

# NIVOCAP

## CAPACITANCE LEVEL TRANSMITTERS



- ◆ Two-wire level transmitter
- ◆ 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 based 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. The Insulator of the probe, the 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," 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 medium. 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 probes also have high temperature design.

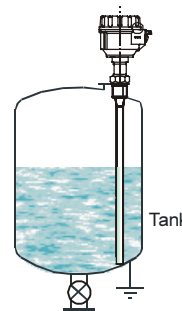
Output: 4 ... 20mA.

Digital communication: using HART modem.

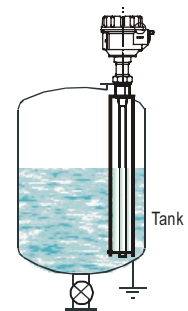
Local display: Plug-in LCD display.

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.

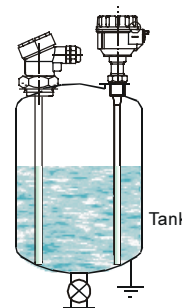
### MEASUREMENT ARRANGEMENTS



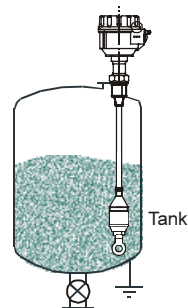
*Rod probe in a vessel with conductive wall*



*Rod probe with coaxial reference probe*




*Rod probe with reference rod*

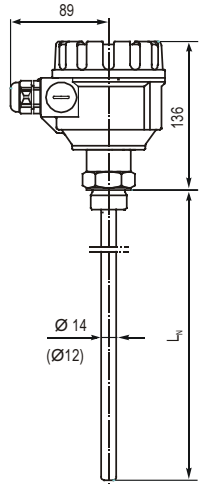
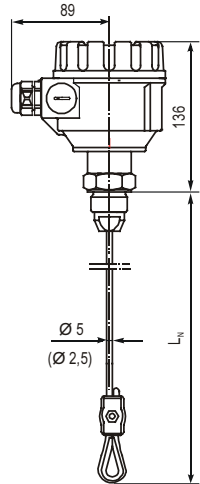
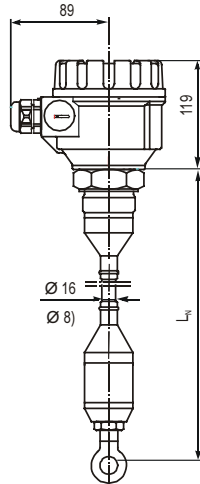
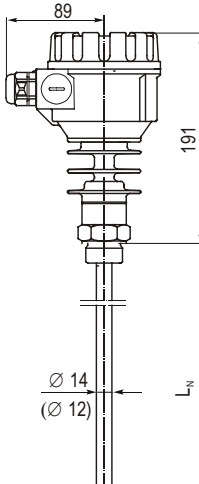


*Cable probe with weight in a conductive vessel*

# 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	St.St. DIN 1.4571		
	Probe	Fully or partially PFA coated St. St. (DIN 1.4301)	Fully or partially FEP coated St. St. cable	PE coated steel cable
Enclosure material		Aluminium casting, Plastic (PBT), glass fibre reinforced (PBT)		
Medium temperature (See: temp. diagram)		standard: -30°C ... +130°C, high temp ver.: -30°C ... +200°C	-30 °C ... +80 °C	
Pressure (See pressure diagram)		Max. 4 MPa (40 bar) +20 °C	maximum 1.6 MPa (16 bar)	
Ambient temperature (See temp. diagram)		-25 °C ... +70 °C		
Maximum tensile load		-	7.7 kN	45 kN
Saturation capacitance of the probe		~600 pF/m	~200 pF/m	~600 pF/m
Output		Analogue: 4 ... 20 mA. 2-wire (3.9 ... 20.5 mA), $R_{max} = U_t - 11.4 V / 0.02A$ , galvanically isolated, protection against power supply transient		
		Output voltage of test connection for loop current: 1mV / 1mA, via resistors in series		
		SAP-202 display module: 6-digit LCD, engineering units and bargraph		
		HART feature, Terminal resistor $\geq 250$ ohm		
Electric connection		M20x1.5 plastic cable gland for $\varnothing 6$ ... $\varnothing 12$ mm cables or M20x1.5 metal cable gland for $\varnothing 7$ ... $\varnothing 13$ mm cables. Wire cross section: 0.5 ... 1.5 mm <sup>2</sup> , 2 x 1/2" NPT thread cable protection tube		
Capacitance range		0 pF ... 5 nF		
Minimum transmitted capacitance (min. SPAN)		10 pF, or 10% (min. SPAN)		
Damping		0, 3, 6, 10, 30, 60, 100, 300 s		
Fault indication		Blinking of COM and VALID LED and transmitting 3.8 or 22 mA fault indication current selected by programming		
Power supply / current consumption		12 ... 36 V DC, maximum 22 mA / 48 ... 800 mW		
Accuracy		$\pm 0.3$ % of the probe length		
Temperature coefficient		$\pm 0.02\%$ / °C		
Relative Dielectric Constant		$\epsilon_{rmin} : 1.5$		
Ingress protection		IP 67		
Electric protection		Class III		
Explosion proof protection		ATEX  II 1 G EEx ia IIB T6		
Intrinsic safety limits		$C \leq 15$ nF, $L \leq 200$ $\mu$ H $U_{max}: 30$ V $I_{max}: 140$ mA $P_{max}: 1,0$ W		
Mass		2.3 kg with 0.5 m probe	1.9 kg with 3 m probe	4.5 kg with 3 m probe

## DIMENSIONS

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

# APPLICATION – SELECTION

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

If the medium is conductive the dielectric constant does not affect the measurement. Non conductive materials can be measured if the relative dielectric constant ( $\epsilon_r$ ) is over 1.5.

**For selection of NIVOCAP transmitter the following should be considered:**

- Range needed (0,2 ... 3 m or 1m ... 20 m)
- Details of application such as conductivity, temperature, pressure,  $\epsilon_r$ , chemical aggressiveness, viscosity
  - Orientation of the tank (horizontal, vertical)
  - Shape of the tank (cylindrical, irregular)

**In the case of conductive mediums such as water, acids, alkalis, water solutions etc.**

- Insulated probes must be used
- The value of the dielectric constant of the medium does not affect the measurement.
- Reference probe must be used if the tank wall is not conductive
- Reference probe must be parallel to the active probe

**In the case of 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)
  - dielectric constant of the medium
  - shape, dimensions and distance of the reference probe

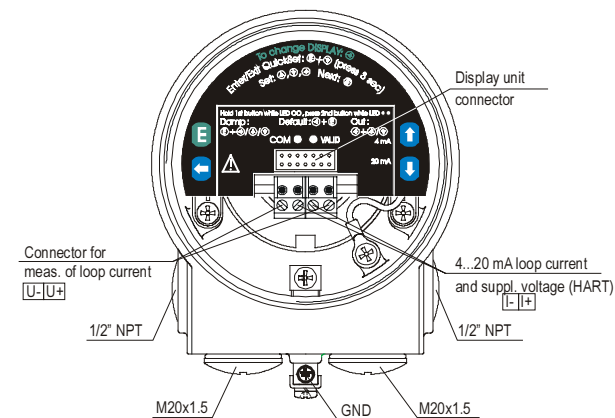
In order to increase capacitance the maximum distance between the active probe and the conductive wall or between the active probe and the reference rod must not exceed 500mm.

**Minimum range (probe length) required**

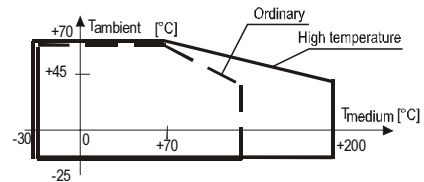
- 0.1 m for conductive mediums
- 0.2 m for non-conductive mediums (depending on  $\epsilon_r$  and with coaxial reference probe)

# INSTALLATION, WIRING

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

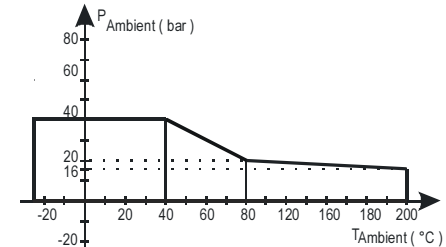


# TEMPERATURE DIAGRAM



If the ambient temperature is higher than +45°C the medium temperature can be less than the nominal temperature.

# PRESSURE



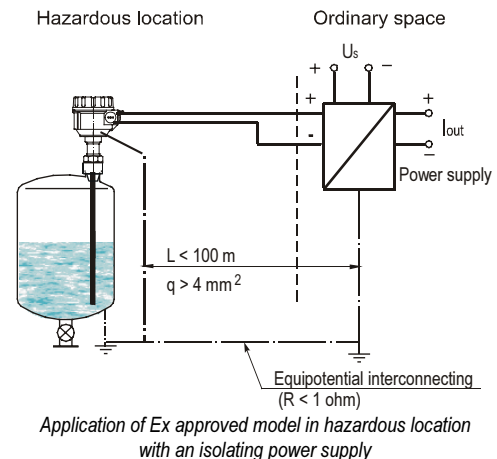
# EXPLOSION PROTECTION

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

Temperature classification chart	
Temperature class	T6
$T_{ambient}$ max.	70°C
$T_{medium}$ max.	80°C

**Conditions for application of the EEx ia models:**

- Both the tank and the capacitance transmitter should be connected into the EP network using a  $q \geq 4 \text{ mm}^2$  Cu cable.
- Since the plastic coating of the cable probe can be charged statically
  - Units can only be used with conductive materials having a relative resistance not exceeding  $10^4 \Omega \text{m}$  under the most unfavorable conditions.
  - The circuit of the electronics has to be grounded. The tank, the transmitter and the power supply should be connected to an equipotential network.
  - The distance between the level transmitter and the EEx ia power supply located in non-hazardous area must not exceed 100 m.

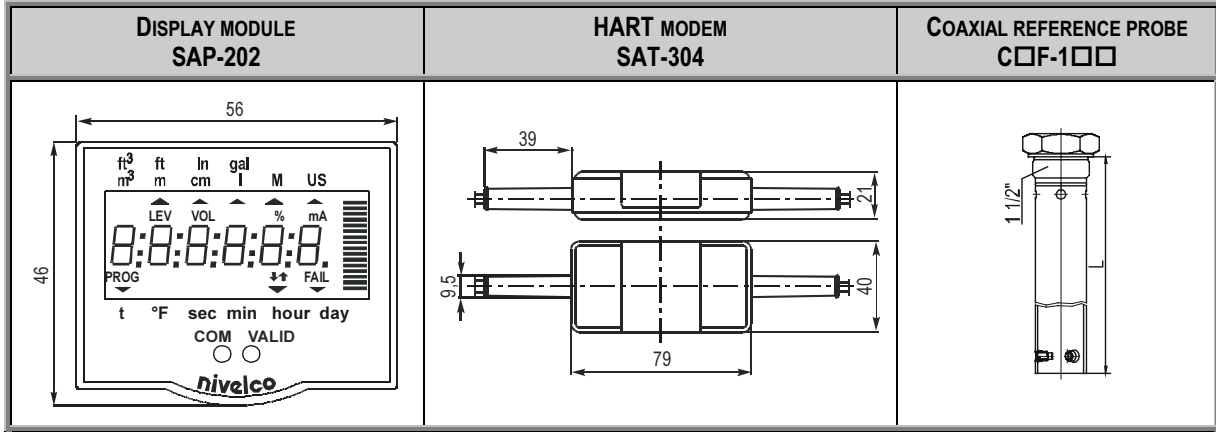


# PROGRAMMING

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:

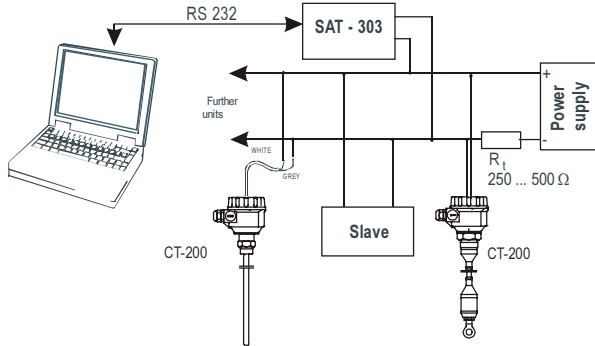
- Assigning minimum level to 4 mA output current
- Assigning maximum level to 20 mA output current
- Selecting fault indication by current output.
- Selecting damping time

# ACCESSORIES



## HART MODEM SAT-303

### ARRANGEMENT



## TECHNICAL DATA

Ambient temperature	-25 °C ... +55 °C
Housing material	Polystyrol
Connection to PC	USB
Cable length to PC	1,8 m
Connection to the HART field	KLEPS 2
Spiral 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
Transmitter	T
Transmitter + SAP-202 display	B
Transmitter high temperature	H
Transmitter high temperature + SAP-202 display	P

PROBE / PROCESS CONNECTION	CODE
Rod / insulated 1" BSP	R
Rod / uninsul. 1" BSP	P
Cable / insul. 1" BSP	K
Cable / uninsul. 1" BSP	L
Heavy Duty Cable / insul. 1 1/2" BSP	N
Rod / insulated 1" NPT	A
Rod / uninsul. 1" NPT	C
Cable / insul. 1" NPT	E
Cable / uninsul. 1" NPT	G
Heavy Duty Cable / insul. 1 1/2" NPT	J

HOUSING MATERIAL	CODE
Alu. Housing	2
Plastic housing	3

INSERTION LENGTH			
CODE	ROD	ROD	CODE
0	0 m	0 m	0
1	1 m	0.1 m	1
2	2 m	:	:
3	3 m	0.9 m	9

OUTPUT / EX	CODE
4 ... 20 mA	2
4 ... 20 mA + HART	4
4 ... 20 mA / Ex	6
4 ... 20 mA + HART / Ex	8

CABLE			
CODE	ROD	ROD	CODE
0	0 m	0 m	0
1	10 m	1 m	1
2	20 m	:	:
		9 m	9

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

## ACCESSORIES

**HART MODEM** SAT-304  
**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	B	1	1 m	0.1 m	1
		2	2 m	:	:
		3	3 m	:	:
				0.9 m	9