

# Technical Catalogue/Datasheet

## Displacer Level Transmitter

### EMKO DLT



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## Principle of Operation & Measurement

Displacer level sensors use Archimedes' Principle to detect liquid level by continuously measuring the weight of a displacer rod immersed in the process liquid.

The displacer is cylindrical in shape with a constant cross-sectional area, fixed length (according to requirement of client) and precise weight. This system composed of level controller, possibly with or without pressure chamber, displacer body (1), moment arm/lever (2), torque tube (3) and other components. The change of the measured liquid(s) medium level causes the buoyancy force of the displacer body to change, and the change cause it to move slightly upward or downward. This movement, through moment arm, is transferred to the torsion component (torque-tube) which rotate angularly with the moment-arm movement synchronously.

The electronic sensing system (controller) coupled to the said torsion-tube, generates a magnetic field differentiation in the Hall-sensor. The level controller measures this (according to the calibrated span), filter the noises, amplify it and in the end propagates a 4~20 mA current output signal.

The microcontroller can be equipped with a temperature sensor (usually RTD Pt-100) to measures the medium temperature to compensate for changes in liquid density caused by changes in process temperature, and the LCD displays information such as the analogue output, process variables, torsion tube rotation angle, and percentage range of the level.

Unlike when measuring single liquid level, when evaluation target is "density" or "interface-level" of two immiscible liquid, it is mandatory that the whole span range of measurement must always be kept full.



## Introduction to EMKO DLT

Our products are designed for continuous measurement of level, interface, and density of liquids in all industrial applications, offering very high reliability and robustness within a wide pressure-temperature and corrosion resistant material range combinations.

After years of manufacturing displacer levels with high quality components, we have accumulated a wealth of experience and our company has mastered more technical characteristics of our controllers, and have richer on-site processing experience, to ensure users to use our products for a long time and safely.

For the controller (transducer) component, after decades of working with EMERSON, we have reached a conclusion that this brand has the best cost-performance ratio and we exclusively using Fisher electronics for this purpose.

In addition to the normal function of providing a 4 to 20 mA current signal, using HART® communications protocol, gives easy access to information critical to process operation. The connection for HART communication may be made at any point in the field wiring that meets the HART impedance requirements. Configuration, calibration, diagnostics, parameter review, signal monitoring and alert monitoring are all available through the HART protocol.

### *Applicable industrial sectors:*

- Oil and Gas plant (upstream or downstream facilities)
- Chemical and Petrochemical plants
- Food and beverage industries

### *Applicable industrial sectors:*

- ATEX/IECE Ex Explosive atmosphere protection certificate
- SIL2 functional safety in case of need.
- PED Compliance/Certification as per DIRECTIVE (EU) 2014-68



## EMKO DLT General Specifications

Construction style	With chamber (different orientation) or without chamber (Top-mount with stilling well)
Process connection:	Flanges as per EN 1092 or ASME B16.5 (or other on request)
Operating pressure:	Up to PN420 (equivalent to Class1500)
Operating temperature:	-150 to 400 °C (Limited to process connection material/rating)
Ambient temperature:	-40 to 80°C (at high ambient temp, usage of sun-shade is mandatory)
Ambient Relative Humidity:	0 to 95%
Construction material:	Transmitter Housing: low copper die-cast aluminium alloy with resistant coating
	Top head assembly: 1.4401/1.4404 (SS316/316L)
	Torque tube: Inconel 600
	Displacer body & Pressure chamber: variable material and grades (e.g.: Carbon steel, Stainless steel, Ni-Cu or Ni-Cr super alloys,...)
Measurement error:	Linearity: $\pm 0.25\%$ of output span
	Hysteresis: $< 0.2\%$ of output span
	Deadband: $< 0.05\%$ of input span
Repeatability:	$\pm 0.1\%$ of full-scale output
Power supply:	Loop-powered (2-wire configuration), 12-30 V DC (For HART communication, min 17.75 VDC is needed)
Outputs & Communication:	4-20 mA DC, Direct or Reverse acting (Liquid level, Interface level or density) Digital communication protocol: HART (require total shunt impedance of 230–600 Ohms) Alarms (as per NAMUR NE 43): <ul style="list-style-type: none"> <li>- High saturation: 20.5 mA</li> <li>- Low saturation: 3.8 mA</li> <li>- High alarm: 22.5 mA</li> <li>- Low Alarm: 3.7 mA</li> </ul>
Cable conduits:	2 x ½ NPT (ISO M20x1.5 adaptor available)
Electromagnetic Compatibility:	Meets EN 61326-1:2013 and EN 61326-2-3:2006
Hazardous Area compliance	ATEX— Intrinsically Safe, Type n, Flameproof IECEX— Ex ia IIC T5 Ga; Ex d IIC T5/T6 Gb.
Ingress protection:	IP66
Local Indicator	LCD with analogue output, process value in engineering units or percentile scale bar graph.

### Note:

- Different model transmitters are available in case of other communication protocols or requirements (e.g. SIL2, Foundation Fieldbus, ...)
- Hot process medium requires the “Heat shield/insulator” to be used for Transducer.

## EMKO DLT Detailed Technical Specifications

### *Power supply:*

12~30V DC; with reverse-polarity protection. (When HART communication is used, the voltage of controller should be larger or equal to 17.75V DC)

### *Input Signal for process medium temperature:*

Interface for 2- or 3-wire 100 ohm platinum RTD for sensing process temperature, or optional user-entered target temperature to permit compensating for changes in specific gravity.

### *Power supply requirement:*

- 12 to 30 V DC / 22.5 mA
- Instrument has reverse polarity protection.
- A minimum compliance voltage of 17.75 is required to guarantee HART communication.

### *Output Signal:*

4~20mA DC + HART (Positive effect - increased output due to increased level, interface or density; or negative effect - decreased output due to increased level, interface or density)

- High saturation: 20.5 mA
- Low saturation: 3.8 mA
- High alarm: 22.5 mA
- Low Alarm: 3.7 mA

NAMUR NE 43 compliant when high alarm level is selected.

Digital: HART 1200 Baud FSK (frequency shift keyed) HART impedance requirements must be met to enable communication. Total shunt impedance across the master device connection (excluding the master and transmitter impedance) must be between 230 and 600 ohms.

In point-to-point configuration, analogue and digital signalling are available. The instrument may be queried digitally for information or placed in Burst mode to regularly transmit unsolicited process information digitally. In multi-drop mode, the output current is fixed at 4 mA, and only digital communication is available.

### *Mounting Positions:*

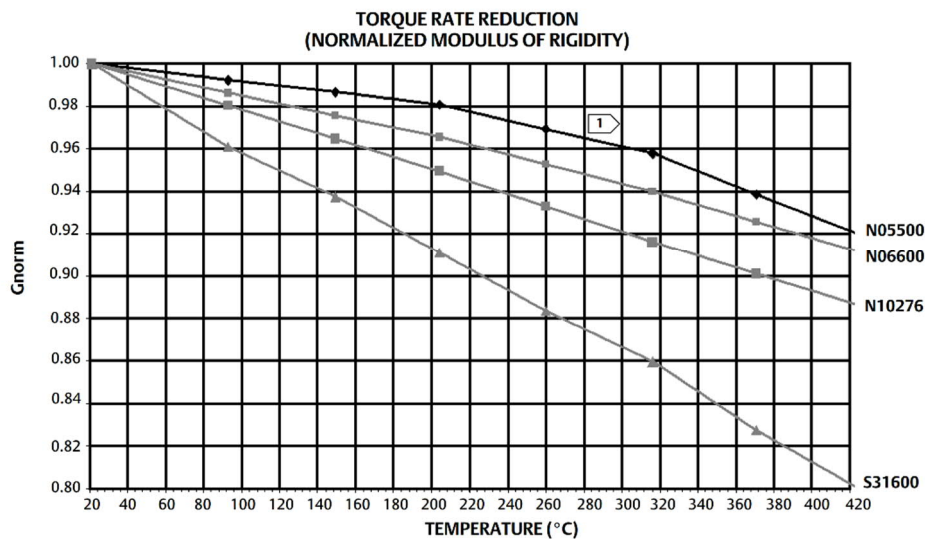
Digital level controller can be fabricated on right- or left-of-displacer, as shown in Figure x.

Also, the top head assembly is fully rotatable and can be fit in 8 different rotational position during the site installation for prevention of any collision with existing equipment.

### Operating Influences:

- Power Supply Effect: Output changes  $<\pm 0.2\%$  of full scale when supply varies between minimum and maximum voltage specifications.
- Ambient Temperature: The combined temperature effect on zero and span without the sensor is less than 0.03% of full scale per degree Kelvin over the operating range -40 to 80°C
- Process Temperature: The torque rate is affected by the process temperature

Theoretical Reversible Temperature Effect on Common Torque Tube Materials

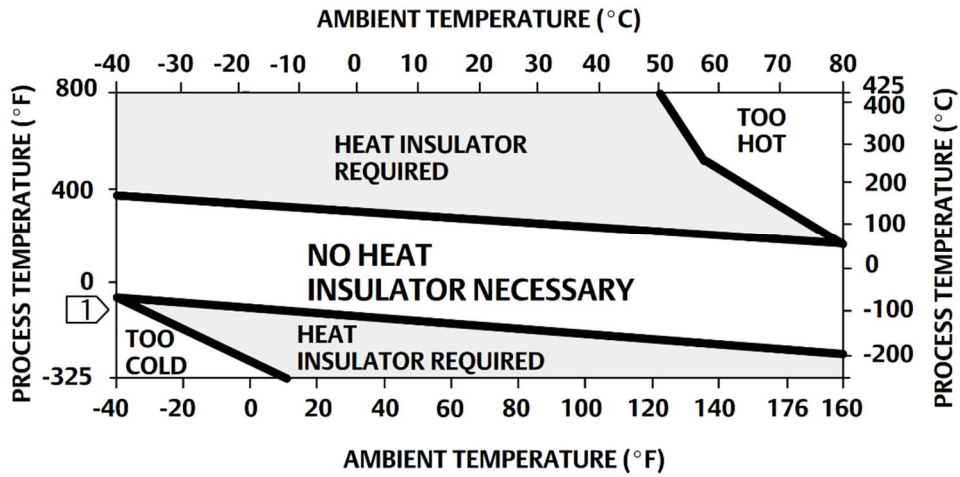


## Construction Materials

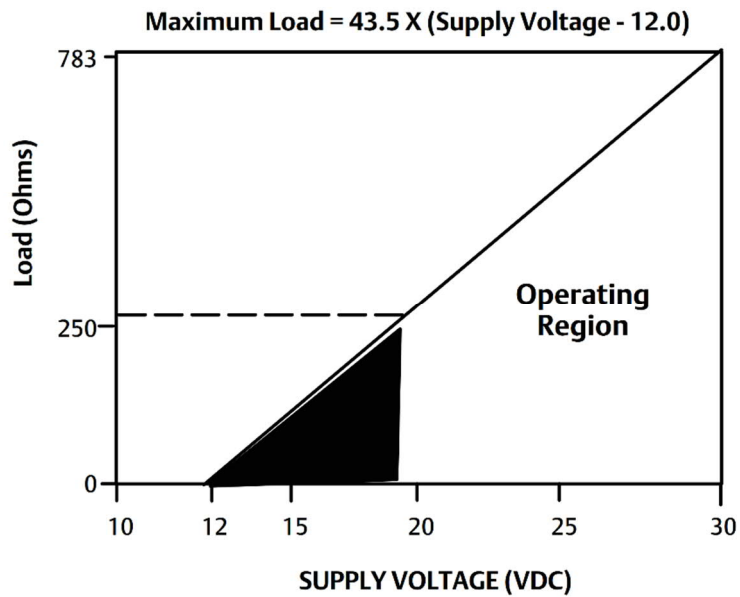
- 1- Transmitter housing:
  - Case and Cover: low copper die-cast aluminium alloy with resistant coating
  - Internal: Plated steel, aluminium, and stainless steel; encapsulated printed wiring boards; Neodymium Iron Boron Magnets.
- 2- Top head assembly: 1.4401/1.4404 (SS316/316L) – **Default & Fixed**
- 3- Torque tube: Inconel 600 (our default choice due to its best stability)
- 4- Displacer body, linkage & Pressure chamber: Variable material and grades
  - Carbon steel (A105 N & A106, ...)
  - Stainless steel (1.4301/1.4304, 1.4401/1.4404, ...)
  - Ni-Cu or Ni-Cr Super alloys (Monel 400, Inconel 625, ...)

Note: on-request, other materials that have not been mentioned here are also available.

## Operating temperature limits related to process medium

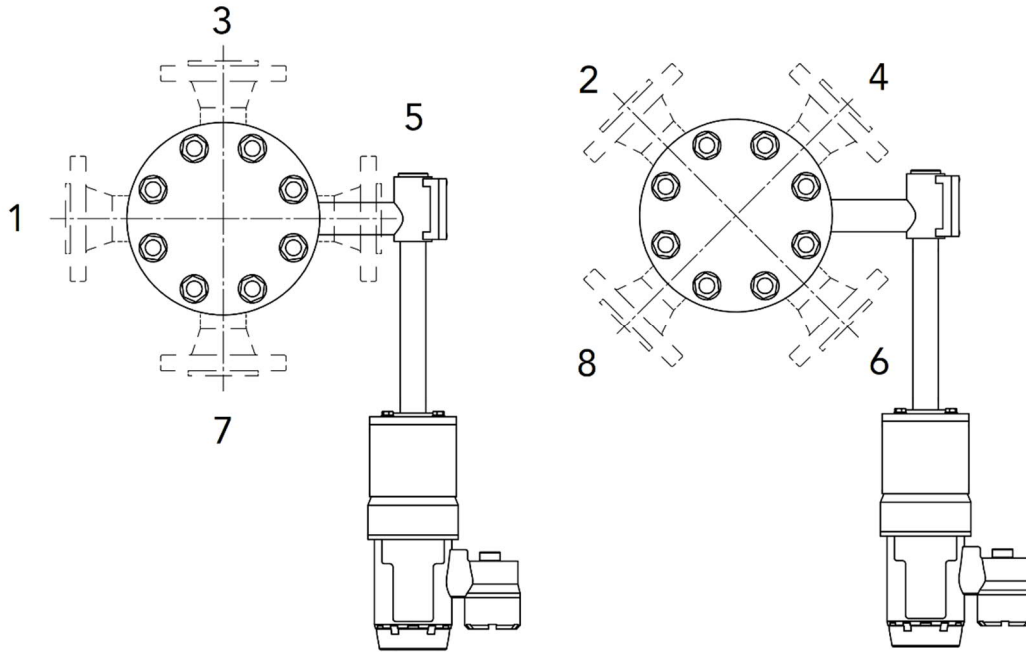


Power Supply Requirements and Load Resistance:

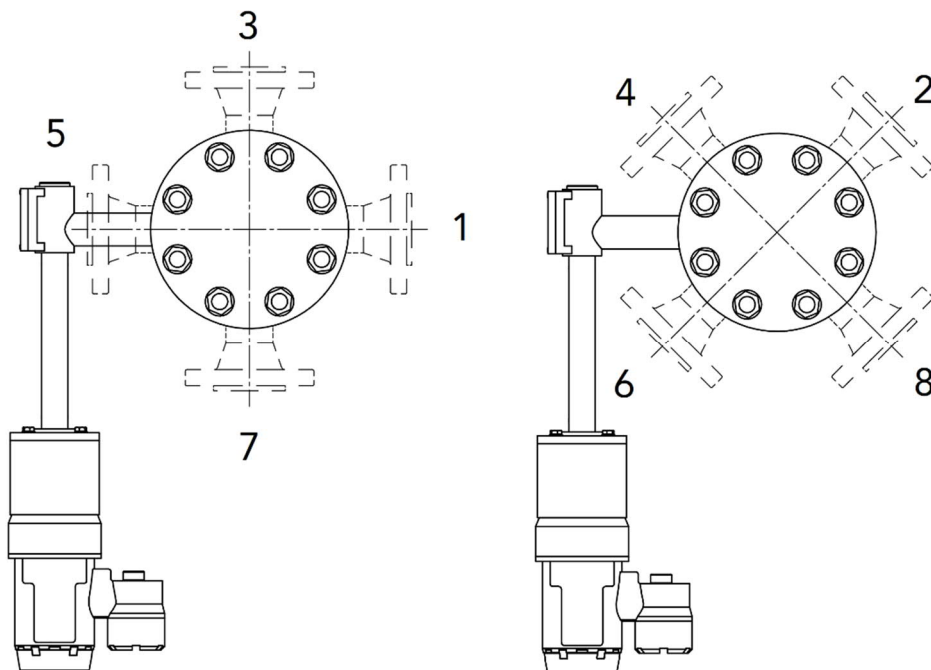


## Installation Examples, Schematic and Orientations

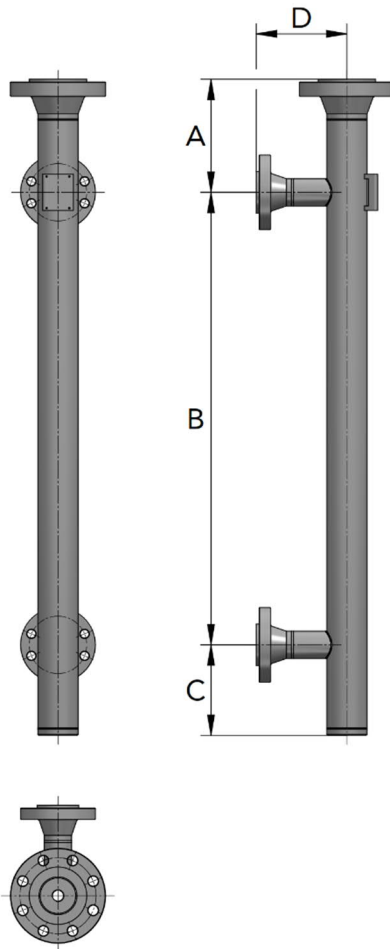
Schematics no. 01, Right-hand side with head rotatable positions



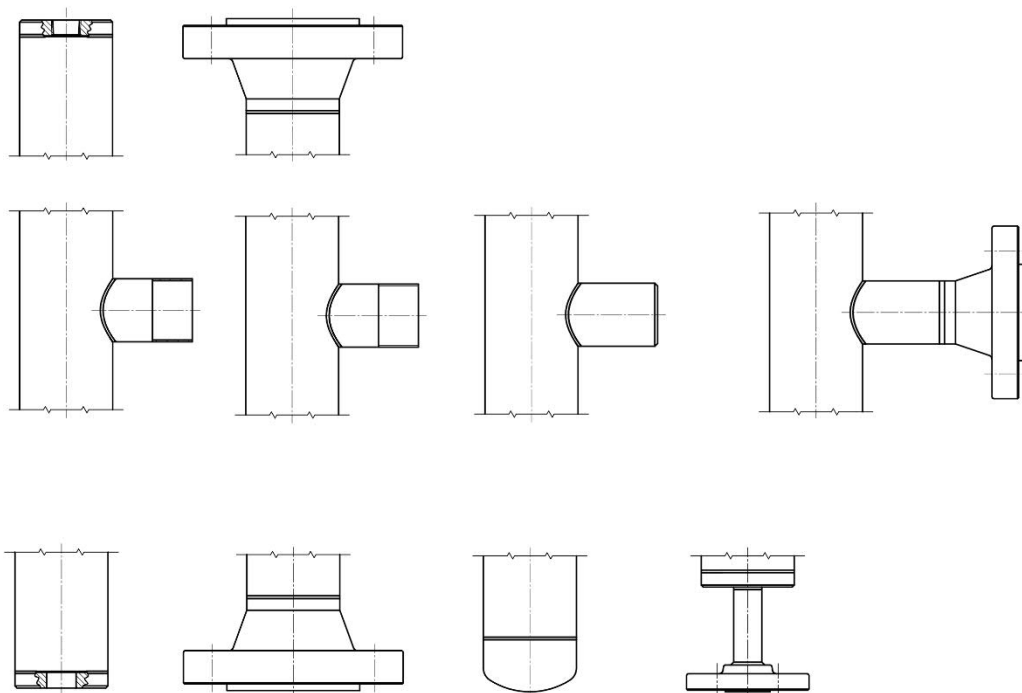
Schematics no. 02, Left-hand side with head rotatable positions



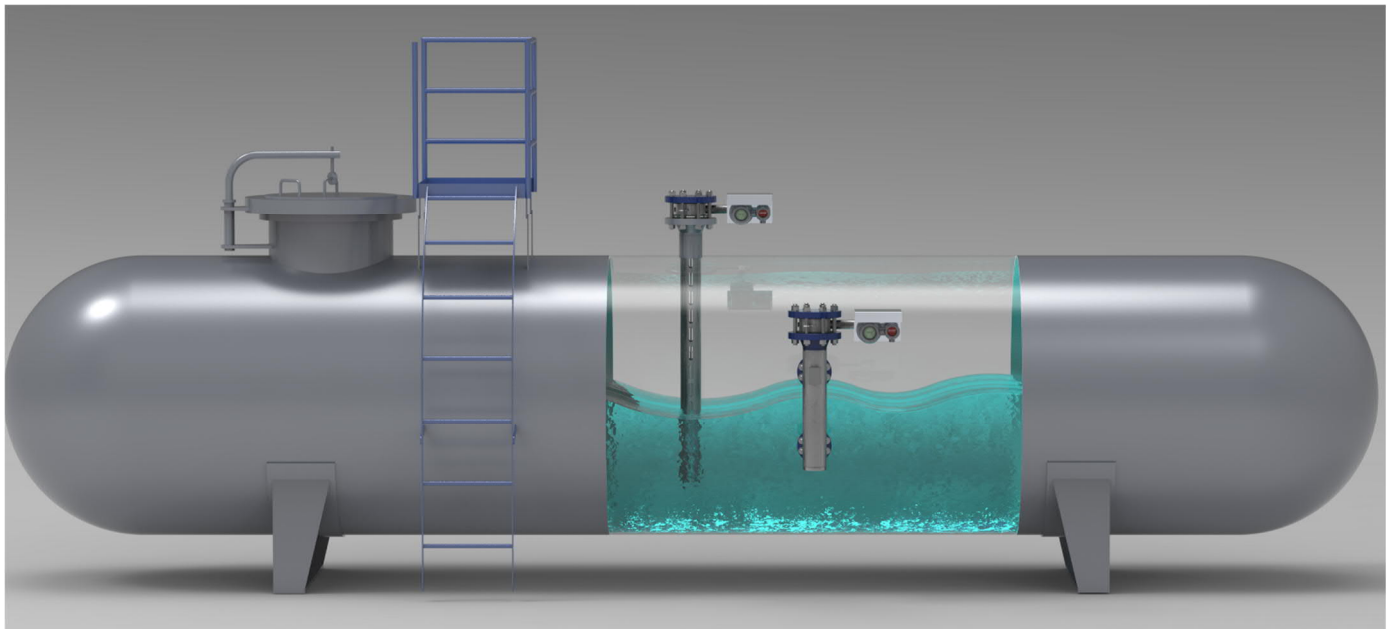
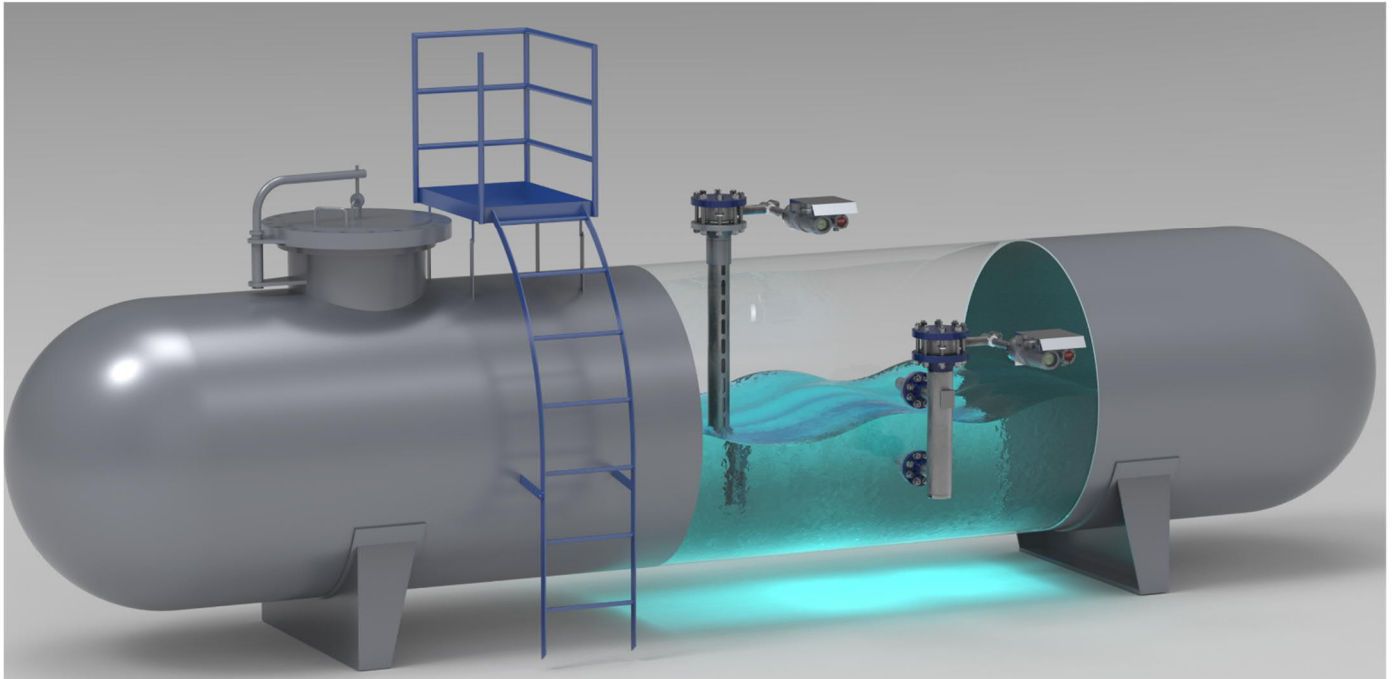
Schematics no. 03, Classic side-side pressure chamber



Schematics no. 04, Available variations for top, bottom & side connection options

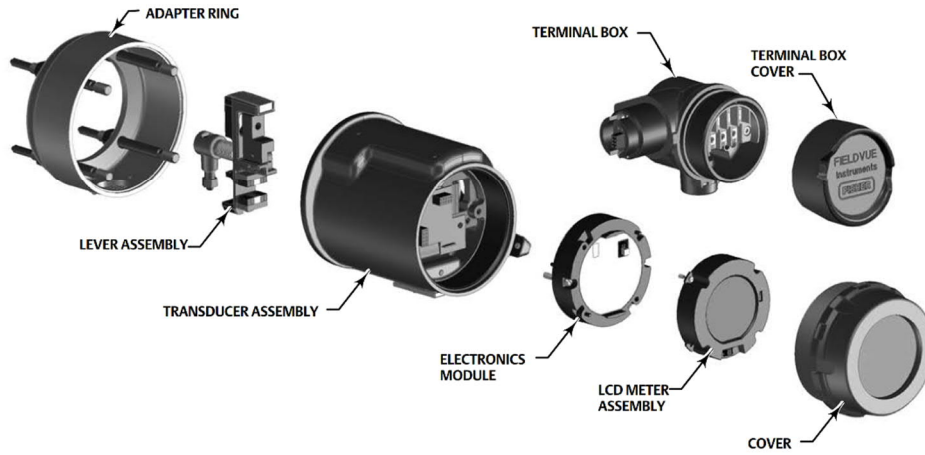


## Installation examples (for both side-side or top-mount versions)

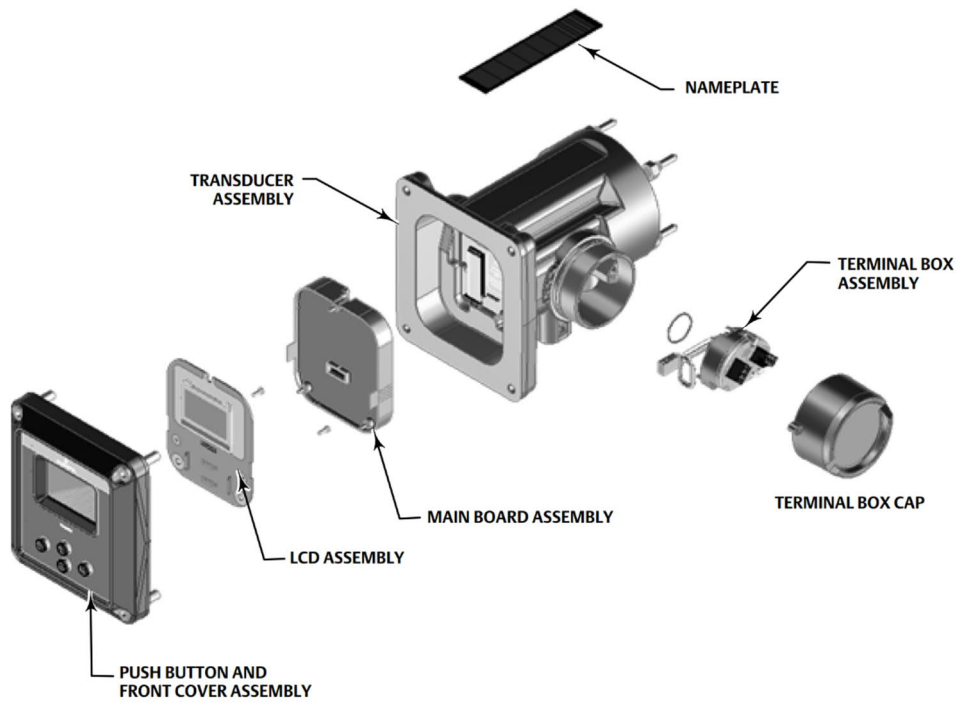


# Transmitter Housing exploded view

FIELDVUE DLC3010 Digital Level Controller Assembly



Fisher DLC3100 Overview



## Order Code Definition Chart

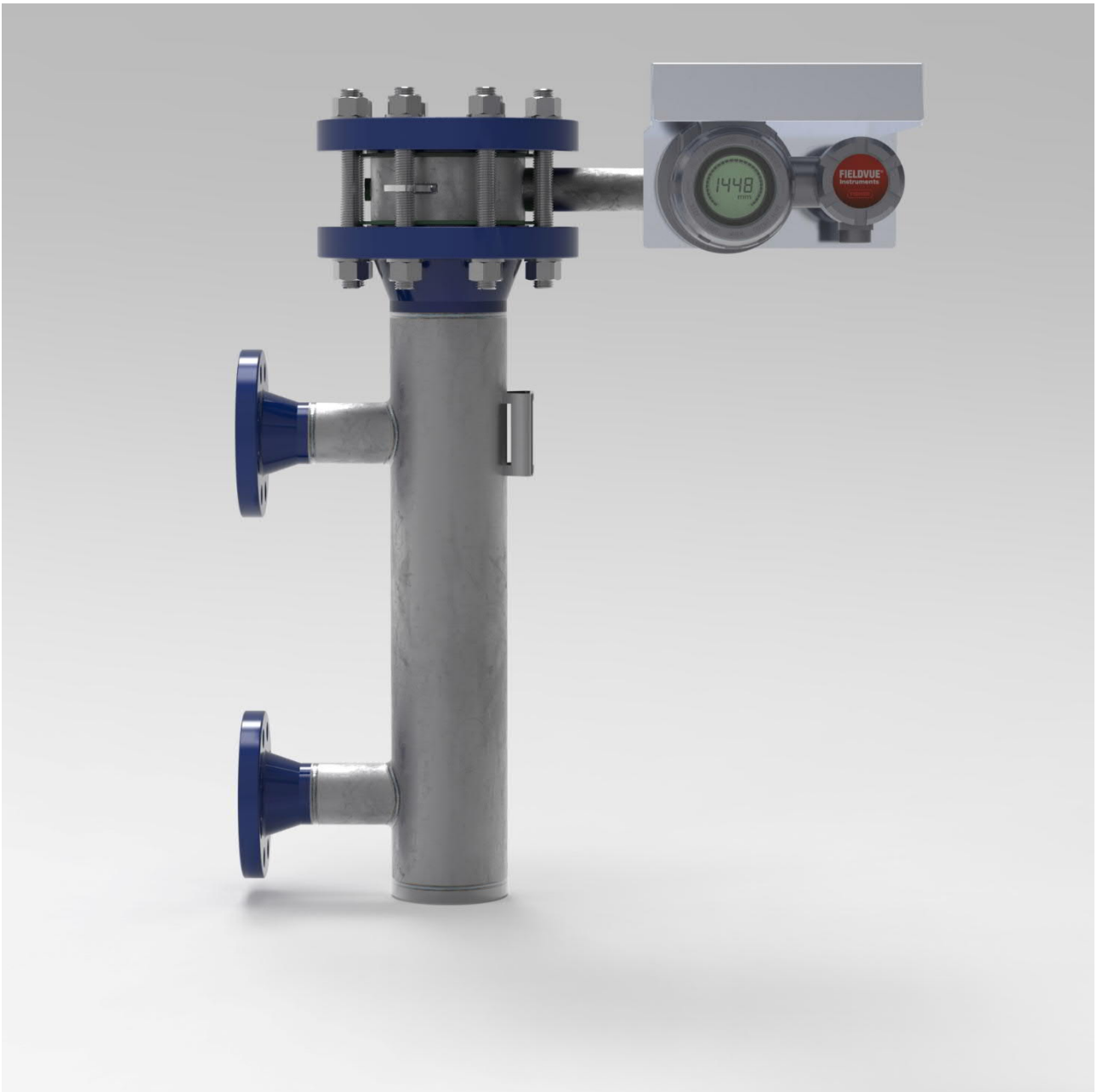
EMKO DLT	x	x	x	x	x	x	x	x	x
<b>Chamber Type</b>									
External Cage, Side-Side	SS								
External Cage, Top-Side	TS								
External Cage, Side-Bottom	SB								
Chamber-less (Top mount)	TM								
Others	-								
<b>Centre-Centre distance (C-C) mm</b>									
	xxxx								
<b>Process Connection Size</b>									
ASME B16.5, NPS 1			NPS 1						
ASME B16.5, NPS 1 1/2			NPS 1 1/2						
ASME B16.5, NPS 2			NPS 2						
EN 1092-1, DN25			DN25						
EN 1092-1, DN40			DN40						
EN 1092-1, DN50			DN50						
Others			-						
<b>Process Connection Rating</b>									
ASME B16.5, Class 150				150#					
ASME B16.5, Class 300				300#					
ASME B16.5, Class 600				600#					
ASME B16.5, Class 900				900#					
ASME B16.5, Class 1500				1500#					
EN 1092-1, PN 10-16-25				PN25					
EN 1092-1, PN 40				PN40					
EN 1092-1, PN 63				PN63					
EN 1092-1, PN 100				PN100					
EN 1092-1, PN 160				PN160					
EN 1092-1, PN 250				PN250					
Others				-					
<b>Process Connection Face</b>									
ASME B16.5, FF					FF				
ASME B16.5, RF					RF				
ASME B16.5, RTJ					RTJ				
EN 1092-1, A					A				
EN 1092-1, B					B				
EN 1092-1, D					D				
Others					-				
<b>Chamber/Process Connection Material</b>									
Carbon Steel (A105N/A106)						CS			
Stainless Steel 1.4301/1.4304 (SS 304/304L)						SS304			
Stainless Steel 1.4401/1.4404 (SS 316/316L)						SS316			
Monel 400						M400			
Inconel 625						I625			
Others						-			
<b>Displacer body Material</b>									
Carbon Steel (A105N/A106)							CS		
Stainless Steel 1.4301/1.4304 (SS 304/304L)							SS304		
Stainless Steel 1.4401/1.4404 (SS 316/316L)							SS316		
Monel 400							M400		
Inconel 625							I625		
Others							-		
<b>Displacer Orientation</b>									
Right-hand								RH	
Left-hand								LH	
<b>Transmitter Type/Model</b>									
EMERSON Fisher DLC3010									DLC3010
EMERSON Fisher DLC3100									DLC3100
EMERSON Fisher DLC3100 SIS									DLC3100 SIS
EMERSON Fisher DLC3020F									DLC3020F
Other									-

<b>Vent</b>		
Thread + plug	VN1	
Thread + block valve	VN2	
Flange	VN3	
Flange + blind	VN4	
Other	-	
<b>Drain</b>		
Thread + plug		DR1
Thread + block valve		DR2
Flange		DR3
Flange + blind		DR4
Other		-
<b>Option(s)</b>		
Transmitter Insulator/Shield		INS
Transmitter Sun-Shade		SUN
Tag/Name plate in 1.4301		TAG
Metal cable glands		GLD
Additional field indicator (ABB DJF200)		FIN
Stilling well (only applicable with Chamber type "TM")		STL
MTC type 3.1 as per EN10204		RP1
Hydro-Pressure test on pressure parts		RP2
NDT (VT & PT) report for pressure parts (on weld seams)		RP3
5-Point Calibration report		RP4
PMI (positive material identification) + report		RP5
Other		-

Order code example:

EMKO DLT-SS-1500-NPS 2-300#-RF-SS316-SS316-RH-DLC3010-VN1-DR1-SUN-TTAG-RP1-RP5

Specification	Code	Description
Chamber Type	SS	External Cage, Side-Side
Centre-Centre distance (C-C) mm	1500	1500 mm
Process Connection Size	NPS 2	ASME B16.5, NPS 2
Process Connection Rating	300#	ASME B16.5, Class 300
Process Connection Face	RF	ASME B16.5, RF
Chamber/Process Connection Material	SS316	Stainless Steel 1.4401/1.4404 (SS 316/316L)
Displacer body Material	SS316	Stainless Steel 1.4401/1.4404 (SS 316/316L)
Displacer Orientation	RH	Right-hand
Transmitter Type/Model	DLC3010	EMERSON Fisher DLC3010
Vent	VN1	Thread + plug (1/2 NPT)
Drain	DR1	Thread + plug (1/2 NPT)
Option(s)	SUN	Transmitter Sun-Shade
	TAG	Tag/Name plate in 1.4301
	RP1	MTC type 3.1 as per EN10204
	RP5	5-Point Calibration report



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