KROHNE
measure the facts

Process instrumentation and Measurement solutions

Overview

Contents

measure
the facts
technology driven by KROHNE

Letter from the Corporate Management

Dear Customers,

Communication techniques are becoming ever more complex, from the field through to the control level. At the same time the demands for recording physical measured variables such as flow rates, fill levels, temperature, pressure and analysis parameters are constantly growing. The principal requirement in this respect is absolute reliability of the measured values. This means the measuring equipment, even when subjected to disruptive influences such as changing flow profiles or inclusion of gas bubbles, must always deliver reliable values, and above all must guarantee virtually 100 % security against failure.

"**Measure the facts**" means not only reliable measurement of standard process variables – even under the most difficult process conditions – but also clear and precise process diagnostics right through to the material composition of the medium. Both of these contribute to improved process control and allow remarkable increases in process efficiency and production.

In order to guarantee this for you, more than 400 engineers in the worldwide KROHNE Group are continuously engaged in research into promising technologies for the future, in pursuit of improved measurement and further developments. We are a family-owned enterprise and we take our responsibilities seriously. We have permanent representation in more than 130 countries and employ more than 3,500 people in order to bring you highly innovative products from a single source, and tailor-made technical solutions to your measurement requirements, now and in the future.

Michael Rademacher-Dubbick

Stephan Neuburger

Global presence

When you are a global enterprise, you want the people you are dealing with to have the same kind of reach. KROHNE has 16 production facilities, owns 44 companies and joint ventures and works with 55 exclusive representatives worldwide. This means you can deal with a contact or a local office wherever you are.

Find your local contact at **www.krohne.com**

- Production facilities
- Sales companies or representatives

Working with people like you gives us a wealth of experience or, as we call it, application knowledge.

This means we have a good idea where to look if you have a measuring task that can't be met by an existing product. We will analyse the problem and come up with a way forward. Our ability to do this time after time is one of the very good reasons we are trusted by customers worldwide.

The industries we serve include:

- Chemical & petrochemical
- Food & beverage
- Heating, ventilation & air conditioning (HVAC)
- Iron, steel & metal
- Marine
- Minerals & mining
- Oil & gas
- Pharmaceutical
- Power generation
- Pulp & paper
- Water & wastewater

Manufacturing of converters in Duisburg, Germany

Production of ultrasonic flowmeters in Dordrecht, the Netherlands

Development and production sites

Headquartered in Duisburg, Germany, KROHNE has a large network of development and production sites who specialise in manufacturing different parts of our product range:

- Bad Oeynhausen, Germany: pressure products
- Breda, the Netherlands: oil & gas metering skids, custody transfer products, leakage detection and localisation systems, flow computers, asset management systems
- Brevik, Norway: cargo handling and ballast monitoring systems for marine applications
- Chengde, China (joint venture): variable area flow- meters, vortex flowmeters, level transmitters
- Dordrecht, the Netherlands: electromagnetic flowmeters, ultrasonic flowmeters
- Duisburg, Germany: variable area flowmeters, vortex flowmeters, radar level transmitters, converter electronics for all devices, analysis sensors and systems
- Malmö, Sweden: temperature assemblies, sensors and transmitters
- Neuss, Germany: spectroscopic analysis systems
- Petaling Jaya, Malaysia: oil & gas metering skids
- Pune, India (joint venture): vortex flowmeters, variable area flowmeters, electromagnetic flow-meters
- Romans-sur-Isère, France: radar and guided radar level transmitters, mechanical level transmitters, level switches
- Samara, Russia: ultrasonic flowmeters, vortex flowmeters, level transmitters
- São Paolo, Brazil (joint venture): electromagnetic flowmeters
- Shanghai, China (joint venture): electromagnetic flowmeters, mass flowmeters, radar and guided radar level transmitters
- Shanghai, China: electromagnetic flowmeters, mass flowmeters
- Wellingborough, United Kingdom: mass flowmeters

At KROHNE, we have a thorough quality and sustainable development policy applied and integrated into all levels of organisation. Available certifications and declarations include:

- Quality management: all KROHNE feeder factories are ISO 9001 certified
- Certified calibration standards (see chapter “Calibration”)
- Welding certifications (ISO 3834)
- Certified environmental management system (ISO 14001)
- Nuclear power certifications: ASME, KTA, I.S.C.I.R., CIS accreditation
- Industry-related certifications: ATEX, IECEx, FM, NEPSI, EHEDG, HART, FOUNDATION fieldbus ITK, GOST, SIL, Achilles JQS, NSF, OHSAS etc.

For more information about quality management and certifications, please visit **www.krohne.com**

Flowmeters and flow controllers

Electromagnetic flowmeters · Mass flowmeters · Ultrasonic flowmeters ·
Variable area flowmeters · Differential pressure · Vortex flowmeters · Flow controllers

Move into the lead: Flowmeters and flow controllers

KROHNE offers a comprehensive range of world-class flowmeters:

- Every flowmeter is wet-calibrated
- We hold over 1,000 patents relating to flow products
- All flowmeters come with the relevant approvals

Our flowmeters are used in just about every type of plant and processes around the world. The expertise we have gained, spanning installation effects, different mediums and meter performance under real process conditions, adds value to every KROHNE meter you purchase.

We are more than capable of handling standard applications, as well as overcoming particularly tough challenges in enterprising ways.

Due to their repeatability and accuracy, our flowmeters are installed as reference meters on standard liquid flow calibration rigs of national metrology institutes such as PTB (Germany), NMi/EuroLoop (the Netherlands) and NMiJ (Japan).

Over 90 years' experience:

1921
Ludwig KROHNE starts manufacturing variable area flowmeters in Duisburg, Germany, to measure the flow of air, gases and liquids.

1952
The first electromagnetic flowmeter (EMF) for industrial measurement is launched.

1981
First EMF with measuring tube made of oxide ceramics and sintered platinum electrodes.

1994
First straight tube Coriolis meter.

1996
First ultrasonic meter for custody transfer of liquids in the world.

2006
The first vortex flowmeter with integrated pressure and temperature compensation.

2008
ALTOSONIC V12, the first 12-chord ultrasonic gas flowmeter with compensating and diagnostic functions.

2010
WATERFLUX EMF with rectangular cross-section allows installation without straight inlets and outlets.

2014
First ultrasonic flowmeter for biogas applications with direct measurement of methane content.

2014
First Vortex flowmeter with integrated gross and net heat measurement for hot water (condensate) and steam.

The modular product line

Converters

IFC 050 C
Basic applications
(Display/Blind)

IFC 050 W
Wall-mounted
(Display/Blind)

IFC 100 W
Wall-mounted

IFC 100 C
Standard
applications

IFC 300 C
General purpose

IFC 300 F
Field housing

IFC 300 R
Rack-mounted

IFC 300 W
Wall-mounted

Flow sensors

OPTIFLUX 1000
The sandwich (wafer) solution for compact installationy

OPTIFLUX 2000
The all-round solution for the water and wastewater industry

WATERFLUX 3000
The solution for measuring small and large flows without requiring inlets or outlets

OPTIFLUX 4000
The standard solution for the process industry

OPTIFLUX 5000 flange
Ceramic measuring tube: maximum media and abrasion resistance and accuracy

OPTIFLUX 6000
The solution for the food and pharmaceutical industry

The specialists

OPTIFLUX 4040 C
2-wire device

OPTIFLUX 7300 C flange
With non-wetted capacitive electrodes and ceramic liner

TIDALFLUX 2300 F
For partially filled pipes, Ex Zone 1

BATCHFLUX 5500
For volumetric filling systems in the beverage industry

Battery-powered water meters

WATERFLUX 3070 C
Compact version

WATERFLUX 3070 C
Compact version, protection rating IP68

WATERFLUX 3070 F
Subsoil installation sensor (protection rating IP68 plus additional protective coating)

Accessories

OPTICHECK
On-site verification tool for calibration verification and documentation

Electromagnetic flowmeters

The measurement principle of electromagnetic flowmeters (EMF) is based on Faraday's law of induction. EMF can measure the volume flow of any electrically conductive liquid medium, even those with low conductivities.

Typical applications include:

- Water industry: revenue metering, district metering, water abstraction, leakage detection
- Wastewater industry: transport networks, sewage treatment plants, sludges
- Food & beverage industry: mixing, dosing and filling of drinks under hygienic conditions, filling systems applications
- Chemical industry: acids, alkalis, dosing applications, abrasive or corrosive mediums
- Pulp & paper industry: pulp, pastes, sludges and other caustic mediums, liquor, additives, bleaches, colourants
- Metal & mining industry: mediums with a high solid content, like ore or excavator mud

OPTIFLUX 4300 in the filtration system in city waterworks

Highlights:

- Minimal or no inlets/outlets
- All KROHNE EMF are wet-calibrated in a direct comparison of volumes
- Large choice of liner materials suitable for potable water, wastewater, chemicals, SIP/CIP and solids
- Suitable for use in custody transfer applications
- Measurement is independent of the flow profile
- Abrasion and corrosion-resistant liners available
- Ceramic measuring tubes and liners available for flange and sandwich versions, also with non-wetted electrodes (capacitive flowmeter)
- Specific models for partially filled pipes
- Virtual reference option: grounding electrodes and grounding rings can be left out
- Electric conductivity of medium can be used for detection of product change
- For high bubble content, high solids content and pulsating flow
- Secure handling of rapid medium changes and pH jumps
- Zero-point stability regardless of changes in medium properties
- Nominal sizes DN 2.5 to 3,000
- 3x100% diagnostics (application and device diagnostic, out-of-spec test) exceeds NAMUR requirements

Mass flowmeters

Highlights:

- Entrained Gas Management EGM: no loss of measurement with gas entrainments up to 100%
- Indication or configurable alarm to improve processes by identifying transient gas entrainments
- Not susceptible to installation effects: can be installed regardless of type of installation (no straight inlets/outlets) and external influences such as tube vibrations
- Only straight tube measuring devices for custody transfer applications in the highest OIML accuracy class of 0.3, approved to OIML R117/MID
- Flow rates from 0.0003 to 2,300 t/h
- Minimal pressure loss with straight tube measuring devices: reduced power consumption of pumps
- High density accuracy, not affected by medium and temperature changes
- Suitable for highly viscous mediums, inhomogeneous mixtures, mediums with solid content or gas inclusions
- Modular design for quick and easy replacement of electronics and/or flow sensors
- Self-draining and easy to clean
- OPTIMASS 7000 suitable for highly sensitive mediums as well as mediums requiring low flow velocity
- Variety of wetted materials (e.g. for corrosive mediums): titanium, stainless steel, HASTELLOY®, tantalum, duplex & super duplex
- Options for secondary containment up to 100 bar/1450 psi (OPTIMASS 2000 up to 150 bar/2176 psi)
- Turnkey solutions for the operation of batch plants

The function of mass flowmeters is based on the Coriolis principle. They allow for a direct measurement of mass flow, density and temperature of liquids and gases as well as calculation of volume flow and mass or volume concentration with a single device.

Typical applications include:

- Chemical: measurement of concentration or density, bulk loading, batching to reactors, hydrocarbon cracking, aggressive, abrasive or viscous mediums or mediums of unknown composition
- Food & beverage: filling machine applications, measurement of degrees Brix, flow, density, specific gravity, additive components dosing
- Pharmaceutical: batching, dosing and filling, solvent extraction ultra-pure water measurement
- Water & wastewater: flocculent dosing, sludge flow and density measurement
- Pulp & paper: paper stock, pulp, additives, bleaches, colourants
- Oil & gas: metering skids, bypass density measurement, CNG/LPG dispensers, leak detection, custody transfer applications such as tanker loading, bunkering and pipeline transfer

OPTIMASS 2000 – Minimal installation footprint

The modular product line

Converters

MFC 300 C/MFC 400 C
General purpose

MFC 300 F/MFC 400 F
Field housing

MFC 300 W
Wall-mounted

MFC 300 R
Rack-mounted

MFC 010
Modbus converter
for economical OEM
system integration

Flow sensors

OPTIMASS 1000
The standard device
with an excellent price-
performance ratio

OPTIMASS 2000
The first choice for bulk
flows for custody transfer

OPTIMASS 3000
Suitable for extremely
low flow rates

OPTIMASS 6000
The standard high-perfor-
mance meter for the
process industry

OPTIMASS 7000
High-end solution
featuring a single straight
measuring tube

The specialists

OPTIGAS 4010
Specially designed for CNG and
LPG in dispensing systems

OPTIBATCH 4011
Specially designed for linear
and rotating filling machines

Accessories

OPTICHECK
On-site verification tool for calibration
verification and documentation

Ultrasonic flowmeters for gas and steam

OPTISONIC 7300 C
Universal 2-beam device for inline measurement of process gases

OPTISONIC 7300 C Biogas
Ultrasonic flowmeter for biogas applications for direct measurement of methane content

OPTISONIC 8300
2-beam ultrasonic flowmeter for superheated steam

Ultrasonic flowmeters for liquids

UFM 3030 C
Universal 3-beam device for inline measurement of liquids

OPTISONIC 3400 C
3-beam ultrasonic flowmeter for liquids with extended process temperatures and high viscosities

UFM 530 HT
Rugged 2-beam high-temperature device for extreme process conditions

OPTISONIC 6300 W
Flexible clamp-on devicewith industrial clamp-on mechanism

OPTISONIC 6300 P
Battery-powered portable clamp-on device

Custody transfer

ALTOSONIC III
Cost-effective 3-beam device to measure light products for custody transfer

ALTOSONIC V12
12-beam device for measuring gas for custody transfer

ALTOSONIC V
5-beam device for measuring crude oil and crude oil products for custody transfer

Process gas measurement
with OPTISONIC 7300

Ultrasonic flowmeters

Using the transit time method, ultrasonic flowmeters measure liquid and gaseous mediums.

Typical applications include:

- Power plants: cooling water and demineralised water, steam, thermal oil (HTF), molten salt
- Chemical industry: metering of liquid hydrocarbons and low-conductivity liquids, including feedstock, solvents, chemical addition in reactor control metering, demineralised water
- Petrochemical refineries: feedstock, cooker feed flow, cracking, desulphurisation, residues, blending of crude oil and refined product
- Petrochemical plants: feedstocks (e.g. naphtha and natural gas), (intermediate) products such as ethylene, propylene, solvents
- Oil & gas industry: measurement of crude oil and refined product, natural gas, liquefied natural gas (LNG) and biogas; standard and custody transfer applications in production, pipeline transfer and leak detection, loading and off-loading, storage and distribution
- Water/utilities: demineralized water, water purification, effluent, compressed air
- HVAC: metering of chilled water and hot water for (custody transfer) energy measurement

Highlights:

- Complete portfolio for liquid, gas and steam applications
- Accuracy and reproducibility regardless of medium properties such as viscosity, temperature, density and electrical conductivity
- Diagnostic and compensation functions for disturbed flow profiles and deposits
- No moving parts or components that protrude into the measuring tube
- Low operating and maintenance costs due to non-wearing parts
- Excellent long-term stability, no recalibration required
- High degree of reliability thanks to redundant measuring paths
- High-temperature versions available
- Large dynamic range
- Bi-directional flow measurement

Highlights:

- Local indication without the need for auxiliary power
- Use in hazardous areas
- Accurate measurement even at very low flow rates (<0.5 l/h)
- Extended turndown ratio up to 100:1
- Suitable for low operating pressures
- Can be used even with short or no straight inlets/outlets
- Modular display and measuring transducer concept: easy component replacement
- World's only all-metal variable area flowmeter with EHEDG certification
- Flowmeters for nuclear power plants meet requirements of KTA 1401, RCC-E, RCC-M and ASME Section III and we are authorized to manufacture products with ASME N stamp and NPT stamp
- SIL2 certified
- Any meter orientation possible: vertical, horizontal or in fall pipes
- Optional limit switches, current output, totalizer, communication interfaces

Variable area flowmeters

Variable area flowmeters are suitable for measuring pure liquids and gases. They have an upright conical tube made of metal, glass or plastic, in which a float moves freely up and down. The flow through the tube causes the float to rise until the forces are in equilibrium.

Typical applications include:

- Measurement and dosing of additives such as catalysts, surfactants, foam and corrosion inhibitors, caustic soda, chlorine or sulphur substances, etc.
- Inerting of tanks or containers
- Measurement and dispensing of rinsing mediums (purge meters)
- Sample feed measurement for analyser systems
- Dosing and monitoring of lubricants and coolants for bearings and seals for process pumps and rotating machinery
- Hygienic applications in the food and pharmaceutical industries
- Measurement of gases and chemicals in laboratories and test facilities
- Gas/oil burner consumption measurement

Measuring the flow of CO_2 in the inlet lines of storage tanks at Eckes-Granini, Germany

Glass devices

DK46, 47, 48, 800
Small and compact dosing meters with valve

VA40
All-purpose flowmeter with various process connections

Metal devices

DK32, 34, 37
With mechanical or electronic indicator and metering valve to set flow value accurately

H250 M40
The new standard device, explosion-proof and intrinsically safe

H250 M9
The proven-in-use, intrinsically safe solution for the process industry

The modular product line

Pressure transmitters

OPTIBAR DP 7060
Differential pressure transmitter for flow applications, already with integrated absolute pressure measurement

Primary elements

OPTIBAR OP 1000
Standard orifice plates with single bore tapping for cost-effective flow measurement

OPTIBAR OP 1200
Robust split ring orifice plates with interchangeable orifice plate

OPTIBAR PT 2000
Averaging pitot tubes for energy-efficient flow measurement with lowest pressure loss

Calibrated meter runs

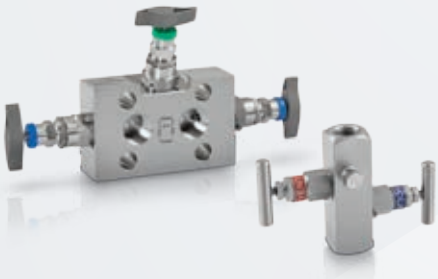
OPTIBAR MR 1000
Calibrated meter run with orifice plate for nominal sizes DN 15...50 / 3/4...2"

OPTIBAR MR 2000
Calibrated meter run with averaging pitot tube for nominal sizes DN 15...50 / 3/4...2"

Flow computers

OPTIBAR FC 1000
Flow computer for pressure and temperature compensated gas and steam measurement and gross/net energy calculation

Accessories



Accessories for safe and easy installation of pressure transmitters in the process:

- Manometer and barstock valves, 3-/5-way valve manifolds, also for steam and high temperature applications
- Condensate pots for steam applications
- Fittings, seals, blind-plugs, oval flange adapter and gauge snubber

Differential pressure flow measurement

The principle of differential pressure (DP) is used to measure volume or mass flow of liquids, gases or steam.

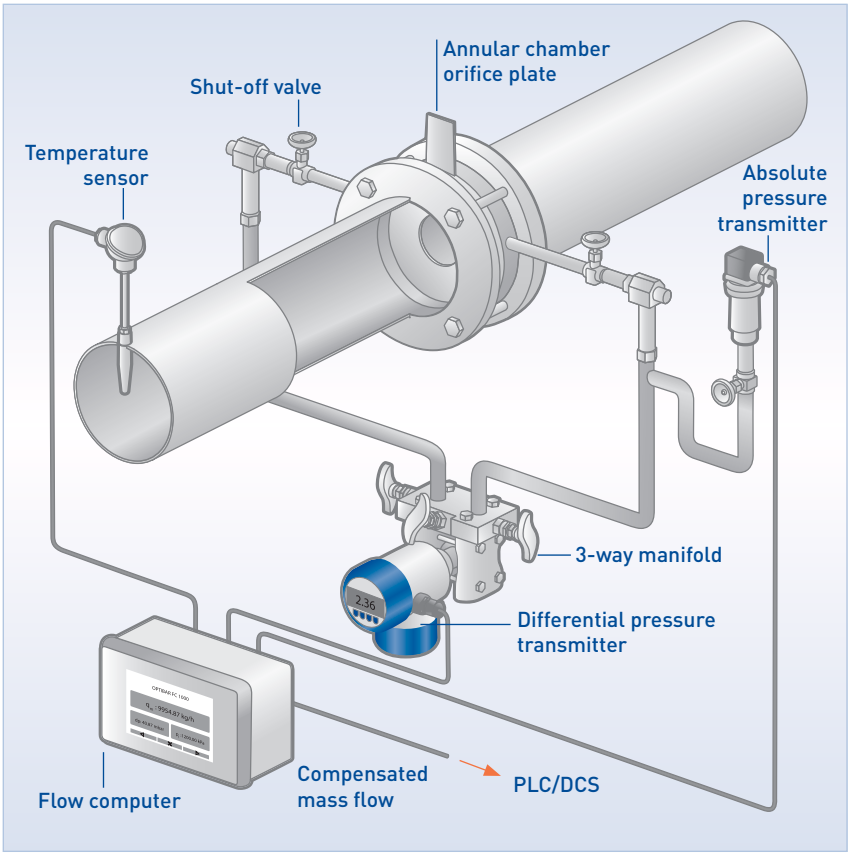
The pressure is measured at two points across a restriction in the line (e.g. a primary element). By using the Bernoulli equation, the difference in pressure between the two points is an indication for flow velocity and, as the pipe size is known, calculated to a volume flow rate.

The OPTIBAR modular product line ranges from DP pressure transmitters to complete DP flow measuring points from one source with matched, pre-configured components, (wet) calibrated and ready to install.

As an alternative to orifice plates, the pitot tube provides a simple, cost-efficient and long-term stable flow measurement solution for:

- Applications that require a low pressure loss
- Retrofit of existing pipes with a flow measurement
- Line sizes > DN 300 / 12"
- Low pressure gases

Complete DP flow measuring point for compensated volume/mass flow



Highlights of DP flow measurement:

- Worldwide standardised flow measurement principle according to ISO 5167
- All measurement uncertainties under operational conditions are known and can be calculated
- Volume or mass flow measurement of liquids, gases or steam
- Medium temperatures -200...+1000°C / -328...1832°F
- Process pressure up to 420 bar / 6091 psi
- Line sizes from DN25...12000 / 1...470"
- One pressure transmitter for all flow applications, compact or remote version
- Integrated absolute pressure measurement
- Pressure and temperature compensation available as option
- Wet-calibrated meter runs for small line sizes and low measurement uncertainty
- Optimisation of measuring points according to a given specification, e.g. short inlet/outlet, low pressure loss, small overall uncertainty, etc.
- Change of pressure transmitter without process interruption
- No moving parts
- NACE compliant materials
- Compliant to PED 97/23/EC with CE marking
- Use in hazardous areas
- Large choice of materials for corrosive and non-corrosive mediums
- Wet calibration up to DN 3000 / 120" possible
- 4...20 mA HART® 7 / HART® SIL 2/3, FOUNDATION ™ fieldbus, PROFIBUS® PA as communication options
- Smallest measuring span 10 mbar / 0.145 psi gauge

Vortex flowmeters

OPTISWIRL 4070 C flange
The universal device with standard integrated temperature compensation for saturated steam

OPTISWIRL 4070 C sandwich
The first vortex flowmeter with integrated pressure and temperature compensation

OPTISWIRL 4200 C flange
Vortex flowmeter with Advanced Vortex Frequency Detection for stable measurement under different process conditions

OPTISWIRL 4200 dual version
Two independent sensors and two signal converters for multiproduct pipelines, redundant measurement or increased safety demands

OPTISWIRL 4200 C sandwich
All advantages of the flange version in a space-saving sandwich design

OPTISWIRL 4200 C 1R / 2R
Integrated reduction of nominal diameter for space-saving and economic installations and large measuring spans

OPTISWIRL 4200 F
Remote version with field housing converter with connection cable up to 50 m/164 ft

Mechanical flow controllers

DW 181
Inline flow controller, process connection 3/4...2" NPT, G3/4...2

DW 182
Inline flow controller, process connection DN15...65, 1/2...2 1/2" ASME

DW 183
Inline flow controller, process connection DN65...200, 3...8" ASME

DW 184
Insertion-type flow controller for pipe diameter ≥250 mm /10", process connection DN150, 6" ASME

Electromagnetic flow controllers

DWM 1000
Monitoring unit with binary output

DWM 2000
Flowmeter with 4...20 mA output

Vortex flowmeters

Vortex flowmeters are based on the principle of the Kármán vortex street and are used in main as well as auxiliary and supply processes.

Capable of compensating for different temperature and pressure conditions, they measure the volume flow of both conducting and non-conducting liquids, industrial gases and steam.

Applications include measurement of:

- Saturated steam and superheated steam
- Gross and net heat for energy management systems
- Hot steam, also for CIP and SIP processes
- Liquefied gas, wet gas and flue gas
- Demineralised water and boiler feed water
- Solvents and heat transfer oil
- Steam boiler monitoring
- Compressor output
- Consumption in compressed air systems
- Free air delivery (FAD)
- Burner consumption

Highlights of vortex flowmeters:

- Integrated pressure and temperature compensation for fluctuating pressures and temperatures
- Temperature compensation for saturated steam included as standard
- Gross and net heat calculation to support advanced energy management
- Non-wearing, fully-welded stainless steel construction with high resistance to corrosion, pressure and temperature
- SIL2 certified
- Redundant Data Management: Easy exchange of electronics without loss of calibration and parametrisation data
- Use in hazardous areas

Mechanical flow controllers

Mechanical flow controllers work via a spring-mounted baffle that changes its position as flow increases. Adjustable switches generate alarms once switching points are reached.

Typical applications include:

- Local indication of flow without power supply – cooling systems, pump protection, lubrication control or cavitation alarm, for instance

Highlights of mechanical flow controllers:

- One limit switch (dry reed contact) as standard, second switch can be added
- For horizontal or vertical pipelines
- Available with screw-type, flange or mounting flange connectors
- Tropical version with Amphenol® sockets and a double coating of epoxy on device
- Additional amplifying relay for switching energies of up to 1200 VA

Electromagnetic flow controllers

Based on Faraday's law of induction, electromagnetic flow controllers monitor or measure the flow speed of electrically conductive liquids.

Typical applications include:

- Largely homogenous liquids, pastes. suspensions and sludges, even with solid content

Highlights of electromagn. flow controllers:

- Minimum conductivity 20 µS/cm
- Sturdy construction, no moving parts
- Parts in contact with medium made of stainless steel and ceramic
- Electronic unit can be replaced under operating conditions
- For pipelines ≥DN 25/1"

Level transmitters and level switches

Continuous level measurement: FMCW radar · TDR guided radar · Ultrasonic · Magnetic bypass · Displacer · Potentiometric · Hydrostatic pressure · Level switches: Vibration · Conductive · Electromagnetic

For the highest level of quality: Level transmitters and level switches

KROHNE offers a comprehensive range of level transmitters and switches for liquids and solids.

Every KROHNE transmitter is calibrated individually and thoroughly tested before it is shipped. This ensures a consistent product quality and guarantees that the meters will work properly once they arrive. KROHNE transmitters use patented technology to deliver high performance and reliability and comply with a broad spectrum of industry standards and approvals.

KROHNE level transmitters are designed for use in the harshest process environments across a wide spectrum of industries all around the world. The expertise we have acquired over the years, covering the effects of installation and different media, and performance under real-world process conditions, adds value to every KROHNE instrument you purchase.

Our product portfolio contains a wide selection of cost-effective level solutions, as well as solutions for high-temperature/pressure environments and use with dense vapours and highly viscous media. For customers with special requirements in terms of materials or mounting, we offer a tailor-made approach which often results in a lower total installed cost.

Over 50 years' experience:

1955
Production of mechanical level transmitters for measuring liquids in tanks and containers begins.

1989
KROHNE introduces the first FMCW radar transmitter for process tanks, pioneering the use of radar level measurement technology in process applications.

1995
KROHNE launches the first TDR guided radar transmitter.

2000
KROHNE developes the first 2-wire FMCW radar device.

2004
The next quantum leap in level measurement comes with the OPTIWAVE and OPTIFLEX series, a new generation of non-contact and guided radar devices with a unique wizard-driven operating concept.

2009
Introduction of the innovative Drop antenna for OPTIWAVE. Its ellipsoidal shape prevents from product deposits in dusty or humid atmospheres.

2012
Modular housing concept with bayonet locking system for OPTIFLEX.

2013
Unique PP/PTFE Wave Horn antennas for OPTIWAVE in corrosive environments.

Continuous level measurement: FMCW non-contact radar

Frequency modulated continuous wave (FMCW) radar emits a high frequency signal which is reflected from the product surface and received back. These transmitters allow for the continuous, contactless level measurement of liquids, pastes, granulates, powders and other solids in a wide variety of industries:

- Chemical & petrochemical: solvents, chlorine, resins, fertilizers (urea), liquefied gas, hydrocarbons, plastics, asphalt (bitumen), acids, bases
- Energy: hydrocarbons, coal, fly ash, biogas, cooling water in power plants
- Food & beverage: syrup, animal feed, juice, spirits, sugar, sodium carbonate, flour, cereals, coffee, chocolate, yeast
- Iron, steel & metal: molten steel, iron-disulphide, ore, coke
- Marine: cargo, ballasts
- Minerals & mining: stone, gravel, sand, lime, cement, concrete, gypsum, calcium carbonate, clinker, coal
- Oil & gas: hydrocarbons, liquefied gases, tank farms
- Pharmaceutical: alcohol, high purity water, solvents, various raw materials
- Pulp & paper: binding agents, wood chips, pulp moulding, titanium oxide
- Water & wastewater: potable, sea and river water, sewage, biological waste

Typical applications include:

- Reaction vessels
- Silos, bunkers and stockpiles for solids
- Leakage monitoring near pipelines/vessels
- Storage and production of toxic or corrosive liquids
- Storage of liquefied gases in high pressure/low temperature spheres
- Hygienic process applications
- Flow measurement in open channels with pre-shaped flumes and weirs

Highlights:

- Distance, level, volume and mass measurement
- Not affected by fixed or moving inserts/agitators
- Large choice of antennas, eg. PP or PTFE Wave Horn antennas for corrosive mediums
- Drop antenna made of plain PP or PTFE: its ellipsoidal shape and non-adhesive surface prevents from product deposits in dusty or humid atmospheres.
- Suitable for high and low process pressure/temperature applications
- Modular design from mechanics to converter
- Metaglas® dual process sealing system for dangerous products

OPTIWAVE 1010
2-wire FMCW radar welded
to BM 26 ADVANCED (bypass
chamber or MLI)

OPTIWAVE 5200 C
2-wire FMCW radar
for liquid applications

OPTIWAVE 5200 F remote version
2-wire FMCW radar
for liquid applications

OPTIWAVE 6300 C Drop antenna
2-wire FMCW radar for
solid applications

OPTIWAVE 6300 C/7300 C Drop antenna
2-wire FMCW radar with flange plate
protection for corrosive media

OPTIWAVE 7300 C Horn antenna
2-wire FMCW radar for
liquid applications

OPTIWAVE 8300 C Marine
2-wire FMCW radar for marine
applications marketed through our
KROHNE Marine sales office

*marketed through KROHNE Marine sales offices (see page 58)

OPTIFLEX 1100 C
2-wire TDR guided radar
for storage or standard
process applications

OPTIFLEX 2200 C
2-wire TDR guided radar for
solid and liquid applications

OPTIFLEX 2200 F remote version
2-wire TDR guided radar for
solid and liquid applications

OPTIFLEX 1300 C
2-wire TDR guided
radar for solid, liquid and
interface applications

OPTIFLEX 4300 C Marine*
2-wire TDR guided
radar for marine and
offshore applications

*marketed through KROHNE Marine sales offices (see page 58)

Continuous level measurement: TDR guided radar

TDR radar (Time Domain Reflectometry) emits electromagnetic pulses which are transmitted along a rigid or flexible conductor before being reflected from the product surface and received. It allows for continuous level measurement of liquids, pastes, granulates, powders and liquid interface in industries which include:

- Chemical & petrochemical: fertilizers (ammonia), solvents, carbon dioxide, hydrocarbons, liquefied gases, plastics, bitumen emulsion
- Energy: hydrocarbons, coal powder, fly ash
- Food & beverage: animal feed, recycled cooking oil, coffee peel
- Iron, steel & metal: ore, cooling water, hydraulic oil
- Marine: cargo, ballasts
- Minerals & mining: mineral powders (cement, coal, alumina, talc, salt), sand, perlite
- Oil & gas: water/hydrocarbon interface, liquefied gases
- Pharmaceutical: solvents, alcohol and intermediate products
- Pulp & paper: binding agents, wood chips, saw dust
- Water & wastewater: potable, sea and river water

Typical applications include:

- Crude oil distillation in extraction vessels
- Storage of liquefied gases in high pressure/low temperature spheres
- Storage of raw materials and intermediates in bulk solid containers
- Separation of liquids
- Rag layer detection in impounding basins
- Condensation vessels for liquids and gases
- Storage of raw and finished products in tank farms of refineries
- Rock crushers, hoppers
- Water towers, basins and reservoirs
- Tide level, flood warning

Highlights:

- Distance, level, volume, mass and/or interface measurement
- Not affected by process conditions: dust, foam, vapour, agitated or boiling surfaces, changes in pressure, temperature and density
- Suitable for high and low process temperature/pressure applications
- Converter can be rotated and removed under process conditions
- Metaglas® dual process sealing system for dangerous products
- Modular design from mechanics to converter

Continuous level measurement: Ultrasonic

This particular transmitter type emits ultrasonic pulses which are reflected from the product surface and received. It is suitable for continuous, non-contact level measurement of liquids and solids in the following industries:

- Chemical: acids, bases, plastics
- Water & wastewater: potable, sea and river water, sewage

Typical applications include:

- Non-contact flow measurement in open channels
- Level of solids in silos and storage tanks
- Slightly corrosive acids and lies
- Hazardous areas
- Sumps, water and wastewater basins

Highlights:

- Integrated temperature sensor for velocity compensation
- Unaffected by product properties
- Set-up without medium
- Gas and dust approvals for hazardous areas
- Highly resistant materials for acoustic signal transducers and process connections

OPTISOUND 3010 C
2-/4-wire ultrasonic level transmitter for small tanks

OPTISOUND 3030 C
2-/4-wire ultrasonic level transmitter for medium-sized tanks

OPTISOUND 3020 C
2-/4-wire ultrasonic level transmitter for small and medium-sized tanks

Magnetic bypass

BM 26 BASIC/
ADVANCED
Magnetic bypass level indicator (MLI) for liquid applications (tube inner diameter 38.4 mm / 1 1/2")

BM 26 A
Magnetic bypass level indicator (MLI) for liquid and interface applications (tube inner diameter 67.4 mm / 2.65")

BM 26 W1010
BM 26 ADVANCED with welded OPTIWAVE 1010 for liquid applications

BM 26 W7300
BM 26 A with OPTIWAVE 7300 for liquid applications

BM 26 F2200
BM 26 A with OPTIFLEX 2200 for liquid level and/or interface applications

RC F1300
Reference chamber with OPTIFLEX 1300 for liquid level and/or interface applications

Displacer

BW 25
Broadband displacer level transmitter for high pressures and temperatures

Potentiometric

BM 500
4-wire potentiometric level transmitter for hygienic applications

Continuous level measurement:

Magnetic bypass

Magnetic bypass float level transmitters are based on the principle of communicating vessels and allow for a continuous level or interface measurement of liquids.

Typical applications include:

- Chemical industry: suitable for safety-related applications – flammable, toxic and corrosive mediums, liquids in low pressure storage and process tanks
- Oil & gas, petrochemical industries: measuring the level of hydrocarbons in refining applications

Highlights of magnetic bypass transmitters:

- Robust stainless steel design also for use in extreme process conditions
- Hermetically sealed (IP68), easy to read local indication
- Variety of process connections, special materials, valves, insulation
- Analogue transmitters (FF/PA/HART®) with optional display
- Adjustable, clamp-on limit switches
- Local float failure indication
- Ex and PED-compliant

Displacer

Based on the Archimedes or displacer principle, these transmitters measure level and separating layers of liquids.

Typical applications include:

- Chemical & petrochemical industries: hydrocarbons, solvents, bases
- Energy, power generation: steam generator, water

Highlights of displacer transmitters:

- Suitable for use in extreme process conditions, e.g. high pressure/ temperature liquids
- Reference vessel available for bypass installation
- Modular design, retrofitting under process conditions is possible
- Converter/indicator scale are mechanically sealed from the process

Potentiometric

Potentiometric transmitters measure the potential difference in voltage between a working and a reference electrode and enable level measurement independent of medium properties.

Applications in the food & beverage, pharmaceutical industries:

- Small tanks and hygienic applications
- Tough, pasty or strongly adhesive media

Highlights of potentiometric transmitters:

- Not sensitive to adhesives and foam
- Defined empty reporting function
- Quick response time
- Automatic position detection
- Resistant to high temperatures (CIP/SIP)
- Compact or remote version

The modular product line

Pressure transmitters

OPTIBAR P 2010
Ultra-compact pressure transmitter with flush metallic diaphragm also for hygienic applications

OPTIBAR PC 5060
Process pressure transmitter with ceramic diaphragm for pressure and level measurement

OPTIBAR PM 5060
Process pressure transmitter with metallic diaphragm also for high pressure ranges and hygienic applications

OPTIBAR DP 7060
Differential pressure transmitter for hydrostatic level measurement with integrated absolute pressure measurement

Diaphragm seals

OPTIBAR DS series
Diaphragm seals for temperatures up to +450 °C / +842 °F or corrosive mediums

OPTIBAR DS direct
Differential pressure transmitter with direct mounted single-sided OPTIBAR DS diaphragm seal

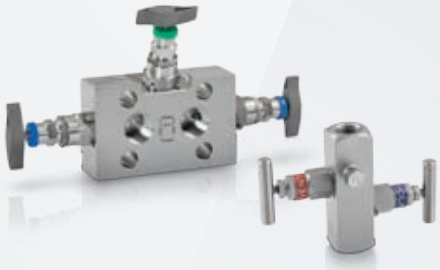
OPTIBAR DS capillary
Differential pressure transmitter with capillary mounted two-sided OPTIBAR DS diaphragm seal

OPTIBAR DS direct/capillary
Differential pressure transmitter with combined direct/capillary mounted two-sided OPTIBAR DS diaphragm seal

Submersible probes

OPTIBAR LC 1010
Submersible level probe with ceramic diaphragm 22 mm / 1" diameter

Accessories



Accessories for safe and easy installation of pressure transmitters in the process:

- Manometer and barstock valves, 3-/5-way valve manifolds, also for steam and high temperature applications
- Flange adapter according to DIN EN and ASME
- Condensate pots for steam applications
- Straight and curved connecting pipes, syphons in U- and circular shapes
- Fittings, seals, blind-plugs, oval flange adapter and gauge snubber

Hydrostatic pressure level measurement

Hydrostatic pressure is used to measure level or density of a liquid in a vessel. The OPTIBAR modular product line offers a complete portfolio for hydrostatic level measurement of corrosive and non-corrosive liquids and slurries.

For open vessels under atmospheric conditions, process pressure transmitters are used:

- OPTIBAR PM 5060 and OPTIBAR P 2010 with fully welded metallic diaphragm for aseptic / hygienic applications
- OPTIBAR PC 5060 with ceramic measuring cell also for abrasive or corrosive liquids, and small measuring ranges (H_2O: 0,25 m / 10")

For closed/pressurised vessels, differential pressure (DP) transmitters are used:

- OPTIBAR DP 7060 for precise level measurement for pressurised containers up to 420 bar / 6091 psi, with integrated head pressure measurement

If the level of a liquid is known, the DP transmitter can also be used to measure the density of the liquid, or the position of interface between two liquids of different density.

The pressure transmitters can be combined with diaphragm seals for high process temperatures up to +450°C / +842°F, corrosive mediums, and can also be equipped with different hygienic and pharmaceutical process connections.

To be used as a simple level measurement solution for wells or tanks, submersible probes are available, perfectly suited for water and wastewater applications.

Typical applications include:

- Level measurement of liquids in open and pressurized vessels
- Level measurement in vessels with agitators
- Hygienic level measurement applications
- Steam boiler monitoring
- Level or interface measurement in distillation columns
- Level measurement in water wells, rainwater retaining / overflow basins

Highlights of hydrostatic pressure products:

- Level, density or interface measurement of liquids in vessels
- Medium temperatures up to +450°C / +842°F
- Process pressure up to 420 bar / 6091 psi
- Not affected by fixed or moving inserts/ agitators
- Not affected by process conditions: dust, foam, vapour, agitated or boiling surfaces, or pressure changes
- Large portfolio of process connections suitable for any industry application
- Different hygienic process connections for a hygienic, dead zone-free installation
- Differential pressure transmitter with integrated absolute pressure measurement to measure head pressure
- Measuring range starting at 10 mbar / 0.14 psi
- Interface measurement, also with emulsion layers
- Multiple functions for vessel linearisation integrated in converter
- NACE compliant materials
- Use in hazardous areas
- Smallest measuring span 10 mbar / 0.145 psi gauge
- 4...20 mA HART® 7 / HART® SIL2/3, FOUNDATION ™ fieldbus, PROFIBUS® PA as communication options

Highlights of vibration switches:

- Unaffected by process conditions
- Rugged oscillating fork, high abrasion resistance
- Reproducible switching point without adjustment
- Continuous self-monitoring of correct oscillating frequency, corrosion and cable breakage to the piezo drive
- Hygienic design with polished surface
- Recurring test acc. to WHG via test button (with SU 501)
- Functional safety: up to SIL2 in a single channel architecture and up to SIL3 in a multiple channel, redundant architecture

Highlights of conductive switches:

- Different hygienic process connections for a hygienic, dead zone-free installation
- The sensitivity of the probe can be switched over via control cable for changing mediums with widely differing conductivity
- Stainless steel or coated probe rods available; not sensitive to foam and adhesions
- Compact or remote version
- Stub, rod or multi-rod electrodes
- Probes can be shortened as needed

Highlights of electromagn. switches:

- Measurement independent of media properties
- Not sensitive to adhesives and foam, condensate or build-up of deposits
- Hygienic installation by means of a hygienic process weld sleeve, nearly flush with the front
- Dry-run protection beyond a nominal width of DN 15
- Not affected by vibration

Level switches:

Vibration

Vibration switches indicate the presence of liquid or solids when the medium comes in contact with their vibrating forks and dampens their oscillation.

Typical applications include:

- Applications with heavy dust build-up and mechanical stresses
- Light bulk goods
- Pump dry-run protection
- Limit and overfill detection
- Liquid detection in pipes
- Detecting solids in water

Conductive

In liquid applications, conductive level switches indicate the change of resistance as soon as their electrodes are covered with medium.

Typical applications include:

- Hygienic applications in the food & beverage and the pharmaceutical industry, e.g. level detection or dry-run protection

Electromagnetic

An electromagnetic switch uses the phase shift that electromagnetic waves experience when emitted to a medium. It is suitable for level detection for liquids and pastes or as a dry-run protection. It can also detect liquid/liquid interfaces or identify the presence of a specific medium.

Applications in the food & beverage, pharmaceutical industries:

- Small tanks and hygienic applications
- Tough, pasty or strongly adhesive media

Vibration

OPTISWITCH 3X00 C
Vibration level switches for solids

OPTISWITCH 4000 C
Vibration level switch for liquids for simple applications

OPTISWITCH 5X00 C
Vibration level switches for liquids for process and high temperature / high pressure applications

Conductive

LS 7200
Conductive switch with one to four switches

Electromagnetic

OPTISWITCH 6500 C
Electromagnetic switch

OPTISWITCH 6600 C
Electromagnetic switch

Pressure measurement

Process pressure · Differential pressure · Hydrostatic pressure

Always the right pressure.
Anytime. Any Process.

Pressure is one of the most commonly measured parameters in the process industry. Today, in over 40 % of all flow applications, differential pressure is still the first choice for metering liquids, gas or steam.

Almost 25 % of all liquid level measurement applications are hydrostatic pressure measurements – in case of pressurized vessels almost exclusively differential pressure level measurements.

With the release of the OPTIBAR series, KROHNE is extending its range of process instrumentation to include pressure measurement.

The OPTIBAR series includes a variety of pressure transmitters with ceramic or metal measuring cells, application specific diaphragm seals, primary elements and accessories to match a wide range of industrial process applications.

Milestones

2012
Introduction of OPTIBAR P 3050 C compact pressure transmitter

2014
Release of OPTIBAR DP 7060 differential pressure transmitter

2015
Complete OPTIBAR series of pressure transmitters, diaphragm seals, primary elements and accessories is released

The modular product line

Pressure transmitters

OPTIBAR P 1010
Ultra-compact pressure transmitter with recessed metallic diaphragm up to 600 bar / 8700 psi

OPTIBAR P 2010
Ultra-compact pressure transmitter with flush metallic diaphragm also for hygienic applications

OPTIBAR P 3050
Compact pressure transmitter with recessed metallic diaphragm, optional display and adjustment module

OPTIBAR PC 5060
Process pressure transmitter with ceramic diaphragm for pressure and level measurement

OPTIBAR PM 5060
Process pressure transmitter with metallic diaphragm also for high pressure ranges and hygienic applications

OPTIBAR DP 7060
Differential pressure transmitter for precise relative gauge pressure measurement with high overload resistance

Diaphragm seals

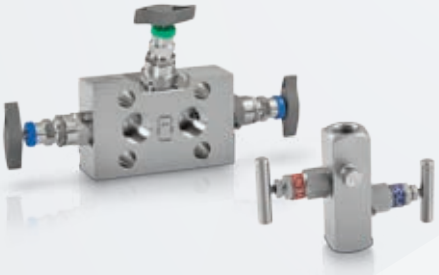
OPTIBAR DS series
Diaphragm seals for temperatures up to +450 °C / +842 °F or corrosive mediums

OPTIBAR DS direct
Differential pressure transmitter with direct mounted single-sided OPTIBAR DS diaphragm seal

OPTIBAR DS capillary
Differential pressure transmitter with capillary mounted two-sided OPTIBAR DS diaphragm seal

OPTIBAR DS direct/capillary
Differential pressure transmitter with combined direct/capillary mounted two-sided OPTIBAR DS diaphragm seal

Accessories



Accessories for safe and easy installation of pressure transmitters in the process

- Manometer and barstock valves, 3-/5-way valve manifolds, also for steam and high temperature applications
- Flange adapter according to DIN EN and ASME
- Condensate pots for steam applications
- Straight and curved connecting pipes, syphons in U- and circular shapes

Process pressure

Process pressure transmitters are used to measure pressure in pipes or vessels.

OPTIBAR PC, PM and DP transmitters feature a modular concept that meets various requirements of modern process applications:

- Intrisically safe and explosion proof
- Optional display and adjustment module
- 4...20 mA HART® 7 / HART® SIL 2/3, FOUNDATION ™ fieldbus, PROFIBUS® PA
- Plastic, 316L, 316L hygienic, Aluminum

Measuring cells:

- Ceramic (OPTIBAR PC 5060)
- Metallic (OPTIBAR PM 5060)
- DP (OPTIBAR DP 7060)

Capacitive ceramic measuring cells (99.9% Al2O3) with high long-term stability, vacuum and overload resistance are used for all common process applications. The robust ceramic diaphragm with integrated diaphragm breakage detection, covers about 80 % of all pressure applications up to +100 bar / +1450 psi gauge.

Metallic measuring cells (strain gauge or piezoresistive) with fully welded process connection are used for high pressures up to +1000 bar / +14504 psi gauge, aseptic processes, and in combination with OPTIBAR DS diaphragm seals for high temperature or corrosive applications.

Typical applications include:

- Pump dry-run protection and compressor monitoring
- Flue gas ventilation control
- Monitoring processes from low pressure to absolute vacuum
- Overload resistant level and overpressure measurement in batch tanks
- Monitoring of supply pressure in pipelines

Differential pressure

For differential pressure (DP) flow measurement please refer to chapter "Flowmeters and flow controllers", page 16.

Hydrostatic pressure

For level, density and interface measurement with hydrostatic pressure, please refer to chapter "Level transmitters and level switches", page 30.

Highlights of process pressure products:

- Process pressures -1...+1000 bar / -14...+14504 psi gauge and 0...+600 bar / 0...+8702 psi gauge absolute
- Process temperatures up to +150°C / +302°F without diaphragm seal
- Ceramic or metallic measuring cells
- Quick step response times even with small measuring ranges
- Over 250 thread, flange and aseptic process connections available
- Duplex, HASTELLOY® C-276, PVDF as well as NACE compliant materials
- Use in hazardous areas

Temperature measurement

Temperature assemblies · Transmitters

A new degree of contact: Temperature measurement

KROHNE temperature assemblies and transmitters are as versatile as your requirements and specific applications need them to be.

Our OPTITEMP line covers a wide range of electrical temperature instruments for industrial temperature measurement. Alongside standard applications, they are also ideal for high temperatures, extreme pressures or high flow velocities.

KROHNE INOR, a fully-owned subsidiary of KROHNE, has been designing and producing temperature measurement equipment for over 75 years. Located in Malmö, Sweden, KROHNE INOR is today one of the world's leading manufacturers of temperature signal transmitters, specialised in industrial temperature measurement.

Building on this specialist knowledge and experience, KROHNE INOR is successfully expanding global production.

Over 75 years' experience:

1939
INOR is started as a family-owned company working with process instrumentation.

1965
Development of the first temperature transmitter.

1974
INOR presents world's first head-mounted transmitter.

2006
KROHNE acquires INOR.

2010
First temperature transmitter with dual sensor input in 4-wire connection.

2011
Temperature transmitter with SmartSense insulation resistance monitoring to detect cracks in the thermowell is developed.

Temperature assemblies

KROHNE has a wide portfolio of standard pre-fitted temperature assemblies for solid, liquid, gaseous and steaming mediums. We can also provide you with systems that are custom-made for your specific requirements.

Typical applications include:

- Chemical industry: measurement of liquids, gases and solids, acids and alkalis, abrasive or corrosive mediums in pipes, vessels and reactors
- Iron & steel industry: measurement in production and during the thermal treatment of steels, gas and ovens, as well as cooling mediums temperatures
- Power generation: steam and flue gas, as well as measurements of cooling mediums and bearing temperatures
- Hygienic applications: production and cleaning processes according to the stringent requirements of GMP, FDA, EHEDG and others

Depending on process conditions – temperature, pressure, flow velocity and medium properties – we will recommend an appropriate temperature assembly and the materials to use. We will then support you when it comes to choosing the right combination of thermo-well and sensors/measuring inserts for your application – resistance (RTD) or thermocouple (TC).

Used in combination with the correct insert, head and neck pipe, our range of thermowells will ensure maximum process certainty.

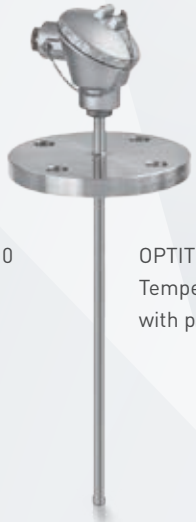
Highlights of temperature assemblies:

- Various process connections: insert, screw-in/threaded, flanged, weld-in, compression fittings, coatings and covers, gas-tight threaded sleeves, sliding flange
- Standardised and customer-specific temperature assemblies
- Replaceable spring-loaded measuring inserts made from mineral isolated cable, durable, with low drift and high resistivity against any mechanical load
- Connection heads for a wide variety of requirements
- Extensive range of accessories

Highlights of thermowells:

- Reduced and tapered tips for faster response
- Wide range of materials
- Additional PTFE or tantalum coating for use in conditions like exposure to a high level of chemicals
- Corrosion and abrasion-resistant versions
- Individual stress calculations
- Various test and examination certificates available, including pressure test, PMI test, X-ray test, ultrasonic test, dye penetration test

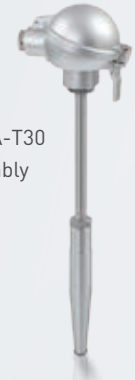
OPTITEMP TRA/TCA-P10
Temperature assembly
for compression fitting



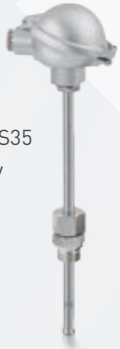
OPTITEMP TRA/TCA-F13
Temperature assembly
with process flange

OPTITEMP TRA/TCA-S22
Temperature assembly
for screw-in

OPTITEMP TRA/TCA-F42
Temperature assembly
with process flange

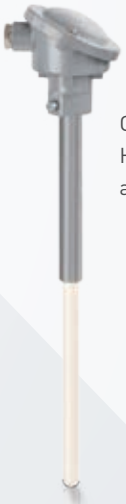


OPTITEMP TRA/TCA-T30
Temperature assembly
for weld-in



OPTITEMP TRA/TCA-TS35
Temperature assembly
for screw-in

OPTITEMP TCA-P62
High temperature
assembly for plug-in



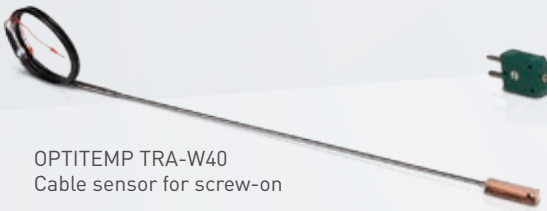
OPTITEMP TCA-P64
High temperature
assembly for plug-in

OPTITEMP TRA/TCA-S50
Temperature assembly
without thermowell

OPTITEMP TRA/TCA-TF56
Temperature assembly
with process flange

OPTITEMP TRA/TCA-TS53
Temperature assembly
for screw-in

OPTITEMP TRA-V20
HVAC temperature
sensor for outdoor
applications



OPTITEMP TRA-W40
Cable sensor for screw-on

OPTITEMP TCA-M50
Mineral insulated thermocouple
with mini thermo plug

OPTITEMP TRA/TCA-W70
Cable sensor with
bayonet fitting

Compact sensors

OPTITEMP TRA-C10
Hygienic compact
sensor with flange

OPTITEMP TRA-C20
Compact sensor
for screw-in

OPTITEMP TRA-C30
Compact sensor
for screw-in

Highlights:

- Analogue temperature transmitters for basic applications
- Digital, universally programmable state-of-the-art transmitters for demanding applications
- Fits any B-connection head and on DIN rail
- Excellent measurement accuracy with high precision, long-term stability and low temperature drift
- HART® 6 compatible transmitters
- PROFIBUS® interface available
- Diagnostic functions for high process safety: monitoring of isolation resistance (SmartSense), sensor drift, sensor breakage and short circuit
- Dual sensor input TC and RTD, 2-, 3- and 4-wire (4-wire on OPTITEMP TT 51 R only) with automatic back-up in case of sensor failure (redundancy)
- High galvanic isolation
- NAMUR compliance: NE 21/NE 43/ NE 53/NE 89/NE 107
- 10-g vibration resistance
- 50-point individual sensor linearisation
- Communication options: PC, FC375/475, AMS, PDM, EDD, DTM
- Ex-approval acc. to ATEX Ex i and Ex n (non-incendive) approvals
- SIL2 (acc. to IEC 61508)
- Configuration via PC without external power supply

Temperature transmitters

In 1974, INOR launched the world's first temperature transmitter which could be built into the connection head of a temperature assembly to convert the sensitive thermometer signal into a stable, noise-immune signal directly at the measuring point.

KROHNE INOR has an extensive programme, based on years of experience developing transmitters, covering low to high-performance accuracy, fail-safe measuring that fits into all kinds of applications in the process industries.

Typical industries include:

- Machine-building industry
- HVAC applications
- Energy & power generation
- Petrochemical
- Oil & gas

OPTITEMP TT 10 C, TT 10 C Ex OPTITEMP TT 10 R
Analogue, adjustable, 2-wire transmitters for Pt100 or thermocouple with current output

OPTITEMP TT 11 C OPTITEMP TT 11 R
Analogue, adjustable 3-wire transmitters for Pt100 or Pt1000 with voltage output

OPTITEMP TT 31 R, TT 31 R Ex
1 or 2-channel universal, programmable 2-wire transmitters for thermocouples and resistance thermometers with current output

OPTITEMP TT 40 C OPTITEMP TT 40 R
Highly precise, universal, programmable 2-wire transmitters for thermocouples and resistance sensors with current output

OPTITEMP TT 32 R
Universal, programmable 4-wire transmitter for thermocouples and resistance sensors with current and voltage output

OPTITEMP TT 20 C
Analogue, programmable 2-wire transmitter for Pt100 with current output

OPTITEMP TT 30 C, TT 30 C Ex OPTITEMP TT 30 R, TT 30 R Ex
Universal, programmable 2-wire transmitters for thermocouples and resistance sensors with current output

OPTITEMP TT 51 C, TT 51 C Ex OPTITEMP TT 51 R, TT 51 R Ex
Highly precise, universal, programmable 2-wire HART® transmitters for thermocouples and resistance sensors with current output, full assessment on SIL2 according to IEC 61508:2010

OPTITEMP TT 60 C, TT 60 C Ex OPTITEMP TT 60 R
Highly precise, universal, programmable PROFIBUS® transmitters for thermocouples and resistance sensors

Analysis products

Analytical sensors with integrated transmitter · Water analysis · Wastewater analysis · Analysis for hygienic applications · Analysis systems for the food & beverage industry

From analysis to the solution: Analysis products

KROHNE is your partner for all aspects of analytical instrumentation. From pH measurement in hazardous explosive atmospheres to inline analysis of protein, fat and lactose in hygienic applications: with the SMARTPAT, OPTISENS, OPTISYS and OPTIQUAD range of analytical devices and systems, KROHNE supplements the measurement of analytical parameters. Our main goals are attaining sturdiness, reliability and quality in the various application areas.

We will gladly assist you in the search for the optimum solution to your measurement task. Should it be necessary to specifically design a measuring system according to your requirements, we are able to modify our systems in line with your needs and include additional components.

Milestones:

2005
First presentation of analysis instruments for the water industry.

2008
Launch of complete portfolio with digital analysis sensors for wastewater treatment plants featuring integrated sensor spray cleaning with air or water.

2008
Launch of turbidity measuring system with unique cuvette calibration and ultrasonic cleaning for easy calibration and low maintenance costs.

2010
KROHNE is the first manufacturer to offer a standardised operating and service concept for both flowmeters and analysis instruments.

2011
First inline spectroscopic analysis system with up to four measuring principles.

2012
OPTISENS range of sensors is expanded with sensors specially suited for food & beverage processes.

2013
KROHNE introduces SMARTPAT: the first digital sensor portfolio with integrated transmitter technology and direct connection to control system via 4...20 mA/ HART®.

Analytical sensors with integrated transmitter

Introduced in 2013, SMARTPAT is the first family of analytical sensors that no longer require transmitters: KROHNE miniaturised the transmitter and fitted it into the sensor head. SMARTPAT sensors significantly reduce the risk of failure from sensor to process control system and ease the handling of analytical sensors in a revolutionary way.

Any SMARTPAT sensor can be connected directly to the process control system, featuring direct communication via 4...20 mA/HART® 7 protocol, the open standard in fieldbus systems. Sensor configuration is possible via PACTware™ (FDT/DTM) or a handheld device with HART® DD. SMARTPAT sensors function in a 2-wire loop powered system. They can be used both in point-to-point operation and for multi-drop installations. Up to 32 sensors can be connected in a loop of more than 1000 m / 3280 ft in length.

For offline sensor calibration the sensor can be connected directly to a PC running PACTware™ (FDT/DTM), using just one cable for bi-directional HART® 7 communication and power supply. Due to the controlled, clean conditions in the laboratory, a much more exact calibration can be performed. This enables more precise measuring results and higher product quality.

Each SMARTPAT sensor is specifically designed for its area of application: approvals and certificates range from installation in explosive (zone 0) to hygienic areas. A large portfolio of accessories, including loop powered indicators, USB interface cable and mounting assemblies, ensures that SMARTPAT fits into your application.

Highlights:

- No external transmitter needed
- Direct communication via 4...20 mA/HART® 7
- VarioPin 2.0 plug connection
- 2-wire sensors for unrestricted use in hazardous areas with zone 0 approval (e.g. IECEx)
- Configuration and offline sensor calibration mounting assemblies via PACTware™ with dedicated DTMs
- Consistent software and operating concept for handheld and PC
- SMARTBASE database for sensor data management and statistics
- Easy installation and retrofitting on site: sensors fit most mounting assemblies

Measurement of pH value in chemical plant

pH/ORP sensors

SMARTPAT PH 8570*
Hygienic pH sensor for food, beverage and pharma industry

SMARTPAT PH 8150*
High performance pH sensor for chemical industry

SMARTPAT PH 8530
pH sensor for pure water applications

SMARTPAT PH 8320* Durable pH sensor for water and wastewater applications

SMARTPAT PH 8510
General purpose pH sensor for water applications

SMARTPAT ORP 8150*
High performance ORP sensor for harsh applications

SMARTPAT ORP 8510 General purpose ORP sensor for water applications

SMARTPAT PH 1590
Rugged pH sensor with 3/4"NPT process connection for water and wastewater applications

SMARTPAT PH 2390
Rugged pH sensor with 3/4" NPT process connection for wastewater applications

SMARTPAT ORP 1590
Rugged ORP sensor with 3/4" NPT process connection for water and wastewater applications

HART® handheld and VarioPin® cables also available

Conductivity sensors

SMARTPAT COND 1200
Conductivity sensor for general purpose water applications

SMARTPAT COND 3200
Conductivity sensor for pure water applications

SMARTPAT COND 5200*
Conductivity sensor for harsh applications

SMARTPAT COND 7200
Conductivity sensor for hygienic applications

Accessories

OPTIBRIDGE*
USB interface cable for offline calibration and configuration with PACTware™ FDT/DTM

SJB 200 W/-Ex
Junction box for connecting sensor with the process control system

SD 200 W/R*
Loop powered indicators for wall or rack mount

SMARTMAC 200 W*
Loop powered operating unit for configuration and calibration of SMARTPAT sensors

Mounting assemblies

SENSOFIT RET 5000
Manual retractable assembly with ball valve for easy sensor exchange without interruptions

SENSOFIT RAM 5810/5830
Automatic retractable assemblies (pneumatic) for demanding process conditions in chemical industry

SENSOFIT RET 5810/5830
Manual retractable assemblies for easy exchange without process interruptions

SENSOFIT INS 1310
Static insertion assembly for reliable connection to tanks and pipes in general purpose applications

SENSOFIT INS 7311/7312
Static insertion assemblies for reliable connection to tanks and pipes in hygienic applications

SENSOFIT FLOW 1710
Flow-through assembly in stainless steel for all applications

SENSOFIT IMM 2920
Immersion assembly for installation in tanks and open basins

*also available with Ex approval

Water analysis

In many industrial processes, reliable water treatment is essential for product quality and improving system safety and efficiency. Water circulation systems becoming contaminated can cause enormous damage and must be detected early by continuously monitoring relevant quality parameters.

In circulating steam or cooling systems, this monitoring avoids the possibility of damaging deposits building up which would lead to corrosion or local overheating. At the same time, continuous monitoring enables you to react immediately to any leaks. Monitoring filtration stages also guarantees the longterm high quality of feed water.

Potable water applications:

- Water quality/limit values monitoring
- Water quality monitoring in distribution network
- Process control water treatment
- Filter monitoring
- Disinfection control

Power plant – cooling water and boiler feed water applications:

- Quality control
- Process control water treatment
- Filter monitoring
- Backflushing control ion exchanger
- Dosing of biozides
- Protection of reverse osmosis (RO) membranes

Food & beverage (steam generation) applications:

- Process control water treatment
- Filter monitoring
- Backflushing control ion exchanger
- Dosing of biozides
- Protection of reverse osmosis (RO) membranes

Turbidity measurement for filter monitoring

The modular product line

MAC 100
Signal converter

OPTISENS PH 8100
pH sensor with Pt100 for low-conductivity media and high temperatures

OPTISENS PH 8300
pH sensor with dirt-repellent PTFE diaphragm for wastewater, surface and process water

OPTISENS PH 8500
pH sensor with ceramic diaphragm for general water applications

OPTISENS PH 9X00
pH sensors with liquid KCl filling for special applications

OPTISENS ORP 8500
ORP sensor with large platinum ring for reliable and precise measurement in all water applications

OPTISENS PH/ORP 8590
pH/ORP sensors with different diaphragm material for water and wastewater applications

OPTISENS CL 1100
Low-maintenance, membrane-free gold electrode sensor for free chlorine, chlorine dioxide and ozon measurements in potable water

OPTISENS COND 1200
2-pole stainless steel sensor for conductivity measurements in all general applications

OPTISENS IND 1000
Reliable dirt-resistant sensor for inductive conductivity measurements suitable for wastewater

Mounting assemblies

SENSOFIT FLOW 1000
Flow assembly with optimised flow profile and easy installation

SENSOFIT INS 1310
Static insertion assembly for reliable connection to tanks and pipes in general purpose applications

SENSOFIT IMM 1000
In polymeric material for all applications with an excellent price-performance ratio

Measuring systems

OPTISYS CL 1100
Measuring system for free chlorine, chlorine dioxide and ozon with automatic sensor cleaning system for safe use and extended lifetime

OPTISYS TUR 1050
Turbidity measuring system with cost-effective cuvette calibration and automatic ultrasonic cleaning system

Wastewater analysis

MAC 100
Signal converter

OPTISENS ADO 2000
Amperometric sensor for dissolved oxygen measurements with easy exchangeable electrode cartridge

OPTISENS ODO 2000
Low maintenance optical sensor for dissolved oxygen measurements, with automatic cleaning, no recalibration required

OPTISENS TUR 2000
90° scattered light sensor for turbidity measurements with NIR-LED for long-term stability and automatic cleaning

Measuring systems

OPTISYS SLM 2100
Optical measuring system for sedimentation profile measurement and continuous tracking of sludge blanket

Mounting assemblies

SENSOFIT IMM 2000
Telescopic rod in fiber glass for OPTISENS ODO/ADO/TUR sensors as well as 3/4" NPT process connection

Analysis for hygienic applications

MAC 100
Signal converter

OPTISENS COND 7200
Conductive conductivity sensor with hygienic connection

OPTISENS IND 7000
Hygienic sensor for inductive conductivity measurements

OPTISYS IND 7100
Inductive measuring system for various industries and applications

OPTISYS IND 8100
Hygienic inductive conductivity measuring system in stainless steel for the food and beverage industry

Wastewater analysis

Measurement and control systems designed to the highest standards make it possible to run sewage treatment plants efficiently and keep costs down. In all areas of industrial or community wastewater treatment, KROHNE provides support for the optimisation of your processes:

Auxiliary materials like chemicals used in precipitation reactions or neutralisations, can be dosed as needed and energy costs can be reduced, for example, in aeration for the biological treatment stage.

You maintain threshold values and reduce sewage treatment fees.

Applications in wastewater treatment include:

- Inlet: monitoring influent values
- Primary clarifier: automatic wasting of primary sludge
- Biological treatment: aeration control
- Secondary clarifier: automatic wasting of sludge, prevention of sludge washout, post-precipitant dosage
- Outlet: monitoring of effluent values
- Determination of chemical oxygen demand (COD) in dairy wastewater

Analysis for hygienic applications

In biotechnology and pharma as well as in food and beverage processes, analytical measurements such as pH or conductivity are widely used for quality measurements and process control. OPTISENS range of sensors is now expanded with sensors specially suited for these applications, starting with pH sensors as well as conductive and inductive conductivity sensors. They are CIP/SIP cleanable, feature hygienic connections and approvals such as EHEDG and FDA.

Applications in biotechnology, pharma, food and beverage include:

- Process control of biotechnological and pharmaceutical fermentation processes
- Process control in the production of cheese, milk, beer, fruit juices, yogurt
- Pure water and ultrapure water monitoring
- Separation processes (milk/water)
- Distillation
- Product control (dairies, breweries, beverages)
- CIP/SIP processes

Inline analysis systems for the food & beverage industry

Spectroscopic analysis systems use illuminants to emit light of different wavelength into a medium. By using up to four optical principles the reflected light will be measured and processed to provide information about the medium composition.

OPTIQUAD spectroscopic analysis systems can be installed directly in the process without the need for a bypass. Depending on the application, OPTIQUAD uses up to four optical principles of spectroscopic analysis: transmission, scattering, fluorescence and refraction of light. It allows for:

- Continuous, non-contact measurement of protein, fat, lactose and total solids in milk products
- Continuous, non-contact measurement of free fatty acids (FFA) content in deep fried oils in frying production
- Continuous measurement of chemical oxygen demand (COD) in the wastewater flow of dairies or cheese factories

Typical applications include:

- Setting a constant ratio of fat to protein. This results in a constant quantity of cheese per cheese producer, avoiding out of specification fillings of the press forms.
- Standardise fat content in drinking milk production
- Measurement and setting of the fat and protein content in the production of UHT milk and evaporated milk
- WPC production: control of the dosage of lactose water to standardize the WPC with respect to total solids (TS) to protein ratio
- Limit value monitoring after the production of non-fat whey in the feed of a reverse osmosis (RO) system to avoid membrane damage due to too high fat concentration
- Raw milk reception quality monitoring, protein segregation and incoming crude material survey
- Monitor FFA value and control maximum FFA value

Highlights:

- Direct inline process measurement, no bypass
- Continuous measurement for precise process control
- Significantly reduces the need for sampling, sample transport and preparation
- No operating costs for chemicals, reagents and cleaning agents
- Up to four optical principles and up to twelve wavelengths: excellent measuring performance, even with mediums with a wide variety of composition
- No moving parts: reduced maintenance
- Operating unit in IP65/NEMA4X housing with touch-screen for simple, hygienic operation
- High quality stainless steel design
- High precision and long-term stability
- Cleaning with standard process cleaning treatment, e.g. CIP/SIP or compressed air (in COD applications)
- Standard VARINLINE® measuring section
- Optional water cooling for high ambient or process temperatures
- Integrated sampling valve for (re-) calibration on site without interrupting the process

The modular product line

Operating unit

OPTIQUAD 4050 W
Wall-mounted with
IP65/NEMA4X housing

Analyser units

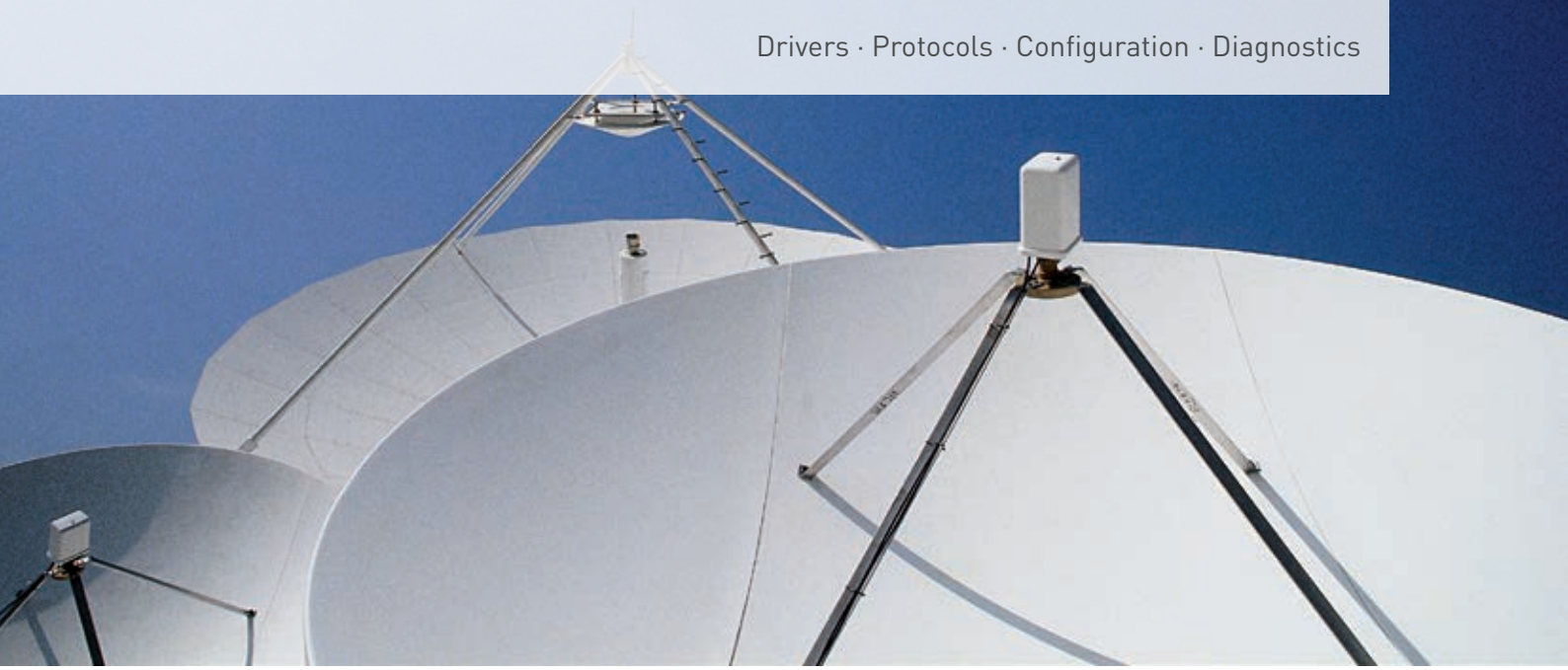
OPTIQUAD-M 4050 W
Continuous inline
measurement of protein,
fat, lactose and total
solids in milk products

OPTIQUAD-FFA 4050 W
Continuous inline
measurement of
free fatty acids (FFA)
in deep fried oils

OPTIQUAD-WW 4050 W
Continuous inline
determination of chemi-
cal oxygen demand (COD)
in dairy wastewater

Communication technology

Drivers · Protocols · Configuration · Diagnostics



Open for the future

PACTware™ and DTMs

PACTware™ is a manufacturer-independent tool based on FDT technology, providing device configuration and operation. It is free of charge.

DTMs are drivers for FDT-based systems. KROHNE DTMs are also available free of charge, without licence and without any functional restrictions.

KROHNE is committed to making communication convenient. Which is why our field devices communicate reliably with controllers, control systems and PCs, and can also be used for a variety of control and regulating tasks. They meet all of the prerequisites for integration into modern plant asset management systems, based on integration technologies such as DD/EDD and FDT/DTM.

We are a longstanding member of PACTware™ and the FDT Group®. Since 2003, we have made DTMs available for our field devices with HART®, PROFIBUS® or FOUNDATION™ fieldbus interfaces.

For remote monitoring of applications such as water metering, KROHNE has developed a GSM-based solution for online data transmission and logging.

So you will always have the information you need conveniently close to hand.

Clear and fast access to process and device data from any level

KROHNE DTMs are available for many field devices with HART®, FOUNDATION™ fieldbus or PROFIBUS® communication interfaces. They can be integrated into all FDT frame applications.

To assure conformity with the FDT standard, KROHNE DTMs are certified by the FDT Group after certification tests at the KROHNE FDT DTM Test Site, accredited in 2014. In addition, intensive interoperability tests with frames of major host system suppliers are performed.

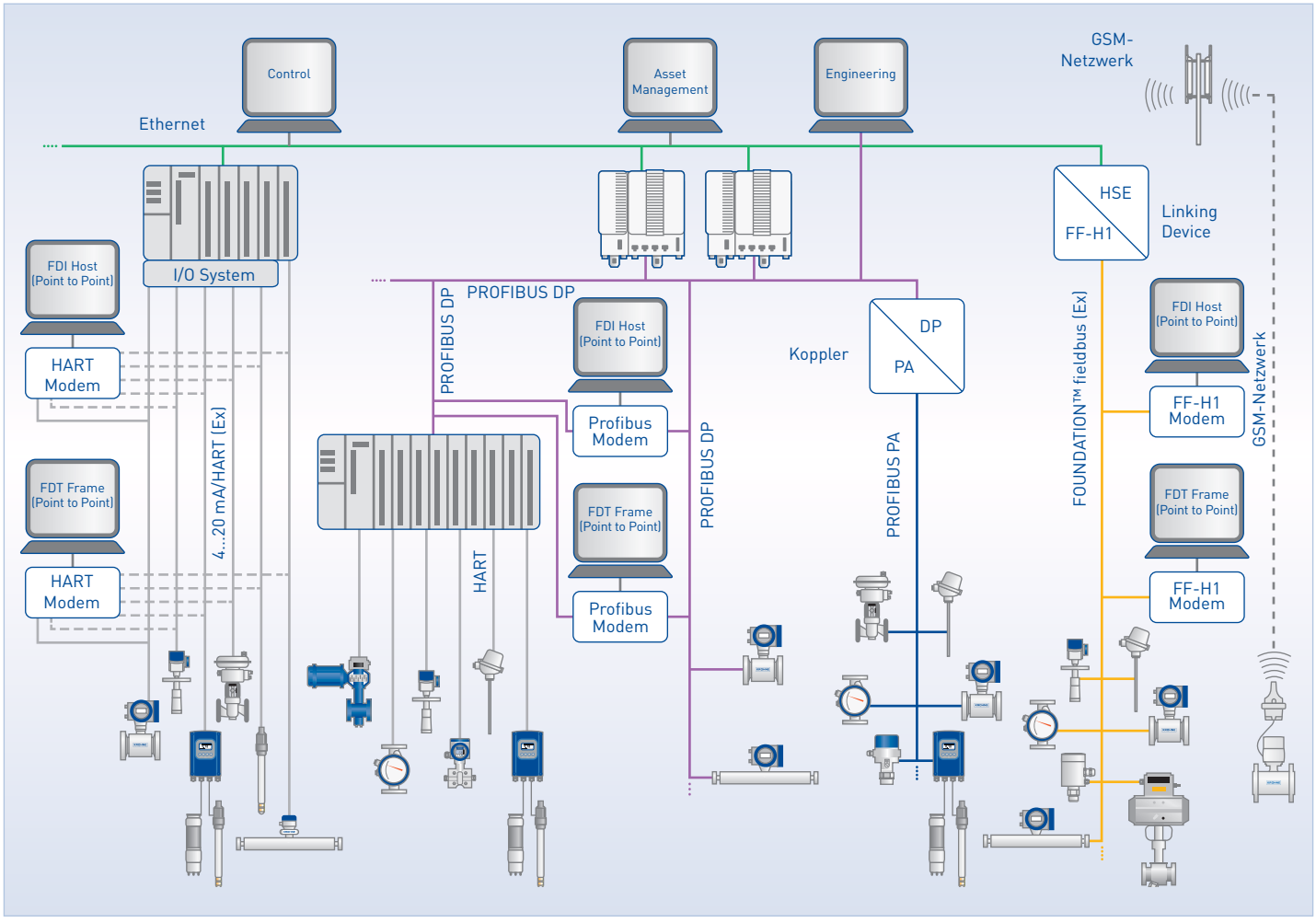
KROHNE DTMs do not require any licence, providing full functionality free of charge. Next to standard operating features, they provide additional information for commissioning and application engineers.

For example, the DTM for the MFC 400 mass flow converter features clear and configurable diagnostics according to NAMUR recommendations NE 107, and an intuitive layout for fast access to the most used functions. DTMs for level devices are enhanced by fully configurable parameterisation screens for easy commissioning.

Together with PACTware™, KROHNE DTMs come alongside the device on a CD and can also be downloaded from KROHNE Download Centre at **www.krohne.com**

Configuration of OPTITEMP TT 51 temperature transmitter via PACTware™

Diagnostic data is categorized or can be user-mapped into five categories according to the severity and ease reactions by the operator. Detailed configuration enables predictive maintenance.



Products and systems for the oil & gas industry

Onshore · Offshore · Upstream · Midstream · Downstream

KROHNE
Oil & Gas

From custody transfer flowmeters to complete solutions

For all oil & gas inquiries, please contact:

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4817 ZG Breda
The Netherlands
Tel.: +31 76 711 200 0
KOGinfo@krohne-oilandgas.com
www.krohne-oilandgas.com

From the well head, through pipelines, onto tankers and into the terminals and refineries, your oil & gas products need to be measured accurately and reliably. Which is where KROHNE Oil & Gas comes in.

Located in Breda, the Netherlands, close to Europe's major oil & gas centres, the growth of KROHNE Oil & Gas over the past 15 years has been particularly dynamic. Today we have one of the industry's largest teams of engineers solely dedicated to oil & gas.

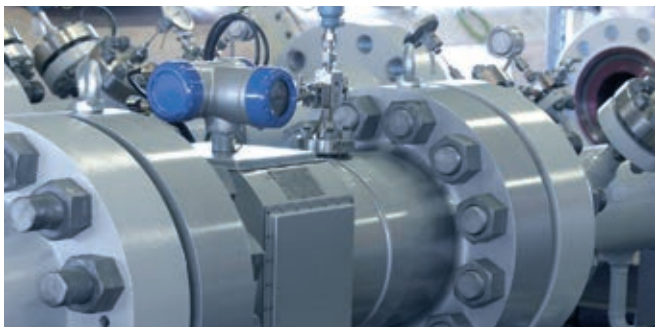
ALTOSONIC V

Custody transfer flowmeters

KROHNE pioneers the most advanced technology available today. Performance monitoring and accuracy are leading features in our custody transfer meters. For more details, see pages 10 onwards for mass flowmeters and pages 12 onwards for ultrasonic flowmeters.

Liquid and gas metering systems

- Extensive experience in all sizes, categories, pressure and flow classes in all parts of the world and for all local and international regulations and specifications
- From metering runs to complete skid-based master-duty systems
- Custody transfer, allocation, fiscal metering
- Sampling systems, analytical & quality measurement systems



Liquid and gas metering systems

Provers, master meters, calibration systems

- From truck and trailer-mounted mobile tank and pipe provers to complete uni/bi-directional provers for verifying on-site
- Meter provers and master meter systems for on-site and off-site proving

Provers and calibration systems

Pipeline monitoring, leak detection and localisation

- PipePatrol, the most sensitive internal leak detection system available, provides very fast and accurate leak detection and localisation in pipelines
- Successfully implemented on gas and liquid pipelines throughout the world with major oil and petrochemical companies, thereby meeting or exceeding all applicable quality and performance regulations, such as the German TRFL and the American API 1130

Supervisory systems

Supervisory systems and flow computers

- SynEnergy hydrocarbon management system with integrated analyser management, metering supervisory and pipeline monitoring
- Predictive maintenance functions to reduce unnecessary work, expense, downtime and eradicate give-away
- SUMMIT 8800 flow computer with touch-screen user interface for multiple runs and on-board logging, trending and ticketing

SUMMIT 8800
flow computer

Measuring systems for the marine industry

Tank monitoring and alarm · Monitoring of fuel consumption and bunkering

KROHNE
Marine

KROHNE Marine –
The marine centre of KROHNE

Based in Norway, KROHNE Marine handles all marine-related activities within KROHNE. This includes sales and marketing, engineering and system design, research and development, aftersales, service and spare parts. Our highly knowledgeable team is always up-to-date with the newest technology and sailing installations.

The marine market is a global market without borders. More than 50 years in the marine business mean KROHNE Marine knows what it takes to deliver high-quality products to demanding ship operators and yards anywhere in the world.

An exclusive network of sales representatives and service agents represent KROHNE Marine in all the main global shipping hubs and shipbuilding countries.

For all marine inquiries,
please contact:

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NO-3950 Brevik
Norway
Tel.: +47 35 561 220
ksl@krohne.no
www.krohne-marine.com

Complete solutions for monitoring liquids onboard all kinds of ships

Heavy-duty stainless steel housing: OPTIWAVE 8300 C Marine can withstand roughest conditions on deck

CARGOMASTER –
The all-in-one tank monitoring system for tankers

The CARGOMASTER system offers complete solutions for tank monitoring and alarming. The system sends readings from all tanks and lines onboard to leading-edge, user-friendly software which runs on all standard marine computers.

The delivery of a CARGOMASTER system includes system software adapted to your individual vessel applications, engineering, drawings, documentation and commissioning.

So it's not surprising CARGOMASTER is installed on all kinds of vessels, from the smallest product tankers to the most complex chemical tankers and large VLCCs.

Fuel consumption monitoring

The EcoMATE system monitors fuel consumption and bunkering and can be set up to monitor and report consumption over a set time period or at regular intervals. OPTIMASS mass flowmeters are usually used for input into the system.

EcoMATE®

KROHNE Marine's global marine support network:

- Service stations
- Sales agents

KROHNE services

Engineering services · Online tools and services · Maintenance services · Quality · Training and seminars · Calibration

Beyond the highest requirements

For us, service starts at our first contact with you and lasts as long as the life of our systems installed at your plant.

Quality and reliability are key to maintaining the highest service standards. All KROHNE feeder factories are ISO 9001 certified. In fact, long before ISO 9000 existed, KROHNE was already manufacturing to the highest industrial standards. Now certification exists in every factory to demonstrate that we not only fulfil ISO requirements but have passed the ISO certification procedure every three years since the standard was introduced.

But it's not simply a one-way process. We actively encourage companies like yours to participate in our research and development activities. Many of our products that are today considered the pinnacle of excellence were developed in cooperation with our customers.

Engineering services through all project stages

- Project management
- Control and asset management systems in project concept phase
- Basic engineering based on the specification required by the user
- Detail engineering phase
- Commissioning services
- On-site start-up and commissioning
- Product training (on-site)
- Calibration services

Please check www.krohne.com for your local service contact.

Proven quality

Before shipping, every meter is thoroughly inspected. This rigorous programme of specific measurements, tests and factory inspections is called KROHNE proved.

So, if you install and operate any KROHNE product by following our operating instructions correctly, problems shouldn't occur. If they do, we will provide you with all the technical support and service you need.

Choose from maintenance and service contracts tailored to suit all business sizes and needs:

- Spare parts and consumables
- Field service and on-site repair
- Returns
- Workshop repair
- Helpdesk

KROHNE Academy and KROHNE Academy online

The KROHNE Academy is a series of seminars organised in collaboration with leading automation companies aimed at plant engineers, operators and contractors across the process industries. It brings industry experts together to provide an insight into the various technologies, industrial standards and procedures that plant operators can find themselves faced with.

Taking place in various countries, KROHNE Academy seminars address key operating issues, from plant safety to ways of increasing plant efficiency and controlling costs, and show possible solutions. They also provide an ideal opportunity for you to speak to the experts and benefit from their vast application knowledge.

Learn more about KROHNE Academy at **www.krohne.com**

KROHNE Academy online is a free eLearning platform that contains audio-enhanced, interactive Web Based Trainings. As with its on-site seminars, the online KROHNE academy learning material is vendor-agnostic and not specific to individual products and/or industries. The main focus of each course is on a measurement technology such as Variable Area, Vortex, Ultrasonic or Mass flow or to a more general topic such as the basics of gas measurement or pipeline leak detection.

Register now for free and start your training at **http://academy-online.krohne.com**

Additional online services:

(Find them at **www.krohne.com**)

- **Configure It**
  Configure It is a highly advanced online configuration tool for standard devices offering free 2D/3D CAD data of KROHNE flow devices for planning engineers. It enables you to configure any KROHNE product to handle your application in a few simple steps.

- **KROVASYS 4**
  Selection and calculation tool for variable area flowmeters.

- **Planning tool for water & wastewater industry**
  The planning tool for wastewater treatment plants as well as water and wastewater applications for generating tender documents covering flow, level, analysis, pressure and temperature.

- **PiCK**
  Get any information related to your KROHNE product from our dedicated online resource PiCK. Just enter your serial number, and key material like manuals, Quick Starts and calibration documents is at your fingertips.

Calibration from KROHNE: Certainty you can count on

Calibration is one of KROHNE's core areas of expertise. If you buy a KROHNE product, you will get a measuring device that performs most accurate with low uncertainty under real process conditions.

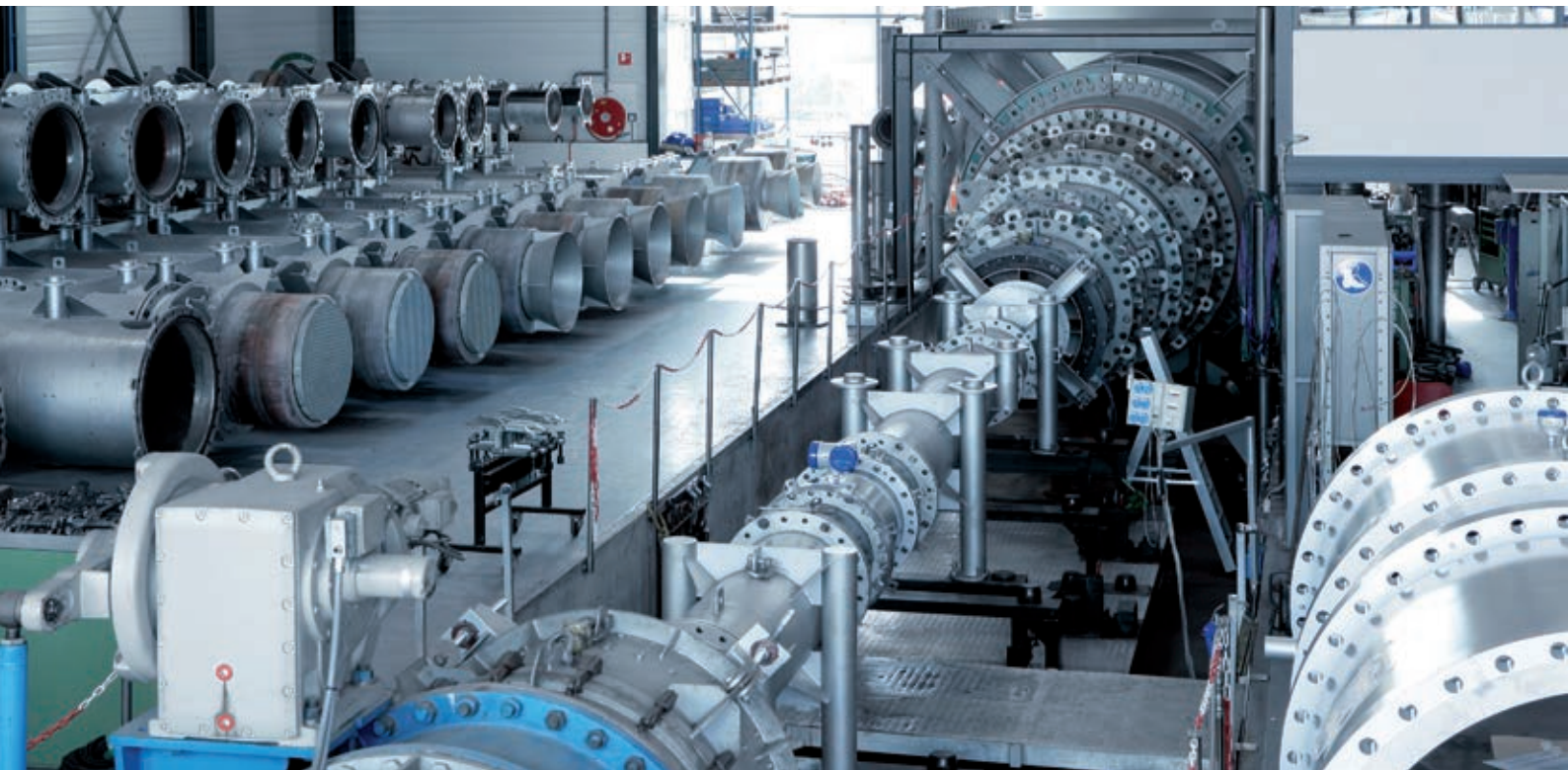
To achieve this, we operate more than 120 calibration facilities for volume flow, mass flow, level, temperature, density and pressure to (wet-)calibrate any device we manufacture. For example, every flowmeter is wet-calibrated using water or air as standard before leaving our facilities.

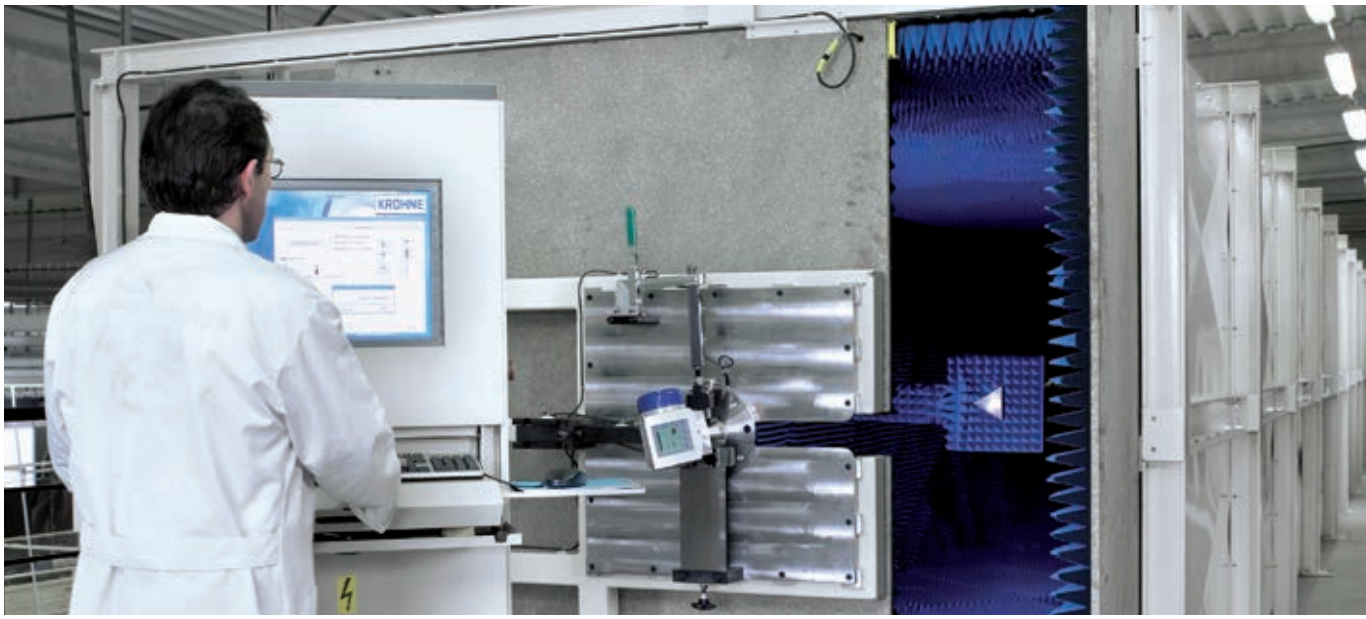
We can also provide customer specific calibration such as:

- Carry out multipoint calibrations
- Vary different parameters such as temperatures, viscosities, pressures etc.
- Use the actual medium or similar
- Build or emulate customer-specific flow geometries
- Use piping provided by the customer

For calibration we only use direct comparison of measurands (e.g. we calibrate our Coriolis mass flowmeters with a gravimetric weighing system). Our calibration rigs are the most accurate used in measuring device production worldwide: the accuracy of the reference is usually 5 to10 times better than that of the meter under test.

The world's most precise volumetric calibration rig for flowmeters up to DN 3000/120"





Stretch for calibration of FMCW level transmitters

This goes for small as well as for very large sizes: KROHNE operates the world's most precise volumetric calibration rig for flowmeters up to DN 3000/120" with a certified accuracy of 0.013 %. The reference vessel is a 44 m/144 ft high tank containing almost ½ million litres/132,000 gal (US) of water which allows for a maximum flow rate of 30,000 m³/h/7,925,000 gal (US)/h.

Certified technology for fiscal & custody transfer applications

Our meters can be calibrated and certified according to various standards such as OIML, API, Measuring Instruments Directive (MI-001, 002, 004, 005), GOST, etc. The standards we use for calibration are ISO/IEC 17025 accredited and traceable to international or national standards. Regular inspections by national metrology institutes, round robin tests and alignments with national and international metrological standards according to ISO 9000 and EN 45000 guarantee the quality and comparability of our calibration rigs. Staff performing the calibrations are trained and given regular re-trainings to ensure quality and continuity.

Volumetric piston prover

KROHNE – Process instrumentation and Measurement solutions

- Flow
- Level
- Temperature
- Pressure
- Process analysis
- Services

Contact

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