Pressure level transmitter

Huba Control

Level sensing relative and absolute pressure transmitter

Type 713

The pressure level transmitter type 713 is used for continuous fluid level measurement of ground and drinking water. The compact design allows the transmitter to be used in applications with restricted access as small as ¾ inch i.d. pipe.
As well as a current output the pressure level transmitter type 713 has been enhanced with energy efficient ratiometric and digital outputs making it ideal for battery powered applications.
The pressure level sensor 713 is based upon the well proven ceramic technology developed by Huba Control over 20 years ago.

Pressure range

0 ... 0.6 - 16 bar

- + Ceramic sensor Al_2O_3 99.6%
- + Continuous level measurement
- + Suitable for drinking water
- + Available with integrated temperature measurement
- + Applicable in ¾ inch pipes
- + Excellent linearity and long term stability

Technical overview

Pressure range

Relative	0 ... 0.6 - 16 bar
Absolute	0.8 ... 1.4 - 6 bar

Operating conditions

Medium		Groundwater
		Drinking water (with EPDM O-ring)
Temperature	Medium and ambient [1]	-20 ... +80 °C
	Storage	-40 ... +80 °C
Overload		acc. order code selection table

Materials in contact with medium

Case	Stainless steel 1.4404 / AISI 316L
Sensor	Ceramic Al_2O_3 (99.6%)
Cable	PE-HD
Protection cover	PPE
Sealing material	FPM, EPDM (for drinking water)

Electrical overview

			Outout	Power supply	Load	Current consumption
Analogue	2 wire		4 ... 20 mA	10 ... 30 VDC	< $\frac{\text{power supply} - 10\,V}{0.02\,A}$ [Ohm]	< 23 mA
	3 wire		ratiom. 10 ... 90%	5 VDC ±10%	> 10 kOhm / < 100 nF	< 3 mA
	4 wire	Pressure	ratiom. 10 ... 90%	5 VDC ±10%	> 10 kOhm / < 100 nF	< 3 mA
	(with temperature)	Temperature	acc. page 5	5 VDC ±10%	> 1 MOhm / < 100 nF	< 3 mA
Digital [2]	3 wire	Pressure	3000 ... 11000 Digits	5 VDC ±10%		< 3 mA
(one wire interface)	(with temperature)	Temperature	acc. page 5	5 VDC ±10%		< 3 mA
Polarity reversal protection	Short circuit proof and protected against polarity reversal.					
Overvoltage protection				4 ... 20 mA / 0 ... 10 V	36 VDC	
				ratiom. 10 ... 90 %	6 VDC	
Electric strength towards case					500 VDC	

Dynamic response

Response time	< 2 ms

Runtime

Time starts at the moment of application of minimal supply voltage	< 10 ms

Electrical connection	Protection standard	Protection class
Cable PE-HD 2 ... 175 m [3]	IP 68	III

Test / Admissions

Electromagnetic compatibility	CE-conform acc. to EN 61326-2-3
Drinking water verification certificate for plastic parts	UBA guidance (KTW and elastomer)
	DVGW process sheet W270
Drinking water approval	ACS
	WRAS
EAC	
UL	ANSI/UL 61010-1 acc. E325110
Shock acc. IEC 60068-2-27	25 g, 6 ms, half sine wave, all 3 directions
Vibration nach IEC 60068-2-6	1 g, 2 ... 2000 Hz with amplitude ±15 mm, 1 Octave/min. all 3 directions

Weight

Without cable	~ 120 g

Packaging

Single packaging	
Multiple packaging	

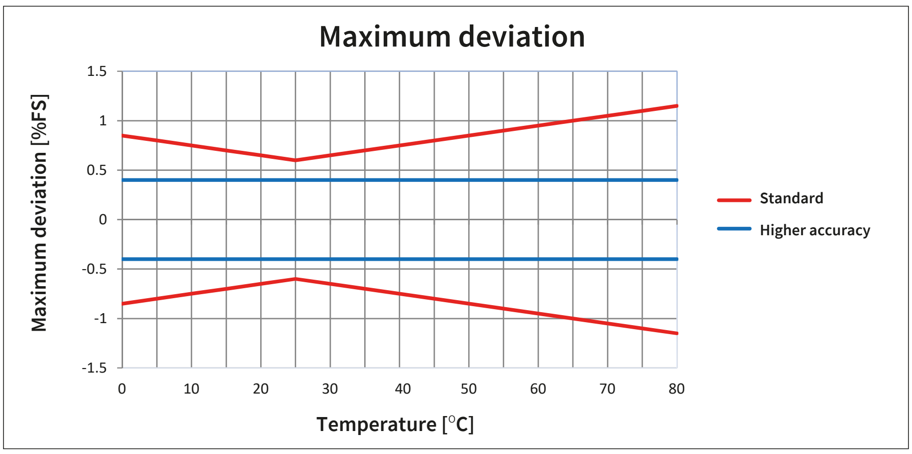
Accuracy

Standard

Parameter		Unit	
Max. deviation at 25 °C [4]		% fs	± 0.6
Resolution		% fs	0.1
Long term stability acc. IEC EN 60770-1	max.	% fs	± 0.25
Thermal characteristic [5]		% fs/10K	± 0.1

Higher accuracy

Parameter		Unit	
Max. deviation [4, 5]		% fs	± 0.4
Resolution		% fs	0.1
Long term stability acc. IEC EN 60770-1	max.	% fs	± 0.25



[1] non-congealing media [2] Application note one wire digital out [3] for digital output max. 60 m [4] incl. zero point, full scale, linearity, hysteresis and repeatability [5] at 0 ... +80 °C

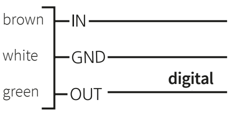
Order code selection table

				1	2	3	4	5	6	7	8	9	10	11
			713.	X	X	X	X	X	X	X	X	X	X	X
Pressure mode	Absolute			8										
	Relative			9										
	Absolute with higher accuracy			C										
	Relative with higher accuracy			D										
Pressure range [1] (relative in bar)		**overload**												
	0 … 0.6 bar	4.8 bar		9,D	1	0								
	0 … 1.0 bar	4.8 bar		9,D	1	1								
	0 … 1.6 bar	4.8 bar		9,D	1	2								
	0 … 2.5 bar	7.5 bar		9,D	1	4								
	0 … 4.0 bar	12.0 bar		9,D	1	5								
	0 … 6.0 bar	18.0 bar		9,D	1	7								
	0 … 10.0 bar	20.0 bar		9,D	3	0								
	0 … 16.0 bar	20.0 bar		9,D	3	1								
Pressure range [1] (absolute)	0.8 … 1.4 bar	4.8 bar		8,C	1	1								
	0.8 … 2.0 bar	6.0 bar		8,C	1	2								
	0.8 … 3.0 bar	9.0 bar		8,C	1	4								
	0.8 … 6.0 bar	18.0 bar	(without UL)	8,C	1	5								
Sealing material	FPM Fluoro-elastomer						0							
	EPDM Ethylene propylene (for drinking water)						1							
Outout / power supply	4 … 20 mA	10 … 30 VDC	2 wire (with housing connection)					0						
	ratiom. 10 … 90%	5 VDC ±10%	3 wire					1						
	ratiom. 10 … 90%	5 VDC ±10%	4 wire (with temperature)					2						
	3000 … 11000 Digits	5 VDC ±10%	3 wire (one wire interface, with temperature)					3						
Electrical connection [2]	Cable	2 m							0	0	1	1		
		3 m							0	1	1	1		
		5 m							0	2	1	1		
		7 m							0	3	1	1		
		10 m							0	4	1	1		
		15 m							0	5	1	1		
		20 m							0	6	1	1		
		25 m							0	7	1	1		
		30 m							0	8	1	1		
		40 m							0	9	1	1		
		50 m							1	0	1	1		
		60 m							1	1	1	1		
		70 m						0,1,2	1	2	1	1		
		80 m						0,1,2	1	3	1	1		
		90 m						0,1,2	1	4	1	1		
		100 m						0,1,2	1	5	1	1		
		125 m						0,1,2	1	6	1	1		
		150 m						0,1,2	1	7	1	1		
		175 m						0,1,2	1	8	1	1		
Admissions	without drinking water approval												0	
	with drinking water approval						1				1		1	
Pressure range variation (optional)	Indicate W and state range on order (e.g.: W 0 … +2 bar/OUT 4 … 20 mA)													W

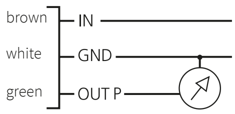
Electrical connections

The electronic GND is connected with a 1MΩ resistor to the level transmitter housing.

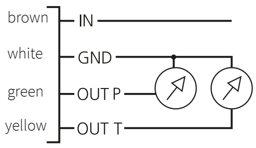
Digital (one wire interface)



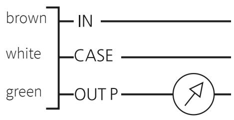
ratiom. 10 … 90%



ratiom. 10 … 90% with temperature



4 … 20 mA

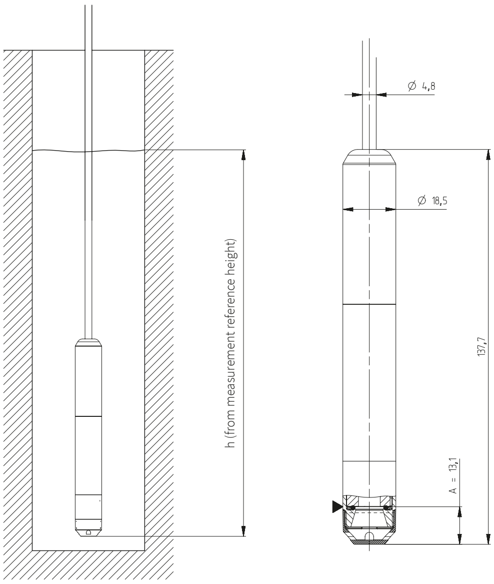


The case connection is connected with the level transmitter housing.

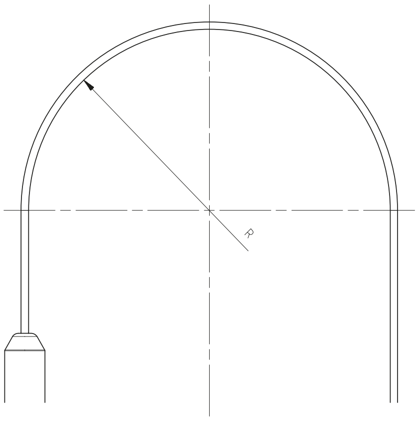
[1] Other pressure range on request

[2] Other cable length on request

Dimensions in mm / Electrical connections



h - Fluid level
▶ - Measurement reference height
A - Distance from protection cover to the position of measuring diaphragm



	Bend radius		
Cable material	fixed	flexible	**Temperature range for fixed installation**
PE	≥ 30 mm	≥ 50 mm	-40°C ... +80°C

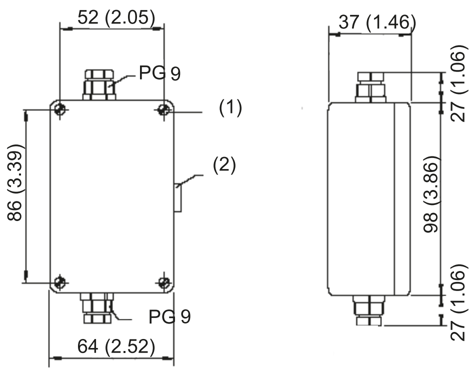
Important: The cable must NOT:

1. Be bent smaller than the bending radius.
   The individual wires on the inside are compressed, the individual wires on the outside are stretched and break off.
2. Be guided around sharp-edged corners.
   In addition to the risk of individual wires being torn off, there is also the risk of the isolation being worn through by e.g. vibration. Use cable bushings, corrugated pipes, edge protection, etc. to protect the cable when drilling holes.

Accessories *(supplied loose)*

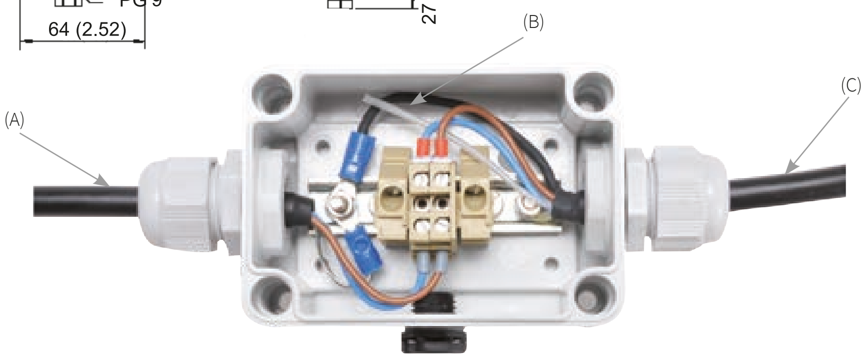
Accessories	Order number
Cable hanger	118026
Connection box (not suitable for output/feeding ratiometric with temp. (4-L))	118027
Humidity protection element (pack of 10)	118068
Calibration certificate	104551

Connection box

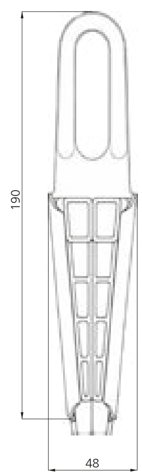


(1) Mounting hole
(2) Vent valve

(A) Measuring value process
(B) Vent pipe
(C) to the transmitter



Cable hanger



hot-dip galvanized steel –
PA6 glass fibre reinforced

Cable Ø 4.5 ... 6.5

Calculation of level

General level with relative pressure sensor: $h = \frac{\Delta p}{\rho \cdot g}$

General level with absolute pressure sensor: $h = \frac{P_{TS} - P_{Baro}}{\rho \cdot g}$

which $$P_{TS} = \frac{U_{TS} - U_{TS\_NP}}{U_{TS\_EW} - U_{TS\_NP}} \cdot (P_{TS\_EW} - P_{TS\_NP}) + P_{TS\_NP}$$

and $$P_{Baro} = \frac{U_{Baro} - U_{Baro\_NP}}{U_{Baro\_EW} - U_{Baro\_NP}} \cdot (P_{Baro\_EW} - P_{Baro\_NP}) + P_{Baro\_NP}$$

Using a second level sensor as barometric air pressure sensor

For level sensor with current output use nominal signal values for I_{TS} ... instead of variables U_{TS} ... (resp. I_{Baro} ... instead of U_{Baro} ...)

Simplification of formula for level sensor with ratiometric output:

$$P_{TS} = \frac{U_{TS} - 0.1 \cdot U_{IN}}{0.8 \cdot U_{IN}} \cdot (P_{TS\_EW} - P_{TS\_NP}) + P_{TS\_NP}$$

$$P_{Baro} = \frac{U_{Baro} - 0.1 \cdot U_{IN}}{0.8 \cdot U_{IN}} \cdot (P_{Baro\_EW} - P_{Baro\_NP}) + P_{Baro\_NP}$$

Using a second level sensor as barometric air pressure sensor

Legend:

h	level [m]	ρ	density of media [kg/m³]
		g	acceleration of fall 9.80665 [m/s²]
Δp	measured relative pressure [Pa]		
P_{TS}	measured pressure of level sensor [Pa]	U_{TS}	signal on level sensor output [V or mA]
P_{BARO}	measured pressure of barometer [Pa]	U_{BARO}	Signal on barometer output [V or mA]
P_{TS_NP}	minimal nominal pressure of level sensor [Pa]	U_{TS_NP}	minimal nominal signal of level sensor [V or mA]
P_{TS_EW}	maximum nominal pressure of level sensor [Pa]	U_{TS_EW}	maximum nominal signal of level sensor [V or mA]
P_{BARO_NP}	minimal nominal pressure of barometer [Pa]	U_{BARO_NP}	minimal nominal signal of barometer [V or mA]
P_{BARO_EW}	maximum nominal pressure of barometer [Pa]	U_{BARO_EW}	maximum nominal signal of barometer [V or mA]

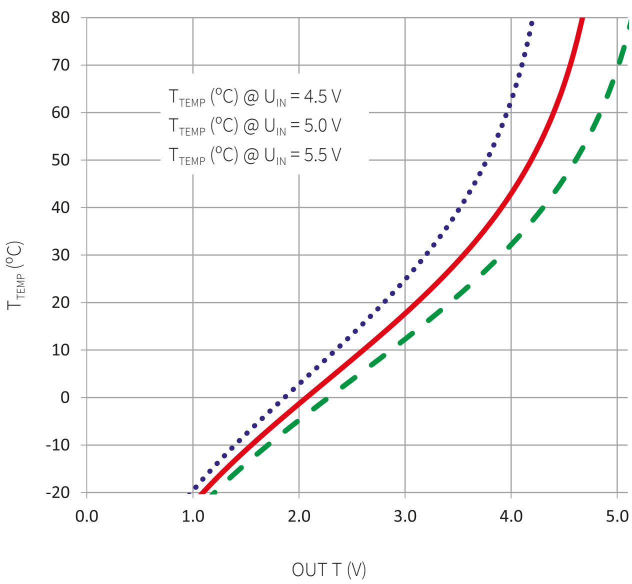
Specification temperature output

ratiom. 10 ... 90%

$$T_{TEMP} = T_0 + 1 \Big/ \left(a + b \cdot \ln\left(R \cdot \left[\frac{U_{IN}}{OUT\ T} - 1\right]\right) + c \cdot \ln\left(R \cdot \left[\frac{U_{IN}}{OUT\ T} - 1\right]\right)^3 \right)$$

T_{TEMP}	Sensor temperature [°C]	OUT T	sensor signal [V]
T_0	-273.15 [°C]	R	20›000 [Ω]
		U_{IN}	power supply 5V ±10%
a	0.001204001		
b	0.000208775		
c	0.000000294		

$T_{TEMP} = f(\text{OUT T})$

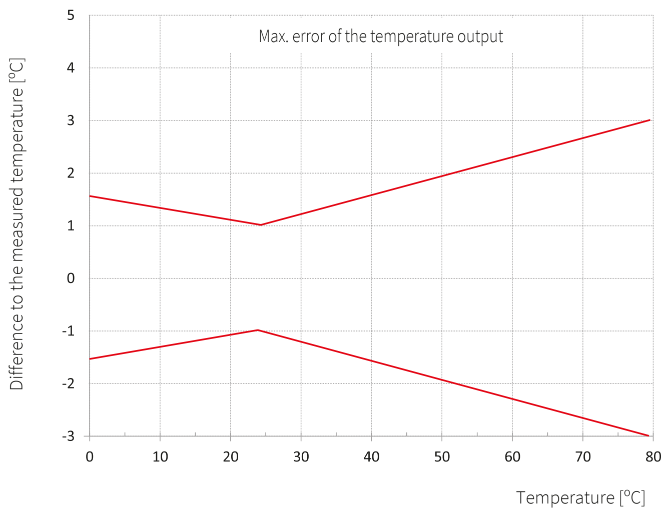


Digital

$$T_{TEMP} = \left(\frac{T_{Dig}}{255} \cdot 200°C\right) - 50°C$$

T_{TEMP}	Sensor temperature [°C]
T_{Dig}	digital value (0 ... 255 digits)

Max. error ±3 °C (bei 0 ... 80 °C)



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