Foundation Fieldbus
Batch Function	No	Yes
Power Supply	12–24 V AC/DC or 115–230 V AC	
Approvals	FM/CSA Class 1, DIV 2	



Product data – MAG 5100W

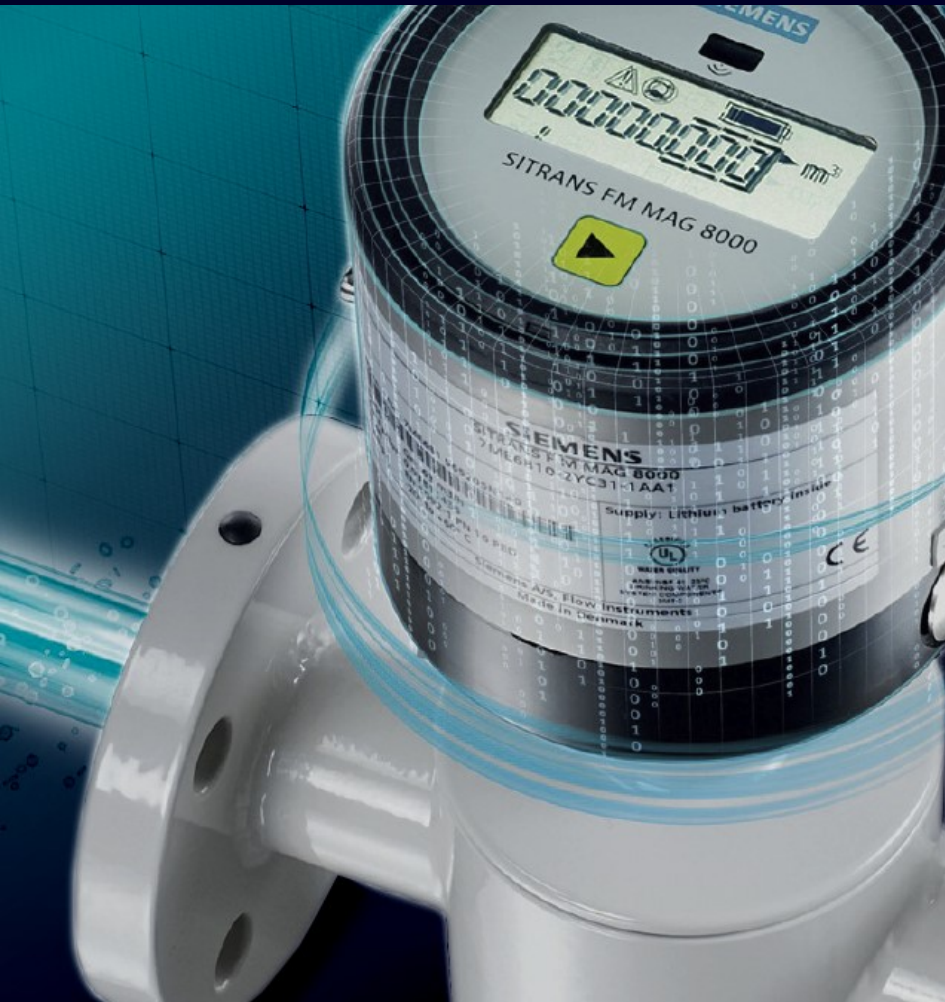
Guaranteed performance

	SITRANS F M MAG 5100W	
Size DN	DN 15-2000 / ½"-78"	
Process temperature	-10...+70 °C / 14...+158 °F	
Flange material	Carbon steel ASTM A 105	
Flange and pressure rating	EN 1092-1 PN10 EN 1092-1 PN16 EN 1092-1 PN40	ANSI B16.5 Class 150 AWWA C-207 Class D AS 4087 PN16
Liner material	EPDM (mainly EU market) NBR Hard Rubber (mainly EU market) Ebonite (mainly non-EU market)	
Electrode material*	Hastelloy C276	
Integrated transmitter choices	MAG 5000, MAG 6000, MAG 6000 I	
Grounding rings	Built-in grounding electrodes to sensor	

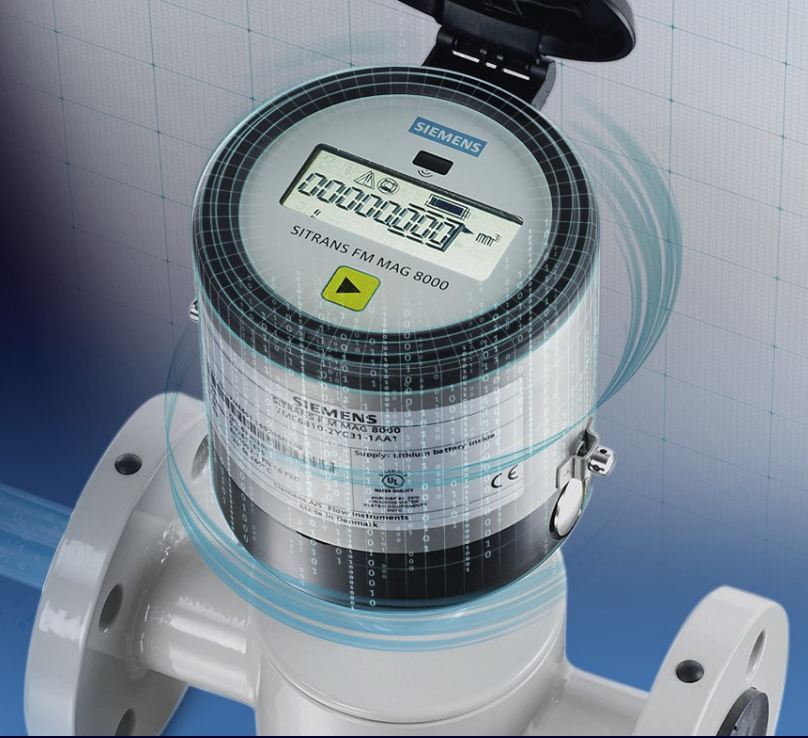


*) PFA: optional grounding electrodes

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The perfect fit for the environmental industry

SITRANS FM MAG 8000

SITRANS F M MAG 8000

Advantages

Advantages

- Locations without current supply
- No moving parts
- Long battery life up to 10 years
- Sensor design IP68
- Easy to install
- Revenue metering
- High accuracy / repeatability
- Leakage detection
- No pressure drop
- Advanced diagnostic functionalities
- Flexible communications
(MODBUS RTU, Sensus protocol encoder
and 3G/UMTS module)



Built-in flexibility

Target industries and applications



Potable water treatment

- Influent flow
- Low/high lift pump well
- Elevated water storage
- Network distribution

Wastewater / reclamation

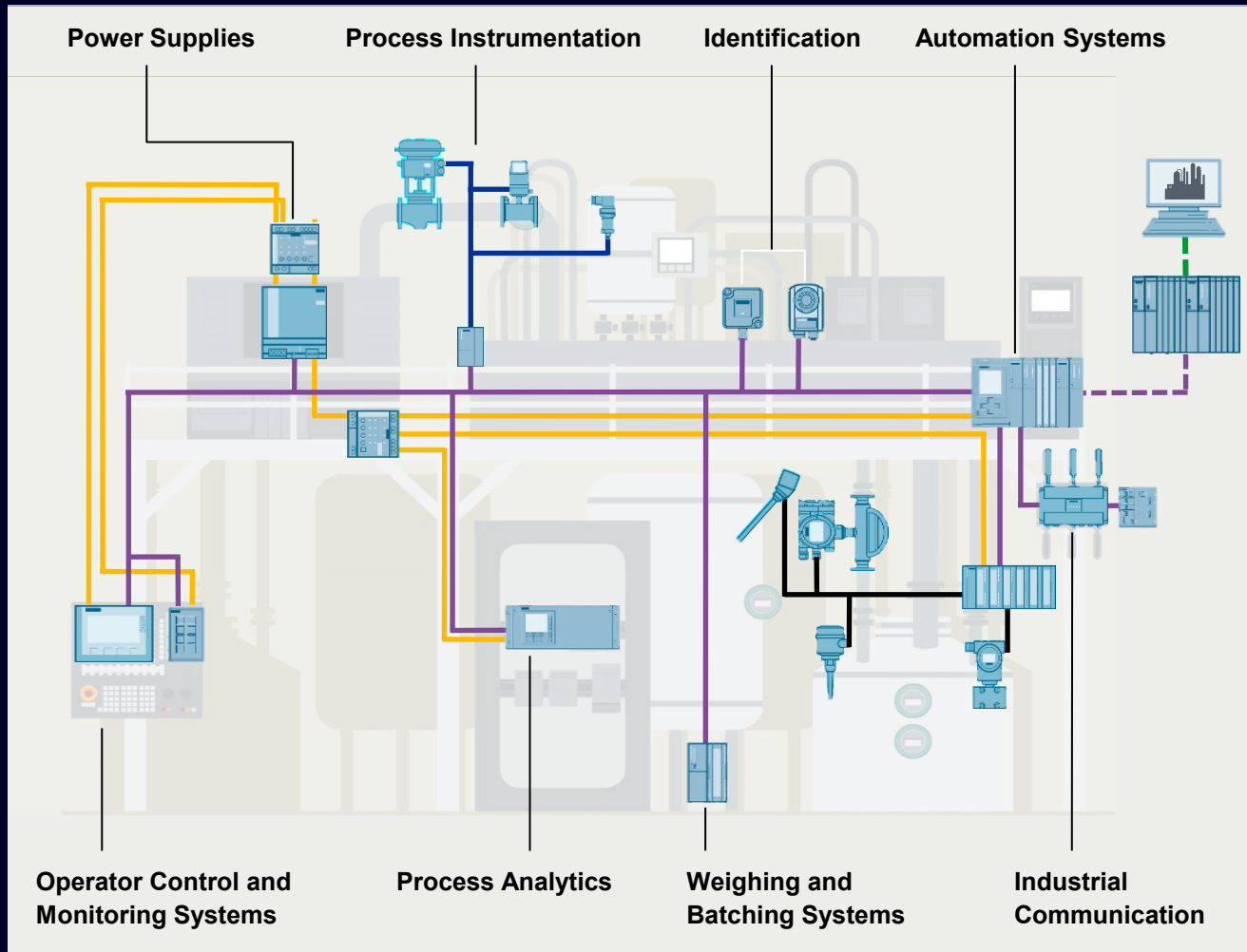
- Influent flow
- Raw sewage
- Activated sludge
- Reclaimed water
- Effluent flow

HVAC / Energy

- Condenser water
- Cooling tower flow
- Distribution lines
- Penstocks
- Thermal storage and lake storage cooling

Application unit – Water Distribution Pump Station

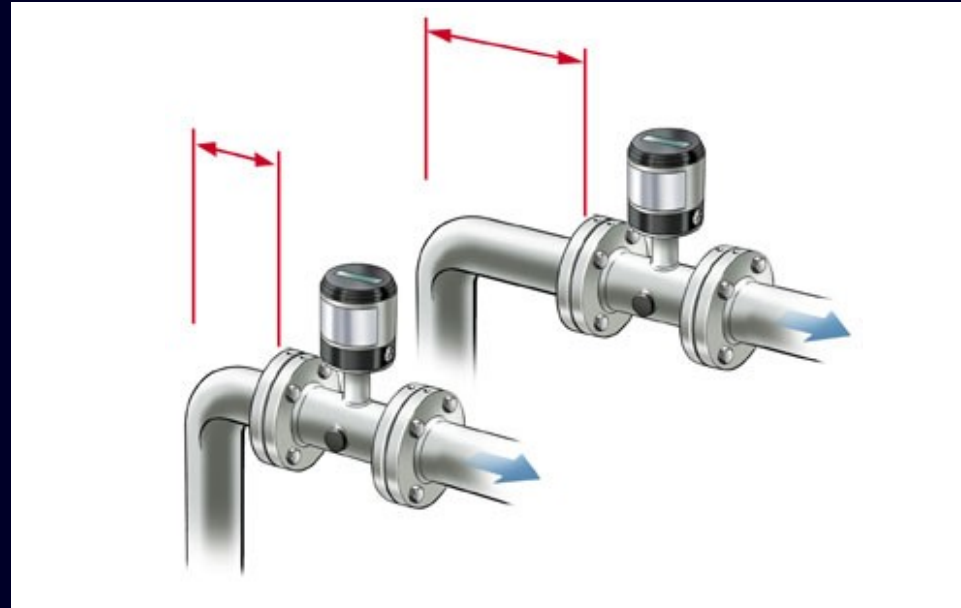
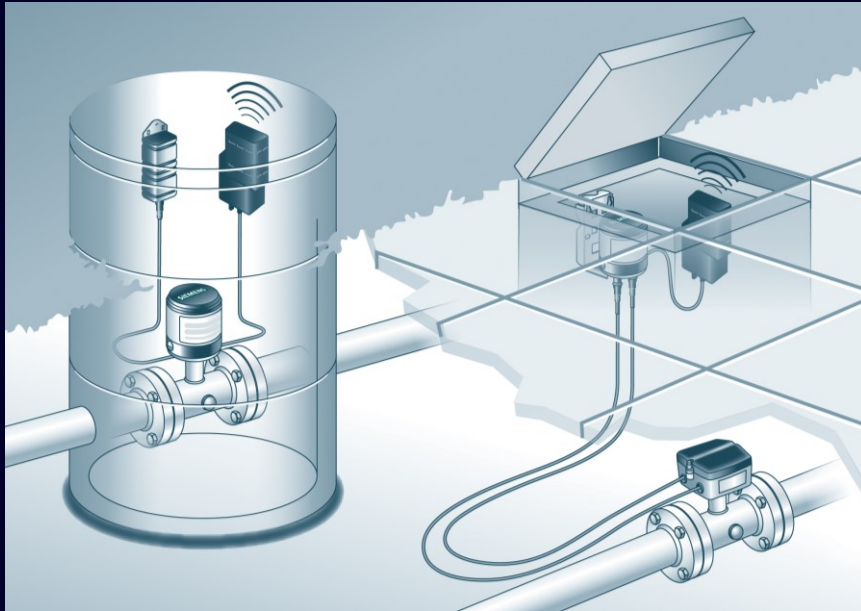
Best in class automation technology for all of your requirements



Solution	Description
Process Instrumentation	<p>Transmitters for maximum efficiency</p> <ul style="list-style-type: none"> • Best-in-class transmitters • Complete portfolio to measure pressure, temperature, flow or level
Industrial Communication	<p>Highly flexible and efficient automation solutions for various wireless networks.</p> <ul style="list-style-type: none"> • Greater flexibility is achieved through mobility • designed for use in critical locations indoor and outdoor
Power Supplies	<ul style="list-style-type: none"> • Energy-efficient operation with reliable and constant power supply for every application.
Operator Control and Monitoring Systems	<p>Optimized operator control and monitoring systems using open and standardized interfaces.</p> <ul style="list-style-type: none"> • Innovative graphical user interface

SITRANS F M MAG 8000 – Easy to install

- Compact / remote mounting with preinstalled sensor cables incl. connection
- IP68/NEMA 6P submersible enclosure for underground installations
- Easy installation with minimum inlet and outlet requirements



Product definition

MAG 8000 WCM – Visualization of the concept

Advantages of the built-in smart concept

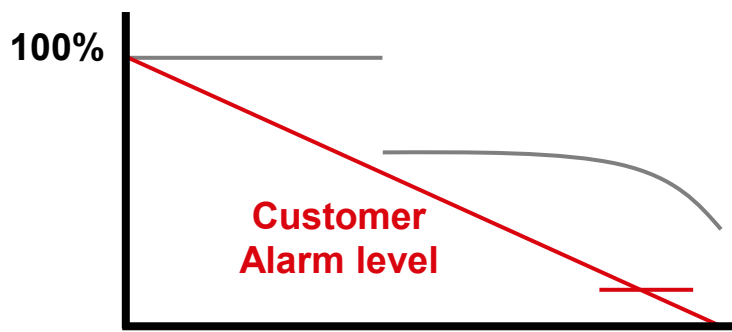
- Easy plug & play for retrofitting
- Built-in module
- IP68 without compromises
- Wireless collection of measuring data
- Battery powered - rechargeable system
- Open analog inputs



SITRANS F M MAG 8000

Power management

- Up to 10 years battery operation without communication modules
- Unique battery power management program
 - Real power consumption including measurement, communication and meter dialogue
 - Customer selectable low power level for call up and alarm registration
 - Temperature included in energy consumption



ID	Name	Setup 1	Unit
500	Latest service date	2004-09-17T08:18:53	
501	Operating hours since power up	1826	h
502	Battery operating time	1754	h
505	Power supply	Battery	
506	Numbers of power up	2	
507	Battery power	2	
508	Battery change enable	No	
509	Battery installation date	2004-09-20T08:36:42	
510	Actual battery capacity	97	%

Product definition

MAG 8000 wireless communication module (WCM)

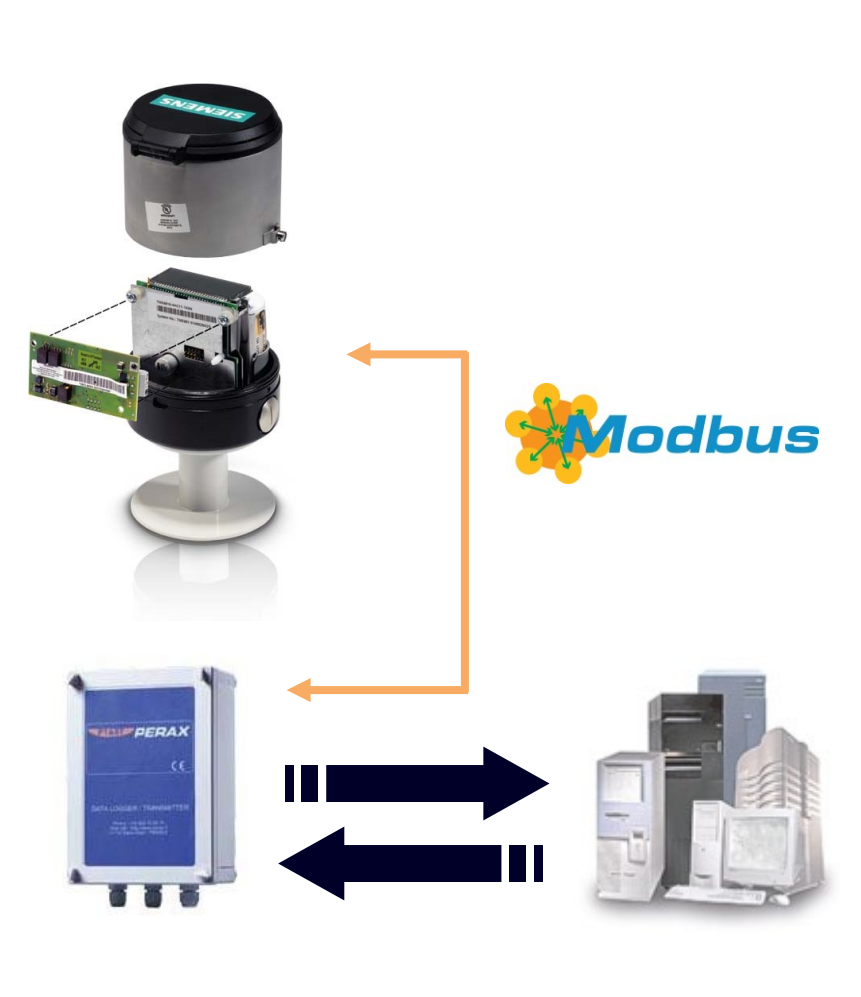
- The MAG 8000 WCM is a wireless communication module based on 3G/UMTS technology
- The WCM is a built-in module that does not affect the IP68 protection of the MAG8000
- Two optional analog inputs
- 4 - 20 mA (external power supply)
- 5 V DC analog input powered by the MAG 8000
- Open communication protocol for the data management server



MAG 8000 flexible communication

Connecting to every external data memory or RTU

- ➔ Pulse output (2)
- ➔ Modbus communication for data export



MAG 8000 wireless communication module (WCM)



- Various sample frequencies
- Sending the measurement data in secured email or FTP protocol
- Basic SMS reporting with TOT 1 values for revenue metering
- Easy configuration via SMS commands
- OPC server for data processing

MAG8000: Wireless communication module, advantages, usability



- Battery lifetime calculated for MAG 8000 + 3G/UMTS module
- Typical runtime when transmitting once a day
- Internal battery 3 years
- External battery 7 years
- Separate antenna with 5m cable length
- MAG 8000 WCM is compatible for future updates, e. g. "always-on" transmission and a micro SD card (extended data storage)

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The perfect fit for the chemical industry

SITRANS F M MAG 3100P

with MAG 6000I

Introduction

The perfect fit for the chemical industry

A robust design satisfies the unique requirements for flowmeters in the chemical industry

For additional applications in the chemical industry the **SITRANS F M MAG 3100** family offers a variety of configurations

SITRANS F M MAG 3100 family



MAG 3100 P

Short lead time



MAG 3100 HT

Temperatures above 150 °C



MAG 3100

Flexible program



Portfolio

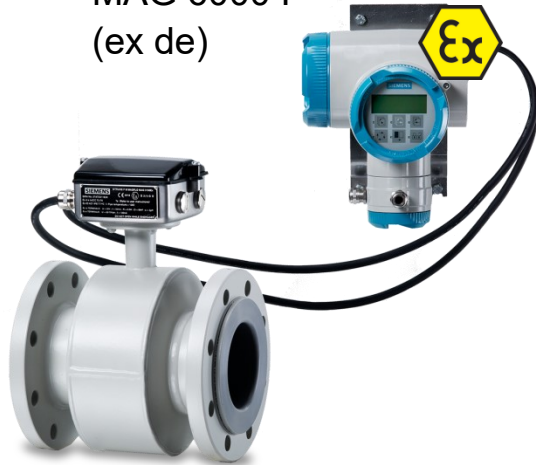
Modular platform with flexible selection:

Products for hazardous area Zone 1 and Div 1 (ATEX, FM, CSA)



3100 P/MAG 6000 I (ex de)

MAG 6000 I
(ex de)



MAG 3100 P

Products for hazardous area Zone 2 and Div 2 (FM, CSA)



MAG 3100 P
(PTFE+PFA)



MAG 5000/MAG 6000



MAG 6000 I

**Different flowmeter options are available to suit any application, guaranteeing the perfect fit.
A wide variety of communication modules and approvals are also available.**

Top highlights

Rely on Siemens as your partner

MAG 3100

Industry optimized liners

Siemens offers both PTFE and PFA liners for high temperatures and with high chemical resistance in a full range of sizes.

Enhanced reliability with SENSORPROM

The unique SENSORPROM memory unit features the highest level of safety and reliability with factory pre-programming and automatic storage function. This ensures fast and easy transmitter replacement without loss of data, reduced accuracy or downtime.



Robust design

Robust design that lasts in harsh and abrasive environments, long service life and low cost-of-ownership.

Grounding electrodes

No grounding rings needed on versions with grounding electrodes allowing to save money, minimize installation time and lower the risk of failure due to maintenance.

Comprehensive diagnostics

Comprehensive identification in easily readable text (including self-check, error messages and status logs).

Target industries / applications – Mag 3100P

Proven to meet the harsh demands in the chemical industry



Basic / Inorganic chemicals

- Water for process cooling
- Water return from steam systems
- Industrial water treatment
- Aqueous acid or alkaline solutions
- Agricultural fertilizer



Pulp & Paper / Polymer chemicals

- Pulp- & paper-making processes
- Chemical fibers
- Water-soluble adhesives



Bio chemicals / O&G Upstream

- Bio-Ethanol
- Petroleum based fluids
- Water injection at wellhead
- Produced water at well
- Frac water
- Conductive bulk material

Realize the full benefits of automation and continuous accuracy



Process optimization



MAG 6000 I with add-on communication module for easy integration in your application, ensuring a totally integrated solution throughout the entire plant.

- Optimize management and process control
- Ensure correct dosing and product quality
- Minimize process time and consumption of high-cost chemicals



Calibration

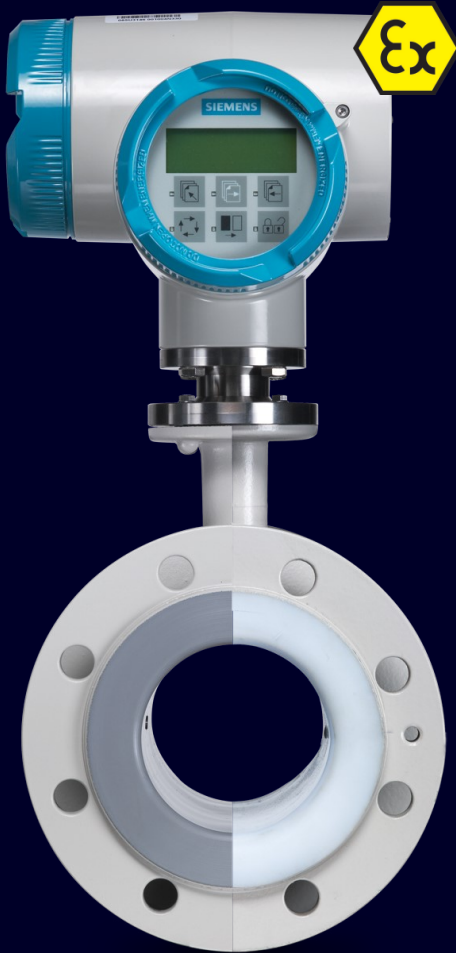


Validated calibration ensures accurate flow measurement. Every Siemens flowmeter is calibrated at facilities that are individually accredited in accordance with ISO / IEC 17025.

- A calibration certificate is shipped with every Siemens sensor
- High-accuracy rigs with better than 0.1% calibration uncertainty
- Documentation for ISO 9001 and ISO 14001 management system

Top highlights – MAG 3100P

The optimized and dedicated solution



Feature / Function	Benefit
<ul style="list-style-type: none"> • Designed and dedicated for the process industry • Standard stock program 	<ul style="list-style-type: none"> • Easy ordering due to pre-configuration and standard selections • Short lead times
<ul style="list-style-type: none"> • PFA liner molded directly in the flowmeter • Reinforced stainless steel tube • Fully welded construction 	<ul style="list-style-type: none"> • Super performance at vacuum pressures 0.01 barabs (PFA) • Withstands temperatures up to 150 °C without deformation • Smooth surface with minimal risk of build-up • No joints allowing water ingress
<ul style="list-style-type: none"> • Approved* for installation in hazardous area 	<ul style="list-style-type: none"> • Maximum safety and reliability • Programmable in hazardous areas due to capacitive touchpad display
<ul style="list-style-type: none"> • HART • PROFIBUS PA/DP • Foundation Fieldbus • Modbus 	<ul style="list-style-type: none"> • Reliable and flexible communication

*) IEC Ex de [ja], ATEX 2GD EEx de [ja], FM Class I, Div. 1 (compact), CSA/FM Class I, Div. 2

Product data – MAG 5000 and 6000

Guaranteed performance

	MAG 6000I
Enclosures	IP67 / NEMA 4X or IP20/66
Max Measuring Error	0.2% ±1 mm/s
Temperature	-20...+60 °C / -4...+140 °F
Display	3-line alpha numeric LCD with backlight, 10 languages
Inputs and Outputs	1 digital input, 1 current output, 1 pulse/frequency output, 1 relay output
Communication	HART, PROFIBUS PA/DP, Modbus RTU/RS 485, FOUNDATION Fieldbus, DeviceNet Ex version: HART, PROFIBUS PA
Batch Function	Yes
Power Supply	18–30 V DC or 115–230 V AC
Approvals	IEC Ex de [ia], ATEX 2GD EEx de [ia], FM Class I, Div. 1 (compact), CSA/FM Class I, Div. 2



Product data

Dedicated and pre-configured or versatile range

SITRANS F M MAG 3100 P

Size DN	DN 15-300 / ½"-12"
Process temperature	-20...+150 °C / -4...+300 °F
Flange material	Carbon steel, St 37.2
Flange and pressure rating	EN 1092-1 PN10 EN 1092-1 PN16 EN 1092-1 PN40 ANSI B16.5 Class 150
Liner material	PTFE PFA*
Electrode material*	Hastelloy C276 (PTFE) Hastelloy C22 (PFA)
Integrated transmitter choices	MAG 5000, MAG 6000, MAG 6000 I
Grounding rings	Stainless steel, Hastelloy, Tantalum



*) PFA: optional grounding electrodes



The perfect fit for the fine chemical industry and food & beverage

SITRANS F M MAG 1100 Family

Agenda



- Introduction 2
- Product description 11
- MAG 5100W 25
- MAG 8000 33
- MAG 3100 46
- **MAG 1100** 57
- TransMag 2 66

Introduction – SITRANS F M

Measuring conductive fluids with the best

Magnetic flow sensors are very accurate inline volumetric flow measurement devices that measure flow of virtually any conductive flowing media. Their accuracy, flexibility, durability, and robust design make them the logical choice for inline flow measurement of conductive liquids.



Features	Advantage	Benefits
Affordability	High accuracy for a competitive price	High value for the money
User-friendly interface	Simplifies programming and customization of setup	Saves time at start-up
Robust construction	Durable performance in tough conditions	Long service life results in reduced cost of ownership
Broad breadth of products	Select the right instrument for the application	<ul style="list-style-type: none"> • Prevents costly errors caused by incorrectly applied meters • Ability to work with one supplier reduces purchase costs
Vericator	Vericator compatible – Independently verifies performance of sensor, transmitter and installation (including cable) without process interruption	<ul style="list-style-type: none"> • Saves time and money • No need to remove sensor to verify • Avoid costly errors or fines resulting from incorrect flow readings

Top highlights – MAG 1100 family

Rely on Siemens as your partner

MAG 1100 family

Offering peace of mind

Vericator compatible – Independently verifies performance of sensor, transmitter and installation (including cable) without process interruption.



Room for growth

Plug & play communication modules allow future upgrades



Comprehensive diagnostics

Comprehensive identification in easily readable text (including self-check, error messages and status logs)



Accuracy



Why accept uncertainties – approved flowmeter calibration by Siemens means you don't have to

Reliability



We calibrate all flowmeters in our own EN 45001 approved laboratories

Easier to commission



The sensorprom memory enables instant measurement from power-up

Target industries / applications – Mag 1100F

Proven to meet the hygienic standards the F&B industry



Dairy products

- Filling & dosing
- Mixing
- CIP cleaning
- Milk
- Cheese
- Yogurt

Breweries

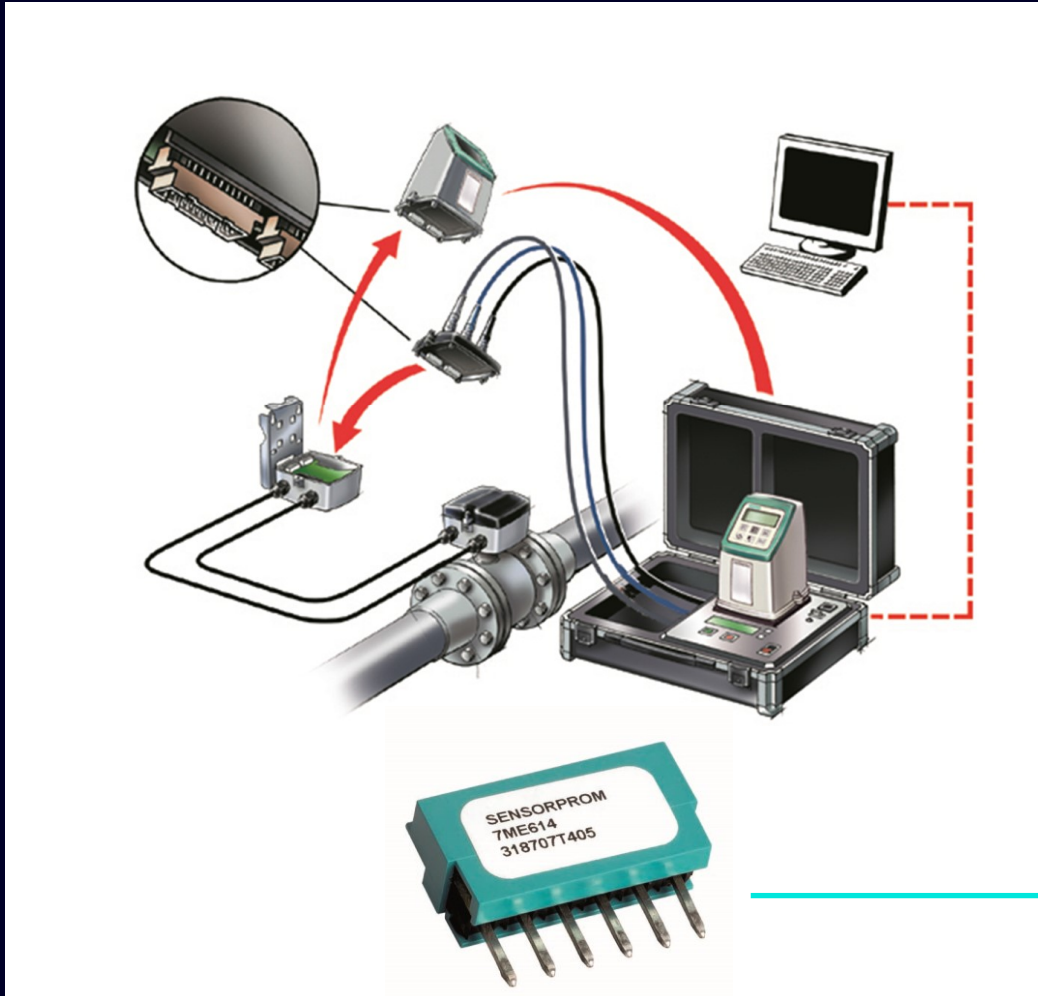
- Filling & dosing
- Process water
- Mixing
- Beer
- Whine
- Distillery

Soft drink

- Filling & dosing
- Process water
- Mixing
- Billing
- Iced tea
- Lemonade
- Fruit punch

System / value-added topics

Verificator: Confidence in your measurement with SITRANS F M



Verificator

- Avoid recalibration and interruption of process
- Verify the correct product quality
- Save money and resources through accurate dosing of the required quantities

• *Typical application:*

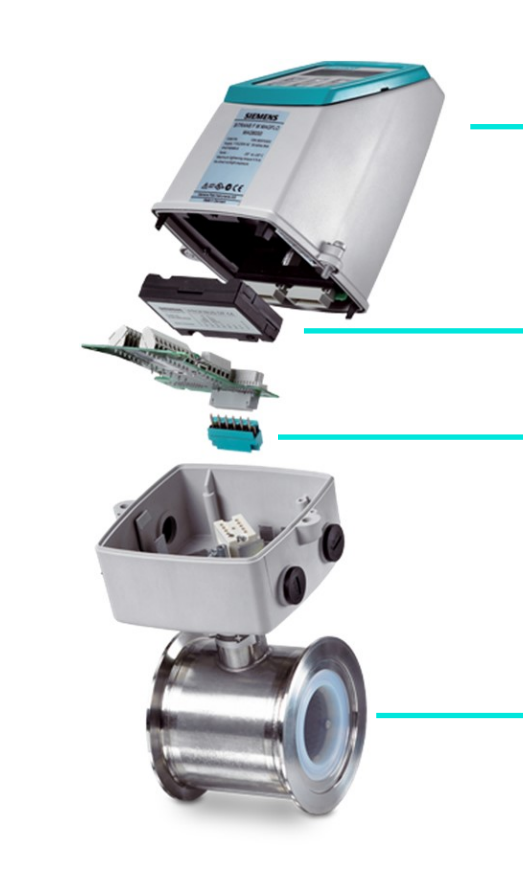
- Siemens sales companies
- Large customers
- New installations
- Service teams

Sensorprom

- Each flow meter has its own identity stored in the SENSORPROM. The information consists of:
- Calibration data
- “Fingerprint” – magnetism properties
- Setup and programming data

Example:
Compact mounting, modular system

MAG6000 transmitter with MAG1100F sensor



Transmitter

Communication module

SENSORPROM-memory unit

MAG 1100F sensor

Top highlights

Perfect choice for the fine chemical industry and food & beverage



Feature / Function	Benefit
<ul style="list-style-type: none">• Ceramic liner and platinum electrodes	<ul style="list-style-type: none">• Withstands temperatures up to 200° C / 392° F• High resistance against corrosion and wear
<ul style="list-style-type: none">• Excitation frequency of 44Hz including batch functionality (with MAG6000 SV)	<ul style="list-style-type: none">• Fast reaction time for high-speed batching applications
<ul style="list-style-type: none">• Meets sanitary requirements and 3A certified	<ul style="list-style-type: none">• Perfect fit for typical applications found in the F&B industry
<ul style="list-style-type: none">• Wide selection of process connections	<ul style="list-style-type: none">• Unique and flexible sanitary connection solutions

Product data – MAG 5000 and 6000

Guaranteed performance

	MAG 5000	MAG 6000
Enclosures	IP67 / NEMA 4X or IP20/66 / NEMA 2/4 Polyamide	
Max Measuring Error	0.4% of rate	0.2% of rate
Display	3-line alpha numeric LCD with backlight, 10 languages	
Inputs and Outputs	1 digital input, 1 current output, 1 pulse/frequency output, 1 relay output	
Communication	HART	HART, Profibus PA/DP, Modbus RTU, Foundation Fieldbus
Batch Function	No	Yes
Power Supply	12–24 V AC/DC or 115–230 V AC	
Approvals	FM/CSA Class 1, DIV 2	



Product data – MAG 1100 family

Guaranteed performance

SITRANS F M MAG 1100 family

Size DN	DN 2–100 / 1/12”–4”
Process temperature	-20...+150 °C / -4...+302 °F
Gasket material (MAG1100F)	EPDM flat gasket EPDM P gasket [PFA] FPM / FKM [Ceramic]
Process connections (MAG1100F)	Weld in: DIN 11850, ISO 2037 (SMS 3008), Tri-Weld/BS 4825-3 Clamp type: DIN 32676, ISO 2852 (SMS 3016), Tri-Clamp/BS 4825-3 Threaded type: DIN 11851, SMS 1145
Liner material	PFA Ceramic
Electrode material	Hastelloy C276 (DN10-15) ; Hastelloy C22 (DN25-100) [PFA] Platinum [Ceramic]
Integrated transmitter choices	MAG 5000, MAG 6000, MAG 6000 I
Grounding rings	Stainless steel, Hastelloy, Tantalum



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SITRANS Transmag FM2

MAG 911E

Sitrans Transmag FM2 – MAG 911E

Content

- Product program
- Working Principle
- Transmitter
- Advance Diagnosis
- Applications

Sitrans Transmag FM2 – MAG 911E

Content

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:

Working Principle

- Traditional pulsed DC magnetic flow meters
- Advanced high-strength AC magnetic flow meters
- Battery-driven water meters

SITRANS FM
TRANSMAG 2 / MAG
911/E



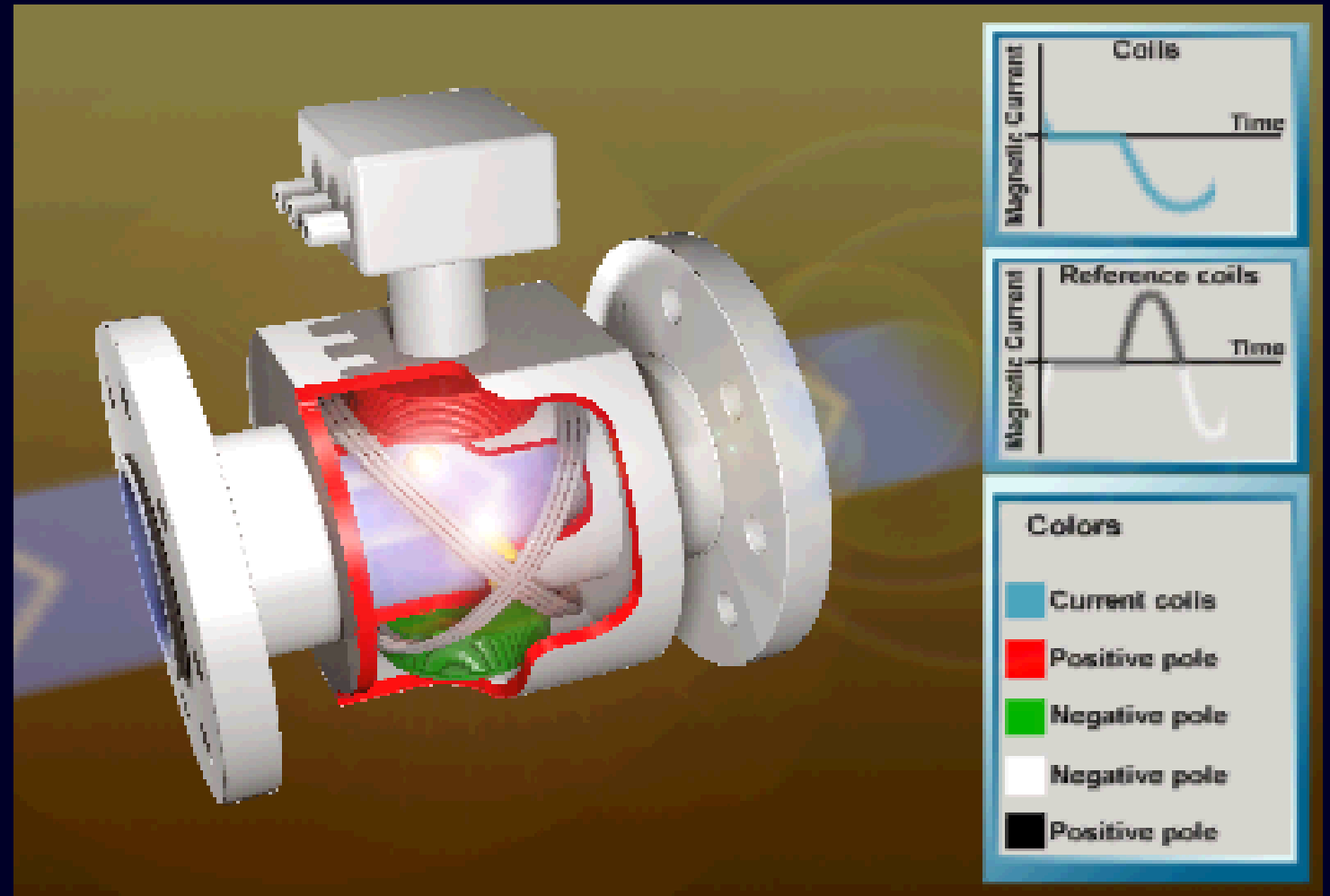
SITRANS F M TRANSMAG 2 / MAG 911 E

- SITRANS F M
- TRANSMAG 2 / MAG 911 E
- HART/PROFIBUS
- Min. conductivity 1 $\mu\text{S}/\text{cm}$ (0.1 $\mu\text{S}/\text{cm}$)
- 2x digital outputs
- Optional 1 x dig. input
- Remote version as standard
- Max. cable length 100 m



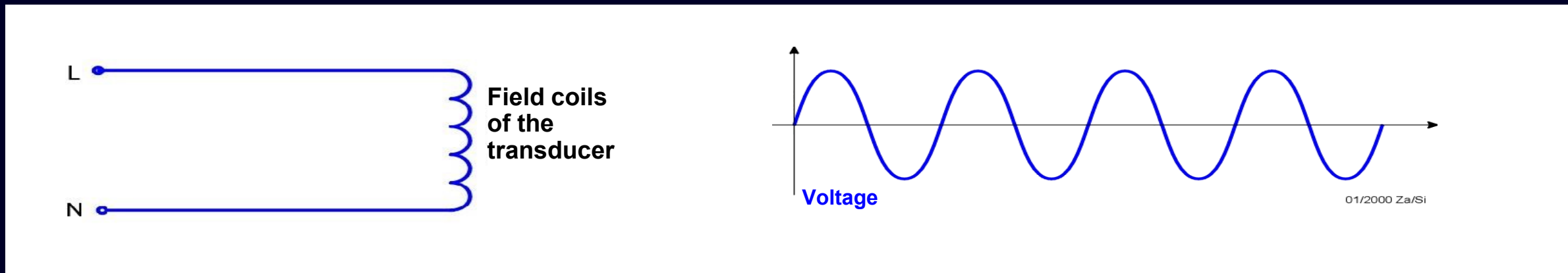
SITRANS F M TRANSMAG MAG911E, Working Principle

This Siemens invention mixed advantages of the pulse DC continuous field (zero point stability) with the continuous alternating field (strong magnetic field) and the result is the pulse alternating field “PAC”.



Ordinary AC principles

The first AC meters are direct supplied the magnetic coils from the alternating voltage system (main supply)



Advantage

- Strong magnetic field by supply from the voltage system.

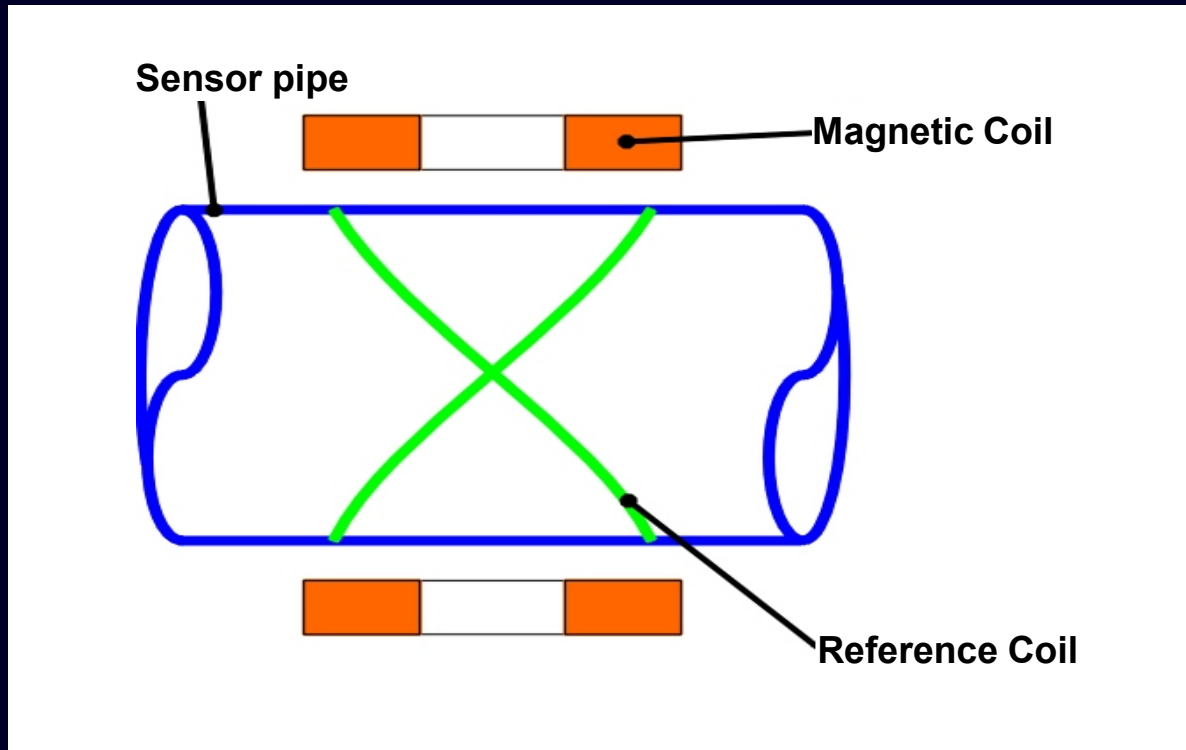
Disadvantages

- Zero point-drift by changes of the phase position
Permanent manual zero point adjusting with standing medium at drift of the grounding potential necessarily.

SITRANS F M TRANSMAG (PAC)

General disadvantage with the alternating field procedure like the magnet. Induction depends on:

- the mains voltage
- and magnetic characteristics of the media



Solution:

Measurement of the magnetic field by additional coils (reference coil)

SITRANS F M TRANSMAG 2 Special Functions

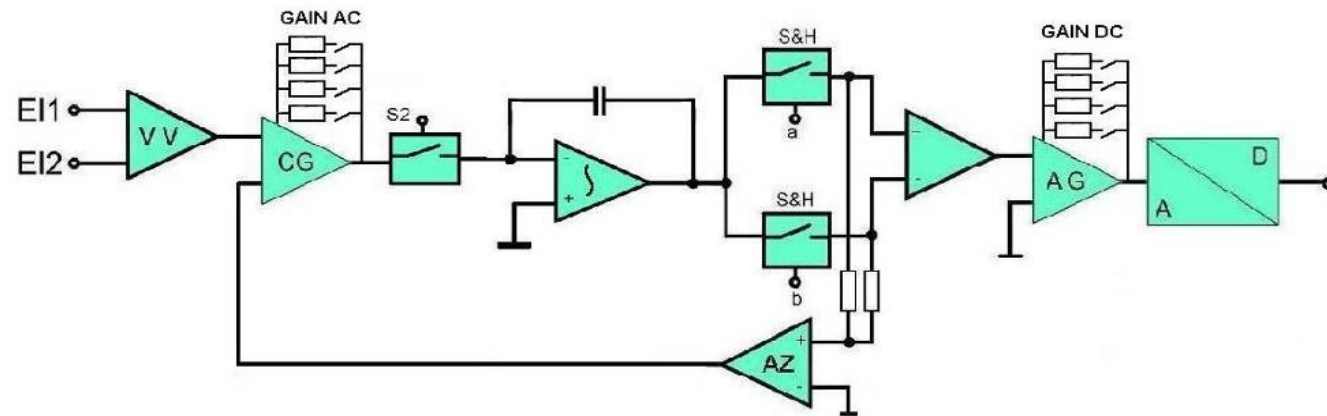
The TRANSMAG 2 can be used for media with up to 70% solids. Very hard particles in the medium, e.g. ores, stones, cement, etc. in the mining or cement industry, produce very large spurious signals at the measuring electrodes.

This can lead to signals that are no longer measurable. For this, the TRANSMAG 2 possesses a so-called "slurry mode", which can be switched ON or OFF via software.

SITRANS F M TRANSMAG 2 Special Functions

The slurry mode reduces the AC gain reinforcement electrode signal by a factor of 1/1 (normally the gain is dependent on the pipe diameter). The zero point circle is suppressed thus more insensitive. Behind the zero point circle the DC gain is also reduced to a factor of 1/1 (normally dependent on the flow range).

Thus, even with very abrasive media, the measure electrodes keep the measuring signal very stable without a loss of measuring dynamics. “Menu code 3.1.8”



SITRANS F M TRANSMAG 2

- Intuitive operating keyboard using a level tree concept on the menu.
- The electronics concept allows for parts exchange within a few minutes without having to use the product manual, as part of the easy concept design.
- Easy replacement via our plug and play concept using the SmartPLUG.
- Full diagnosis functions for extended service or special process needs.

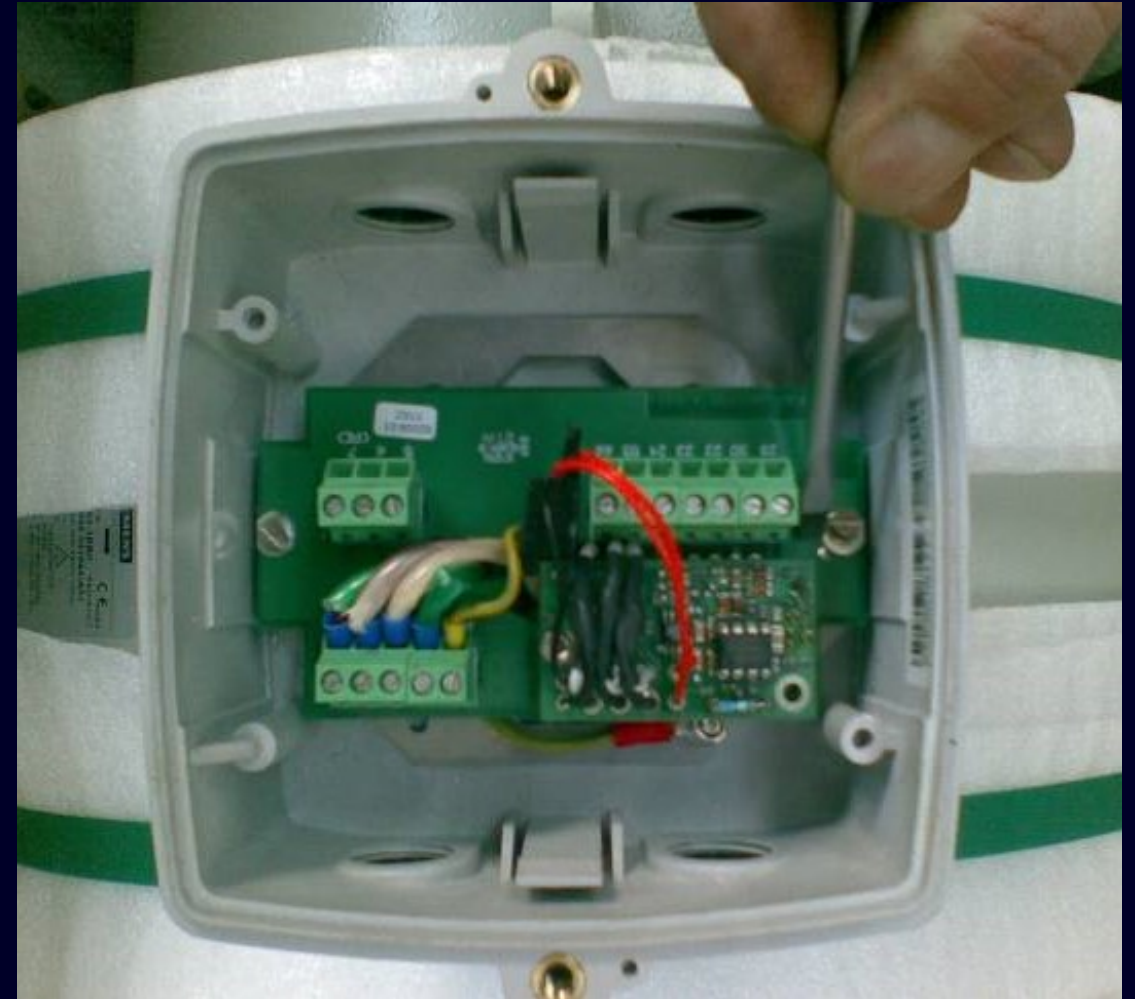


SITRANS F M SmartPlug-Technology

**All SITRANS F M MAG 911/E
use the SmartPlug – technology.**

In each sensor a SmartPlug is integrated. After calibration the specific calibration data of the sensor is stored in case of any emergency.

SmartPlug possesses an integrated preamplifier for signal voltage and reference voltage.



SITRANS F M TRANSMAG 2 Advance Diagnosis

An extensive service menu provides the information needed it to make a complete diagnosis of the sensor and electrodes; quickly identifying the problem as an application or hardware problem in short time.

The display on the electronics shows in the home position a flashing “D” or “F” in the top right hand corner.

- “D” Device error
- “F” Application error
- General check the device Status in Menu 2.1

Advanced diagnosis using PDM

Extended service info

SIMATIC PDM - TEST 2 [Temporary project]

File Device View Options Help

Parameter	Value	Unit	Status
» » Service			
Customer Code	0		Loaded
» » » Controlvalues			
Volt.Uref	25832,87		Loaded
VoltUsig	-2283		Loaded
VoltUel1	1927		Loaded
VoltUel2	14255		Loaded
flow % range	0,00	%	Loaded
Sampling Frequ	19,91	Hz	Loaded
Service Info	00201084		Loaded
» » » » Self test			
0%	0		Loaded
FS	0,00000		Loaded
» » » » Zero Trim			
Zero trim	0,000000	m/s	Loaded
» » » » Trim Param.			
Calfactor	1,000000		Loaded
CFH	923,33	s/m	Loaded
CFR	125		Loaded
ZPH	0,000000		Loaded
» » » » » Empty Tube Det.			
actValue E1	66,65548	%	Loaded
actValue E2	100	%	Loaded
Treshold	33	%	Loaded

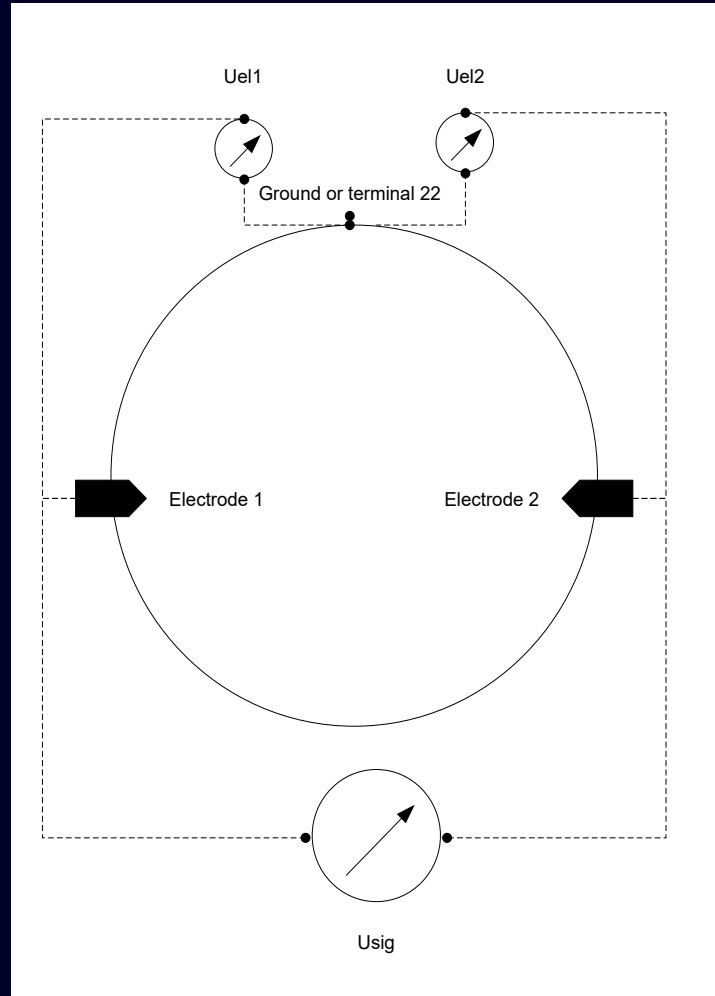
Advanced diagnosis using PDM

Extended service info

Volt Usig is the electrode signal giving the flow reading.

Volt Uel1 and Volt Uel2 is the single electrode electrical potential measured between ground and the electrode itself.

Parameter	Value	Unit	Status
» » Service			
Customer Code	0		Loaded
» » » Controlvalues			
Volt.Uref	26070,79		Loaded
VoltUsig	32		Loaded
VoltUel1	-265		Loaded
VoltUel2	-394		Loaded



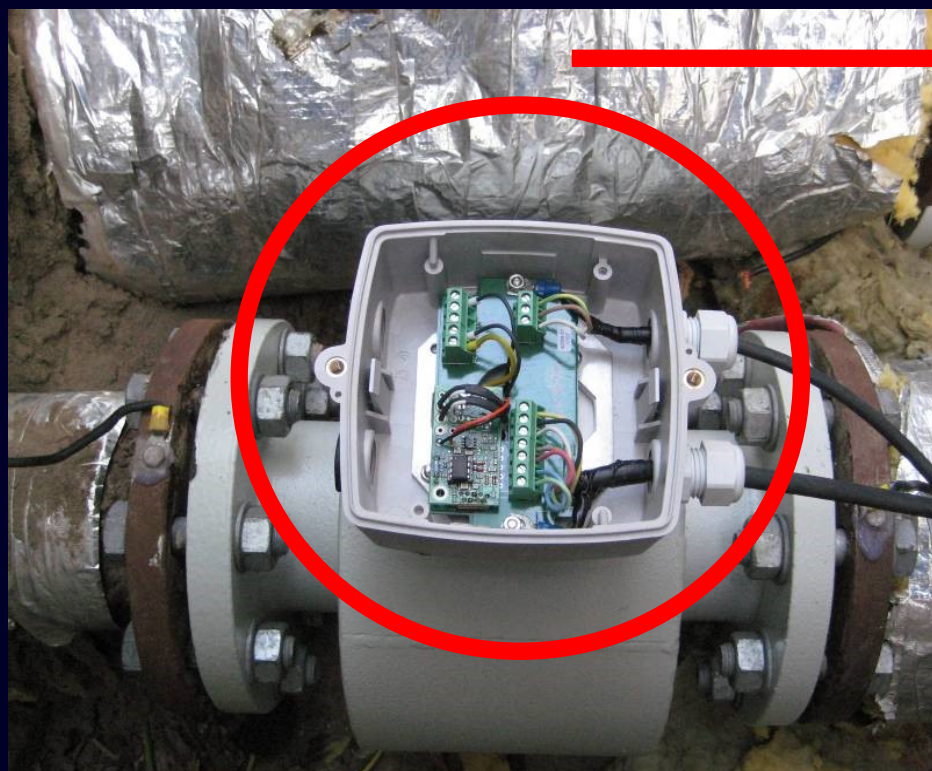
1. If these values are far apart there is a problem,
2. either the electrodes are covered,
3. the preamplifier on the SmartPlug is defective.
4. sensor is empty

SITRANS F M TRANSMAG 2 / MAG 911 E

Typical installation in the field:

Extreme applications –

- high solids content up to 70%
- stable measurement all the time.



TRANSMAG 2: Focus Areas

There are numerous industries but some of them have particular process requirements that need special treatment such as:

- Wastewater
- Mining, Aggregate and Cement
- Pulp & Paper



SITRANS F M TRANSMAG 2 / MAG 911 E

Material options

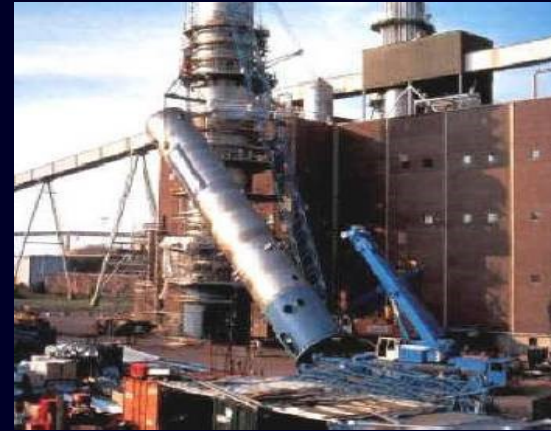
Liner materials with SITRANS F M MAG 911/E	
Neoprene	Standard applications, water
Hard rubber	Standard applications, water, wastewater, warm water
Linatex	Abrasive Medias with high solids
PTFE	Aggressive chemicals, pulp and paper, high temperature application up to 150°C
Novolak	Low abrasive medias, pulp and paper

Electrodes material with SITRANS F M MAG 911/E	
SS 316 Ti	Standard, water, wastewater, heating systems
Hastelloy C-4	Chemicals
Titanium	Chlorine, chlorite, salt peter and chromic acid, textile-bleach
Tantalum	For most of all acids
Platinum	Resistant opposite most liquids

Mining and metals

Many mining areas require measurement of flow for their processes.

- Magnetite and other metal slurries being extracted from the refinery
- Coolant lines that will just have water
- Chemical lines that separate the ores from the rock



Reasons for electrode noise

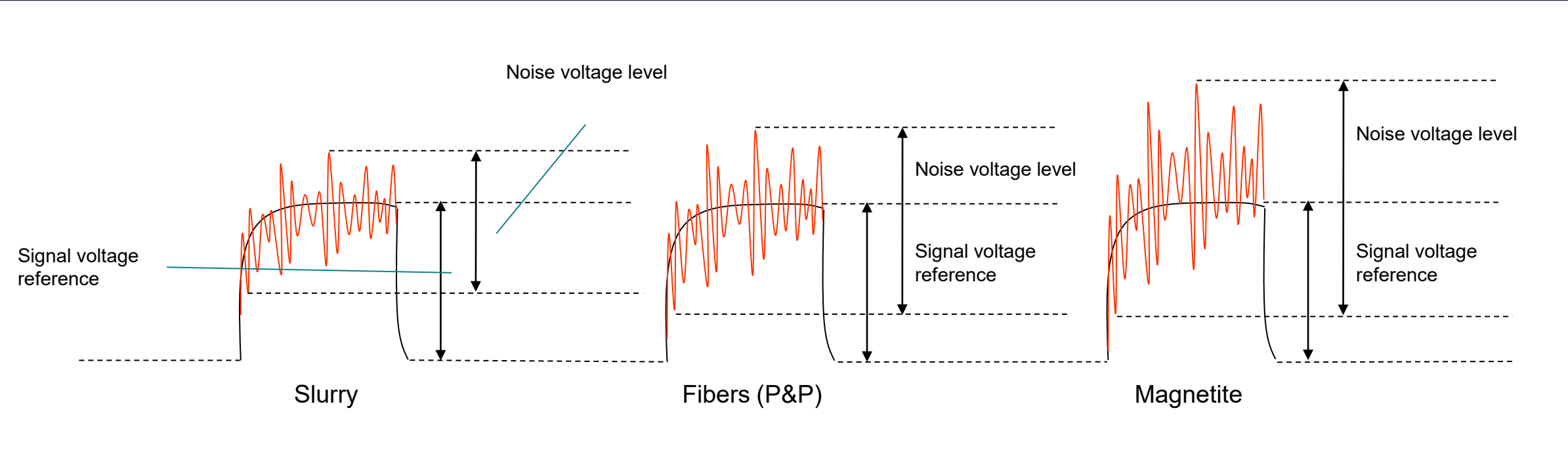
There are three types of electrode noise:

- Static loaded particles
- Particles hitting the electrodes causing a piezo effect.
- Electro chemical activity in measuring pipes“D“ Device error

Other factors are also major contributors to electrode noise:

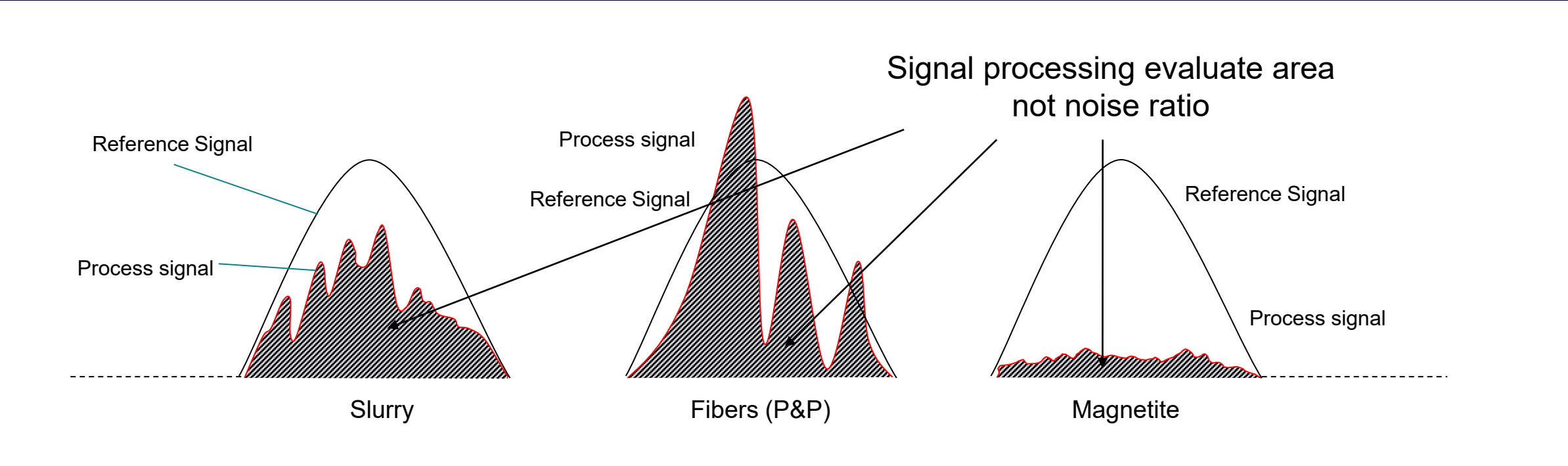
- Flow rate: higher flow rate causes higher noise level
- Grain Size: bigger particles cause higher impact energy on electrodes
- Solid Concentration: Higher concentration causes higher noise level
- Air
- Homogeneity
- Conductivity jumps
- Chemical additives

Noise evaluation in DC meters



As shown on the graph the noise signal is relative large compared to the measured signal performed by voltage levels.

Noise evaluation in PAC meters



With PAC the signal strength is better due to the high energy on the coils but the signal processing via integration system results in lower sensitivity even in harsh applications.

How to prevent influence on measurement

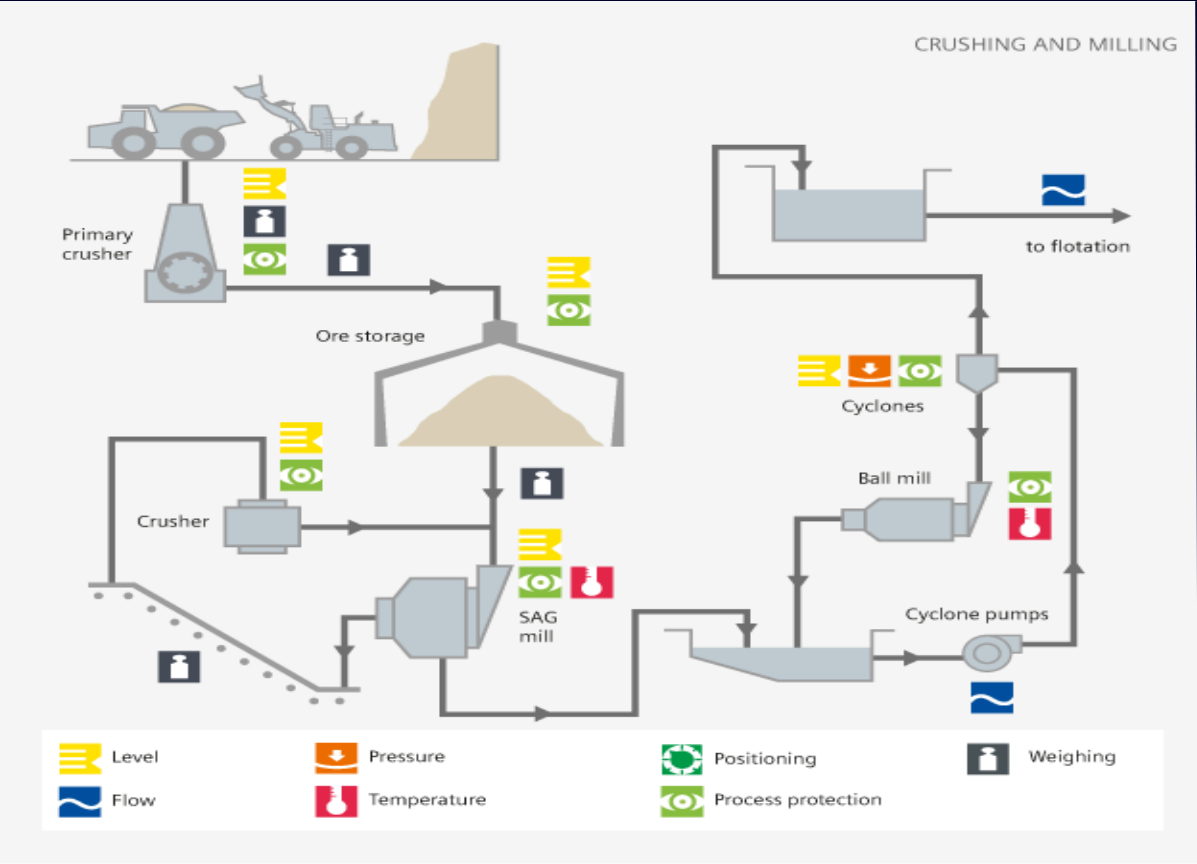
There are different possibilities to prevent or limit electrode noise from influencing the stability of the output signal.

- Enlarge the magnetic field → better signal noise relation
- Choose a harder electrode material (like e.g. Hastelloy or Tungsten Carbide) → lower noise level
- Or a mix of both → 911/E sensor

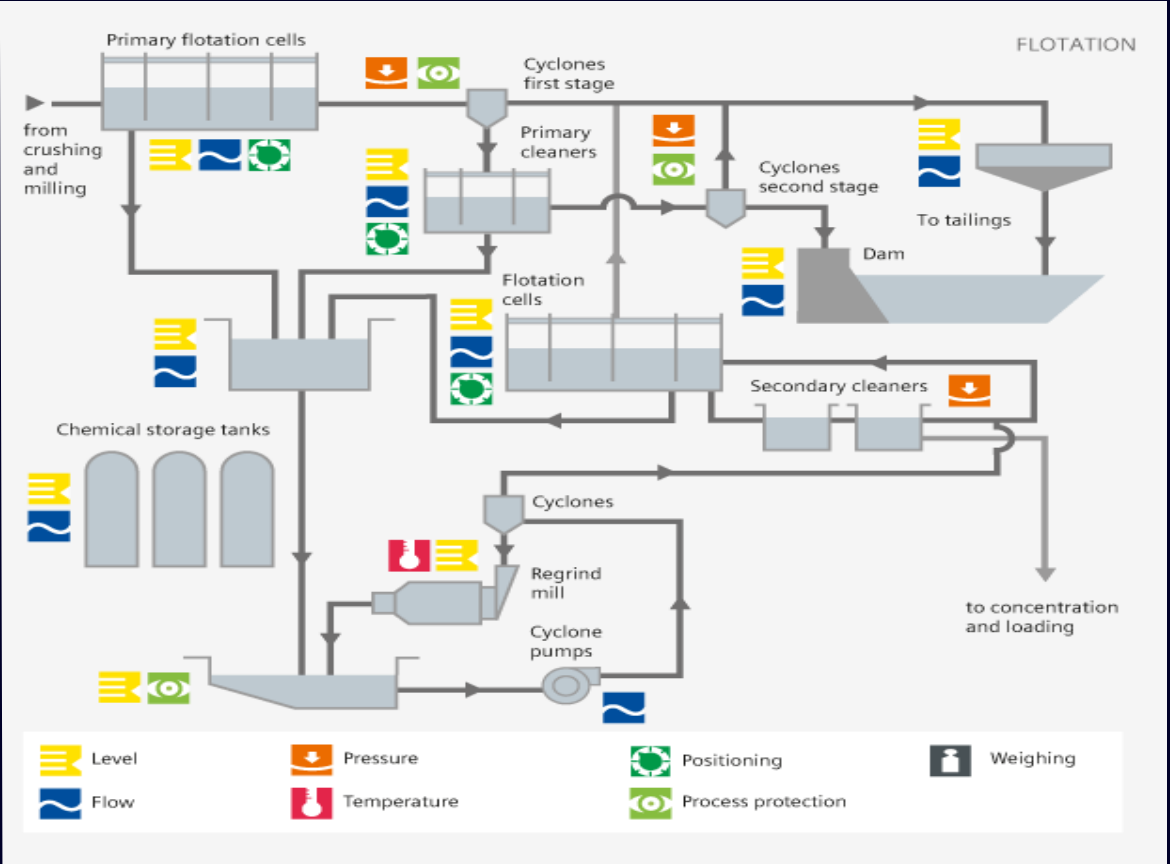
Main influences of noise in MAG-meter applications

	Typical DC Meter	AC Technology	PAC Technology
Signal noise	Homogeneity % Solids (30% max) Jumps in Conductivity Particle size	Homogeneity % Solids (~50%) Zero point stability	Homogeneity % Solids (70% max)

Mining Process



Rocky slurry



Fine slurry

General mining process conditions

The complexity of the mining process involves different aspects that must be taken into consideration:

- The different process stages present a wide range of particle sizes that can be categorized as big particles (e.g. rocks in the size range of cm) or fine particles (e.g. dust in the size range of mm).
- The solids content and the shape of the particles are important factors because they influence the abrasiveness.
- High temperature which often occur in fine slurry applications, have an influence on the corrosion.
- In many mining applications the slurry contains very aggressive chemicals in order to separate the material. This makes it difficult to define which parameter is the most important for the evaluation, chemical or abrasion resistance.

Primaries: Selection

Fine slurry:

Linatex

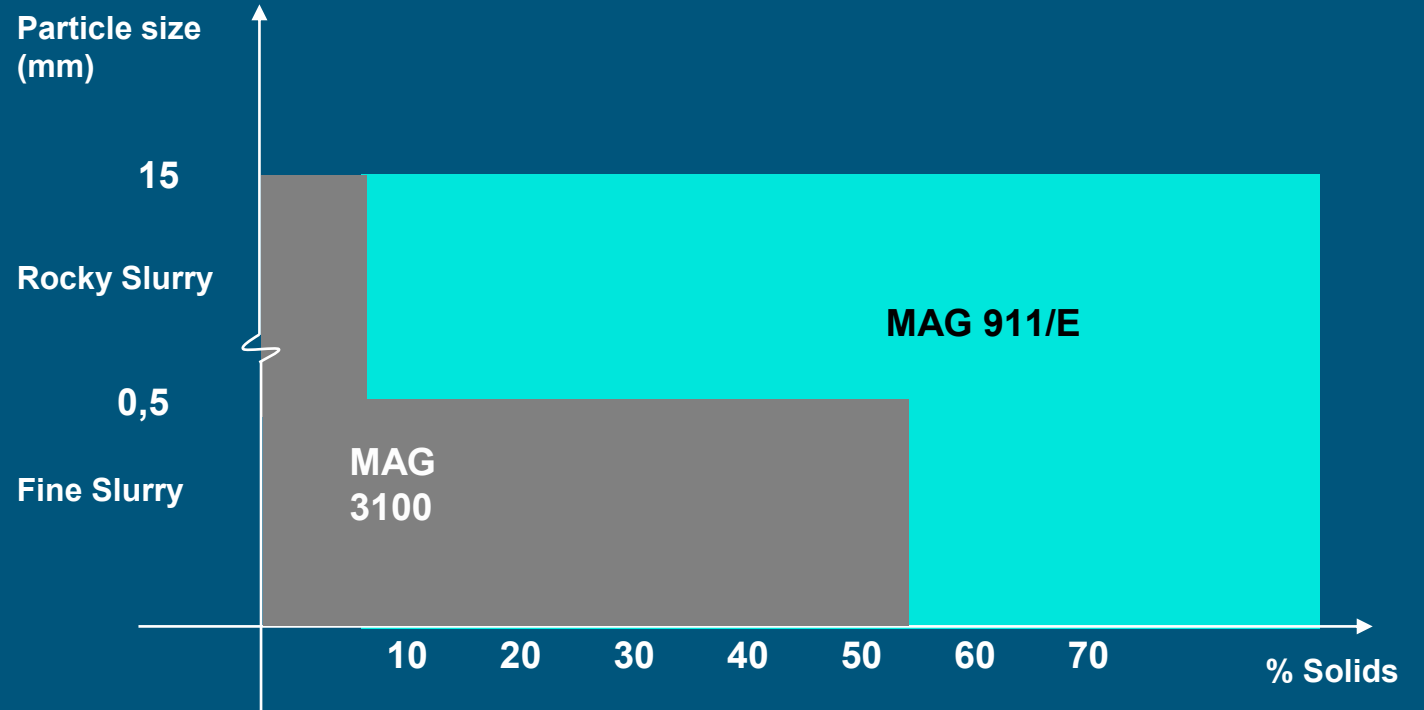
+ Tungsten Carbide electrodes –
no chemicals

Linatex or PTFE or PFA –
with chemicals

Rocky slurry:

Thick Linatex (as a special)

+ Tungsten Carbide electrodes,
Neoprene



Mining applications

How to select the proper liner for 3100?

Sensor	% Solids	Particle size	Particle character	Chemical	Liner
3100	7	2-10 mm	abrasive	Yes	Neoprene
				No	Linatex
			nonabrasive	Yes	PTFE
				No	Neoprene
	30	≤ 0.5	abrasive	Yes	Neoprene
				No	Linatex
			nonabrasive	Yes	PTFE
				No	Neoprene

Note: The information contained in this table is only a guideline.
 For particle sizes larger than 10 mm, the concentration of solids has to be lower.



Mining applications

How to select the proper liner for 911/E?

Sensor	% Solids	Particle size	Particle character	Chemical	Liner
911/E	70 (including magnetite)	2-10 mm	abrasive	Yes	Neoprene
				No	Linatex
			nonabrasive	Yes	PTFE
				No	Neoprene
	30	≤ 0.5	abrasive	Yes	Neoprene
				No	Linatex
			nonabrasive	Yes	PTFE
				No	Linatex/ Neoprene

Note: The information contained in this table is only a guideline.
For particle sizes larger than 10 mm, the concentration of solids has to be lower.

Installation conditions

Depending of the flow speed* and characteristics of the materials, the recommendations for preventing abrasion are:

* Flow conditions must be observed to avoid sedimentation, depending of the % of solids and type of particles

Source: Handbook on Mine Fill, Y. Potvin, Australian centre for Geomechanics 2005

Vertical Installation:

Fine Slurry (≤ 0.5 mm)

MAG 3100 ≤ 2 m/s

911/E ≤ 3 m/s

Rocky Slurry (≥ 15 mm)

MAG 3100 ≤ 2 m/s

911/E ≤ 3 m/s

Note:

Vertical Installation reduces the abrasion effects and avoids the sedimentation problems.

Pulp and paper

This market has many different components that need measurement:

- Water lines
- Chemical lines for Black and Green liquor
- Another commonly measured product is:
Pulp Stock, a fibrous liquid that contains wood fibers.



Main influences for accurate measure in P & P applications

	Typical DC Meter	AC Technology	PAC Technology
Signal Noise	Homogeneity % Consistency (3-4%) Jumps in Conductivity Air Increasing fiber length Fiber hardness Flowrate Temperature steps	Homogeneity % Consistency (~12%) Zero point stability Temperature steps	Homogeneity % Consistency (15%)

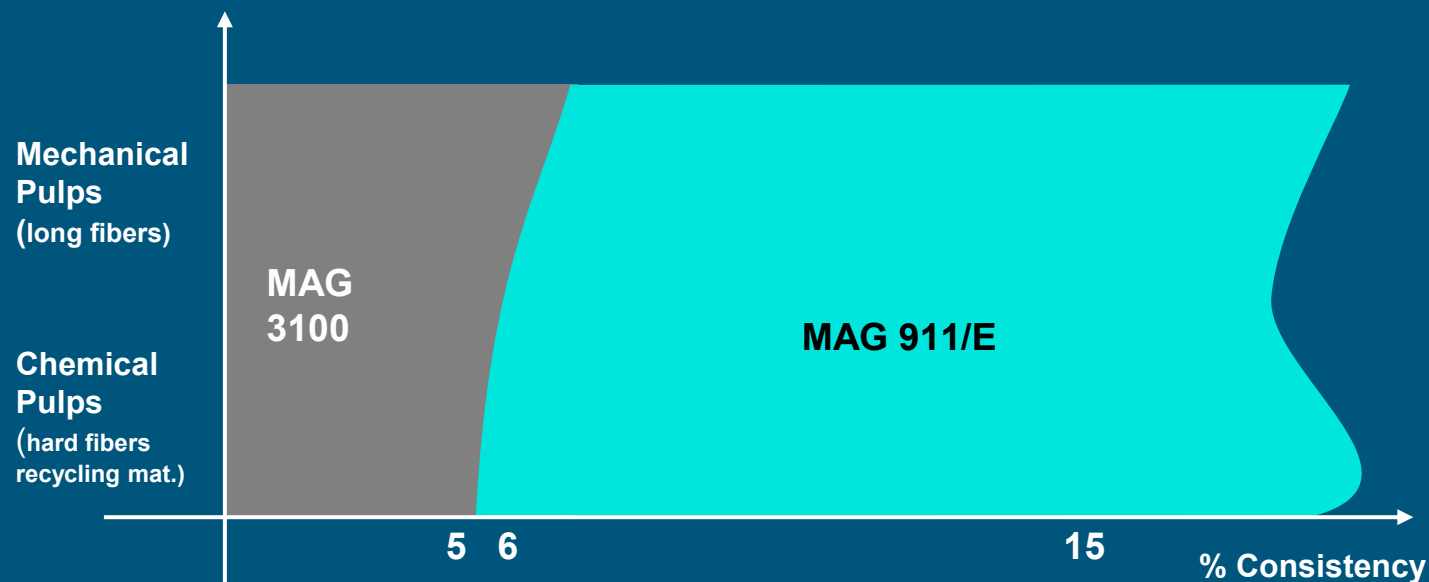
Primaries: Selection

Lining:

- PFA or PTFE

Electrodes:

- Stainless steel 1,4571 in water applications
- Hastelloy C in pulp applications
- Tantalum or Pt/Rh in bleaching applications



Which liner to choose?

- PFA / PTFE in general is recommended
- PFA for continuous black liquor applications

The selection of the liner may determine the lifetime of the meter.

Please notice:

Any liner other than PFA/PTFE – **Not recommended in any P&P plants.**
Even if you think that the water is just for a cooling application.
In some cases the cooling system is in contact with the processed fluid!



Which electrode to choose?

Standard electrodes 1.4571
used in 95% of the applications



Duplex electrodes
in concentrated black liquors
→ corrosion resistance



Tantalum, Pt/Rh electrodes
in bleaching applications
→ corrosion resistance



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