Proline t-mass F/I 300/500

With long-term stability and a keen sense for utility gases

Whether compressed air or dry utility gases – e.g. CO_2, N_2, O_2, Ar or natural gas, t-mass 300/500 is the ideal flowmeter for such applications.

- Gas Engine for maximum application flexiblity: 22 standard gases can be selected and combinable mixtures of these (with up to 8 components)
- Robust design (maintenance-free)
- High operational safety thanks to Heartbeat Technology for permanent diagnosis, verification and monitoring
- Developed acc. to IEC 61508 (SIL 2)
- Unique alarm functions
- High accuracy (±1.0% o.r.), repeatability (±0.25% o.r.) and turndown (up to 1000:1)
- Over 100 000 t-mass devices successfully installed worldwide since 2003

Tap to navigate

Robust and innovative sensor design

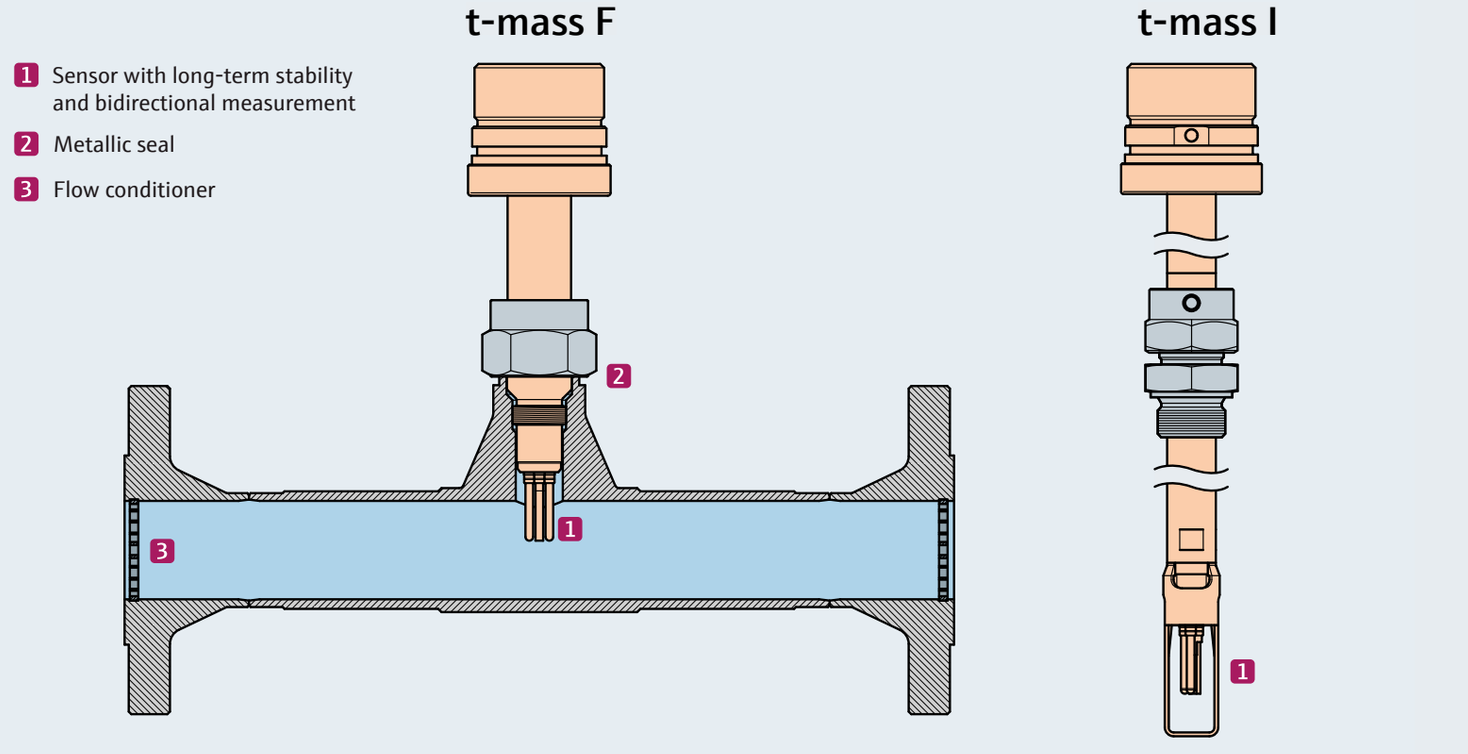
For optimum measuring performance and process control

Robust design | Measuring principle | Monitoring functions | Sensor removal/installation | Flow conditioner | Technical data

Tap/click to navigate

The t-mass F and t-mass I are robust sensors for long-term operation

- High accuracy (±1.0% o.r.) and repeatability (±0.25% o.r.) thanks to patented sensors with long-term stability
- Maximum robustness against vibrations, solid particles and process fluctuations
- High corrosion resistance: wetted parts (stainless steel / Alloy C22) according to NACE MR0175/MR0103



Heartbeat Sensor Integrity test verifies that the sensor is working within its tolerances and delivering quality measurements.

Robust and innovative sensor design

For optimum measuring performance and process control

Robust design | Measuring principle | Monitoring functions | Sensor removal/installation | Flow conditioner | Technical data

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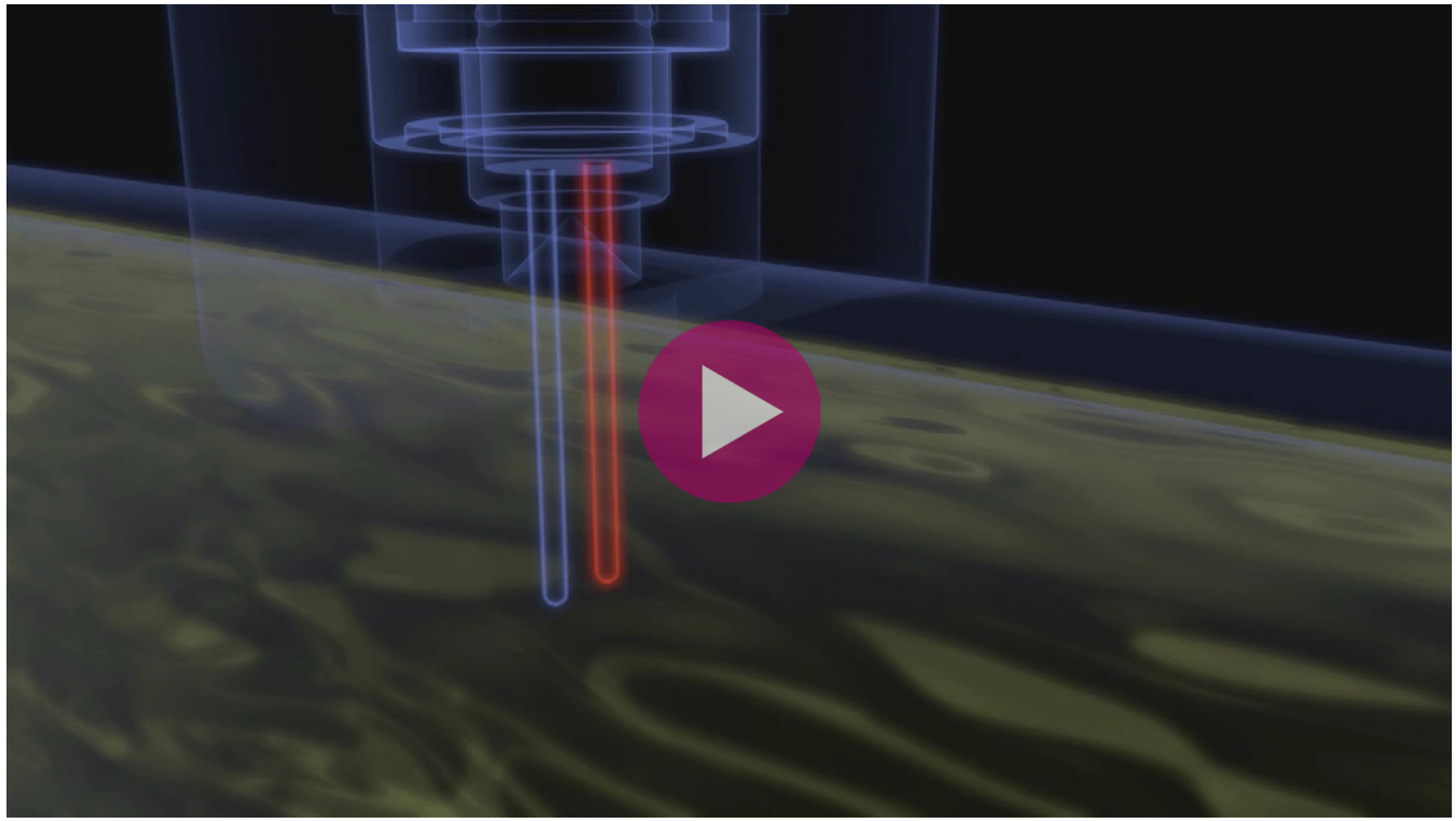
Measuring principle

A thermal flowmeter contains two temperature sensors. One sensor measures the current fluid temperature as the reference. The second sensor is heated to obtain a defined temperature differential. As soon as the fluid in the measuring tube starts to flow, the flow carries off some of the heat from the heated sensor. The electric heating current required to maintain the temperature differential is a direct measure of mass flow.



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Reverse flow detection / Bidirectional measurement

- Reverse flow detection:
  - Gas flow is measured in forwards direction only
  - Warning/alarm message for reverse flow
- Bidirectional measuring mode:
  - For totalizer/balancing measurements
  - For measuring the net flow: forwards and/or reverse

Wetness detection / Pulsating flow detection (Heartbeat Technology)

- Detection of condensate drops on the sensor:
  - Prevention of corrosion damage (for moist gases)
  - Prevention of incorrect measurement results
- Detection of (unwanted) pulsating flow

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Robust and innovative sensor design

For optimum measuring performance and process control

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t-mass F (inline version):

- Easy removal/installation using union nut (e.g. for cleaning the sensor from dirt and build-up)
- No impairment of measuring performance
- Tongue-and-groove connection for correct positioning during installation
- Industry-optimized metallic seal design: High corrosion resistance and CSA-approved single-seal design

t-mass I (insertion version)

Cost-effective and time-effective replacement of damaged sensor guards:

- Replacement can be done on site by a service technician because the slip-on (non-welded) sensor guard has a bayonet lock
- No recalibration required after installation/replacement

The sensor guard of t-mass I offers the following advantages:

- Protection of the sensor from damage during removal/installation
- Conditioned flow in the sensor area and thus consistently high measuring performance

Robust and innovative sensor design

For optimum measuring performance and process control

Robust design | Measuring principle | Monitoring functions | Sensor removal/installation | Flow conditioner | Technical data

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Flow conditioner

t-mass F is optionally available with a built-in conditioner. This can minimize unwanted swirls and/or distorted velocity profiles that both impair measuring accuracy:

- New perforated plate design developed using CFD simulation:
  - For optimal measuring performance
  - For minimum pressure loss
  - For reduced inlet/outlet runs
- Fixed perforated plate integrated firmly into the flanges:
  - No additional effort when mounting t-mass into the pipeline or during removal/installation (e.g. for recalibration)
  - No additional seals
  - Optionally with one or two conditioners (bidirectional measurement)

Tap/click to play film

For t-mass I (insertion version), we recommend the "Mitsubishi" design (DK6004):

- Distance between conditioner and sensor: min. 8 × DN (DN = Nominal Diameter)
- Inlet run upstream of conditioner: min. 5 × DN

Robust and innovative sensor design

For optimum measuring performance and process control

Robust design | Measuring principle | Monitoring functions | Sensor removal/installation | Flow conditioner | Technical data

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t-mass F/I (sensors)

Nominal diameter	▪ t-mass F: DN 15 to 100 (½ to 4")	▪ t-mass I: DN 80 to 1500 (3 to 60")
Process connections	▪ t-mass F: flanges (EN, ASME, JIS), threads (EN 10226-1/ISO 7-1, ASME MNPT) ▪ t-mass I: compression fittings G/NPT (¾", 1")	
Min./max. flow (air)	t-mass F: 0.38 to 2900 Nm³/h (0.23 to 1800 sft³/min) t-mass I: 1613 to 567236 Nm³/h (1020 to 358 474 sft³/min)	
Process pressure	Max. PN 40 (Class 300)	
Process temperature	–40 to +180 °C (–40 to +356 °F)	
Degree of protection	Standard: IP66/67 (Type 4X enclosure) Option (Proline 500): IP68 (Type 6P enclosure)	
Max. measured error (mass flow)	±1.0% o.r. (10 to 100% o.f.s)* ±0.1% o.f.s. (1 to 10% o.f.s)*	
Repeatability	±0.25% o.r.	
Turndown	Up to 1000:1	
Materials (wetted parts)	1.4404/1.4435 (316L), Alloy C22	
Pressure loss	Negligible	
Approvals Conformity	▪ ATEX, IECEx, cCSAus, EAC, NEPSI, INMETRO ▪ PED, CRN	▪ NACE MR0175/MR0103 ▪ SIL 2/3

*o.r. (of reading), o.f.s (of full scale)

Subject to modification

Transmitters – Proline 300/500

For seamless system integration

Overview | Technical data – Proline 300 | Technical data – Proline 500

Tap/click to navigate

Proline 300

Compact, easily accessible transmitter

- Multifunctional, four-wire transmitter
- Reduced complexity thanks to freely configurable I/Os
- Heartbeat Technology for device verification during operation

Proline 500

Remote transmitter with up to 4 I/Os

- Same functionality and operation as Proline 300
- Remote installation: up to 300 meters (1000 ft) between sensor and transmitter
- Heartbeat Technology for device verification during operation

Transmitters – Proline 300/500

For seamless system integration

Overview | Technical data – Proline 300 | Technical data – Proline 500

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Proline 300 (compact)

Subject to modification

Display	**Standard** 4-line backlit display with Touch Control (operation from outside)	**Option** With remote display
Operation	Via local display, web server, WLAN, as well as various operating tools (FieldCare, HART handheld terminal, etc.)	
Materials	**Transmitter** Aluminum	**Remote display** Aluminum, stainless steel die-cast
Power supply	AC 100 to 230 V (50/60 Hz), DC 24 V (50/60 Hz)	
Ambient temperature	**Standard** –40 to +60 °C (–40 to +140 °F)	**Option** –50 to +60 °C (–58 to +140 °F)
Degree of protection	IP66/67 (Type 4X enclosure)	
Outputs Inputs Communication	**Port 1** Current output (4–20 mA, HART) or digital communication via HART and Modbus RS485	**Port 2/3** Freely configurable I/O modules: – Current output (4–20 mA) – Pulse/frequency/switch output – Pulse output – Relay output – Current input (4–20 mA) – Status input

Transmitters – Proline 300/500

For seamless system integration

Overview | Technical data – Proline 300 | Technical data – Proline 500

Tap/click to navigate

Proline 500 (remote)

Subject to modification

Display	4-line backlit display with Touch Control (operation from outside)	
Operation	Via local display, web server, WLAN, as well as various operating tools (FieldCare, HART handheld terminal, etc.)	
Materials	**Sensor connection housing** Aluminum, stainless steel die-cast	**Transmitter (digital)** Aluminum, polycarbonate (in prep.)
Power supply	AC 100 to 230 V (50/60 Hz), DC 24 V (50/60 Hz)	
Ambient temperature	**Standard** –40 to +60 °C (–40 to +140 °F)	**Option** –50 to +60 °C (–58 to +140 °F)
Degree of protection	IP66/67 (Type 4X enclosure)	
Outputs Inputs Communication	**Port 1** Current output (4–20 mA, HART) or digital communication via HART and Modbus RS485	**Port 2/3/4 (Proline 500 digital)** Freely configurable I/O modules: – Current output (4–20 mA) – Pulse/frequency/switch output – Pulse output – Relay output – Current input (4–20 mA) – Status input

Gas Engine

For one-of-a-kind process monitoring and control

What is the "Gas Engine"? | Customer benefits

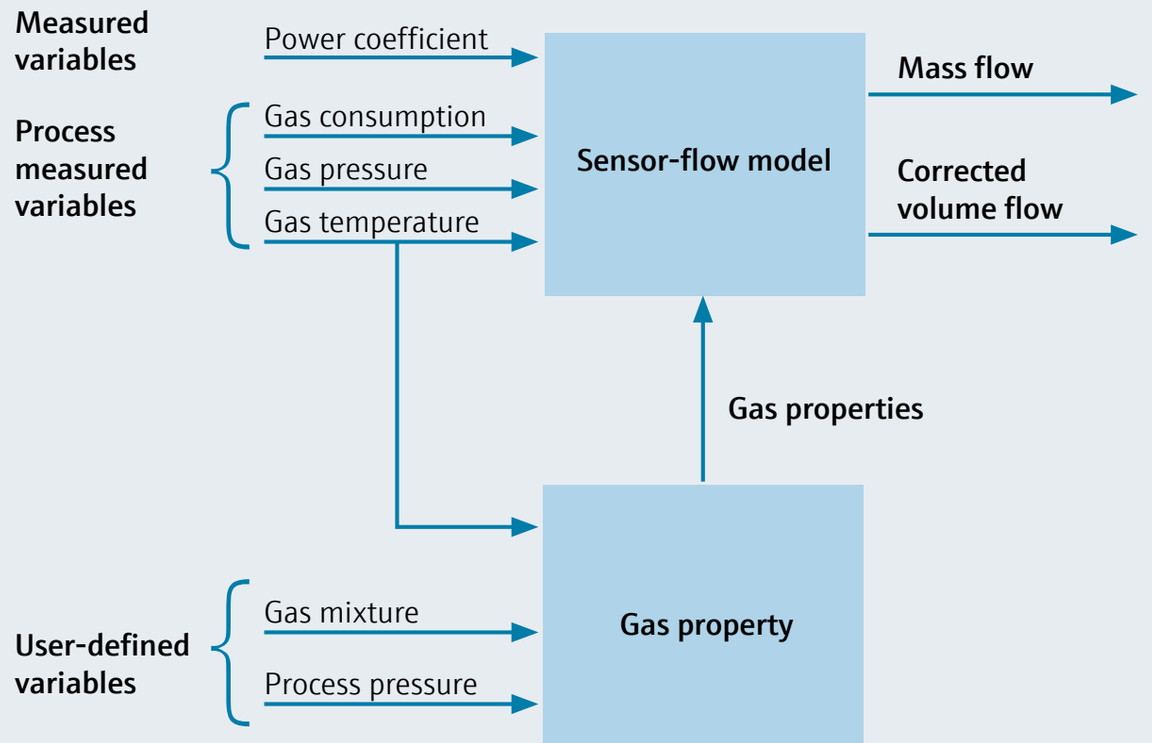
Tap/click to navigate

The t-mass 300/500 transmitters are equipped as standard with the unique "Gas Engine." This patented model is based on an air calibration, using a highly accurate and repeatable flow rig (▸ see Calibration technology) and a sophisticated software model that calculates mass flow for the user's actual gas and process conditions.

Gas property calculator

The gas properties – e.g. viscosity, specific heat capacity, thermal conductivity, etc. – of the programmed pure gas or gas mixture are calculated at the actual programmed process pressure and measured gas temperature. The gas property calculator runs in real time and the gas property data is continually updated and input into the sensor-flow model.
The gas is selected from an internal selection list of 22 common process gases and mixtures of these with up to 8 components.

Gas Engine model



Gas Engine

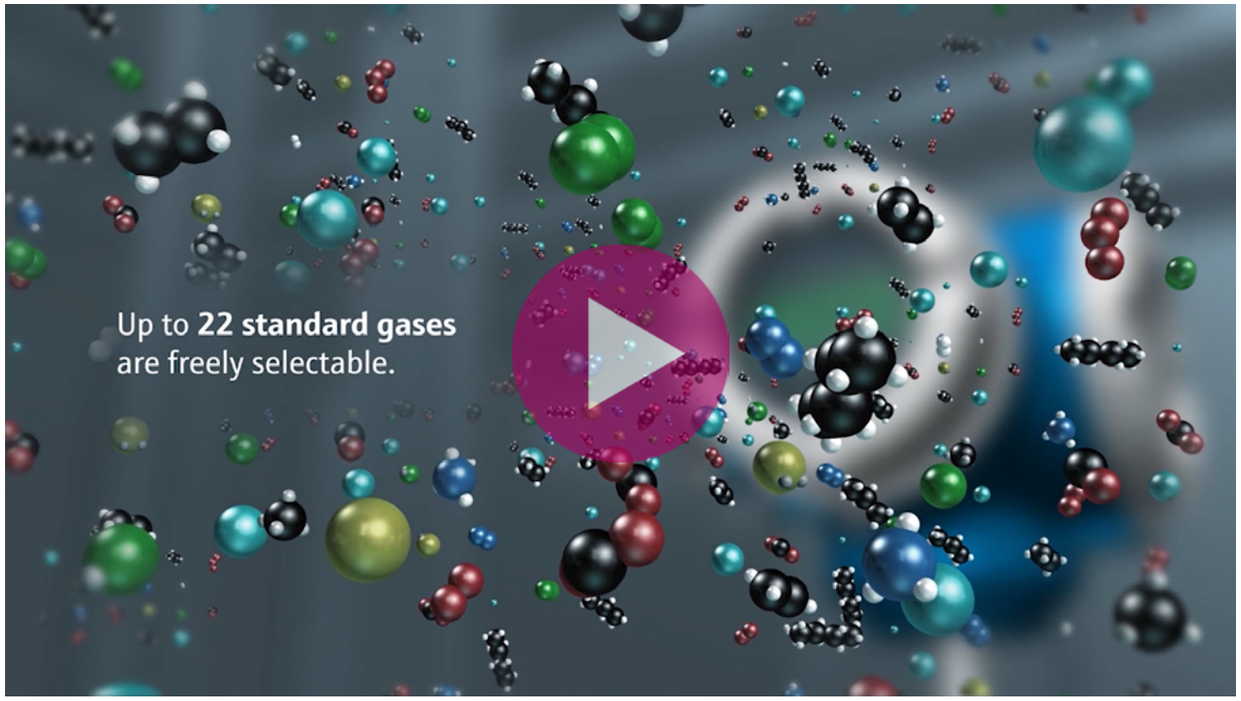
For one-of-a-kind process monitoring and control

What is the “Gas Engine”? | Customer benefits

Tap/click to navigate

The Gas Engine provides the user with several operating benefits:

- Exact measurement of customer-specific pure and mixed gases:
  - 22 standard gases can be selected as well as mixtures of these gases
  - Also selectable: ozone (O_3), ozone-oxygen blends (O_3/O_2), water vapor, as well as special gases by request
- Calculating flow velocity, density, corrected volume or energy flow for current operating conditions
- Dynamic correction of pressure and temperature changes
- Changing programmed gases without recalibration possible
- Switch function for two predefined gas groups via status input (e.g. for flushing processes with other gases)



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Operation

Concept and possibilities

Operation concept | Operation possibilities

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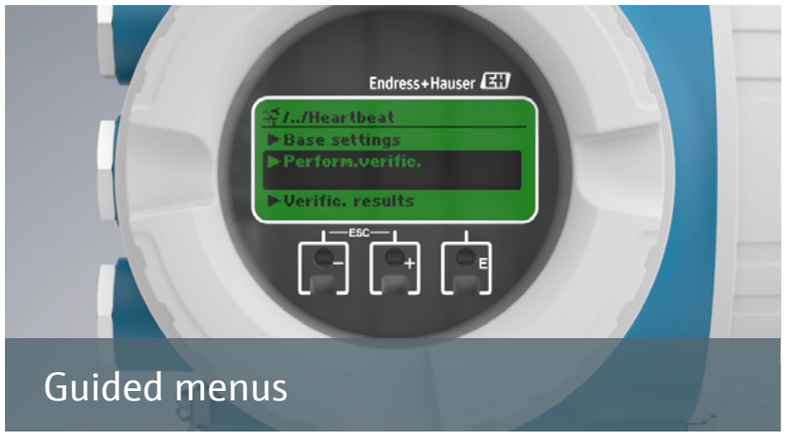


Guided menus

Operator-oriented menu structure

- For commissioning
- For operation
- For diagnostics
- For expert level functions

Easy commissioning

Fast and safe commissioning

- Guided menus (“Make-it-run” wizards)
- Menu guidance with brief parameter/ function descriptions
- Device access via web server
- WLAN access via mobile handheld terminal, tablet or smartphone

Web server

Reliable operation

- Operation in 17 local languages
- Uniform operating concept for devices and operating tools
- HistoROM: Data storage concept (automatic backup, copy, compare or restore data). No need for reconfiguring after a service case.

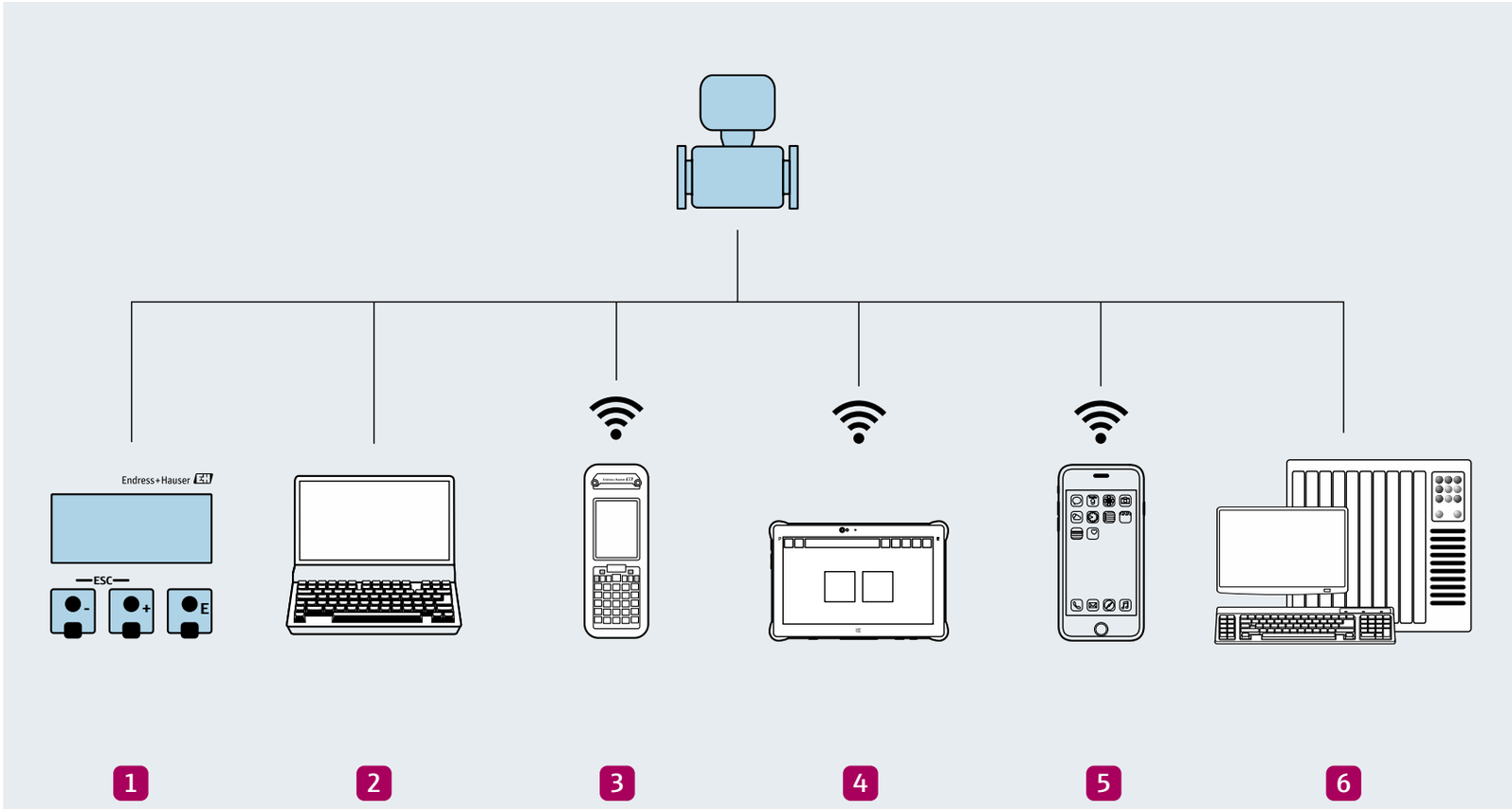
Operation

Concept and possibilities

Operation concept | Operation possibilities

Tap/click to navigate

1. Local operation via **display** module
2. Computer with **web browser** (e.g. Internet Explorer) or with operating tool (e.g. FieldCare, DeviceCare, AMS Device Manager, SIMATIC PDM)
3. **Field Xpert** SFX350 or SFX370
4. **Field Communicator** 475
5. **Mobile** handheld terminal, tablet or smartphone
6. **Control system** (e.g. PLC)



Application areas and examples

t-mass F/I in the gas industry

Steel production (Ar)
Exact injection of an argon oxygen blend into the steel smelt (argon flushing) for degassing/homogenizing the steel alloy and for removing oxygen from the smelt.

Disinfection (O_3)
Precise injection of ozone for disinfection of water, e.g. drinking water, wastewater, process water, ultrapure water, etc.

Beverage production (CO_2)
Reliable and repeatable measurement of carbon dioxide in the beverage industry, e.g. for producing mineral water.

Application areas and examples

t-mass F/I in the gas industry

Compressed air (utilities)
Accurate measurement and monitoring of compressed air in distribution networks, e.g. for leak detection or for exact cost allocation of compressed air production.

Aeration (wastewater treatment plant)
Continuous recording of air flow for aeration of the activated sludge basin.

Ventilation duct (buildings)
Reliable measurement and control of air flows in office and industrial buildings at low pressure and low flow velocity.

Application areas and examples

t-mass F/I in the gas industry

Protective gas (N_2)
Recording and monitoring of nitrogen as protection or inert gas in the food industry as well as in the oil and gas industry.

Coolant (H_2)
Ideal control of the hydrogen consumption when cooling turbo generators (250 to 450 MW) in electrical plants.

Application areas and examples

t-mass F/I in the gas industry

Oxidation process (O_2)
Highly accurate addition of pure oxygen in process air, e.g. for oxidation processes in petrochemicals or optimization of combustion processes.

Natural gas (fuel)
Exact consumption measurement of natural gas, for example as fuel for heating steam boilers.

Process safety

Around the clock

- SIL-compliant device development according to IEC 61508
- Reliable device/process monitoring thanks to Heartbeat Technology (▸ see Heartbeat Technology)
- Clear diagnostic messages according to NAMUR NE107 with remedy instructions (Failure / Function check / Out of specification / Maintenance required)
- Comprehensive monitoring and alarm functions

Heartbeat Technology

For increased plant availability and safe operation

Diagnostics

Permanent process/device diagnostics

- Self-diagnostics around the clock
- Developed acc. to IEC 61508 (SIL)
- Clear diagnostic messages according to NAMUR NE107 with remedy instructions

Verification

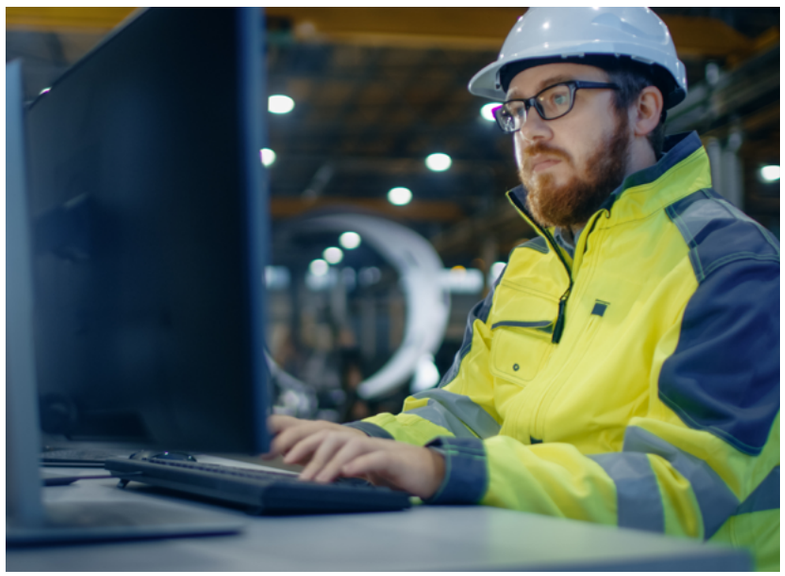
Documented verification without process interruption

- Metrologically traceable verification results (ISO 9001)
- Reduced verification effort: verification can be triggered at any time on the device or via higher level systems (no field presence required)

Monitoring

Additional information for predictive maintenance

- Process optimization and maintenance planning (e.g. to prevent corrosion)
- Early recognition of disturbances in the process, e.g. condensate or pulsating flow.



Calibration measuring technology for premium accuracy

Precision that pays for itself

At Endress+Hauser, all flowmeters are subjected to strict quality controls and are checked, calibrated and adjusted on the foremost state-of-the-art calibration facilities in the world. Our air calibration facilities ensure that you can fully rely on t-mass F/I 300/500 for maximum measuring performance in your plant:

- Accredited by the Swiss Accreditation Service (SAS) and by the American A2LA in accordance with ISO/IEC 17025
- Fully traceable to national standards
- Measuring range: 0.05 to 10 000 kg/h (0.11 to 22 046 lb/h)
- Maximum measuring uncertainty: ±0.3% o.r.
- Master meters: nozzles, rotary piston and turbine gas meters