

For liquids

# NIVOCAP

CAPACITIVE LEVEL TRANSMITTERS



LEVEL TRANSMITTERS

30 YEARS

LEVEL



OUR PROFESSION IS YOUR LEVEL

## NIVOCAP CAPACITIVE LEVEL TRANSMITTERS

### MAIN FEATURES

- Max. 20 m measurement range
- Vertical mounting
- Rod or cable probe versions
- $-30 \dots +200^\circ\text{C}$  medium temperature
- Max. 40 bar medium pressure
- 32-point linearization table
- Indirect assignment of 0% and 100%
- 4-20 mA + HART output
- Ex version
- IP67 protection

### APPLICATIONS

- Level and volume measurement
- Level measurement of conductive and non-conductive materials
- Level measurement of liquids
- For high pressure and high temperature mediums



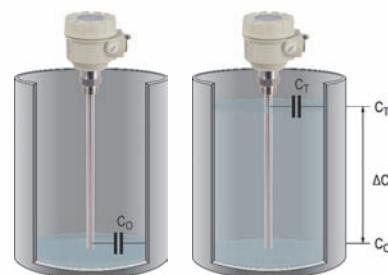
### GENERAL DESCRIPTION

NIVOCAP 2-wire capacitive level transmitters provide an ideal solution for level measurement of conductive or non-conductive liquids. The probe of the instrument and the reference probe (which can be either the metal wall of the tank or installed separately) operate as opposing plates of a capacitor. Between the plates of this capacitor the air is replaced by a medium with greater dielectric constant than the air during filling the tank, therefore the capacitance is changing directly proportional to the level. The incorporated electronic circuitry measures the capacitance difference and converts it to an output signal proportional to level.

### OPERATION, SETTING UP

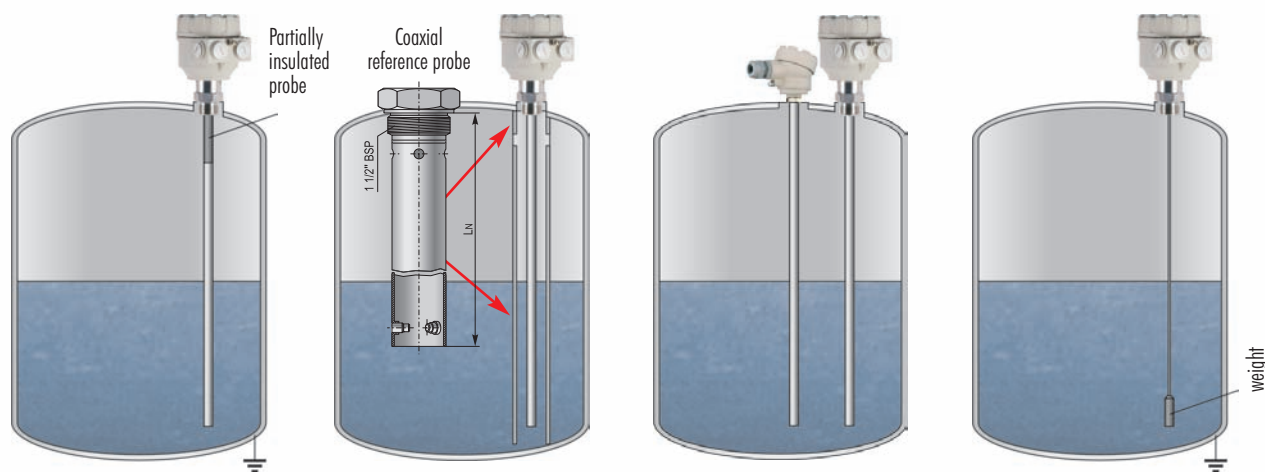
The plates of the capacitor are the probe and the reference probe (wall of the tank). The dielectric constant of the air is  $\epsilon_r = 1$ . The basic capacity of the probe mounted in empty tank is  $C_0$ , which depends on the relative dielectric constant of the air and the mounting position. During filling the capacitance between probe and reference will increase proportionally with the level and the  $\epsilon_r$  relative dielectric constant of the medium. The condition of an accurate level metering is that the change of capacity has to be proportional to the change in level. To comply with the above the probe and the referential probe have to be parallel, because capacity depends on the distance between the two plates. Best suited for the most accurate level measurement is the so called coaxial arrangement.

Setting up the NIVOCAP is easy. Using a simple technique the unit is to be "taught" the minimal (close to minimal) and maximal (close to maximal) levels. If fully filling and draining is inconvenient or not feasible, the teaching is possible at any odd levels with the help of indirect assignment feature.



$C_0$  = basic capacitance  
 $C_T$  = end capacitance  
 $\Delta C$  = capacitance change

### MEASUREMENT ARRANGEMENTS



#### Rod probe

Metal tank and non-conductive medium.  
 The rod probe is insulated partially at the process connection.

#### Rod probe

With coaxial tube reference probe

#### Rod probe

With reference rod probe


#### Cable probe with weight

Metal tank

## TECHNICAL DATA

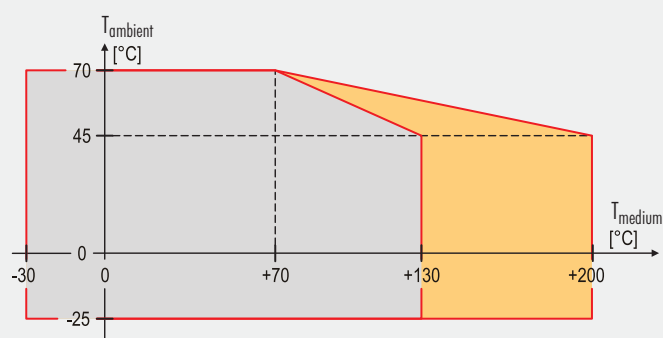
Version		Rod probe	High temp. rod probe	Cable probe
Measurement range ( $L_N$ )		0.2 – 3 m		1 – 20 m
Capacitance range		0 pF...5 nF		
Min. capacitance change		Max. ( $I_{out}$ ) SPAN: 10 pF or 10% FS then greater		
Saturation capacitance of the insulated probe		~600 pF/m		~200 pF/m
Relative dielectric constant		$\epsilon_r$ , min. 1.5		
Process connection		As per order codes		
Material of wetted parts	Threaded part	DIN 1.4571 stainless steel		
	Probe	Fully or partially PFA coated stainless steel (DIN 1.4301)		Fully FEP coated steel cable
Housing material		Paint coated aluminium or plastic (PBT)		
Medium temperature (see: temperature diagram)		-30°C ... +130 °C	-30°C ... +200 °C	-30°C ... +130 °C
Ambient temperature		See: temperature diagram		
Medium pressure		See: pressure diagram		
Power supply / consumption		12 - 36 V DC / max. 800 mW, overvoltage protection against transients		
Output data	Output signals	Analogue: 4...20 mA (3.9...20.5 mA) $R_{max} = U_I - 11.4 \text{ V} / 0.02 \text{ A}$ Error indication: 3.8 mA or 22 mA		
		Digital: HART		
		Display: SAP-202, 6-digit LCD, dimensions, bargraph		
		Current loop test: 10 mV/1 mA via resistor in series		
	Damping time	0, 3, 6 ... 300 sec selectable		
	Linearity error	$\pm 0.3\%$ FS		
		Temperature error		$\pm 0.02\%$ / °C FS
Electrical connection		2 x M20x1.5 plastic cable glands for cable Ø6-12 mm, Ex version: 2 x M20x1.5 steel cable glands for cable Ø7-13 mm, wire cross section: 0.5...1.5 mm <sup>2</sup> (shielded cable is recommended), 2 x NPT 1/2" internal thread for cable protective pipe		
Electrical connection		Class III.		
Ingress protection		IP67		
Mass		≈ 2.5 kg 0.5 m probe	≈ 3 kg 0.5 m probe	≈ 2 kg 3 m probe

## SPECIAL DATA FOR EX CERTIFIED MODELS

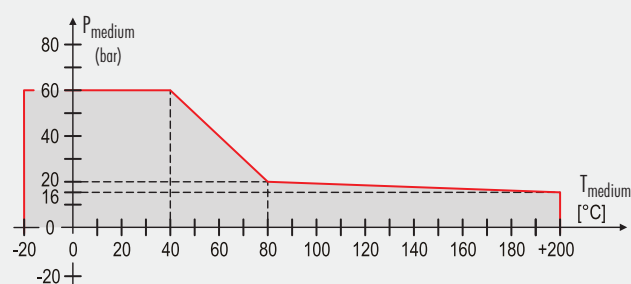
Protection type	ia
Ex marking	ATEX  II 1G EEx ia IIB T6
Intrinsically safe	$C_i \leq 15 \text{ nF}$ ; $L_i \leq 200 \mu\text{H}$ ; $U_i \leq 30 \text{ V}$ ; $I_i \leq 140 \text{ mA}$ ; $P_i \leq 1 \text{ W}$
Applicable Ex power supply (EEx ia approved)	$U_o < 30 \text{ V}$ ; $I_o < 140 \text{ mA}$ ; $P_o < 1 \text{ W}$
Temperature classification	T ambient: max. 70 °C; T medium: max. 80 °C

## TEMPERATURE AND PRESSURE DATA

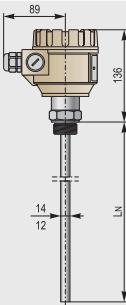
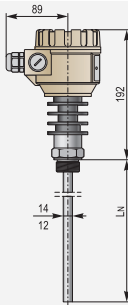
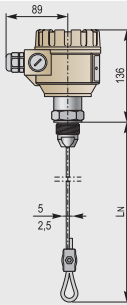
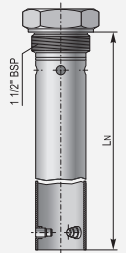
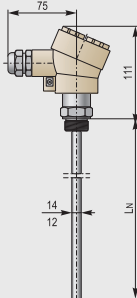
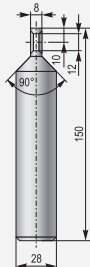
Temperature diagram



Pressure diagram



## DIMENSIONS

Rod probe	High temp. rod probe	Cable probe
		
Coaxial reference probe	Rod reference probe	Weight
		

## PROBE SELECTION

Consequences of the capacitive operation principle: Relative dielectric constant of the medium should be taken into consideration. Measurement will be accurate only in case of suitable probe and reference probe selection.

	Medium	
	Conductive	Non-conductive
Insulated probe, reference probe	■	■
Partially insulated probe, reference probe		■
Relative dielectric constant ( $\epsilon_r$ )		min. 1.5

	Reference probe		
	Rod	Coaxial	Tank
Conductive tank	■	■	■
Non-conductive tank	■	■	

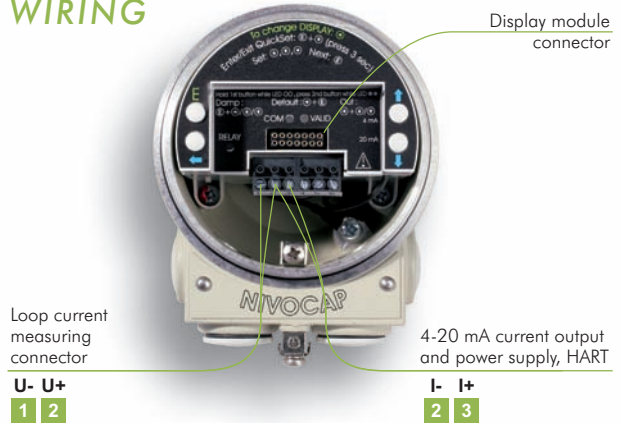
Informative $\epsilon_r$ values			
Air	1	Petrol	2.3
Liquid gases	1.2 – 1.7	Bitumen	2.6
Fuel oil	1.9 – 4	Motor-oil	2.6
Standard oils	2 – 4	Acids	4 – 6
Butanol	11	Glucose	30
Isopropyl alcohol	18	Glycerol	37
Ammonia	21	Water	80
Ethyl alcohol	24	Sulphuric acid (T=20°C)	84

## DISPLAY

Basic functions can be configured by the programming buttons. With the help of the **SAP-202** plug-in display a simplified programming can be accomplished which covers full parameter programming.

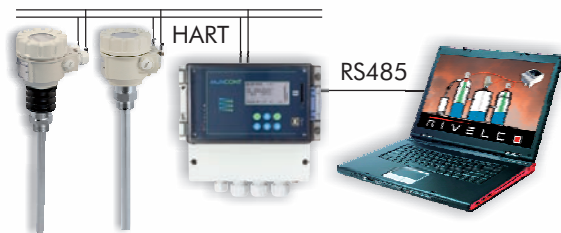


## WIRING



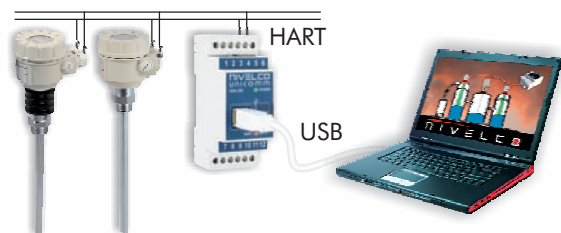
## NIVOCAP TRANSMITTERS IN A HART MULTIDROP LOOP

The **MultiCONT** can handle a max. of 15 HART capable (e.g. level, temperature, pressure, pH, dissolved oxygen, etc.) transmitters. The digital (HART) information is processed, displayed and if needed it can be transmitted via RS485 communication line to a PC. Remote programming of the transmitters is also possible. Visualisation on PC can be accomplished with **NIVISION** process visualisation software.



## NIVOCAP TRANSMITTERS IN SYSTEM WITH A PC

The instrument with HART output can be connected to a PC using a **UNICOMM** HART-USB modem. Max. 15 normal instruments can be connected to a HART line. Measured values can be visualised and/or the instruments can be programmed via digital HART communication. Applicable software: **EView** configuration software or **NIVISION** process visualization software.



## ORDER CODES (NOT ALL COMBINATIONS AVAILABLE)

### NIVOCAP capacitive level transmitters

NIVOCAP C ■ ■ - ■ ■ ■ - <sup>1</sup>

Type	Code
Transmitter	T
Transmitter + display	B
High temperature transmitter <sup>2</sup>	H
High temperature transmitter + display <sup>2</sup>	P

Housing	Code
Aluminium	2
Plastic	3

<sup>1</sup> The order code of an Ex version should end in „Ex“

<sup>2</sup> Not available in Ex version

<sup>3</sup> Special process connections are available on request, e.g.: TRICLAMP, sanitary

Probe				Code
Process connection <sup>3</sup>	1" BSP	Rod probe	fully insulated	R
			partially insulated	P
	1" NPT	Cable probe	fully insulated	K
			partially insulated	L
	1" NPT	Rod probe	fully insulated	A

Output / Ex	Code
4-20 mA	2
4-20 mA + HART	4
4-20 mA / Ex ia	6
4-20 mA + HART / Ex ia	8

Code	Probe length		Code
Rod			
0	0 m	0 m	0
1	1 m	0.1 m	1
2	2 m	0.2 m	2
3	3 m	0.3 m	3
		⋮	⋮
		0.9 m	9

Cable			
0	0 m	0 m	0
1	10 m	1 m	1
2	20 m	2 m	2
		3 m	3
		⋮	⋮
		9 m	9

## ACCESSORIES

### NIVOCAP reference probes for capacitive rod probes

NIVOCAP C ■ ■ - 1 ■ ■

Process connection	Code
1 ½" BSP	A
1 ½" NPT	D
1" BSP	F
1" NPT	E

Type	Code
Coaxial <sup>1</sup>	F
Rod, fully insulated <sup>2</sup>	R
Rod, partially insulated <sup>2</sup>	P

<sup>1</sup> Only with 1 ½" process connection

<sup>2</sup> Only with 1" process connection

Code	Probe length		Code
0	0 m	0 m	0
1	1 m	0.1 m	1
2	2 m	0.2 m	2
3	3 m	0.3 m	3
		⋮	⋮
		0.9 m	9

### FLANGES

MFT- ■ ■ ■ - ■

Standard / Material	Code
DIN/A38	1
DIN/1.4571	2
DIN/PP	3
DIN/A38+PTFE	4
ANSI/A38	5
ANSI/1.4571	6
ANSI/PP	7
ANSI/A38+PTFE	8

Size		Code
DIN	ANSI	
DN50	2"	0
DN65	2 ½"	1
DN80	3"	2
DN100	4"	3

Pressure	Code
PN16/150 psi	1
PN25/300 psi	2
PN40/600 psi	3

Instrument connection	Code
1" BSP	2
1" NPT	5
1 ½" BSP	7
1 ½" NPT	8

### Other accessories

MultiCONT P-200	Multichannel process controller
SAP-202	Plug-in display
UNICOMM SAT-304 / SAK-305	HART-USB / RS485 Modem
CTK-103-0M-400-01	Counterweight for cable probe