

Taking Clamp-on Ultrasonic Flow to a NEW Level of Performance



What we will cover

Principle of operation

New innovative features and benefits

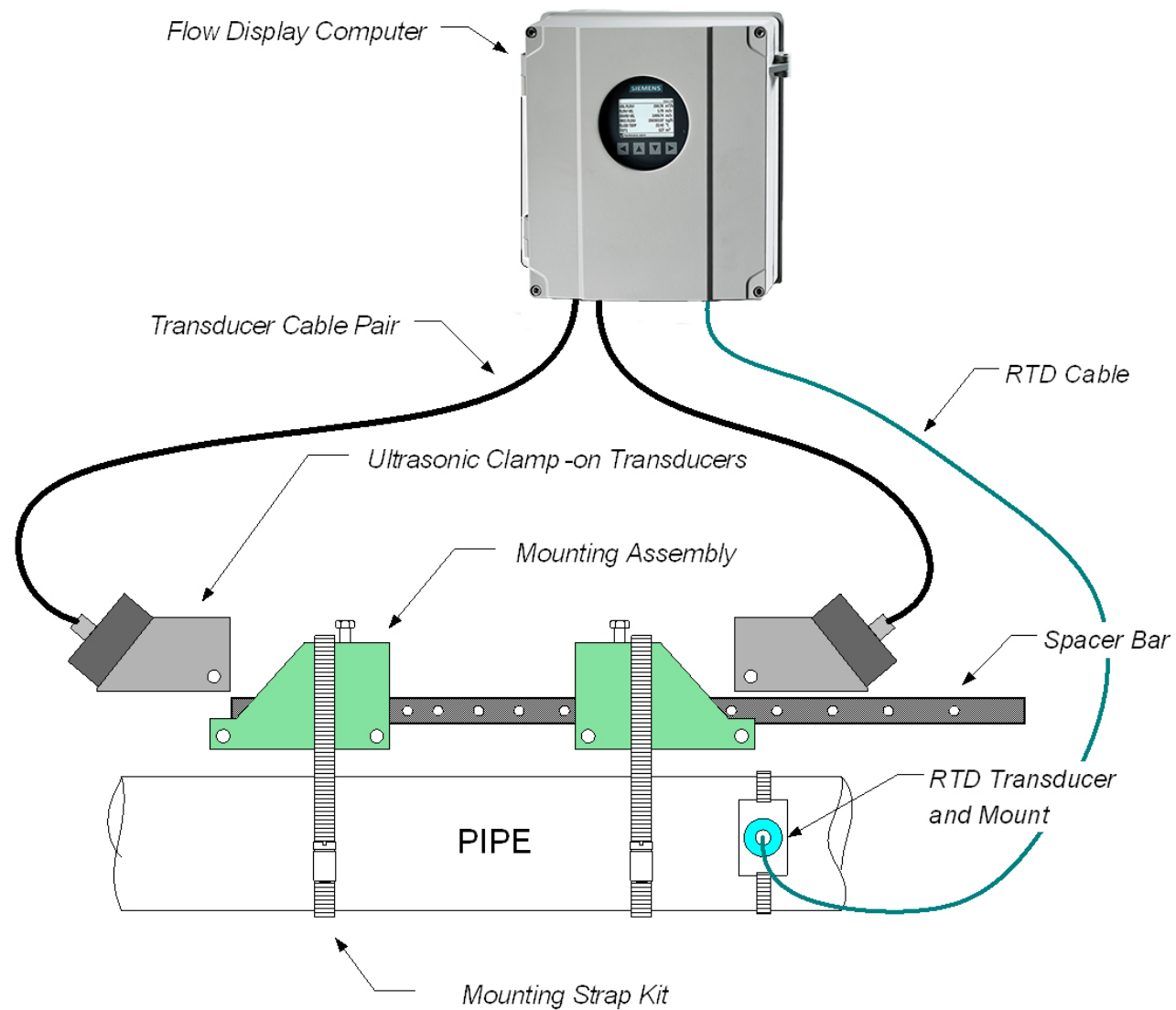
Industry specific applications

Installation tips and tricks

Selection criteria



Ultrasonic Clamp-On System Components



Benefits

Non-Intrusive

No Need to Cut Pipes - No Process Shutdown for Installation

Can measure liquids & gases

Low Installation Costs

Measure Pipes From 1/4" – 360"

No Pressure Drop or Energy Loss

No Moving Parts to Wear or Foul - Little to No Maintenance

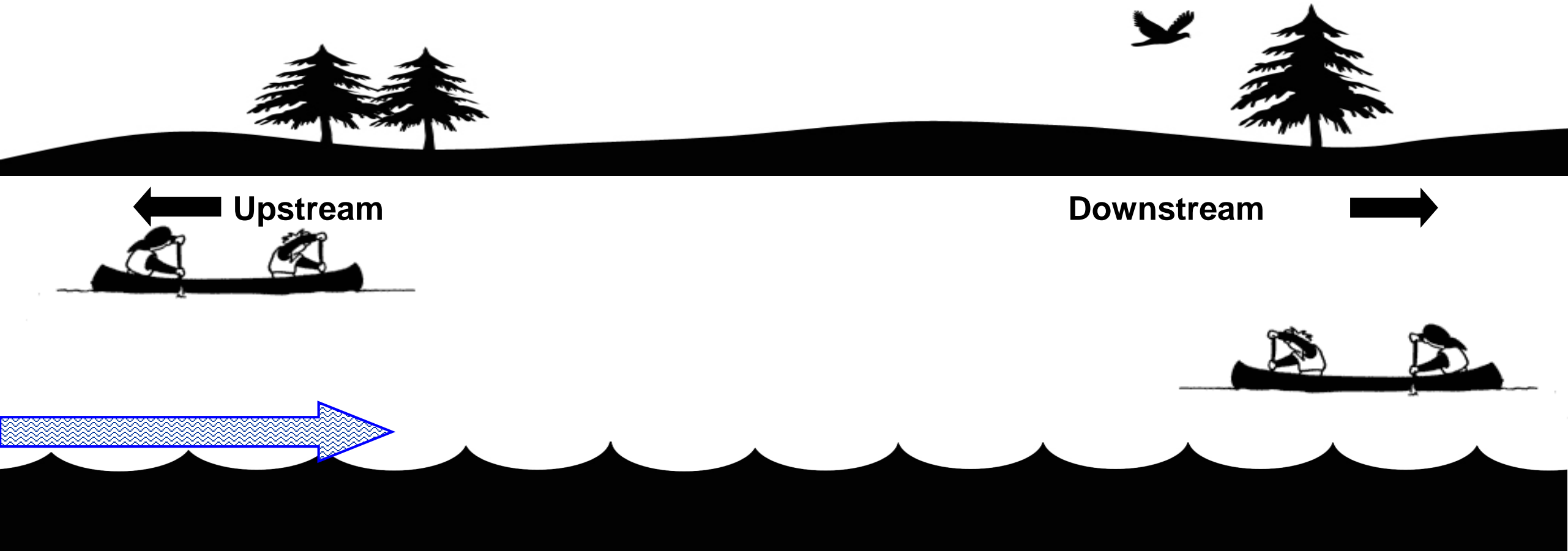
Maintains Calibration

Wide Turn-Down Ratio

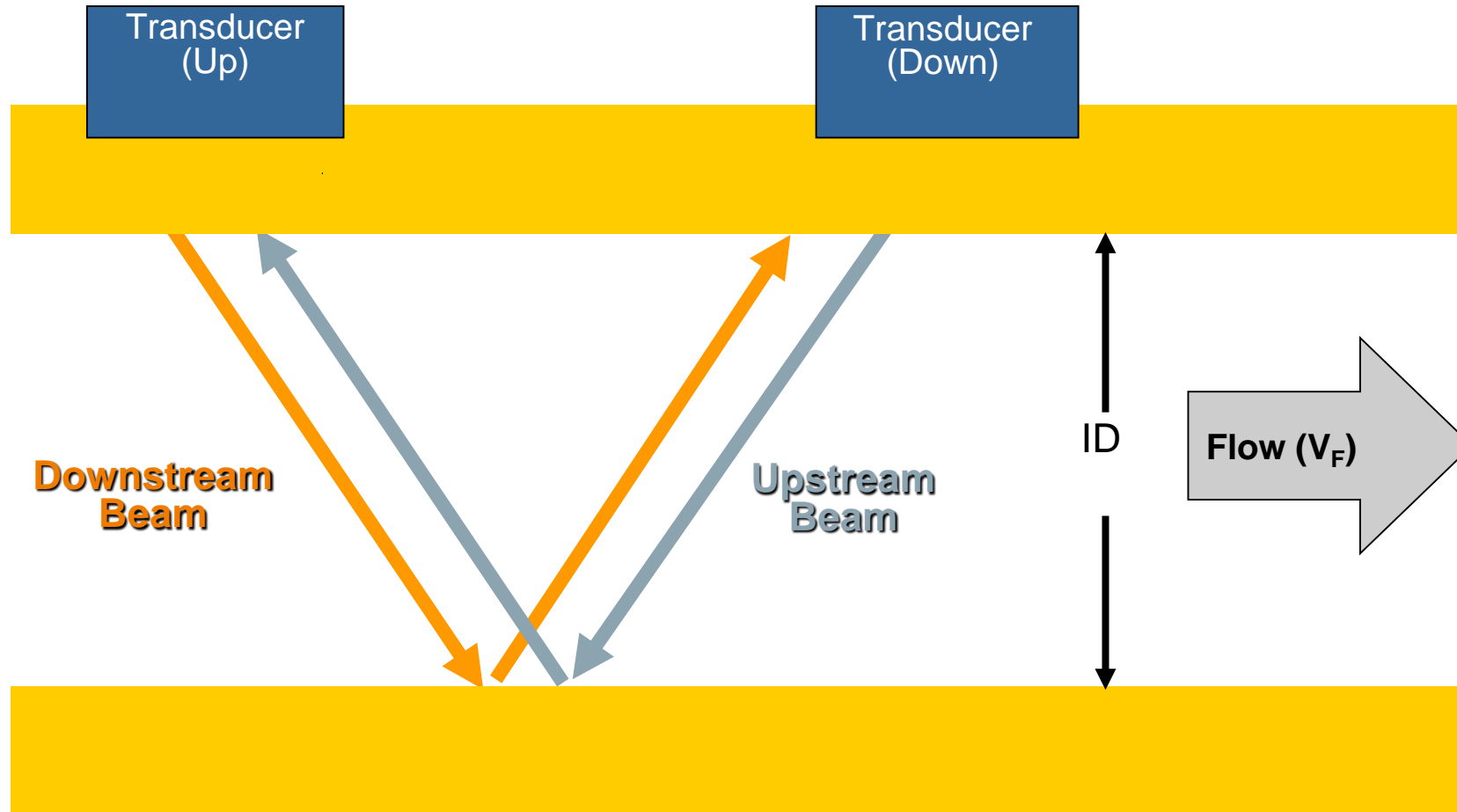


Principles of Operation – Transit Time

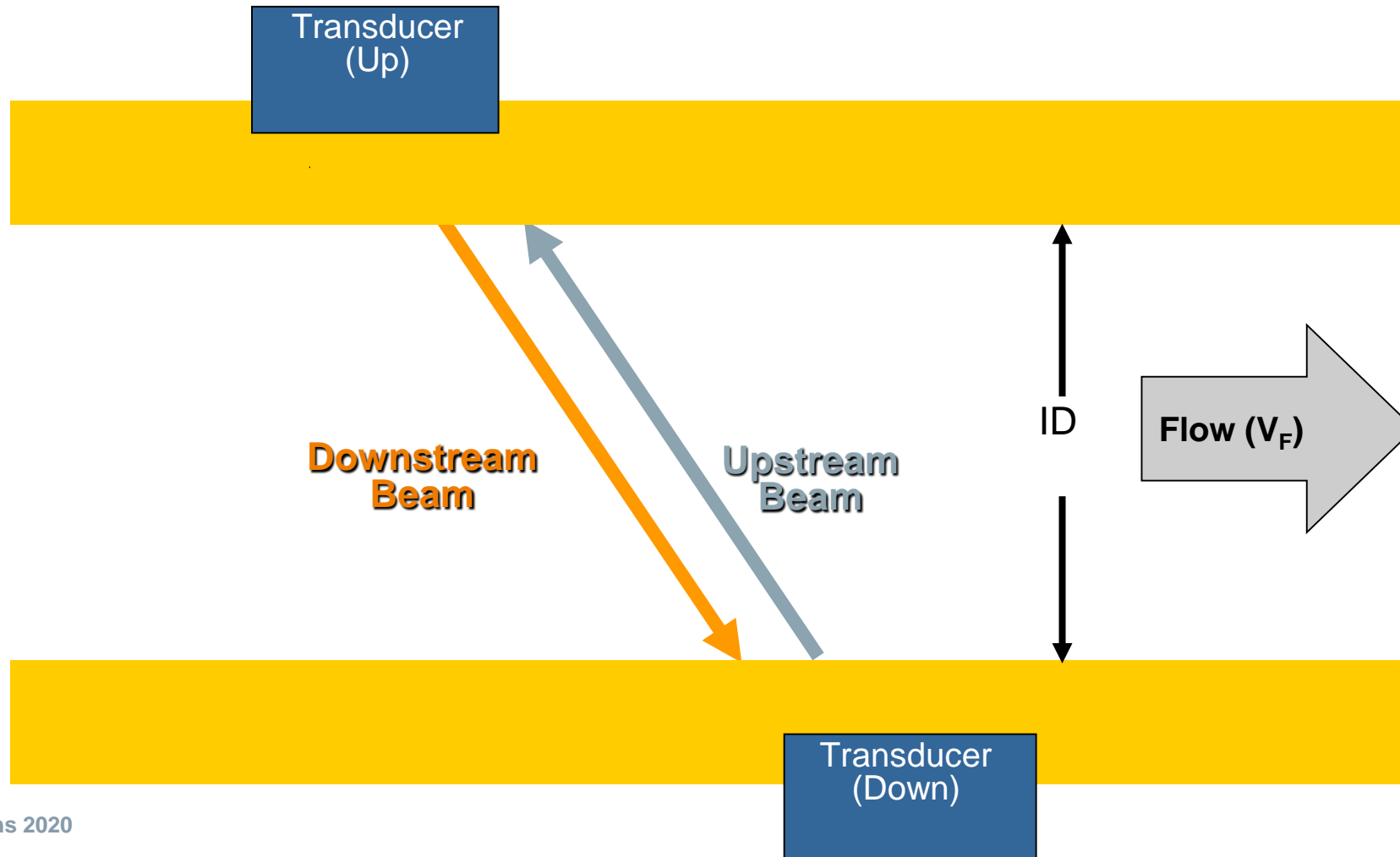
There is a time difference. Why?



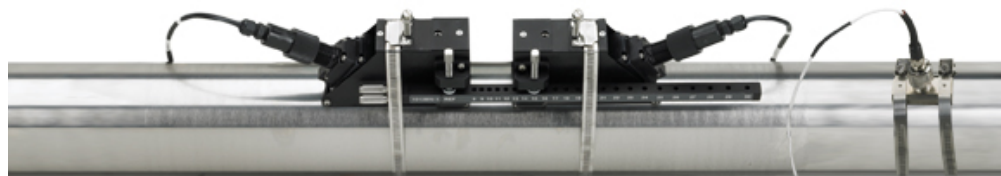
Principle of Operation (Reflect Mount)



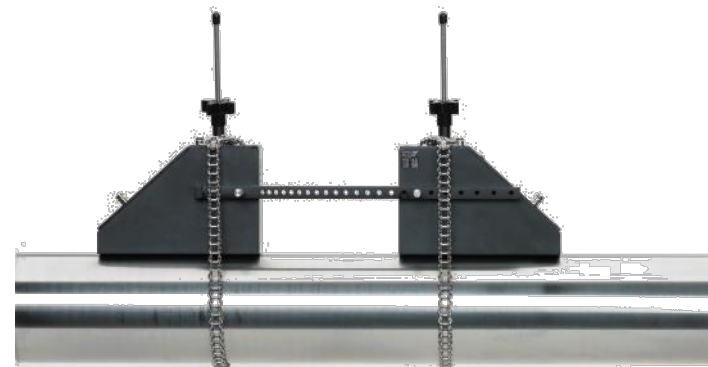
Principle of Operation (Direct Mount)



Mounting Configurations (Frames, Ladder Chain)



Mounting Frames



Ladder chain Mounting Straps
(for quick temporary measurement)

Mounting Configurations (Magnetic)

Magnetic Mounting features and applications:

Features:

(Rare Earth) Nickel-plated Neodymium Iron Boron (NdFeB)

Resists a load of 20lbs min

HP & Universal size C, D, and E

Capable of accepting straps

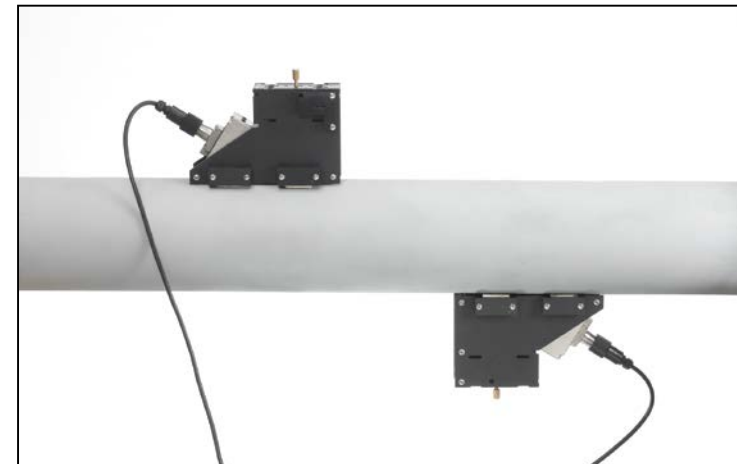
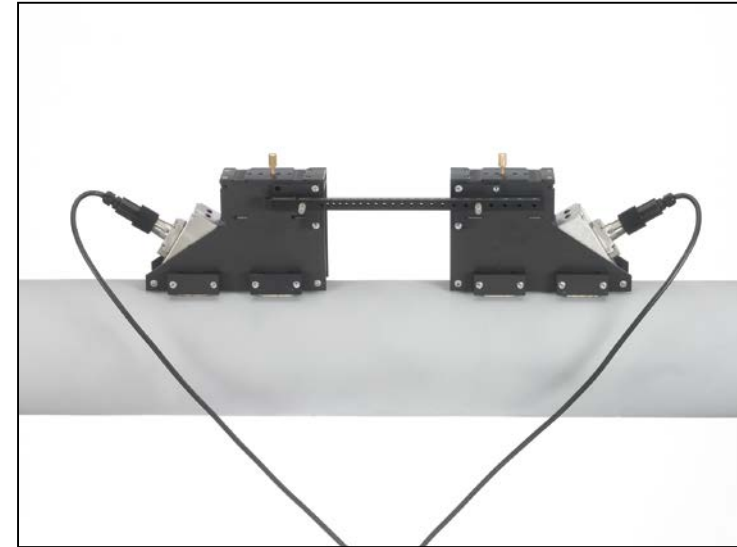
Available in Stainless (special)

One size fits all

Applications:

Temporary measurement

Large diameter pipes



Mounting Configurations (High Precision sensor mount)

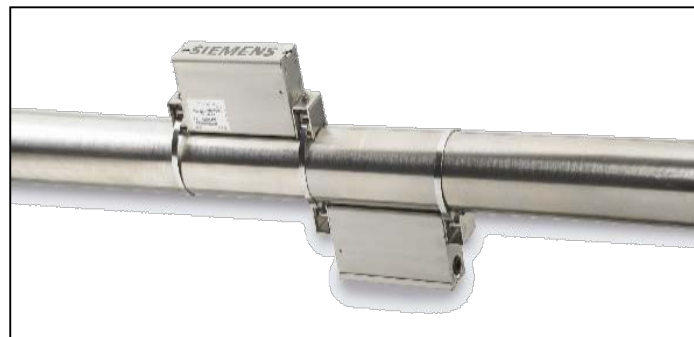
High Precision sensor mount features

316 Stainless

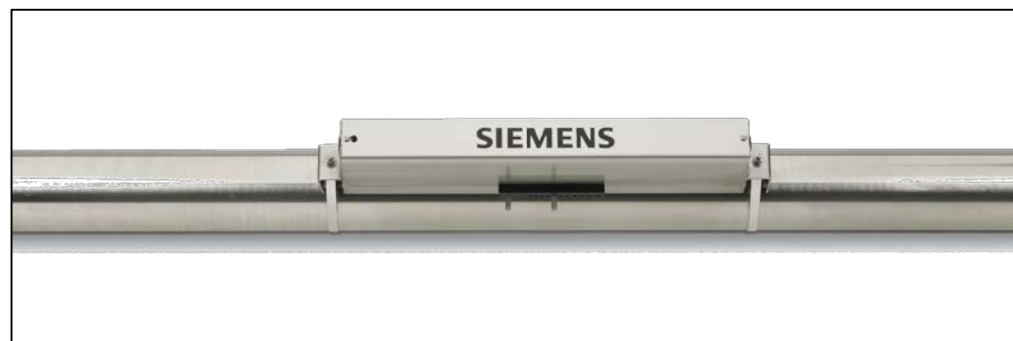
Compatible with sensor size:

- C & D High Precision
- E Universal

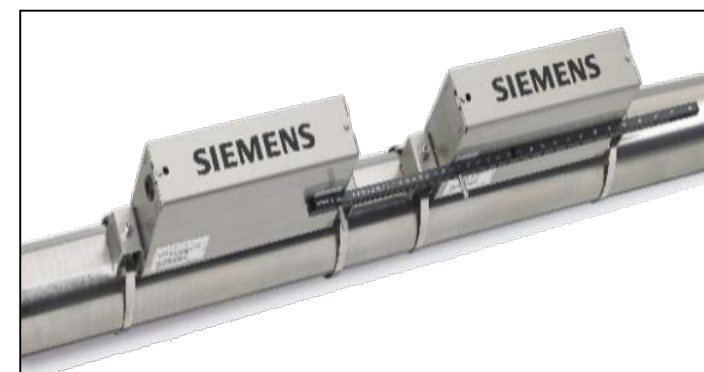
Single and Dual enclosure



Dual Enclosure (Direct Mount)



Single Enclosure (Reflect Mount)



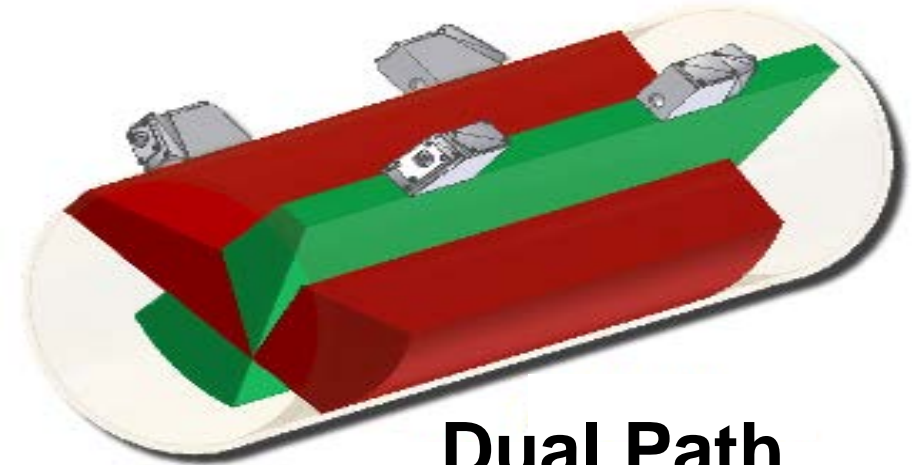
Dual Enclosure (Reflect Mount)

Principles of Operation

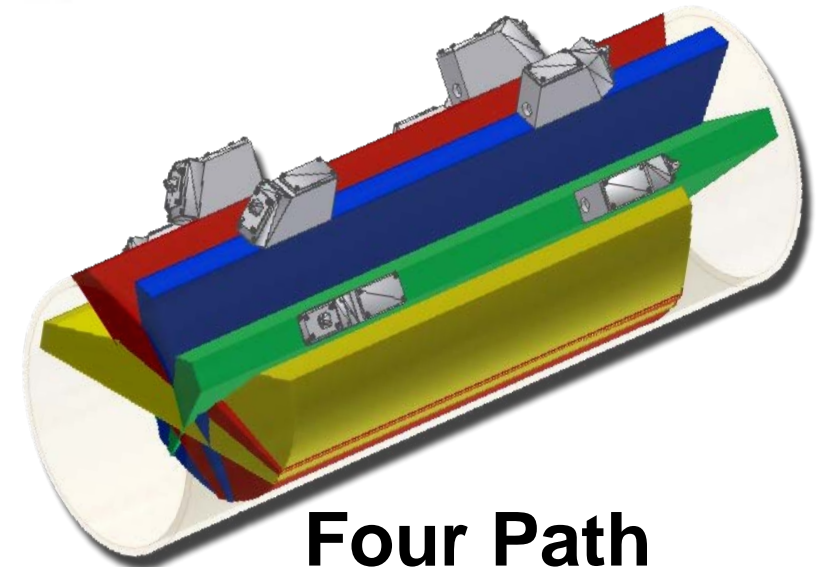
Dual / Four Path installations increase flow sample averaging for greater precision

Benefits

- Greater cross-sectional averaging
- Improved accuracy
- Improved repeatability
- Adds redundancy
- Reduces or eliminates error due to asymmetrical flow profile
 - On pipes with limited straight run
 - On “Out-of-round” pipes
- Eliminates “crossflow” induced errors



Dual Path



Four Path

Principles of Operation – Flow Profile

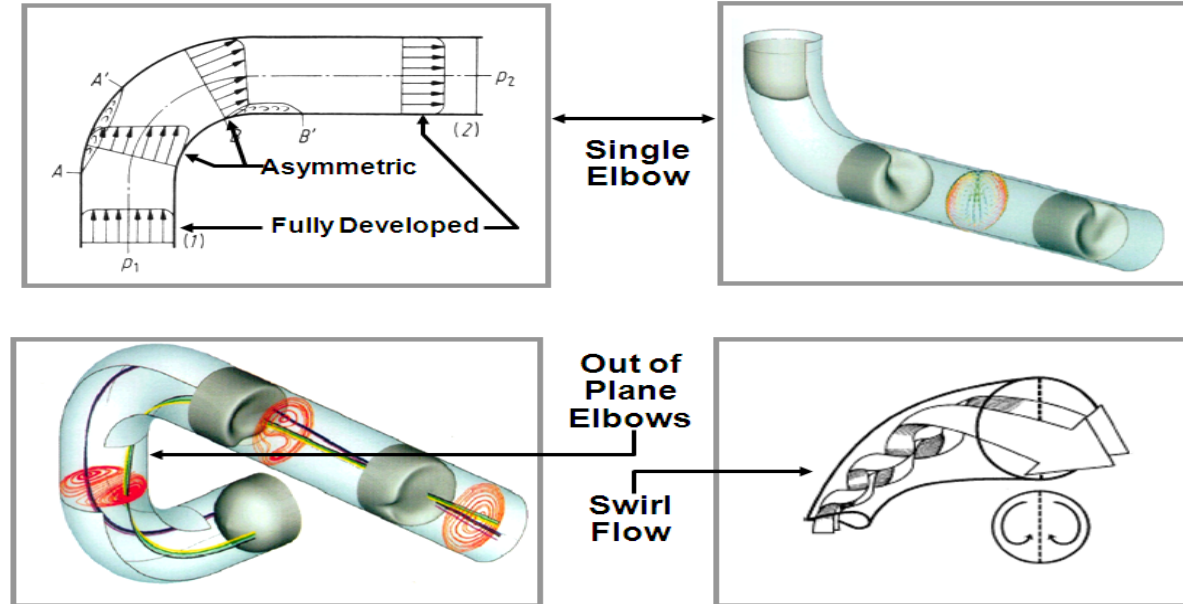
Most flow meter types require sufficient straight piping run upstream to produce a fully developed flow condition

Out of Plane Elbows

- Produces a full counter-propagating swirl that can persist for >40 diameters

Single Elbow

- Distorts the flow profile for a short distance before resuming to fully developed



Principles of Operation – Flow Profile

When applications present limited straight piping conditions the flow profile at the point of measurement will not be fully developed; this will affect the accuracy of most flowmeters.

All Siemens Clamp-on meters have the ability to correct for the theoretical flow profile based on actual piping. FS220 and FS230 can correct for upstream and downstream with the use of the on-board **Pipe Configuration Menu Tool**. With it you can choose the configuration most representative of the meter installation point...

<u>Fully Developed</u>	Sensor installation upstream and downstream of a sufficiently long straight pipe run to ensure fully developed flow (Default)
<u>Single Elbow</u>	Single 90 degree Elbow upstream of sensor installation
<u>DbI Elbow “-”</u>	Double in-plane Elbows upstream of sensor installation
<u>DbI Elbow “+”</u>	Double out-of-plane Elbows upstream of sensor installation
<u>Expander</u>	Pipe expansion upstream of sensor installation
<u>Reducer</u>	Pipe reduction upstream of sensor installation
<u>Header Inlet</u>	Header or pipe manifold upstream of sensor installation

If a condition other than “Fully Developed” is programmed; the distance between the condition and the sensor is also programmable to enable computation of the necessary correction. **Upstream and Downstream allows for best bidirectional flow measurement.**

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The NEW SIEMENS FS230



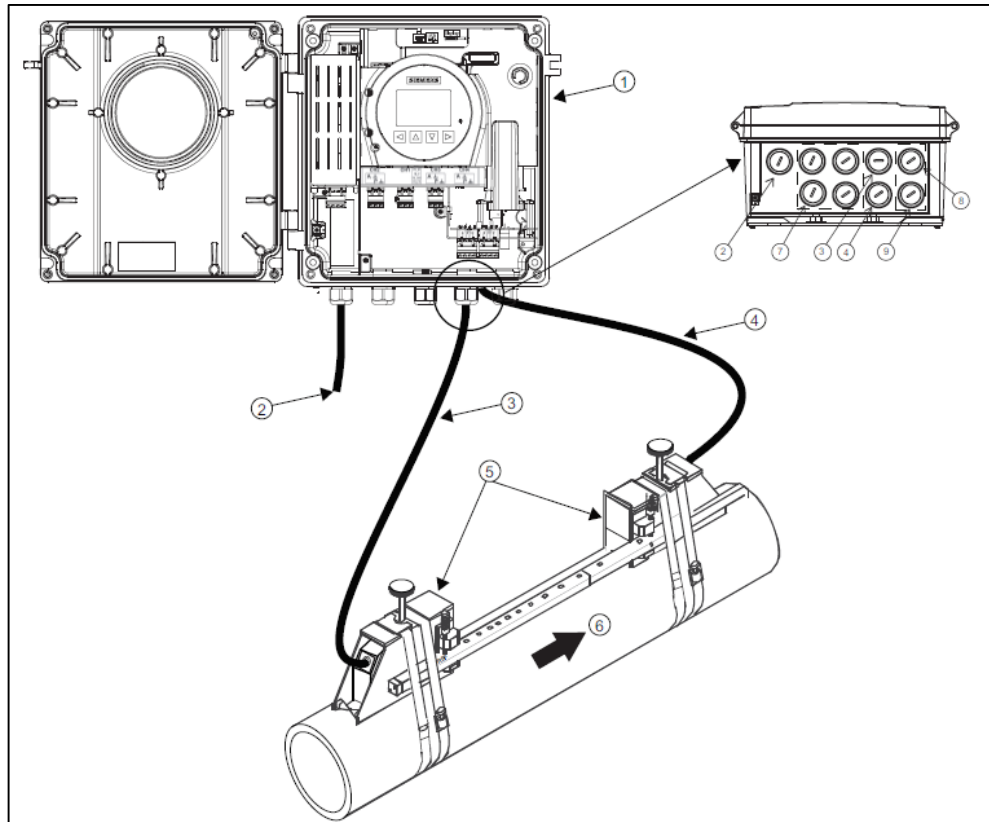
Features and Benefits

- Digital Platform – Flow meter technologies share a common platform
- DSL (**D**igital **S**ensor **L**ink) -Digitizes the ultrasonic signal
- Wall-mount enclosure w/internal DSL, 1 or 2 path
- DSL external, up to 4-Path
- Enclosure material: Aluminum, Rating: IP66/67, NEMA 4X
- Approvals: FM, FMc, ATEX, IECEx
- Up to 6 I/O channels combining analog, relay or digital outputs & binary input + RTD
- Fully graphical display, 240 x 160 pixels
- 24 to 90 V DC, 100 to 240 V AC universal power supply

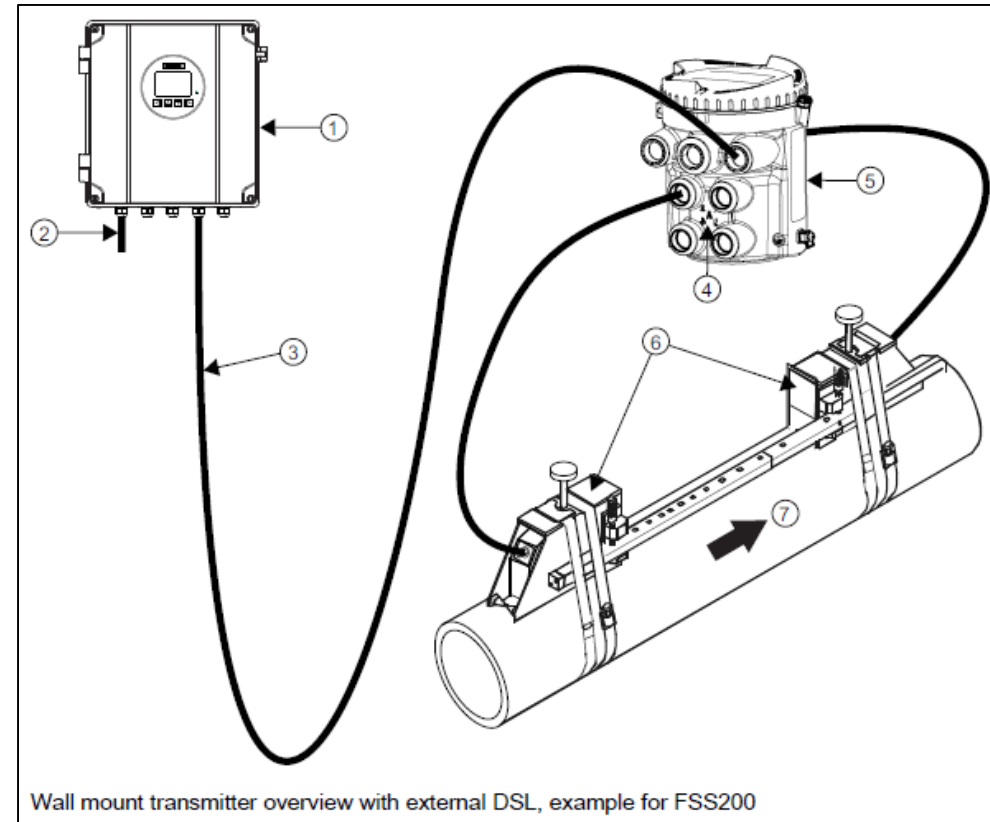


External DSL

Features and Benefits



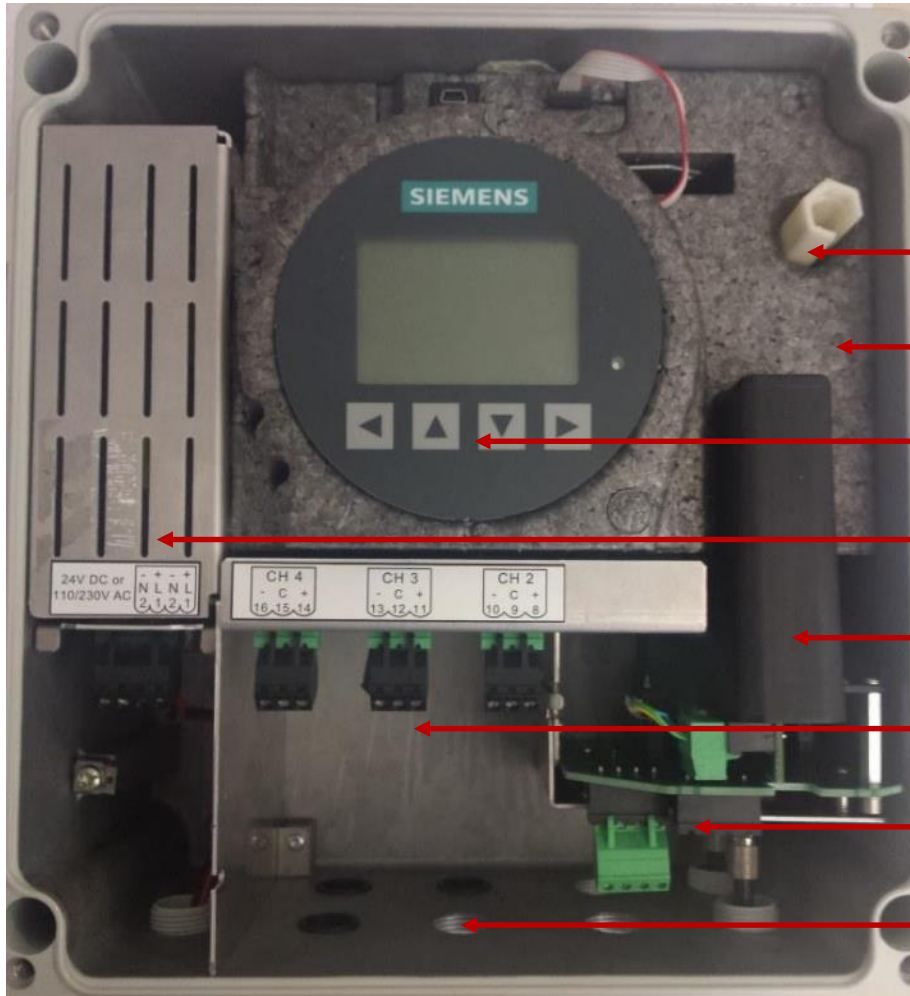
Wall mount FST030 w. integrated DSL



Wall mount transmitter overview with external DSL, example for FSS200

Wall mount FST030 w. external DSL

Features and Benefits – Modular Design



- Wall housing painted aluminum die-cast, Lid removable, IP 66/67, -40°C up to +60°C
- F-Connector Tool – connecting the sensor cables
- Lining hard foam (Temp, Shock, Service)
- HMI Display with 4 key pad
- Power supply Cover with terminal compartment
- Internal DSL-Module (up to dual-path)
- Terminal compartment I/O – Channel 1, 2, 3 and 4
- DSL-analog in channel 5 & 6 – Temperature by RTD
- Cable entry 9 x M20x1,5

Features and Benefits – Standard / Customizable HMI

One HMI

Full graphical Display

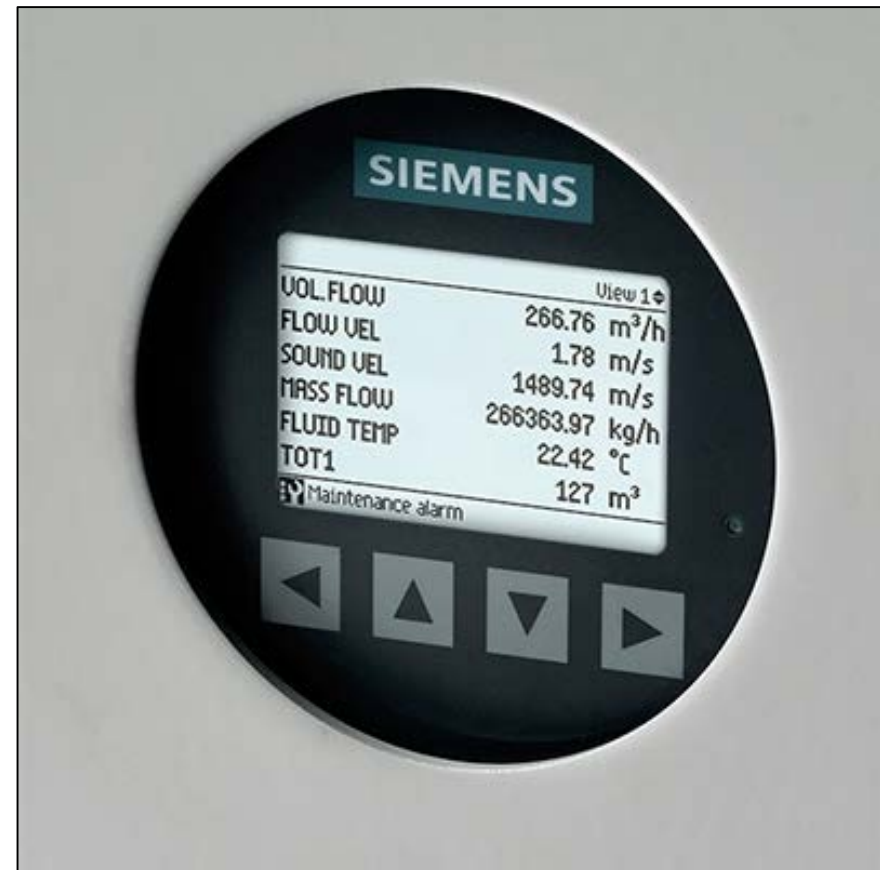
4 Navigation keys

Uniform look and feel

Trending and graphics

BENEFITS

- Easy standardized navigation
- 6 Configurable views
- Customization of top-level views
- Multiparameter display function
 - Including sensor signal
- Reduced training costs



Features and Benefits – SensorFlash

SensorFlash - All in One

Standard interface (MicroSD Card*)
Accessible via PDM through the USB Port
Contains factory-specific and calibration data
Certificates

BENEFITS

- Access via a PC
- 4GB Standard-Upgradeable to 32GB
- Simplifies startup
- System data backup
- Traceability for certification and audits



Features and Benefits – USB Interface

USB Interface

Standard connector and protocol (USB 2.0)

BENEFITS

- Easy access
- Commissioning
- Service and diagnostics without disturbing communication
- PDM Connectivity
 - Including Access to SensorFlash



Features and Benefits – Wiring

Simple Wiring

BENEFITS

- Easy Wiring
- Safe installation
- Time Efficient



Features and Benefits – Update Rate

100Hz Output

100Hz update rate to transmitter
Less noise within signal
Detection of rapid changes in flow

BENEFITS

- Higher accuracy
- Better performance
- Increased measurement cycle
- Efficient in-field calibration
- Reliable measurement



Ideal for oil and gas applications when calibrating with small/large volume provers, compressor stations with pulsating flow

Features and Benefits – Freely Configurable I/O's

Available I/O's

Up to six I/O channels are configured as follows

- **Channel 1**
 - Channel 1 is 4 to 20 mA analog output with HART 7.5. The current signal can be configured for mass flow, volume flow and includes the availability of active or passive - function selected by wiring on the non-Ex terminals. Alternative Modbus RTU RS 485 is available.
- **Channel 2**
 - Channel 2 is a signal output which can be freely configured for any process variable.
 - Analog current (0/4 to 20 mA)
 - Frequency or pulse
 - Operational and alarm status



Features and Benefits – Freely Configurable I/O's



- **Channels 3 and 4**
 - Channels 3 and 4 can be ordered with signal (freely configured for any process variable) or relay outputs, or signal input.
 - **Signal output can be user configured to:**
 - Analog current (0/4 to 20 mA), Frequency or pulse, Redundant frequency or pulse (linked to channel 2), Operational and alarm status
 - **Signal input can be user configured to:**
 - Totalizer reset functions, Force outputs or freeze process values, Initiate automatic zero point adjustment
 - **Relay can be user configured to:**
 - Alarm status
- **Channels 5 and 6**
 - RTD temperature inputs for 1000, 500 or 100 ohm RTD's
 - 2, 3 or 4 wire RTD's supported



Features and Benefits – Enhanced Diagnostics

Enhanced Diagnostics

Signal wave shapes
Signal-to-noise ratio
Signal strength

BENEFITS

- Assessment of flowmeter status
- Detailed information about the measured medium



Features and Benefits – Additional Functions

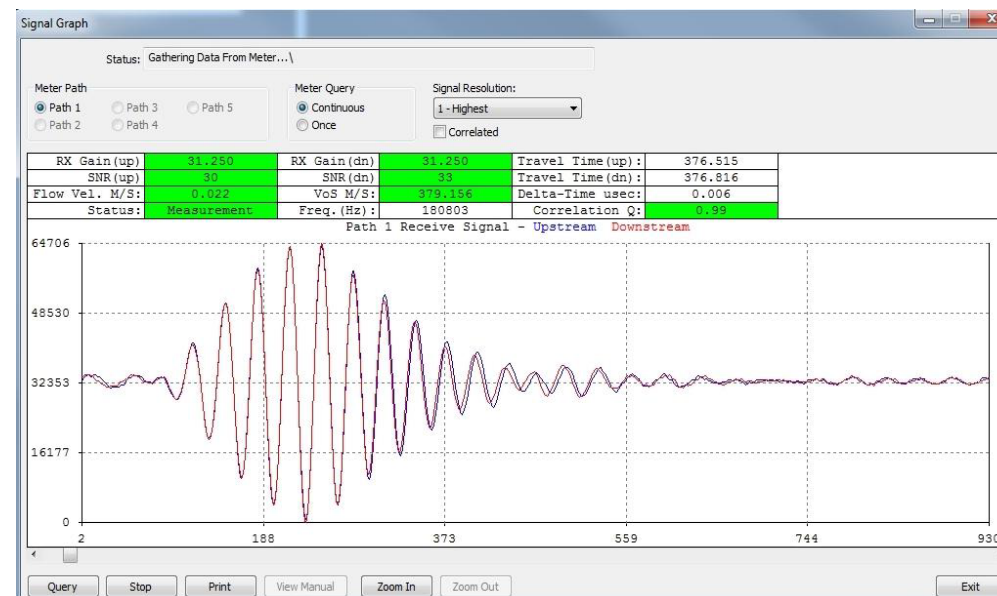
Functions:

The following functions are available:

- Outputs can be individually configured for mass flow, volume flow etc. and are freely configurable
- Three built-in totalizers – Three custom configurable totalizers (forward, reverse, or net flow counting)
- Independent low flow cut-offs, adjustable
- Flow direction adjustable, Uni/bidirectional flow measurement
- Temp and/or Pressure compensated – Pipe expansion compensation guaranteeing an accurate measurement
- Alarm system
- Change log – Parameter change log, time stamped entry onto SD card to track device changes
- Internal data logger (4GB standard, upgradeable to 32GB)
- Display of operating time with real-time clock
- Programmable limit switches
- Full service menu
- Precise temperature measurement ensures optimal accuracy on mass flow and density
- Fully compatible with Siemens PDM

Features and Benefits – FS200 Software

- The intuitive and simple to use FS200 Clamp-on Utility Software:
- Enables communication with any SITRANS FS230 or FS220 clamp-on ultrasonic flowmeter
- Assess the condition of an installation
- Application sizing
- Collects data for comparison with prior baseline data
- Allows loading of AGA gas tables



System requirements

- SITRANS FS230 or FS220 clamp-on ultrasonic flowmeter with firmware version 1.00.00-06 or later
- Microsoft Windows 7, XP or 2000 operating systems
- Installed and actively measuring flow (or at zero flow)
 - An uninstalled flowmeter or inactive site will provide no diagnostic information for the software to use

Features and Benefits – SIMATIC PDM Software

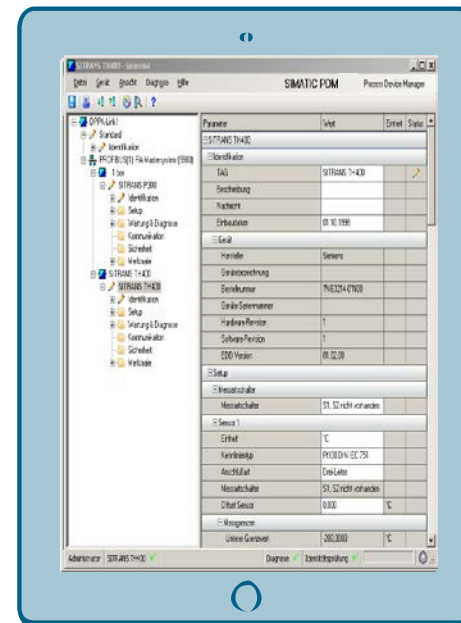
SIMATIC PDM – Process Device Manager The Universal Tool for Engineering and Commissioning

Standard connector and protocol (USB 2.0)

PDM BENEFITS

- Easy access
- Commissioning
- Service and diagnostics without disturbing communication
- Parameterization
- Diagnostics
- Device management

PDM has more than 5,000 devices from over 200 manufacturers in it's device library



Features and Benefits – Simulator

PC based “LUI” Simulator Software Tool

- Duplicates full transmitter program menu
- Full programming experience for familiarization with menu training
- Simplifies support and assistance
- Allows for program testing without the need of a transmitter/sensors



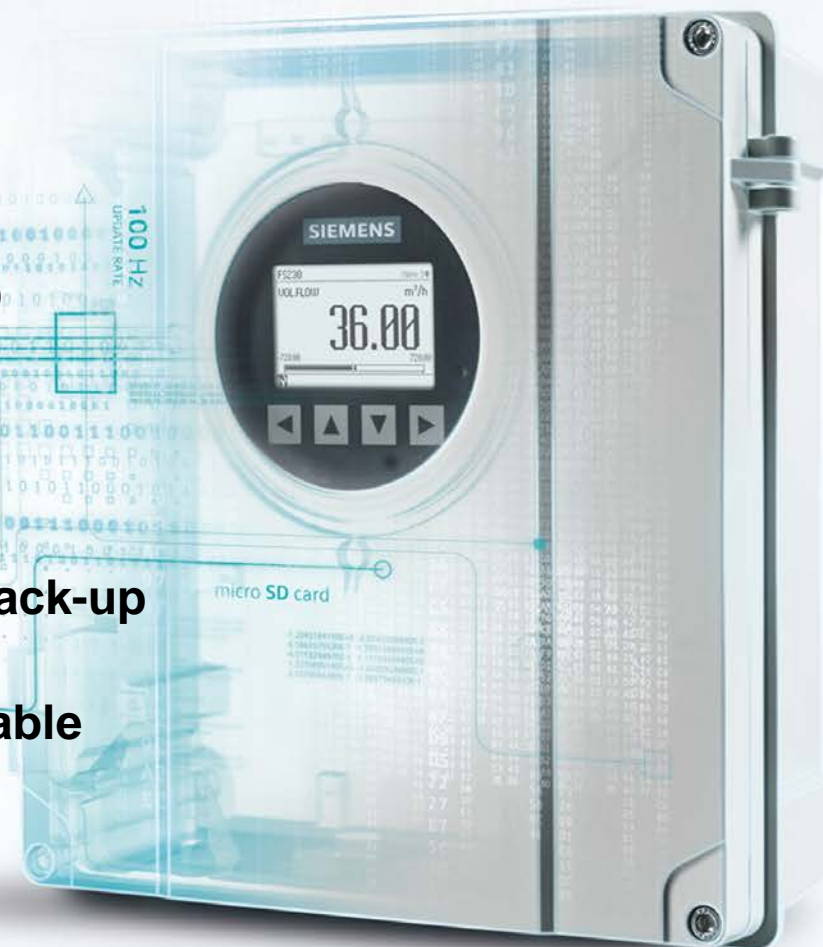
QR code – Easy access to critical device data

- Readable with any smartphone
- Provides access directly to support web site
- Set up videos
- Configuration tutorials
- Installation and operation manuals
- Certificates
- Build data on assigned device
- Data sheet
- FAQ
- Approvals data



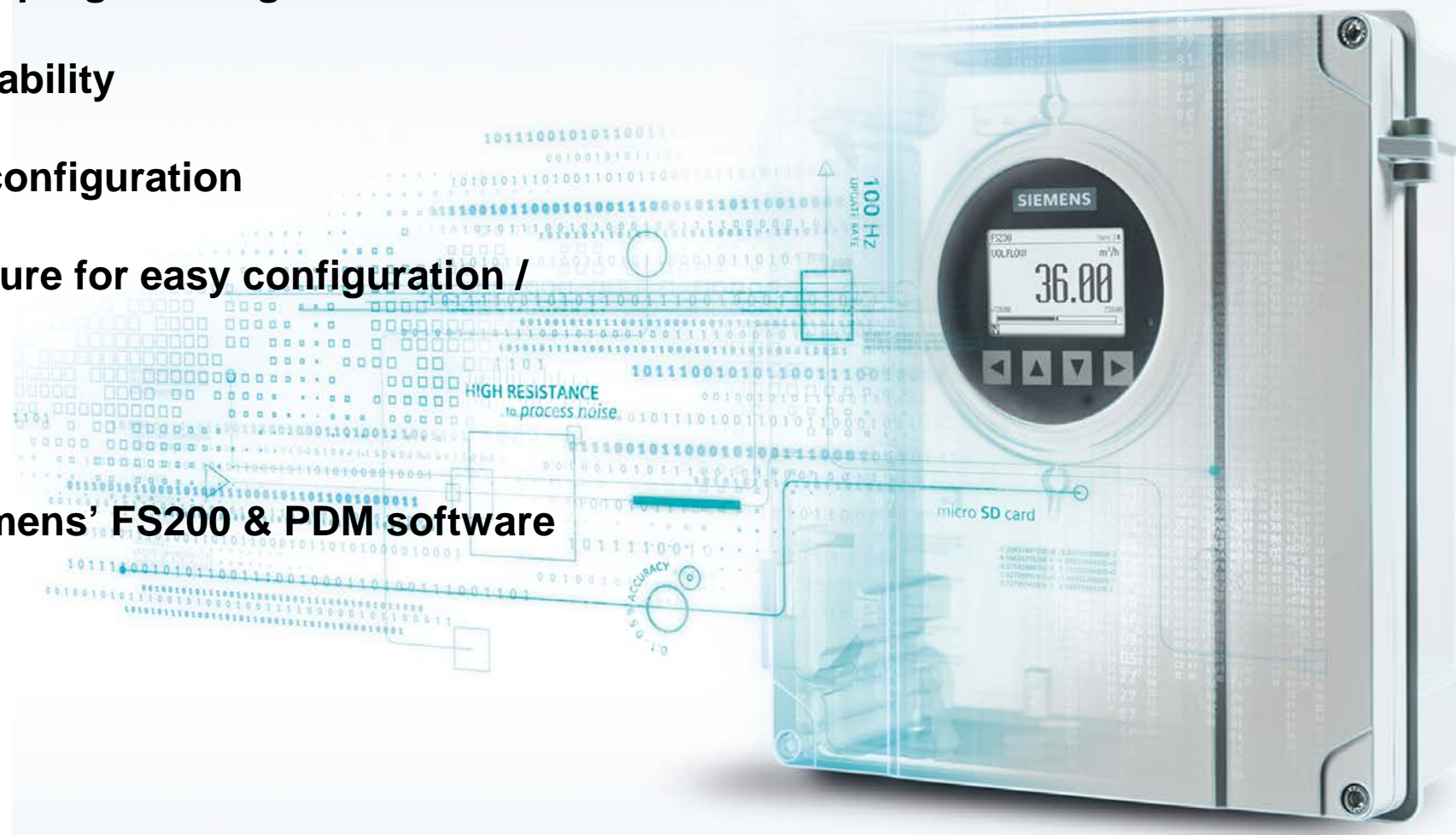
Summary

- 100hz update for improved performance
 - Improved calibration to meet API and AGA standards
- Three user configurable totalizers
- Input accepted from any 2,3,or 4 wire 100, 500, or 1000 ohm RTD
- Built in SD card for data logging and Site storage
- USB service port – service meter without any downtime
 - Sensor Flash – Calibration data, operating instructions, data back-up
- Common modules across technologies- spares are interchangeable



Summary

- Quick start menu for easy programming
- Advanced diagnostic capability
- Advanced alarm and I/O configuration
- User friendly menu structure for easy configuration / Customizable menus
- PC simulator HMI
- Fully interactive with Siemens' FS200 & PDM software



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Applications



Wastewater
 Raw Sewage
 Effluent
 Sludges
 Mixed liquor
 Chemicals



Power
 Nuclear
 Fossil
 Hydroelectric



Gas
 Checkmetering &
 Allocation
 Flow Survey Verification
 LAUF Gas Analysis
 Production/ Storage

Water
 Raw water
 Potable water
 Chemicals



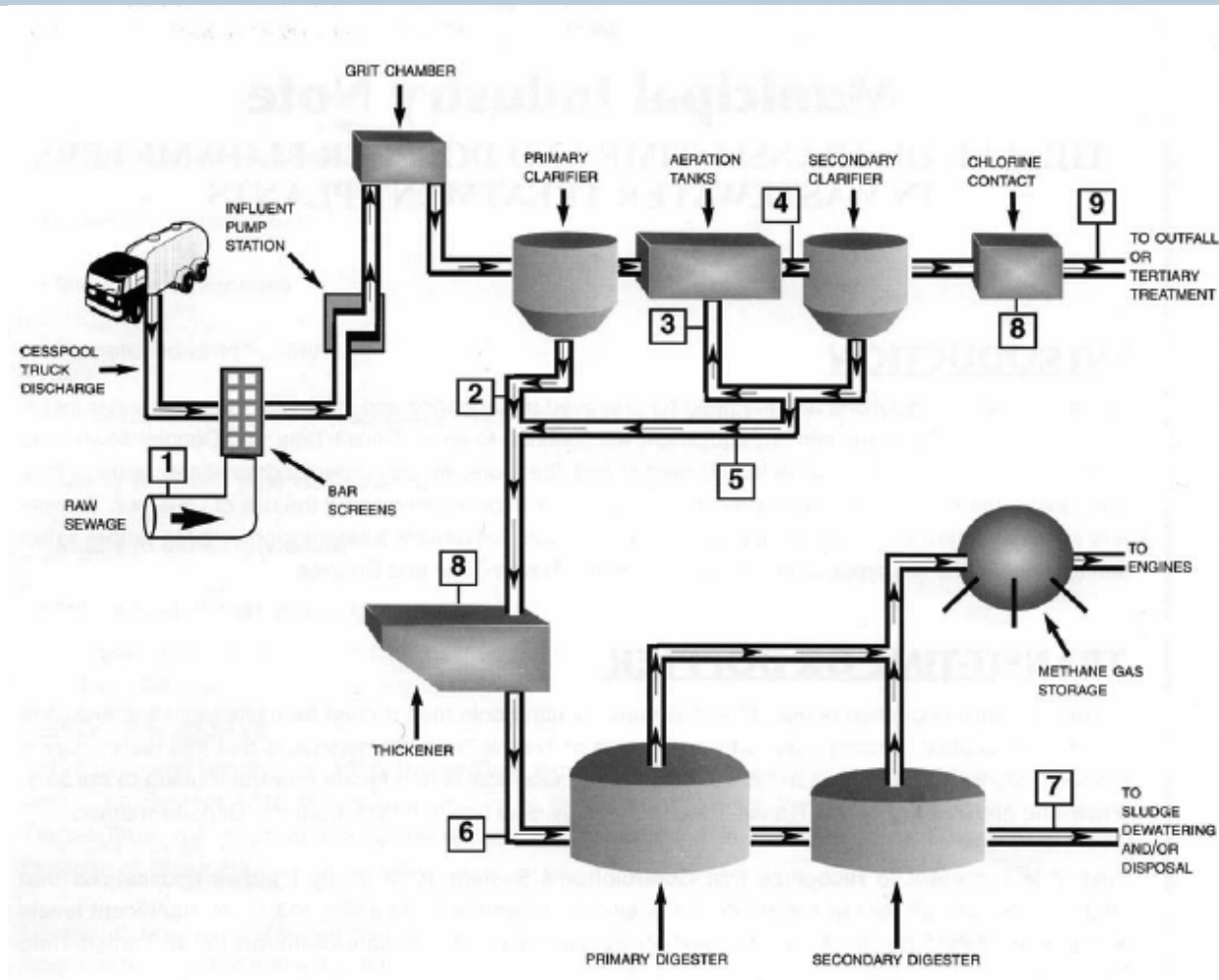
HVAC
 Chillers
 Condensers
 Hot and cold water
 systems



Hydrocarbon Petroleum
 Interface Detection
 Standard Volume (Net) Flow
 Ship Loading/Unloading
 Process Control Metering
 Tank Measurement



Primary and Secondary Sewage Treatment



1. Raw Sewage
2. Primary Sludge
3. Return Activated Sludge
4. Mixed Liquor
5. Waste Activated Sludge
6. Thickened Sludge
7. Digested Sludge
8. Chemical Additives
9. Effluents

Sewage Pumping

Project information

- Application area: Sewage Pumping

Customer challenge

- No system in place to measure flow
- Electromagnetic flowmeters that weren't functioning properly
- 1,861 sewage pumping stations
- Relied on coarse flow data derived from calculating the rate of change in sump levels

Siemens solution/ services

- Siemens Clamp-on ultrasonic flow meters

Customer benefit

- Time savings – easy installation
- Cost savings – hardware & install
- Improved accuracy



Drinking Water

Project information

- Application area: Drinking water pipeline, 72" Mortar Covered

Customer challenge

- Replace an existing insertion ultrasonic flowmeter
- 72" CS pipe with 2" mortar/mesh covering outside

Siemens solution/ services

- 'E' sensors mounted to the outside of 72" pipe
- Mortar cut away to form window areas to mount sensors in reflect
- Spacing determined by the meter programming
- Meter worked first try accurately; and in 2 hrs. time

Customer benefit

- Non-intrusive
- Ease of installation
- Lower cost than alternative
- No leak points / valve sealing issues



Industry specific applications

Oil – Product and crude oil pipelines

- Operational measurements
- Tank farm, storage facilities
- Check metering
- Product detection on multi product pipes
- Batch detection on multi crude oil margin pipes
- Leak detection (balance)
- Scraper pig detection
- Segment control and monitoring
- pump control and monitoring
- Tanker loading (e. G. LNG – products)

Clamp-on ultrasonic flow meters combat pipeline losses



Siemens clamp-on meters are based on a **compensated volume balance** method, allowing pipeline leak detection software to accurately monitor flow between two meters.

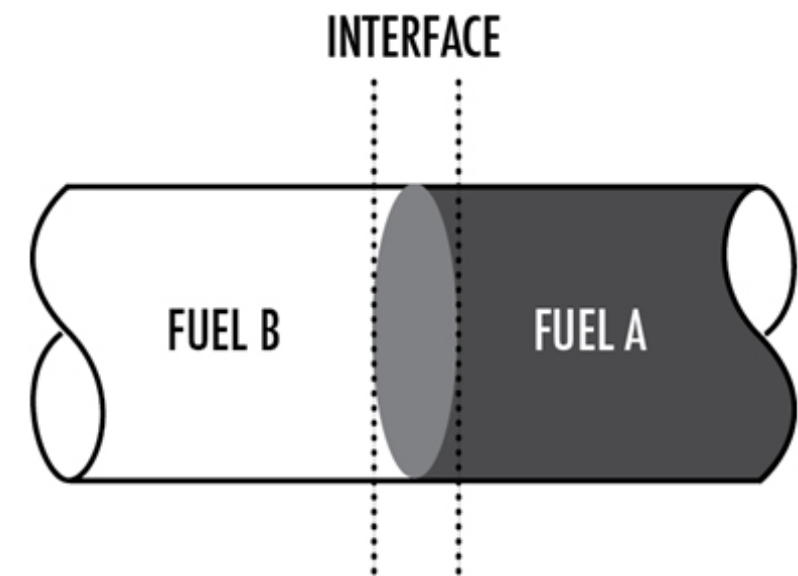
Volume in = Volume out

Siemens clamp-on meters **compensate** for expansion and contraction of the fluid and pipe as a result of temperature changes in the fluid or environment.

Clamp-on ultrasonic flow meters combat pipeline losses

In addition to assisting with pipeline losses, Siemens clamp-on flow meters offer the following functions:

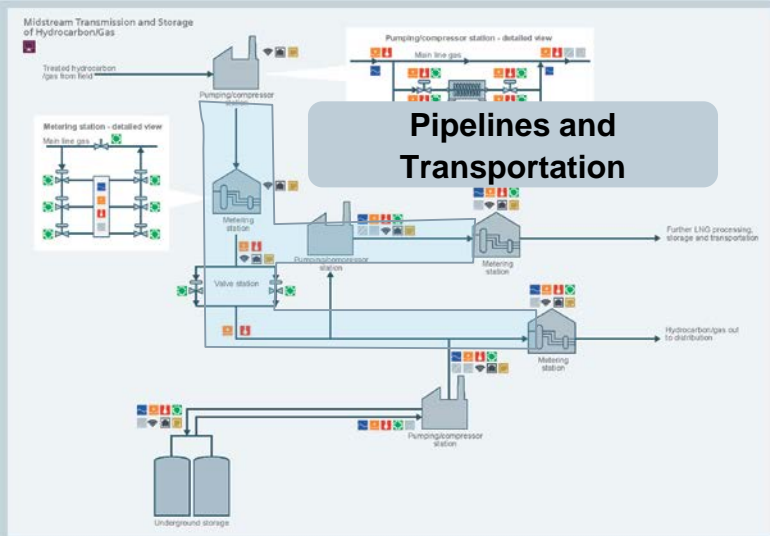
- **Standard volume / mass** – Flow measurement can be corrected for both temp. and pressure
- **Interface detection** – Determining when product shifts from one to another in the pipe
- **Field checking other flow meters** – Comparisons between the clamp-on meter flow values and those from inline meters such as DP cells, turbine or gear-driven meters can help uncover orifice holders with seal leaks, low flows that are missed, and leaks past the gear seals.



Oil & Gas - Midstream Applications

Pipeline and transportation (leak detection)

SIEMENS



Siemens recommended solution(s)



SITRANS TS500



SITRANS FS230



SITRANS P420

Application Challenge:

- Long distances to cover
- Measurements required throughout the pipeline.
- Dynamic process conditions.
- Security and environmental protection.

Solution and Benefits:

- Conforms to *PHMSA part 195.
- Non intrusive
- Standard volume/mass.
- Product identification.
- Pipeline pig detection.



Clamp-on ultrasonic flow meters combat pipeline losses

In addition to assisting with pipeline losses, Siemens clamp-on flow meters offer the following functions:

- **Valve leak check** – It is easy to temporarily install a pair of transducers for leak checking a suspect valve. If velocity is indicated, a complete installation can be performed to obtain further data. Low velocity, even a fraction of a foot per second, accumulates to significant value over time.
- **Evaluating the performance of pigging or cleaning** – The clamp-on meter is useful to identify change effects for special field actions like cleaning. Base data can be obtained at four or more flow rates before cleaning and then the related tube can be cleaned and another set of data will show the effect of cleaning.



Industry specific applications

Natural Gas – Pipelines

- Operational measurements
- Natural gas storage
- Check metering
- Segment control and monitoring
- Compressor station
- Process gases, compressed air
- LAUF – Lost and Unaccounted For

AGAS Calculations

Status: Calculation Completed Successfully Create AGAS Table

Units
 Pressure: BARA Temperature: Celsius Velocity: meters/second Density: kg/M3 Enthalpy: kJ/kg

Gas Composition and Mole Fraction %

Helium: 0.0	CO2: 2.0	Ethane: 5.0	n-Butane: 1.0	n-Hexane: 0.0	n-Nonane: 1.0	Water: 0.0
Hydrogen: 3.0	H2S: 0.0	Propane: 2.0	i-Pentane: 1.0	n-Heptane: 0.0	n-Decane: 0.0	CO: 0.0
Nitrogen: 0.0	Methane: 85.0	i-Butane: 0.0	n-Pentane: 0.0	n-Octane: 0.0	Argon: 0.0	O2: 0.0

Buttons: Normalize Clear Open Save Save As Total: 100.0

Gas Pressure and Temperature

Base Pressure: 1.0	Minimum Pressure: 20.0	Maximum Pressure: 40.0	Base Temperature: 15.4	Minimum Temperature: 5.0	Maximum: 20.0
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Z-Factor

Temperature (deg C)	Pressure (BARA)								
	20.0000	22.2222	24.4444	26.6667	28.8889	31.1111	33.3333	35.5556	37.7778
5.0000	0.9364	0.9293	0.9222	0.9150	0.9079	0.9008	0.8937	0.8866	0.8795
6.6667	0.9377	0.9308	0.9238	0.9168	0.9099	0.9029	0.8960	0.8890	0.8821
8.3333	0.9390	0.9322	0.9254	0.9186	0.9118	0.9050	0.8982	0.8914	0.8847
10.0000	0.9403	0.9336	0.9269	0.9203	0.9136	0.9070	0.9004	0.8938	0.8872
11.6667	0.9415	0.9350	0.9285	0.9220	0.9155	0.9090	0.9025	0.8960	0.8896
13.3333	0.9427	0.9363	0.9300	0.9236	0.9172	0.9109	0.9046	0.8983	0.8920
15.0000	0.9439	0.9376	0.9314	0.9252	0.9190	0.9128	0.9066	0.9004	0.8943
16.6667	0.9450	0.9389	0.9328	0.9267	0.9207	0.9146	0.9086	0.9026	0.8966
18.3333	0.9461	0.9402	0.9342	0.9283	0.9223	0.9164	0.9105	0.9046	0.8988
20.0000	0.9472	0.9414	0.9356	0.9297	0.9239	0.9182	0.9124	0.9066	0.9009

Speed of Sound (M/SEC)

Temperature (deg C)	Pressure (BARA)								
	20.0000	22.2222	24.4444	26.6667	28.8889	31.1111	33.3333	35.5556	37.7778
5.0000	375.3709	374.1604	372.9811	371.8353	370.7254	369.6541	368.6239	367.6377	366.6983
6.6667	376.6370	375.4488	374.2912	373.1666	372.0771	371.0252	370.0135	369.0445	368.1211
8.3333	377.8978	376.7320	375.5963	374.4930	373.4241	372.3920	371.3992	370.4480	369.5413
10.0000	379.1530	378.0096	376.8959	375.8140	374.7659	373.7539	372.7802	371.8473	370.9576
11.6667	380.4023	379.2814	378.1897	377.1292	376.1020	375.1102	374.1559	373.2415	372.3692
13.3333	381.6456	380.5470	379.4773	378.4383	377.4320	376.4604	375.5257	374.6299	373.7754
15.0000	382.8828	381.8063	380.7585	379.7409	378.7555	377.8042	376.8890	376.0121	375.1755
16.6667	384.1135	383.0592	382.0330	381.0368	380.0722	379.1412	378.2456	377.3875	376.5689
18.3333	385.3379	384.3054	383.3008	382.3258	381.3819	380.4711	379.5951	378.7558	377.9553
20.0000	386.5557	385.5450	384.5617	383.6077	382.6844	381.7936	380.9371	380.1167	379.3342

Buttons: Calculate Send Table Erase Flash Stop Print View Manual Exit

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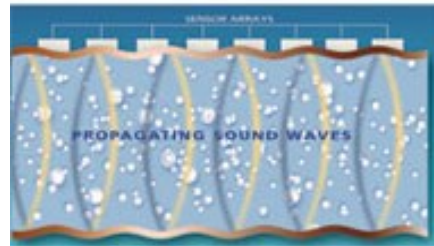
Installation tips and tricks

Selection criteria

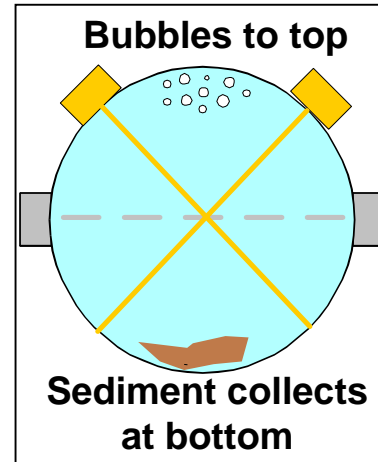


Application Considerations

Liquid Condition



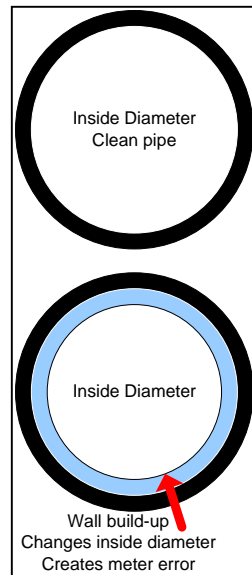
Transducer location



Piping configuration



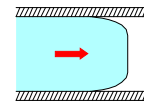
Pipe Condition



Pipe Orientation

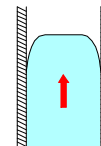
Horizontal

(Good)



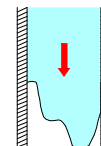
Vertical up

(Preferred)



Vertical down

(Questionable)

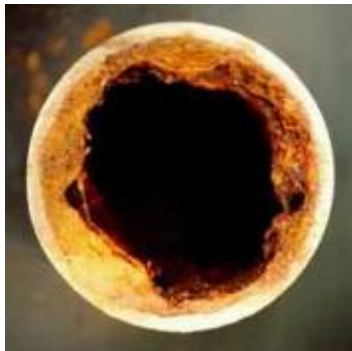


Other Consideration

Full Pipe

Straight Run Req.

Sonically conductive pipe material



What we will cover

Principle of operation

New innovative features and benefits

Industry specific applications

Installation tips and tricks

Selection criteria



Selection Criteria - Application Data Sheet

Process Information					
Liquid Data:					
Liquid Name / Description:	<input type="text"/>	Solids or Gas:	<input type="text"/> % (If Applicable)	Particle Size:	<input type="text"/> (If Known)
Temp Range:	Min: <input type="text"/>	Typ: <input type="text"/>	Max: <input type="text"/>	<input type="checkbox"/> °F	<input type="checkbox"/> °C
Pressure @ zero flow:	<input type="text"/>	<input type="checkbox"/> BAR	<input type="checkbox"/> PSI	Pressure @ nominal flow:	<input type="text"/> <input type="checkbox"/> BAR <input type="checkbox"/> PSI
Viscosity	<input type="text"/>	@ Temp	<input type="text"/>	<input type="checkbox"/> °F	<input type="checkbox"/> °C
S.G. or API	<input type="text"/>	@ Temp	<input type="text"/>	<input type="checkbox"/> °F	<input type="checkbox"/> °C

Selection Criteria - Application Data Sheet

<u>Process:</u>	
Flow Volume Units <u>Choose</u>	Flow Time Units <u>Choose</u>
Flow Rate:	Min: <input type="text"/> Typ: <input type="text"/> Max: <input type="text"/>
The Flow is:	<input type="checkbox"/> Continuous <input type="checkbox"/> On/Off <input type="checkbox"/> Pulsating <input type="checkbox"/> Single Direction <input type="checkbox"/> Bi-Directional
If On/Off or Pulsing, describe on/off times or batch size:	Time on: <input type="text"/> Time off: <input type="text"/> Batch Size <input type="text"/>

Selection Criteria - Application Data Sheet

<u>Pipe Data:</u>	
Actual Outside Diameter: <input type="text"/> <input type="checkbox"/> Inches <input type="checkbox"/> mm <OR> Nominal Pipe Size: <input type="text"/> <input type="checkbox"/> Inches <input type="checkbox"/> mm	
Pipe Material: Choose if Other: <input type="text"/>	Material Class: Choose if Other: <input type="text"/>
Pipe Wall Thickness: <input type="text"/>	Pipe Schedule: Choose if Other: <input type="text"/>
Liner Material: Choose if Other: <input type="text"/>	Liner Thickness: <input type="text"/> <input type="checkbox"/> Inches <input type="checkbox"/> mm



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PD PA Process Instrumentation Portfolio

Flow

- Magnetic
- Clamp-on ultrasonic
- In-line ultrasonic
- Coriolis
- Vortex



Level

- Capacitance
- Radar
- Guided wave radar
- Ultrasonic



Pressure / Temperature / Positioners/ Pneumatics

- Pressure
- Temperature
- Digital Electro-Pneumatic positioners
- Regulators



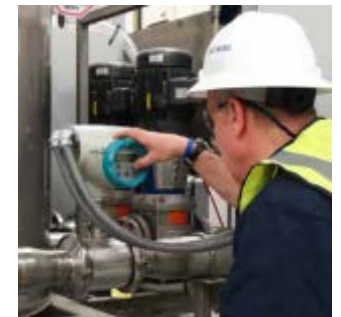
Weighing

- Dynamic and Static Weighing
- Process Protection

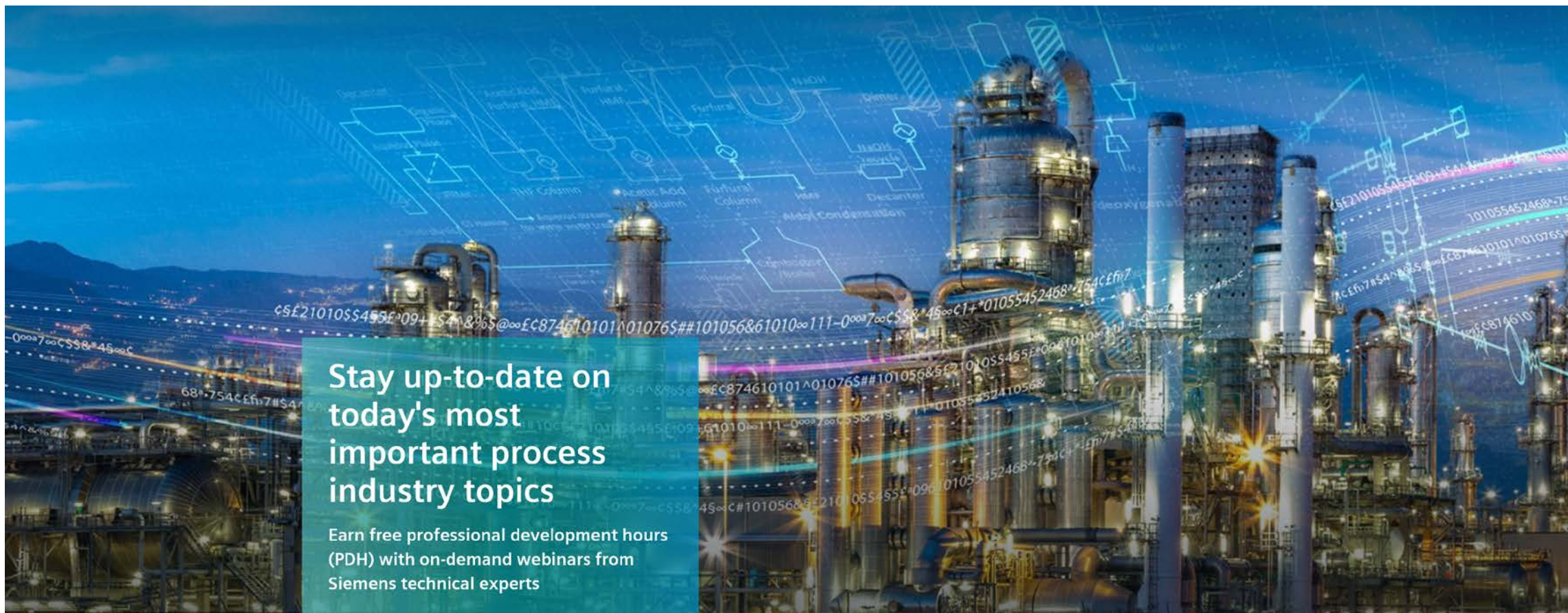


Services

- Local support
- Start-up
- Calibration
- Troubleshooting
- Training



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Thank you for your attention!



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