Complete measuring point, bypass for level measurement

Your one-stop shop – Cost savings that do the talking!

Endress+Hauser
People for Process Automation

Cost savings that do the talking!

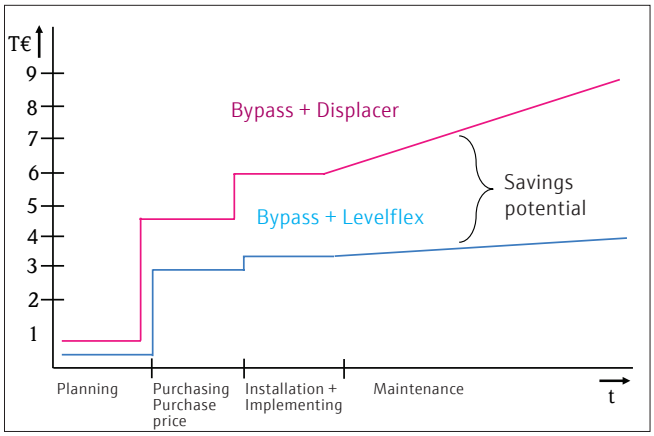
Displacement systems have been used in the past for level measurement in the bypass. Guided radar devices (TDR) provide an optimum solution for such measuring tasks and offer numerous convincing cost benefits. The most important cost benefits are listed below.

Optimizing life-cycle costs Bypass vessels with a nominal diameter of DN 100 are typically used in displacement systems. The Levelflex guided radar can be used 1:1 in such bypasses. Potential cost savings are even higher for new plants, or when modernizing existing plants, as this technology also works in DN 50 bypass vessels. The procurement of high-quality steel bypasses alone involves a cost reduction of approx. 25 %.

Planning/procurement: time is money Leave the coordination of your bypass measuring point to the specialists at Endress+Hauser. We'll take care of:

- Engineering the bypass measuring point
- CAD drawings
- Procuring bypasses, screws, nuts, washers, seals
- Selecting the measuring technology
- Mounting, configuring, functional testing
- System calibration incl. report
- Complete documentation

Our staff has the requisite experience and will help you dramatically reduce the time invested in such tasks. Acceptance testing can be performed at Endress+Hauser in the factory or on site in the plant.



Operating costs in comparison to a standard application

Advantages compared to conventional methods:

- Practically no measuring range limitation through use of separable rods
- Measurement not affected by the density of the medium
- No mechanical moving parts when transporting and in the process

Cost savings that do the talking!

Minimize load and mounting costs The Levelflex guided radar device can be premounted in the bypass and preconfigured when delivered. This is not possible with displacement systems as mechanical damage cannot be ruled out during transportation – a clear advantage particularly in terms of export shipments.

Reducing maintenance costs The maintenance of a mechanical moving measuring instrument, like that of a displacer, is complex, time-consuming and expensive. Crane systems are often needed for removal work. The Levelflex guided radar is practically maintenance-free since it has no mechanical moving parts, thereby reducing your plant's downtime.

Safety is money

- We clarify the subject of compliance with the PED (Pressure Equipment Directive) for you
- We have approvals such as
  - IEC 61508/61511 (SIL 2: min, max, range)
  - boiler approval in accordance with EN 12952/12953

  for the relevant measuring devices to provide solutions for demanding measuring

What Endress+Hauser offers as one integrated functional unit for the complete bypass solution

...is more than simply individual modules assembled together!

What else is required according to the PED?

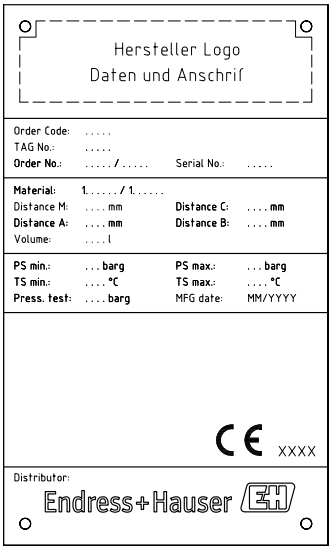
- A risk assessment must be carried out to determine the pressure-related risks of the complete bypass system. The system must then be designed and built based on this assessment.
- The manufacturer is responsible for ensuring that the requirements of the EU Pressure Equipment Directive are observed, for fitting the CE marking and for issuing an EC Declaration of Conformity.
- The pressure equipment must be designed for loadings appropriate to its intended use and other reasonably foreseeable operating conditions. In particular, the following factors must be taken into account:
  - Internal and external pressure
  - Ambient and operational temperatures
  - Static pressure and mass of contents in operating and test conditions
  - Traffic, wind, earthquake loading
  - Reaction forces and moments which result from the supports, attachments, piping etc.
  - Corrosion and erosion, fatigue etc.

As manufacturers, we also offer:

- A contact and person who is responsible for the complete measuring point
- Operating Instructions for the entire system

Additional optional information recommended by Endress+Hauser or considered necessary by the user:

- Certificates for material inspection as per EN 10204 3.1
- Detailed design calculations
- Working drawings
- Welding reports
- Results of non-destructive tests
- Dye penetration test
- PMI test
- X-ray test
- Results of dimensional checks
- Comprehensive documentation on pressure tests
- System calibration report



Nameplate

Advantages of the complete measuring point:

Comprehensive documentation of the measuring technology and bypass in its assembled state by a manufacturer.

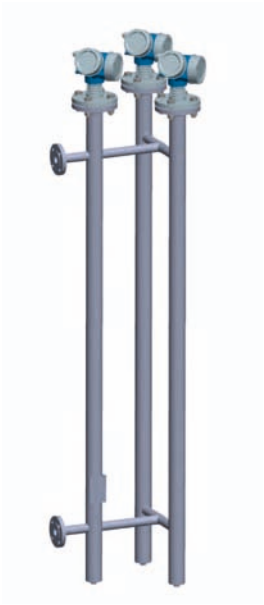
Examples of bypass versions

Endress+Hauser manufactures the bypasses you order for the specific measuring point

Drain screw

Drain tap

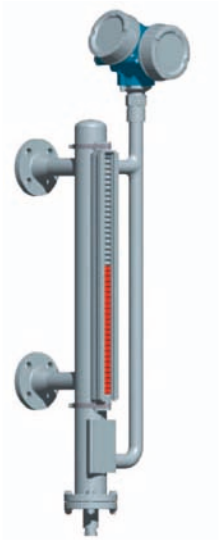
Drain flange



Redundancy measurement

Redundancy measurement with magnetic roller indicator guided level-radar, screwed

Redundancy measurement with magnetic roller indicator guided level-radar, with flange



Redundancy measurement with magnetic roller indicator high pressure application

Get your measuring technology from the specialist

Endress+Hauser has been working in the area of level measurement and limit detection since 1953. The company is now a full-range process-automation supplier and provides all of the important measured variables such as level, flow rate, pressure, temperature and analysis measuring technology from a single source. System components, services and complete automation solutions complement the company's offering.

There is a choice of 10 different measurement methods in the area of level measuring technology alone. The following methods are particularly important in the chemicals, petrochemicals and energy industries:

- Guided radar
- Free-space radar
- Vibration measuring technology
- Capacitive measuring technology

The industries listed above have stringent requirements as safety and plant availability are of utmost importance in these sectors. Endress+Hauser has therefore defined standards for the development of new measuring devices, which take the following requirements into account:

- Certificates such as Ex, WHG (German Water Resources Act), boiler approval
- Plant safety in accordance with SIL 2/3
- "Second containment", e.g. gas-tight feedthrough
- High temperature and high pressure ranges
- Namur requirements

In the next few pages, we outline the most important measuring devices, along with the related technical data, to equip bypass measuring points.

Examples of measuring technology

Levelflex FMP51
Guided radar for continuous level measurement
- For temperatures from -40 °C to +200 °C
- For pressures from -1 to 40 bar
- Suitable for interface measurement

Levelflex FMP54
Guided radar for continuous level measurement
- For temperatures from -196 °C to +450 °C
- For pressures from -1 to 400 bar
- Resistant to hot steam (ceramic seal)
- Ultimate safety as standard thanks to gas-tight feedthrough (glass feedthrough up to 400 bar)
- Suitable for interface measurement
- Boiler approval in accordance with EN 12952/12953

Liquicap M FMI51
Capacitance probe
- For temperatures from -60 °C to +200 °C
- For pressures from -1 to 100 bar
- Suitable for interface measurement

Micropilot FMR51
Level measurement with radar, non-contact
- For temperatures from -196 °C to +450 °C
- For pressures from -1 to 160 bar

Liquiphant M FTL50, 51
Tuning fork probe
- For temperatures from -50 °C to +150 °C
- For pressures from -1 to 100 bar

Liquiphant S FTL70, 71
Tuning fork probe
- For temperatures from -60 °C to +280 °C
- For pressures from -1 to 100 bar

Continuous level measurement

in the bypass with Levelflex guided radar

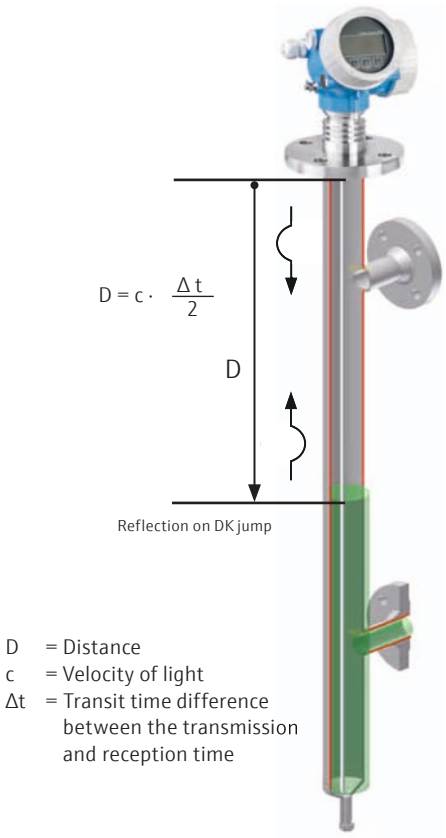
Through continuous development of signal coupling and software, one single robust rod is the best solution for reliable guided radar level measurement.

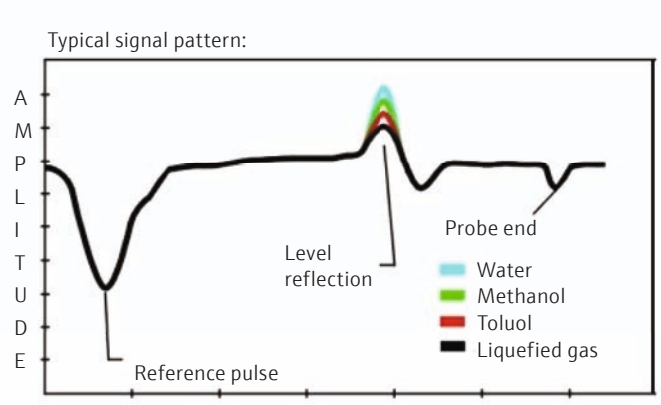
Installed in the bypass, the single-rod probe has the same high performance as a coaxial probe, however. In this way, products with DK >1.4, such as liquefied gases for example, can be measured reliably. The bypass outlets and welding seams up to 5 mm do not affect the measurement.

Microwave pulses are sent along the rod in the direction of the medium surface. The jump in DK (change of dielectric constant from atmosphere to medium surface) causes the high-frequency microwave pulses to be reflected to the receiver. With the propagation velocity known, the level is determined from the transit time of the pulses. Due to the properties of the microwave pulses, these are practically independent of medium and process properties such as:

- Changes in density
- Conductivity
- Change in medium (DK value >1.4)
- Steam
- Gas overlay
- Fluctuations in temperature

Guided microwave pulses





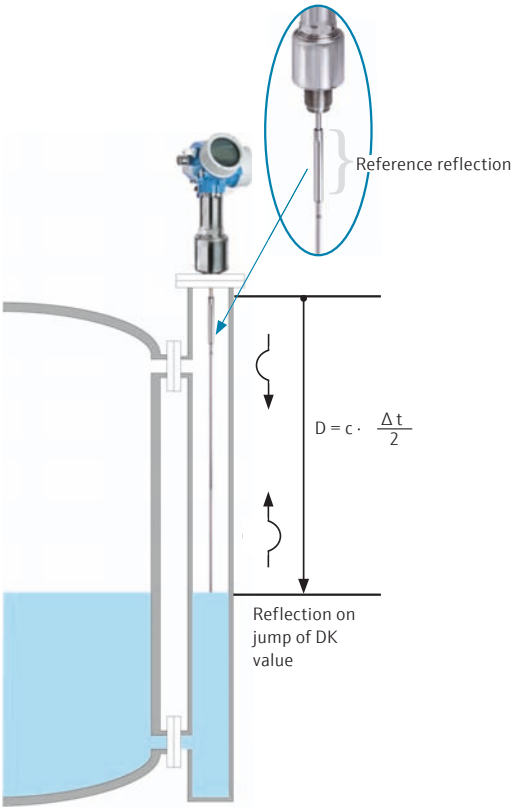
Continuous level measurement

Gas phase compensation

Generally speaking, radar waves are not affected by temperature, pressure and gas layering. However, under certain pressure and temperature conditions (see table below), the DK value of the gas phase changes significantly with polar substances such as water, solutions, ammonia etc. These conditions reduce the propagation velocity of the microwave signals in the gas-steam mixture above the liquid to be measured. This results in the fact that the probe displays too low a level.

To ensure that an accurate measured value is returned in such demanding conditions, the Levelflex M FMP54 high-pressure high-temperature probe has a compensation routine. Defined reference reflection combined with a special software algorithm automatically correct the level value, thereby providing correct measurement. This ensures that an accurate and reliable measured value is provided in all gas phases even for

- Temperature: -196 to +450 °C
- Pressure: -1 to +400 bar



Gasphase	Temperature		Pressure							
	°C	°F	1 bar	2 bar	5 bar	10 bar	20 bar	50 bar	100 bar	200 bar
			14.5 psi	29 psi	72.5 psi	145 psi	290 psi	725 psi	1450 psi	2900 psi
Steam (water vapor)	100	212	0.26 %							
	120	248	0.23 %	0.50 %						
	152	306	0.20 %	0.42 %	1.14 %					
	180	356	0.17 %	0.37 %	0.99 %	2.10 %				
	212	414	0.15 %	0.32 %	0.86 %	1.79 %	3.9 %			
	264	507	0.12 %	0.26 %	0.69 %	1.44 %	3.0 %	9.2 %		
	311	592	0.09 %	0.22 %	0.58 %	1.21 %	2.5 %	7.1 %	19.3 %	
	366	691	0.07 %	0.18 %	0.49 %	1.01 %	2.1 %	5.7 %	13.2 %	76 %

Measuring error in % caused by gas phases in steam

Now with boiler approval in accordance with EN 12952/12953

Diverse-redundant level measurement

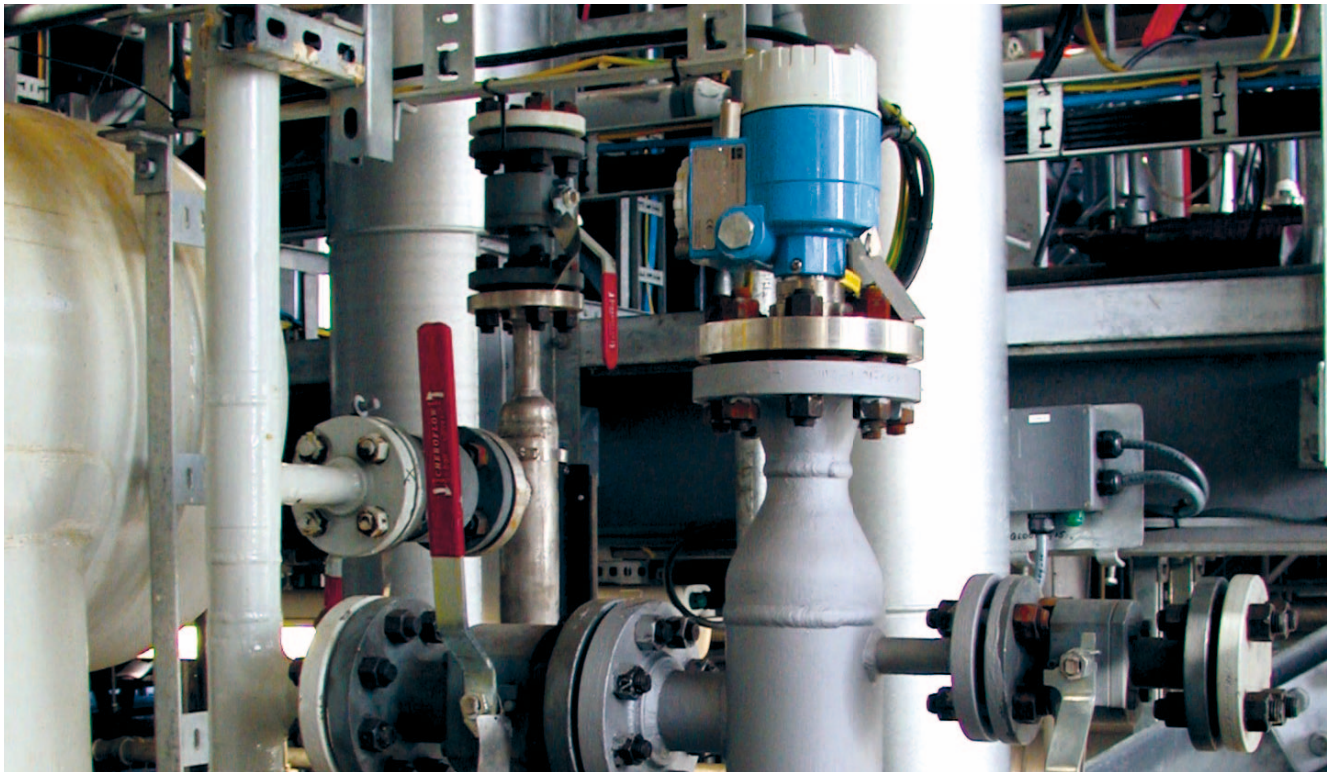
in the bypass with Levelflex guided radar and magnetic roller indicator

By combining guided radar measurement with a magnetic roller indicator, the quest for high availability in critical applications is answered.

- Diverse-redundant measurement (using different measurement methods)
- Local display without local power supply enables a visual check by operating staff in the event of a fault

The tried-and-tested magnetic roller indicator, combined with advanced guided radar measuring technology, guarantees high-grade functionality and reliability.

Interface measurement



Interface measurement
- In the bypass with Levelflex guided rod probe, used where the interfaces are obvious
- In the bypass with Liquicap M capacitance probe, used for emulsions

Advantages of the Levelflex
- Measurement not affected by density, conductivity and temperature
- Simultaneous measurement of the level of the interface, layer thickness and total level

Advantages of the Liquicap M
- Low-cost, high-functionality interface measuring point
- Reliable measurement regardless of thickness of emulsion layer

Both measurement methods have no mechanical moving parts and are not affected by system vibrations. Regular maintenance which is needed when using mechanical systems is reduced considerably.

Limit detection

in the bypass with Liquiphant M/S vibration limit switch

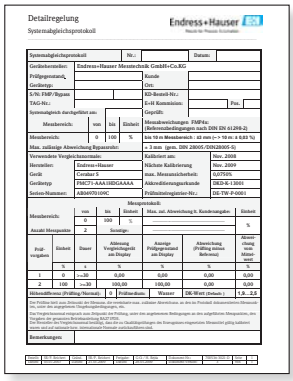
Innovation from the specialists. With the invention of the vibration measuring principle, Endress+Hauser made its mark worldwide for safe and reliable limit detection in liquids. The Liquiphant generation of limit detection devices quickly became classics in the field with over two million units now in operation.

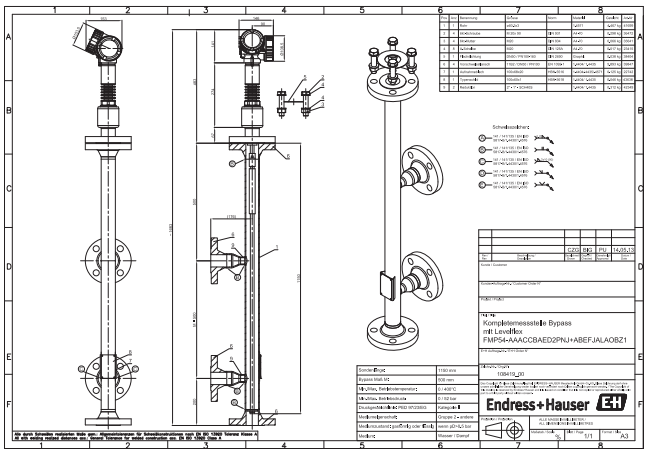
- Universal usage: in changing media, with buildup, external vibrations, foam generation, abrasion, turbulence, solids and gas content
- Constant switch point, exact to the millimeter, without calibration
- Maintenance and long-lasting as no mechanical moving parts

Decisive advantage: Liquiphant M/S reliably and accurately measures the level, virtually unaffected by the physical properties of the medium and irrespective of the medium's electrical properties.

Services for the complete measuring point bypass

Mounting/configuring/functional testing:
- Performed for all complete systems including test certificates before delivery


Detailregelung
Systemabgleichsprotokoll
Endress+Hauser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Endress+Hauser

Measuring point engineering:
- Selection of optimum measuring technology and calculation of threaded connectors

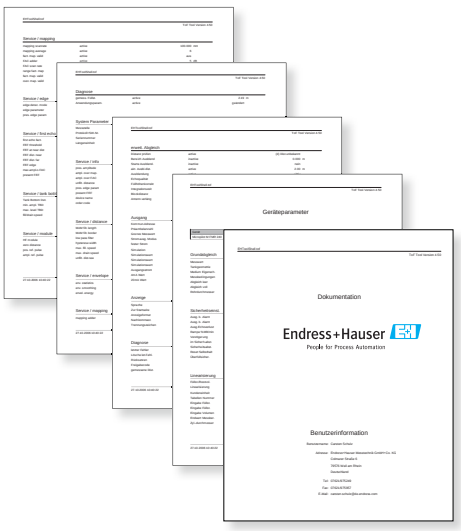
CAD drawing:
- Creation of a CAD drawing of the bypass and measuring device as per customer specifications

System calibration:
- Using water as the test medium, multipoint system calibrations are performed and logged as per customer requirements.

Documentation:
- Complete creation of the documentation e.g. parameter lists of the measuring devices for the complete measuring point

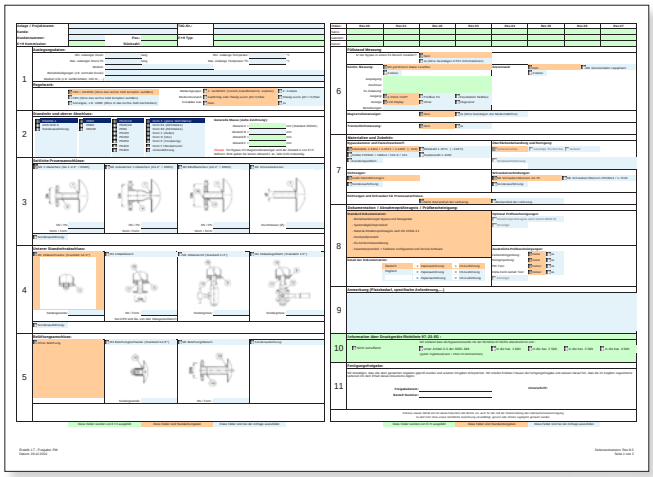
Commissioning in the plant:
- Performed by Endress+Hauser service technician on site

Acceptance:
- At Endress+Hauser in the factory or on site in the plant

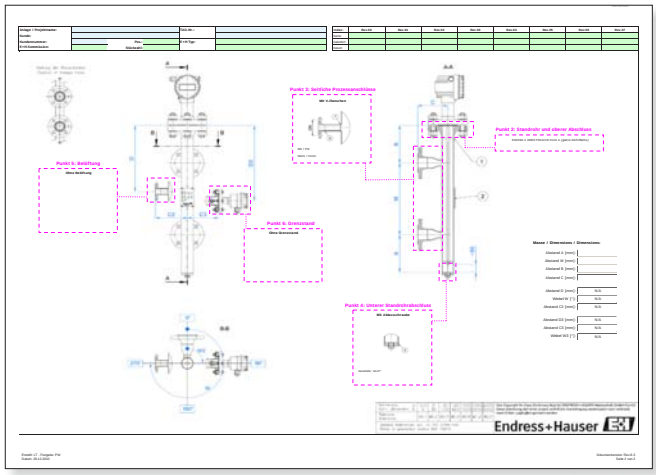

Geräteparameter
Dokumentation
Endress+Hauser
People for Process Automation
Benutzerinformation

Consulting service provided by Endress+Hauser field sales force

We have simplified things for you. With a simple data sheet to plan a bypass measuring point, Endress+Hauser's field sales force creates a precise manufacturing template in accordance with your specifications.



Data sheet page 1



Data sheet page 2

Bypass details and applications with Levelflex: mount – connect – measure

Bypass applications in the chemical industry

Commissioning by Endress+Hauser in the factory or on site in the plant

- Short commissioning times thanks to preconfigured measuring systems
- Cost-effective packages
- Complete warranty as of commissioning
- Training and instruction of your operating staff
- Acceptance and report by Endress+Hauser

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