Foxboro Eckardt

Transmitters with Displacer for level, density and interface

fully configurable

heavy duty

rugged design

class 2500
API 10000

Zone 0

FDT-DTM Technology

Profibus PA

true force sensor

FOUNDATION fieldbus

HART

High Reliability

Schneider Electric

invensys

About our company

The names Foxboro and Eckardt stand for two world technology leaders in the field of process automation.

Foxboro and Eckardt, founded in 1908 and 1873 respectively, have made substantial contributions towards a safer and more economical operation in numerous plants around the world with state-of-the-art automation systems. Our success is based on a relationship of mutual trust with our customers.

Our company is part of the Invensys Operations Management and is located in Germany (Stuttgart) and France (Soultz nearby Basel). Engineering and Development is achieved in Stuttgart, while production is completed in France where we manufacture more than 60,000 control valve positioners a year.

Foxboro Eckardt Control Valve Positioners, Gauge, Absolute and Differential Pressure Transmitters, Level Transmitters, Flow Transmitters, and Analytical Devices are in operation at more than a million different facilities throughout the world.

Foxboro Eckardt is well known as a high quality instrumentation manufacturer. We are certified in accordance to DIN EN ISO 9001. In production we focus on high quality and reliable products that will exceed our quality control testing before leaving the factory.

Certified to manufacture transmitters and Process Control Equipment with ATEX, FM, CSA, INMETRO, GOST or NEPSI certification, Foxboro Eckardt provide solutions for the HART, FF H1, Profibus PA communication and SIL2 / SIL3 certified devices.

For more information on our products, please visit our website www.foxboro-eckardt.eu

Contents

The Foxboro Eckardt Level Transmitters are for measurement of level, interface or density of liquids, with high accuracy, even under difficult conditions such as high pressure, high temperature and corrosive liquids, even in explosive atmospheres.

The extensive product line gives you solutions for almost every application. Ruggedised design and high reliability, easy configuration via digital communication and local LCD, long design life and freedom from maintenance reduces the effective costs running your plant and increases its profitability.

Overview

Foxboro Eckardt – Your Partner in Level measurement

The continuous measurement of liquid level for exact indication and control of process sequences is among the most important measuring tasks in the chemical and petrochemical process industry.

The intelligent transmitter program from Foxboro Eckardt always has the right solution available for your liquid level applications.

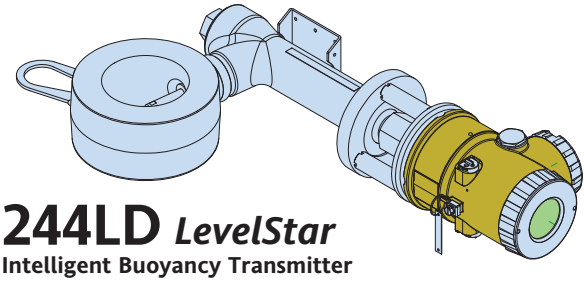
Each measurement makes special demands on the sensor technology employed and the transmitters used.

Along with diverse measuring tasks such as liquid level, density or interface detection, there are also application specific process conditions which are critical to the selection of the transmitter.

We provide 'designed to measure' solutions for your process conditions.

The careful selection of process sensors, transmitters and materials, lay the foundation for successful measurement and optimum results.

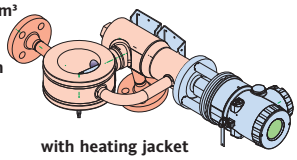
Process Condition	Buoyancy Transmitter
High Temperature	✔
High Pressure	✔
Very Low Temperature	✔
Vacuum	✔
Vapours	✔
Foam Formation	✔
Disturbing Tank fittings	✔ + 204DC
Corrosive Media	✔
Highly Viscose Media	✔
Varying Electrical Properties	✔
Measuring Task	
Continuous Filling Level (liquid)	✔
Density (liquid)	✔
Liquid Interface (liquid/liquid)	✔
Compound	✔
Volume	✔



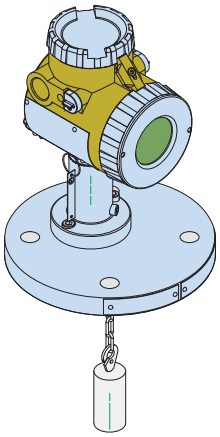
244LD *LevelStar*

Intelligent Buoyancy Transmitter

Medium –196...+500°C, 100...2000 kg/m³
Ambient Temp –40...+85°C
DN 80, DN 100, ANSI 3", 4"
PN 16...500, Meas. Length 5 cm...15 m
Span 2...20 N, Fv max 25 N
Outp 4-20 mA / Hart / PB-PA / FF
+: with heating jacket



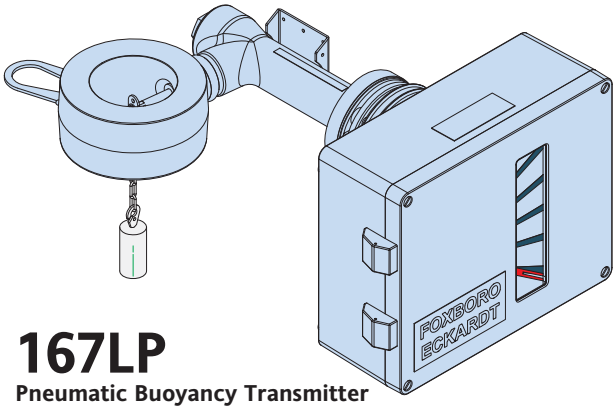
with heating jacket



244LVP *LevelStar*

Intelligent Buoyancy Transmitter

Medium –50...+150°C, 100...2000 kg/m³
Ambient Temp –40...+85°C
DN 50, DN 80, ANSI 2", 3"
PN 40, Meas. Length 5 cm...3 m
Span 2...20 N, Fv max 25 N
Outp 4-20 mA / Hart



167LP

Pneumatic Buoyancy Transmitter

Medium –196...+400°C, 100...1600 kg/m³
Ambient Temp –40...+90°C
DN 80, DN 100, ANSI 3", 4"
PN 16...250, Meas. Length 35 cm...3 m
Span 3...15 N, Fv max 25 N
Outp 0.2...1 bar
+: with heating jacket

The continuous measuring of liquid level, interface and density is based on Archimedes buoyancy principle. An element submerged in liquid (process wetted, cylindrical measuring element) is subjected to a buoyancy force, proportionate to the weight force of the fluid volume displaced.

The buoyancy element is designed so that it will submerge despite the buoyancy force of the process medium. At constant fluid density, the measuring element records the process level, independent of physical influence (disturbance and variables). This offers considerable advantages over other technologies, i.e. non-contact measuring principles.

The Dielectric Constant (DK Value), temperature, pressure, foam formation of the medium etc., will have negligible or no influence on the accuracy of the measurement.

The measuring device is suitable for extreme process conditions, such as Cryogenic and High temperatures (–196°C to +500°C). With process pressures up to 500 bar (depending on the transmitter type).

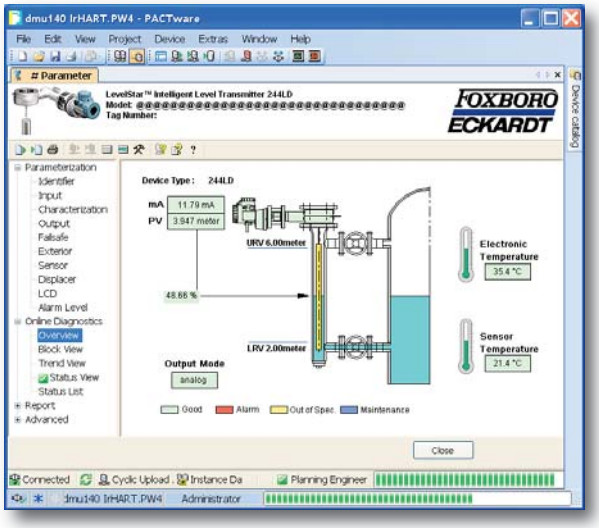
The intelligent transmitters are certified for hazardous areas to FM, ATEX Zone 0, etc., and are available with overfill protection to WHG standards. The standard measuring ranges for liquid level is from 0.35 to 3 m. We can offer specific solutions for applications with larger and smaller measuring ranges if required.

Tradition meets Progress

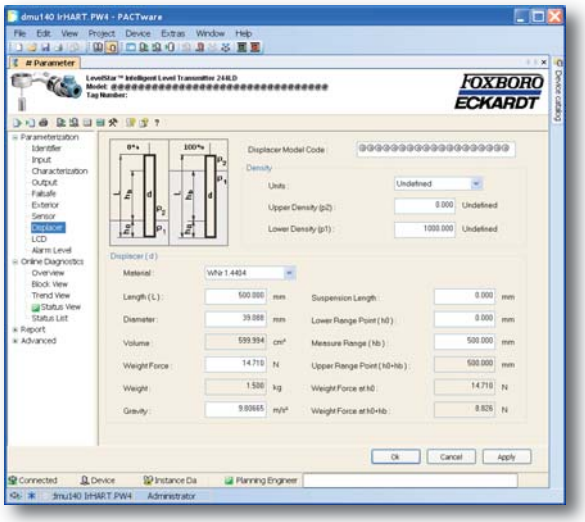
The modular design of the liquid level transmitters from Foxboro Eckardt enables an economic modernization of installed instruments, through uncomplicated exchange of sensor technology, resp. electronic modules.

Whether digital or pneumatic – we will take care of your Level needs!

PACTware: Operation



FDT-DTM: Configuration



244LD *LevelStar* Buoyancy Transmitter with Torque Tube

High performance level transmitter

Best in class.

The 244LD *LevelStar* is designed to measure continuously level, interface or density for process and tank control. Its outstanding technical data makes it to one of the best Level Transmitters in the market. The latest FDT / DTM technology is used to offer online recalibration and diagnostic. The transmitter theory is based on Archimedes buoyancy principle. It is very rugged, has a long life cycle and requires no maintenance. A wide range of materials allows the optimal adaption to the process. The 244LD *LevelStar* is extremely reliable and very precise even at extreme process temperature and pressure.

The 244LD *LevelStar* joins the experience of Foxboro Eckardt with most advanced FDT / DTM technology and is the premium product in the Foxboro Eckardt level transmitter portfolio.

HART COMMUNICATION PROTOCOL · PROFIBUS · Fieldbus Foundation · approved for SIL2 applications · 4-20 mA · Ex

In Process

- Measuring range
  0 .. 50 mm to 0 .. 15 m /
  2 inch to 45 feet
- At given level:
- Measuring of density
- Position of interface of two liquids
- Process temperature
  –196 to +500 °C (–320 .. +932 °F)
- Process pressure
  vacuum to 500 bar /
  ANSI Class 2500
- Nominal widths DN 80 and DN 100
  (3 inch, 4 inch)
- Material (process wetted)
  steel 1.0460, Stainless Steel 1.4404
  or Hastelloy C
- Accuracy ± 0,2 %
- Sensor with no moving parts
- Reliable interface measurement
  – also at diffuse interface
- Rel. Humidity up to 100 %,
  condensation permitted
- Electrical Classification explosion
  Proof and Intrinsically Safe acc. to
  ATEX and FM
- Approved for SIL2 applications
- Optional Heating Jacket

Electronic

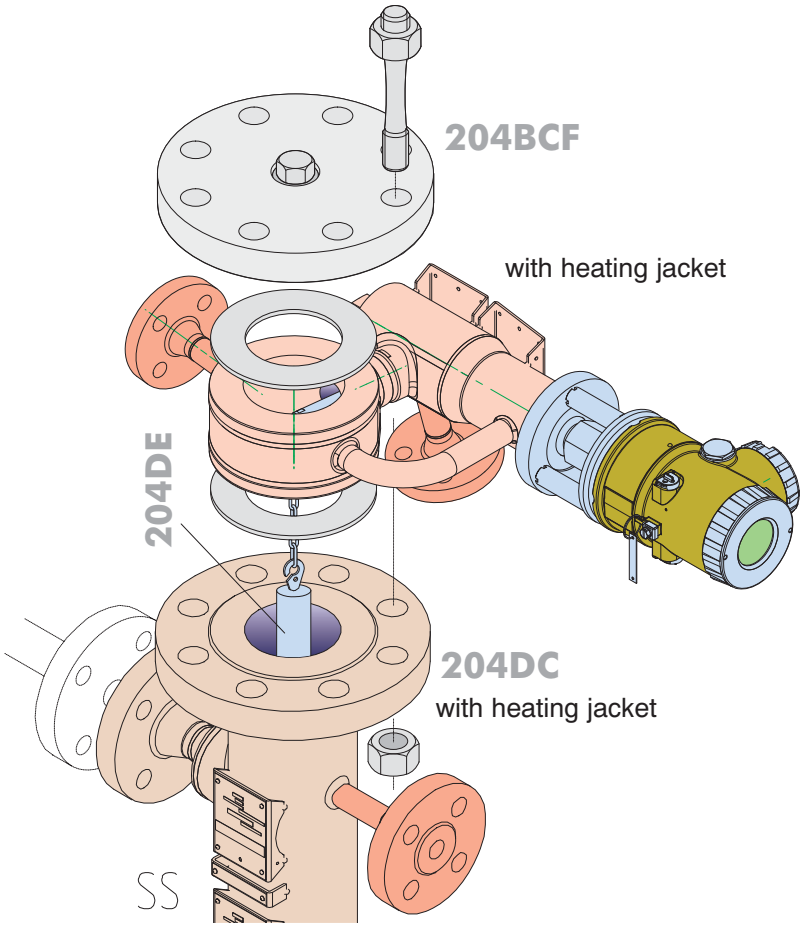
- Two-wire transmitter,
  Power supply 12 to 42 V DC
- Output Signal linear or
  customized
- Communication
  – HART:
  Analog 4 to 20 mA
  – PROFIBUS-PA and
  FOUNDATION Fieldbus:
  based on fiedbus protocol
  IEC 1158-2 according to FISCO,
  Base current 10.5 mA ±0.5 mA
- Protection of housing IP 66
- Temperature –40 to +85°C

Operation

- On the Instrument with push buttons for calibration, buttons and LCD display for configuration
- Digital with HART Hand Terminal or FDT-DTM Software for calibration and configuration
- LCD Display for Measured values, Status and configuration

Influence in the Process

Temperature	▸ very little influence
Pressure	▸ very little influence
Steam, Fog	▸ no influence
Dielectric constant	▸ no influence
Foam	▸ no influence
Vibrations	▸ minimised due to Smart Smoothing + Damping
Motion of Fluid	▸ very little influence (if necessary use protecting tube or displacer chamber)
Diffuse Interface	▸ no influence
Displacer stroke	▸ Zero (no position alteration at liquid level change)
Corrosive Fluids	▸ no influence (instruments are delivered in resistant materials)
Vessel material	▸ no influence
Deposits on vessel	▸ no influence
Deposits on displacer	▸ very little influence



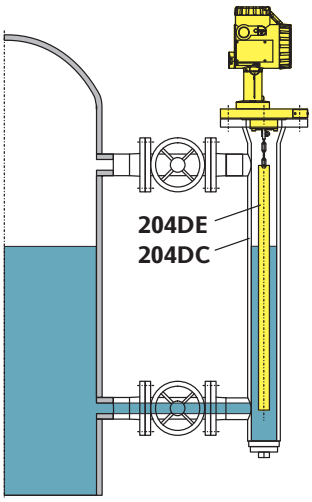
244LVP *LevelStar* Intelligent Buoyancy Transmitter

The cost effective solution.

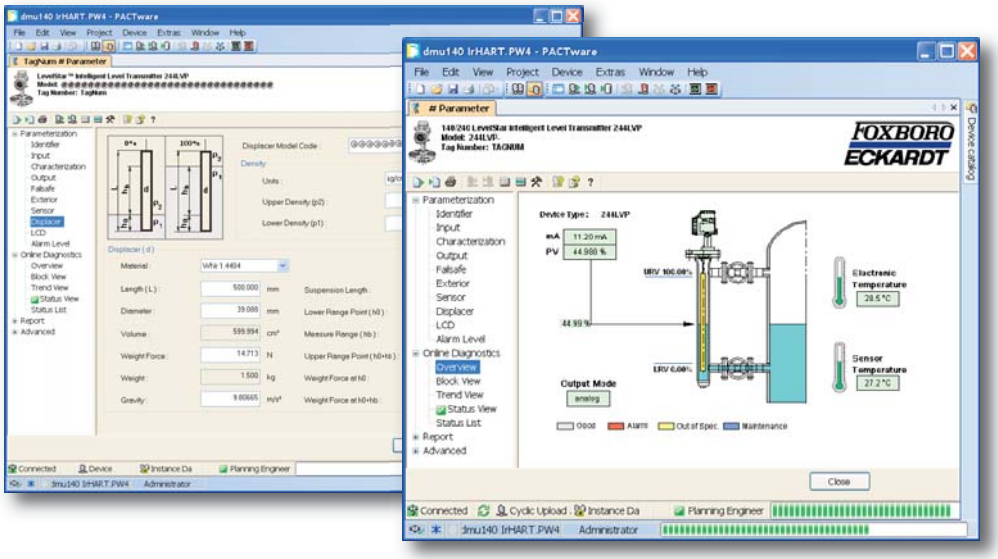
The 244LVP *LevelStar* is designed to measure continuously level, interface or density for process and tank control. The 244LVP is the proven alternative solution to guided micro wave or radar sensors.

Process wetted parts consist of stainless steel 316L (1.4404) or Hastelloy C for the optimal adaption to the process at the lowest price. It is very rugged, has a long life cycle and requires no maintenance. The process connections are as DN 50 or DN 80 respectively 2” or 3” ANSI Class 300.

The 244LVP *LevelStar* joins the experience of Foxboro Eckardt with most advanced FDT / DTM technology.



Mounted e.g. at side of vessel, with displacer chamber 204DC and displacer 204DE



In Process

- Level measuring range 0 to 50 mm up to 0 to 3 m / 0 to 2 inch up to 0 to 9 feet
- At given level:
- Measuring of density
- Position of interface of two liquids
- Process temperature –50 to +150 °C (–58 to +302 °F)
- Process pressure vacuum to 40 bar / ANSI Class 300
- Nominal widths DN 50 and DN 80 (2 inch, 3 inch)
- Material (process wetted) Stainless Steel 1.4404 or 1.4571
- Accuracy ± 0.2 %
- Sensor with no moving parts
- Reliable interface measurement – also at diffuse interface
- Rel. Humidity up to 100 %, condensation permitted
- Electrical Classification Explosion Proof and Intrinsically Safe acc. to ATEX, FM, ...
- Approved for SIL2 applications

Electronic

- 2-wire transmitter
- Output Signal linear or customized
- Communication HART: Analog 4 to 20 mA
- Power Supply 12 to 42 V DC
- Protection of housing IP 66
- Temperature –40 to +85°C

Operation

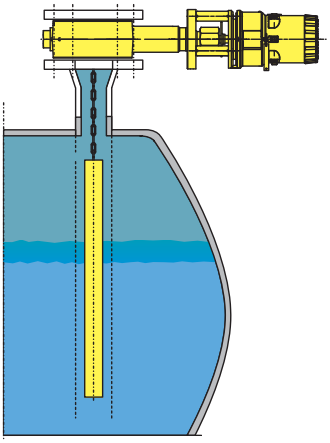
- On the Instrument with push buttons and LCD display for configuration
- Digital with HART Hand Terminal or FDT/DTM Software for calibration and configuration
- LCD display for measured values, status and configuration
- Upper part with LCD turnable to the operator

Influence in the Process

Temperature	▸ very little influence
Pressure	▸ very little influence
Steam, Fog	▸ no influence
Dielectric constant	▸ no influence
Foam	▸ no influence
Vibrations	▸ minimised due to Smart Smoothing and Damping
Motion of fluid	▸ very little influence (if necessary use protecting tube or displacer chamber)
Diffuse interface	▸ no influence
Displacer stroke	▸ Zero (no position alteration at liquid level change)
Corrosive fluids	▸ no influence (instruments are delivered in resistant materials)
Vessel material	▸ no influence
Deposits on vessel	▸ no influence
Deposits on displacer	▸ very little influence

Interface measurement

The challenge – Interface measurement



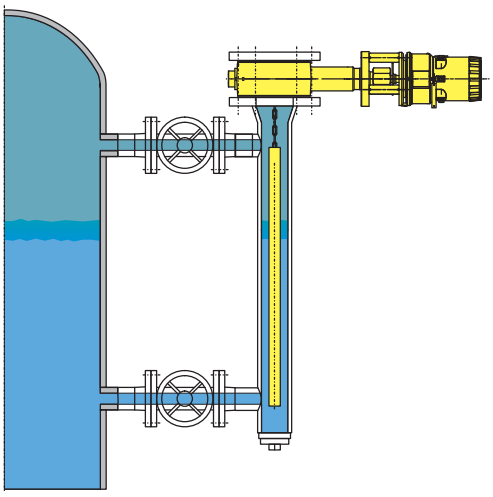
In a number of processes in chemical or petro-chemical industries there are two different fluids, as oil and water, in a tank, reactor or separator.
After settling, there is an interface between the two fluids - depending on fluids, as a clear interface or a diffuse layer.
For the process, or the process control, it is important to determine precisely the location of that interface.
And in most cases, there is rough environment: Aggressive liquids, high pressure, high temperature, explosive atmospheres ...

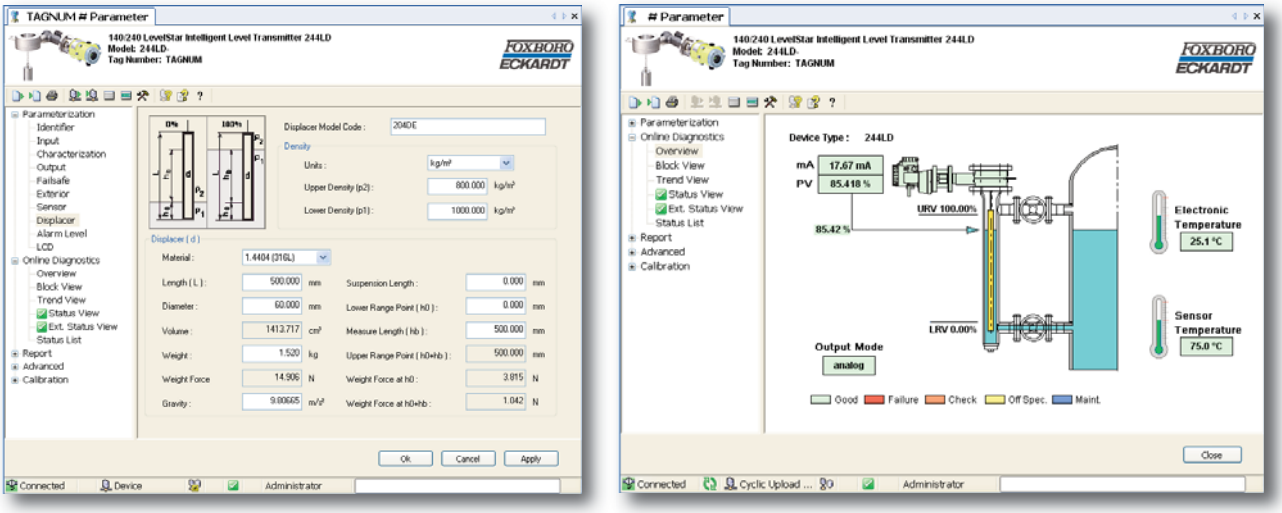
Our displacer transmitters measure the difference of buoancy forces of the two fluids; the displacer is always fully immersed in the fluids.

The displacer transmitter 244LD and 244LVP are the ideal products to measure the interface of two fluids.

The sensor technology used in all Levelstar transmitters is ideal to achieve best results even if the density difference of the two fluids is very small (minimum difference approx. 50 kg/m3) - the dimension of displacer element is calculated according to the given process parameters.

Our torque tube technology allows extreme environmental and process conditions: Temperatures from –196°C to 500°C, and pressures up to 500 bar.





Operation with FDT/DTM Software

A wide range of resistant materials for the wetted parts are available, as well as the usual Electrical Classification Certificates.

The Displacer and Displacer Chambers are built customized according the clients specification.

Easy calibration

The calibration of the transmitter is very easy. It is a fully electronically calibration, no weights are needed. Using the Levelstar DTM, the displacer dimensions, the displacer weight, the upper and lower density of fluids has to be entered to calibrate the transmitter to the process needs.

If you run process water, Methyl-ester, Gross Well Fluid or whatever: We will find the solution.

Influence in the Process

Temperature	▸ very little influence
Pressure	▸ very little influence
Steam, Fog	▸ no influence
Dielectric constant	▸ no influence
Foam	▸ no influence
Vibrations	▸ minimised due to Smart Smoothing and Damping
Motion of fluid	▸ very little influence (if necessary use protecting tube or displacer chamber)
Diffuse interface	▸ no influence
Displacer stroke	▸ Zero (no position alteration at interface position change)
Corrosive fluids	▸ no influence (instruments are delivered in resistant materials)
Vessel material	▸ no influence
Deposits on vessel	▸ no influence
Deposits on displacer	▸ very little influence

167LP Pneumatic Buoyancy Transmitter

Large local indicator visible from a distance

The pneumatic solution.

The pneumatic buoyancy transmitter 167LP can continuously measure level, interface or density of liquids for process and tank control. It is suitable for all industry applications, with pressures up to 250 bar and temperatures from –196 °C to +400 °C.

Process wetted parts consist of stainless steel 1.4404 (316L), Hastelloy C or Carbon Steel; displacer is made of SS, PTFE, PTFE+Carbon or Hastelloy C for the optimum adaptation to the process at the lowest price.

It is extreme rugged, has a long live cycle and requires no maintenance.

In Process

- Measuring range
  0 .. 35 cm to 0 .. 3 m /
  0 .. 1 feet to 0 .. 9 feet
- At given level:
- Measuring of density
- Position of interface of two liquids
- Process temperature
  –196 to +500 °C (–320 .. +932 °F)
- Process pressure
  vacuum to 250 bar /
  ANSI Class 1500
- Nominal widths DN 80 and DN 100 (3 inch, 4 inch)
- The span can be set over a 1:5 ratio
- A wide selection of materials facilitates service under corrosive conditions
- Material (process wetted)
  Carbon steel 1.0460, Stainless Steel 1.4404 or Hastelloy C
- Material opproval certificates acc. to EN 10204-3.1 available
- Accuracy < 1 %
- Sensor with no moving parts
- Reliable interface measurement – also at diffuse interface
- Rel. Humidity up to 100 %, condensation permitted
- Optional Heating Jacket

Protection

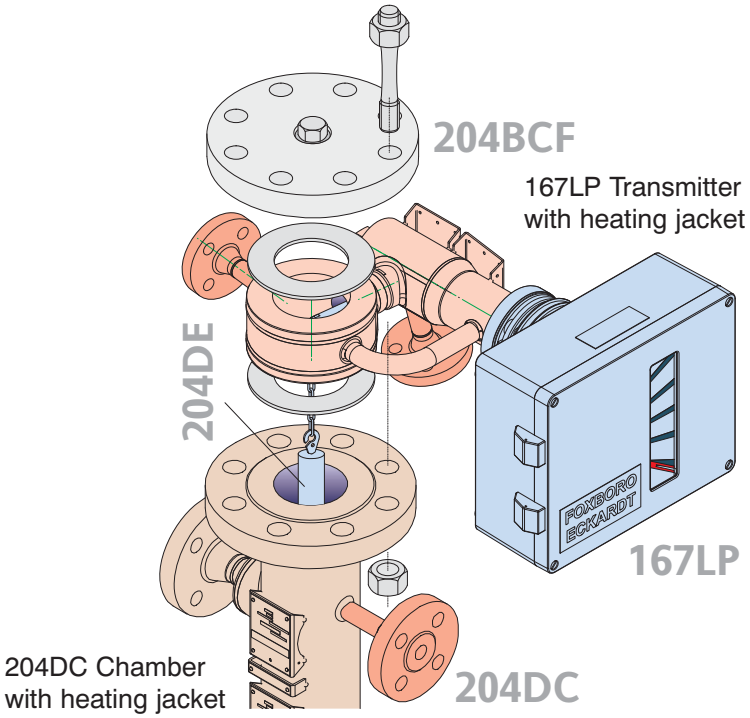
- Protection class IP 55
- Eplosion protection acc. to ATEX
  For use at Zone 1, group IIC
  For use at Zone 0 for tanks or pipes
  II 1/2 G c IIB + H_2 + C_2H_2
  II 1/2 G c IIC
- Licensed for use on sea ships in the Germanische Lloyd class, or on other structures classified by Germanische Lloyd

Operation

- Output 0.2 to 1 bar or 3 to 15 psi
- Supply air 1.4 ± 0.1 bar / 20 ± 1.4 psi, low air consumption

Influence in the Process

Temperature	▸ very little influence
Pressure	▸ very little influence
Steam, Fog	▸ no influence
Dielectric constant	▸ no influence
Foam	▸ no influence
Vibrations	▸ minimised due to damping
Motion of Fluid	▸ very little influence (if necessary use protecting tube or displacer chamber)
Diffuse Interface	▸ no influence
Displacer stroke	▸ Zero (no position alteration at liquid level change)
Corrosive Fluids	▸ no influence (instruments are delivered in resistant materials)
Vessel material	▸ no influence
Deposits on vessel	▸ no influence
Deposits on displacer	▸ very little influence

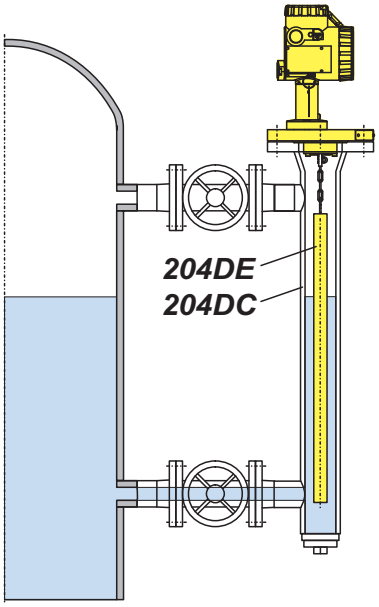


204DC
Displacer Chamber

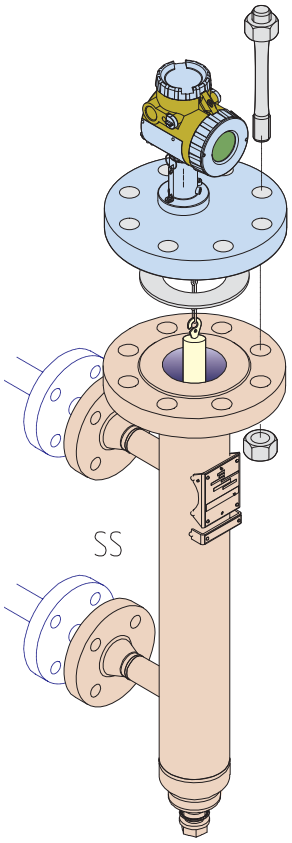
A displacer chamber is mounted on the side of the vessel, and the transmitter at its top flange.
Displacer chambers are offered in four vessel mounting arrangements (see illustration right: "Side-Side").
All mounting arrangements are also available with heating jacket.
The drain valves, etc. are to procure on site.

Materials, Pressure Ratings, Flange Sizes, Contact Faces, Pipe Sizes, Drain Types: Flange, Screw, Ball valve, Pipe piece for welding,
Heating Jacket see PSS.

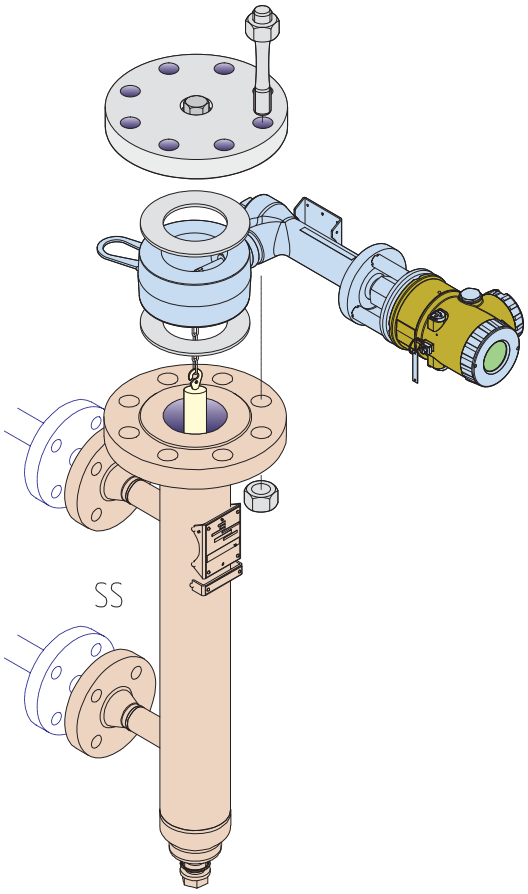
Overview: Types of Transmitters
We offer both Level transmitters for flange mounting and for sandwich assembly, depending on the measurement task.



Flange mounted
shown: with 244LVP *LevelStar*

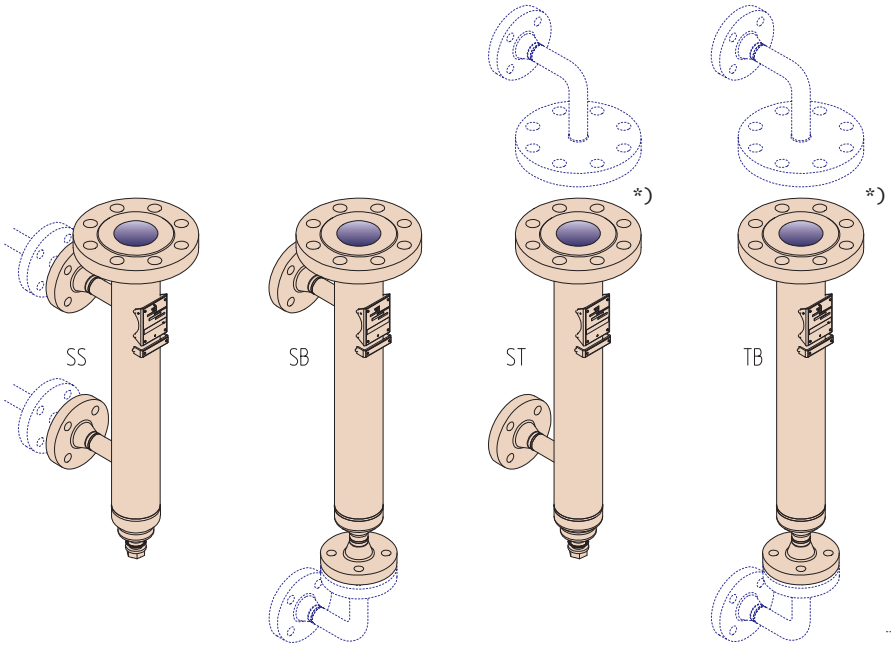


Sandwich mounted
shown: with 244LD *LevelStar*

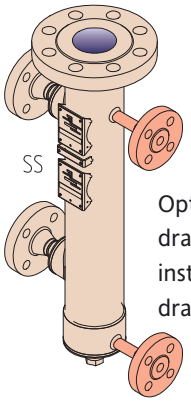


Overview: Mounting arrangements

Side-Side | Side-Bottom | Side-Top | Top-Bottom



All mounting arrangements also available with heating jacket (shown: "Side-Side")

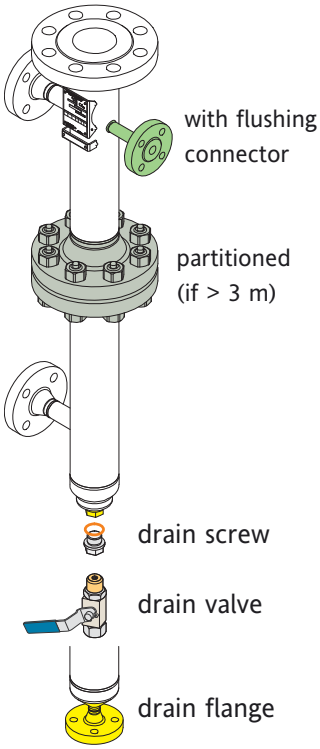


Option: with drain flange instead of drain screw

..... to procure on site

*) only possible with sandwich mounted devices: 244LD · 167LP

Versions / Options



with flushing connector

partitioned (if > 3 m)

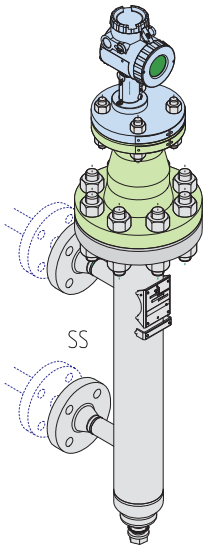
drain screw

drain valve

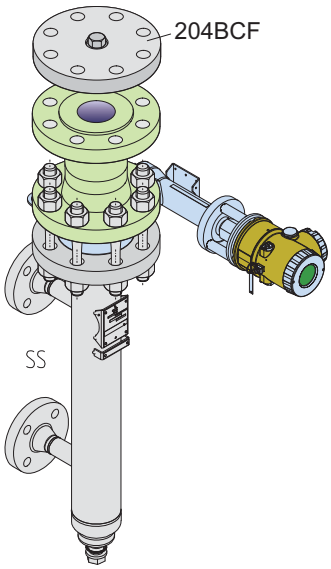
drain flange

204FK Flange combination...

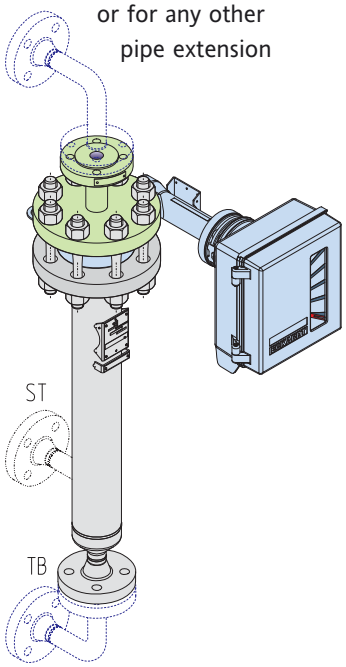
... for adapting of different flange sizes



...simplified service inspection without removing transmitter screws



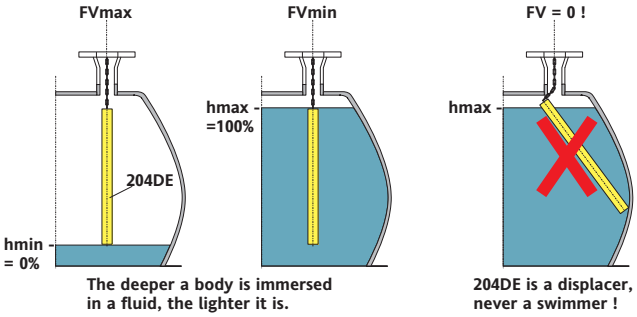
... reduction of flange size with displacer chamber with -ST or -TB design or for any other pipe extension



204DE
Displacer Element

Buoyancy measurement

Our measurement systems consist of a Buoyancy Transmitter and a displacer. Measured is the buoyancy force exercised by the displacer through the medium. Weight and volume determines the buoyancy force, at the respective density of the measuring medium. Furthermore, the pressure resistance and the temperature plays a important role in the material selection.



The measurement range is the lenght of the displacer.

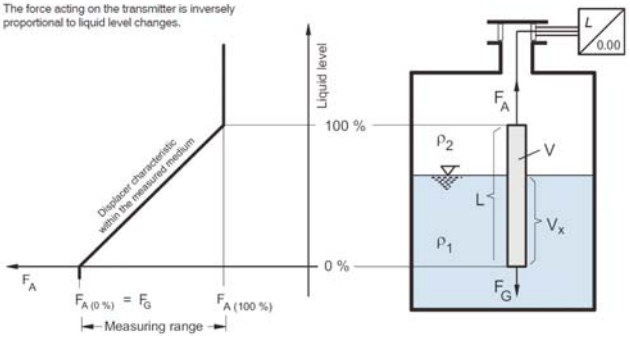
The displacer must be designed for the pressure rating of the vessel - however, at least to the operating pressure - and ordered accordingly. Here the maximum possible temperature must be taken into consideration. Displacers made of PTFE are made from solid material, and are, therefore, suitable for all pressures (Note the maximum temperature of PTFE).

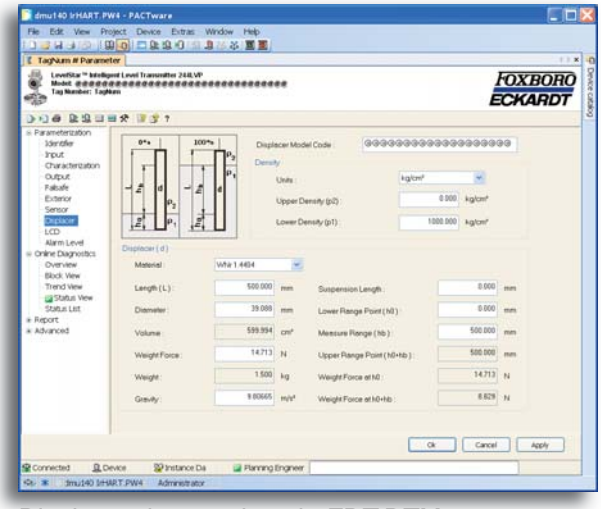
Displacers with a length of more than 3 m (1 m with PTFE) are divided. The sections are screwed together and secured, or they are attached together with spring clamps.

$F_A = V_x \cdot \rho_1 \cdot g + (V - V_x) \cdot \rho_2 \cdot g$

F_A Buoyancy force
V Volume of displacer
V_x Volume of medium displaced by measuring body with density ρ_1
ρ_1 Average density of heavier medium
ρ_2 Average density of lighter medium
g Local acceleration due to gravity
F_G Displacer body weight force

The force acting on the transmitter is inversely proportional to liquid level changes.





Displacer data setting via FDT-DTM

If the transmitter is exposed to external vibrations by means of the installation, it is recommended to order the displacer with a damping spring which is attached to the suspension chain.
This spring is specially matched to the resonance frequency of the displacer and is made of stainless steel or HC.

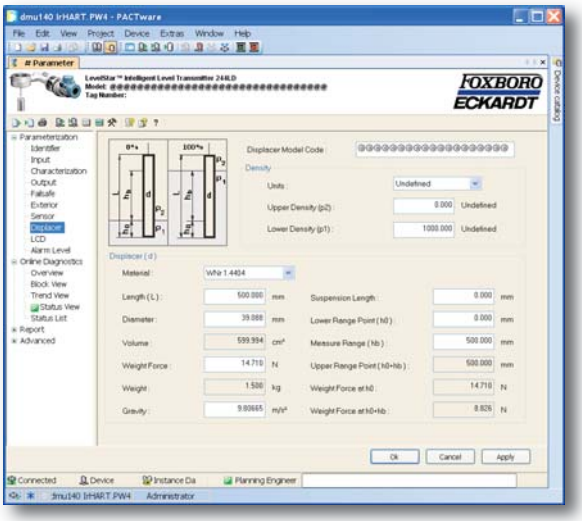
When using a displacer chamber the gap between displacer and cage should not be less than 10 mm (~½ inch).

Operation and Configuration

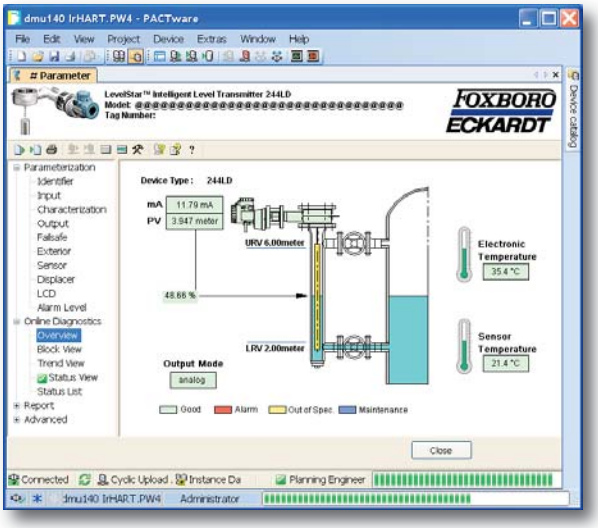
Intelligent, PC-supported

The operating software FDT-DTM based on Windows 7 and XP serves for operation and configuration of intelligent and communicable field instruments with HART and protocols as well as Profibus PA and Foundation Fieldbus (FF).

FDT-DTM: Configuration



PACTware: Operation



Displayed Instrument Characteristics and Measuring Values

FDT-DTM offers the possibility to continuosly display instrument characteristics and measuring values as well as providing the ability carry out configuration in a very user friendly and timely manner.

- Displayed instrument characteristics
  - – Instrument variant
  - – Instrument location / instrument type
  - – Measuring Point Number / Name
  - – etc.
- Configurable Instrument Functions
  - – Inlet / Outlet (measuring range, physics unit, etc.)
  - – Characteristic curve, (linear, square root, customized with max. 32 set points)
  - – Output signal damping
  - – Safety regulations
  - – Local display / local key

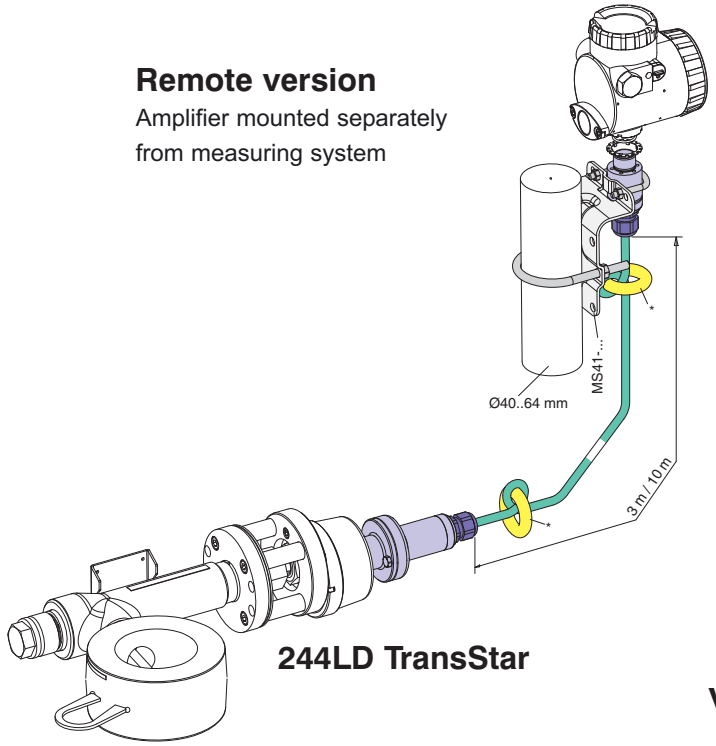
Foxboro Eckardt makes available to you an extensive Online-Support-Service via World Wide Web – wherever you are – 24 hours a day, 365 days per year.

Available online is general technical information on measuring technique and detailed information about the intelligent displacer transmitters.
If you want to freshen up your knowledge about the measuring principles, simulate buoyancy forces, make technical drawings of your measuring arrangement or simply want to solve interesting perplexities, we offer the service to you.

Special versions

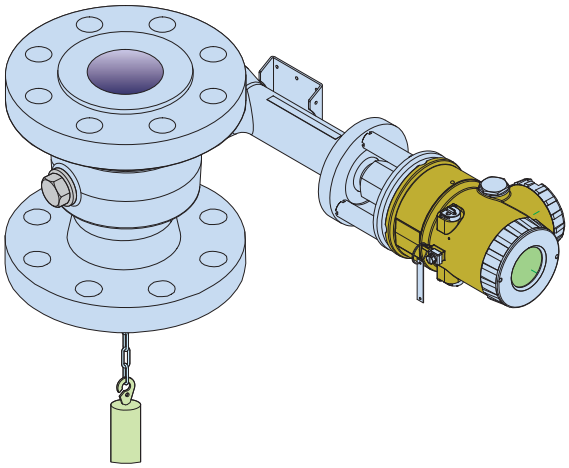
Remote version

Amplifier mounted separately
from measuring system

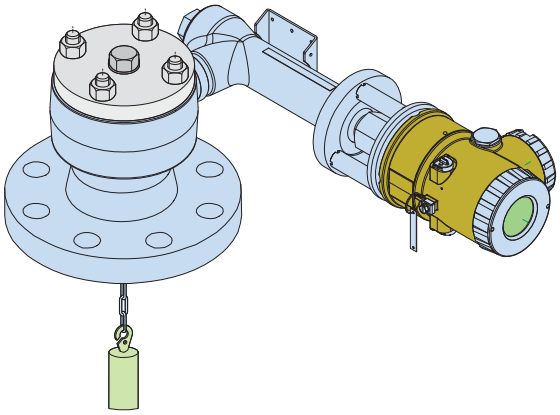


244LD TransStar

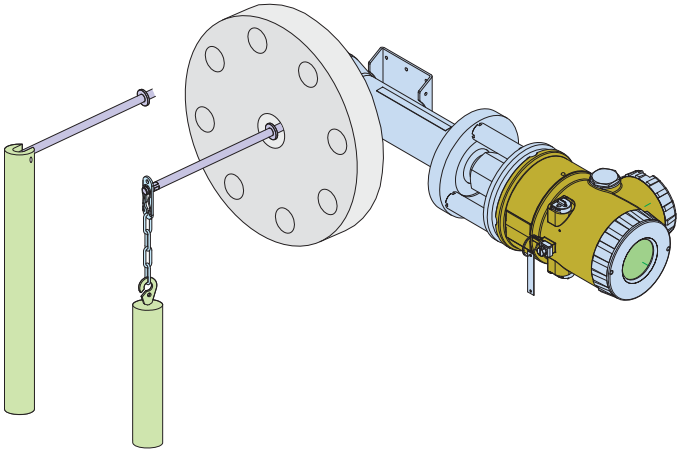
Version with two welded flanges



Version with welded flange and cover flange



For mounting <u>at side</u> of vessel



Summary

Product Feature Matrix

The buoyancy transmitters are designed to perform continuous measurements for liquid level, interface or density of liquids in the process of all industrial applications.
Even under extreme temperatures, high process pressure and corrosive liquids, the devices measure with consistent reliability and high precision. They are approved for installations in contact with explosive atmospheres, 167LP also for use on sea ships.

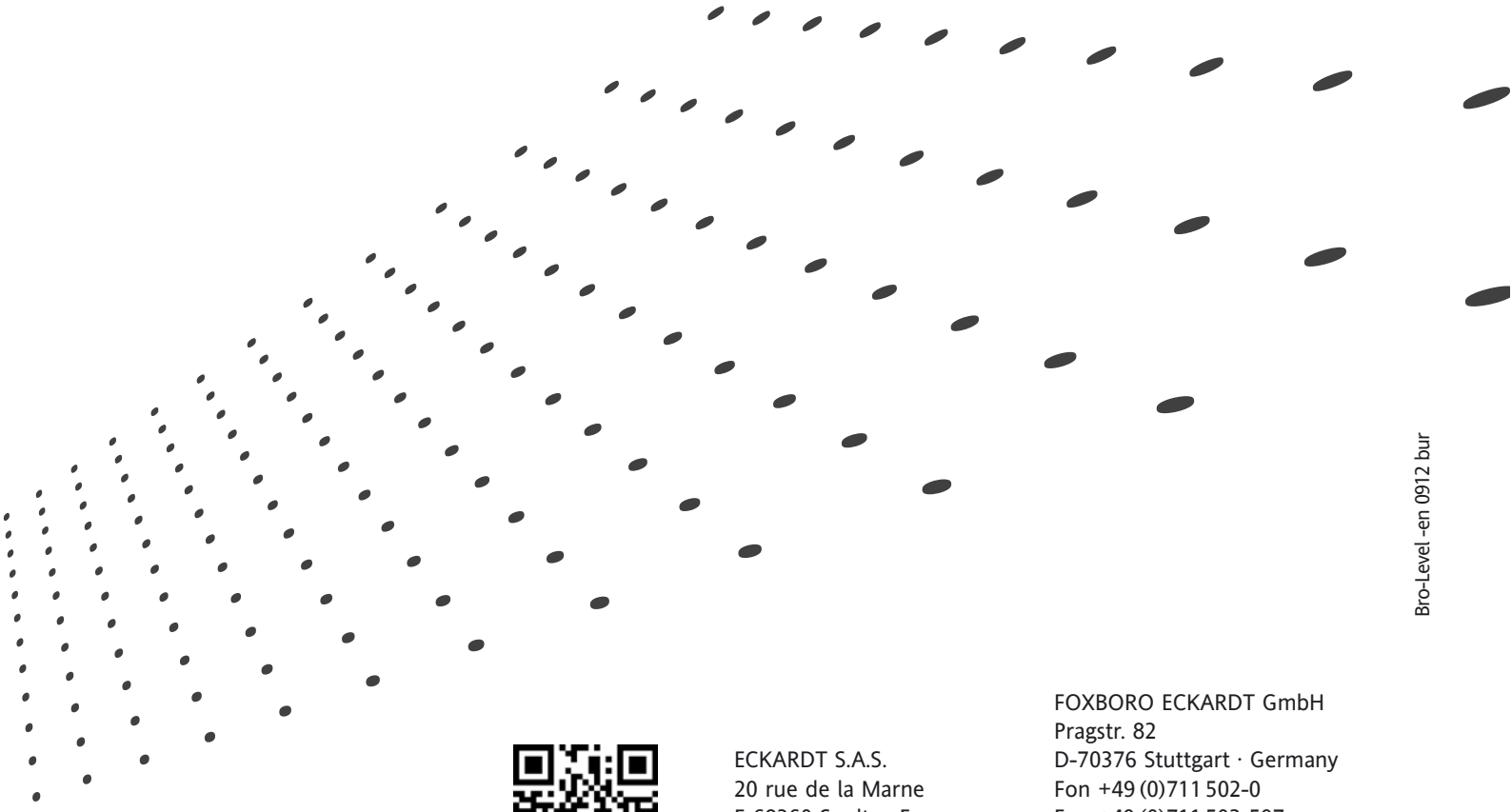
Selection Guide

Connection	digital, two-wire	digital, two-wire	pneumatic
Mounting	Sandwich mounted	Flange mounted	Sandwich mounted
Output Signal / dig. Communication	4 to 20 mA / Hart / PB-PA / FF	4-20 mA / Hart	pneumatic 0.2 to1 bar
FDT-DTM with advanced features	Yes	Yes	
Measuring Length	5 cm ...15 m	5 cm ... 3 m	35 cm ... 3 m
Medium, Density (f.Level)	100...2000 kg/m³	100...2000 kg/m³	100...1600 kg/m³
Medium, Temperature	–196 ... +500°C	–50 ... +150°C	–196 ... +400°C
Medium, Pressure	PN 16 ... 500	PN 40	PN 16 ... 250
Flange Size	DN 80, DN 100, ANSI 3”, 4”	DN 50, DN 80, ANSI 2”, 3”	DN 80, DN 100, ANSI 3”, 4”
SIL 2 Certification	Yes	Yes	
Ambient Temperature	–40...+85°C	–40...+85°C	–40...+90°C
optional	+: with heating jacket		+: with heating jacket
Your Solution:	244LD LevelStar	244LVP LevelStar	167LP

For all LevelStar devices:
- Local multilingual full graphic LCD, configurable in %, mA or physical units, and messages in clear text

For all digital devices:
- Easy adaptation to the measuring point
- Linear or customized characteristic
- 32 point linearisation for volumetric measurement
- Backdocumentation of measuring point
- Continuous self-diagnostics, Status and diagnostic messages
- Configurable safety value
- Local display in %, mA or physical units
- Micro sintermetal sensor technology

For all devices:
- Materials for use with aggressive media
- Accessories for mounting and operation: Displacer Chamber 204DC, Displacer 204DE, Flange combination 204FK and Cover Flange Kit 204BCF see 204xx.



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