

CONDUCTIVITY ANALYZERS

Conductivity analyzers for liquid **C-31xx** series (analyzers) are designed for use in various industries as salinity meters and concentration meters. Analyzers can also be used to determine the quality of pure and ultra-pure water in water treatment systems in the power, electronic, pharmaceutical, food processing and other industries. A special group of analyzers is designed for use in nuclear power plants (NPP) and nuclear industry facilities.

In terms of structural composition the analyzers are divided into:

- analyzers, consisting of an "active" primary transducer (PT) and a measuring instrument (MI). An "active" PT consists of an electrical conductivity sensor and the primary transducer electronic unit. In this case, the PT can be installed to considerable distances of several hundred meters from the MI;
- analyzers, consisting of a "passive" PT and measuring instrument (MI). This design of the "passive" PT doesn't have any electronic unit and features in fact an electrical conductivity sensor and can be placed at a distance of only several meters from the MI;
- transmitters "active" PT without measuring device.

ANALYZERS WITH PASSIVE PRIMARY TRANSDUCERS (SENSORS)

C-3102 is a low cost device, designed for systems that do not require high accuracy of measurement, for example, potable water treatment systems. **C-3102** sensor is of a compact design and can be easily installed into pipes by means of lugs. Measuring unit provides indication of the measured parameters: specific electrical conductivity (SEC) and temperature, generation of an output signal proportional to the SEC and signaling the measured volumes over-ranging set-points.



C-3122.x.P The instrument is a two-channel liquid analyzer with electrical conductivity contact sensors and has all the functional parameters necessary for up-to-date analyzer: a large measuring range, analog and digital output signals, liquid flow measurement and display function, graphical display and a built-in high-capacity archive. Analyzers have several versions, differing in design and functional specifications.



The main purpose of the analyzer **C-3122.x.P** is the use at heating power plants, water and wastewater plants, CIP-washing mashines, where is needed determinate a boundry of medium (environment) limits. CIP-washing mashines, where is necessary to determine the bounds of liquids (water - washing solutions). Conductivity can be used together with the hydraulic panel and be applied at the power industry enterprises.

C-3122.x.P.I An analyzer that has the same specifications as the previous example, two-channel, designed for SEC (Specific Electrical Conductivity) high values measurement by using proximity inductive transducer. The inductive sensors design requires their use in corrosive and soiled liquids. The analyzers is designed for use as a concentration meters of water solutions of acids, alcals and salts.



CONDUCTIVITY TRANSMITTERS

C-3110 and **C-3130**-conductivity transmitters are powered by the DC voltage (12...36) V and provide standard output signals of DC torque output or interface RS-485 with ModBus protocol. Transmitters shall be installed directly on a controlled facility: a pipe or a tank.



Transmitter **C-3110** is provided with a probe transducer and is used to measure SEC of small concentrations of dissolved solids, salts, alclis and may be used to measure ultra-pure water SEC.



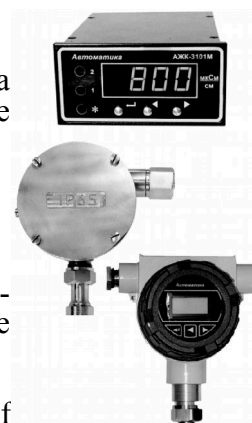
Transmitter **C-3130** is provided with a proximity inductive transducer and is used to measure SEC up to 1 Sm/sm. Main function – to measure concentration of acids and alkalis.

ANALYZERS WITH ACTIVE PRIMARY TRANSDUCERS (SENSORS)

C-3101M conductivity meter, consists of an active primary transducer and a measuring instrument. In consequence of modern technical solutions the analyzer **C-3101M** provides consumers with the following features:

1. Programmable selection of one of four measuring ranges (for C-3101M.1: (0... 1); (0... 10); (0... 100); (0... 1000) $\mu\text{S}/\text{cm}$; for C-3101M.2: (0... 1); (0... 10); (0... 100); (0... 1000) mS/cm)
2. Ability to activate the automatic range selection mode.
3. Mode selection of a temperature compensation: on/off mode, mode of ultra-pure water thermal compensation. With this mode, the reduction temperature and temperature rate can be easily programmed.
4. Simplified calibration with one buffer solution.
5. When using the instrument as a concentration meter (**C-3101M.K**) in case of a non-linear dependence of the solution concentration from the SEC an output characteristic linear approximation mode, based on known SEC dependency of a concentrations is provided (see Figure 1).

The analyzer can work with both types of sensors - contact and proximity inductive.



C-3101M.x.NP conductivity analyzer of improved reliability, which was developed for severe operating conditions (according to the requirements for nuclear power plants). The analyzer is using in the same way as C-3101M, but has a design and schematic changes. Focus is maintained on the problems of electromagnetic compatibility (EMC), seismic resistance, vibration and impact resistance, operation requirements of the primary transducer in the conditions possible radiation effects.



C-3122 – dual channel conductivity meter, consisting of one or two primary transducers and one measuring instrument. Graphical display provides visualization of the monitored values time history, instrument also recording them in the built-in archive and transmitting of the measured data in the form of universal current signals and through the interface RS-485 Modbus RTU Protocol. The instrument special feature is that it can measure simultaneously both electric conductivity of the solution and its pH value.

1. Quantity of plug-in primary transducers (specific electrical conductivity (SEC) or pH) — 1 or 2.
2. Graphical display (128 x 64) with an option of displaying trends by

measuring and archive viewing.

3. Two channels data archiving.

4. Quantity of configurable analog output signals - 2.

Conductometric analyzers of liquid

5. Quantity of configurable discrete (alarm relay) output signals - 4.
6. Interface RS-485 with a Modbus RTU protocol.

The analyzer can work with both contact and proximity inductive sensors.



C-3122.x.NP - the analyzer is developed on the basis of the **C-3122** analyzer and is designed for use in severe environmental conditions, such as: seismic resistance, climatic conditions, radiation resistance, difficult situation for electromagnetic compatibility (EMC). Special technical solutions (split connectors) allow to provide a quick replacement of the sensors in the rooms with a nuclear radiation.

BENCHTOP CONDUCTIVITY METERS

C-3104 - a laboratory conductivity, equipped with a sensor with platinized electrodes and a tripod, provided with a high accuracy and stability when SEC measuring within the range from 0.00 $\mu\text{S}/\text{cm}$ to 20.00 mS/cm .

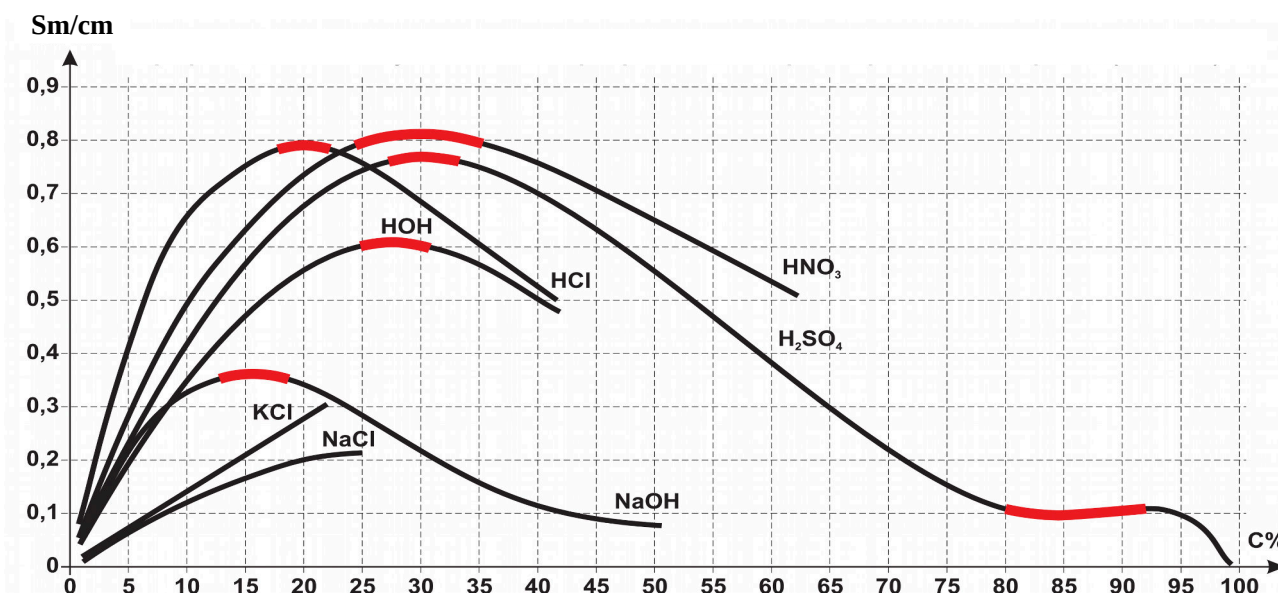


Figure 1 Specific electrical conductivity (SEC) and solutions concentration curve ($t=20^\circ\text{C}$)

Conductometric analyzers of liquid

Table of common

Description	C-3101M(Ex)	C-3101M.(x).NP	C-3122
Quantity of meas ch	1	1	2
Measuring ranges ¹⁾	from 0..1 to 0..1000 μ S/cm from 0..1 to 0..1000 mS/cm concentration of the solutions (H ₂ SO ₄ , HNO ₃ , HCl, NaOH, KOH, NaCl, etc.)		
Quantity of SEC measuring ranges for one modification	4		
Range adjustment possibility (according to output signal)	Yes		
SEC measurement basic percentage error, %	2		
Linearization	Yes		
The primary transducer (sensor)/purpose	Active/flow or submersible		
PT enclosure type IP65	D, S, I	S	D, S, I
Temperature and pressure limits	5..95 °C ³⁾ ; 1,6 MPa; (5..150) °C ⁴⁾	(5..95) °C ³⁾ ; 1,6 MPa (5..120) °C; 0,6 MPa	(5..95) °C ³⁾ ; 1,6 MPa; (5..150) °C ⁴⁾
Connection between PT and MI	3 wires up to 1000 m	4 wires up to 800 m	3 wires up to 1000 m
Measuring instrument	panel mounted - 48x96	panel mounted - 48x96	panel mounted - 96x96, IP54 (front panel); wall mounted- 190x175x112,5 IP65
Output signals	(0...5), (4...20) mA; two relays	(0...5), (4...20) mA; two relays	0..5, 4..20 mA; 4 relays RS-485 Modbus RTU
Alarm system	2 SEC set points (concentration)	2 SEC set points (concentration)	4 set points, according to SEC or temperature for any channel
Data display	Digital 4 digits	Digital 4 digits	Digital, graphics, archive
Features	Explosion proof marking for PT in the "I" enclosure: IExdIIIBT6_X May be completed with a hydraulic panel HP-3101 with a cation exchange filter. It have a "bilinear" output current scale.		May be operated with one or two PT It have a "bilinear" output current scale.

Conductometric analyzers of liquid

technical characteristics

C-3122.x.P	C-3122.x.P.I	C-3122.x.NP
2	2	2
from (0..1) to (0..1000) $\mu\text{S/cm}$; from (0..1) to (0..100) mS/cm with automatic range selection (0..100) MOhm/cm	from (0...10) to (0...1000) mS/cm concentration of the solutions (H_2SO_4 , HCl , HNO_3 , NaOH , KOH , NaCl etc.)	from (0...10) to (0...1000) $\mu\text{S/cm}$; from (0...10) to (0...1000) mS/cm concentration of the solutions (H_2SO_4 , HCl , HNO_3 , NaOH , KOH , NaCl etc.)
4	3	4
Yes		
2	2	2 (max. 5 when measuring solutions concentration)
N/A	Yes	Yes
passive sensor/flow-submersible	passive sensor/flow-submersible	active/flow or submersible
-	-	D, S, I
(5..95) $^{\circ}\text{C}$; 1,6 MPa;	(5..80) $^{\circ}\text{C}$ ³⁾ ; 0,6 MPa; (5..150) $^{\circ}\text{C}$ ⁴⁾	(5...95) $^{\circ}\text{C}$; 1,6 MPa; (5..120) $^{\circ}\text{C}$; 0,6 MPa
special cable up to 15 m	special cable up to 10 m	3 wires up to 800 m
panel mounted - 96x96, IP54 (on the front panel); wall mount -190x175x112,5 mm IP65	panel mounted - 96x96, IP54 (on the front panel); wall mount -190x175x112,5 mm IP65	wall mount -190x175x112,5 mm IP65
(0... 5), (4... 20) mA; from 3 to 8 relays; RS-485 Modbus RTU	(0... 5), (4... 20) mA; from 3 to 8 relays; RS-485 Modbus RTU	(0...5), (4...20) mA; four relays RS-485 Modbus protocol RTU
From 3 to 8 set points can be programmed for any values	4 set points are programmable for any values	4 set points are programmable according to SEC or temperature for any channel
digital, graphics, archive	digital, graphics, archive	digital, graphics, archive
Can be operated with one or two sensors Can be supplied with a hydraulic panel	Can be operated with one or two sensors	

Notes:

- 1) all the analyzers provide temperature measurement and thermal compensation while measuring SEC;
- 2) basic percentage error;
- 3) custom-made - up to 120 $^{\circ}\text{C}$ (BT design).
- 4) proximity inductive transducer.

Conductometric analyzers of liquid

Table of common

Description	C-3102	C-3110 (Ex)
Quantity of measuring channels	1	
Measuring ranges¹⁾	from (0...10) to (0...20) mS/cm	from (0..1) to (0..1000) μ S/cm from (0..1) to (0..100) mS/cm concentration of the solutions (H ₂ SO ₄ , HNO ₃ , HCl, NaOH, KOH, NaCl, etc.)
Quantity of SEC measuring ranges for one modification	1	4
Range adjustment possibility (according to output signal)	No	Yes
SEC measurement basic percentage error, %	2 or 4	2
Linearization	No	Yes
The primary transducer (sensor)/purpose	passive sensor/flow-submersible	active/flow or submersible
PT enclosure type (IP65)	-	S, I (wall mounted)
Temperature and pressure limits	(5..95)°C, 1,6 MPa;	(5..95)°C, 1,6 MPa;
Connection between PT and MI:	3 wires/up to 10 m	-
Measuring instrument	panel mounted - 48x96	-
Output signals	(0...5), (4...20) mA two relays	(0...5), (0...20), (4...20) mA or RS-485 (RS-232), Modbus Protocol (RTU, ASCII)
Alarm system	1 SEC set point and 1 temperature set point or 2 SEC set points	N/A
Data display	Digital 4 digits	Digital 4 digits
Features	-	Explosion protection marking 1ExdIIBT6 X

Conductometric analyzers of liquid

technical characteristics

C-3130 (Ex)	C-3104	
1		
from (0..10) to (0..1000) mS/cm concentration of the solutions (H ₂ SO ₄ , HNO ₃ , HCl, NaOH, KOH, NaCl, etc.)	from (0..10) µS/cm to (0.. 20) mS/cm, with measuring range automatic selection	
3	-	
Yes	No	
2	1	
Yes	No	
active sensor, flow type or submersible	passive sensor with 1 m cable/submersible	
S, I (wall mounted)	Benchtop	
(5...80)°C, (5...100)°C, 1,6 Mpa (5...150)°C ⁴⁾ ; P<0,6 MPa	(5... 90)°C, 0,1 MPa;	
-	-	
-	Benchtop -190x142x92 mm, IP54 (on the front panel)	
(0...5), (0...20), (4...20) mA or RS-485 (RS-232), Modbus Protocol (RTU, ASCII)	RS-485 (RS-232), Modbus protocol (RTU, ASCII)	
No	No	
Digital 4 digits	digital, graphics, archive	
Explosion protection marking 1ExdIIBT6 X		

Notes:

- 1) all the analyzers provide temperature measurement and thermal compensation while measuring SEC;
- 2) basic percentage error;
- 3) custom-made - up to 120°C (BT design).
- 4) proximity inductive transducer.

RECOMMENDATIONS ON SELECTION AND INSTALLATION OF SENSORS SPECIFIC ELECTRICAL CONDUCTIVITY (SEC)

1. Installation of contact sensors SEC.

Depending on the purpose, the sensors can be installed on the hydropanel, process piping or tanks.

1.1. Contact sensors are installing on the hydraulic panel to measure SEC less than $10 \mu\text{S} / \text{cm}$. One or two sensors are installing. Two, if it is required to control the depletion of the cation exchanger in the H-filter.

1.2. When installing on a process pipeline, the following rules must be adhered to:

1.2.1. If the process is continuous, it is best to install a sensor on the bypass line. The bypass provides operational maintenance of the sensor (cleaning, calibration, repair) without stopping the process. When measuring SEC water solutions above $100 \text{ mS} / \text{cm}$, it is also necessary to install the sensor on the bypass line. Control of high conductivity SEC (more than $100 \text{ mS} / \text{cm}$) can be performed only by flow sensors ECS-1.15 and ECS-3101M.2.02, which have a large constant.

1.2.2. When measuring SEC up to $100 \text{ mS} / \text{cm}$, the sensors can be installed directly on the pipeline. If a pipeline have small diameter (up to 50 mm), then it is necessary to use either an expansion fitting with a lug mounted on it for mounting the sensor, or special holders HM-4.3-xx; HM-4.4-xx; HM-4.5-xx; HM-4.6-xx; HF-3.1-01/02. With a pipe diameter of 50 mm, use the HM-4.1-01; HM-4.2-01 holders.

With a pipeline diameter of more than 50 mm, the contact sensor can be mounted via a straight or "oblique" lug welded into the pipeline.

If the sensor is mounted on a vertical section of the pipeline, it is installed in such a way that the inflow of the measured liquid to it is from below. At the same time, the sensor is installed either in the "slanting" lug or on the top of the pipe elbow. It is necessary that the gap between the sensor face and the pipeline wall is not less than 20 mm.

1.3. Installation of sensors in the tank.

Sensors SEC are mounted in technological tanks with special fittings, which can be installed in the lug on the thread or with the help of flanges.

Contact sensors ECS-1.14, ECS-1.06 can be used as submersible only for control of the SEC up to $100 \text{ mS} / \text{cm}$.

If the SEC is more than $100 \text{ mS} / \text{cm}$ at the operating temperature, then contactless (inductive) sensors should be used.

If there is an agitator (mixer) in the tank, the sensor is installed either in the "casing" or in the recirculation line.

An important condition for an accurate measurement of SEC is the absence of an air bubble between the electrodes, and continuous renewal of fluid in the annular gap between the electrodes, which should be taken into account when designing a system of control SEC.

In the event that the pipeline or the upper cover of tank is high, which complicates the operational maintenance of the SEC sensor, it is recommended that the primary converter of the SEC be installed below, at a convenient location, separate from the transmitter, but not farther than 5 meters from it.

When the analyzer mounted separately, sensor must be mounted not farther than 20 meters from transmitter if $\text{SEC} \delta < 200 \mu\text{Sm/cm}$ and not farther than 5 meters, if $\text{SEC} \delta > 200 \mu\text{Sm/cm}$.

2. Installation of proximity inductive sensors of SEC.

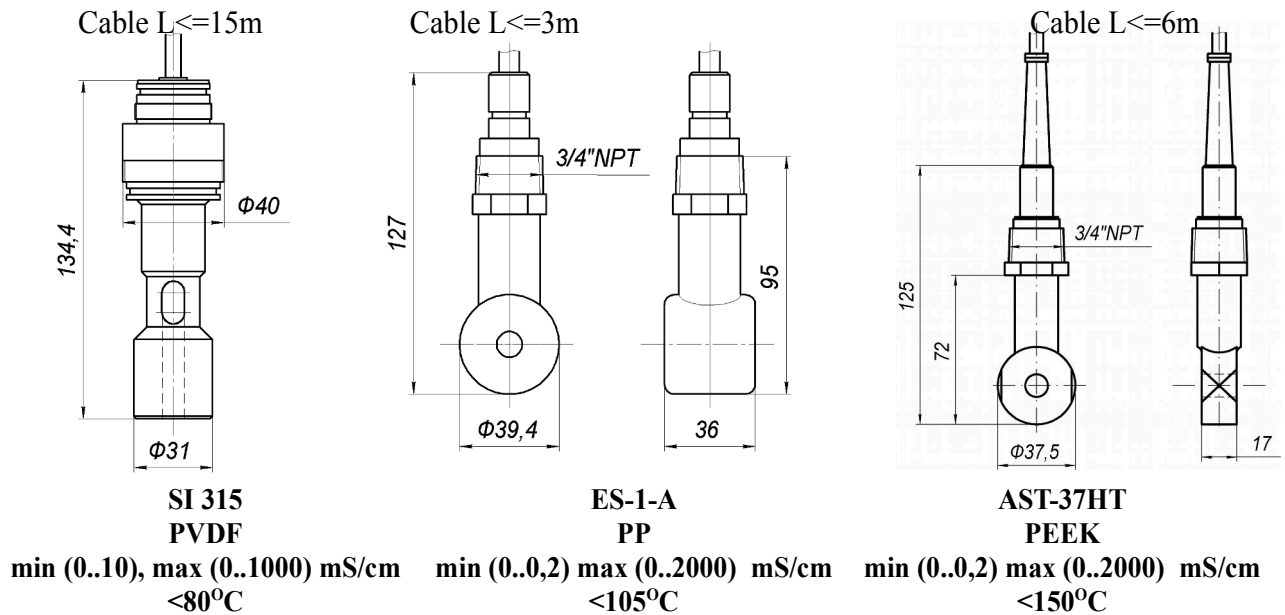
Proximity inductive sensors of SEC:

Installation of SI315, ES-1-A, AST-37HT are used for measuring high SEC (more than 1000 $\mu\text{S/cm}$), as well as measuring the concentrations of water solutions of acids, alkalis, salts.

The above sensors differ from each other with the materials used (polypropylene, PVDF, PEEK), as well as permissible values of temperature and pressure.

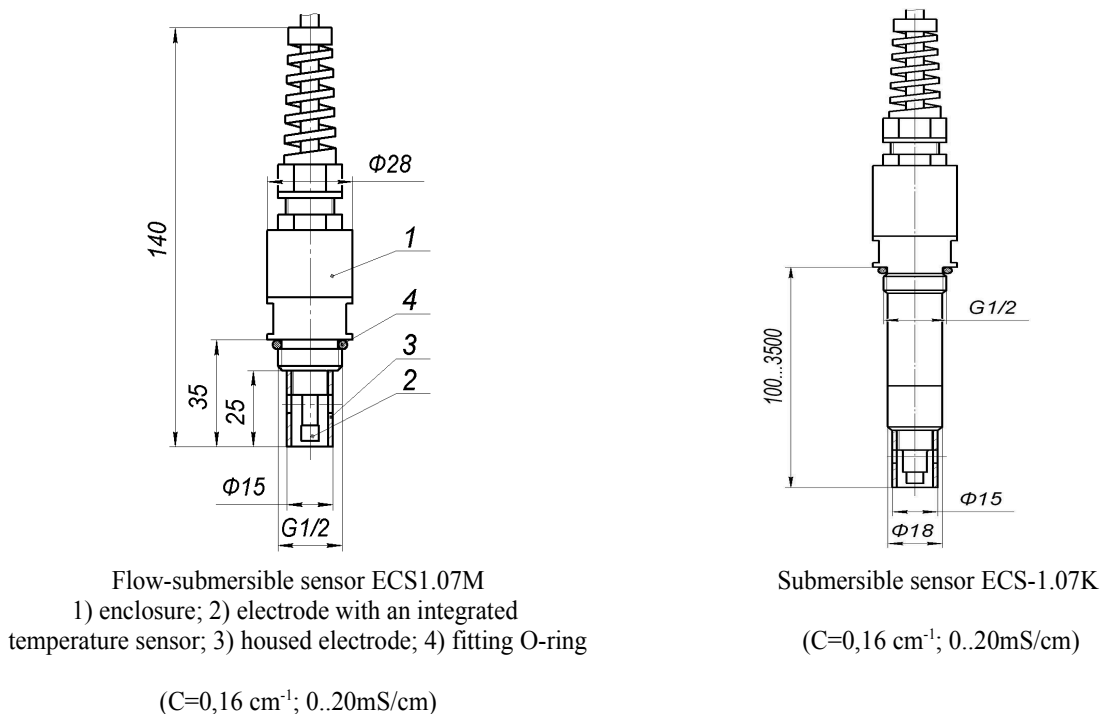
The installation of proximity inductive sensors of SEC can be carried out in a pipeline or in a tank. The sensor distance to the walls of the pipeline or vessel must be farther than 30 mm.

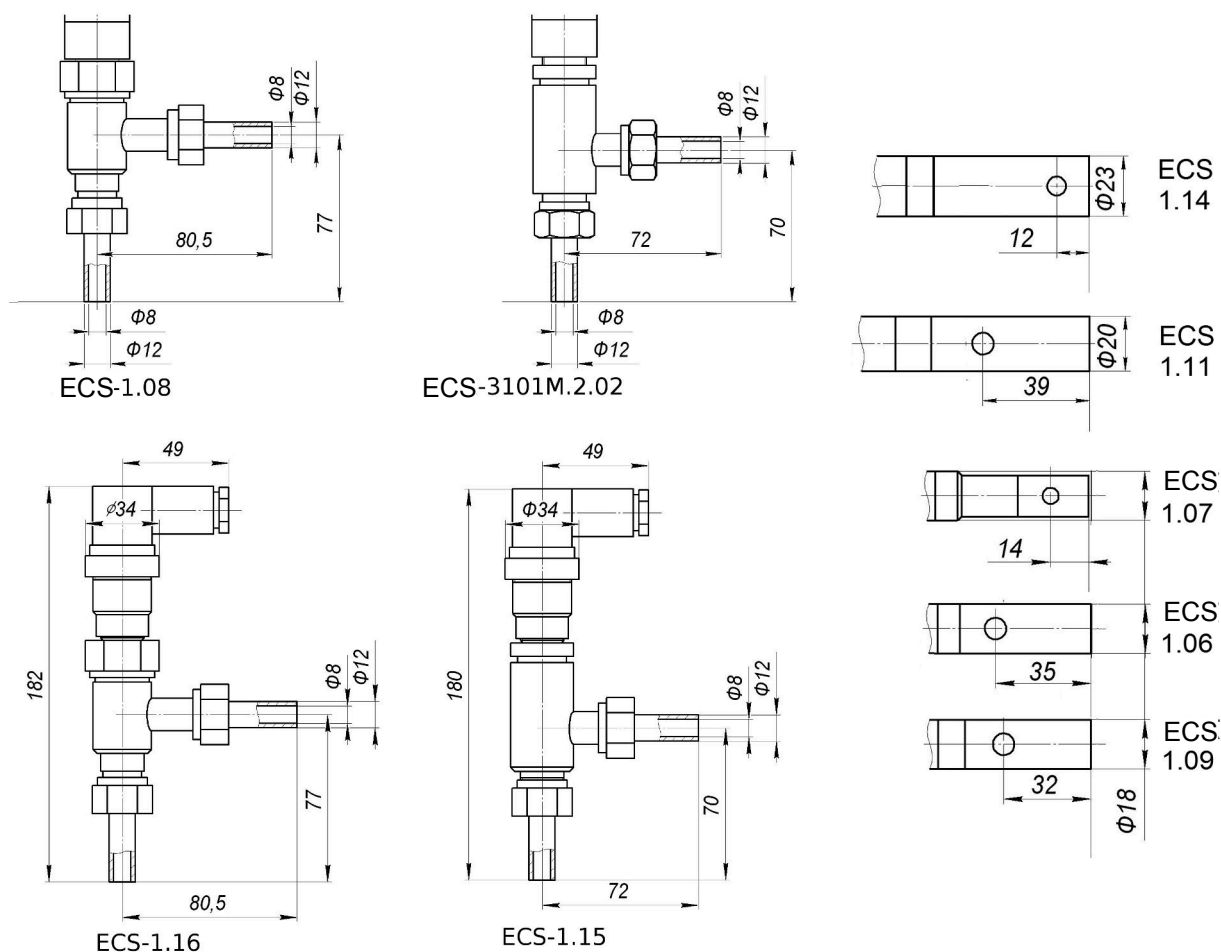
To install the sensors, use the fittings according to the section of the "Holders for sensors" in this catalog. The sensor drawings are also located in Fig. 7 of the device C-3122.P.I.



3. Contact conductometric sensors

Parameters of the analyzed liquid: up to + 120°C, no more than 1,6 MPa





ECS-1.08: $C=0,02 \text{ cm}^{-1}$. δ : 0-1000 $\mu\text{S}/\text{cm}$. ECS-1.16 — ECS-1.08, but with a connector
 ECS-3101M2: $C=10,0 \text{ cm}^{-1}$. δ : 0-1000mSm/cm. ECS-1.15 – ECS-3101M2, but with a connector
 ECS-1.09 (ECS-1.09T; ECS-1.09NP): $C=0,02 \text{ cm}^{-1}$. δ : 0-1000 $\mu\text{S}/\text{cm}$.
 ECS-1.06 (ECS-1.09T; ECS-1.09NP): $C=2,86 \text{ cm}^{-1}$. δ : 0-100mSm/cm.
 ECS-1.07: $C=0,16 \text{ cm}^{-1}$. δ : 0-1000 $\mu\text{S}/\text{cm}$, 0-20mSm/cm.
 ECS-1.11: $C=0,04 \text{ cm}^{-1}$. δ : 0-1000 $\mu\text{S}/\text{cm}$.
 ECS-1.14: $C=1,0 \text{ cm}^{-1}$. δ : 0-100mSm/cm.

Difference between ECS-1.09T and ECS-1.09NP; ECS-1.09T and ECS-1.09NP – in sealing materials

Contact sensors can be produced from next materials: SS321L, SS316, SS904, titanium, tantalum. Please, write needed material in your order.