PORAC

PAYAM OFOGH RAHE ABRISHAM Co.

FIELD INSTRUMENT AND VALVE

Instrumentation Solutions

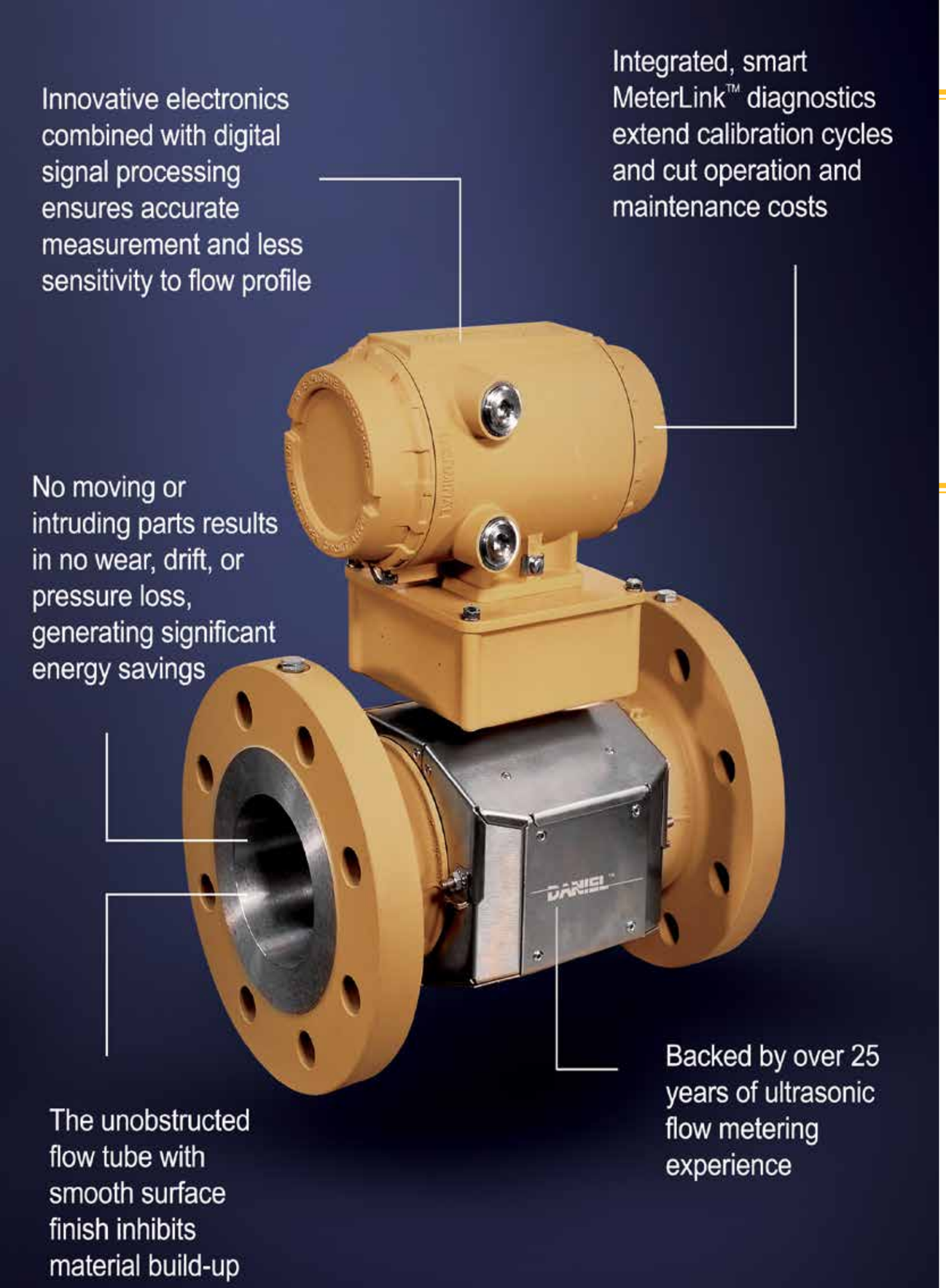
|Temperature|Pressure|Level|Analyzer|Density|Flow|Manual Valves|

پیام افق راه ابریشم

شرکت پیام افق راه ابریشم بر اساس بهره‌مندی از نیروی انسانی مجرب و نوآور به منظور تامین نیازهای صنایع کشور و دستیابی به رضایت‌مندی کارفرمایان؛ تنوع محصولات خود را با تکیه بر فناوری و پیشرو در زمینه صنعت ساخت و تامین تجهیزات نفت، گاز، پتروشیمی و سایر صنایع ارائه می‌دهد. همچنین با هدف تسهیل در تامین تجهیزات مورد نیاز پروژه‌های خود، اقدام به تاسیس شرکت‌هایی در کشورهای ترکیه و امارات متحده عربی نموده است.
این شرکت، در زمینه ادوات ابزار دقیق و کنترلی، محصولاتی را برای اندازه‌گیری پارامترهای مختلف فرآیندی مانند سطح، دبی، رطوبت، فشار، اندازه‌گیری مخزن و سنسورهای حرکت تامین می‌نماید.

Our Mission

Products



Flow Measurement

Accurate flow measurement of liquids, slurries or solids, with different chemical and physical properties plays an important role in process automation. Inaccurate flow measurements can potentially cause serious results and can lead to significant losses in productivity.
BAM Industry offers a comprehensive range of Electromagnetic, Ultrasonic, Coriolis, Positive Displacement, RF Capacitance and Solid Flow Meters to meet the needs of different applications. Our wide portfolio ensures that you have the right flow meter for every application, medium and industry.
All of these products are designed to give you maximum accuracy, stability, safety and reliability,

Manufacturers

Endress+Hauser
Bopp & Reuther
KROHNE
M&T
RHEONIK
Micro Motion
OVAL
Rototherm
SIERRA
DANIEL

Flow Measurement

Orifice Plate

- Most comon and widely used differential pressure producer
- Suitable for a wide range of flow measurement applications in line sizes of 50mm and above
- Wide range of materials including exotics such as monel, hastelloy, as well as ceramic
- Orifice sizing on request
- Proven technology
- Range of Orifice Types

- Concentric Square Edge
- Conical Entrance
- Quarter Circle
- Segmental

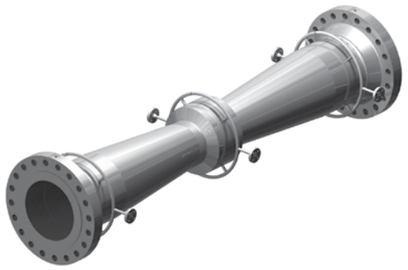
Orifice / Flange Union

- Orifice flange assemblies consist of a pair offlanges, studs, nuts, gaskets, jacking screws and plugs (where requested)
- Orifice flanges ensure best flow measurement accuracy with an economic solution
- Wide range of materials, including ASTM A105N Carbon Steel, ASTM A350 LF2 Carbon Steel , ASTM A182 F316L Stainless Steel as standards
- Exotic materials used depending on application
- Ratings from 300 lb to 2500 lb
- Sizes from 1” Nominal Bore
- Corner Tapping Versions Available

Flow Nozzele

- If high temperatures and velocities are present, the flow nozzle may provide a better solution than an orifice plate.
- Its construction makes it substantially more rigid and flow coefficient data at high Reynolds number is better documented
- The inlet is contoured, and may be either radius entrance (ISA1932) or elliptical entrance (ASME long radius)
- The flow nozzle has about %65 greater flow capacity than an orifice with the same diameter

Classical Venturi Tubes



- Classical Venturi Tubes - used on applications where a low permanent pressure loss is required.
- Can be used on clean and dirty fluid in line sizes from 1” to 60”
- Calculation, design and manufacture to BS EN ISO 5167:1
- Fabricated from plate or machined from bar/forgings
- Flanged or weld-in construction
- Wide range of material grades
- Calibration service on request

Magnetic

- The measuring principle is virtually independent of pressure, density, temperature and viscosity
- Even fluids with entrained solids can be metered, e.g. ore slurry or cellulose pulp
- Wide range of nominal diameters (DN 2 to 12/1 ;2400 to 90»)
- Free pipe cross-section: CIP/SIP cleanable, piggable
- No moving parts, maintenance-free

Ultrasonic flowmeters

- Measurement independent of pressure , density, temperature, conductivity and viscosity (for homogeneous fluids)
- Free pipe cross-section, no pressure loss
- No moving parts, minimum maintenance and upkeep
- Long service life, no abrasion or corrosion from the fluid
- In-line or clamp-on design for stationary or temporary flow measurements

Vortex

- Universally suitable for measuring liquids, gases and steam
- Largely unaffected by changes in pressure , density, temperature and viscosity
- High long-term stability: no zero-point drift and lifetime K-factor
- Large turndown of typically 10:1 to 30:1 for gas /steam, or up to 40:1 for liquids
- Wide temperature range: –200 to 400+ °C (450+ °C on demand)

Coriolis mass

- Universal measuring principle for liquids and gases
- Multivariable measurement – simultaneous - measuring of mass flow, density, temperature and viscosity
- High measuring accuracy: typically %0.1± o.r. , optionally: %0.05± o.r. (PremiumCal)
- Measuring principle independent of the physical fluid properties and the flow profile
- No inlet/outlet runs necessary

Flow Measurement

Differential Pressure

- With silicon cell for process pressures up to 700bar (10,500psi)
- Small flush-mount process connections and guaranteed overload resistance silicon cell
- With diaphragm seal process temperatures from 70- up to °400+C (94- to °752+F)
- The electronic differential pressure system eliminates traditional mechanical issues resulting in greater process availability and reliability. Also safety risks are minimized with the electronic dp system architecture and design

Variable Area

- Simple, low-cost installation: Measurement and indication without auxiliary power supply
- Universal Ex concept: Ex i and Ex d
- Modular scalability – from mechanical to fieldbus
- Any installation position: vertical upward ,horizontal, vertical downward
- Robust measuring tube construction for high process temperatures and extreme operating pressures
- Extended measuring span: up to 1 : 100
- High application safety, even with extremely low flows

PD Flowmeter

- High accuracy: %0.5± RD (Option: %0.2± RD)
- Metering chamber is of a pocketless configuration and is applicable to a wide range of liquids including chemical liquids.
- Low pressure loss, high durability

Thermal mass

- Compressed air (consumption, distribution)
- Carbon dioxide (for beverage production and chilling)
- Argon (in steel production)
- Nitrogen and oxygen (production)
- Natural gas (for burners and boiler feed control)
- Air and biogas measurement (e.g. in wastewater plants)

Turbine Flow Meter

- proven, reliable measurement system
- approved by local bureau of standards
- high measuring accuracy
- high reproducibility
- harge flows
- inductive pulse pick up

Pitot-Tube

- Threaded and Flanged process connection
- PN-16PN150-40lbs300-lbs
- DN40 - DN800
- Sensor Sizes: 35/25/20
- T max.: 450C° / 842F
- End support as an option
- condensation pots
- Sensor material: AISI 316Ti

Level Measurement

Level measurement and level control is important in all industries, from mining through to fine chemicals. Such is the diversity of materials to be measured that no single instrument is capable of reliable operation with all materials.
BAM Industry offers a versatile range of contacting and non-contacting instruments for point level and continuous level measurement to ensure that users are able to select the most appropriate instrument for their applications.
All our level measurement instruments have been field proven in countless applications through years of experience in many process industries worldwide like – Cement, Power, Iron & Steel, Water & wastewater, Food & Food Processing, Chemical, Pharmaceutical, Fertilizer & many other.

- Radar
- Ultrasonic
- Float / Displacer / Magnetic / Vibration / Electrode

Manufacturers

VEGA
KLAY INSTRUMENTS
KROHNE
SOR MEASUREMENT AND CONTROL
SIEMENS Ingenuity for life
WIKA
Foxboro by Schneider Electric
Endress+Hauser People for Process Automation
SIERRA
KLINGER United Kingdom

Level Measurement

Guided Radar level Meter

- Reliable measurement: Unaffected by medium surfaces and tank obstacles or baffles
- Additional measuring safety through End-of-Probe (EoP) evaluation
- Safe measurement also during filling

Radar Level Meter

- Non-contact, maintenance-free measurement
- Unaffected by medium properties like density and conductivity, in bulk solids also unaffected by filling noise and dust
- Freely adjustable measuring range
- For high temperatures up to °450+C/°842+F

Capacitance level Meter

- Proven and tested measuring principle - robust and safe
- Universally adaptable probe
- Reliable operation also in strong build-up formation and viscous media
- Easy commissioning

Servo level Meter

- Unaffected by medium properties like conductivity or dielectric constant
- Custody transfer applications

Ultrasonic Level Meter

- Non-contact, maintenance-free measurement
- Measurement unaffected by media properties, like dc value or density
- Calibration without filling or discharging
- Self-cleaning effect due to vibrating sensor diaphragm

Vibronic point level

- Unaffected by media
- Unaffected by media properties
- Easy installation and ready for use without calibration
- Self-monitoring
- No wear and tear, maintenance-free

Conductive level Meter

- Multipoint detection with one process connection
- Simple instrumentation

Radiometric level

- Non-contact measurement from outside
- For extreme measuring tasks where other principles can not be used anymore
- Source container with manual or pneumatic switching on/off and padlock, cylinder lock or locking bolt for fixing the switching position

Level Measurement

Level Switch for liquids

- Robust and compact
- All stainless steel
- FDA and EHEDG conformity
- Suitable for CIP / SIP cleaning
- Accurate adjustability

Tank Gauging Device

- Automatic calibration
- High level of accuracy
- Less cabling – only 2 wires
- No moving parts – longer lifetime
- Flexible and easy installation
- Explosion proof

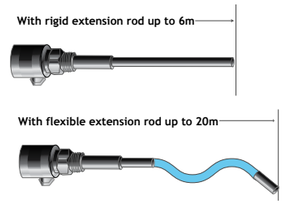
Tank Level Alarm

- Works with any type of liquid and liquefied gas
- Easy installation
- No maintenance
- No moving parts
- No electronics inside the tank
- No sensitivity to vapor, moisture and foam
- Automatic self test
- Lengths on request
- Only steel rod inside the tank
  (electronics and connections outside)

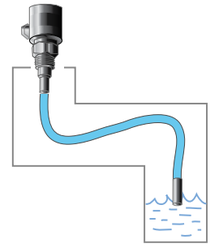
Ultrasonic Tank Switch

- Any type of liquid
- Only steel rod inside the tank
  (electronics and connections outside)
- Fully welded construction
- No moving parts
- Extended temperature range
- No maintenance required
- Automatic self test
- No calibration needed
- Explosion proof
- Pre-adjustable alarm points
- No sensitivity to foam
- More than 300 possible variations

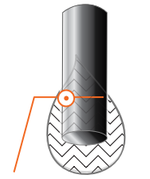
Main advantages of Ultrasonic Level Switch



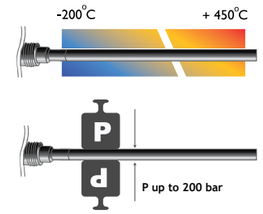
Wide length range



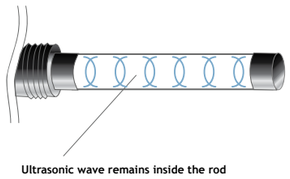
Possibility to bend



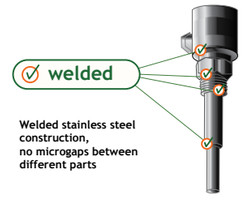
Resistance to sticking



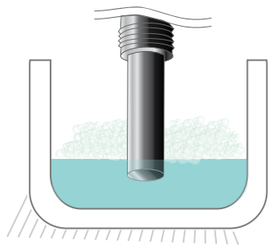
Wide temperature
and pressure range



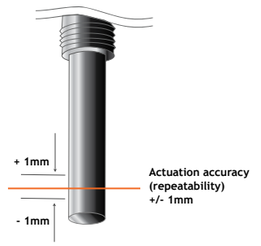
High reliability -
no moving parts



Reliable construction
ensures safe application
in harsh environments



No sensitivity to foam



High accuracy (repeatability)

Level Measurement

Electromechanical Level

- Unaffected by medium properties
- Unaffected by dc value
- Proven and reliable measurement

Float Switch Level

- Reliable and cost-effective point level detection in liquids
- Electrical connections to NAMUR for hazardous areas (to Zone 1) or change-over contact (AC/DC) for universal standard application

Magnetic Level Indicator

- Minimal leak points as compared to sight glasses
- No process liquid in contact with indicator glass
- Designed for both gas/liquid and liquid /liquid interface measurements
- Measure both interface and top level with one indicator

Transparent Level gauge

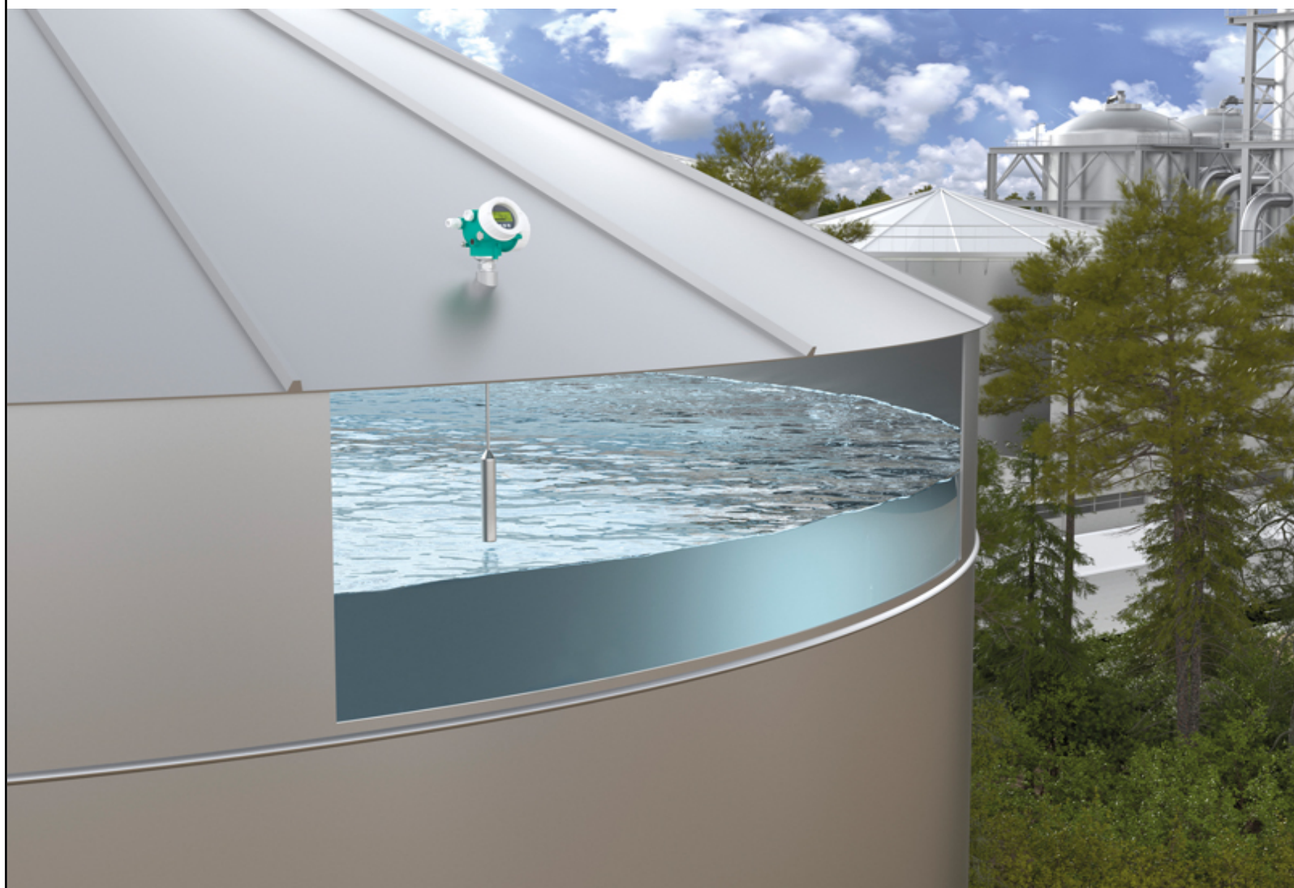
- Direct view of the fluid level
- Suitable for steam application
- No electronic signal, no fault
- Cheaper solution to check the fluid level
- Easy maintenance
- Very long life in service

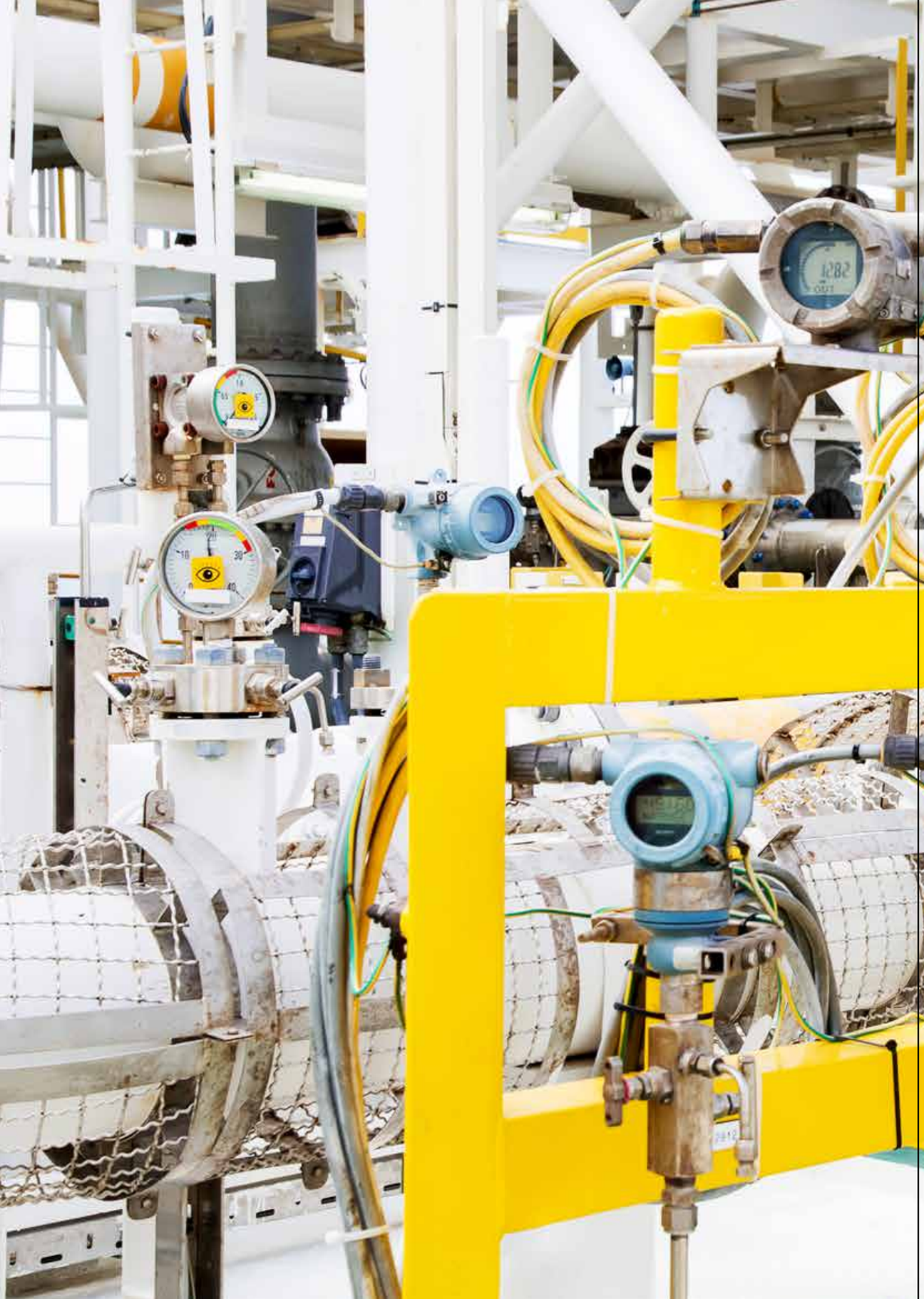
Paddle Switch

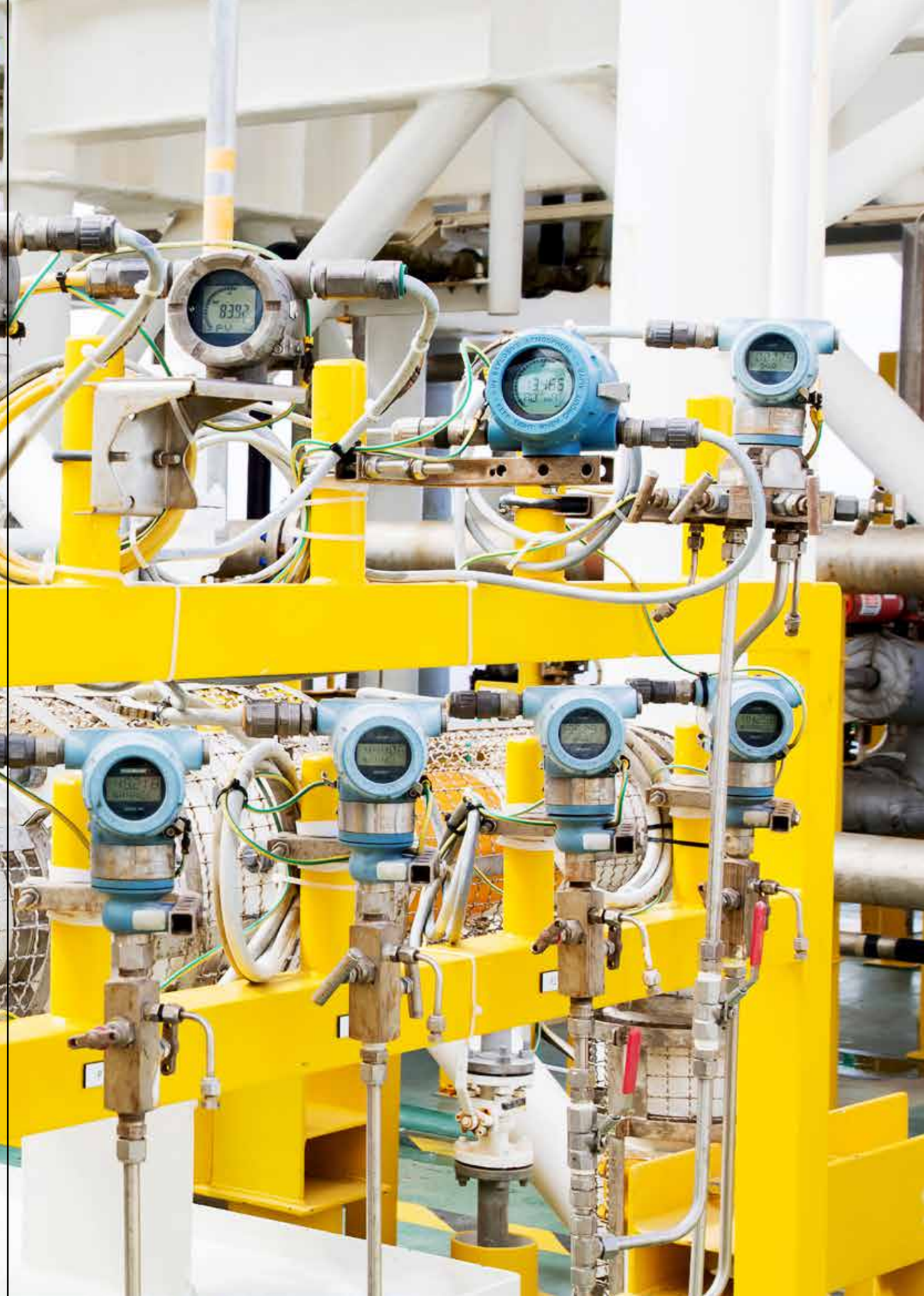
- Measuring principle for simple applications
- No calibration required

Microwave Barrier

- Non-invasive - tanks penetrated by microwaves from outside
- Measuring principle almost unaffected by process conditions
- Mechanical robust solution - maintenance free







Pressure Measurement

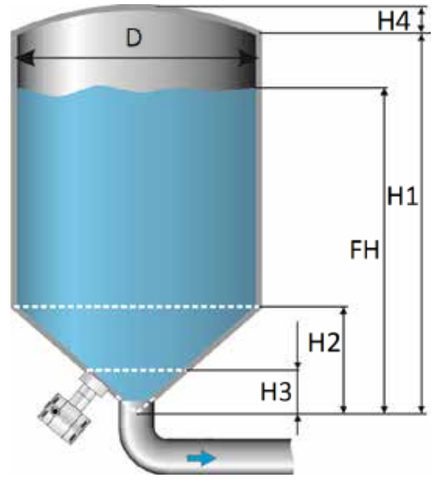
Complete range of instruments for measuring gauge, differential and absolute pressure. In addition to high measuring precision and ruggedness, defining features include the convenience and functionality of a modular system as well as the perfect safety concept. We have a proven range of products for all pressure applications .

Manufacturers

Rotothern instrumentation and control
EMERSON
KLAY INSTRUMENTS
TEMPRESS
SOR MEASUREMENT AND CONTROL
SIEMENS Ingenuity for life
WIKA
ASHCROFT
NUOVA FIMA
Endress+Hauser People for Process Automation
YOKOGAWA
STIKO
ITT Industries Engineered for life

Linearization Vertical Tank With a Control Bottom

LINEARIZATION VERTICAL TANK WITH A CONICAL BOTTOM



1. Navigate to **Vert. Sphere**. with the navigation button, and push to confirm.
2. Two choices appear on the screen: **Input** and **Simulate**
3. Select **Input**, and push to confirm.
4. Six choices appear on the screen:

Display	Drawing	Explanation
Height1	**H1**	The height of the tank
Diameter	**D**	The diameter of the tank
Height 2	**H2**	the height of the cone
Height 3	**H3**	The height till the topside of the diaphragm
Height 4	**H4**	The height of the parabolic tank roof
Fill Height	**FH**	The maximum percentage of filling of the tank

5. Fill in each value, and confirm with the navigation button. **The entered value's must be in meters.**
6. Select SAVE to save the setting.
7. The transmitter will return to the main menu.

SIMULATION

After linearization is entered and stored, it is possible to perform a simulation based on the entered value's. Based on the value entered in mWc, the transmitter will display the number of hectoliters (on the basis of the specified linearization values).

1. Navigate to program point **P111 – TANK LIN,** and push the navigation button to enter the menu.
2. Navigate to **Vert. Sphere**. with the navigation button, and push to confirm.
3. Two choices appear on the screen: **Input** and **Simulate**
4. Select **Simulate**, and push to confirm.
5. Fill in the desired value based on mWc, the number of hectoliters change directly with a change in the value mWc.

Main advantages Our Diaphragm

Our advantages against oil filled capillary systems & seals

With our well proven Flush Diaphragm Technology we have some **big advantages against transmit-ters . with oil filled capillary seals**

Instead of using oil filled capillaries we use our strong Hytrel cable (with venting tube inside) between the process connection and the remote stainless steel electronics housing, which gives a lot of advantages.

Find below our major advantages:

1. **Strong and small diaphragm**
   - Laser welded
   - Standard polished

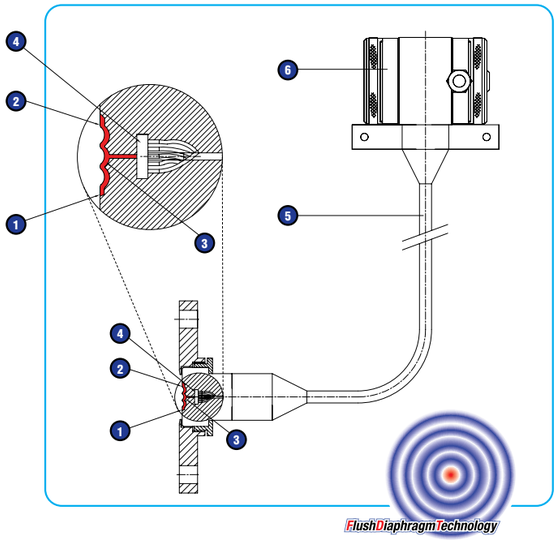
2. **Minimum oil filling**
   - Between sensor and diaphragm by using our Flush Diaphragm Technology

3. **Wave structure (back-up) behind diaphragm**
   - Equal to diaphragm structure
   - Good protection against overpressure
   - Perfect long term stability

4. **Pressure sensor near the process**
   - Build-in Temperature Sensor
   - **Active** Temperature compensation
   - No mounting position effect!

5. **Strong "vented" cable (Hytrel)**

6. **Electronics housing complete Stainless.Steel**



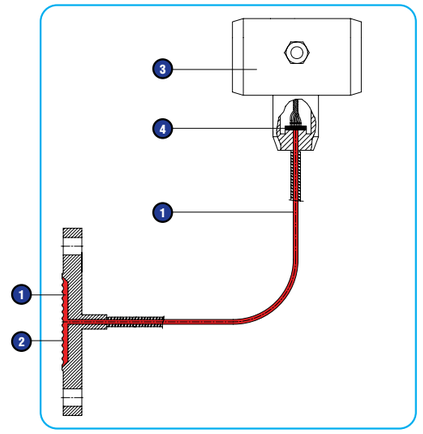
Disadvantages capillary systems:

1. - **Lots of oil filling**
   - Sensitive for temperature fluctuations
   - No Temperature compensation
   - Expensive solution

2. - Large diaphragm necessary,
   more sensitive for damaging

3. - Mounted on a standard transmitter
   - **No** active temperature compensation
   - **Large mounting position effects**

4. - Pressure sensor
   No "feeling" with the process.



Pressure Measurement

Pressure Gauge

- Stainless steel, bronze and monel Bourdon tube options
- Wide selection of pressure connections and pressure ranges
- Teflon®-coated, 400 stainless steel movement
- PLUS!™ Performance (option) dampens vibration, shock and pulsation effects; provides liquid-fill performance in a dry gauge

DP Gauge

- Based on the high-quality pressure gauges
- Also with simultaneous indication of the working pressure
- Robust and durable
- For each application the right instrument

DP Transmitter

- All stainless steel housing
- Adjustable with unique programming button
- Graphic display with backlight
- Local indicator (option)
- Intrinsically safe ATEX and IECEx: Ex ia IIC T6 Ga

Pressure Switch

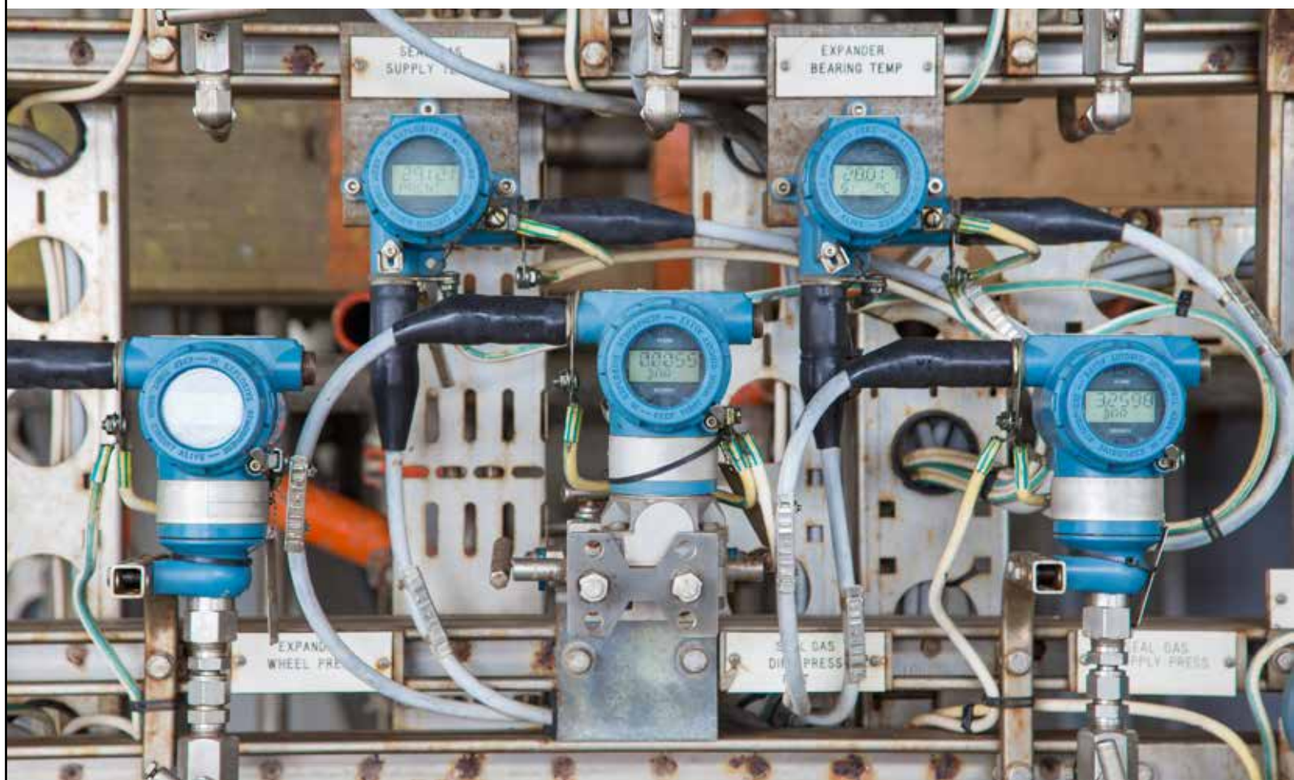
- Adjustable setpoints from %100-%15 of range
- Fixed or limited adjustable deadband
- Wide selection of switch elements and wetted materials
- Internal setpoint locking screw

Pressure Transmitter

- All stainless steel housing
- Adjustable with programming button, without test pressure
- Graphic display with backlight
- Local indicator (option)
- All current process connections

Hydrostatic LT

- Strong flush diaphragm
- Perfect long term stability
- Fixed or adjustable range
- Active temperature compensation



Temperature Measurement

Mechanical temperature measurement work on the bimetal, expansion or gas actuation principle. This enables scale ranges of 200- to 700+ °C in different class accuracies, response times and resilience to environmental influences. Diverse connection designs, stem diameters and individual stem lengths enable a flexible measuring point design. Dial thermometers with capillaries are particularly versatile. All thermometers, if needed, are suited for operation in a thermowell.
Thermowells For demanding operating conditions thermowells are available both in solid-machined and fabricated designs. The variants offered differ mainly in their designs; with flanges, with threads or for welding. Furthermore, thermowells are available in Van Stone design and with connections for sanitary applications. The choice of material and manufacturing to customer requirements ensures optimal protection of the sensor and precise measurements.

Manufacturers

Rototerm instrumentation and control
EMERSON
KLAY INSTRUMENTS
TEMPRESS
SOR MEASUREMENT AND CONTROL
SIEMENS Ingenuity for life
WIKA
ASHCROFT
thermo-electra measurement and control technics
Endress+Hauser People for Process Automation
YOKOGAWA
ITT Industries Engineered for life

Temperature Measurement

Bimetal Thermometer

- Robust, hermetically sealed stainless steel case
- External adjustment allows quick, limited span adjustments;
- reduces maintenance and recalibration costs
- Maxivision® dial for easy readability and parallax elimination
- Optional 316 stainless steel for 5» Everyangle design

multi-input temperature

- Get ultra-stable temperature measurement for precise inventory calculations and custody transfer for API chapter 7.3 compliance.
- Obtain outstanding temperature conversion accuracy of 0.05± °C (0.09± °F).
- Connect up to 16 three- or four-wire temperature elements.
- Include integrated water level sensor.
- Benefit from convenient and safe installation with two-wire IS bus power supply.

temperature switch

- Choice of temperature ranges (from °40- to °750F)
- Fixed or limited adjustable deadband
- Direct or remote reading thermal systems
- Adjustable setpoints from %100-%0 of range
- Internal set point locking screw

Temperature Transmitter

- Industry-leading accuracy and reliability for best performance in critical control and safety applications
- Transmitter-sensor matching improves measurement accuracy up to %75
- Device dashboards provide easy interface for simplified device configuration and diagnostic troubleshooting

Thermowell

- Solid drilled thermowell
- Flanged and screwed designs
- Sized to the millimetre (40 thousands of an inch)

Gas Actuated

- Scale ranges from 700+ ... 200- °C
- Fast response behaviour
- Case and stem from stainless steel
- Various connection and case mounting designs

Analyzers Measurement

We offer the most complete range of analyzers, transmitters, and sensors for the continuous on-line measurement of pH, ORP, conductivity, dissolved oxygen, ozone, chlorine, and turbidity.
Our sensors and analyzers are used extensively in the chemical process, food & beverage, power, mineral processing, petroleum refining, pharmaceutical, primary metals, pulp and paper, semiconductor, textile, water and wastewater industries.

Manufacturers

EMERSON
ABB
SIEMENS
Ingenuity for life
SICK
Knick
Endress+Hauser
People for Process Automation
YOKOGAWA

Analyzers Measurement Liquid

PH / ORP

- Our pH sensors and transmitters meet all requirements from basic functionality up to multichannel and multiparameter measurement.
- We offer pH buffers, pH solutions and pH standards for pH calibration to ultimate precision. They are produced in our own permanent calibration laboratory that has successfully passed the DAkkS accreditation (German accreditation authority).

Conductivity

- We offer helpful conductivity calibration solutions and conductivity calibration standards for accurate measurements.
- The exact cell constant of the conductivity sensors is factory-measured and certified.
- Our portfolio of conductivity sensors and transmitters covers all conductivity measuring ranges and all commonly used process connections.
- Compact devices consisting of conductivity sensor and transmitter are perfectly suitable for the food & beverage industry.

Dissolved Oxygen

- We offer oxygen sensors and transmitters that meet all requirements from basic functionality up to multichannel and multiparameter measurement.
- Our oxygen transmitters process the measuring signal of each oxygen sensor and display it as you prefer: as oxygen partial pressure, oxygen concentration or oxygen percentage saturation.
- To provide you with full flexibility, our dissolved oxygen probes are designed both for use in channels and basins as well as for installation in pipes and tanks.

Turbidity

- We provide you the full range of instruments for turbidity measurement: turbidity meters, total solids meters and suspended solids meters with matching turbidity transmitters and accessories.
- Our turbidity probes provide you with full flexibility. Mount them directly in the pipe or in a flow assembly for fast inline measurement without product loss or install them with a holder in any open channel, basin or tank.

Chlorine Measurement

- With us you get the full range of instruments for water disinfection: free chlorine sensors, total chlorine sensors and chlorine dioxide sensors with matching transmitters and accessories.
- Our chlorine sensors and transmitters meet all requirements from basic functionality up to multichannel and multiparameter measurement.
- To provide you with full flexibility, our chlorine probes are designed both for use in channels and basins as well as for installation in flow assemblies.

TOC, COD and SAC

- Our TOC, COD and SAC analyzers are available for all applications from fast inline measurement to regulation-compliant online analysis.
- We offer COD standards and reagents as well as TOC standards and reagents for standardized, high-precision measurements. They are supplied complete with all required material safety data sheets (MSDS).
- Our sample conditioning systems help you prepare homogeneous samples for total organic carbon monitoring. For COD analysis, a y-strainer ensures easy process integration. It delivers representative samples containing the right amount of solids.

Manual **Valves**

Manual valves are fixed devices that are installed to begin/control/end the flow of liquids and are usually installed in industrial areas across the world. These valves require human intervention to be controlled thus the word manual.

Manufacturers

AST
ARCA ONSITE
JC VALVES
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Manual **Valves**

Ball Valves

- Increased plant and personnel safety via blowout-proof stem and high-torque transmission with minimum mechanical backlash
- Broad application versatility enabled by extensive size range and options, including fire-safe tested versions
- High performance enabled by direct actuator mounting capabilities of the Turnex actuator

Butterfly Valves

- Increased uptime compared to loose liners resulting from integrally molded elastomer body liner that is not prone to stretching
- Low maintenance requirements from liner construction that is designed to last throughout the entire valve life cycle
- Reduced operating costs due to primary and secondary stem seal that prevents ingress of foreign material into the valve
- Installation speed and simplicity enabled by a gasket that is integral to the body, and the body liner that eliminates potential for damage to expensive seats

Gate Valves

- Installed base-proven design with over 600 Equiwedge gate valves, MSIVs, and MFIVs installed in operating nuclear power generation plants
- Minimized closing time that is %100 verifiable prior to plant startup or during outages to ensure safe shutdown of reactor to prevent meltdown
- Gas/hydraulic actuator design provides ability to close valve within 3 to 5 seconds of receipt of signal

Check Valves

- Rapid disassembly/reassembly during maintenance and repair that minimizes exposure to radiation
- Environmental/regulatory compliance and improved plant safety due to ALARA-compliant design
- Functional qualifications per ratings in accordance with ASME Section III, Class 1 pressure class 1878 (intermediate) requirements
- Greater process control through standard available dual seat disc design for leak-free sealing at both high- and low-pressure differentials

Safety valves

- High blow-off capacity in comparison to valve size
- Universal valve for many applications up to DN 16 / 400» or 300 bar / 4350 psig
- Proven thousands of times
- Outstanding value for the price
- Simple and robust construction
- Single trim (identical internal parts for steam/gas/ liquid) allows economical maintenance
- Large selection of options for different operating conditions
- Can be equipped with additional supplementary loading system or bursting discs

Actuators

An actuator is a component of a machine that produces force, torque, or displacement, when an electrical, pneumatic or hydraulic input is supplied to it in a system (called an actuating system). The effect is usually produced in a controlled way. An actuator translates such an input signal into the required form of mechanical energy. It is a type of transducer. In simple terms, it is a mover.

Manufacturers

BIFFI

SUSIN

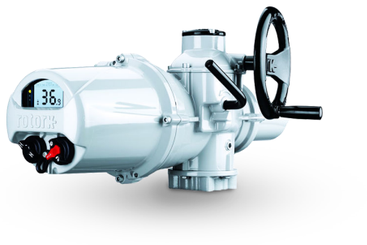
AIR TORQUE

AVAMO
ACTUATOR TECHNOLOGY | MADE IN GERMANY

i-TORK®

Actuators

Electric Actuator

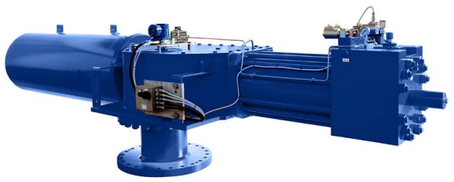


The enclosure or housing that protects the motor, associated electrics/or electronics and gears, varies depending on the area of application of the electrical actuator. For internal domestic applications only a dustproof enclosure is needed, for valve actuators exposed to the elements a weatherproof housing is needed and motor actuators located in hazardous areas require an explosion proof housing.
Electrical connectivity can vary from traditional cable glands which require a cover to be removed and cables connected to an internal terminal strip, or external DIN connectors that eliminate the need to remove any covers to make the electrical connections.

Pneumatic Actuator

A pneumatic actuator is similar to a hydraulic one but uses a gas (usually air) instead of a liquid. Compared to hydraulic actuators, pneumatic ones are less complicated because they do not need pipes for the return and recycling of the working fluid. On the other hand, they still need external infrastructure such as compressors, reservoirs, filters, and air treatment subsystems, which often makes them less convenient that electrical and electromechanical actuators.

Hydraulic Actuator



A hydraulic actuator typically uses the pressure of a liquid (usually oil) to cause a piston to slide inside a hollow cylindrical tube linear, rotatory or oscillatory motion. In a single acting actuator the fluid pressure is applied to just one side of the piston, so that it applies useful force in only one direction. The opposite motion may be affected by a spring, by gravity, or by other forces present in the system. In a double acting actuator, the return stroke is driven by fluid pressure applied to the opposite side of the piston.

Electro-Hydraulic Actuator

Another approach is an electrohydraulic actuator, where the electric motor remains the prime mover but provides torque to operate a hydraulic accumulator that is then used to transmit actuation force in much the same way that diesel engine/hydraulics are typically used in heavy equipment.

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