

INSTRUCTION MANUAL

SA 8265. 106

**MULTIPARAMETER WATER QUALITY
PROBE**

S/N _____

REP N° _____

Release: R 2.4x



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1 PRODUCT PRESENTATION

This probe allows the following measuring:

- * **Level**
- * **Temperature**
- * **Conductivity**
- * **pH**
- * **O.R.P.**
- * **Dissolved Oxygen**
- * **Turbidity** (option 091.181)

Applications:

- Well water
- Underground aquifers
- Rivers & Lakes
- Estuaries & Oceans
- Wastewater treatment
- Industrial effluents

The probe is watertight and it contains:

- sensors
- electronic circuits
- microprocessor
- RS485 serial interface

This version is suitable for applications with external data logger and power supply.

The probe receives Commands from a P.C. or a Terminal and it answers consequently by sending data, messages or setting the internal calibration or configuration procedures.

This version includes the following technical features not present in the standard models with diameter 70 mm:

- differential pressure sensor for the level measuring
- 30 m cable built in
- venting tubing connected to the pressure sensor for the barometric pressure compensation.

2 GENERAL WARNINGS AND INFORMATION FOR ALL USERS

2.1 WARRANTY

This product is guaranteed for all manufacturing defects.

Please take a look at the terms and conditions described on the Warranty Certificate at the end of the manual.

2.2 AFTER SALES SERVICE

B&C Electronics offers to all of its Customers the following services:

- a free of charge Technical Assistance over the phone for problems regarding installation, calibration and regular maintenance;
- a Repairing Service in our Carnate (Italy) headquarter for all types of damages, calibration or for a scheduled maintenance.

Please take a look at the Technical Support data sheet at the end of the manual for more details.

2.3 CE MARKING

This instrument is manufactured according to the following European Community directives:

- 72/23/EEC “Electrical safety – low tension” amended in 93/68/EEC
- 2004/108/CEE (previously 89/336/EEC) “Electromagnetic compatibility)

The **CE** marking is placed on the packaging and on the S/N label of the instrument.

2.4 SAFETY WARNINGS

It is important to underline the fact that electronic instruments are subject to accidents. For this, it is important to take all necessary precautions to avoid damages caused by malfunctions.

All types of operations must be performed by authorized and trained staff.

The use of this controller must respect the parameters described in the “Technical specification”, so to avoid potential damages and a reduction of its operating life.

3 TECHNICAL SPECIFICATION

(at Temp. = 20 °C and 12 V)

<u>Sensors</u>	<u>Default</u>
1) Level	
P/N: SA8265.106	
Scale: 2 bar	
Level: 0.000/20.000 m (relative pressure)	
Resolution of data: 0.001 m	
Zero adjustment: ± 2.000 m	0.000 m
Sensitivity of sensor: 65.0%/135.0%	100.0 %
2) Temperature	
Sensor: RTD Pt1000	
Scale: -5.00/+55.00°C	
Resolution: 0.01°C	
Zero: ± 2.00	0.00 °C
Manual Temperature: -5.00/55.00°C	20.00 °C
3) Conductivity	
Sensor: Cell K=1.00	
Scale: 6.000/60.000 mS	6.000mS
Autoranging: On/Off	On
Scale: 6.000 mS	
Resolution: 0.001 mS	
Zero: ± 0.600 mS	0.000mS
Scale: 60.000 mS	
Resolution: 0.001 mS	
Zero: ± 6.000 mS	0.000mS
Sensitivity: 60.0%/160.0%	100.0 %
ATC Coefficient: 0.00/3.50%/°C	0.00 %/°C
Temperature reference: 10/30°C	20 °C
Calibration solution auto recognized: 1.000/2.000/10.00/20.00 mS	
4) pH	
Scale pH: -2.000/16.000 pH	
Resolution: 0.001 pH	
Zero: ± 2.000 pH	0.000 pH
Sensitivity: 80.0%/110.0%	100.0 %
Buffer solution auto recognized: BDH 4.00 pH/7.00 pH/9.00 pH	

5) O.R.P.

Scale: -1100.0/1100.0mV	
Resolution: 0.1 mV	
Zero: ±100.0 mV	0.0 mV
Sensitivity: 80.0%/110.0%	100.0 %
Buffer solution auto recognized: Mettler 220mV/468 mV	

6) Dissolved Oxygen

Sensor: Polarographic cell	
unit of measure: mmHg, %air, ppm ,mg/l	%air
unit of measure: mmHg	
Scale: 0.00/200.00 mmHg	
Resolution: 0.01 mmHg	
unit of measure: %air	
Scale: 0.00/200.00 %air	
Resolution: 0.01 %air	
unit of measure: ppm	
Scale: 0.000/20.000 ppm	
Resolution: 0.001 ppm	
unit of measure: mg/l	
Scale: 0.000/20.000 mg/l	
Resolution: 0.001 mg/l	
Zero: ±60.0nA	0.0 nA
Sensitivity: 80.0/170.0%	100.0 %
Barometric Pressure: 500/800 mmHg	760 mmHg
Salinity: 0/60000 ppm (Chloride)	0 ppm
Relative Humidity: 0/100 %	50 %

7) General parameter

Filter Response time on continuous acquisition: 1"/60"	10"
Filter Response time on programmed acq.: 1"/60" not active	10"
ID number: 0/32	0

Serial interface

Type: RS485 isolated	
Connecting distance: 4000' (1300m)	
Up to 16 probes in network	
Speed: 2400 bit/s	
Length: 8 bit	
Bit of Stop: 1	
Parity: None	

Power

External
Voltage: 9/14 Volt
Current: 40/25 mA

Cable

Length: 30 m (other on request)
Type: SZ 928
External jacket: polyurethane
Venting tubing diameter: DI 0,5 x DE 1,5 mm

Material in contact with liquids

PVC Body
Sea water Bronze connector
O-Ring in NBR (Acrylat Nitrile)

Dimension

Diameter: 70 mm
Probe length: 410 mm
Total length: 510 mm safety hook included

Weight

Probe: 3000 g
Cable: 2250 g

Factory calibration report

On request

Accessories (to be ordered separately)

SA8000	connecting software
BC8601	RS232/RS485 converter (or equivalent model)
SZ928	extension cable

8) Option

091.181	Turbidity scale 0/4000 NTU
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4 COMMUNICATION PROTOCOL

Serial interface

Baud rate: 2400 bit/s
 Bit length: 8 bit
 Nbr. of stop bit: 1
 Parity: None

Command format

2 byte of ID (00 - 32)
 1 byte of Command
 CR (Ascii 13)

The probe will recognize own ID and the ID 00.

Set of Commands

A after receiving the Command the probe will send the data on the serial port.
 E after receiving the Command the probe may accept the calibration by sending related data and/or messages

L, F, O, T reserved commands

After receiving the Command A, the prove will send data in the following format:

```
SA8265- 01 0.0 01/01/01 01:01:01 ±20.000m ±20.00°C ±40.000mS ±
...+. ...|. ...+. ...|. ...+. ...|. ...+. ...|. ...+. ...|. ...+. ...|.
12.000pH ±1000.0mV ±100.00%air 00/00/00xx
```

where:

SA8265: P/N of the probe
 01: ID of the probe
 0.0: Voltage of the power supply
 01/01/01: Date (only for models SA8060.x0x with data logger)
 01:01:01: Hour (only for models SA8060.x0x with data logger)

After the data, the probe will send measuring data in the following format:

for the measure is given:

- Sign (+ or -)
- measuring value (ranging of 6 characters on the right)

for the unit of measure is given:

- unit of measure (ranging of 4 character on the left)
- 1 blank (Ascii 32)

To the end of the record:

00/00/00	non applicable
xx	2 bytes containing the BCC of the sent record
CR LF	end of transmission of the record

When receiving the Command E, the probe will send data with the following format

SA8265- 01|.....|xx

SA8265:	P/N of the probe
01:	ID of the probe
..... :	32 characters of a message
xx:	2 bytes BCC
CR LF	end of transmission of the record

After Command E being received, the following Commands are active:

Command	Function
M	the Command selects the parameter to be calibrated
C	the Command starts the calibration sequences
U	the Command increments the values or changes the selections
D	the Command decrements the values or changes the selections
I	the Command confirms the values or the selections
R	the Command resets to the factory calibration/selection

After the Command the probe performs the related internal operations, then it will send a record of data or messages concerning the new setting or status.

BCC calculation

The BCC of the messages sent by the probe is calculated as the XOR of all bytes contained in the message (CR and LF excluded) divided by 2 nibble. The two nibble are then transformed in the corresponding ASCII codes.

5 OPERATION

5.1 PACKING AND UNPACKING

The probe is delivered in a safe package for transportation.

Keep the packaging materials for eventual shipment of the probe to the factory for maintenance.

5.2 CONNECTIONS

The probe is operating with the following minimum devices:

- a power supplier 9/12 Vdc 50 mA
- a terminal suitable to send Commands and to receive data and messages

In alternative to the Terminal, a P.C. provided with:

- MS DOS 3.1 or superior
- memory 640 K
- interface RS485

If the RS485 interface is not available, it is necessary to use the RS485/RS485 converter BC8601 or an equivalent model.

It is available a connecting Software P/N SA8000 designed for the continuous operation of the probe by sending Commands and receiving data.

The same software allows easy calibration and setting of the probe.

The received characters are inserted in a virtual display of 2x16 characters on the screen of the P.C.

The probe should be connected to the external power supplier and to network by means of a cable depending of the application.

The probe is provided with a 5 pin connector described in Fig. 1.

The connections of the cable/connector are the following:

pin nbr. 1: wire <u>a</u>	interface	RS485
pin nbr. 2: wire <u>b</u>	interface	RS485
pin nbr. 3: wire <u>Ground</u>	interface	RS485
pin nbr. 4: Power <u>+</u>		
pin nbr. 5: Power <u>-</u>		

5.3 INSTALLATION

- fasten the cable to the security hook of the probe;
(see Fig. 1)
- avoid immersion deeper than the max. value on the specifications;
- in order to avoid internal condensation of moisture, do not cut the cable because its end is epoxy sealed;
- check the power voltage conforming to the specifications.

WARNINGS

- *Do not bend the cable less than 10 cm loop to avoid the internal tubing breakage.*
- *Keep the top end of the venting tubing in a dry condition to avoid the condensation of moisture at the bottom of the tubing itself. Place a dryer (silica gel or similar) next to the tubing end.*

5.4 PRE-OPERATION

Before the regular operation, refer to Fig. 2 and Fig. 3 in order to:

- Remove the sticker from the bottom of the probe.
- Unscrew the perforated cap protecting the sensors.
- Remove the protective cap from the reference, pH, ORP and dissolved oxygen sensors. Keep the caps to be reinstalled for a long period of storage.
- Tighten the perforated cap.
- Immerse the probe in tap water for 30 minutes if sensors have been stored dry.
- Immerse the probe in the liquid being measured for 5 minutes in order to reach the thermal equilibrium.
- Switch on the probe for 5 minutes in order to polarize properly the dissolved oxygen sensor.

Verify if the factory calibrated parameters are suitable for the application.
(See chapter CALIBRATION for the new setting).

5.5 OPERATIONS AFTER THE MEASURING CYCLE

Refer to Fig. 2 for the recommended action after using of the probe:

- Check the cleaning condition and rinse the sensors with tap water, using eventually a soft brush in order to remove residual scales.
- Install the plastic caps filled with tap water on the sensors for a long period of storage.

If the use of the probe is not continuous we suggest the following:

- Keep the probe in vertical position with sensors low.
- Preserve the probe dry at room temperature.

6 CALIBRATIONS

Calibrations include the standardization of the sensors and the selection of the operating parameters of the probe.

Probes are delivered with factory calibration and parameter setting as described in the default specifications.

The following chapter shows operation, adjustment and selections for each measuring parameter.

The operating parameter selection is a special operation to do during the installation only.

The sensor calibration is a periodical operation to do regularly.

Refer to Fig. 4 for the operations to perform during the sensors by means of standard solutions.

Repeat the same action for each parameter to be calibrated.

When a specific sensor must be replaced, refer to Fig. 5 and Fig. 6.

During the calibration the probe may send error messages because of exceeding of the limits for the specific parameter.

In general these messages have the following meaning:

- sensor to be cleaned or replaced
- wrong standard solution

When the error message appears, the calibration is not performed. The probe maintains the previous calibration.

Messages are available for 5 minutes.

By sending the Command **I** the probe turns to the next function.

Stability check

During the calibration the software controls the stability of the measuring value, sending the message 'WAIT*'.
When the readout reaches the stability, the probe will send the message 'READY'.

The operator may skip the stability check by sending the Command I.

The probe will memorize the reading value and will send the message 'Skip stability'.

Suggested buffer solutions

The specification chapter describes the memorized buffer solutions of pH, ORP and conductivity. We suggest to use those solutions to make easy the calibration procedure, because the probe will recognize automatically their value by sending the message BS.

In order to simplify the instruction manual, the following description will show the 32 characters sent after receiving the Command E.

As described those characters follow the ID characters and are followed by BCC and CR LF .

6.1 LEVEL

The following calibration are allowed:

1. Zero adjustment
2. Sensitivity adjustment

The probe is factory calibrated but it needs a field calibration because the level measuring is based on hydrostatic pressure depending of the liquid density.

M send the Command to get the following answer:

```
| LEVEL 2.000m |
```

2.000m: actual value of level

Active Commands: M C I

Visualization and adjustment of zero level

C the probe will answer the Command with:

```
| CAL LEVEL            ZERO    0.50m |
```

0.50 m: actual zero in memory

Active Commands: M C I

C send the Command to activate the zero adjustment.

```
| CAL L. READY          0.72m |
```

READY: the message shows the stability of the level value
0.72 m: measuring value of the level

Active Commands: M I R

Keep the probe in air and send the Command:

I - the Command performs the zero level adjustment
- the probe send the following record for level calibration:

Level calibration

The level calibration may be done in two ways:

- 1) by adjusting the sensor sensitivity value
- 2) by adjusting the level readout

```
| CAL LEVEL SENS      100.0% |
```

100.0%: actual sensitivity in memory

Active Commands: M U/D I

1. Adjust the sensitivity value and send the Command I.
 - or
 2. Send the Command I without modifying the % value.
- The probe is now ready to adjust the sensitivity by modifying the level measuring value.

Dip the probe at a known depth and adjust as follows:

```
| CAL L. READY          10.020m |
```

READY: message of reached stability
10.020 m: level value as measured/inserted

Active Commands: M U/D I R

- Dip the probe to a known depth
- Adjust the measuring value
- Send the Command I to confirm the new value

6.2 TEMPERATURE

It is possible to adjust one point of temperature.

The probe is factory calibrated but the operator may calibrate the measuring value as follows:

M send the Command in order to get the following answer:

```
|TEMP. 20.00°C|
```

20.00°C: actual temperature value

Active Commands: M C I

Dip the probe in a liquid at known temperature and wait for the stability:

C send the Command in order to get the following answer:

```
|CAL TEMP. ZERO 2.00°C|
```

2.00°C: actual zero value in memory

Active Commands: M C I

C send the command to modify the value.

```
|CAL T. READY 20.00°C|
```

READY: the message shows the reached stability of the readout.
20.00°C: value as measured/inserted.

Active Commands: M U/D I R

- Adjust the temperature value
- Send the Command I to enter the new value.

Notes:

the probe turns automatically to the manual temperature if the temperature sensor is not installed or it is damaged.

In manual temperature mode, the inserted value will be the considered as new manual temperature value, and the symbol °CM appears.

6.3 CONDUCTIVITY

The following sequence is available:

1. measuring scale selection
2. autoranging ON/OFF selection
3. Zero adjustment
4. Sensitivity adjustment
5. Reference temperature selection
6. Temperature coefficient selection

The calibration must be performed only after the above selection are done.

M send the Command in order to get the following answer:

```
| COND. 25.000mS T.REF:20 TC:2.20 |
```

25.000mS: actual conductivity value

20 °C: reference temperature

2.20%/°C: temperature compensation coefficient

Active Commands: M C I

C send the Command to activate the calibration sequence.

```
| CAL COND. FS:60.000mS |
```

60.000mS(6.000mS): full scale as selected

Active Commands: M U/D I

```
| CAL COND. AUTORANGING: OFF |
```

ON(OFF): autoranging activated (deactivated).

Active Commands: M U/D I

The autoranging allows the automatic switch to the upper scale, if the lower scale (6 mS) has been selected.

```
| CAL COND. ZERO 0.080mS |
```

0.080mS: zero value of the selected scale.

Active Commands: M C I

Calibration mode selection

By using the KCl standard solution with value:

1000 mS - 2000 mS - 10,000 mS - 20,000 mS

it is possible to select the automatic calibration mode.

Actually their conductivity values at 20°C are internally memorized together with the corresponding temperature coefficient.

```
|CAL COND. SENS AUTO BS |
```

AUTO BS(MANUAL): calibration mode as selected

Active Commands: M U/D I

- Select AUTO if the following KCl standard are used:
1,000mS - 2,000 mS - 10,000 mS - 20,000 mS
- Select MANUAL if other standard solution are used.

Calibration by means of recognized Solutions

During this kind of calibration the probe uses the following values, related to the specifications of the solutions:

- Reference temperature: 20,0°C
- Temperature coefficient: 2,10 %/°C for the scale 6 mS
2,05 %/°C for the scale 60 mS.

The probe measures the standard solutions value and checks the readout stability. When the stability has reached the probe send the message 'READY'.

If the stability has not reached, the operator may send the Command I. The probe will send the message 'Skip Stability' to allow the manual calibration.

After the stability check the probe will evaluate the compatibility of the readout with the memorized values.

If the measuring is compatible the probe will send the message 'BS' (Buffer Solution) and the measuring will take the value of the standard solution at 20°C.

```
|CAL C. READY BS 10.000mS |
```

READY: the stability has been reached.

BS: the readout is corresponding to the standard solution value.

10.000mS: recognized standard solution value

Active Commands: M U/D I R

Calibration by means of not memorized standard solutions

Before using those solutions, make sure the temperature coefficient of the probe is same as the coefficient of the standard solution to be used.

The probe is configured in MANUAL, and it may be calibrated only after the readout stability of the conductivity confirmed by the message 'READY'.

If the stability has not reached send the Command I to skip the stability.
The message 'Skip Stability' will be sent.

```
| CAL C . READY          10.000mS |
```

READY: the stability has been reached.
10.000mS: measuring conductivity value.

Active Commands: M U/D I R

Reference temperature for the automatic compensation

The reference temperature is normally set to 20 °C.

The conductivity value at any temperature will be calculated at 20 °C through the temperature coefficient value.

```
| CAL COND .          T.REF:20 °C |
```

20 °C: reference temperature value.

Active Commands: M U/D I

Temperature coefficient

```
| CAL COND .          TC: 2.20 %/°C |
```

2.20%/°C: temperature coefficient value.

Active Commands: M U/D I

Select the temperature coefficient as desired.
(For drinking water select the value 2,2 %/°C.)

How to calculate the unknown temperature coefficient

Operate as follows:

- set the TC = 0
- set the reference temperature at 20 °C
- measure the conductivity value C1 at temperature T1
- measure the conductivity value C2 at temperature T2

Calculate the temperature coefficient TC as follows:

$$TC = \frac{C2 - C1}{C1 (T2 - 20) - C2 (T1 - 20)} \times 100$$

The temperature values may be taken from the probe readout on the D1 Display.

Remember that:

- The measuring accuracy is depending of the accuracy of the standard solutions used for the calibration.
- The contamination and the evaporation change the conductivity value of the standard solution.

6.4 PH

It is possible to perform the following operations:

1. Zero and sensitivity adjustment by means of two buffer solutions
2. Zero adjustment by means of one buffer solution

Suggestions

If the protective cap of the electrode is empty and the electrode is dry, dip the sensor into the tap water for 3 hours before start the calibration.

Follow the instructions of the pH and reference electrodes SA9100 end SA9110.
The temperature sensor performs the temperature compensation.

Calibrate by using the buffer solutions mod. SZ959 at pH=4 pH=7 pH=9, as they are recognized by the software of the probe.

- dip the pH and reference electrodes in the buffer pH=7 to adjust the 1st point.
- dip the pH and reference electrodes in the buffer pH=4 or pH=9 to adjust the 2nd point.

It is possible to calibrate the 2 points with buffers pH=4 and pH=9 as well.

Rinse in clean water before dipping the sensor in the new buffer solution in order to avoid the contamination.

Because of the good quality of the sensor, the user may calibrate just the first point as regular by doing the 2nd point calibration in the same buffer solution the 1st point calibration.

In this case the probe will not modify the sensitivity.

We suggest to do the one point calibration by means of a buffer solution with the pH value as close as possible to the liquid being measured.

The probe does not perform the calibration if the zero deviation is more than ± 2 pH.
This means the reference electrode must be replaced or regenerated.

The probe does not perform the calibration if the sensitivity deviation is $< 80\%$.
This means the pH electrode must be replaced.

The probe does not perform the calibration if the sensitivity deviation is $> 110\%$.
This means the buffer solution is wrong.

NOTE 1

Send the Command R to turn the probe to the factory calibration.

NOTE 2

If the Reference electrode is replaced, the ORP calibration is required as well.

Calibration sequence

M send the Command in order to get the following answer:

```
|pH 14.000pH A:-0.30pH S:100%|
```

14.000pH: actual pH value

-0.30 pH: asymmetric potential of the sensor

100%: slope of the sensor

Active Commands: M C I

C the command activates the calibration sequence

The probe measures the value of the buffer solutions and checks the stability of the readout.
When the stability has reached the probe sends the message 'READY'.

If the stability has not reached, the operator may send the Command I.
The probe will send the message 'Skip Stability' to allow the manual calibration.

After the stability check the probe will evaluate the compatibility of the readout with the memorized values.

If the measuring is compatible the probe will send the message 'BS' (Buffer Solution) and the measuring value will be replaced by the value of the standard solution at 20°C.

- If the operator is using the memorized solutions it is enough to send the Command I.
- If the operator is using solutions not memorized, it is necessary to insert the value after the stability message
'READY ', by means of the Commands U/D and confirming by the Command I.

Calibration of the 1st point

```
| CAL pH READY BS P1* 4.010pH |
```

READY: the message shows the reached stability

BS: the readout is corresponding to the memorized buffer solution

P1*: 1st point

4.010pH: pH value of the memorized buffer

Calibration of the 2nd point

```
| CAL pH READY BS P2* 7.000pH |
```

READY: the message shows the reached stability

BS: the readout is corresponding to the memorized buffer solution

P2*: 2nd point

7.000pH: pH value of the memorized buffer

If the difference between the 1st and 2nd point is smaller than 1.00 pH, the probe will perform only the asymmetry adjustment.

The calibration results as one point calibration (zero calibration).

6.5 ORP

It is possible to perform the following operations:

1. Zero and sensitivity adjustment by means of two buffer solutions
2. Zero adjustment by means of one buffer solution

Suggestions

If the protective cap of the electrode is empty and the electrode is dry, dip the sensor into the tap water for 3 hours before start the calibration.

Follow the instructions of the ORP and reference electrodes SA9100 and SA9120.

Calibrate by using the buffer solutions mod. SZ961 at 220mV and SZ964 at 468 mV, as they are recognized by the software of the probe.

- dip the ORP and reference electrodes in the buffer SZ961 to adjust the 1st point.
- dip the ORP and reference electrodes in the buffer SZ964 to adjust the 2nd point.

Rinse in clean water before dipping the sensor in the new buffer solution in order to avoid the contamination.

Because of the good quality of the sensor, the user may calibrate just the first point as regular by doing the 2nd point calibration in the same buffer solution the 1st point calibration. In this case the probe will not modify the sensitivity.

The probe does not perform the calibration if the zero deviation is more than ± 100 mV. This means the reference electrode must be replaced or regenerated.

The probe does not perform the calibration if the sensitivity deviation is < 80 %. This means the ORP electrode must be replaced.

The probe does not perform the calibration if the sensitivity deviation is > 110 %. This means the buffer solution is wrong.

NOTE 1

Send the Command R to turn the probe to the factory calibration.

NOTE 2

If the reference electrode is replaced, the pH calibration is required as well.

Calibration sequence

M send the Command in order to get the following answer:

```
|REDOX 210.0mV A: 10mV S:100%|
```

210.0mV: actual redox value

10mV: asymmetric potential of the sensor

100%: slope of the sensor

Active Commands: M C I

C the Command activates the calibration sequences.

The probe measures the value of the buffer solutions and checks the stability of the readout. When the stability has reached the probe send the message 'READY'.

If the stability has not reached, the operator may send the Command I. The probe will send the message 'Skip Stability' to allow the manual calibration.

After the stability check the probe will evaluate the compatibility of the readout with the memorized values.

If the measuring is compatible the probe will send the message 'BS' (Buffer Solution) and the measuring value will be replaced by the value of the standard solution at 20°C.

- If the operator is using the memorized solutions it is enough to send the Command I.

- If the operator is using solutions not memorized, it is necessary to insert the value after the stability message

'READY', by means of the Commands U/D and confirming by the Command I.

Calibration of the 1st point

```
|CAL Rx READY BS P1* 220.0mV |
```

READY: the message shows the reached stability

BS: the readout is corresponding to the memorized buffer solution

P1*: 1st point

220.0mV: redox value of the memorized Buffer

Calibration of the 2nd point

```
|CAL Rx READY BS P2* 468.0mV |
```

READY: the message shows the reached stability

BS: the readout is corresponding to the memorized buffer solution

P2*: 2nd point

468.0mV: redox value of the memorized buffer

If the difference between the 1st and 2nd point is smaller than 100 mV, the probe will perform only the asymmetry adjustment.

The calibration results as one point calibration (zero calibration).

6.6 DISSOLVED OXYGEN

It is possible to perform the following operations:

1. Measuring unit of measure selection
2. Zero adjustment
3. Sensitivity adjustment
4. Barometric pressure setting
5. Salinity setting
6. Relative humidity setting

The calibration must be performed only after the setting of the above parameters.

M send the Command in order to get the following answer:

```
|D.O. 9.200ppm p:760 sal: 10000|
```

9.200ppm: actual D.O. value and unit of measure

760: pressure value in mmHg

10000: salinity value (ppm of chloride)

Active Commands: M C I

C send the Command to activate the selection and calibration sequences.

Measuring unit selection

```
|CAL D.O. %air _____|
```

%air (ppm - mg/l - mmHg): unit of measure as selected.

Active Commands: M U/D I

Zero visualization

```
|CAL D.O. ZERO 0.30 nA _____|
```

0.3 nA: actual zero into the memory

Active Commands: M C I

C send the Command to activate the zero adjustment

Automatic sensitivity calibration in air

It is available only if the "AUTO" mode has been selected.

- Remove the probe from the liquid and make sure the cell is dry and the temperature readout is steady.
- Keep the probe in air with a known R.H. or with a H₂O saturated vapour (RH=100%)
- Wait for the readout stabilization (message 'READY').
- send the Command I to confirm the value.

```
|CAL O2 READY   A   100.00%air|
```

READY: the message indicates the reached stability of the readout

A: the message shows the calibration method in air

100.00%: dissolved oxygen measuring value

Active Commands: M I R

Manual Sensitivity calibration

It is available only if the "MANUAL" mode has been selected.

- Keep the probe immersed into the liquid being measured.
- Perform the D.O. measuring by means of a laboratory instrument.
- Insert the value and send the Command I.

```
|CAL O2 READY   M   100.00%air|
```

READY: the message indicates the reached stability

M: the message shows the MANUAL method as selected

100.0 %: dissolved oxygen measuring/inserted value

Active Commands: M U/D I R

Secondary parameter insertionBarometric Pressure

| CAL D.O. _____ p: 760 mmHg |

760 mmHg: pressure value as inserted

Active Commands: M U/D I

Salinity (chloride)

| CAL D.O. _____ sal:10000ppm |

10000ppm: Salinity value as inserted

Active Commands: M U/D I

Relative Humidity

| CAL D.O. _____ RH: 100 % |

100 %: R.H. value as inserted

Active Commands: M U/D I

6.7 SOFTWARE FILTER

The Software filter response is the time to reach the 90% of the input signal variation generated by the sensors.

The action of the filter will improve the stability of the readout but it will increase the response time of the acquisition.

During the calibration the probe will use automatically the filter response time equal to 10 seconds.

It is possible to perform the following operations:

1. Selection of the response time during the acquisition
2. Selection of the response time during the programmed acquisition (not available for this model)

M send the Command in order to get the following answer:

```
|RT CONT.: 10 sRT PROG.: 15 s|
```

10s: response time during the continuous operation

15s: response time during the programmed operation

Active Commands: M C I

C send the Command to activate the response time calibration.

```
|CAL RT CONT.: 10 s|
```

CONT. 10": response time during the continuous operation

Active Commands: M U/D I

```
|CAL RT PROG.: 15 s|
```

Not available for this model

Active Commands: M U/D I

6.8 ID NUMBER

M send the Command in order to get the following answer:

```
|SA8265 R2.4x ID: 27|
```

SA8065: P/N of the probe

R2.4x: software release

27: Identification number of the probe

Active Commands: M C

C send the Command to activate the modification of the ID number of the probe.

```
|SA8265 R2.4x CAL ID: 27|
```

27: actual ID number of the probe

Active Commands: M U/D I

Note: the new ID number will be active only after the next switching on.

7 PREVENTIVE MAINTENANCE

We suggest to check the cleaning status of the sensors and to perform the following preventive maintenance periodically and depending of the application:

- Remove the probe from the liquid.
- Unscrew and remove carefully the protective terminal of the sensors and take note of the kind of dirt on the sensors. (Fig. 2)
- Rinse the sensor with clean or distilled water and use eventually a soft brush.
- Reinstall the protective cap fastening by hand.

NOTE: If sensors are very dirty it is necessary to increase the frequency of this preventive maintenance.

WARNINGS:

the preventive maintenance does not require the access to the internal electronic circuits.

If the probe is open it is necessary to pay attention to the O-ring status and position in order to maintain the watertight.

Any internal leakage and malfunctioning due to an imperfect fastening of the body by the operator is not covered by warranty.

Exceptional maintenance

This maintenance may be necessary when the probe is damaged or not working in some functions. It may be requested as yearly preventive maintenance as well.

The necessary operations may require the internal inspection of the probe to be done in our laboratory.

Sensors identification

The sensors identification is done by means of Fig. 3 and Fig. 5 describing their position in the probe.

The symbol is printed on the label placed between the two O.R. of the sensor.

Sensors maintenance

The Level sensor does not require any kind of maintenance. It may be replaced only in factory.

Other sensors are extractable and they may be replaced by the operator.

We suggest to clean carefully the probe by rinsing in water, before proceeding to replace a sensor.
Dry the probe and operate in a dry room.
Remove and insert the sensors by following instruction of Fig. 6.

Sensors instruction

The operator's instruction for sensors SA9100 - SA9110 - SA9120 - SA9130 - SA9150 - SA9160 are shown in the corresponding figures enclosed in this manual.
Each figure shows the technical specifications and accessories provided with the sensor.

8 ATTACHMENTS

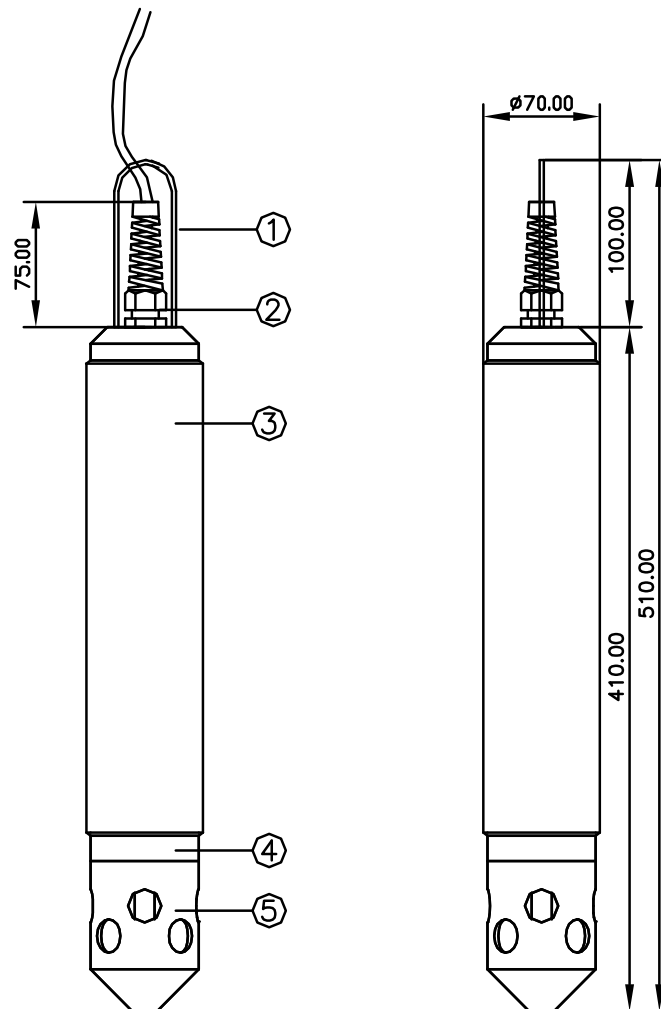
This manual includes the following attachments:

Table	Dissolved oxygen solubility
Fig.1	Dimensions of the probe
Fig.2	Setting up of the probe
Fig.3	Position of the sensors
Fig.4	Calibration of the sensors
Fig.5	Dimensions of the extractable sensors
Fig.6	Replacement of the sensors
Pag.1/1	SA9100
Pag.1/1	SA9110
Pag.1/1	SA9120
Pag.1/1	SA9130
Pag.1/1	SA9150
Pag.1/2	SA9160
Pag.2/2	SA9160

SOLUBILITY OF THE OXYGEN INTO AIR SATURATED WATER (mg/l)

TEMP (°C)	PRESSURE (mm Hg)								
	715	730	745	750	755	760	765	770	775
0	13.70	13.99	14.28	14.37	14.47	14.57	14.66	14.76	14.86
1	13.33	13.61	13.89	13.98	14.08	14.17	14.27	14.36	14.45
2	12.97	13.24	13.52	13.61	13.70	13.79	13.88	13.97	14.07
3	12.63	12.89	13.16	13.25	13.34	13.43	13.52	13.61	13.69
4	12.30	12.56	12.82	12.90	12.99	13.08	13.16	13.25	13.34
5	11.98	12.23	12.49	12.57	12.66	12.74	12.83	12.91	13.00
6	11.68	11.93	12.17	12.25	12.34	12.42	12.50	12.58	12.67
7	11.39	11.63	11.87	11.95	12.03	12.11	12.19	12.27	12.35
8	11.11	11.34	11.58	11.66	11.74	11.81	11.89	11.97	12.05
9	10.84	11.07	11.30	11.38	11.45	11.53	11.61	11.68	11.76
10	10.58	10.81	11.03	11.11	11.18	11.26	11.33	11.41	11.48
11	10.33	10.55	10.77	10.85	10.92	10.99	11.07	11.14	11.21
12	10.10	10.31	10.53	10.60	10.67	10.74	10.81	10.89	10.96
13	9.87	10.08	10.29	10.36	10.43	10.50	10.57	10.64	10.71
14	9.65	9.86	10.06	10.13	10.20	10.27	10.34	10.41	10.48
15	9.44	9.64	9.84	9.91	9.98	10.05	10.11	10.18	10.25
16	9.24	9.44	9.64	9.70	9.77	9.83	9.90	9.96	10.03
17	9.05	9.24	9.43	9.50	9.56	9.63	9.69	9.76	9.82
18	8.86	9.05	9.24	9.30	9.37	9.43	9.49	9.56	9.62
19	8.68	8.87	9.05	9.12	9.18	9.24	9.30	9.36	9.43
20	8.51	8.69	8.87	8.93	9.00	9.06	9.12	9.18	9.24
21	8.34	8.52	8.70	8.76	8.82	8.88	8.94	9.00	9.06
22	8.18	8.36	8.53	8.59	8.65	8.71	8.77	8.83	8.89
23	8.03	8.20	8.37	8.43	8.49	8.55	8.61	8.66	8.72
24	7.88	8.05	8.22	8.28	8.33	8.39	8.45	8.50	8.56
25	7.73	7.90	8.07	8.13	8.18	8.24	8.29	8.35	8.41
26	7.60	7.76	7.93	7.98	8.04	8.09	8.15	8.20	8.26
27	7.46	7.62	7.79	7.84	7.89	7.95	8.00	8.06	8.11
28	7.33	7.49	7.65	7.70	7.76	7.81	7.86	7.92	7.97
29	7.20	7.36	7.52	7.57	7.63	7.68	7.73	7.78	7.84
30	7.08	7.24	7.39	7.44	7.50	7.55	7.60	7.65	7.70
31	6.96	7.12	7.27	7.32	7.37	7.42	7.47	7.52	7.58
32	6.85	7.00	7.15	7.20	7.25	7.30	7.35	7.40	7.45
33	6.73	6.88	7.03	7.08	7.13	7.18	7.23	7.28	7.33
34	6.62	6.77	6.92	6.97	7.02	7.07	7.11	7.16	7.21
35	6.52	6.66	6.81	6.86	6.90	6.95	7.00	7.05	7.10
36	6.41	6.55	6.70	6.75	6.79	6.84	6.89	6.94	6.98
37	6.31	6.45	6.59	6.64	6.69	6.73	6.78	6.83	6.88
38	6.21	6.35	6.49	6.53	6.58	6.63	6.67	6.72	6.77
39	6.11	6.25	6.39	6.43	6.48	6.52	6.57	6.62	6.66
40	6.01	6.15	6.29	6.33	6.38	6.42	6.47	6.51	6.56

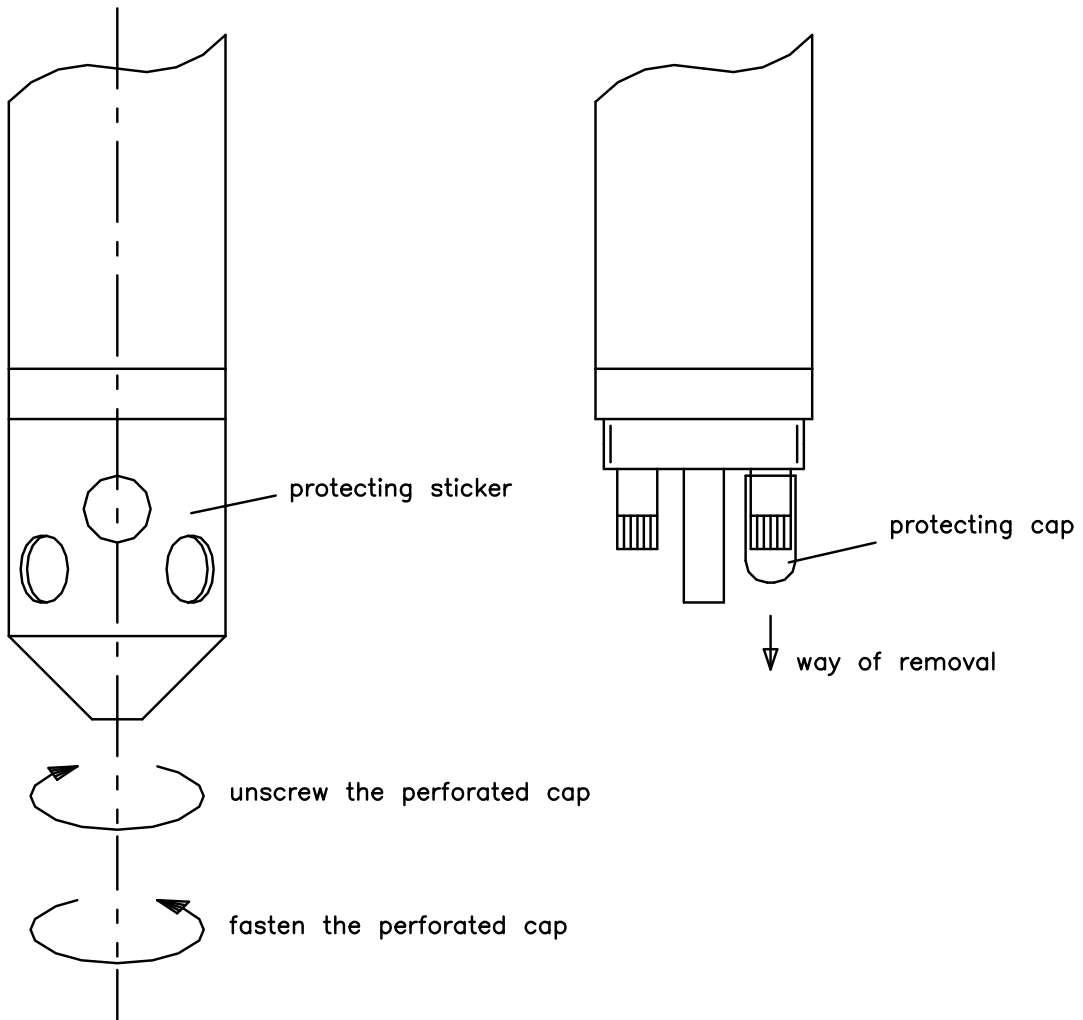
SA8265.106
Dimensions (mm)



1. Security hook
2. Gland
3. Body of the probe
4. Sensors holder
5. Sensors protection

FIG. 1

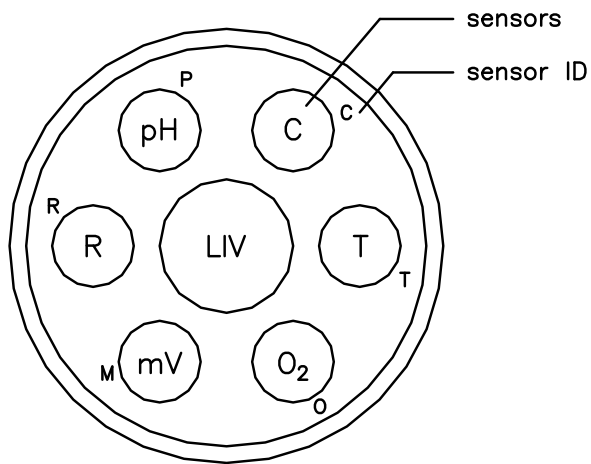
SA80XX.xxx / SA82XX.xxx
PREPARATION OF THE PROBE



1. Remove the protecting sticker
2. Unscrew the protecting cap
3. Remove the storage cap from Reference and D.Oxygen electrode
4. Tighten the protecting cap

FIG. 2

SA80XX.xxx/SA82XX.xxx
 POSITION OF THE SENSORS



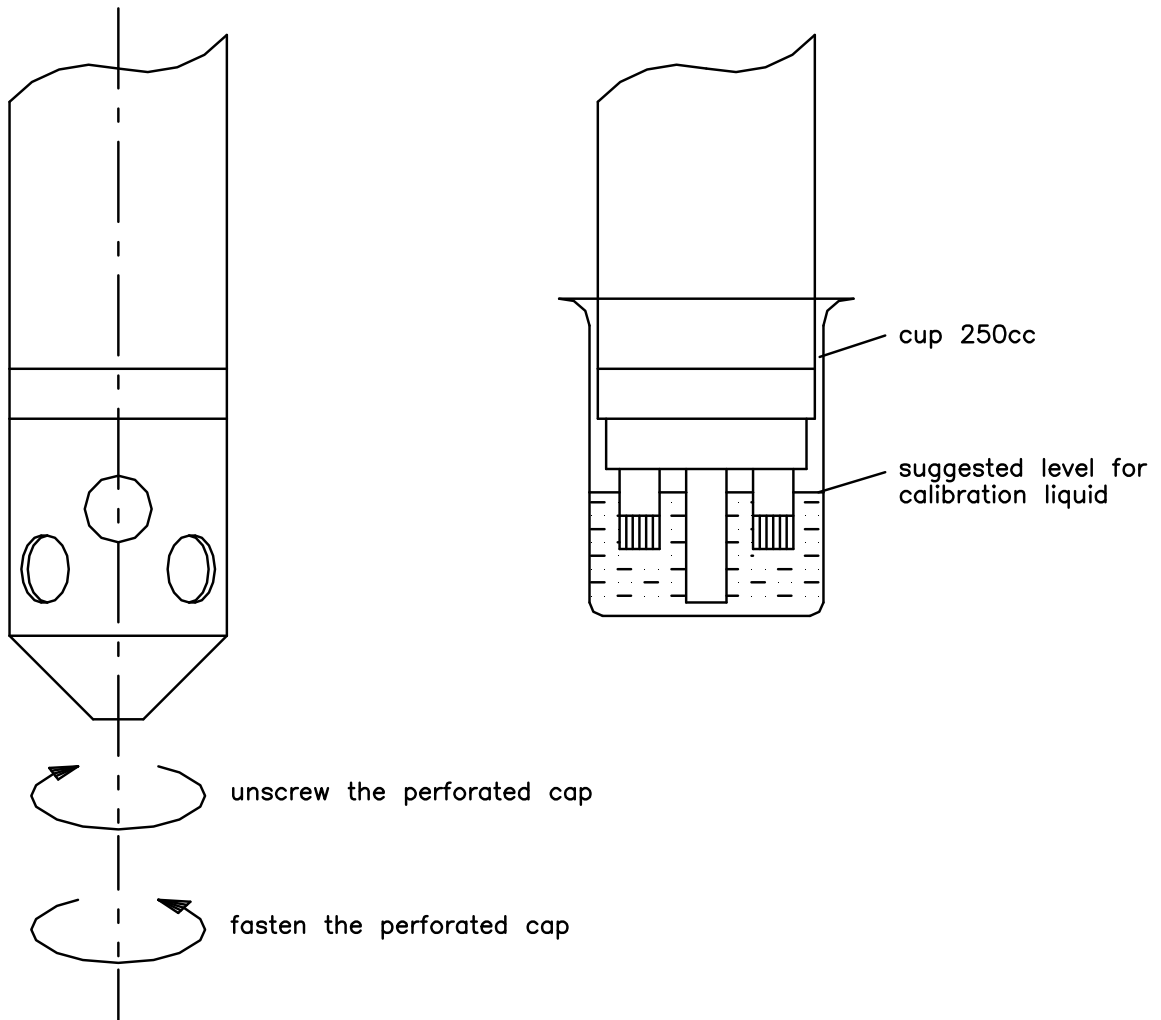
view from bottom

SENSOR	DESCRIPTION	SYMBOL
LIV	level	
pH	pH	P
R	reference	R
mV	redox	M
O ₂	d. oxygen	O
T	temperature	T
C	conductivity	C

The position of the sensor is shown by the symbol printed on the sensor holder

FIG. 3

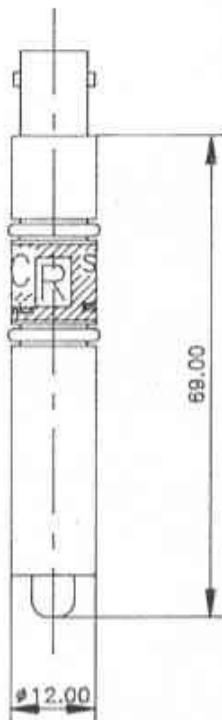
SA80XX.xxx/SA82XX.xxx
SENSOR CALIBRATION



1. Unscrew the protecting cap
2. Check the cleaning condition of the sensor
3. Fill the glass with the Standard solution
4. Dip the probe into the glass
5. Check the full immersion of the sensor
6. Perform the calibration of the specific sensor
7. Tighten the protecting cap

FIG. 4

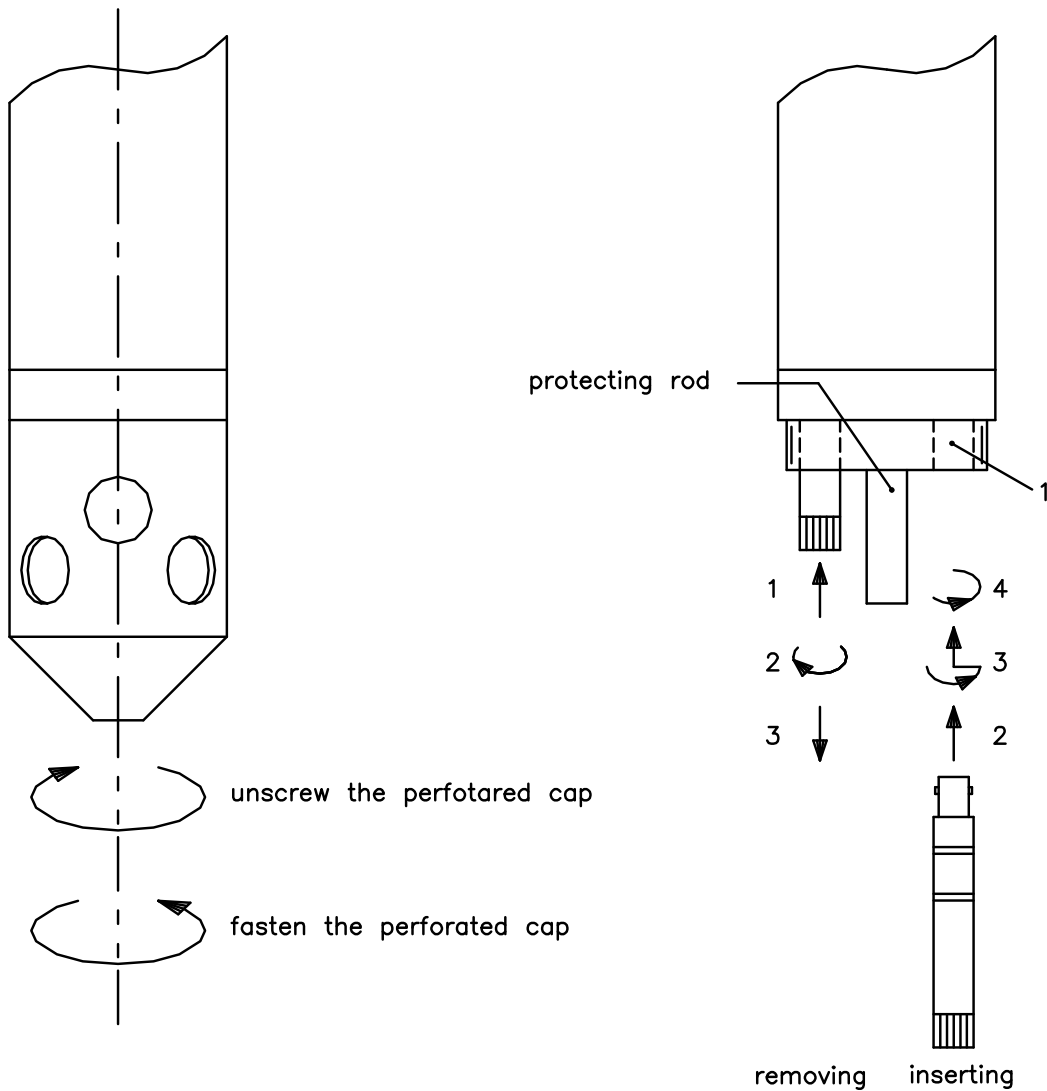
EXTRACTABLE SENSOR
Dimensions (mm)



P/N	Description	Symbol
SA9100	Reference	R
SA9110	pH	P
SA9120	Redox	M
SA9130	Conductivity	C
SA9150	Temperature	T
SA9160	D. Oxygen	O

Fig. 5

SA80XX.xxx/SA82XX.xxx
SENSORS REPLACEMENT



REMOVING THE SENSOR

1. Pull the sensor up
2. Rotate 1/4 turn counterclockwise
3. Pull the sensor down

INSERTING THE SENSOR

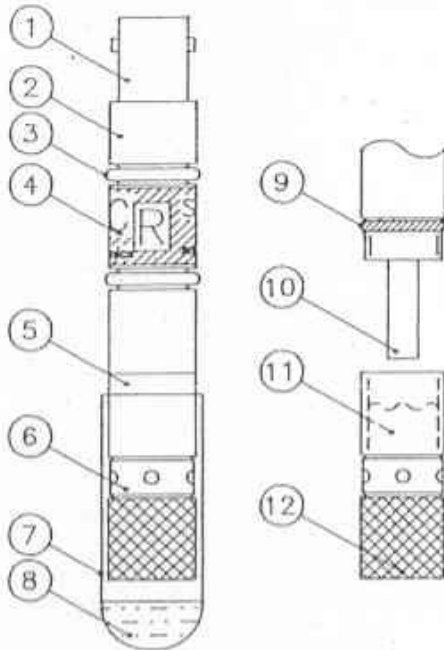
1. Grease with vaseline inside the sensor seat
2. Insert the sensor and pull up gently
3. Rotate the sensor to match the BNC guide
4. Rotate 1/4 turn clockwise to fasten the BNC

NOTE

The sensor replacement is easier if the protecting rod is removed and reinstalled after the operation

FIG. 6

SA9100
REFERENCE ELECTRODE



Specifications

- Electrode: Ag/AgCl
- Pressure: 30 bar max.

Description

1. Connector
2. Body
3. O ring
4. ID label
5. Reservoir
6. Silicon tube
7. Protecting cap
8. Storage liquid
9. Internal O ring
10. Sensing part
11. Electrolyte
12. Ceramic junction

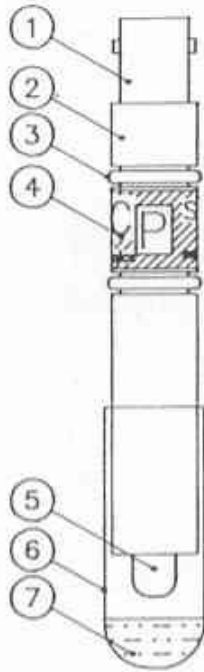
- a. Electrolyte bottle
- b. Internal O ring
- c. Silicon tube

Instructions

- A) Start up:
 - Remove the cap
 - Dip in water for 1 day if sensor is dry
 - Eliminate air bubbles by following the procedure C)
- B) Maintenance:
 - Clean the ceramic junction with 2% HCl
 - Follow procedure C)
- C) Electrolyte refilling
 - Unscrew the reservoir
 - Fill the electrolyte
 - Remove eventual air bubbles in reservoir
 - Fasten the reservoir and let run out the liquid in excess
- D) Storage
 - Fill the cap with water and install it

Fig. 1/1

SA9110
pH ELECTRODE



Specifications

- Electrode: Glass
- Range: 0-14 pH
- Pressure: 30 bar max.

Description

1. Connector
2. Body
3. O ring
4. ID label
5. Glass bulb
6. Protecting cap
7. Storage liquid

Accessories

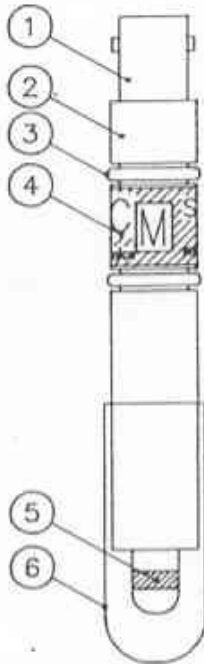
//

Instructions

- A) Start up:
 - Remove the cap
 - Dip in water for one day if sensor is dry
- B) Maintenance:
 - Clean the bulb with 2% HCl solution
- C) Regeneration
 - //
- D) Storage
 - Fill the cap with water and install it

Fig. 1/1

SA9120
O.R.P. ELECTRODE



Specifications

- Electrode: Platinum
- Pressure: 30 bar max.

Description

1. Connector
2. Body
3. O ring
4. ID label
5. Platinum ring
6. Protecting cap

Accessories

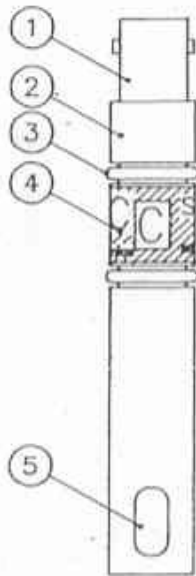
//

Instructions

- A) Start up:
 - Remove the cap
 - Dip in water for 1 day if sensor is dry
- B) Maintenance:
 - Clean the Platinum ring with 2% HCl solution
- C) Regeneration
 - //
- D) Storage
 - Fill the cap with water and install it

Fig. 1/1

SA9130
E.CONDUCTIVITY SENSOR



Specifications

- Electrodes: graphite
- Cell constant: 1
- Pressure: 30 bar max.

Description

- 1. Connector
- 2. Body
- 3. O ring
- 4. ID label
- 5. Measuring electrodes

Accessories

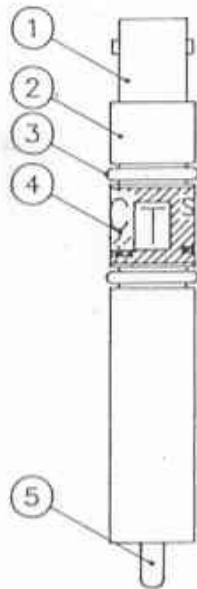
//

Instructions

- A) Start up:
//
- B) Maintenance:
- Clean the dirty sensor with 2% HCl solution
- C) Regeneration:
//
- D) Storage:
- In a dry room

Fig. 1/1

SA9150
TEMPERATURE SENSOR



Specifications

- RTD sensor: Pt1000
- Class: B
- Pressure: 30 bar max.

Description

- 1. Connector
- 2. Body
- 3. O ring
- 4. ID label
- 5. RTD

Accessories

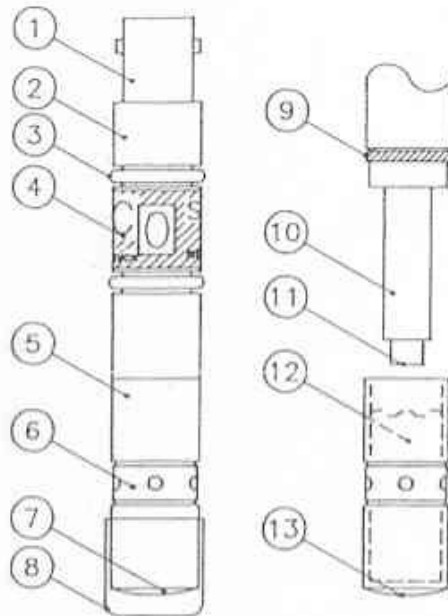
//

Instructions

- A) Start up: //
- B) Maintenance:
 - clean the dirty sensor with 2% HCl solution
- C) Regeneration: //
- D) Storage:
 - in a dry room

Fig. 1/1

SA9160
DISSOLVED OXYGEN ELECTRODE



Specifications

- Cell: polarographic
- Current: 30 nA in air
- Pressure: 30 bar max.

Description

1. Connector
2. Body
3. O ring
4. ID label
5. Electrolyte reservoir
6. Silicon tube
7. Sensing membrane
8. Protecting cap
9. Internal O ring
10. Anode Ag
11. Cathode Pt
12. Electrolyte
13. Membrane cartridge
14. Cartridge O ring
15. Tool for extracting the cartridge

Accessories

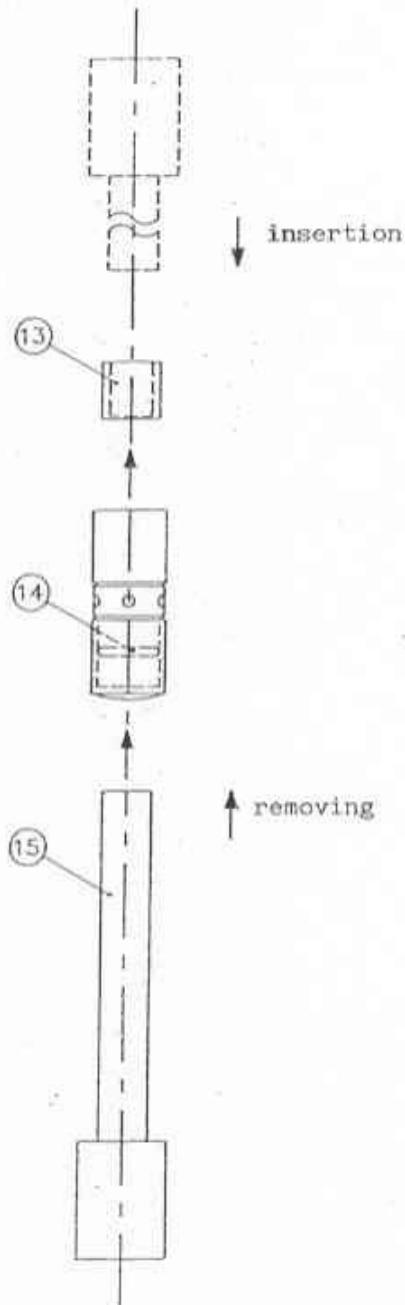
- a. Electrolyte bottle
- b. Cartridge
- c. Tool
- a. Electrolyte bottle
- b. Internal O ring
- c. Silicon tube

Instructions

- A) Start up:
 - Remove the cap
 - Dip in water for 1 day before calibrating
 - Eliminate air bubbles by following the procedure C)
- B) Maintenance:
 - Clean the membrane with 2% HCl solution
 - Follow procedure C)
- C) Electrolyte refilling
 - Unscrew the reservoir
 - Fill the electrolyte
 - Remove eventual air bubbles in reservoir
 - Fasten the reservoir and let run out the liquid in excess
- D) Storage
 - Fill the cap with water and install it

Fig. 1/2

SA9160
DISSOLVED OXYGEN ELECTRODE



13. Cartridge
14. Cartridge O ring
15. Tool

Membrane replacement

- Replace membrane when:
 - * it is broken
 - * the sensitivity is low

Operations

- Remove the electrolyte
- Lean the tool 15 to the bottom of the cartridge
- Push up gently to remove the cartridge from the internal O ring
- Check the O ring condition and replace if necessary
- Position the new cartridge
- Push by tool the new cartridge in the original position. Be careful so that the membrane will protrude from the reservoir
- Proceed by following the instruction C) on pag. 1/2

Fig. 2/2

WARRANTY CERTIFICATE

- 1) Your product is covered by B&C Electronics Warranty for 5 years from the date of shipment. In order for this Warranty to be valid, the Manufacturer must determine that the instrument failed due to defective materials or workmanship.
- 2) The Warranty is void if the product has been subject to misuse and abuse, or if the damage is caused by a faulty installation or maintenance.
- 3) The Warranty includes the repair of the instrument at no charge. All repairs will be completed at the Manufacturer's facilities in Carnate, Italy.
- 4) B&C Electronics assumes no liability for consequential damages of any kind, and the buyer by accepting this equipment will assume all liability for the consequences of its use by the Customer, his employees, or others.

REPAIRS

- 1) In order to efficiently solve your problem, we suggest You to ship the instrument along with the Technical Support's Data Sheet (following page) and a Repair Order.
- 2) The estimate, if requested by the Customer, is free of charge when it is followed by the Customer confirmation for repair. As opposite, if the Customer shall not decide to have the instrument repaired, he will be charged to cover labor and other expenses needed.
- 3) All instruments that need to be repaired must be shipped pre-paid to B&C Electronics. All other expenses that have not been previously discussed will be charged to Customer.
- 4) Our Sales Dept. will contact You to inform You about the estimate or to offer you an alternative, in particular when:
 - the repairing cost is too high compared to the cost of a new instrument,
 - the repairing results being technically impossible or unreliable
- 5) In order to quickly return the repaired instrument, unless differently required by the Customer, the shipment will be freight collect and through the Customer's usual forwarder.

*B&C Electronics Srl - Via per Villanova 3 - 20040 Carnate (Mi) - P.IVA 00729030965
Tel (+39) 039 63 1721 - Fax (+39) 039 607 6099 - info@bc-electronics.it - www.bc-electronics.it*

TECHNICAL SUPPORT

Data sheet

In case of damage, we suggest You to contact our Technical Support by email or phone. If it is necessary for the instrument to be repaired, we recommend to photocopy and fill out this data sheet to be sent along with the instrument, so to help us identifying the problem and therefore accelerate the repairing process.

ESTIMATE

REPAIR

COMPANY NAME

ADDRESS

ZIP

CITY

REFER TO MR./MISS.

PHONE

MODEL

S/N

DATE

Please check the operator’s manual to better identify the area where the problem seems to be and please provide a brief description of the damage:

- SENSOR
- POWER SUPPLY
- CALIBRATION
- DISPLAY
- ANALOG OUTPUT
- SET POINT
- RELAY CONTACTS
- PERIODICAL MALFUNCTIONING

➤ *DESCRIPTION*

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