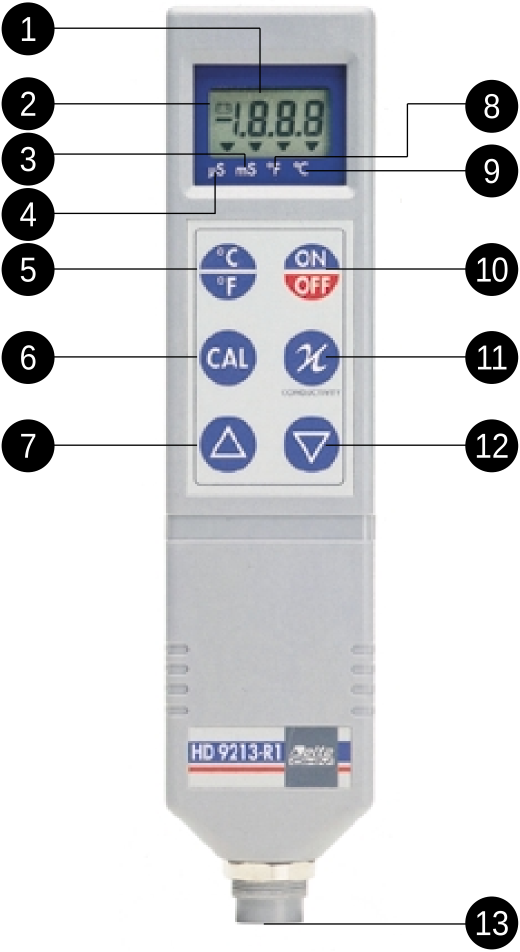
HD 9213-R1

INSTRUCTION MANUAL

HD 9213-R1



HD 9213-R1

ENGLISH

MICROPROCESSOR CONDUCTIVITY METER - THERMOMETER

1 LCD Display

2 Battery symbol

3 Symbol indicating that the reading is in milliSiemens

4 Symbol indicating that the reading is in microSiemens

5 Key for selecting temperature reading in °C or °F

6 Key for enabling the calibration function

7 Key that increases the value to be set during the parameter setting phase

8 Symbol indicating that the temperature reading is in °F

9 Symbol indicating that the temperature reading is in °C

10 ON/OFF key for switching the instrument on and off

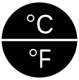
11 Key for selecting conductivity measurement

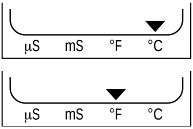
12 Key that decreases the value to be set during the parameter setting phase

13 Connector for the input of the conductivity and temperature probes, DIN 45326 8-pole male connector

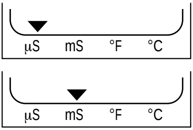
Key	Symbols lit besides the numbers	Description
ON/OFF	All the symbols are lit for a few seconds after switching on	Switches the instrument on and off. The instrument switches itself off automatically about 8 minutes after the ON/OFF key has been pressed. It is provided with an auto power off function.
RESET + ON/OFF	The battery symbol flashes	If the °C/°F key is held down simultaneously with the ON/OFF key when switching on, the AUTO POWER OFF function is disabled and power is supplied without interruption. To switch off, press the ON/OFF key. The battery symbol flashes during this function.
	C 1 C2 C3	When switching on, one of the three messages appears after all the symbols. The message that appears indicates for what type of calibration the instrument is set, or what type was set previously.
	c0.1 c 1.0 c 10	Next appears one of the following messages. The message that appears indicates for what cell constant (**0.1 - 1.0 - 10**), if any, the instrument is set, or what constant was set previously.

Key	Symbols lit besides the numbers	Description



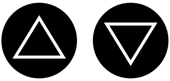


Key for selecting the temperature reading in °C or °F.
The ▼ symbol indicates the unit chosen.
When used in combination with others, the key also carries out other functions.



When this key is pressed, if a probe for conductivity measurement is connected, the instrument measures the conductivity of the liquid being tested, giving a reading that may be expressed in µS or in mS.
When used in combination with others, the key also carries out other functions.

When pressed during conductivity measurement, this key enables the automatic or manual calibration function.



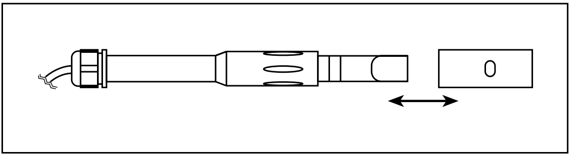
These keys increase △ or decrease ▽ the value indicated on the display when pressed during automatic or manual calibration, setting of the cell constant factor, setting of the reference temperature of the measurement, setting of the temperature compensation value, or calibration of the instrument.

GENERAL INFORMATION

The HD 9213-R1 is normally supplied with the combined 4-electrode and temperature probe SPT13.

The cell measurement area is bounded by a Pocan tube. A positioning key, directs correctly the insertion of the tube into the probe. To clean the probe, pull the tube along the probe axle. **It is not possible to take measurements without this tube.**

The instrument may be fitted with 2-electrode conductivity probes with cell constant **0.1 - 1 - 10**; they may also be fitted with temperature measuring probes of the series **TP 9..** in various configurations and degrees of precision.



FUNCTIONS

1 - **AUTO POWER OFF DISABLE**

To disable the automatic cut-out function, proceed as follows: switch on the instrument with the **ON/OFF** key, holding down the **°C/°F** key until all the symbols disappear, then release the **°C/°F** key. The [battery] symbol flashes.

2 - **REFERENCE TEMPERATURE 20°C or 25°C**

To set the reference temperature, proceed as follows: switch on the instrument with the **ON/OFF** key, holding down the **CAL** key until all the symbols disappear, then release the **CAL** key. Using the △ or ▽ key, set the desired value **r20** or **r25**, which stand for 20°C or 25°C. To quit this routine, press the χ key.

3 - **SELECTING THE CELL CONSTANT**

To select the cell constant for probes with 2 electrodes, proceed as follows: switch on the instrument with the **ON/OFF** key, holding down the χ key until all the symbols disappear, then release the χ key. One of the messages **c 0.1, c 1.0** or **c 10** appears on the display. Using the △ and ▽ keys, set the desired cell constant **c 0.1, c 1.0** or **c 10** which

stand for cell constant 0.1 or 1 or 10.
To quit this routine, press the ϰ key.

CALIBRATION CODES OF THE TEMPERATURE PROBES

The instrument has 5 codes, 3 of which are used for calling calibrations while 2 are calibration procedures. They are identified as follows:

C1: The instrument operates with the original calibration performed in the Delta Ohm workshop. It cannot be altered.
C2: The instrument operates with temperature calibration of the instrument alone, performed with a suitable simulator.
C3: The instrument takes measurements and operates with a certain temperature probe; the calibration of instrument and probe is the one that gives the most precise results.
C6: Procedure for calibrating the temperature section of the instrument, performed with a suitable calibrator.
C8: Procedure for calibrating the instrument together with a certain temperature probe. The two points on the scale are calibrated with a calibration furnace.

PROCEDURE FOR ENABLING AND CALLING ONE OF THE THREE STORED CALIBRATIONS

To select codes **C1**, **C2** or **C3**, proceed as follows: switch on the instrument with the **ON/OFF** key, holding down the ϰ key and the **CAL** key until all the symbols disappear. The message **CAL** then appears, followed by **00**; using the △ and ▽ keys, set the desired code, that is **C1**, **C2** or **C3**.
Confirm by pressing the **CAL** key. The symbol flashes and the **CAL** message remains fixed for a few seconds; the instrument then switches off and the procedure is complete.

PROCEDURE FOR CALIBRATING THE TEMPERATURE SECTION OF THE INSTRUMENT AND FOR STORING CALIBRATION

To calibrate the instrument temperature code **C6**, proceed as follows: switch on the instrument with the **ON/OFF** key, holding down the ϰ key and the **CAL** key until all the symbols disappear. The message **CAL** then appears, followed by **00**; using the △ and ▽ keys, set the code **C6**.
Press the **CAL** key.

Simulate 0°C at the instrument input with a suitable simulator; using the △ and ▽ keys, set on the display the correct value which corresponds to the first calibration point.
Next simulate the second calibration point and set the correct value on the display using the △ and ▽ keys. Press the **CAL** key to store the calibration performed.

PROCEDURE FOR CALIBRATING THE INSTRUMENT WITH ITS TEMPERATURE PROBE AND FOR STORING THE DATA

To calibrate the instrument with its temperature probe, code **C8**, proceed as follows: switch on the instrument with the **ON/OFF** key, holding down the χ key and the **CAL** key until all the symbols disappear. The message **CAL** then appears, followed by **00**; using the △ and ▽ keys, set the code **C8**.
Connect the desired temperature probe to the instrument; insert it in the calibration furnace at 0°C corresponding to the first calibration point, then set the correct value on the display using the △ and ▽ keys.
Insert the temperature probe in the calibration furnace for the second calibration point, then set the correct value corresponding to the second calibration point on the display, using the △ and ▽ keys.
Press the **CAL** key to store the calibration performed.

CALIBRATING THE CONDUCTIVITY SECTION OF THE INSTRUMENT

The instrument is able to recognize two standard calibration solutions: a **0.1** - mole solution of KCl and a **0.01** - mole solution of KCl. These solutions are on sale in specialized shops or they may be prepared by following the procedures given below. Calibration is automatic when using one of these two solutions.
Manual calibration is possible using a standard solution with a different conductivity from the solution used in automatic calibration.

PREPARATION OF STANDARD CALIBRATION SOLUTIONS

Dry the potassium chloride (KCl) at 105...120°C (221...248°F) for two hours. For a 1-mole solution, dissolve 74.555 g KCl in one litre of demineralized water with conductivity less than 3 µS/cm. For a 0.1-mole solution, dissolve 7.456 g KCl in one litre of demineralized water with conductivity less than 1 µS/cm. For a 0.01-mole solution, add 100 millilitres of 0.1-mole solution to 900 millilitres of demineralized water with conductivity less than 1 µS/cm.

T \ c	0.01 M	0.1 M	1 M
18°C	1.225 mS/cm	11.19 mS/cm	98.24 mS/cm
19°C	1.251 mS/cm	11.43 mS/cm	100.16 mS/cm
20°C	1.278 mS/cm	11.67 mS/cm	102.09 mS/cm
21°C	1.305 mS/cm	11.91 mS/cm	104.02 mS/cm
22°C	1.332 mS/cm	12.15 mS/cm	105.94 mS/cm
23°C	1.359 mS/cm	12.39 mS/cm	107.89 mS/cm
24°C	1.386 mS/cm	12.64 mS/cm	109.84 mS/cm
25°C	1.413 mS/cm	12.88 mS/cm	111.80 mS/cm

AUTOMATIC CALIBRATION

Automatic calibration is possible with a 0.1-mole (or 0.01-mole) solution of KCl. The temperature of the solution must be between 15°C (59°F) and 30°C (86°F), otherwise the error signal **"E3"** appears.

a) Switch on the instrument by pressing the **ON/OFF** key.

b) Immerse the conductimetry cell in the sample solution so that the electrodes are covered.

c) Shake the probe gently so that any air inside it will escape.

d) Press the **CAL** key. The conductivity value of the solution at the probe temperature appears on the display. For example 1278 µS at 20°C (68°F) and the µS (or mS) symbol flashes.

e) Press the **CAL** key again to confirm the value displayed (or adjust this value with the △ and ▽ keys before pressing **CAL** again). The µS (or mS) symbol stops flashing.

Note: when leaving calibration mode the value on the display may increase or decrease. This happens only if the temperature of the liquid is different from 20°C (25°C) (which is the temperature at which the conductivity values are normalized). In fact, when the temperature is different from 20°C (25°C) the instrument indicates the conductivity value with the temperature compensation made according to the α_T coefficient, set by the user, which may be considerably different from the value of the calibration solution.

f) Rinse the probe in water. If measurements are later made at low conductivity, **we advise rinsing it in distilled or bidistilled water**.

At this point the instrument is calibrated and ready for use.

MANUAL CALIBRATION

Manual calibration is possible using solutions with any conductivity. However it is necessary to know the conductivity of the solution at the temperature at which calibration is to be carried out. Follow these instructions:

a) Immerse the conductimetry cell in the solution with known conductivity so that the electrodes are covered with liquid. Switch on the instrument by pressing the **ON/OFF** key.

b) Press the α_T key. The temperature coefficient used for calculating the temperature compensation in conductivity measurements is displayed. Using the ▽ key, bring the value displayed to **0.00**. In this way the temperature compensation in conductivity measurement is excluded.

c) Take the temperature reading by pressing the **°C/°F** key. On the basis of the temperature determine the conductivity of the calibration solution, for example by looking it up in a table that indicates conductivity as a function of temperature.

d) Press the $\varkappa$ key. Press the **CAL** key. The µS (or mS) symbol flashes. If the conductivity of the calibration solution is close to that used in automatic calibration, the instrument proposes this value. Using the △ and ▽ keys, set the conductivity value determined at point **c**. If the conductivity of the calibration solution is very different from the one used in automatic calibration, **"E1"** (slope >150% of the rated value) or **"E2"** (slope <30% of the rated value) is displayed. In both cases it is sufficient to press the △ or ▽ key to cancel the error signal. Using the same keys, set the conductivity value determined at point **c**.

e) Press the **CAL** key again to confirm the value displayed. The µS (or mS) symbol stops flashing. Rinse the probe with water. **If measurements are later made at low conductivity, we advise rinsing it in distilled or, better, bidistilled water**.

At this point the instrument is calibrated and ready for use.

TEMPERATURE COMPENSATION

The temperature coefficient α_T is the percentage measurement of the variation of conductivity with temperature and is expressed in %/°C (or %/°F). The electric conductivity of a metal decreases as the temperature increases, while it increases in a liquid. There therefore arises the problem that the conductivity of two liquids cannot be directly compared if the measurement has not been made at the same standard reference temperature, which in chemical measurements is 20°C (25°C). If the measurement is taken at a temperature different from 20°C (25°C), an approximate assessment of the conductivity of the liquid at 20°C (25°C) may be obtained by means of temperature compensation, defined by the following formula (see also fig. 3.1):

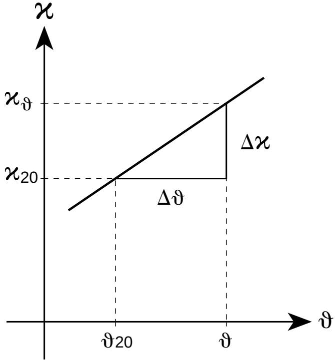
$$\varkappa\vartheta = \varkappa 20 \left[1 + \frac{\alpha_T}{100} (\vartheta - 20) \right]$$

where: ϑ = temperature expressed in °C
$\varkappa\vartheta$ = conductivity at temperature ϑ (°C)
$\varkappa 20$ = conductivity at 20°C (25°C)
$\alpha_T 20$ = temperature coefficient expressed in %/°C

Unfortunately the formula does not give good results if the temperature is appreciably different from 20°C (25°C) because α_T is not constant, but a non-linear function of the temperature and the conductivity. Also, it is not generally known before taking the measurement, unless it can be found on tables referring to the liquid to be examined. α_T may be experimentally determined by taking two measurements, one at 20°C (25°C) and another at the temperature ϑ, having previously excluded temperature compensation (in the HD 9213-R1 this may be done by setting α_T at 0.00, see the next paragraph). The formula for calculating α_T is the following:

$$\alpha_T = \frac{(\varkappa\vartheta - \varkappa 20)}{\varkappa - 20} \times \frac{100}{\varkappa 20}$$

For the definition of the variables see the figure



Definition of the temperature coefficient

In the HD 9213-R1 temperature compensation is automatic and therefore it is sufficient to set the temperature coefficient α_T of the liquid with the following procedure:

SETTING THE TEMPERATURE COEFFICIENT α_T

To set the temperature coefficient α_T, proceed as follows:
Switch on the instrument by pressing the **ON/OFF** key, choose the measuring unit **°C** or **°F**, then press the **CAL** and **°C/°F** keys simultaneously; using the △ and ▽ keys, set the desired coefficient value between 0.00 and 4.00. Then press the **°C/°F** key to store the chosen value of α_T. The value of α_T may be set independently in either °C or °F.

Conductivity and corresponding temperature coefficients of certain substances (25°C)

Substance	Concentration	Conductivity 10^4S•cm^{-1}	Temperature coefficient %/°C
NaOH (15°C)	5	1969	2.01
	10	3124	2.17
	15	3463	2.49
	20	3270	2.99
	30	2022	4.50
	40	1164	6.48
KOH (15°C)	25.2	5403	2.09
	29.4	5434	2.21
	33.6	5221	2.36
	42.0	4212	2.83
NH_3 (15°C)	0.10	2.51	2.46
	1.60	8.67	2.38
	4.01	10.95	2.50
	8.03	10.38	2.62
	16.15	6.32	3.01
	30.5	1.93	–
HF	1.5	198	7.20
	4.8	593	6.66
HCl	24.5	2832	5.83
	5	3948	1.58
	10	6302	1.56
	20	7615	1.54
	30	6620	1.52
	40	5152	–
H_2SO_4	5	2085	1.21
	10	3915	1.28
	20	6527	1.45
	40	6800	1.78
	50	5405	1.93
	60	3726	2.13
	80	1105	3.49
	100.14	187	0.30
HNO_3	6.2	3123	1.47
	12.4	5418	1.42
	31.0	7819	1.39
	49.6	6341	1.57
	62.0	4964	1.57
H_3PO_4 (15°C)	10	566	1.04
	20	1129	1.14
	40	2070	1.50
	45	2087	1.61
	50	2073	1.74
NaCl	5	676	2.17
	10	1211	2.14
	15	1642	2.12
	20	1957	2.16
	25	2135	2.27

Substance	Concentration	Conductivity 10^4S•cm^{-1}	Temperature coefficient %/°C
Na_2SO_4	5	409	2.36
	10	687	2.49
	15	886	2.56
Na_2CO_3	5	456	2.52
	10	705	2.71
	15	836	2.94
KCl	5	690	2.01
	10	1359	1.88
	15	2020	1.79
	20	2677	1.68
	21	2810	1.66
KBr (15°C)	5	465	2.06
	10	928	1.94
	20	1907	1.77
KCN	3.25	507	2.07
	6.5	1026	1.93
NH_4Cl	5	918	1.98
	10	1776	1.86
	15	2586	1.71
	20	3365	1.61
	25	4025	1.54
$(NH_4)_2SO_4$ (15°C)	5	552	2.15
	10	1010	2.03
	20	1779	1.93
	30	2292	1.91
NH_4NO_3 (15°C)	5	590	2.03
	10	1117	1.94
	30	2841	1.68
	50	3622	1.56
$CuSO_4$	2.5	109	2.13
	5	189	2.16
	10	320	2.18
	15	421	2.31
CH_3COOH	1	5.84	–
	10	15.26	1.69
	15	16.19	1.74
	20	16.05	1.79
	30	14.01	1.86
	60	4.56	2.06

HOW TO MEASURE CONDUCTIVITY

a) **Connect the connector of the conductimetry cell to the instrument paying attention to the polarization mark. Immerse the probe in the solution so that the electrodes are covered.** Shake the probe gently so that any air inside it will escape.

b) Switch on the instrument by pressing the **ON/OFF** key. If the instrument has not been calibrated, proceed to do so.

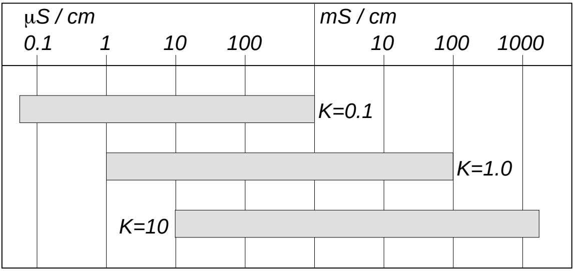
c) Set the temperature coefficient.

d) Press the $\varkappa$ key to measure the conductivity of the liquid with reference to the temperature of 20°C or 25°C. If you wish to measure the absolute conductivity (that is without temperature compensation) just set α_T at 0.00.

e) After use rinse the probe with clean or, better, distilled water.

MEASURING CONDUCTIVITY WITH 2-ELECTRODE PROBES

The instrument may be fitted with 2-electrode probes with or without a Pt100 temperature sensor and cell constant K 0.1, 1 or 10 • cm^{-1}.
The measuring range of these cells is indicated in the diagram below:



APPLICATIONS OF CONDUCTIVITY MEASUREMENTS

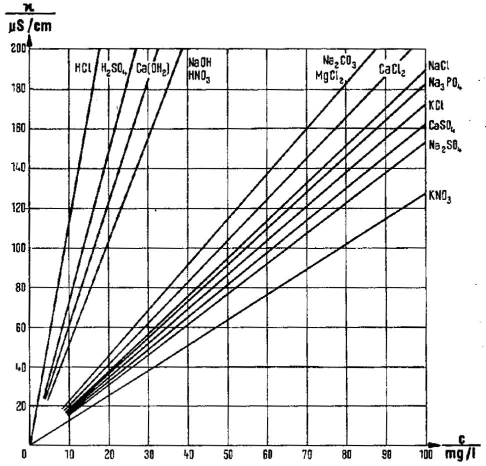
It must always be remembered that the conductivity of a liquid is proportional to the total amount of dissolved substances and not to one specific substance. Despite this there are many applications of conductivity, especially for quality controls.

CHECKING IMPURITIES IN WATER

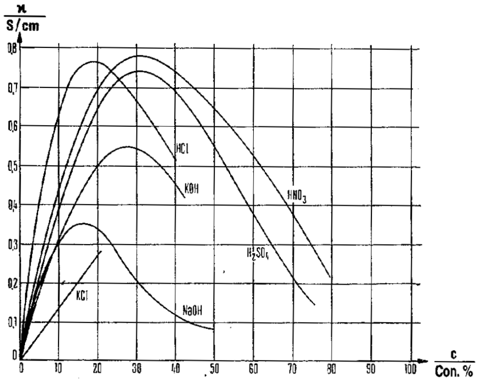
The most frequent applications are in the demineralization of water, by distillation, ionic exchange or inverse osmosis. Of course it is not possible to measure impurities that do not contribute to conductivity, such as sand, oil, micro-organisms, etc. Good distilled water should have a conductivity of less than a few µS.
An interesting application is the determination of impurities in sugar. Sugar is not an electrolyte and does not contribute to a variation of conductivity if it is dissolved in demineralized water, but impurities do.

DETERMINING THE CONCENTRATION OF A SOLUTION

If there is only one electrolyte in a solution, its concentration may be determined by measuring the conductivity. For example, the graphs above show the conductivity trend of a number of electrolytes as a function of concentration. If the curve that gives the conductivity as a function of concentration shows a maximum value, the concentration cannot be determined for certain because for a given conductivity value there are two concentration values. In this case the solution must be dissolved so at so obtain a certain value. If the solution contains more than one type of electrolyte, the concentration of the individual components cannot be determined unless particular conditions are present. For example, an acid or a strong base contribute much more than a salt to the increase in conductivity. Typical examples: regulation of detergent in industrial washing, regulation of degreasing baths, regulation of galvanic baths, checking milk, checking fertilizer in irrigation systems, etc.



Conductivity of dilute solutions.



Conductivity of high concentration solutions.

CHECKING CONDUCTIVITY IN MULTI-ELECTROLYTE SOLUTIONS

A conductimetry control often allows the chemical-physical variation of a solution to be detected. In oceanography the total saline content may be determined by means of conductivity measurements. In lake or river water a variation in conductivity is often the sign of pollution due to industrial waste water. The hardness of the feeding water for boilers, cooling towers, steam generators, etc. may be determined approximately by means of conductivity measurements. (In Italy it is sufficient to multiply the conductivity at 20°C by 0.7 to obtain the quantity of equivalent salinity expressed in ppm of $CaCO_3$). In the food industry the concentration of various saline solutions for preserving foodstuffs may be determined by measuring conductivity.

SALINITY OF THE SOIL

It is a known fact that for different types of plants, flowers and cereals there are optimum soil salinity values. **Conductivity measuring allows indirect determination of the salinity of the soil.**

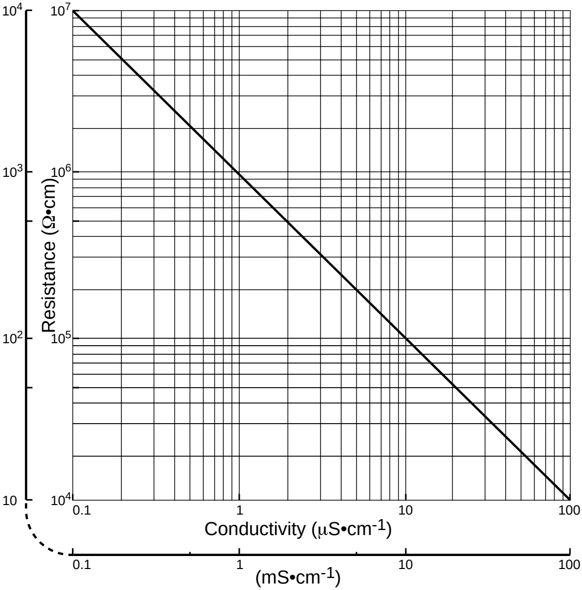
The method adopted by the Italian Society of Science of the Soil is the following:

Take a sample of soil, dry it in the air and riddle it at 2 mm. Dissolve it in 5 times its volume of demineralized water. Stir for about 30 minutes. Let the liquid rest for a few minutes and take the measurement with an electrode immersed in the liquid just over the soil sediment. The conductivity found must be expressed in µS/cm at the temperature of 20°C. The salinity of the soil is calculated with the formula:

$$S = \frac{0.32 \bullet \varkappa 20}{1000}$$

where: S = salinity of the soil in gr/100 of soil
$\varkappa$20 = conductivity expressed in µS at 20°C

The measured values allow the regulation of the dose of fertilizer in the irrigation water.



Correspondence between electric resistance and conductivity

ERROR INDICATION

OL: Overload warning.

E1: The solution used for conductivity calibration is wrong because the slope calculation gives a value >150% of the rated value.

E2: The solution used for conductivity calibration is wrong because the slope calculation gives a value <30% of the rated value.

E3: The temperature of the calibration solution is not between 15°C (59°F) and 30°C (86°F). Calibration is inadmissible outside this range.

METHOD OF USE

* Ensure that the measuring area is not live. The instrument is not insulated; during measurement with non-insulated probes ensure that it does not come in contact with live surfaces with a voltage of more than 24V. This could be dangerous for the instrument but especially for the operator who could receive an electric shock.
* Do not expose the probes to gases or liquids which could corrode the material with which the probes are covered. Ensure that the type of material with which the probe is made (POCAN - Alumina/Platinum) is compatible with the environment in which the measurement is to be taken.
* Do not bend or deform the probes as this could cause irreparable damage.
* Always use the most suitable probe for the measurement to be taken.
* Be careful with the range of use of the probe, **measurements at limit values are possible only for short periods**.
* In order to obtain a reliable measurement, avoid too sudden variations in temperature.
* Measurements on non metal surfaces require a great deal of time on account of their low heat conductivity.
* Always clean the probe carefully after use.
* The instrument is resistant to water but it is not watertight and should not therefore be immersed in water. If it should fall into the water, take it out immediately and check that no water has infiltrated.
* Avoid taking measurements in the presence of high frequency sources, microwaves or large magnetic fields, as the results would not be very reliable.

LOW BATTERY WARNING AND BATTERY REPLACEMENT

If the battery voltage falls below a certain level, the 🔋 symbol appears on the display. From that moment there remains about 1 hour autonomous operation. The battery should be replaced as soon as possible, otherwise, if the voltage falls even further, the data shown are no longer correct; the battery symbol disappears. The battery used is an ordinary 9V zinc-carbon battery, IEC6LF22.

To change the battery, unscrew the cross-headed screw on the door of the battery compartment,

open the door,

take out the old battery and put in the new one.

After replacing it, close the door, inserting the tag on the door into the slot provided, then fasten the retaining screw on the door.

Ensure that the instrument is switched off before changing the battery. When disposing of the old battery, place it in the special refuse collection, in this way you will help protect nature.

FAULTY OPERATION WHEN SWITCHING ON AFTER CHANGING THE BATTERY

If the instrument does not switch on or off after changing the battery, repeat the battery changing procedure, waiting for a few minutes to allow the circuit condenser capacities to be completely discharged, then insert the battery.
Check that the battery you are using is really efficient; sometimes unused batteries have not been recently manufactured so, due to the auto-discharge phenomenon, their voltage level is insufficient for correct operation of the instrument.

WARNINGS

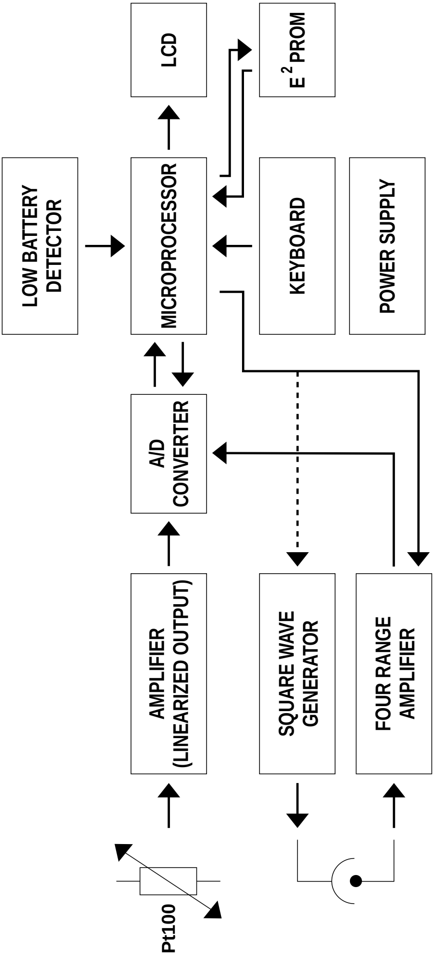
- If the instrument is not to be used for a long time the battery must be removed.
- If the battery is flat it must be replaced immediately.
- Take steps to avoid leakage of liquid from the battery.
- Use good quality leakproof batteries.

MAINTENANCE

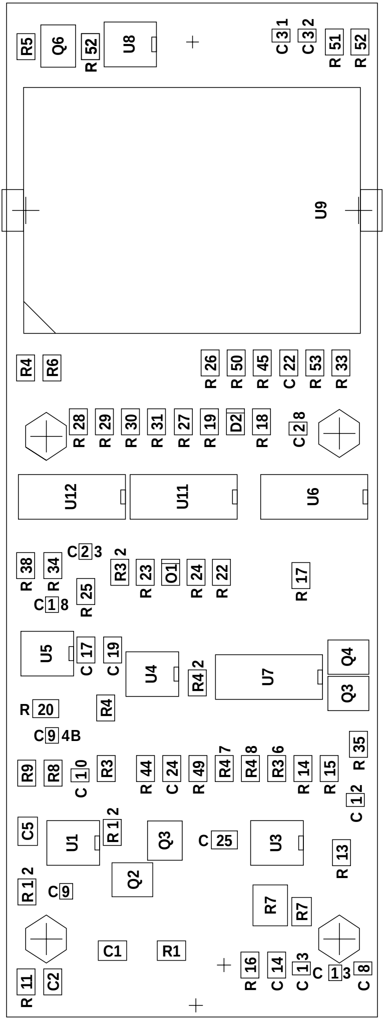
Storage conditions
- Temperature: -20...+60°C.
- Humidity: less than 85% relative humidity.
- Do not store the instrument in places where:
    1) There is a high degree of humidity
    2) The instrument is exposed to direct sunlight
    3) The instrument is exposed to a source of high temperature
    4) There are strong vibrations
    5) There is steam, salt and/or corrosive gas.

The instrument body is made of plastic so it must not be cleaned with detergents which can spoil plastic.

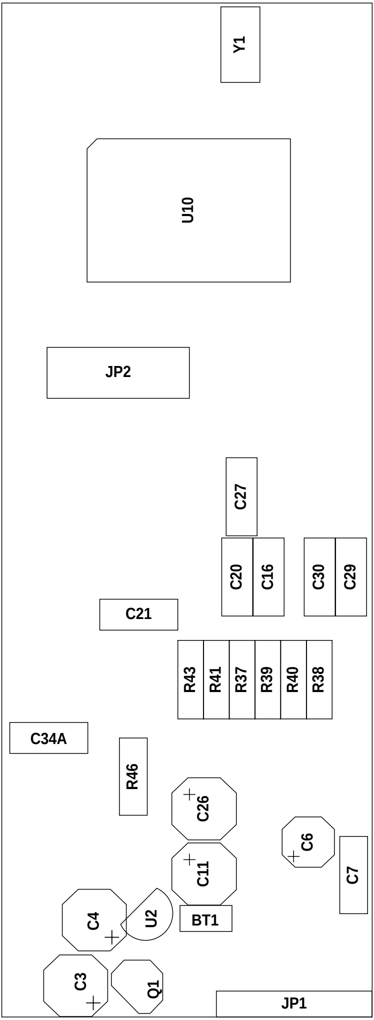
BLOCK DIAGRAM



ARRANGEMENT OF COMPONENTS



ARRANGEMENT OF COMPONENTS



GUARANTEE

This instrument is strictly inspected before being sold. However if there should be any defect due to manufacture and/or transport, apply to the dealer from whom you bought the instrument.
The guarantee period is 2 (two) years from the date of purchase. During this period all defects found by us will be repaired free of charge, **excluding those due to incorrect use and careless handling**.
The probes are not covered by the guarantee, as they can be irreparably damaged after only a few minutes of incorrect use.

TECHNICAL CHARACTERISTICS

- Display: LCD with 3½ digits, height 8 mm.
- Measuring ranges and instrument resolution:

0... 199.9 µS	resolution	0.1 µS
0... 1999 µS	resolution	1 µS
0... 19.99 mS	resolution	0.1 mS.

  Measuring range with combined 4-electrode and temperature probe: from 5 µS to 20 mS with automatic change of scale, temperature from 0°C to 90°C.

  Compatibility of the combined probe with 4 electrodes: the electrodes are made of platinum. The isolating part is of POCAN. The temperature sensor is of platinum. **Measuring range with 2-electrode probe** and cell constant:

0.1:	from 0.1 µS	to 1 mS
1:	from 10 µS	to 10 mS
10:	from 100 µS	to 20 mS

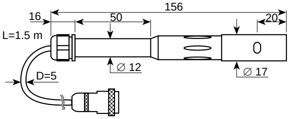
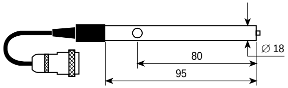
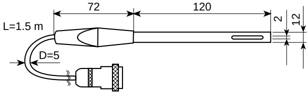
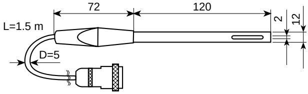
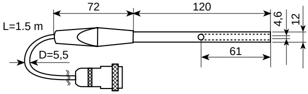
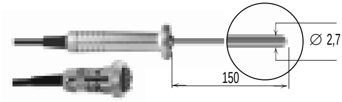
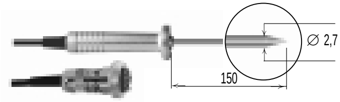
  temperature 0°C to 100°C.

  Temperature measuring range with probes of the TP9.. series: from -50°C to 200°C.
- Instrument precision: ±0.5% full scale ±0.5% of reading for conductivity; ±0.2°C ±0.5% of reading plus probe error for temperature.
- Temperature compensation α_T: automatic between t = 0.00 and t 4.00%/°C.
- Automatic calibration between: 15°C and 30°C; above and below these values the symbol E3 appears.
- Conversion frequency: 1 second.
- Functions: Autorange, automatic/manual calibration, auto power off, instrument calibration on EEPROM, low battery signal.

- Instrument working temperature: 0...50°C.
- Working temperature of the combined probe SPT13, made of Pocan, with 4 electrodes: 0...90°C.
- Working temperature of the epoxy probe with 2 electrodes: 0...50°C.
- Storage temperature: -20...+60°C.
- Relative humidity: 10...85% R.H.
- Power supply: 9V battery, IEC6LF22, duration about 100 hours with zinc/carbon battery.
- Connections: DIN 45326 round male connector on the instrument, female connector in the probes.
- Instrument case: ABS Bayer NOVODUR, grey colour 7553CF.
- Dimensions instrument: 42x185x23 mm, weight 130 grams.
- Kit dimensions: 430x240x55 mm, weight 850 grams.

ORDER CODES

- **HD 9213-R1:** Kit composed of the instrument complete with zinc/carbon battery, SPT13 combined probe with 4 electrodes, instructions manual, case.
- **SPT13:** Combined Pocan temperature/conductivity probe with 4 electrodes for HD 9213-R1.
- **HD 9213S:** Combined temperature/conductivity probe with 4 electrodes for HD 9213.
- **SPT01:** Combined epoxy conductivity and temperature probe with 2 electrodes, cell constant 0.1.
- **SPT1:** Combined epoxy conductivity and temperature probe with 2 electrodes, cell constant 1.
- **SPT10:** Combined epoxy conductivity and temperature probe with 2 electrodes, cell constant 10.
- **TP9A:** Immersion temperature probe with Pt100 sensor, precision class A.
- **TP9AP:** Penetration temperature probe, Pt100 sensor, precision class A.
- **HD 8712:** Conductivity calibration solution 12.880 µS/cm at 25°C; 0.1 mol/l.
- **HD 8714:** Conductivity calibration solution 1.413 µS/cm at 25°C; 0.01 mol/l.

COD.	SENSOR WORKING RANGE	DIMENSIONS
SPT13	K = 0,7 (5 µS...20 mS) (0...90°C)	
HD 9213S	K = 3 (5 µS...20 mS) (0...60°C)	
SPT01	K = 0,1 (0,1 µS...1 mS) (0...50°C)	
SPT1	K = 1 (10 µS...10 mS) (0...50°C)	
SPT10	K = 10 (100 µS...200 mS) (0...50°C)	
TP9A	-70...+400°C	
TP9AP	-70...+400°C	

GUARANTEE CONDITIONS
All our appliances have been subjected to strict tests and are guaranteed for 24 months from date of purchase. The Company undertakes to repair or replace free of charge any parts which it considers to be inefficient within the guarantee period. Complete replacement of the instrument is excluded and no requests for damages are recognized, whatever their origin. Repairs are carried out in our own Technical Service Department. Transport expenses are borne by the buyer. **The guarantee does not include: accidental breakages due to transport, incorrect use or neglect, incorrect connection to voltage different from that contemplated for the instrument, probes, sensors, electrodes and all accessories.** Furthermore the guarantee is not valid if the instrument has been repaired or tampered with by unauthorized third parties, or adjusted for faults or casual checking. The guarantee is valid only if all parts of the guarantee card have been filled in. Any instruments sent for repairs must be accompanied by their guarantee certificate. For all disputes the competent court is the Court of Padua.

CE CONFORMITY	
Safety	EN61000-4-2, EN61010-1 level 3
Electrostatic discharge	EN61000-4-2 level 3
Electric fast transients	EN61000-4-4 level 3
Voltage variations	EN61000-4-11
Electromagnetic interference sucseptibility	IEC1000-4-3
Electromagnetic interference emission	EN55020 class B

SIT CALIBRATION
CENTRE N° 124

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