



NIVOCAP

CAPACITANCE LEVEL TRANSMITTERS



- ◆ Two-wire; HART feature
- ◆ Microcontroller based
- ◆ Rigid and flexible probes
- ◆ Plug-in field display module
- ◆ Simple programming
- ◆ Ex version available
- ◆ High temperature model
- ◆ HART communication

ABOUT THE NIVOCAP

Nivocap CT-200 series is a two wire level transmitter working on the capacitance measuring principle.

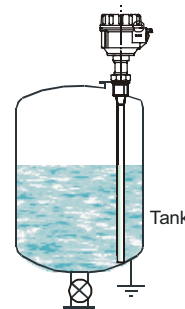
The active probe of the unit and the conductive wall of the vessel (or a reference probe if the wall is not conductive) make up the plates of a capacitor. Insulator of the probe, surrounding air or the material in the tank provide the dielectric material.

If the tank is empty the basic capacitance is C_0 while the dielectric coefficient " ϵ_r " of the air is 0. If the air will be replaced by material with higher dielectric constant than that of the air, the capacitance will be changed, i.e. capacitance will increase with rising material. This change of the sensed capacitance converted to output signal will be proportional to the level change.

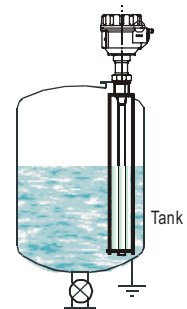
The complete series consists of three model groups with rod (0.2 m ... 3 m range), light and heavy cable probes (1 m ... 20 m range) available with or without insulator, offered in ordinary and Ex version. Units with rod and light cable probes also have high temperature design.

The microcontroller based electronics can be programmed by push buttons on the front panel of the unit or remotely from a PC through HART interface. Using the plug in display module facilitates programming and provides for local display of the measured values.

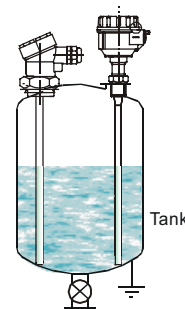
MEASUREMENT ARRANGEMENTS



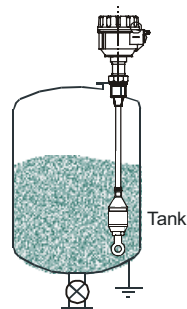
Rod probe in a vessel with conductive wall



Rod probe with coaxial reference probe




Rod probe with reference rod



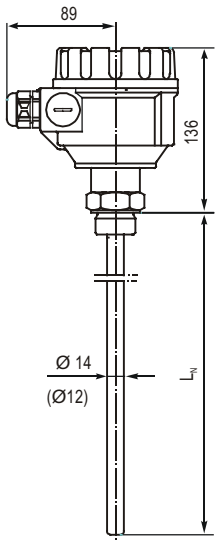
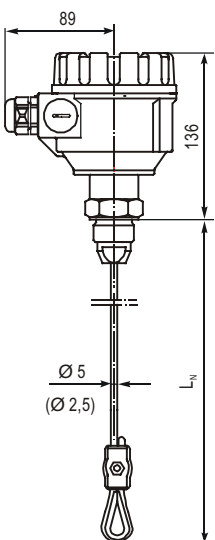
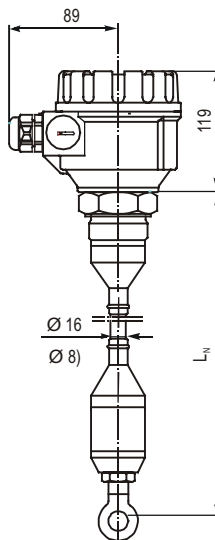
Cable probe with weight in a conductive vessel

TECHNICAL DATA

TYPE		ROD PROBE CTR-2□□-□	CABLE PROBES CTK-2□□-□	HEAVY DUTY CABLE PROBES CTN-2□□-□
Range		0.2 ... 3 m	1 ... 20 m	
Material of wetted parts	Process connection	Stainless steel (DIN 1.4571)		
	Probe	Partly or fully PFA coated steel St. St. DIN 1.4301	Partly or fully FEP coated steel cable	Partly or fully PE coated steel cable
Housing material		Aluminum casting or plastic (PBT glass fibre reinforced, flame retardant)		
Medium temperature*		- 30 °C... + 200 °C		-25 °C ... + 80 °C
Medium pressure*		max. 4 MPa (40 bar) +20°C		16 bar
Ambient temperature*		-25 °C ... + 70 °C		
Mechanical strength		-	7.7 kN	45 kN
Saturation capacitance of the coated probe		~600 pF/m	~200 pF/m	~600 pF/m
Output		4 ... 20 mA, two wire (3,9 ... 20,5 mA)		
Voltage output for checking output current		Voltage measurement on a serial resistor: 1 mV / 1 mA		
Digital communication		HART**		
Display (on plug in module SAP-202**)		6 digits, 7 mm size LCD		
Measurement range		0 pF ... 5 nF		
Minimum transmittance range of capacitance (min. SPAN)		10 pF, or 10%		
Damping		3 s, 10 s or 60 s		
Fault indication		By blinking of the COM and the VALID LEDs and by change of the output current to 3.8 mA or to 22 mA (selectable)		
Transmitter voltage/power supply		12 ... 36 V DC max. 22 mA / 48 ... 800 mW		
Load resistance (max.)		$R_{tmax} = \frac{U_t - 12 V}{0,02 A}$ Where U_t is the supply voltage. (For HART interface $R_{tmin.}$ 250 Ohm)		
Accuracy		± 0.3 %		
Temperature coefficient		± 0.02% / °C		
Electrical connection		Pg 16 or M 20 x 1.5 for cables Ø 8 mm ... Ø 15 mm, or Ø 6 mm ... 12 mm, in Ex version for cables Ø 9.5 mm ... Ø 10 mm		
Process connection		1", 1 1/2" NPT or BSP		1 1/2" NPT or BSP
Ingress Protection		IP 67		
Electrical protection	Normal version	Class III		
	Ex version, ATEX	Limited overload power circuit Ex protection mark:  II 1G EEx ia IIB T6 Ex power supply: $U_{max} = 30 V$ $I_{max} = 80 mA$ $P_{max} = 0.8 W$		
Mass		2.3 kg with 0.5 m probe	1.9 kg with 3 m probe	4.5 kg with 3 m probe

* See derating diagrams and temp. classification chart ** Under development

DIMENSIONS

ROD PROBE CTR-2□□-□	LIGHT CABLE PROBE CTK-2□□-□	HEAVY DUTY CABLE PROBE CTN-2□□-□
		

APPLICATION – SELECTION

NIVOCAP CT-200 capacitance transmitters can be used for level measuring of conductive and non conductive liquids both in general purpose and hazardous locations as well as of solids whether free flowing or lumpy.

If the medium is conductive the dielectric constant is indifferent. Non conductive materials can be measured if the relative dielectric constant (ϵ_r) is over 1.5.

For selection of NIVOCAP transmitter the following should be considered

- Range needed (0,2 ... 3 m or 1 m ... 20 m)
- Details of application such as conductivity, temperature, pressure, ϵ_r , chemical aggressiveness, viscosity are to be cleared
 - Position of the tank (horizontal, vertical)
 - Shape of the tank (cylindrical, irregular)

Conductive mediums such as water, acids, alkalis, water solutions etc.

- Insulated probes must be used
- Value of the dielectric constant is indifferent

Non-conductive mediums such as oil products and solvents

- Probes with and without insulation can be used. The capacitance change as a consequence of the change of the level depends on the following:
 - distance between the active probe and the tank wall (assuming it is conductive) resp. the reference rod
 - dielectric constant of the medium
 - shape, dimension and distance of the reference probe
- Reference probe must be used if the tank wall is not conductive
- Reference probe must be parallel to the active probe

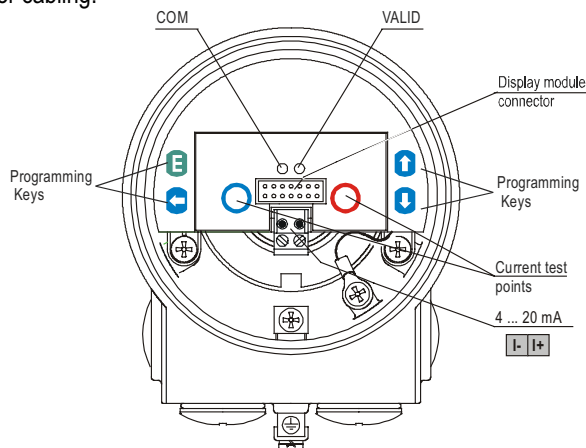
In order to increase capacitance between the active probe and the conductive wall or between the active probe and the reference rod should be as small as possible and must not exceed 500 mm.

Minimum probe length required

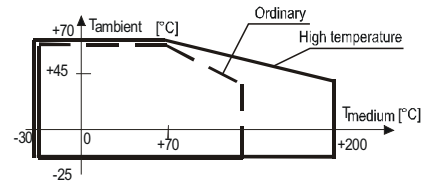
- 0.1 m for conductive mediums
- 0.2 m for non-conductive mediums (depending on ϵ_r and with coaxial reference probe)

INSTALLATION, WIRING

The unit should be installed vertically by screwing in the threaded process connection. The bottom end of the cable probes is suggested to be fixed by weight or should be fastened to the tank. Grounding terminals are provided both outside an inside of the unit. Shielded cables are recommended for cabling.

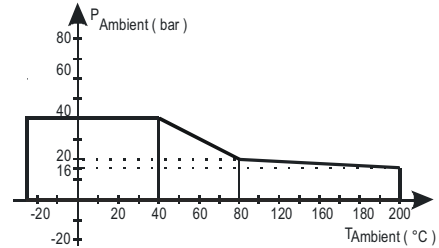


DERATING DIAGRAM



If the ambient temperature is higher than +45 °C the medium temperature should not exceed values as above

PRESSURE



EXPLOSION PROTECTION

Explosion proof models are ATEX II 1G EEx ia IIB T6 certified.

Conditions for application of the EEx ia models:

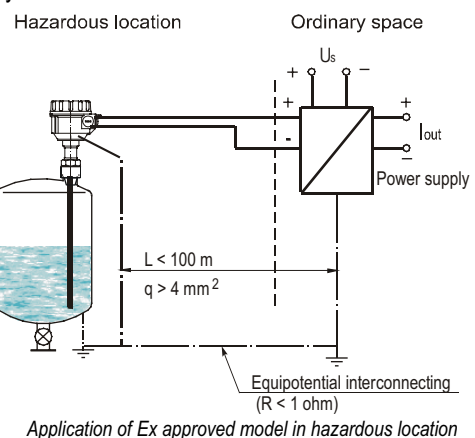
Temperature classification chart

Temperature class	T6
T _{ambient max.}	70
T _{medium max.}	80

Both the tank and the capacitance transmitter should be interconnected with the EP network.

Since the plastic coating of the cable probe can be charged statically therefore

- Units can only be used for conductive materials with a specific resistance not exceeding $10^4 \Omega m$ even at the most unfavorable places and under the most unfavorable conditions.
 - The circuitry of the electronics has to be grounded
 - Tank, transmitter and power supply should be interconnected to the equipotential network. This interconnection cable should be of Cu with cross section of $q > 4 \text{ mm}^2$
- Distance between the level transmitter and the EEx ia power supply located in non-hazardous area must not exceed 100 m.

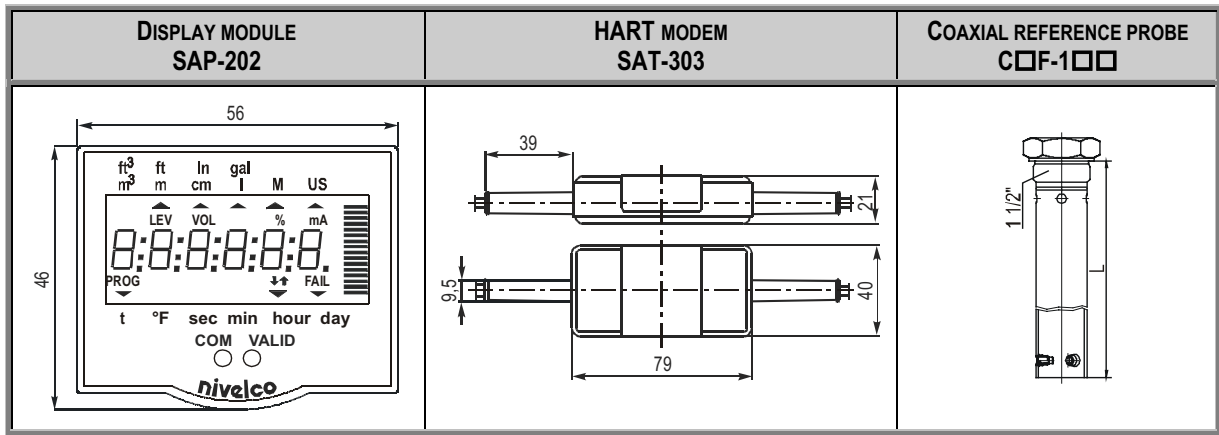


PROGRAMMING

NIVOCAP CT-200 level transmitter should be adjusted to the given application by programming with or without plug in display module with push buttons, or remotely through HART protocol by:

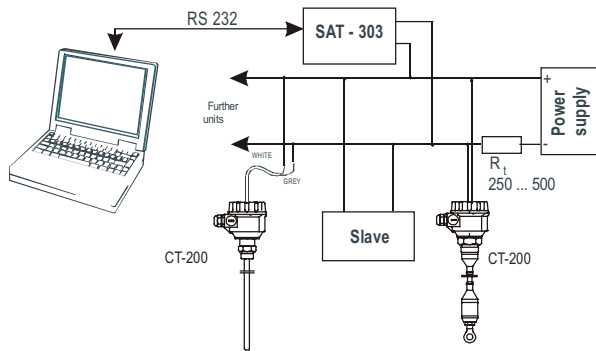
- Assigning minimum level to 4 mA output current
- Assigning maximum level to 20 mA output current
- Selecting fault indication by current output.
- Selecting damping time

ACCESSORIES



HART MODEM SAT-303

ARRANGEMENT



TECHNICAL DATA

Ambient temperature	-25 °C ... +50 °C
Housing material	Polystyrol
Connection to PC	DB-9 – RS232
Cable length to PC	0,2 m
Connection to the HART field	KLEPS 2
Cable to the HART field	0,6 m (1.1 m)
Ingress protection	IP 20
Electrical protection	III
Mass	0.1 kg

ORDER CODES (NOT ALL COMBINATIONS ARE POSSIBLE)

NIVOCAP C - -

FUNCTION	CODE	PROBE / PROCESS CONNECTION	CODE	HOUSING MATERIAL	CODE	INSERTION LENGTH			OUTPUT / EX	CODE	
						CODE	ROD	CODE			
Transmitter	T	Rod / insulated 1" BSP	R	Alu. housing	2	0	0 m	0 m	0	4 ... 20 mA / ordinary	2
Transmitter + SAP-202 display	B	Rod / uninsul. 1" BSP	P	Plastic housing	3	1	1 m	0.1	1	4 ... 20 mA + HART / ordin.	4
Transmitter high temperature	H	Cable / insul. 1" BSP	K			2	2 m	:	:	4 ... 20 mA / Ex	6
Transmitter high temperature + SAP-202 display	P	Cable / uninsul. 1" BSP	L			3	3 m	0.9 m	9	4 ... 20 mA + HART / Ex	8
		Cable / insul. 1 1/2" BSP	N			CABLE					
		Rod / insulated 1" NPT	A			0	0 m	0 m	0		
		Rod / uninsul. 1" NPT	C			1	10 m	1 m	1		
		Cable / insul. 1" NPT	E			2	20 m	:	:		
		Cable / uninsul. 1" NPT	G								
		Cable / insul. 1 1/2" NPT	J					9 m	9		

The order code of an Ex version instrument ends with an "Ex"

ACCESSORIES

HART MODEM SAT-303
DISPLAY SAP-202
WEIGHT cable probe CTK-103-0M-400-01
WEIGHT heavy duty cable probe CTN-103-0M-400-00

COAXIAL REFERENCE PROBE NIVOCAP C F - 1 - 0

PROCESS CONNECTION	CODE	INSERTION LENGTH			
		CODE	ROD	CODE	
BSP	A	0	0 m	0 m	0
NPT	D	1	1 m	0.1 m	1
		2	2 m	:	:
		3	3 m	:	:
				0.9 m	9

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