ANALYTICAL EQUIPMENT FOR

VZOR

ECOLOGY AND POWER INDUSTRY

MARK-1102 CONDUCTIVITY/ CONCENTRATION METER

Operation Manual

АЯ 74

Nizhny Novgorod
2011

VZOR will appreciate any suggestions and comments aimed at product quality improvement.

If you have any trouble with the instrument performance, please contact us in writing or by phone.

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C O N T E N T S

1 DESCRIPTION AND OPERATION

1.1 Purpose

1.1.1 Product name and identification
A panel-mounted conductivity meter with supply voltage of 220 V:
MARK-1102 conductivity/concentration meter
TU 4215-033-39232169-2009 specifications.

A wall-mounted conductivity meter with supply voltage of 220 V:
MARK-1102/1 conductivity/concentration meter
TU 4215-033-39232169-2009 specifications.

A panel-mounted conductivity meter with supply voltage of 36 V:
MARK-1102/2 conductivity/concentration meter
TU 4215-033-39232169-2009 specifications.

A wall-mounted conductivity meter with supply voltage of 36 V:
MARK-1102/3 conductivity/concentration meter
TU 4215-033-39232169-2009 specifications.

1.1.2 Purpose

The conductivity meter is designed to measure electric conductivity (SEC), electric conductivity referred to 25 °C and mass fraction (concentration) of water-dissolved substances (NaCl, NaOH, HNO_3, H_2SO_4 and HCl).

Applications − heat power engineering and productions processes in a variety of industries.

1.1.3 Conductivity meter type:

- noncontact;
- low frequency;
- single-range;
- with flow-type or main/immersion conductivity probes;
- quick-response;
- with two measuring channels;
- with automatic temperature compensation;
- with a measuring converter as a panel- or wall-mounted unit;
- measurement readouts on the display, via the current output and RS-485 port;
- with an electronic preamplifier removed from the measuring converter and installed close to the conductivity probe to increase the distance between the measuring converter and the conductivity probe.

1.2 Basic parameters

1.2.1 By resistance to climatic effects this conductivity meter version falls within B4 group as per GOST R 52931-2008.

1.2.2 By resistance to mechanical action the conductivity meter version falls within L1 group as per GOST R 52931-2008.

1.2.3 Protection of the conductivity meter components provided by casings as per GOST 14254-96 is as shown in Table 1.1.

Table 1.1

Conductivity meter version	Component name and identification	Degree of protection as per GOST 14254 (IP code)
MARK-1102	CU-1102 converting unit BP56.01.000 (panel-mounted version)	IP30
MARK-1102/1	CU-1102 converting unit BP56.01.000-01 (wall-mounted version)	IP65
MARK-1102/2	CU-1102 converting unit BP56.01.000-02 (panel-mounted version)	IP30
MARK-1102/3	CU-1102 converting unit BP56.01.000-03 (wall-mounted version)	IP65
MARK-1102 MARK-1102/1 MARK-1102/2 MARK-1102/3	PU-1102 probe unit BP56.02.000: – AU-1102 amplifier unit; – InPro 7250 ST/Pt1000/3m inductive conductivity probe	 IP62 IP62

1.2.4 By resistance to atmospheric pressure the conductivity meter version falls within P1 as per GOST R 52931-2008.

1.2.5 Conductivity meter versions depending on the type of installation and supply voltage are shown in Table 1.2 below.

Table 1.2

Conductivity meter version	Conductivity meter version by type of installation	Supply voltage, V
MARK-1102	panel-mounted	220
MARK-1102/1	wall-mounted	220
MARK-1102/2	panel-mounted	36
MARK-1102/3	wall-mounted	36

1.2.6 Analyte medium parameters

1.2.6.1 Analyte medium temperature range (conductivity meter's temperature compensation range), °C:

- SEC measurement ……..……..... 0 to +70;
- NaCl mass fraction measurement ……...……...……..... 0 to +60;
- NaOH mass fraction measurement ……..…… 0 to +70;

– HNO_3 mass fraction measurement ……..…….. 0 to +50;
– H_2SO_4 mass fraction measurement ……..…. 0 to +70;
– HCl mass fraction measurement ……..…….. 0 to + 50.

1.2.6.2 Analyte medium pressure, MPa, max …….. 0.8.

1.2.7 Operating conditions

1.2.7.1 Ambient air temperature, °C ……..…… + 5 to + 50.

1.2.7.2 Ambient air relative humidity at +35 °C and below without moisture condensation, %, max …….. 80.

1.2.7.3 Atmospheric pressure, kPa (mm of Hg) …..... 84.0 to 106.7 (630 to 800).

1.2.8 The conductivity meter is powered from 220 or 36 V AC (50 ± 1) Hz mains depending on the version, with the supply voltage tolerance varying from –15 to +10 %.

1.2.9 Power consumption, V·A, max ……..……..…..…… 10.

1.2.10 Overall dimensions and weights of the conductivity meter components are as shown in Table 1.3 below.

Table 1.3

Conductivity meter version	Component name and identification	Overall dimensions, mm, max	Weight, kg, max
MARK-1102	CU-1102 converting unit BP56.01.000	252×146×100	2.60
MARK-1102/1	CU-1102 converting unit BP56.01.000-01	266×170×95	2.60
MARK-1102/2	CU-1102 converting unit BP56.01.000-02	252×146×100	2.60
MARK-1102/3	CU-1102 converting unit BP56.01.000-03	266×170×95	2.60
MARK-1102, MARK-1102/1 MARK-1102/2 MARK-1102/3	PU-1102 probe unit BP56.02.000: – AU-1102 amplifier unit; – InPro 7250 ST/Pt1000/3m inductive conductivity probe.	 140×70×30 250×47×36	 0.3 0.5

1.2.11 Conductivity meters in shipping crates withstand transportation conditions as per GOST R 52931-2008.

1.2.11.1 Temperature, °C ……..... –20 to +50.

1.2.11.2 Relative air humidity at 35 °C, % ……..……..……..……..…….. 95.

1.2.11.3 Sinusoidal vibration with a frequency of 5-35 Hz, shift amplitude of 0.35 mm in the direction shown by the "Top" mark on a crate.

1.2.12 Reliability requirements

1.2.12.1 Mean time to failure, h, minimum ……..……... 20.000.

1.2.12.2 Mean time to fix, h, maximum ……..……... 2.

1.2.12.3 Conductivity meter's mean life, years, minimum ..……..…….. 10.

1.2.13 Resistance of electrical insulation of the conductivity meter's supply circuits between plug pins and case, MΩ, minimum:

- at ambient temperature of (20 ± 5) °C ……..…….. 40;
- at ambient temperature of 50 °C ..……..…… 10;
- at ambient temperature of 35 °C and relative humidity of 80 % …….. 5.

1.2.14 Electrical insulation of the conductivity meter's supply circuits relative to the converting unit case handles a 1 min 1.5 kV testing voltage of sinusoidal AC 50 Hz at an ambient temperature of (20 ± 5) °C relative humidity from 30 to 80 %.

1.2.15 Electrical insulation between the external terminal of the converting unit earthing and its case, Ω, maximum ……..... 0.1.

1.3 Specifications

1.3.1 SEC measuring range, mSm/cm……..... 0 to 1.000.

1.3.2 Mass fraction measuring range for water dissolved substances, %:

- NaCl mass fraction measurement ……..……..... 0 to 15;
- NaOH mass fraction measurement ……..…….... 0 to 10;
- HNO_3 mass fraction measurement ……..……..…..….. 0 to 15;
- H_2SO_4 mass fraction measurement ……..……..…… 0 to 15;
- HCl mass fraction measurement ……..……..…… 0 to 10.

1.3.3 The conductivity meter's margin of allowable basic absolute measuring error (on display) at an analyte medium temperature of (25.0 ± 0.2) °C and ambient air temperature of (20 ± 5) °C:

- SEC measurement, mSm/cm ……..……... ± (1.0 + 0.04χ);
- measurement of mass fraction of water-dissolved substances, %..... ± (0.03 + 0.04*C*),

where χ is measured SEC value, mSm/cm;

C is measured value of mass fraction of water-dissolved substances, %.

1.3.4 The function of converting the measured X (χ, mSm/cm or C) value into the converting unit's output current at an ambient air temperature of (20 ± 5) °C is as follows:

- for 4-20 mA current output at a maximum load of 500 Ω:

$$I_{output} = 4 + 16 \cdot \frac{X}{X_{range}};$$

- for 0-5 mA current output at a maximum load of 2 kΩ:

$$I_{output} = 5 \cdot \frac{X}{X_{range}},$$

where *X* is measured χ, mSm/cm or *C* value, %;

X_{range} is programmed measuring range for χ, mSm/cm or *C*, % ("current output measuring range").

1.3.5 The conductivity meter's margin of allowable basic absolute error for current output:

– SEC measurement, mSm/cm ……. ± [(1.0 + 0.002χ_{range}) + 0.04χ];

– measurement of mass fraction of water-dissolved substances, %…….…….. ± [(0.03 + 0.002C_{range}) + 0.04C].

1.3.6 The conductivity meter's margin of allowable complementary absolute measuring error caused by analyte medium temperature variations within a temperature compensation range:

– SEC measurement, mSm/cm ……..…….. ± 0.04χ;

– measurement of mass fraction of water-dissolved substances, %...±0.04C.

1.3.7 The conductivity meter's margins of allowable complementary absolute error (on display) resulting from ambient temperature deviation from normal temperature (20 ± 5) °C per each ±10 °C within the entire range from +5 to +50 °C:

– SEC measurement, mSm/cm ……..…….. ± 0.004χ;

– measurement of mass fraction of water-dissolved substances, %..... ± 0.004C.

1.3.8 The conductivity meter's margins of allowable complementary absolute error (for current output) resulting from ambient temperature deviation from normal temperature (20 ± 5) °C per each ±10 °C within the entire range from +5 to +50 °C:

– SEC measurement, mSm/cm ……..……..... ± (0.0025χ_{range} + 0.004χ);

– measurement of mass fraction of water-dissolved substances, %…….……. ± (0.0025C_{range} +0.004C).

1.3.9 The conductivity meter's analyte medium temperature measuring range, °C ….……..……...…..… 0 to +70.

1.3.10 The conductivity meter's margins of allowable basic absolute measuring error for analyte medium temperature at an ambient air temperature of (20 ± 5) °C, °C ……..…..…….. ± 0.5.

1.3.11 The conductivity meter's margins of allowable complementary absolute error (for current output) for temperature measurement, resulting from ambient temperature deviation from normal temperature (20 ± 5) °C per each ± 10 °C within the entire range from +5 to +50 °C, °C …….. ±0.1.

1.3.12 Margins of allowable fractional error for measuring the conductivity probe's electrolytic constant, % ……. ± 3.

1.3.13 The conductivity meter's transient period with stepwise SEC variations, s, maximum ……..…… 30.

1.3.14 Step response time $t_{0.9}$ of the conductivity meter with conductivity probe, with stepwise variations in the analyte medium temperature, min, maximum…….……..……..... 5.

1.3.15 The conductivity meter's indication stability for 8 h, at least:

– SEC measurement, mSm/cm ……..……...…… ± 0.02χ;

– measurement of mass fraction of water-dissolved substances, %...±0.02C.

1.3.16 The conductivity meter's operating mode setting time, min, maximum…..……..…… 5.

1.3.17 Any excess by the measured value of SEC or mass fraction of water-dissolved substances over the programmed measuring range limits will cause the following actions to occur: the “OVERLOAD” indicator will come on, the alarm will be sounded, the relay’s dry contacts will close and the “Overload!” sign will be displayed.

1.3.18 Any excess by the measured value of SEC or mass fraction of water-dissolved substances over the threshold limits will cause ▲ or ▼ to be displayed and the relay’s dry contacts to close.

1.3.19 When connected to a personal computer (PC), the conductivity meter exchanges information with PC via the RS-485 interface.

1.4 Product components

The conductivity meter is comprised of the following components:

- CU-1102 panel-mounted (for MARK-1102 and MARK-1102/2 versions) or wall-mounted (for MARK-1102/1 and MARK-1102/3 versions) converting unit;
- PU-1102 probe unit;
- connecting cables;
- mounting parts kit;
- tool and accessory kit.

The PU-1102 probe unit incorporates the AU-1102 amplifier unit and the InPro 7250 ST/Pt1000/3m inductive conductivity probe (“conductivity probe”).

1.5 Design and operation

1.5.1 Conductivity meter general data

The conductivity meter is a dual-channel measuring instrument designed for continuous measuring of SEC or mass fraction (concentration) of water-dissolved substances (NaCl, NaOH, HNO_3, H_2SO_4, HCl) via two measuring channels A and B.

The measured value of SEC or mass fraction (concentration) of water-dissolved substances is displayed on a readout device − a digital LCD display (“the display”), with the least significant digit of 0.1 mSm/cm for SEC measurements and 0.01 for measuring the mass fraction of water-dissolved substances. It provides separate or simultaneous indication of parameters measured in channels A and B.

Each channel has a dedicated programmable range for current output measurements.

The lower limit of the programmable range for current output measurements is always 0 mSm/cm (0 %).

The upper limit may be set within a range from 1 to 1.000 mSm/cm for SEC measurements and from 0.1 to 15 % for measuring the mass fraction of water-dissolved substances. The preset upper limit of current output measurement is shown on the display.

The conductivity meter has two outputs with unified output DC signals from 0 to 5 mA or from 4 to 20 mA, corresponding to two measuring channels for SEC or mass fraction (concentration) of water-dissolved substances. The upper limit of the programmable range for current output measurement corresponds to a current of 5 or 20 mA. The required current output range (from 0 to 5 mA or from 4 to 20 mA) is chosen by the user separately for each channel through an option on the conductivity meter menu.

In addition to unified output DC signals from 0 to 5 mA or from 4 to 20 mA, the conductivity meter menu enables unified output signals from 0 to 20 mA to be set in each of the channels.

The conductivity meter range for display measurements is independent of the set output current range.

The conductivity meter range for display measurements:

– SEC measurements − from 0 to 1.000 mSm/cm;

– measurements of mass fraction (concentration) of water-dissolved substances − from 0 to 15 % (for NaCl, HNO_3, H_2SO_4) or from 0 to 10 % (for NaOH, HCl).

For measurements of SEC and measurements of mass fraction of water-dissolved substances beyond the set measuring range the measuring error is not normalized.

The conductivity meter comprises InPro 7250 ST/Pt1000/3m noncontact inductive conductivity probes with built-in heat sensors and 3 m long cable.

The PU-1102 probe unit incorporates the AU-1102 amplifier unit and the InPro 7250 ST/Pt1000/3m conductivity probe. The PU-1102 probe unit may be taken up to 100 m away from the converting unit.

The values C_S, cm^{-1} characterizing each particular conductivity probe are read off from the amplifier unit memory when the sensor unit is connected to the converting unit, thereby enabling interchangeability of the sensor units.

For easier EC monitoring, provision is made in the conductivity meter for temperature compensation, i.e. reference of the SEC absolute value to SEC at 25 °C.

The linear temperature compensation factor depending on the composition of agents dissolved in water may be set by the user within a range from 0.0100 to 0.0300 $°C^{-1}$.

The conductivity meter has a measuring mode for SEC not referred to 25 °C (with temperature compensation disabled).

In the conductivity meter's mass fraction measuring mode the SEC value referred to 25 °C is converted into the value of the solution selected from the conductivity meter menu.

Any excess by the measured value of SEC or mass fraction (concentration) of water-dissolved substances over the upper limit of the current output measuring range will cause the "**OVERLOAD**" indicator to come on, the "**OVERLOAD!**" sign and the flashing symbol of an overloaded parameter ("χ" or "**C**"**)** to be displayed and the relay's dry contacts to close.

If the analyte medium temperature goes beyond the range from 0 to +70 °C, the "**OVERLOAD**" indicator will come on, the alarm will be sounded and the relay's dry contacts will close. Also, the "**OVERLOAD!**" sign and the flashing symbol "**°C**" will be displayed.

Each of the conductivity meter's channels has two freely programmable thresholds setting the upper and lower monitoring limits for the measured value of SEC or mass fraction (concentration) of water-dissolved substances. If values of SEC or mass fraction (concentration) of water-dissolved substances EC or salinity values exceed the threshold limits, the relay's dry contacts will close and a sign of the upper or lower threshold limit will be displayed.

1.5.2 Conductivity meter's operating principle

1.5.2.1 SEC measuring principle

The conductivity meter measures the value of current induced in the circuit formed by a current-conducting solution.

The case of the conductivity probe immersed in a solution features two closely installed toroidal coils. AC voltage, applied to one of the coils, induces in the second one a current, whose value is directly proportional to the solution electric conductivity. The current value subject to the probe's electrolytic constant C_P is converted into the controlled medium SEC. The measured temperature value is used to define SEC referred to 25 °C.

1.5.2.2 Temperature measuring principle

The platinum thermoresistor built in the conductivity probe housing is used as a heat sensor.

Temperature values are determined through recalculation of the measured heat sensor resistance value.

1.5.2.3 Principle of measuring the mass fraction (concentration) of water-dissolved substances

The mass fraction (concentration) of water-dissolved substances is defined by conversion of a temperature-compensated (referred to 25 °C) solution SEC into the concentration of a solution selected on the conductivity meter menu according to a specific relationship.

1.5.3 Conductivity meter's components

1.5.3.1 Converting unit

The CU-1102 converting unit is designed to convert the sensor unit signals, display measuring data, generate a signal at current outputs, control the relay's dry contacts and data communication to PC.

The converting unit is powered from 220 V DC 50 Hz or 36 V50 Hz mains (depending on the version) through the built-in power supply.

The converting unit casing is made of aluminum alloy.

The converting unit front panel features the following components (Fig. 1.1):

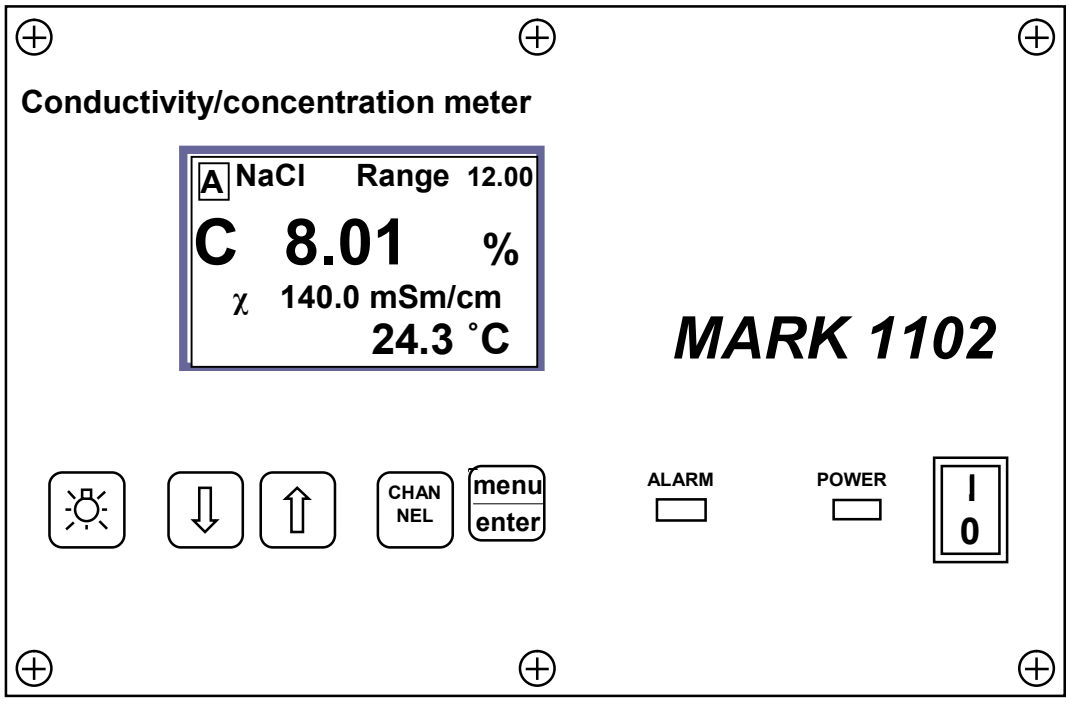


Fig. 1.1 − Layout of controls and indicators on the converting unit face panel

– display screen designed to indicate the measured value of SEC (or that referred to 25 °C), mass fraction (concentration) of water-dissolved substances, the conductivity meter temperature and operating modes and to work with screen menus;

– button "☼" to switch on and off the display screen illumination;

– "⇓" and "⇑" buttons to move down and up the menu in the parameter monitoring and changing mode and to change the settings;

– "**CHANNEL**" button to change the indication mode (channel A, channel B or both channels) and perform some operations in the **MENU** mode;

– "$\frac{\textbf{menu}}{\textbf{enter}}$" button to enter the menu (invoke the parameter monitoring and changing mode) and confirm the values and operating modes selected in programming;

– "**POWER**" button to switch the conductivity meter on and off;

– "**POWER**" green light power on indicator;

– "**OVERLOAD**" red light indicator to show an overloaded programmable range for current output measurement or analyte medium temperature exceeding the range from 0 to +70 °C.

The panel-mounted CU rear panel (see Fig. 1.2) and the wall-mounted CU lower panel (see Fig. 1.3) feature the following components:

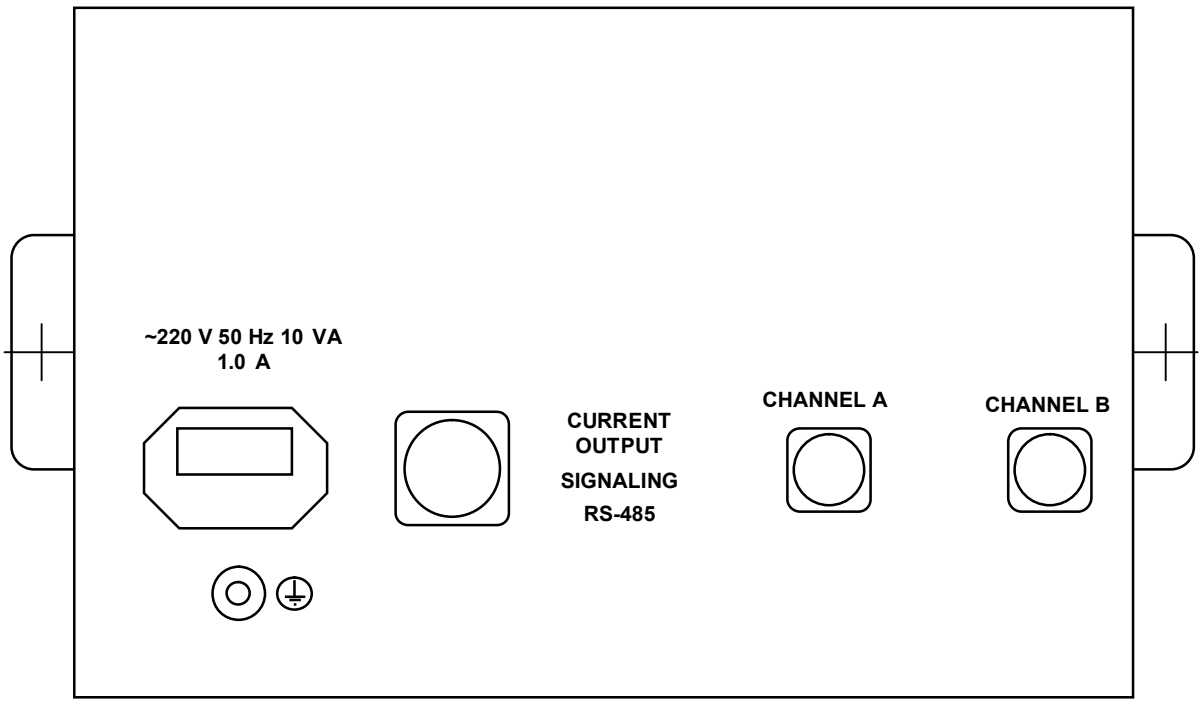


Fig. 1.2 − Layout of connectors on the panel-mounted converting unit rear panel

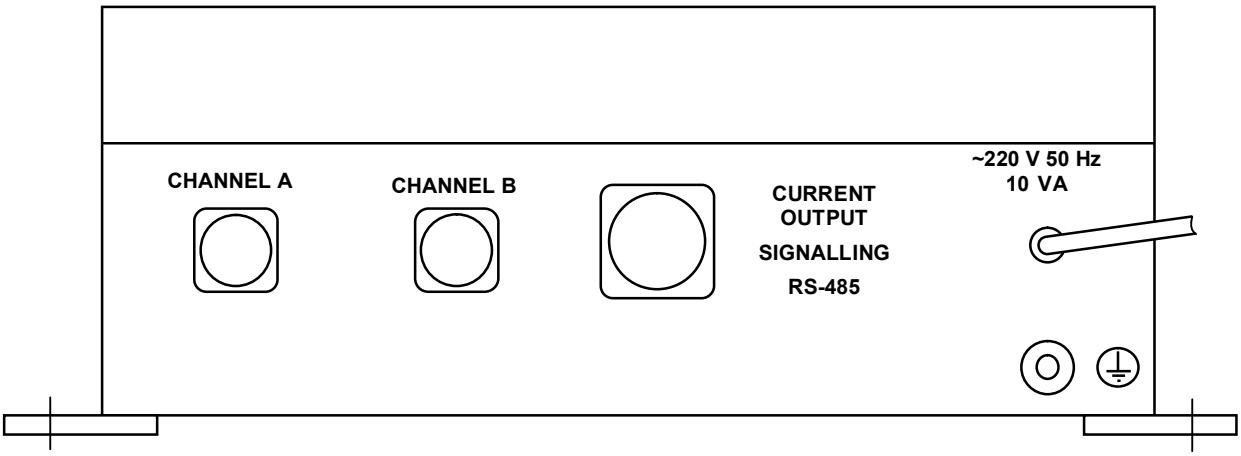


Fig. 1.3 − Layout of connectors the wall-mounted converting unit lower panel

– two connectors “**CHANNEL A**” and “**CHANNEL B**” to hook up conductivity probes to the converting unit;

– “**CURRENT OUTPUT, SIGNALING, RS-485**” connector to hook up recording and actuating equipment and to hook up the conductivity meter to PC;

– terminal “ ⏚ ” to connect protective earthing to the conductivity meter frame.

The panel-mounted CU rear panel features the “**~220 V 50 Hz 10 V·A 1.0 A**” mains connector.

The wall-mounted converting unit lower panel features the “**~220 V 50 Hz 10 V·A 1.0 A**” sealed mains cable inlet.

1.5.3.2 Sensor unit

The PU-1102 probe unit (Fig. 1.4) is comprised of AU-1102 amplifier unit 1 and conductivity probe 2.

The amplifier unit has a sealed aluminum alloy housing. Shielded connecting cable 3 from the conductivity probe runs through sealed cable inlet 4 to connect to terminal blocks located on the casing inner cardboard, according to 2.3.5. The shielded cable hooking up the amplifier to converting units is connected to “ENTRY” connector 5.

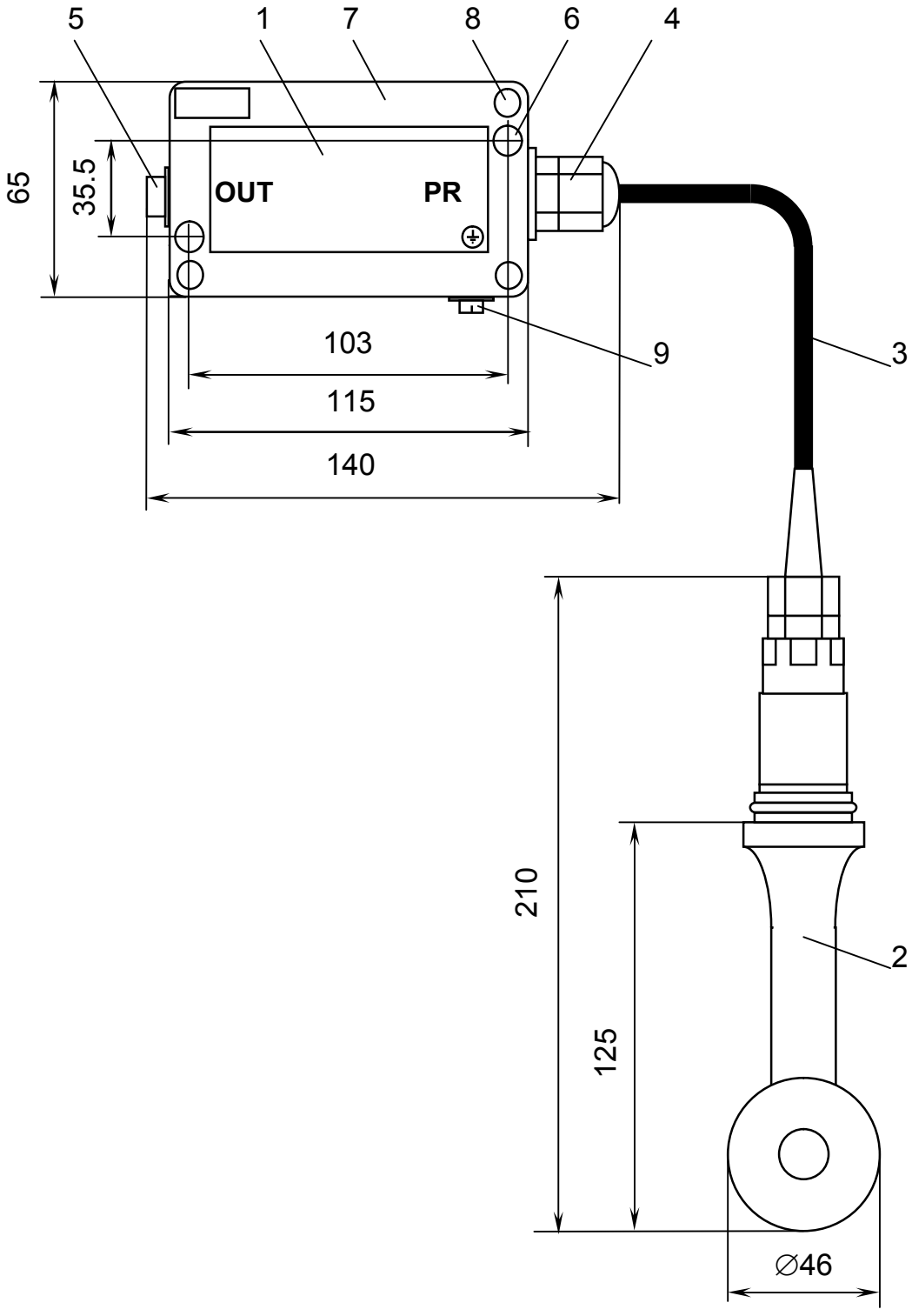


Fig. 1.4 – PU-1102 probe unit

The amplifier unit is secured to the vertical surface with screws M4×8 using holes 6. Cover 7 seals the amplifier unit cardboard and secured with screws 8.

Screw 9 is designed for the earthing wire connection.

1.5.4 Measuring screens

1.5.4.1 Types of measuring mode screens

The conductivity meter has the following measuring mode screens:

– single-channel (A or B) measuring mode screen is as shown in Fig. 1.5 and 1.6;

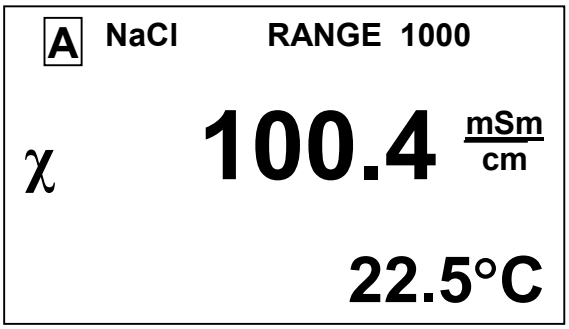


Fig. 1.5

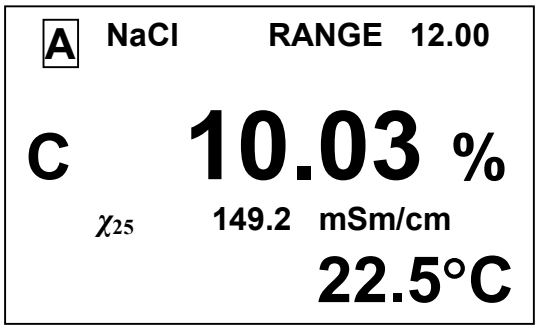


Fig. 1.6

– dual channel (A and B) measuring mode screen is as shown in Fig. 1.7.

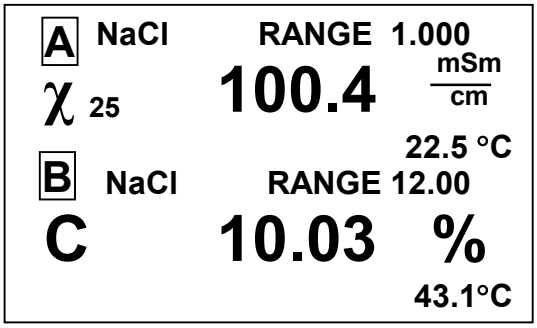


Fig. 1.7

Toggling among measuring channel indication modes is by successively pressing the "**CHANNEL**" button, with channel A or B readings or both channel A and B readings displayed.

Indicated on the screens are channel names (A or B), solutions, current output measuring range values for each channel and measured values of SEC, SEC referred to 25 °C or mass fraction (concentration) of water-dissolved substances as well as temperature.

If the conductivity probe is only connected to one channel, measurements may be performed for this channel only.

1.5.5 Types of setting monitoring and changing mode screens (MENU modes)

1.5.5.1 General information on handling the **MENU**

The **MENU** mode is entered from the measuring mode by pressing the "**menu**/**enter**" button.

The conductivity meter has three screen menus:

- **MENU [A]**;
- **MENU [B]**;
- **MENU [A] [B]**.

Toggling among screen menus is by successively pressing the "**CHANNEL**".

MENU [A] and **MENU [B]** screens reflect the status of individual channel parameters and is shown in Fig. 1.8.

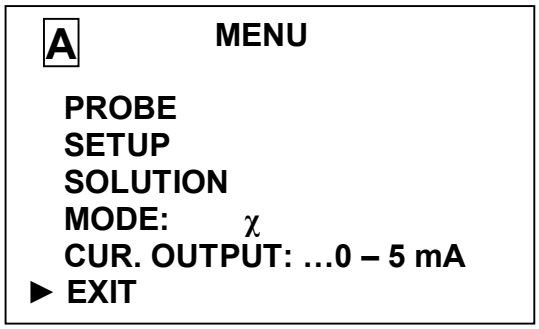


Fig. 1.8

MENU [A] [B] screen reflects the conductivity meter's parameters common for both measuring channels and is shown in Fig. 1.9.

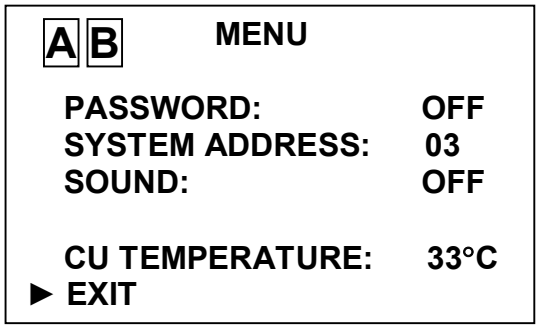


Fig. 1.9

The required menu item is highlighted with the "►" marker moved up and down the screen with the "⇓"/"⇑" buttons.

After the "►" marker is set at the required menu item, press the "**menu / enter**" button.

To exit **MENU** screens, set the marker at the **EXIT** line and press the "**menu / enter**" button.

1.5.5.2 Entry of numerical values in **MENU [A]**, **MENU [B]** and **MENU [A] [B]**

As required, the conductivity meter allows the user to change numerical values in menu lines or enter new ones. This concerns, for example, selection of a programmable current output measuring, entry of threshold values etc.

Left scrolling is by the "**CHANNEL**" button.

Right scrolling is by the "**menu / enter**" button.

Number increasing or decreasing is by "⇓"/"⇑" buttons.

Proceed as follows to enter or change a numerical value:

- set the "►" marker at this line;
- press the "**menu / enter**" button; the first digit will be flashing;
- use the "⇓"/"⇑" buttons to set the first digit value;
- press the "**menu / enter**" button; the second digit will be flashing;
- use the "⇓"/"⇑" buttons to set the second digit value;
- press the "**menu / enter**" button; set the other digits.

Once all the digits and units of measurements are set (no number is flashing), use the "⇓"/"⇑" buttons to set the "►" marker at another line and enter another value, if necessary.

Once all the digits and units of measurements are set (no number is flashing), use the "⇓"/"⇑" buttons to set the "►" marker at the **EXIT** line and press the "**menu / enter**" button.

1.5.5.3 Using **MENU [A]** and **MENU [B]** screens (Fig. 1.10)

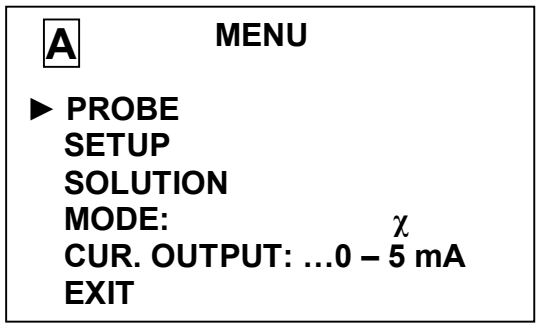


Fig. 1.10

The required menu item is highlighted with the "►" marker moved up and down the screen with the "⇓"/"⇑" buttons. After the "►" marker is set at the required menu item, press the "**menu**/**enter**" button.

To exit **MENU** screens, set the "►" marker at the **EXIT** line and press the "**menu**/**enter**" button.

► PROBE

The screen is shown in as shown in Fig. 1.11.

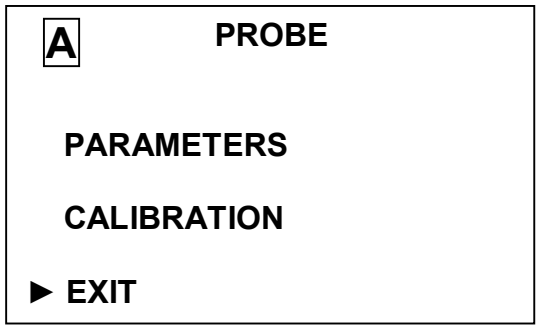


Fig. 1.11

PARAMETERS – menu item intended for the conductivity probe's parameter viewing and updating.

The screen is as shown in Fig. 1.12 below.

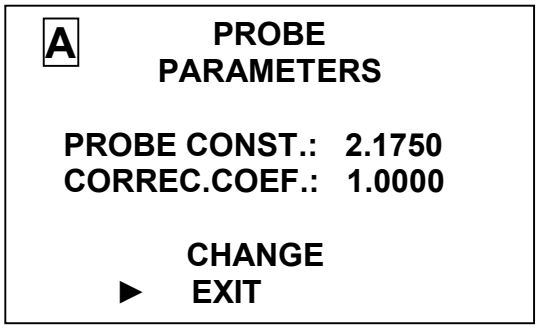


Fig. 1.12

If the cursor is set at the **CHANGE** line, the screen will change as shown in Fig. 1.13.

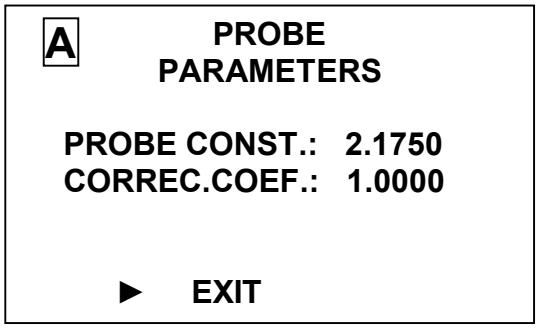


Fig. 1.13

While choosing the line you need, set the required values digit by digit.

CALIBRATION is a menu item designed for calibration of the conductivity meter.

Calibration is to be performed subject to 2.3.6.

► SETUP

The screen is as shown in Fig. 1.14.

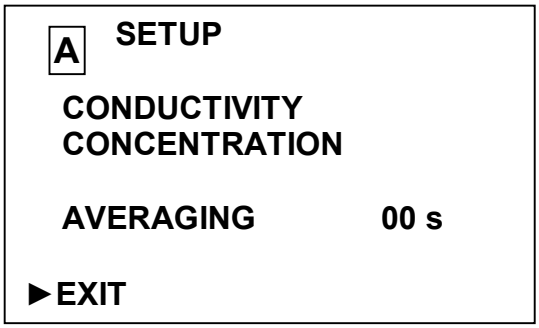


Fig. 1.14

Depending on whether the **CONDUCTIVITY** or **CONCENTRATION** line is chosen, the screen as shown in Fig. 1.15 or 1.16 will appear.

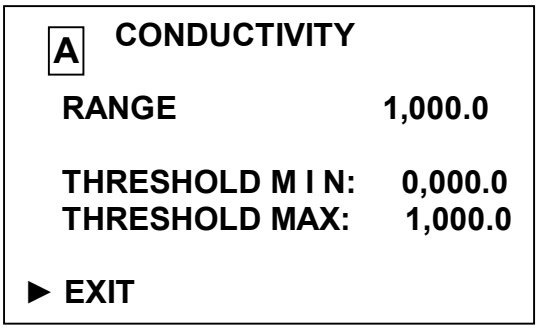


Fig. 1.15

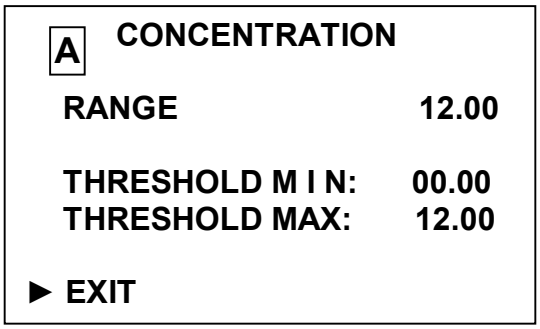


Fig. 1.16

The user may set the upper limit of the current output measuring range and change or view the minimum and maximum threshold values.

The unit of measurement of conductivity is mSm/cm and that of mass fraction of water-dissolved substances is %.

The value of the programmable current output measuring range should be set within the following limits:

– for conductivity measurements – from 1 to 1.000.0 mSm/cm;

– for measurements of mass fraction of water-dissolved substances – from 0.1 % to the values as listed in 1.3.2.

The **M I N** threshold value should be set within the following range:

– for conductivity measurements – from 0.0 to 999.0 mSm/cm;

– for measurements of mass fraction of water-dissolved substances – from 0.0 % to 99 % of the values as listed in 1.3.2.

The **MAX** threshold value should be set within the following range:

– for conductivity measurements – from 1 to 1.000.0 mSm/cm;

– for measurements of mass fraction of water-dissolved substances – from 0.1 % to the values as listed in 1.3.2.

Once all the digit values are selected, set the marker at the **EXIT** line and press the "**menu / enter**" button. This action will cause the screen as shown in Fig. 1.17 to appear.

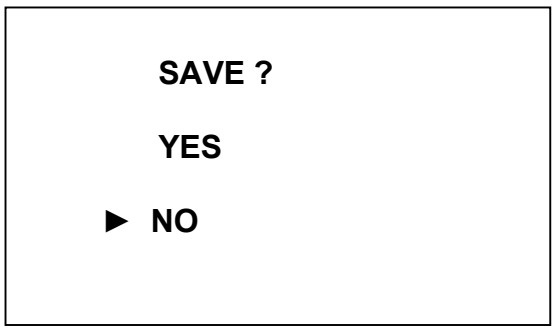


Fig. 1.17

Use the "⇓"/"⇑" buttons to set the "►" marker at the **YES** line, and press the "**menu / enter**" button. The conductivity meter will change over to the **SETUP** mode, saving the set measuring range value and changed threshold values.

By choosing the **AVERAGING** line the user can digit by digit set the required indication averaging time in order for the mean value of parameters measured within the time specified to be displayed.

► SOLUTION

The screens are as shown in Fig. 1.18 and 1.19.

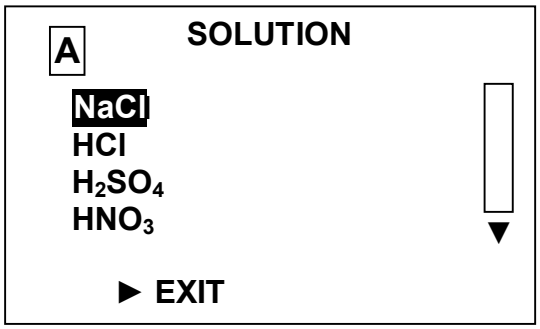


Fig. 1.18

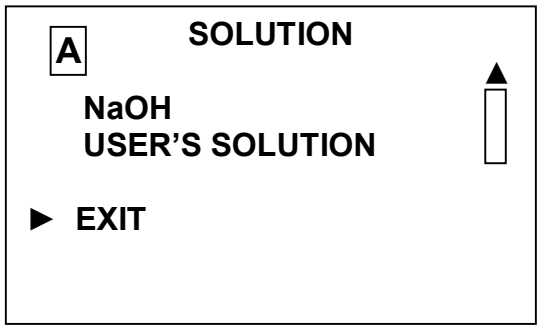


Fig. 1.19

Use the "⇓"/"⇑" buttons to select the desired solution. Pressing the "**menu** / **enter**" button the chosen line is highlighted.

When selecting the user's solution, pressing the "**menu** / **enter**" button will cause the screen as shown in Fig. 1.20 to appear.

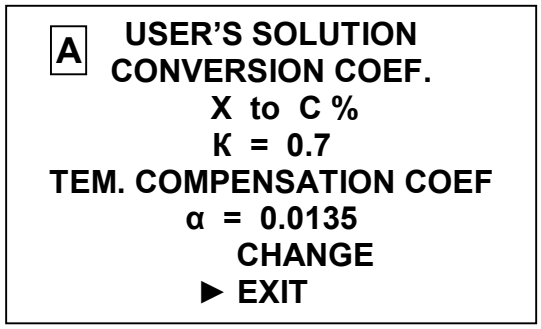


Fig. 1.20

Selecting the **CHANGE** line and pressing the "**menu** / **enter**" button will cause the screen as shown in Fig. 1.21 to appear, enabling the user to change any of the coefficients.

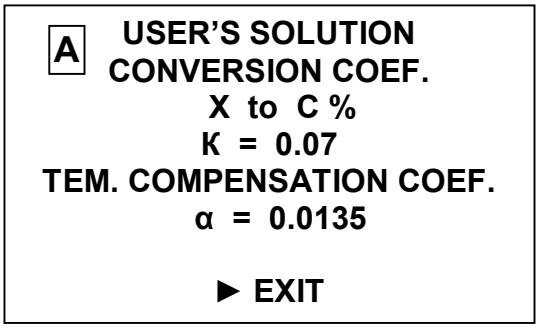


Fig. 1.21

Use the "⇓"/"⇑" buttons to select the coefficient to be changed and correct it as required.

Conversion of SEC, χ and mSm/cm readings into those of the mass fraction of a water-dissolved substance *C*, %, is done with the following formula:

$$C = K\chi,$$

where *K* – conversion coefficient, $\frac{\%}{\text{mSm/cm}}$.

► **MODE** – a menu line intended for measuring mode selection.

Set the marker at the ► **MODE** line. Press successively the "**menu**/**enter**" button to select a measuring mode. This action will cause one of the following characters corresponding to the selected measuring mode to appear in the **MODE** line:

"**χ**" − measurement of SEC not referred to 25 °C;
"χ_{25}" − measurement of SEC referred to 25 °C;
"**C**" − measuring the mass fraction of a water-dissolved substances.

► **CUR. OUTPUT:** – this menu item is intended to select an unified output DC signal (0 to 5 mA, 4 to 20 mA or 0 to 20 mA) by pressing the"**menu**/**enter**" button.

1.5.5.4 Using **MENU [A] [B]** screen

The **MENU [A] [B]** screen (Fig. 1.22) enables the user to change the conductivity meter's parameters common for both channels.

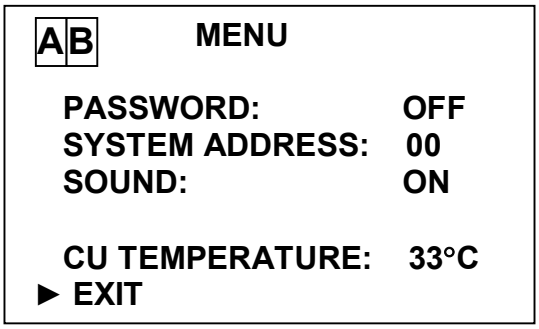


Fig. 1.22

Use of this screen menu is similar to that of **MENU [A]**, **MENU [B]** screens.

► **PASSWORD: ON** – this menu item is intended to restrict access to changing the conductivity meter's parameters.

If the password feature is disabled (**PASSWORD: OFF**) no password is requested for changeover from the measuring mode to the **MENU** mode.

If the password feature is enabled (**PASSWORD: ON**) the conductivity meter will request the password (**12**) to be entered to change over from the measuring mode to the **MENU** mode.

The screen as shown in Fig.1.23 will appear.

Fig. 1.23

The first digit to be entered will be flashing on the screen.

Use the "⇓"/"⇑" buttons to set the value of the first password value (**1**) and press the "**menu**/**enter**" button. As the second digit starts flashing on the screen, set the password value (**2**) and press the "**menu**/**enter**" button.

If the correct password is entered the **MENU** screen will drop into view. If a wrong password is entered the conductivity meter will switch over to the measuring mode.

► **SYSTEM ADDRESS: 00** – this **MENU [A] [B]** item is intended to set the conductivity meter's system address in case a few networked instruments operate on the RS-485 interface. The system address identifies a specific conductivity meter in the network and may take values from **00** to **32**. In out-of-network operation the system address does not matter.

► **SOUND: −** this **MENU [A] [B]** item is intended to disable the conductivity meter's alarm signal, if necessary.

► **TEMPERATURE CU: −** this **MENU [A] [B]** item is intended to indicate the CU case inside temperature.

1.5.5.5 Manual temperature setting mode

To simulate the analyte medium temperature for calibration of the conductivity meter, the instrument has a manual temperature setting feature. The analyte medium temperature is simulated by setting up the desired value on the conductivity meter display.

Changing over to this mode is by successively pressing the "⇓" and "**menu** / **enter**" buttons.

The screen as shown in Fig. 1.24 will appear.

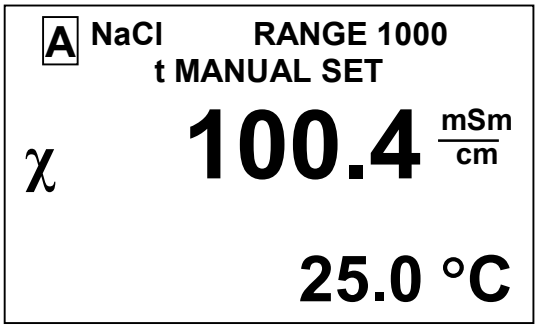


Fig. 1.24

The "**t MANUAL SET**" and a temperature value of 25 °C will appear on the display.

To change the temperature, press the "⇓" button; this action will cause the screen as shown in Fig. 1.25 to appear.

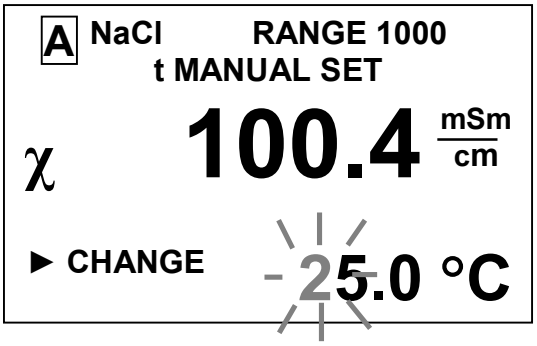


Fig. 1.25

Set, digit by digit, the required temperature value (1.5.5.2). Once all the digits are entered (no number is flashing), the "**CHANGE**" indication will disappear.

To set another temperature value, press the "⇓" button again. After the screen as shown in Fig. 1.25 appears, proceed similarly to set the required value.

To change over to the measuring mode with the temperature measured by the conductivity meter, press the "⇑" button.

Note − It is impossible to toggle between the channels in the manual temperature setting mode.

1.5.5.6 Warning and failure screens

The warning screen shown in Fig. 1.26 will appear if the connecting cable is not connected to the converting unit.

Fig. 1.26

The warning screen shown in Fig. 1.27 will appear if the connecting cable is not connected to the amplifier unit or if the amplifier unit is not responding.

Fig. 1.27

The warning screen shown in Fig. 1.28 will appear if the measured SEC value exceeds the current output measuring range. Set the appropriate current output measuring range.

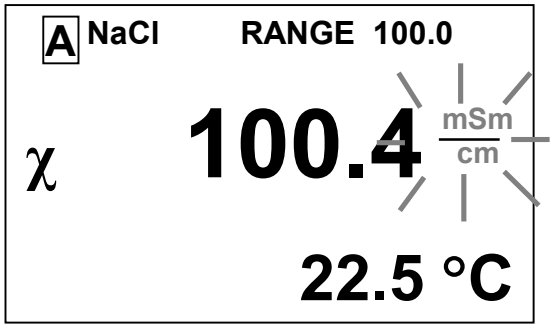


Fig. 1.28

The warning screen shown in Fig. 1.29 will appear if the measured value of mass fraction of water-dissolved substances exceeds the current output measuring range. Set the appropriate current output measuring range for mass fraction of water-dissolved substances.

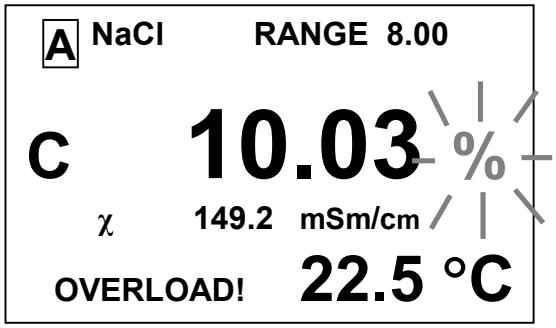


Fig. 1.29

The warning screen shown in Fig. 1.30 will appear if the analyte solution temperature is below 0 °C or above 70 °C.

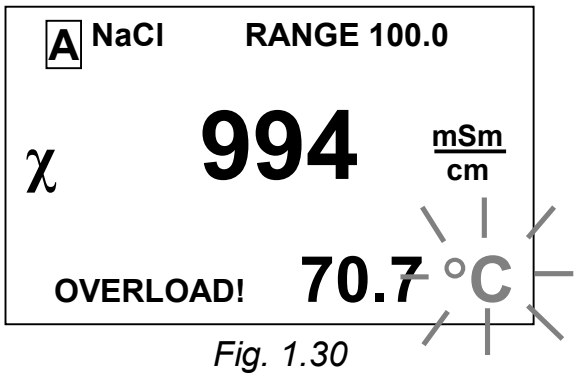


Fig. 1.30

The warning screen shown in Fig. 1.31 will appear if the measured SEC value is below the **MIN** threshold.

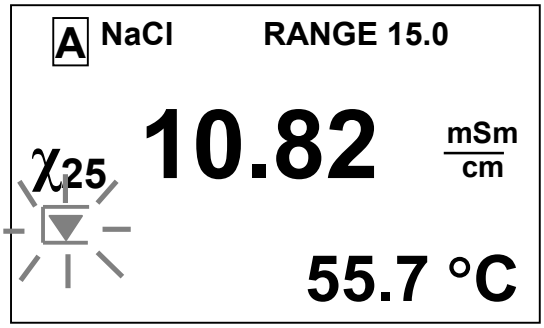


Fig. 1.31

The warning screen shown in Fig. 1.32 will appear if the measured SEC value is above the **MAX** threshold.

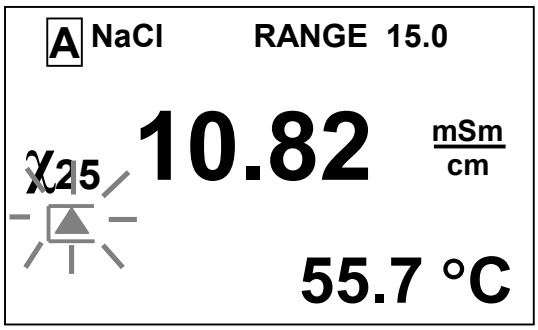


Fig. 1.32

2 INTENDED USE

2.1 Operating limitations

2.1.1 If a conductivity meter set includes a panel-mounted converting unit, install it so as to prevent ingress of water as its housing has IP30 protection.

2.1.2 Protect the converting unit against impacts as it comprises glass components.

2.1.3 For measuring cell measurements the analyte solution consumption rate should range between 5 and 200 dm^3/h.

2.1.4 When making immersion measurements, dip the conductivity probe (without fixtures) 50 to 120 mm into an analyte solution, ensuring that the distance to the walls and bottom of the analyte solution container is at least 30 mm.

2.1.5 In main pipeline measurements the analyte medium pressure should not exceed 0.8 MPa.

2.2 Safety precautions

2.2.1 The conductivity meter must be operated by personnel familiar with this Manual, the document “InPro 7250ST Series. Inductive Conductivity Probes. Operation Manual” and chemical solution handling rules.

2.2.2 The conductivity meter must be used in compliance with the Rules for Operation of Customers’ Electrical Installations, the Safety Rules for Operation of Customers’ Electrical Installations and GOST 12.2.007.0-75 requirements.

2.2.3 The converting unit must be installed so that the de-energizing of the conductivity meter is not hindered.

2.2.4 The conductivity meter must not be used with the CU case cover removed and CU unearthed.

2.2.5 Electric circuits providing connection to the “**CURRENT OUTPUT**, **SIGNALING**, **RS-485**” connector must use a shielded cable or wires laid in cable troughs or conduits.

2.2.6 The PU-1102 probe unit and the converting unit are connected by a shielded cable.

2.3 Conductivity meter setting-up procedures

2.3.1 Before use, unpack the conductivity meter, check the set for completeness and make sure the components are intact. If the conductivity meter has stayed in cold environment, keep it at room temperature for at least 2 h before starting setting-up procedures.

2.3.2 Converting unit Installation and connection

Install CU so that the de-energizing of the conductivity meter is not hindered.

The layout of attachment holes provided in the panel for a panel-mounted CU is shown in Fig. 2.1.

A panel-mounted CU is installed on the panel inside. The plate included in the panel-mounted conductivity meter delivery set is installed on the panel face.

M5 screws with nuts included in the delivery set are used for attachment.

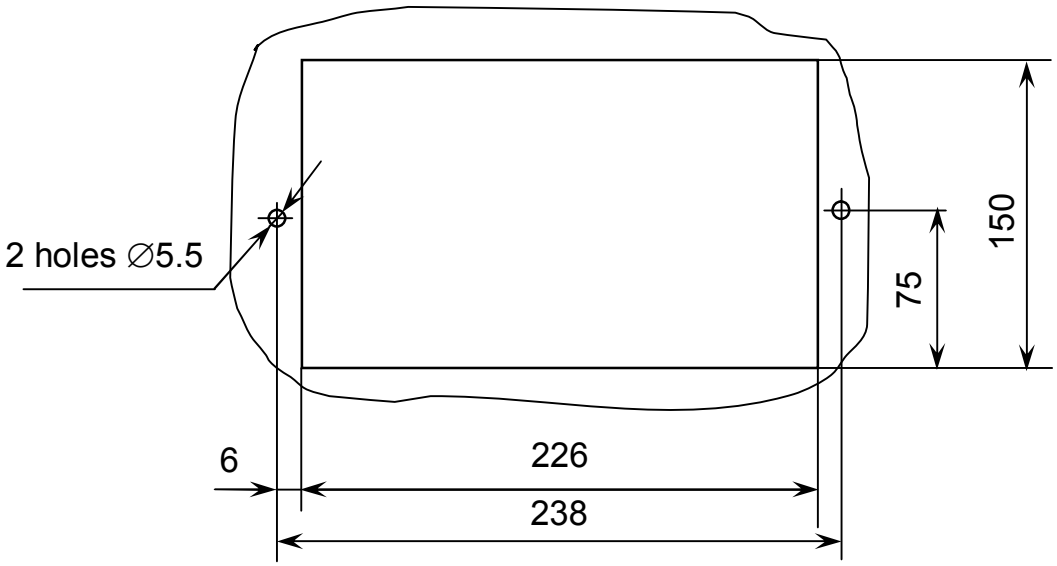


Fig.2.1 − Layout of attachment holes for a panel-mounted converting unit

The layout of holes for vertical attachment of a wall-mounted CU is shown in Fig. 2.2.

Earth the converting unit case by connecting a copper wire with a section of at least 0.35 mm^2 to the block earth terminal.

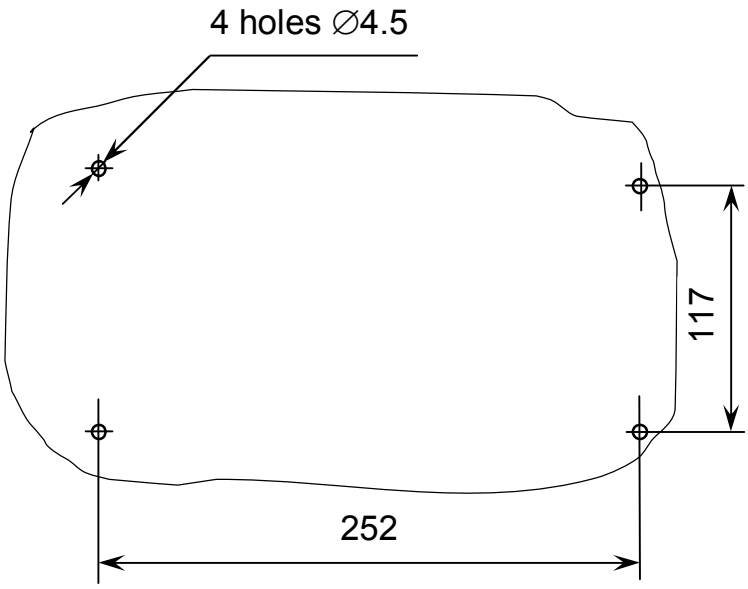


Fig. 2.2 − Layout of holes for vertical attachment of a wall-mounted converting unit

Connect to the converting unit the SCZ-1 mains cable with the MSL-202 plug (europlug) at one end (for connection to 220 V AC 50 Hz or 36 V 50 Hz mains) and the MSL-107 receptacle at the other end (for connection to the converting unit). The cable is 1.7 m long.

The SCZ-1 mains cable with the MSL-202 plug (europlug) at one end (for connection to 220 V AC 50 Hz or 36 V 50 Hz mains) is used for wall-mounted converting units. The other end is taken through the sealed inlet to the instrument's power supply board located inside the converting unit case. The cable is 1.5 m long.

2.3.3 Converting unit's external connections

External connections of the converting unit are made to the "**CURRENT OUTPUT**, **SIGNALING**, **RS-485**" connector on the rear panel of a panel-mounted converting unit or on the lower panel of a wall-mounted converting unit, as shown in Fig.1.2 and 1.3, using the PC19TB receptacle included in the mounting parts kit.

The PC19TB receptacle contact layout (view as seen from the soldered contact side) is shown in Fig. 2.3.

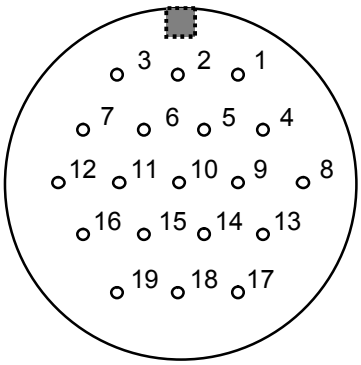


Fig. 2.3

2.3.3.1 Connection of current meter to converting unit

Connection of the external device to the current output is through the "**CURRENT OUTPUT**, **SIGNALING**, **RS-485**" connector contacts, as per Table 2.1.

Table 2.1

Contact No.	5	6	9	10
Circuit	Channel A (+)	Channel A (–)	Channel B (+)	Channel B (−)

Contacts 6 and 10 are interconnected.

The 4-20 mA range load must not exceed 500 Ω.
The 0-5 mA range load must not exceed 2 kΩ.

2.3.3.2 RS-485 interface connection

Connection of the PC's RS-485 port to the transducer unit is through the "**CURRENT OUTPUT**, **SIGNALING**, **RS-485**" connector contacts, according to Table 2.2.

Table 2.2

Contact	Circuit
11	SG (signal ground)
14	DAT+ (Data +)
15	DAT– (Data –)

IMPORTANT: De-energize your PC and transducer unit before connecting them!

Rate of exchange – 19.200 bps.

2.3.3.3 Connection of external actuating and warning equipment

Connection of external actuating and warning equipment to the transducer unit is through the "**CURRENT OUTPUT**, **SIGNALING**, **RS-485**" connector contacts.

If the measured DOC dissolved oxygen concentration values and analyte medium temperature exceed the specified limits, the relay's dry contacts close the circuits between the connector contacts, as per Table 2.3.

Threshold parameters are changed in accordance with 1.5.5.

The peak switching current is 150 mA at 36 V AC.

Table 2.3

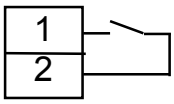
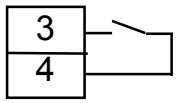
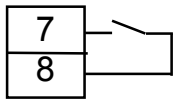
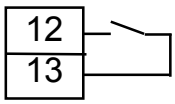
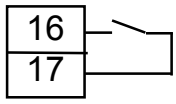
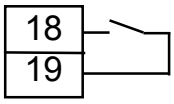
Controlled parameter	Channel	Controlled parameter value	No. of contacts, between which circuit is closed
Measured SEC value, mSm/cm. Measured value of mass fraction of water-dissolved substances, ppm.	A	above upper limit and below lower limit of the current output measuring subrange	
Measured temperature value, °C		above 70 °C	

Table 2.2 (Continue)

Controlled parameter	Channel	Controlled parameter value	No. of contacts, between which circuit is closed
Measured SEC value, mSm/cm. Measured value of mass fraction of water-dissolved substances, ppm.	B	above upper limit and below lower limit of the current output measuring subrange	
Measured temperature value, °C		above 70 °C	
Measured SEC value, mSm/cm. Measured value of mass fraction of water-dissolved substances, ppm.	A	below MIN threshold value	
		above MAX threshold value	
Measured SEC value, mSm/cm. Measured value of mass fraction of water-dissolved substances, ppm.	B	below MIN threshold value	
		above MAX threshold value	

2.3.4 Installation of InPro 7250 ST/Pt1000/3m conductivity probe

2.3.4.1 Installation of the conductivity probe in a flow-through cell is as shown in Fig. 2.4. Use is made of the BP56.02.310 flow-through installation kit supplied upon agreement with the client.

The flow-through cell is made of stainless steel.

Before installing the conductivity probe into the measuring cell, put the threaded sleeve onto it against the stop, from the cable side.

Screw the threaded sleeve into the measuring cell body.

Insert the conductivity probe into the threaded sleeve against the stop and retain it with the locknut.

The measuring cell is secured to the vertical surface with the clamp or M10 bolt.

The measuring cell's inlet and outlet connections have nipples with an outside diameter of 6 mm. Connection of the pipe supplying and carrying off the analyte solution is by welding.

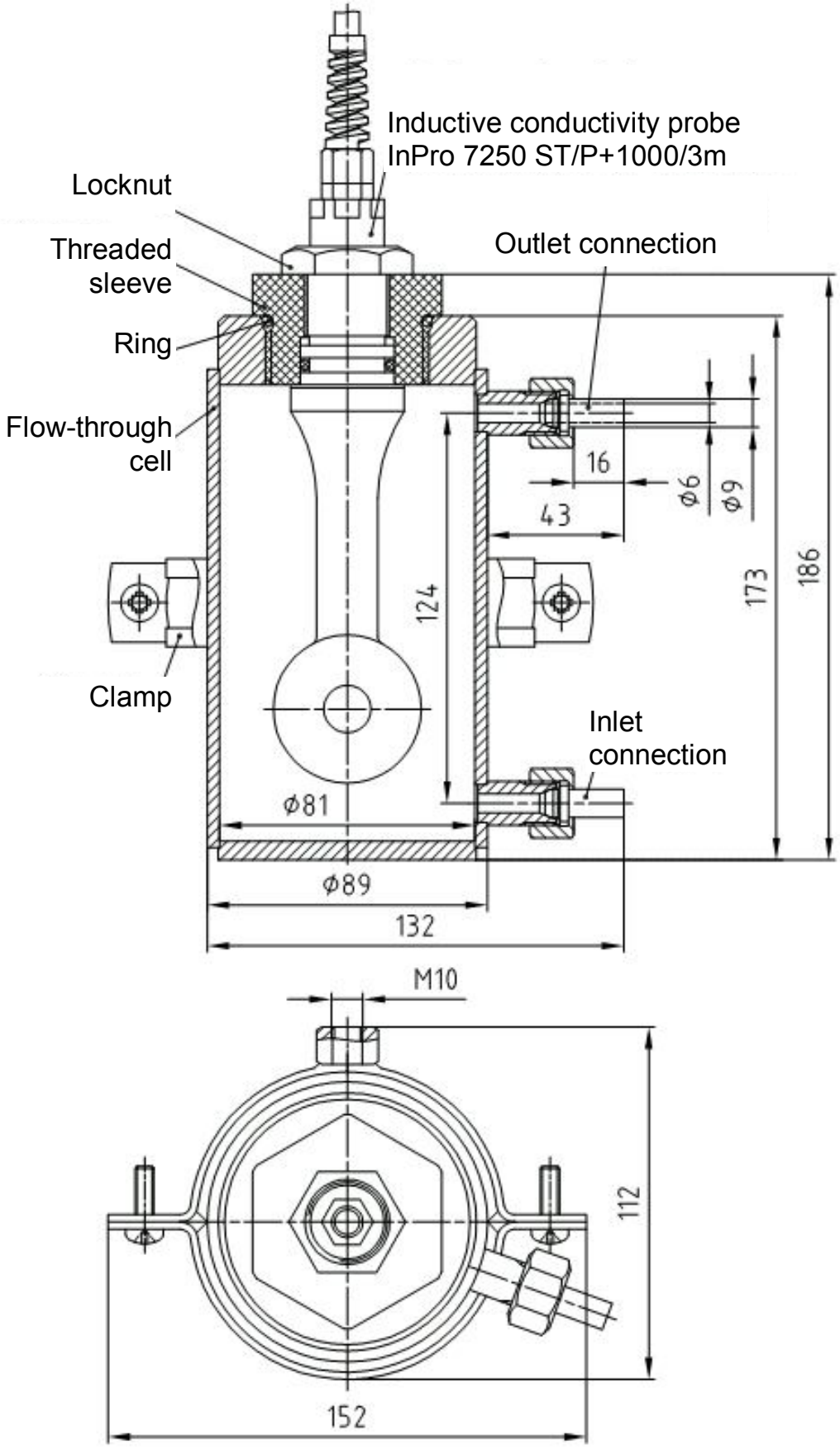


Fig.2.4 − Installation of the conductivity probe in a flow-through cell

2.3.4.2 Installation of the conductivity probe in a main pipeline is as shown in Fig.2.5. Use the BP56.02.320 tie-in kit supplied upon agreement with the client.

Installation of the conductivity probe in a main pipeline is subject to the recommendations contained in “InPro 7250ST Series. Inductive Conductivity Probes. Operation Manual”.

The pipe and threaded sleeve supplied upon agreement with the client are used for main pipeline measurements.

The pipe should be welded vertically into the pipeline as shown in Fig. 2.5.

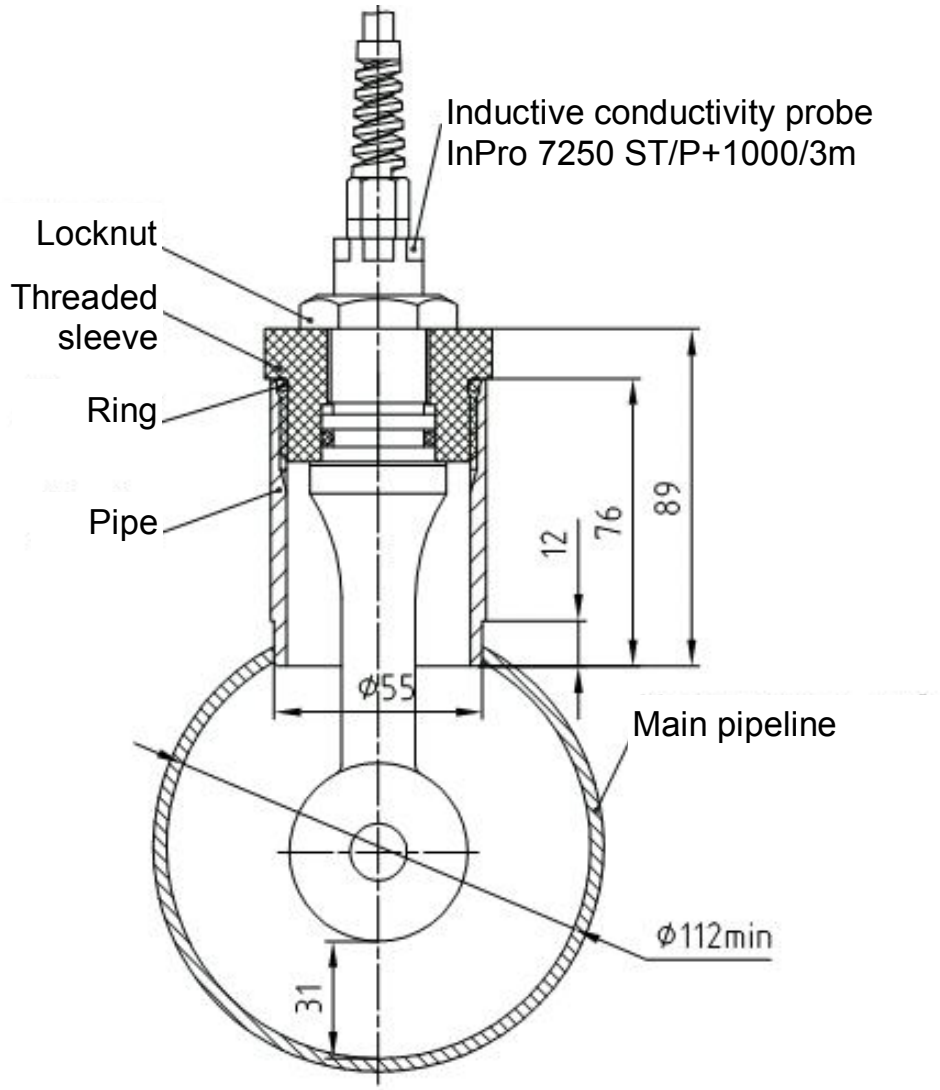


Fig.2.5 – Installation of the conductivity probe in a main pipeline

Put the threaded sleeve onto the probe from the cable side.

Screw the threaded sleeve into the pipe.

Insert the conductivity probe into the threaded sleeve as far as it will go and retain it with the locknut.

Note − If a pipeline diameter is less than 112 mm, enter a correction factor, which is chosen from the table in Appendix B, in the **PROBE PARAMETERS** menu.

2.3.4.3 Conductivity probe fittings for up to 2.5 m deep measurements

If a conductivity probe is designed for up to 2.5 m deep measurements it is delivered installed in a special fixture as depicted in Fig. 2.6. Use is made of the BP56.02.330 flow-through installation kit supplied upon agreement with the client.

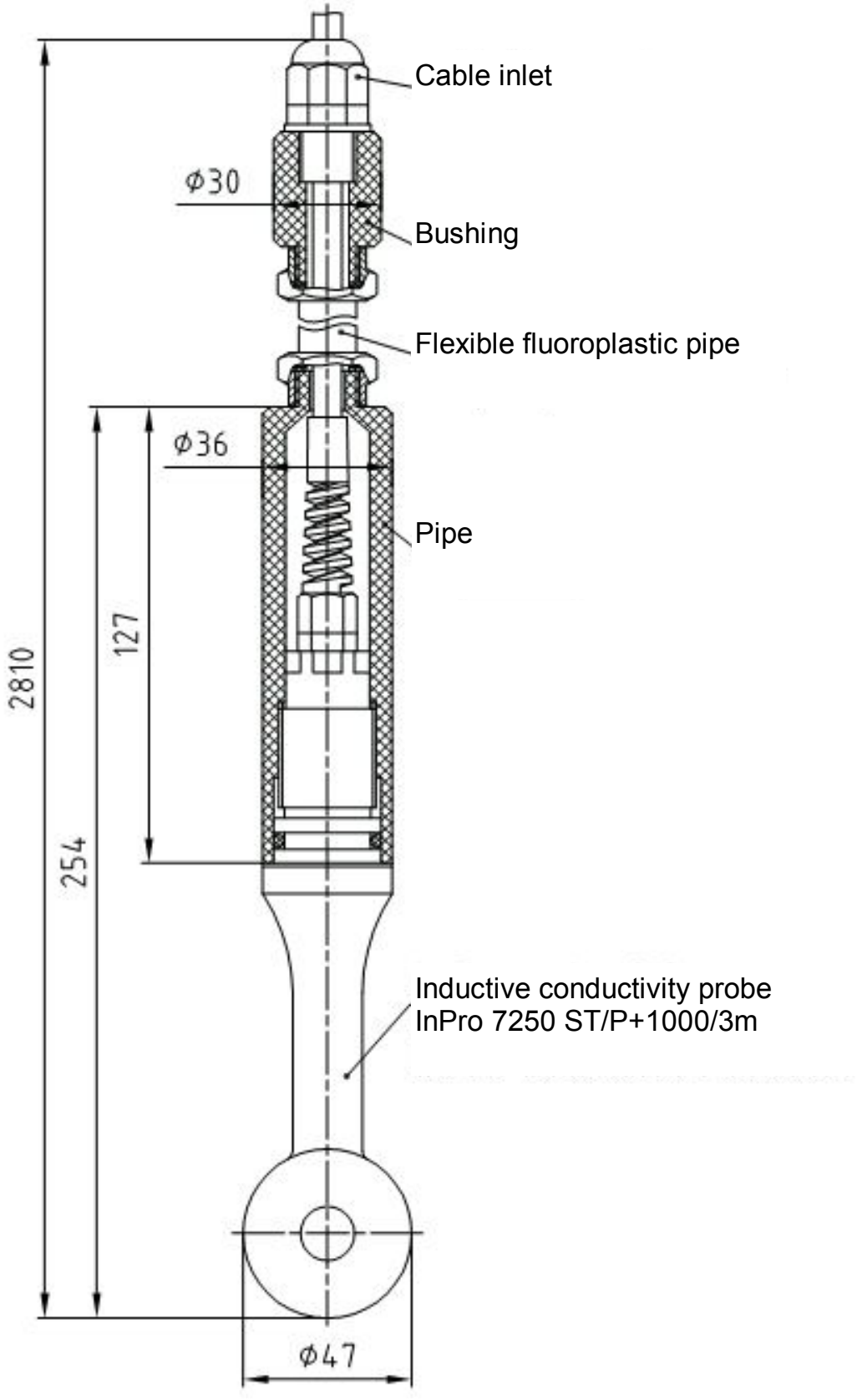


Fig. 2.6 – Conductivity meter immersion mounting kit

The pipe and bushing with sealed cable inlets are screwed onto the conductivity probe from the cable side. Put on the cable is a flexible fluoroplastic pipe taken along with the cable through the sealed cable inlets on the pipe and bushing.

2.3.4.4 Immersion measurements without fixtures

Location of the conductivity probe for immersion measurements without fixtures is as shown in Fig. 2.7.

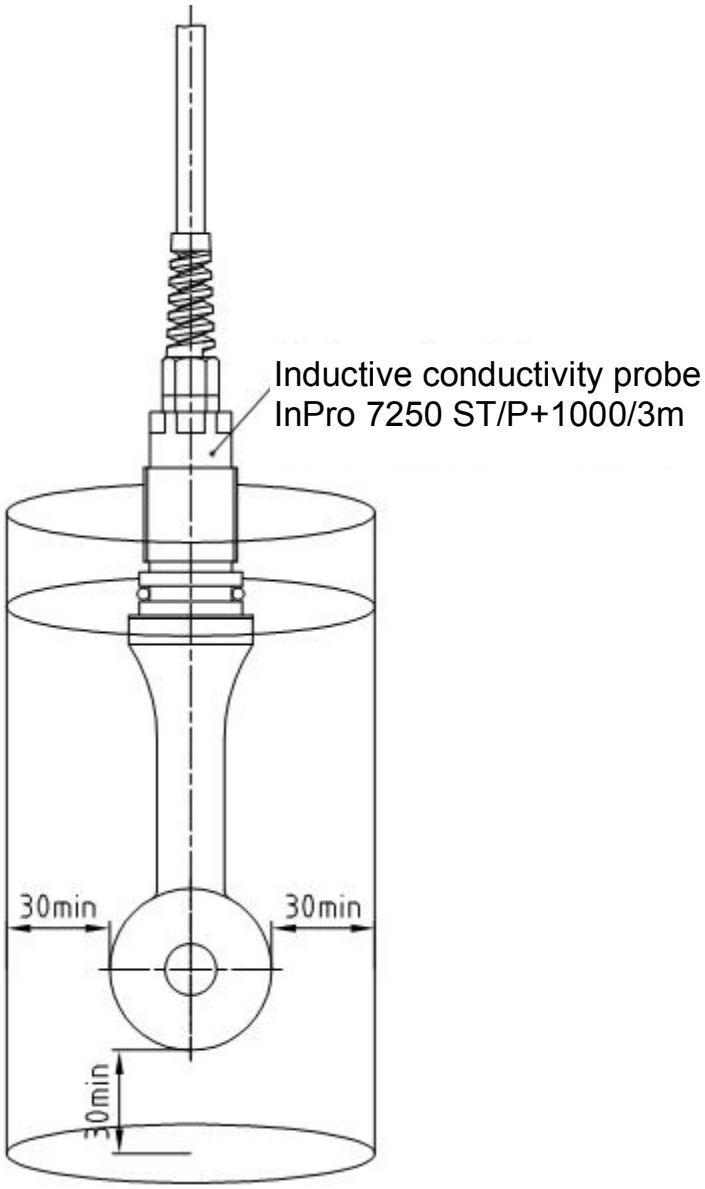


Fig.2.7 – Location of the conductivity probe for immersion measurements without fixtures

When making immersion measurements, dip the conductivity probe 50 to 120 mm into an analyte solution, ensuring that the distance to the walls and bottom of the analyte solution container is at least 30 mm.

2.3.5 Connection of conductivity probe to AU-1102 amplifier unit

Cable connection is as depicted in Fig. 2.8.

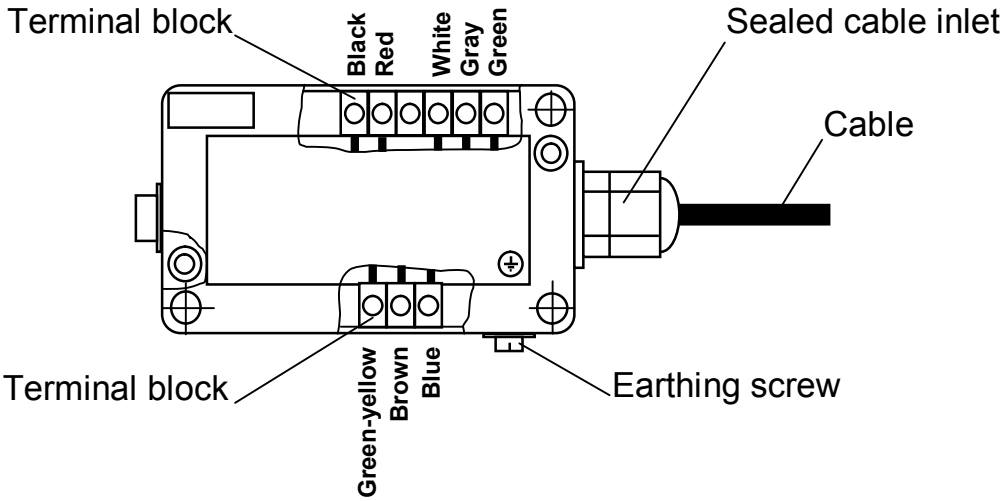


Fig.2.8 − Cable connection from the conductivity probe to the amplifier unit

IMPORTANT: Connection must be performed in accordance with the numbers specified in 4 and 5 of BP56.00.000РЭ Operation Manual!

The conductivity probe number is on its case.
The PU-1102 probe unit number is on the amplifier unit case.

Remove the amplifier unit cover.
Take the cable from the conductivity probe through the sealed cable inlet to the terminal blocks located on the board in accordance with color marking shown in Fig. 2.8.
Close the amplifier unit cover.
Install the amplifier unit on the vertical surface. Attachment holes are subject to 1.5.3.2.
Earth the amplifier unit case by connecting a copper wire with a section of at least 0.35 mm^2 to the amplifier unit earthing screw.

2.3.6 Testing and changing the conductivity meter's parameters

Use the cables from the delivery set to connect the converting and amplifier units. Connect the converting unit to the power line.

Push on the **POWER** switch; the green light indicator on the front panel will come on. A sound signal is produced to indicate that the conductivity meter is on.

Proceed as follows:

– press the "**menu**/**enter**" button, the conductivity meter will switch over to the parameter monitoring and changing mode;

– check the probe connectors for correct connection to the appropriate measuring channel;

– by pressing the **CHANNEL** button, check parameters specified in **MENU [A]**, **MENU [B]** and **MENU [A].[B]** and adjust them, if necessary, according to 1.5.5.

On the **PROBE PARAMETERS** menu, check correctness of the set value in the **PROBE CONST.** line.

The correction coefficient depending on measurement conditions should be set in the **CORREC. COEF.** line.

For measuring cell measurements, the correction coefficient is stored in the conductivity meter prior to shipment to the user.

If the distance between the conductivity meter and pipeline walls is less than 30 mm, enter the correction coefficient allowing for this distance as well as the material they are made of.

The correction coefficient is chosen from the table in Appendix B.

The user may then proceed to measurements.

2.3.7 Conductivity probe constant calibration

The conductivity probe constant calibration is performed if the SEC measuring error falls outside the range specified in 1.3.3.

Prior to calibration, establish the setup as shown in Fig. 2.9.

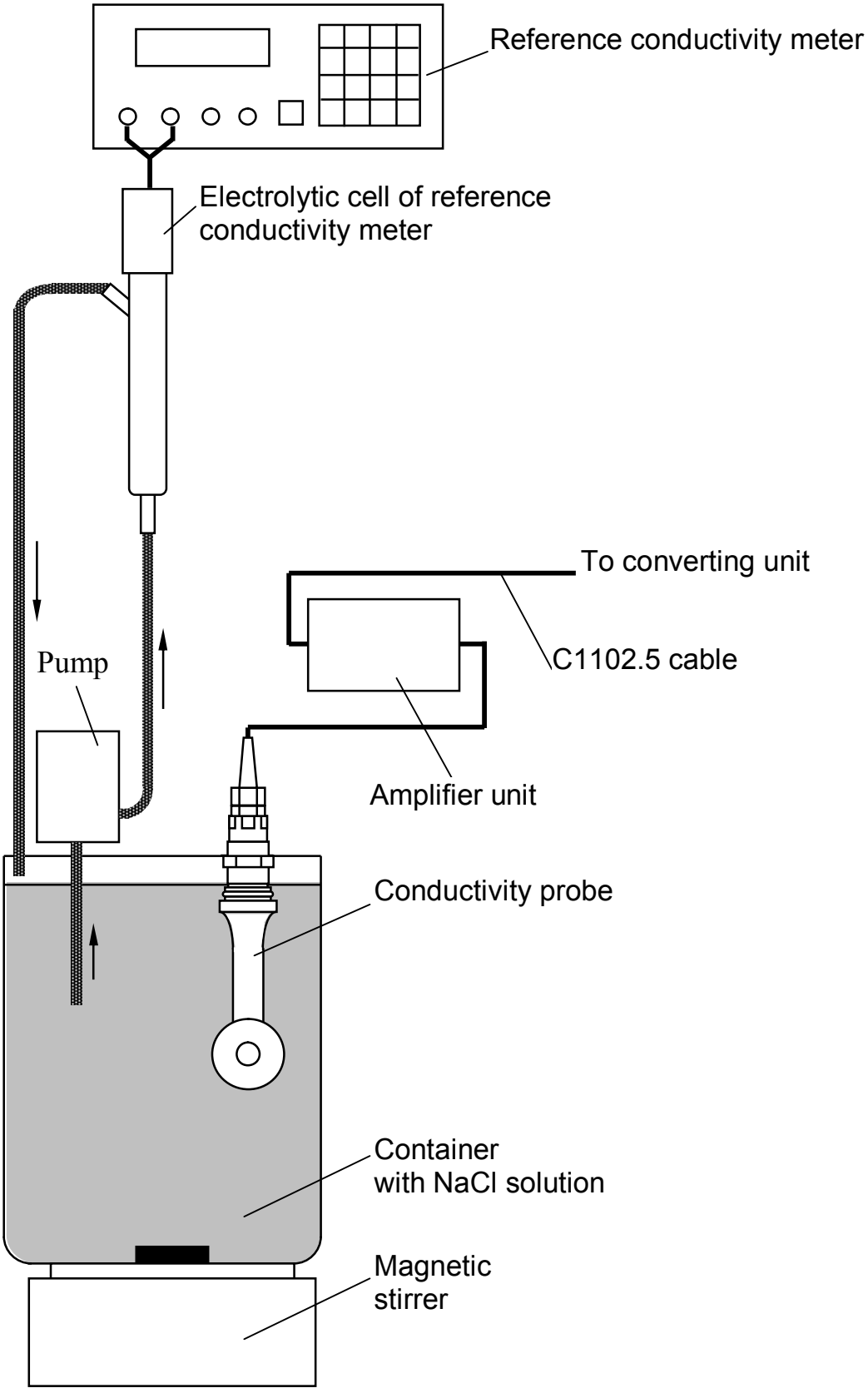


Fig.2.9 – Setup for conductivity meter constant calibration

Pour 1M NaCl solution (58.45 g of NaCl per dm^3 of solution) into a 3 dm^3 container.

Install the container on the magnetic stirrer.

Put the reference temperature meter into the container.

Dip the conductivity probe (without fixtures) 50 to 120 mm into an analyte solution, ensuring that the distance to the walls and bottom of the analyte solution container is at least 30 mm.

Place the conductivity probe, electrolytic cell and container with NaCl solution in similar temperature conditions at (20 ± 5)°C. Hold the conductivity probe in the solution container for at least 5 min.

Set the NaCl flow through the electrolytic cell of the reference conductivity meter.

Turn on the conductivity meter under check.

Invoke the mode of measuring SEC not referred to 25 °C ("χ").

Set the value of the programmed current output measuring range 1.000 mSm/cm.

Select threshold values equal to 0 mSm/cm (**MIN**) and 1.000 mSm/cm (**MAX**).

Turn on the reference conductivity meter.

Turn off temperature compensation of the reference conductivity meter.

Turn off the pump.

Wait for the steady state indications of both conductivity meters.

Probe constant calibration operations

1 While in the **PROBE** menu, set the cursor at the **CALIBRATION** line and press the "**menu**/**enter**" button; the screen as shown in Fig. 2.10 will appear.

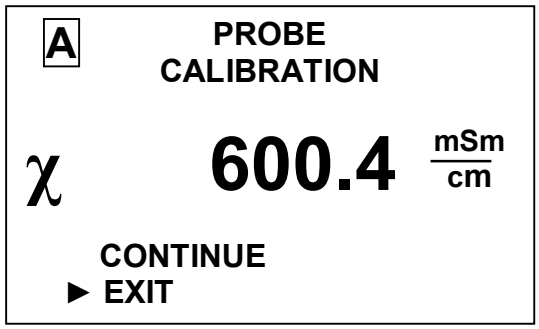


Fig.2.10

2 Choose the **CONTINUE** line, which may cause the screen depicted, for instance, in Fig. 2.11 to appear.

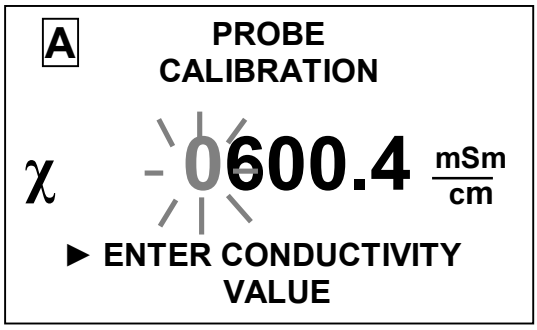


Fig.2.11

3 Digit by digit, enter the number corresponding to the reference conductivity meter. Entry completed, the screen as shown in Fig. 2.12 will appear.

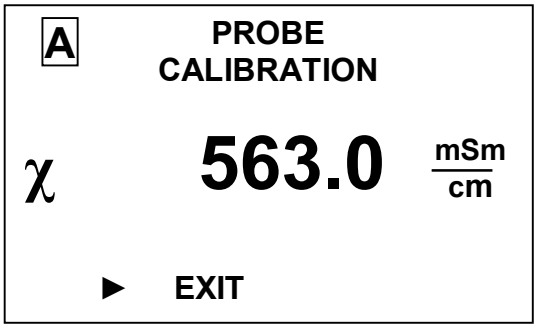


Fig.2.12

4 Pressing the "**menu**/**enter**" button will cause the screen as per Fig. 2.13 to appear with the probe constant values corrected according to the reference conductivity meter's readings.

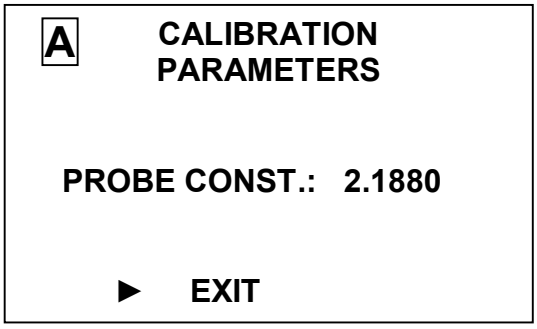


Fig.2.13

5 Press the "**menu**/**enter**" button to cause the screen as per Fig. 2.14 to appear.

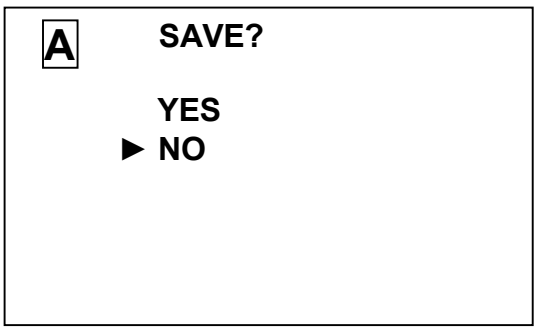


Fig.2.14

6 Set the cursor at **YES** and press the "**menu**/**enter**" button for the conductivity meter to go into the channel menu.

Note − The conductivity probe constant may be calibrated without using the reference conductivity meter against 1M NaCl solution, prepared from standard titers. In this case, for calibration, the user should measure the solution temperature and enter the conductivity value corresponding to the measured solution temperature. The 1M NaCl solution conductivity dependency table is provided in Table B.

2.4 Measurements

To perform measurements, proceed as follows:

– push on the **POWER** switch on the front panel, the display screen will come on;

– check correct setting of the conductivity meter's parameters and operating modes;

– use the **CHANNEL** button to select indication of channel A, channel B or both channels.

The screen indication updating time may reach 30 s.

Note − A ratio between molar concentration (mole/dm^3), mass concentration (ppt) and mass fraction (%) of water-dissolved substance is provided in the table of Appendix D.

2.5 Troubleshooting

Typical failures of the conductivity meter and remedial actions are provided in Table 2.1.

If any troubles listed in Table 2.1 occur, perform the steps recommended in the “Remedy” column.

Table 2.1

Trouble	Probable cause	Remedy
Conductivity meter will not turn on	Blown fuses	Factory repair
Unstable conductivity meter readings	Open cable or loose contact in amplifier unit connector	Check and provide reliable contact or remedy the cable fault
Measured value of SEC or mass fraction of water-dissolved substances is markedly different from the actual value	Open connecting cable	Check contact joints at connectors and restore connection, if necessary.
	Ingress of moisture into CU connector and cardboards, and into probe unit connector	Dry the converting unit or probe unit connector.
	Contaminated conductivity probe	Wash the conductivity probe (3.1).
Measured value of SEC referred to 25 °C or mass fraction of water-dissolved substances is markedly different from the actual value	Open connecting cable	Check wire connections at the conductivity probe connector, temperature sensor connector and restore connection.
	Ingress of moisture into CU connector and cardboards, and into probe unit connector	Dry the converting unit or probe unit connector.
On the graphical display there are zeros in all digits and ranges, channel temperature is not displayed	Open heat sensor circuit	Eliminate the heat sensor circuit fault
On the graphical display there are zeros in all digits and ranges, channel temperature is displayed	Open conductivity meter circuit	Eliminate the conductivity meter circuit fault

Table 2.4 cont'd

Trouble	Probable cause	Remedy
WARNING! NO COMMUNICATION WITH PROBE! indication comes on when the conductivity meter is turned on or during measurements	Cable (between the converting and amplifier units) is not connected to the amplifier unit connector	Connect the cable to the amplifier unit
	Damaged connecting cable	Connecting cable is liable to repair
	Contact broken by cable soldering in connectors connected either to amplifier or converting units	Connecting cable is liable to repair

2.6 2.6 Supply line fuses

The power transformer windings feature:

– two ВП2Б-1В (0.5 А/250 V) fuses in МАРК–1102 and МАРК-1102/1 conductivity meter versions;

– two ВП2Б-1В (5 А/250 V) fuses in МАРК–1102/2 and МАРК-1102/3 conductivity meter versions.

3 MAINTENANCE

Conductivity probes are washed by their multiple immersions in distilled water.

The converting unit requires no maintenance.

Only mild detergents should be used for cleaning the exterior surfaces of the converting and amplifier units.

1 WARNING: PREVENT washing and analyte solutions from getting on the connectors of the converting and amplifier units!

2 WARNING: The converting unit SHALL NOT be opened throughout the guarantee period!

4 DELIVERY SET

4.1 The delivery set is as shown in Table 4.1.

Table 4.1

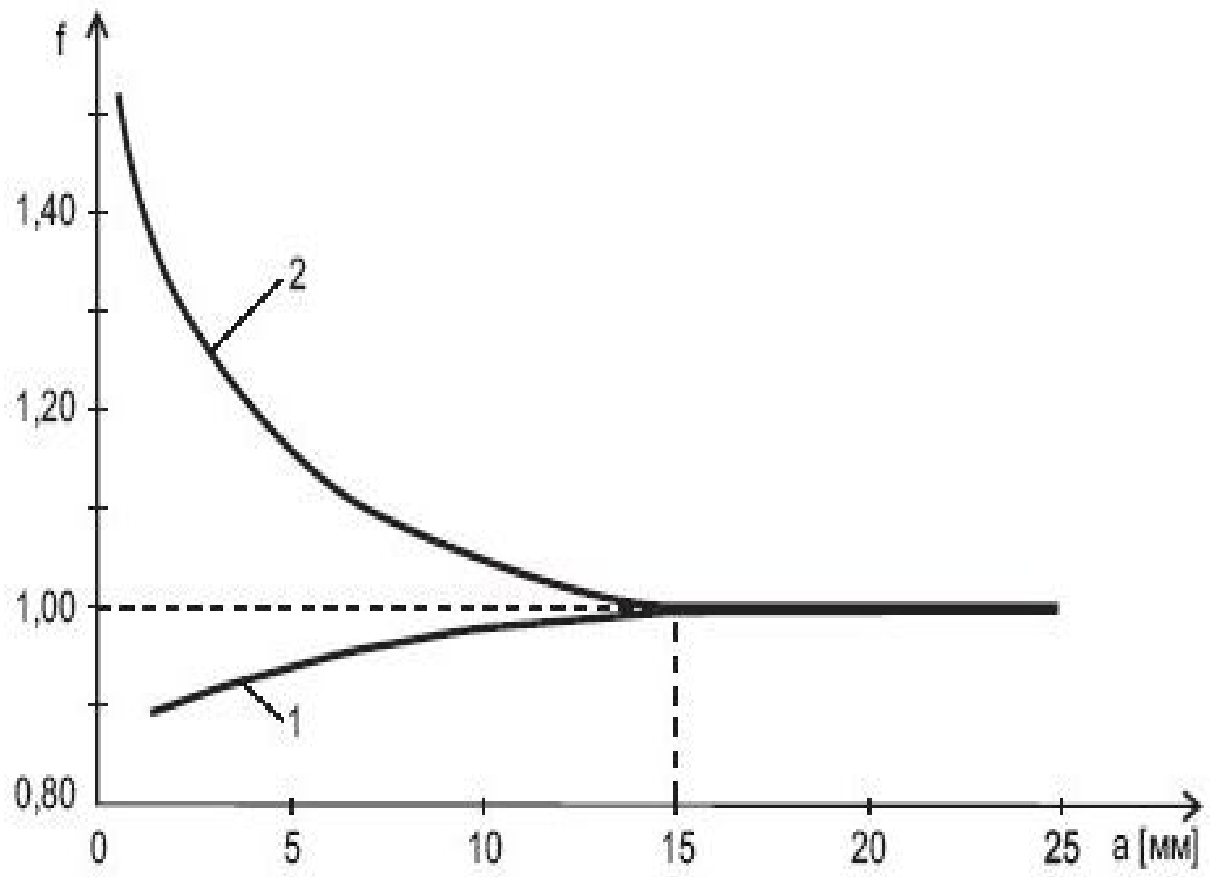
Description	Code	Quantity per version MARK-			
		1102	1102/1	1102/2	1102/3
1 БП-1102 Converting unit	BP56.01.000	1	–	–	–
	BP56.01.000-01	–	1	–	–
	BP56.01.000-02	–	–	1	–
	BP56.01.000-03	–	–	–	1
2 БД-1102 sensor unit: – БУ-1102 amplifier unit; – InPro 7250 ST/Pt1000/3m inductive conductivity probe	BP56.02.000 BP56.02.100	1*	1*	1*	1*
3 К1102.5 connecting cable	BP56.03.000	1**	1**	1**	1**
4 К1102.L connecting cable***	BP56.03.000-01	1*	1*	1*	1*
5 Mounting parts kit: – PC19TB receptacle and housing	BP56.07.000	1	1	1	1
6 Mounting parts kit	BP56.10.000	1	–	1	–
7 Mounting parts kit (to БД-1102 probe unit): – flow-through installation kit; – tie-in kit; – immersion installation kit.	BP56.02.300 BP56.02.310 BP56.02.320 BP56.02.330	 **** **** ****	 **** **** ****	 **** **** ****	 **** **** ****
8 Operation Manual	BP56.00.000РЭ	1	1	1	1

* Quantity (1 or 2) to be approved by the client.
** Quantity corresponds to that of sensor units.
*** Length L to be approved by the client (from 5 to 100 m).
**** To be approved by the client.

APPENDIX A

(*recommended*)

Relationship between correction coefficient f
and distance from conductivity probe
to pipe or container walls (mm) and material



1 – curve for a metal pipe or container;
2 – curve for a dielectric pipe or container.

APPENDIX B

(*mandatory*)

1M NaCl solution conductivity versus temperature

Table B.1

t, °C	χ, mSm/cm	*t*, °C	χ, mSm/cm
15.0	68.669	22.5	81.545
15.5	69.528	23.0	82.403
16.0	70.386	23.5	83.261
16.5	71.244	24.0	84.120
17.0	72.103	24.5	84.978
17.5	72.961	25.0	85.836
18.0	73.819	25.5	86.695
18.5	74.678	26.0	87.553
19.0	75.536	26.5	88.412
19.5	76.394	27.0	89.270
20.0	77.253	27.5	90.128
20.5	78.111	28.0	90.987
21.0	78.970	28.5	91.845
21.5	79.828	29.0	92.703
22.0	80.686	29.5	93.562
		30.0	94.420

APPENDIX C

(*mandatory*)

Ratio between molar concentration, mass concentration and mass fraction of water-dissolved substances

Table C.1

Solution	Molar concentration, mole/dm^3	Mass concentration, ppt	Mass fraction, %
NaCl	0.1	5.844	0.582
	0.2	11.688	1.162
	0.3	17.532	1.736
	0.5	29.22	2.871
	1	58.44	5.629
	2	116.88	10.852
	3	175.32	15.750
NaOH	0.1	4	0.401
	0.2	8	0.795
	0.3	12	1.187
	0.5	20	1.960
	1	40	3.841
	2	80	7.406
	3	120	10.743
HNO_3	0.1	6.301	0.630
	0.2	12.602	1.254
	0.3	18.903	1.874
	0.5	31.505	3.103
	1	63.01	6.106
	2	126.02	11.828
	3	189.03	17.188
H_2SO_4	0.1	9.808	0.976
	0.2	19.616	1.940
	0.3	29.424	2.892
	0.5	49.04	4.761
	1	98.08	9.245
	2	196.16	17.507
HCl	0.1	3.6	0.361
	0.2	7.2	0.720
	0.3	10.8	1.08
	0.5	18.0	1.79
	1	36.0	3.54
	2	72	6.97
	3	108	10.30