p200 LAQ

Analysis line of water physical and chemical parameters
User's Manual

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1 General safety considerations

The “Water Line” is a measuring instrument which allows to acquire electrical parameters, process and store them.

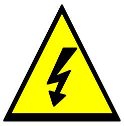
This equipment is in conformity of the requirements of the rule 73/23CEE modified through 93/68/CEE

and of the rule EMC 89/336/CEE.

The equipment has been designed in conformity of the rule CEI EN 61010: for the operator safety it is necessary to follows all the procedures of the present manual and read with care all the notes marked with the symbol:

(CAUTION warns you of a potential hazard)

or with the symbol:



(WARNING, alarms you to a serious hazard)

The “Water Line” equipment has to be managed by trained personnel.

The labels giving caution to possible dangerous procedures require constant attention.

1.1 Product overview

This manual provides information for installing , operating and maintenance of the product.

The equipment has been designed for local application and the provided sensors allow the measurement of the following parameters:

- Temperature
- Conductivity
- Dissolved oxygen
- Ph
- Redox
- Turbidity

The application fields:

- Monitoring the quality of marine and costal waters.
- Monitoring the quality of lakes waters.
- Monitoring the quality of river and lagoon waters.
- Remote control integrating system for the water management.

Take care of this manual and keep at operators disposal a copy.

1.2 Warning

The manufacturer declines any responsibility for failures due to the instructions non compliance, negligent handling, tampering, use not allowed by the manual, wrongful use and operation by not trained operators.

Only authorized personnel has to enter within the working area for normal use and maintenance operations.

1.3 Safety precautions

- The equipment does not work when inflammable gas and smokes are present and in any room having explosion risk.
- Do not operate any measurement when instrument anomalies are found as deformation or failures.
- Do not operate inside the equipment without the presence of a second person which can grant a first assistance in case of need.
- Without proper authorization do not remove, replace or modify any electrical or mechanical components, which can be done by only qualified and trained personnel, after the power is set off.

1.4 Transportation

To avoid damaging to the equipment during its transport maintain it always in a vertical position without shaking it.

1.5 Removing the packing

Before removing the packing and settling the instrument, be sure to have taken the following precautions:

- Use suitable gloves to protect from possible erasures etc.
- If possible damages occur during the transport chargeable to the supplier, give the instrument back to the supplier
- Once the packing has been moved, lay the instrument and its components on a flat surface.
- Always avoid to turn the instrument upside down.
- Pay attention to the sockets in the front and rear part of the case of the instrument during the operation

Before settling the instrument control that:

- The voltage of feeding is in accordance with the operative conditions of the instrument
- Control that the general switch of the instrument isn't working (?)
- Avoid switching on the instrument before having followed the instructions of settling and starting written in this user's guide.

1.6 During the working

During the working, never open the instrument (removing the electrodes from the cell of measurement) without having switched off the equipment disconnecting the feeding of the 12V.

Anyway always wear the suitable dressing to prevent accidents expected in the working environment.

1.7 Storage

It is necessary to pay a particular attention to store the electrodes. To maintain the speed of **response,** the electrode of **PH** and **REDOX** must be maintained damp.

The ideal solution to store is the buffer solution at PH 4 with an addition of 1/100 of KCl saturated, provided that it is without dyes.

For short storages, the tap water can be sufficient (don't use distilled water) put in the reservoir of protection applied on the terminal of the electrode.

The storing of the electrode of **OXIGEN** requires to apply the pierced cap and the storing in a dry place.

Finally the electrode of **CONDUCTIVITY** doesn't need any protection.

Keep the instrument in an environment with a temperature between 0 and 40℃. Be sure that the instrument is laid in a steady position and that it is impossible to damage or move it caused by inexperience or distraction. Don't lay on (any) other instrument or weighs superior to some Kilos. Don't lay the instrument to other instruments and be sure of the firmness and stability of the underneath housing.

2 Maintenance

2.1 Ordinary maintenance

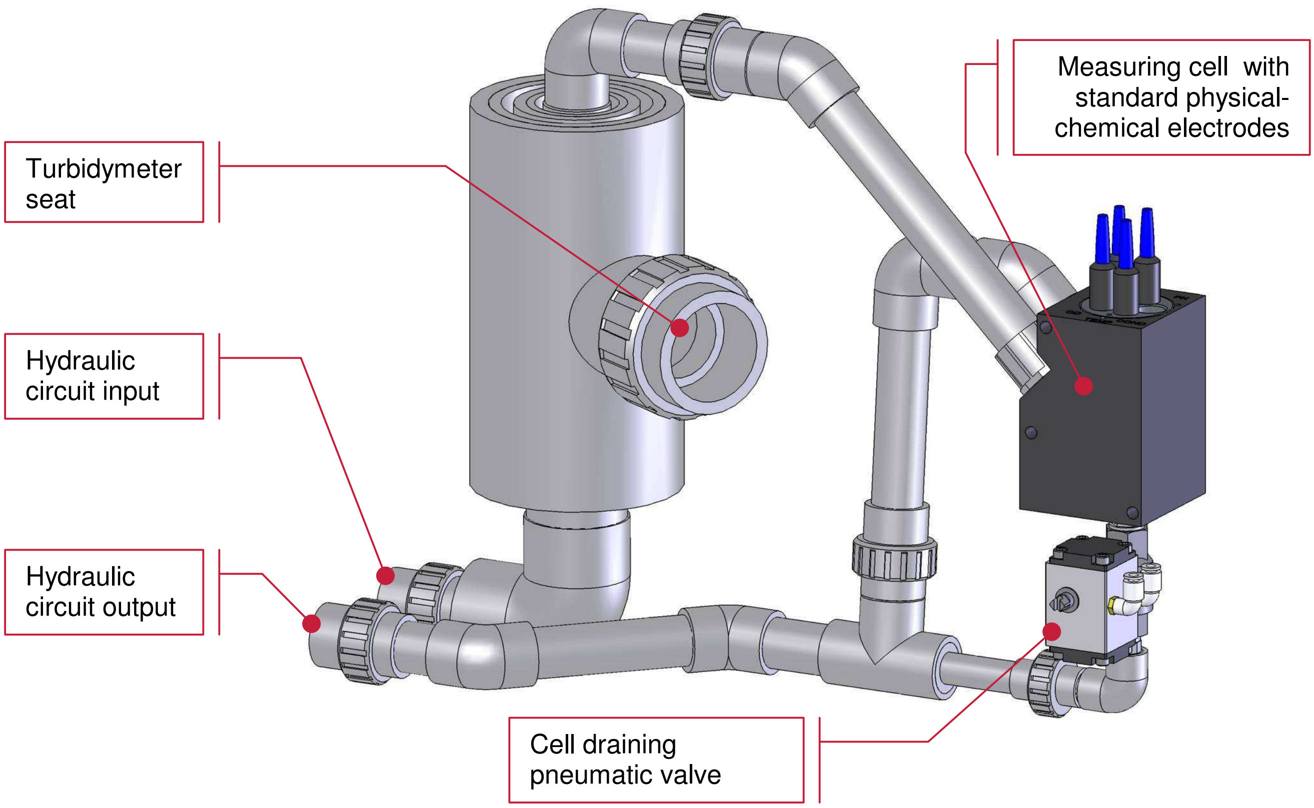
For the good working of (the) LAQ, it is advisable a monthly ordinary operation or of a different frequency (depending on the second type of examined water) of cleaning of the cell of measurement and of the electrodes using distilled water, or clean water and (some) absorbent paper to dry.

The line of water LAQ has a daily compressed air system of self-cleaning, supplied by an external compressor, operated by solenoid valves commanded in pre-established frequencies..

2.1.1 Cleaning procedure and general control

Before beginning the operations of cleaning of the electrodes it is necessary to stop the flow of monitored water (turning the pump off) pressing the key "SCARICO CELLA" from the menu of Olimpo logger.

Keep pressed for more than two seconds the key "S" of the keyboard on the front panel, the LAQ will begin the reset procedure, as indicated in the display keep pressed again the key "S" to confirm and you will enter the menu. See the different options going up and down with the keys "UP" and "DOWN" until you see "SCARICO CELLA" (for default and in normal conditions of acquisitions the value is set to "0"), press the key "M" to change the value from "0" to "1" and press "RETURN", exit from the menu pressing the key "S", the machine will stop the feeding pump and will open the solenoid valves which will enable the water discharge in the circuit.



Cleaning of the electrodes and cell of measure

To begin cleaning extract the electrodes of pH, potential redox, temperature, dissolved oxygen and/or conductivity from their seat in the measurement cell (see photo) loosing the three most external locking screws of the steel electrodes holder and the three most internal socket head screws which lock the electrodes by pressure on the o-ring internal to the electrodes holder .

Extract carefully the electrodes from their seat.

Clean the electrodes with water, handling them carefully, and then put them on their original seats.

If the internal cleaning of the measurement cell is needed extract all the electrodes, the compressed air little pipe and the probe of temperature, unscrew completely the three locking screws of the electrodes holder and extract it from its cell. Clean with water and paper inside the cell top remove possible sediments deposed in the normal flow of the examined water. Reinsert the electrodes holder blocking it with the three screws.

Once the electrodes have been cleaned it is advisable to make a visual verification of the chemical and physical values immerging for some minutes the electrode in a sample solution of a known value and verify the measurement reading the value indicated on the display of the LAQ. Possible differences between this value and the one of the sample solution can be inserted as correction coefficients in the measure carried out by LAQ.

Once the cleaning operations have been finished place again the electrodes in its own holder (the position, except the probe of temperature, isn't obliged, the electrodes are interchangeable) inserting them tightly. Then tighten the three socket head screws many times until the extraction of the electrodes isn't enabled.

Turbidity probe

When the water flow is steady unscrew the 2" ¾ PVC locking ring nut .

Extract the probe and wash it with water removing sediments deposits if any.

For possible operations of specific maintenance and the procedures to be carried out on the probe refer to the attached user's guide.

Anyway, the turbidymeter is supplied with an automatic cleaning brush.

Once the cleaning operations of the probe have been finished, place it again in its seat maintaining the brush vertical upside following the water flow (which is from below to up) and rotate it counter clockwise of about 40°, close it again in its seat with the PVC ring nut .

The general cleaning operations have been finished.

To restore the automatic monitoring system , re-set up in the menu, following the procedure described previously, the value of the command "SCARICO CELL" at "0" and exit from the menu.

When the reset procedure has finished LAQ will take again its work of analysis and storing of the acquired data

2.1.2 *Cleaning procedures and specific control for each electrode*

Temperature

The probe of temperature is a Pt1000 thermo resistance sealed in a steel housing directly inserted in the electrodes holder..

Its cleaning is simply made with water and paper to remove the possible deposited dirtiness.

For a possible verification of good functioning read the value of detected temperature on the display.

pH electrode

This electrode can supply valid data without maintenance even for a period of a lot of months (it can reach a small shift, one or two decimals in 3/5 months)

For a specific cleaning from deposits and organic fouling dip the electrode in a solution of 0.1M of HCl, 0.1M of NaOH and again in 0.1M of HCl. Each immersion will last about 5 minutes.

For the cleaning of films of organic oils or greases wash the end of the electrode in a liquid detergent and water. If this procedure doesn't regenerate the electrode, then clean the porous buffer with a solution of KCl diluted at a temperature of 60÷80 degrees, for about 10 minutes. Cool the electrode while it is electrode is immerged in the solution before trying to work it again.

For the periodic verification of the measured parameter a standard solution at pH 7.01 and 4.01 (type Hanna, HI 7007 and HI 7004) is to be used. These ones must be used in the automatic calibration expected by LAQ as the only system of calibration where it's impossible to use only one solution or of other values as these ones are preset and cannot be modified by the user in the LAQ system.

Redox potential electrode

This electrode too doesn't need any frequent maintenance due to a good stability for several months.

The specific phases of cleaning of this electrode are the same described for the electrode of pH.

For the periodic verification a standard solution of 468 mV (type Crison n 94-10) is to be used.

This solution too is used in the automatic calibration of the LAQ as the only system of calibration and its values are reset in the LAQ.

Conductibility Electrode

Good lasting in the time of the good measuring conditions even for this electrode; it has a small shift of few µS/cm in 3/5 months.

To clean the small rings, if fouled, a solution of HCl at 2% is used.

For a periodic verification of the measure use the standard solution at 1413 µS/cm at 25°C (type Hanna Instruments HI 7031). Use the solution at 12280 µS/cm at 25°C for waters with a conductivity superior to 3000 µS (type Hanna Instruments HI 7030). Always dip the probe of temperature in the standard chemical solutions as the measure on the liquid is supplied compensated at 25°C.

The standard solution at 1413 µS/cm at 25°C is used for the automatic calibration expected by LAQ as a unique calibration system where it isn't possible to use a solution of another value because the same value is preset and the user cannot change it.

Oxygen dissolved electrode

The measure of this parameter is particularly critical during the time; to obtain a certain continuity of the reliability of the datum it is necessary to carry out a frequent periodic maintenance which involves, at least ,the replacement of the electrolyte solution. The operation is carried out by unscrewing and screwing the capsule containing the Teflon membrane (this must be replaced if it is broken or at least after 5-6 months), every 15 days. The membrane can be cleaned, if it there is any deposit, with a solution of HCL at 2%.

This is done to avoid the whole consumption and to delay the consequent and natural wear caused by the oxidation of the anode and the cathode which make the electrode no longer usable.

As regards the parameter a verification of the value of the span in the air after some minutes of polarization of the electrode in clean water. In case of the replacement of the membrane carry out the verification of zero in a saturated solution of sulphite of sodium.

The solution of zero oxygen is used in the automatic calibration expected by LAQ as the only system of calibration which carries out the value of the span in the air.

The proven life of the Oxygen electrode is very limited, shorter than one year.

Frequent maintenance to obtain reliable historical data is necessary.

2.2 Electrodes calibration

The calibration of the electrodes is carried out by the LAQ automatically in two specific times: either **immediate,** with selection of the relevant electrode, or **cyclic,** setting in the configuration the time which elapses between two calibrations of the electrodes.

The procedure of calibration, either immediate or cyclic, for all the electrodes.

2.2.1 Starting of the immediate calibration

To start the immediate procedure of calibration press the Key "S" for more than two seconds. The procedure of reset will ask to press again for other two seconds the key "S" as a confirmation begins. In this way enter in the menu Olimpo where you can select, with use of the keyboard, the following three keys:

T=Pr.ora A=Azz.mem C=Configurazione

Digit "C" followed by "RETURN" and go to the configuration menu.

On single line, and with the arrow keys "UP" and "DOWN", it is possible to slide all the settlements previously charged in the configuration of the instrument.

Select the line of the electrode (it is also possible to make a multiple selection) to be calibrated with an immediate procedure: default flag is set to "0",then by means of the keyboard digit the letter "M" to modify and set it to "1" and digit "RETURN". Through the key "S" exit from the menu and the procedure of calibration will begin and can last some minutes depending on the selected electrode. If you have decided to calibrate more electrodes they will be calibrated in sequence.

2.2.2 Programming Cyclic Calibration

To start the cyclic procedure of calibration press the Key "S" for more than two seconds. The procedure of reset begins and as a confirmation it will ask to press for other two seconds the key "S". In this way enter to the menu Olimpo where you can select, with use of the keyboard, the following)three keys:

T=Pr.ora A=Azz.mem C=Configurazione

Digit "C" followed by "RETURN" and go to the configuration menu.

On single line, and with the arrow keys "UP" and "DOWN", it is possible to slide all the settlements previously charged in the configuration of the instrument.

Select the line of the electrode (it is also possible to make a multiple selection) to be calibrated with an immediate procedure: default flag is set to “0”,then by means of the keyboard digit the letter “M” to modify and set it to “1” and digit “RETURN”. Through the key “S” exit from the menu and the procedure of calibration will begin and can last some minutes depending on the selected electrode. If you have decided to calibrate more electrodes they will be calibrated in sequence.

2.2.3 Note on the automatic calibration

The calibration of the electrodes of pH, conductivity, potential redox, and oxygen is foreseen only in automatic **mode** using titrated solutions of the values already described previously.

Introduce the relevant draft small pipes, on the bottom of the LAQ, in the bottles of the selected solutions,

assuring that the liquid is sufficient for the number of the expected calibrations (consumption of about 130ml of solution for every single calibration of the single electrode). Don’t exchange the solutions since the titrated values are strictly set and cannot be modified).

Start the way of calibration, immediate or cyclic; the immediate one is carried out as soon as the cycle of acquisition is reset, the cyclic one when the number of hours set on the menu is elapsed.

During the phase of calibration the system before turns the pump off and then activates in sequence the valve of the foreseen solution and the peristaltic pump which charges the titrated solutions; on the display there is any meaningful information for some minutes until the observation of the first and the second point of calibration with the calculation of offset and slope used successively for the correction of the acquired parameter. The life of the calibration is of about 10/12 minutes for every single probe.

At the end the system automatically returns in the measures acquisition.

3 Technical specification of the electrodes

3.1 Temperature

Measuring technique : thermo resistance Pt1000 (DIN)

Range : -5 ÷ 60 °C

Precision : ± 0.2 °C

Resolution : 0.1 °C

3.2 pH

Sensor : glass electrode with built in reference Ag/AgCl

Measuring technique : Potentiometric using an electrode combined with a separated reference electrode

Range : 2 ÷ 12 unità

Precision : ± 0.1 unità

Resolution : 0.05 unità

Working temperature : -5 ÷ 60 °C

Compensation : automatic for temperature 0 ÷ 40 °C

Calibration method : with standard solution

3.3 Redox potential

Sensor : glass electrode with built in reference Ag/AgCl

Measuring technique : Potentiometric

Range : -1000 ÷ 1000 mV

Precision of the transmitter : ± 25 mV

Resolution : 5 mV

Working temperature : -5 ÷ 60 °C

Calibration method : with standard solution

3.4 Conductivity

Measuring technique : Conductive with 3 electrodes cell in black platinum

Range : 0 ÷ 3000 µS/cm ; 0 ÷ 50000 µS/cm

Precision : ± 30 µS/cm ; ± 500 µS/cm

Resolution : 2 µS ; 20 µS

Working temperature : -5 ÷ 60 °C

Temperature compensation: 0 ÷ 40 °C

Calibration method : with standard solution

3.5 Dissolved oxygen

Measuring technique : Polarographic cell (Cel of Clark) made of aggregate with 4 electrodes with anode Ag and cathode Pt; reference Pt-Pt, membrane in teflon

Range : 0 ÷ 20 mg/l (0 ÷ 100 % in saturation)

Precision : ± 1 mg/l

Resolution : 0.5 mg/l

Working temperature : 0 ÷ 60 °C

Compensation temperature : 0 ÷ 40 °C

Calibration method : in the air

3.6 Turbidity sensor

On the basis of the exigencies of the customer, it is possible to supply the sensor of torbidity supplied by Endress Hauser (model CUS 31 – W2A) or the one supplied by Lange (model SOLITAX SC).

3.6.1 Endress Hauser Sensor CUS 31 – W2A

Principle of measure : nephelometric, light scattering at 90° NIR according to EN 27027

Range : 0.000 ÷ 9999 FNU, 0.00 ÷ 3000 ppm, 0.0 ÷ 3.0 g/l, 0.0 ÷ 200.0%

Wave length : 880 nm

Optical compensation : with reference photo diodes

Temperature / pressure : 25°C / 6bar ………50°C / 1 bar

Connection cable : 4 wire with terminals

Max. cable length : 200 m

Temperature sensor : NTC

Working temperature : -5 ÷ +50°C

Storage tempearture : -20 ÷ +60°C

Protection class : IP 68

3.6.2 Lange Sensor SOLITAX SC

Principle of measure : Infrared light scattered at 90°C

Range : 0 ÷ 4000 NTU o 0,001 ÷ 50,0 g/l

Precision : ± 2% of the measure value or ± 0.5 NTU, the major one

Reproducibility : ± 1% of the measure value or ± 0.2 NTU , the major one

Resolution: Automatic selection range; from 0 to 2 decimal positions accordino to the indicated value

Flow rate : 3 m/s (10 ft/s) maximum

Temperature : 0 ÷ 40 °C

Pressure : maximum 4 bar

Probe cleaning : silicon rubber with quartz window

4 Working of the LAQ

4.1 Start up of the instrument

Plug in the line supply cable to electric network (220V, 50Hz) and press the switch power (I /O).

4.2 Acquisition cycle

When powered , the instrument automatically start the CYCLE of data acquisition. This cycle is carried out with the interval set in the configuration generated by OLIMPOSW.

In Figure 1 an example of video display during the acquisition cycle is represented

```
   SIAP+MICROS        16:45:30        15/03/2007

--------------------------RAW-----------CAL----
Conducibilità      uS/cm = ---           ---
pH                       = ---           ---
Oxygen                 % = ---           ---
-----------------------------------------------
Working Pump             = 1
Turbidity            NTU = ---      STS = ---
Water level           cm = 50
Temperature           gC = ---
Battery                V = 12,8   Flow = 0
-----------------------------------------------
Power UPS (1=OK)  Before = 1     After = 0
Power switch (1=OK)   #0 = 1        #1 = 0
Counter = 4              Interval = 360
```

Figure 1 – Acquisition cycle

The sample to be analysed is flowed in the cell of measure where there are the different analysis electrodes..

The acquisition of measures is carried out every 30 seconds at least.

In any case it is possible to set the acquisition cycle by using the software OlimpoSW..

The **acquisition timing and recording** of the different acquired data are normally set by OLIMPO SW as follows

Instantaneous every 30 seconds

Average every 60 minutes

Minimum and maximum every 60 seconds

4.3 Recording

The instrument manages a **RAM** memory for the recording of the acquired data.

The subdivision typical of the memory (RAM) is indicated below :

File 1 = 5 Kbyte	**File 4 = 5 Kbyte**	**File 7 = 1 Kbyte**
File 2 = 5 Kbyte	**File 5 = 5 Kbyte**	**File 8 = 1 Kbyte**
File 3 = 5 Kbyte	**File 6 = 300 Kbyte**	**File 9 = 1 Kbyte**

The averaged data acquired by the instrument are stored on the file 6, the instantaneous data are normally stored on the file 1 while the alarms are stored on the file 4.

4.4 Recording autonomy

Taking in consideration a recording with a dynamic record trace (see the relevant paragraph), an instrument of water quality which acquires 5 parameters and stores an average every 30 minutes has an autonomy of :

FILE 6 300K INTERNAL MEMORY = ABOUT 60GG

4.5 Data format

The data stored on the files of the instrument are formatted according a standard "Siap+Micros" defined **Dynamic record trace**

The **Dynamic record trace** contains all the information about the station (number of the station), the date and the hour (time) of the storing of the data and the typology of the stored data.

In the record traces with a *dynamic structure,* its length is **variable** depending on the number and on the kind of the contained data.

Whether the data to insert are minimum, the length of the same layout and, as a consequence, the spaces occupied by the data will be very small.

This trace allows to contain the instantaneous data (available by the logger, continuously), the statistical data

(available by the logger with the preselected frequency), the alarm data (available by the logger depending on the event).

The trace is made by three different parts called respectively:

- **Head**
- **Body**
- **Terminator**

Everyone of these parts is internally subdivided in separated fields by the character: ","(ASCII 44).

All the data (*Instantaneous Data, Statistical Data, Alarm Data, Calibration Data etc.*) managed by the system are recorded in the internal memory (RAM) of the instrument and, if any, in the memory card.

According to the kind of the datum, the recording is carried out in different areas of the memories.

The subdivision of the areas is dictated, as described later, by precise exigencies of filing

Area n° 1	0.5 Kbyte, for the storing of the **Instantaneous Data**
Area n° 2	0.5 Kbyte, for the storing of the **Incoming Messages** (Teleprogramming)
Area n° 3	0.5 Kbyte, for the storing of the **Outgoing Messages** (Teleprogramming)
Area n° 4	0.5 Kbyte, for the storing of the **Alarm data**
Area n° 5	0.5 Kbyte, **Auxiliary**
Area n° 6	300 Kbyte for the storing of the **Statistical Data**
Area n° 7	0.1 Kbyte, **Auxiliary**
Area n° 8	0.1 Kbyte, **Auxiliary**
Area n° 9	0.1 Kbyte, **Auxiliary**

The *data* are stored in the corresponding area of the memory. They are stored as sequences of characters ASCII. The modes of storing of the data depend on the specific type of the above mentioned *datum.* These modes are described by the *record trace* which define its structure.

In a few words, 4 different types of filing have been implemented, one for each type of *datum.*

The 4 types are:

1. Record trace of the *Statistical Data*
2. Record trace of the *Instantaneous Data*
3. Record trace of the *Alarm Data*
4. Record trace of the *Calibration Data*

The *Centre* carries out the requests of the data reading through the programme OLIMPOSW or management programme of the networks, the module of communication answers with the data stored in the files. Nel seguito these 4 *record traces* used are described in detail.

It is fundamental to underline the following notes for their description:

- The strip of characters are written with all the capital letters
- Each variable field is identified by a name (written in small letters) and the values it can take are indicated.
- The decimal point, when it is present, is identified by the character ".".
- To make a separation between a field an the next one the comma is always used ",".

To be noticed:

In the following notes all the entries such as **Voltage, Counter, Period, Frequency** are considered **Analog Inputs**, the On/Off entries (logic state high or low) are exclusively called **Digital Inputs**.

4.6 Record trace of the statistical data

The *Statistical Data* are available with this trace in the file **n°6** (internal memory) or in the file **n°10** (memory card).

4.6.1 Head

The **Head** of the *record trace* contains all the general information allowing the identification of the record on the basis of the temporal event and of the station identification.

In detail its size is :

STid_stazione , 6 , hh.nn.ss , gg , mm , aa , 0 , Mnum_input ,

the meaning of the different fields is summarized in the following table:

STid_stazione	Header identifying the beginning of the *Head of the record*. It *is composed by the characters* "ST" plus a number indicating the code (ID) of the station. For example: the *Header* ST01 identifies the record of the Station 1
6	Constant code identifying the record trace with a *dynamic structure*.
hh.nn.ss	Hour, minutes and seconds of the event in the format: hh.nn.ss. As alternative since *statistical data are concerned* is possible to use even the format hh.nn

gg	Day of the event of storing of the record in the format: day
mm	Month of the event of storing f the record in the format: mm
aa	Year of the event of storing of the record in the format: aa
0	Constant code identifying the record trace with a *dynamic structure*.
Mnum_input	Header identifying the *head* of the record. It's consists by the character "M" + a number which indicates the total number of parameters (analog inputs and/or digitals ON/OFF) contained in the *body* of the record trace. As ex: M9 shows a total of 9 parameters, while M50 a total of 50 parameters.

4.6.2 Body

The body of the record trace contains the Statistical Data (averages, minimum, maximum, standard deviation, variance, etc) relative to each parameter of the measure.

The body of the record trace is therefore made by the repetition of a block of repeated information as may times as the number of parameters to be represented.

In particular the dimension of the body presents in the following way:

RECORD BODY = block _1 + "," + block_2+ ","+ block_3 + ...

Each block is composed by several sections which form the register of the represented parameter . The block has a dynamic structure, therefore there can be several sections suited to represent it. In the specific case of the statistical data, there isn't a fixed number of sections, but they can vary on the basis of precise necessities.

In detail, each block is structured as follows:

BLOCK_1 = id + "," + constant "," + value

where in detail the various fields take the following meaning:

id	Number code identifying in an univocal way the parameter (the analog or ditgital input on/off) the following sections refer to.
costante	Character ASCII (from ASCII 65 to ASCII 90) which expresses the meaning of the following field "valore".
valore	Numeric value which represents a characteristic of the examining parameter. This characteristic can be the measure of value of the parameter, a particular code, a particular status and so on...

The following table supplies a description of the values which the field “constant” can take and the following field (**value**) in the particular application of the statistical data :

constant	Meaning taken by the following field (value).
A	INSTANTANEOUS VALUE of the parameter (detected in the instant of storing of the record) identified in the field **id**
B	AVERAGE VALUE of the parameter, identified by the field **id**
C	MINIMUM VALUE of the parameter, identified by the field **id**
D	MAXIMUM VALUE of the parameter, identified by the field **id**
E	COUNTING of the parameter, identified by the field **id**
F	STANDARD DEVIATION of the parameter, identified by the field **id**
G	VARIANCEof the parameter, identified by the field **id**
H	SUMMATION of the parameter, identified by the field **id**
L	MINUTE MINIMUM (expressed in minutes beginning from midnight)
M	MINUTE MAXIMUM (expressed in minutes beginning from midnight)
R	ERROR of the parameter, identified by the field **id**
I	INVALIDATION PERCENTAGE of the parameter, identified by the field **id**

To be noticed:

The letters Z, X, Y are reserved.

From the table you can notice that the field “**value**” takes different meanings depending on the field which comes before it.

Therefore a **block** suited to represent a parameter of measure could be structured as follows:

id + “,” + B + “,” + average value

id + “,” + C + “,” + minimum value

id + “,” + D + “,” + maximum value

For the represented sections it isn’t necessary to respect a precise order, besides their number can vary depending on the information to be supplied by the represented parameter.

It is therefore possible to supply a parameter, *the average statistical datum or the minimum one or the maximum one* always inserting **id** of the measure (the corresponding **block** is formed by **id + “,” constant+ “,” value**).

In the situations where the field “value” of any section isn’t a valid numeric value, it is replaced with a specific character which is “*” (ASCII 42). This character is also defined as “lacking datum”.

4.6.3 Terminator

The terminator is a field which indicates the end of the record trace It is formed by the character "#" (ASCII 35) + a number indicating the whole fields of the record between the beginning header **"ST"** and terminator "**#**" included.

For example **#50** indicates that the record is formed by 50 fields with "header" "**ST**" and terminator "**#**" included.

4.6.4 Statistical data record trace pattern

The monitoring station n.2 on February 4th 1996 at two o' clock p.m. has stored a record trace of Statistical Data regarding a Parameter of Temperature and a Parameter of Humidity similar to the following one :

ST02 , 6 , 14.00 , 04 , 02 , 96 , 0 , M03 , 1 , B , 18.5 , 1 , C ,17.1 , 1, D , 20.1, #18

Where :

ST02	Station n°2	**STid_stazione**
6	Constant code of the record trace with a dynamic *structure*	**6**
14.00	*Hour and minute* of the event	**hh.nn**
04	*Day* of the event	**Gg**
02	*Month* of the event	**Mm**
96	*Year* of the event	**Aa**
0	Constant code of the *Statistical Data*	**0**
M03	It means that 3 blocks able to represent 3 parameters follow	**Mnum_input**
1	Parameter ID (*Temperature*)	**Id**
B	Indicates that the following parameter is an *mean statistical datum*	**Constant**
18.5	*Mean statistical datum* of the *Temperature*	**Value**
1	Parameter ID (*Temperature*)	**Id**
C	Indicates that the following parameter is an *minimum statistical datum*	**Constant**
17.1	*Minimal statistical datum* of the *temperature*	**Value**
1	Parameter ID (*Temperature*)	**Id**
D	Indicates that the following parameter is an *maximum statistical datum*	**Constant**
20.1	*Dato statistico massimo* della *Temperatura*	**Value**
#18	*Terminatore*	**Terminator**

4.7 Record Trace of the instantaneous data

The instantaneous data are available on **file n°1** of the internal memory of the instrument.

4.7.1 Head

The *Head of the record trace* contains the general information which allow the identification of the record on the basis of the time occurrence and on the station belonging

In detail its size is as follows:

STid_station , 6 , hh.nn.ss , gg , mm , aa , 1 , Mnum_input ,

the meaning of the different fields is summarized in the following table :

STid_station	**Header** which identifies the beginning of the head of the record. It is composed by the characters "ST" and a number indicating the code (ID) of the station. For example the *Header* **ST01** identifies the record of the Station **1**.
6	Constant code which identifies the record trace with a *dynamic structure*.
hh.nn.ss	Hours, minutes and seconds of the event in the size: **hh.mm.ss**
Gg	Day of the event of storing of the record in the size:**gg**.
Mm	Month of the event of storing of the record in the size:**mm**
Aa	Year of the event of the storing of the record in the size: **yy**.
1	Constant code which identifies the record trace for the *instantaneous data*
Mnum_input	Header which identifies the end of the **Head** of the record. It is composed by the character "M" and a number indicating the whole number of parameters (analog and/or digital input ON/OFF) contained in the **Body** of the record trace. For example M9 indicates a total of 9 parameters while M50 indicates a total of 50 parameters.

4.7.2 Body

The Body of the record trace contains the Instantaneous Data regarding each parameter of measure. It is therefore formed by the repetition of a block of information repeated as many times as the number of the parameters to be represented.

In particular, the format of the body presents as follows:

BODY RECORD = block_1 + "," + block _2 + "," + block _3 +......

Each block is composed by several sections which form the register of the represented parameter. The block has a dynamic structure, therefore there can be several sections suited to represent it. In the specific case of the instantaneous data, 3 sections are sufficient.

In particular each block is structured as follows:

BLOCK_1 = id + "," + section _1 + "," + section _2 + "," + section _3

where in detail the different fields take the following meaning:

id	Code number identifying in a univocal way the parameter (the analog or digital input on/off) the following sections refer to
Section_1	Alphanumeric code composed by two different fields containing only an information regarding the parameter of measure
Section_2	Alphanumeric code composed by two different fields containing only an information regarding the parameter of measure
Section_3	Alphanumeric code composed by two different fields containing only an information regarding the parameter of measure

Each section is, on its turn, disassembled by two fields which compete to give an only one information regarding the parameter. In particular each section is structured as follows :

SECTION_N = constant + “,” + value

where in detail the two fields take on the following meaning:

Constant	Character ASCII (from ASCII 65 to ASCII 90) which expresses the meaning of the field “following” value
value	Numeric value representing a characteristic of the parameter to be examined. This feature can be *the value of measure of the parameter, a particular code, a particular state, and so on…*

The following table supplies a description of the values the **“constant”** field and the following field (**value**) in the particular application of the *Instantaneous Data*:

constant	Meaning taken by the following field (**value**).
T	TYPE (analog or digital) of the parameter, identified by the field **id**
A	INSTANTANEOUS VALUE of the parameter, identified by the field **id**
S	STATUS of the parameter, identified by the field **id**

You can notice that the field **“value”** takes different meanings depending on the previous field. The following tables supply a description of the vales which the field “**value**” can takes for each kind of **“constant”.**

constant	**value**	
T	**0**	To identify an analog parameter
	1	To identify a digital parameter On/off

constant	**value**
A	Any numeric value (*Instantaneous datum* of the above mentioned parameter)

constant	value	
S	**0**	Instantaneous datum of the parameter correctly acquired.
	1	Error of acquisition ……
	2	Parameter in the state of out monitor
	3	Instantaneous datum in the state of over-range.
	4	Instantaneous datum for a variation of the associated digital input.
	5	Instantaneous datum for a invalidation of the associated digital input.
	6	Instantaneous datum in the state of minimum alarm.
	7	Instantaneous datum in the state of minimum pre-alarm.
	8	Instantaneous datum in the state of maximum pre-alarm.
	9	Instantaneous datum in the state of maximum alarm.
	10	Datum not available for waiting a new conditioning .
	11	Test
	12	Alarm (only for a digital parameter ON/OFF)
	13	Reference for Zero calibration
	14	Datum waiting the Zero calibration
	15	Datum in Zero calibration
	16	Datum waiting the Span calibration
	17	Datum in Span calibration
	18	Datum in draining

Therefore a **block** able to represent an *Instantaneous Datum* of a parameter of measure could be structured as follows:

id + "," + T + "," + value_1 + "," + A + "," + value_2 +"," + S + "," + value_3

Section_1 **Section _2** **Section _3**

The three represented sections aren't positional, so it isn't necessary they respect a precise order, but it's good to represent them with the above mentioned succession.

Depending on the status of the parameter *(in acquisition, in alarm, in calibration, etc…)* defined by the section **S + "," + value_3**, its corresponding instantaneous datum defined by the section **A + "," + value_1,** can be found in the situation of *invalidity.*

In this situation. the **value_1** is no longer a numeric datum, but it is replaced by a specific character which is "*" (ASCII 42). This character is also defined as ***"lacking datum"***.

4.7.3 Terminator

The terminator is a field which identifies the end of the record trace. The *terminator* is composed by the character "**#**" (ASCII 35) and a number indicating the total number of fields of the record beginning headers

"ST" and terminator "**#**" included. For example 50 indicates that the record is composed by 50 fields in total with *header* **"ST"** and terminator "**#**" included:

ST02 , 6 , 13.45.15 , 04 , 02 , 96 , 1 , M02 , 1 , T , 0 , A , 13.5 , S , 0 , 2 , T , 0, A , * , S , 1 , #23

where:

ST02	Station n°2	**STid_station**
6	Constant code of the trace record with a *dynamic structure*	**6**
13.45.15	*Hour, minute and second* of the event	**hh.nn.ss**
04	*Day* of the event	**gg**
02	*Month* of the event	**mm**
96	*Year* of the event	**aa**
1	Constant code identifying the *Instantaneous Data*	**1**
M02	It means that 2 blocks able to represent 2 parameters follow	**Mnum_input**
1	ID of the *first* parameter	**id**
T	Specifies that the following field is the *kind* of parameter	**constant**
0	Analog parameter	**value**
A	Indicates that the following field is the *instantaneous datum* of the parameter	**constant**
13.5	*Instantaneous datum* of the parameter with id=1	**value**
S	Specifies that the following field is the *status* of the parameter	**constant**
0	Indicates that the instantaneous datum *has been acquired correctly*	**value**
2	ID of the second parameter	**Id**
T	Specifies that the following field is the *type* of parameter	**constant**
0	Analog parameter	**value**
A	Specifies that the following field is the *instantaneous datum of the parameter*	**constant**
*****	*Lacking datum* (it hasn't been possible to acquire the datum)	**value**
S	Specifies that the following is the *status* of the parameter	**constant**
1	Indicates that the instantaneous datum hasn't been acquired correctly caused by an electric fault	**value**
#23	*Terminator*	**terminator**

Note

The used format is the one where the datum is filed in a proper way, without any marking.

4.8 Record trace of the alarm data

The instantaneous data are available on **file n°1** of the internal memory of the instrument.

4.8.1 Head

The *Head of the record trace* contains the general information which allow the identification of the record on the basis of the time occurrence and on the station belonging

In detail its size is as follows:

STid_station , 6 , hh.nn.ss , gg , mm , aa , 2 , Mnum_input ,

i the meaning of the different fields is summarized in the following table:

STid_station	**Header** which identifies the beginning of the head of the record. It is composed by the characters "ST" and a number indicating the code (ID) of the station. For example the *Header* **ST01** identifies the record of the Station **1**.
6	Constant code which identifies the record trace with a *dynamic structure*.
hh.nn.ss	Hours, minutes and seconds of the event in the size: **hh.mm.ss**
gg	Day of the event of storing of the record in the size: **gg**
mm	Month of the event of storing of the record in the size: **mm**
aa	Year of the event of the storing of the record in the size: **yy**
2	Constant code which identifies the record trace for the *instantaneous data*
Mnum_input	Header which identifies the end of the **Head** of the record. It is composed by the character "M" and a number indicating the whole number of parameters (analog and/or digital input ON/OFF) contained in the **Body** of the record trace. For example M9 indicates a total of 9 parameters while M50 indicates a total of 50 parameters

4.8.2 Body

The Body of the record trace contains the Instantaneous Data regarding each parameter of measure. It is therefore formed by the repetition of a block of information repeated as many times as the number of the parameters to be represented.

In particular, the format of the body presents as follows:

BODY RECORD = block_1 + "," + block_2 + "," + block_3 +......

Each block is composed by several sections which form the register of the represented parameter. The block has a *dynamic structure*, therefore there can be several sections suited to represent it

In the specific case of the parameter in state of alarm, 4 sections are sufficient.

In particular each block is structured as follows:

BLOCK_1 = id + "," + section _1 + "," + section _2 + "," + section_3 + "," + section_4

where in detail the two fields take the following meaning:

id	Code number identifying in a univocal way the parameter (the analog or digital input on/off) the following sections refer to.
Section_1	Alphanumeric code composed by two different fields containing only an information regarding the parameter of measure.
Section_2	Alphanumeric code composed by two different fields containing only an information regarding the parameter of measure.
Section_3	Alphanumeric code composed by two different fields containing only an information regarding the parameter of measure.
Section_4	Alphanumeric code composed by two different fields containing only an information regarding the parameter of measure.

Each section is, on its turn, disassembled by two fields which compete to give an only information regarding the parameter in a state of alarm .

In detail each section is structured as follows:

SECTION_N = constant + "," + value

where in detail the two fields take the following meaning:

constant	Character ASCII (from ASCII 65 to ASCII 90) which expresses the meaning of the field "following" value.
value	Numeric value representing a characteristic of the parameter to be examined. This feature can be *the value of measure of the parameter, a particular code, a particular state, and so on…*

The following table supplies a description of the values the **"constant"** field and the following field (**value**) in the particular application of the *Data in state of alarm* :

constant	**Meaning taken by the next field (value)**
T	TYPE (analog or digital) of the parameter, identified by the field **id**
W	TYPE of alarm of the parameter, identified by the field **id.**
A	INSTANTANEOUS VALUE of the parameter, identified by the field **id**.
V	ALARM THRESHOLD of the parameter, identified by the field **id**.

From the table you can notice that the field “**value**” takes different meanings depending on the previous field.

The following tables supply a description of the values which the field “**value**” can take for every kind of “**constant**”.

constant	value	
T	**0**	To identify an analog parameter
	1	To identify a digital parameter On/off

constant	value	
W	**4**	Out of scale
	3	Acquisition error
	2	Maximum alarm
	1	Pre-alarm of maximum and threshold of warning
	0	Alarm end
	-1	Pre-alarm of minimum or warning threshold
	-2	Minimum alarm

constant	value
A	Any numeric value *(Instantaneous datum in alarm* of the above mentioned parameter. If the value is wrongly acquired, from the electric point of view, it is replaced by the character “*”.

constant	value
V	The value of the alarm or pre-alarm threshold of the parameter identified by ID which has been overcome by the instantaneous value.

Then a **block** able to represent an *Alarm* of a measure parameter could be structured as follows:

id + “,” + T + “,” + valore_1 +“,” + W + “,” + valore_2 +”,” + A + “,” + valore_3 +”,” + V + “,” + valore_4

Sezione_1 **Sezione_2** **Sezione_3** **Sezione_4**

The four represented sections aren't positional, so it isn't necessary they respect a precise order. but it's good to represent them with the above mentioned succession.

4.8.3 Terminator

The terminator is a field which indicates the end of the record trace. It is formed by the character "**#**" (ASCII 35) + a number indicating the whole fields of the record between the beginning header **"ST"** and terminator "**#**" included.

For example **#50** indicates that the record is formed by 50 fields with "header" "**ST**" and terminator "**#**" included.

4.8.4 Example of record trace of the alarm

The monitoring station n.2 on February 4th 1996 at two o' clock p.m. has stored a record trace of Data in state of alarm similar to the following one:

ST02 , 6 , 13.45 , 04 , 02 , 96 , 2 , M01 , 10 , T , 0 , W , 2 , A , 13.5 , V , 10 , #18

where:

ST02	Station n°2	**STid_station**
6	Constant code of the record trace with a *dynamic structure*	**6**
13.45	*Hour and minute* of the event	**hh.nn**
04	*Day* of the event	**gg**
02	*Month* of the event	**mm**
96	Year *of the event*	**aa**
2	Identification constant code of the *Statistical Data*	**2**
M01	It means that 1blocks able to represent 1 parameter follows	**Mnum_input**
10	ID of the alarm parameter	**id**
T	It specifies that the next field is the *kind* of parameter	**costante**
0	*Analog* Parameter	**valore**
W	Indicates that the next field is the *alarm threshold* of the parameter	**costante**
2	*Maximum Alarm*	**valore**
A	Specifies that the next field is the instantaneous datum of the alarm parameter	**costante**
13.5	*Instantaneous datum* of the alarm parameter	**valore**
V	Specifies that the next field is the alarm threshold of the parameter	**costante**
10	Alarm threshold of the parameter	**valore**
#18	*Terminator*	**terminatore**

Note:

The used format is the one the datum is filed in a proper way, without any note.

5 Characteristics and regulations

5.1 Technical specifications

Model	LAQ
Microprocessor	• 16 bit Microprocessor with internal registri at (?) 320 bit in technology HCMOS and components SMD • Clock 14.7 MHz with a possible internal divider to reduce the consumptions during the working in stand-by • Sistema operativo in lingua italiana residente su flash-eprom; • Operative system in Italian on flash-eprom; • 132KB RAM used by the operative system and by the user's programme • 128KB flash-eprom used by the operative system • LCD Display 16x 40
Output	n. 6 chemical and physical parameters (see table below)
Communication	A serial door RS485 o RS232 usable either by the user's programme or by the operative system.
Programmes Memory	128KB flash-eprom type
Data Memory	384KB SRAM type
Clock	Hours, minutes, seconds, day, month, year and automatic recognition of leap years. The clock manages the timings of the system of acquisition
Main performance	Storing of: date and hour, instantaneous, average, minimum, maximum data, status of the data storing, general status. Configuration of: measures, correction formulas, engineering units, frequency of recording, thresholds and type of alarms. Diagnosis tests Teleprogramming from local and from remote by means of a commuted/dedicated telephone line , GSM mobile phone, radio. The software of teleprogramming of the Instrument is in the operative system: this allows the operator to re-program the instrument even in case of loss of the user's programme.
Electric characteristics	Power supply: 220 VAC Consumption: 55 mA (stand-by); 120mA (during the acquisition)
Working temperature	-5 ÷ 60 °C
Dimensions	1150 x 600 x 300 mm
Configuration software	OLIMPO SW compatible with Win 95 / 98 / NT / 2000 / XP

Output: n. 6 chemical and physical parameters

	Range	Precision	Resolution
• Temperature	-5 +60 °C	±0,2 °C	0,1 °C
• Conductivity	0÷3000 µS/cm	±30 µS/cm	2 µS/cm
	0÷30000 µS/cm	±300 µS/cm	20 µS/cm
• Dissolved oxygen	0÷20 mg/l	±0.5 mg/l	0,1 mg/l
• pH	2÷12 units	±0,1 units	0,05 units
• Redox	-1÷1 V	±25 mV	5 mV

5.2 Safety rules

This manual has all the technical documentation showing that this product has all the essential safety requirements expected the applicable directives.

The detailed examination of the project and of the modes of implementation has allowed to establish the risks of the product during all its life, if correctly used, and therefore to define its essential applicable requirements. They can be in one or more directions and they can be satisfied without thinking of the direction they belong to. To apply a direction to a product two conditions are necessary:

- that the product enters its application field
- that the product presents some risks the essential requirements of the directive refer to

From the analysis of the risks, described in the following pages, the European directives applicable to the product have turned out to be the following:

Main rule	Rules with additions or variations	Title	Reference of the law in Italy
73/23/CEE	93/68/CEE	Low voltage Rule	L. 791/77; D.Lgs 626/96; D.Lgs. 277/97;
89/336/CEE	93/68/CEE 92/31/CEE	Rule of the Electromagnetic Compatibility (EMC)	D.Lgs. 615/96

This product enters the field of application of the Low voltage Rule 73/23/CEE understood in Italy with law 791/77, because some of its components are part of the definition of the article 1:

"The provisions of this law apply to the electrical material to be used to a nominal voltage included between 50 and 1.000 Volts in alternate current and between 75 and 1.500 Volts in direct current, with the following exceptions:

a) electric materials to be used in environments exposed to dangers of explosion;

b) electric materials for radiology and clinical use;

c) electric parts of lifts and elevators (hoists);

d) electric counters;

e) sockets and plugs of current for a domestic use;

f) devices of power supply of the electric networks;

g) materials regarding the radioelectric noises

h) special electric materials, to be used on the ships and on the aircrafts and for the railways, in conformity with the provisions of security established by international boards, the States members of the European Community participate;

i) electric material to be exported out of the European Community"

This product falls within the application field of the Directive about the Electromagnetic Compatibility (EMC) 89/336/CEE agreed in Italy with Law decree 615/96, because some of its components fall within the definition of the article 2.:

“1.This decree is applied to the instruments which can create electromagnetic emissions or whose working can be altered by electromagnetic noises present in the environment. It fixes the requirements of protection as regards electromagnetic compatibility as well as the the modes of control.

2. The instruments manufactured for a military use don’t fall within the application field of this decree, unless they are available in commerce.

3.The radio equipments used by the radio-amateurs don’t fall within the application field of this decree, unless they are available in commerce.

4.The provisions described in the paragraph don’t apply or cease to be applied to those equipm3entswhose requirements about protection as regards electromagnetic compatibility are established by rules of accordance of specific directions of the European Community.

5.The provisions of the law 22May 1980, n. 209 are not applied to the instruments mentioned in paragraph 1”.

It doesn’t fall within the field of application of the Directive Machines 89/392/CEE and successive modifications agreed in Italy with DPR 459/96, as it is described in paragraph 2 of the article 1:

“…Omissis

2. To reach the purposes of these rules “machine” means a set of pieces or organs, of which one at least is mobile, connected among them, even through actuators, with circuits of command and of power or other systems of connection, connected firmly for a well determined application, mainly for the transformation, the treating, the moving or the packing of materials.

…Omissis”

5.3 EMC

This equipment has been designed) in accordance with the requirements of EEC 89/336/using the well agreed rule CEI EN 61326-1 and the compatibility has been tested relatively to:

EN 50081-1

EN 50082-2

5.4 Environmental conditions of use

The equipment has been designed to be used according the specifications shown in the following table:

Expected use and limits of the equipment	**Data / Available information**
Use..	The expected use only includes the meausres of physical and chemical parameters for hydrometry and telecontrol and automation of water systems, sewerage (systems)
Expected wrong uses and contraindications	Its use both in a hobby and in a domestic environment is wrong, as well as a use by unskilled and/or not trained people.
Environment of use	It cannot be used in environments with gas or explosive, corrosive and inflammable vapours.
Environmental critical factors	The environmental conditions for a correct use are: Temperature of use: -5 +60 Storage temperature: -30 +70
Professional standing or experience required to the operators	The personnel must be skilled or duly trained about the risks he can run.
Determination of the expected “working life” of the equipment taking into account the use	The peripheral stations and the components used are built with resistant and rugged materials. All the components can be replaced and/or repaired, a limit time of use isn’t foreseen. Specific interventions of maintenance, and if necessary, of replacement following a fixed frequency are foreseen for all the components, with reference to the deterioration or breaking of some of their parts.
Space limits	The peripheral stations haven’t any part in movement, therefore the possible fence of the area isn’t necessary for the security of people. The Customer can ask for it to prevent possible tamperings. The manufacturer directly provides for the installation of the stations. The Customer must supply, at the installation location, the electric energy and an area which can be in accordance with the required exigencies.

5.5 Declaration of compliance of EEC

Declaration of compliance

Siap + Micros Srl Via del Lavoro, 1 – 31010 Castello Roganzuolo di S. Fior (TV) – Italia

declares that the represented equipment is compliant according the following directives (all applicable modifications included) :

73/23/CEE Directive Low Voltage
89/336/CEE Directive Electromagnetic compatibility

and that all the regulations and/or specifications mentioned below have been enforced.

CEI-EN 61010-1	Prescriptions of safety for electric equipments of measure, control and for a use in the laboratory
CEI-EN 611131-2	Control of programmable) Part 2:specifications and tests of the equipments.
CEI-EN 41003	Particular requirements of safety for equipments to be connected to the telecommunication networks
CEI 64-8/1÷7	Electric systems with a rated voltage of no more than 1000V alternate current and 1500V direct current
CEI 17-13/1	Assembled equipments of protection and control for low voltage (L.T.boards) – Part1: Equipment of series subject to tests of type (AS) and non series equipments partially subject to tests of type (ANS).

6 Allegato "A"

6.1 Use of the electrodes PHOENIX

Introduction

The matched electrodes for pH and redox are designed to obtain the greatest reliability, accuracy and use's ease. The reference half-cell is normally sealed but it can be supplied as rechargeable. In this case the filling is made through the small hole closed by rubber ring below the high terminal of the electrode. Each electrode is supplied with a protection reservoir filled with a solution which holds wetted the junction buffer.

Setup

Remove the plastic protection reservoir, rinse the electrode terminal using tap water and

Warning : remove the black film

which is located between the middle wire and the screen of the coaxial cable (if the film is not removed the working of the electrode may be endangered when connected to the equipment terminals).

Some air bubbles may be entered, during transportation, inside the pH sensitive bulb, in that case it is necessary to shake the electrode like a clinical thermometer.

After a storage long period, before put in operation, dip the electrode for 30 minutes in water in order to hydrate the bulb and obtain an operative contact of the junction liquid with the solution to be measured.

Sometimes , due to a long storage, the electrode can present on the pH bulb a film which can removed according the cleaning instructions. With regard to the electrodes having the rechargeable reference, it is necessary remove the rubber cap during the working and close the hole when the electrode is not in operation.

Requested materials

- buffer solutions: two buffer solutions are requested to obtain a precise standardization. One of them has to have a value close to that of the liked field.
- pH meter: the electrodes operate with all the instrument available on the market

Electrodes standardization

- connect the electrode in the buffer solution at pH=7 and shake until the measure becomes stable (30s)
- adjust the pH meter "zero" to obtain pH=7
- rinse in distilled water the electrode and dip it in the buffer solution at pH=4 (in case the sample to be measured is alkaline utilize the buffer solution at pH=9,2 or pH=10). Shake for a short while until the reading is stabilized (30s).
- adjust the "sensitivity" of the pH meter and the manual temperature compensation (if automatic dip the electrode and the temperature sensor) to obtain a correct reading. In case of unsuccessful operation, follow the electrode cleaning procedure.
- rinse in distilled water the electrode and dip it in the solution to be measured, shaking.
- to obtain accurate calibration it's advisable that the buffer solutions can reach the same temperature of the sample to be measured, or take into account the value of the buffer solution at the measuring temperature.

Storage of the electrode

In order to maintain the speed response, the electrode has to be saved wet (moist). The perfect storage solution is the buffer solution pH-4 with an addition of 1/100 KCl saturated, provided that it is without colorants. For short storage it's sufficient the tap water (no distilled water) into the protection reservoir placed on the spherical terminal of the electrode.

Cleaning

The electrodes mechanically whole can be restored to a correct working by the following procedures:

a) Deposits and organic fouling

Dissolve the deposits plunging the electrode into a solution 0,1M HCl , 0,1M NaOH, and once more into 0,1M HCl. Every dipping will last 5 minutes.

b) Organic oils film or greases

Wash the end of the electrode into a detergent liquid and water. If the solvent of the film is known, wash with the same. Unsuccessful procedure for the electrode regeneration means that the reference liquid is obstructed or the porous buffer is clogged. Then clean the porous buffer by a KCl diluted solution at 60-80 °C temperature , for 10 minutes approx. Before try again the working, Let to cool the electrode while is dipped into the solution.

Filling solution

a) The Calomel electrode requires a KCl4M filling;

b) The Ag/AgCl requires a KCl4M saturated with AgCl.

c) maintain the filling at the refilling hole level.

For a dual junction electrode contact the manufacturer regarding the filling type and the saline bridge.

The sealed electrodes does not require any filling.

6.2 Use of the REDOX electrodes

Contrary to the pH measures, the oxido-reduction potentials cannot be standardized by buffer solutions.

Like the pH electrodes, the redox ones are subject to abrasion, to surface film constituted by the liquid under examination the chemical content of which can poison the electrode, if the system in which is dipped is not more under control.

To improve the redox measures reliability it is suggested the following method to test the electrodes into solution having standard potential, giving an information whether the electrode works correctly or requires a maintenance.

Operation control

- connect the electrode to a calibrated redox-meter (mvoltmeter);
- prepare in a bowl on magnetic agitator a solution consisting of a pH=7 buffer saturated with Chinidrone (look at the presence of Chinidrone not dissolved crystals);
- dip the electrode while the agitator is working and measure the potentials which , within a ±10mV, have to comply with the following values:

temperature	°C	20	25	30
potential	mV	+92	+86	+79

- remove the electrode and rinse quite well in water ;
- prepare a second solution with pH-4 buffer saturated with Chinidrone and dip the electrode while the agitator is working;

- control that the potentials have the following values depending on the temperature:

temperature ℃	20	25	30
potential mV	+268	+263	+258

The difference (mV) between the two solution is 177, theoretically. The absolute values can shift up and down of some mV due to the reference potential variation with regard to theoretic value.

Having correct potentials, rinse quite well in distilled water and the electrode is ready to be used.

If the potential difference is more than 10 mV from 177mV, wash the electrode in turpentine (3 volumes of hydrochloric acid + 1 volume of nitric acid, both concentrated);

Warning: this solution is very corrosive

Repeat the mentioned tests, and having satisfactory results, install the electrode .

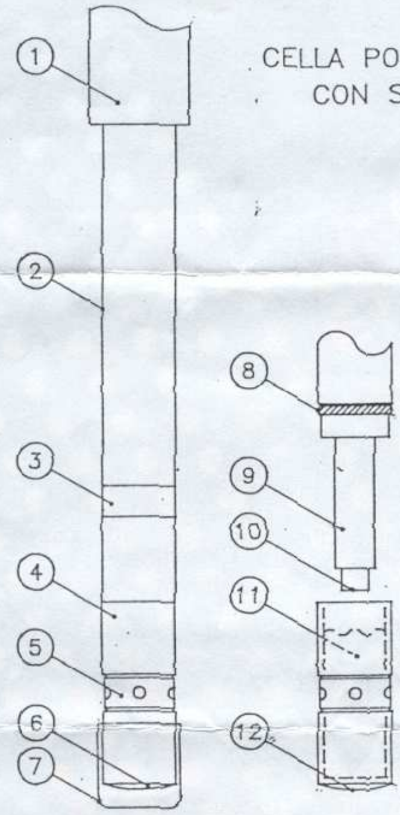
Note: the Chinidrone solution is unstable . Trow out after the use

As alternative, to have more quick controls, it's possible to utilize buffer solutions with known values of oxidoreduction potentials (catalogue B&C Electronics)

- SZ961 +220mV solution
- SZ962 +420 mV solution

7 Allegato "B"

CELLA POLAROGRAFICA PER MISURA O_2
CON SENSORE DI TEMPERATURA



CARATTERISTICHE

Sensore O_2:
- Cella polarografica
- Corrente aria 250 nA

Sensore temperatura:
- RTD Pt100

CONDIZIONI DI IMPIEGO

- Pressione 0÷2 bar
- Temperatura 0÷50 °C

ISTRUZIONI

A) Avviamento
- Togliere il cappuccio di protezione
- Se sono visibili bolle d'aria eliminarle seguendo le procedure del punto C)
- Tenere a bagno 1 giorno in acqua di rubinetto prima di tarare la cella

B) Manutenzione
- Pulire la membrana con HCl 2% se e' incrostata
- Se sono visibili bolle d'aria eliminarle seguendo le procedure del punto C)

C) Ripristino del liquido di riempimento
- Togliere il serbatoio svitandolo
- Colmarlo di liquido di riempimento
- Eliminare le eventuali bolle d'aria
- Riavvitare il serbatoio lasciando defluire l'eccesso di liquido di riempimento

D) Conservazione
- Rimettere il cappuccio di protezione
- Conservare in luogo asciutto

Descrizione delle parti

1. Cap
2. Corpo elettrodo
3. Sensore temperatura
4. Estremita' del serbatoio
5. Tubo silicone
6. Membrana di misura
7. Cappuccio protettivo
8. Guarnizione OR interna
9. Anodo Ag
10. Catodo Pt
11. Liquido riempimento
12. Cartuccia membrana
13. Guarnizione OR cartuccia membrana
14. Attrezzo estrazione cartuccia membrana

Accessori forniti

a. Liquido di riempimento
b. Membrana cartuccia
c. Attrezzo per sostituzione cartuccia
d. Tubo silicone
e. OR interno
f. OR cartuccia membrana
g. Siringa

COLLEGAMENTI

- Cavo coax interno Pt (K)
- Cavo coax schermo Ag (A)
- Rosso RTD 100ohm Pt
- Bianco/verde RTD 100ohm Pt

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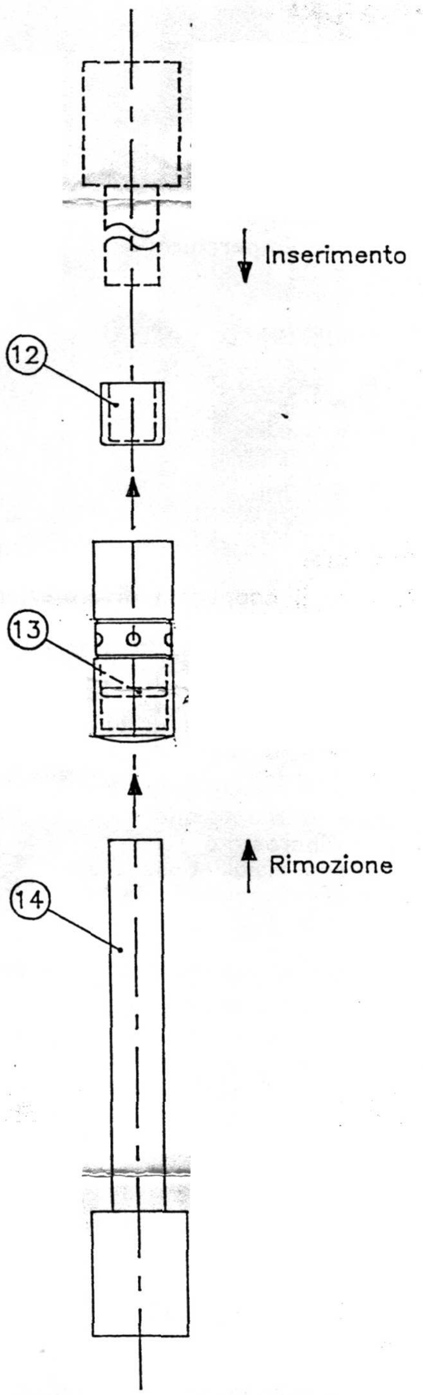


13. Cartuccia con membrana
14. OR cartuccia membrana
15. Attrezzo per sostituzione cartuccia

SOSTITUZIONE MEMBRANA

- La sostituzione della membrana si rende necessaria:
  - in caso di rottura della stessa
  - in caso di sensibilita' insufficiente

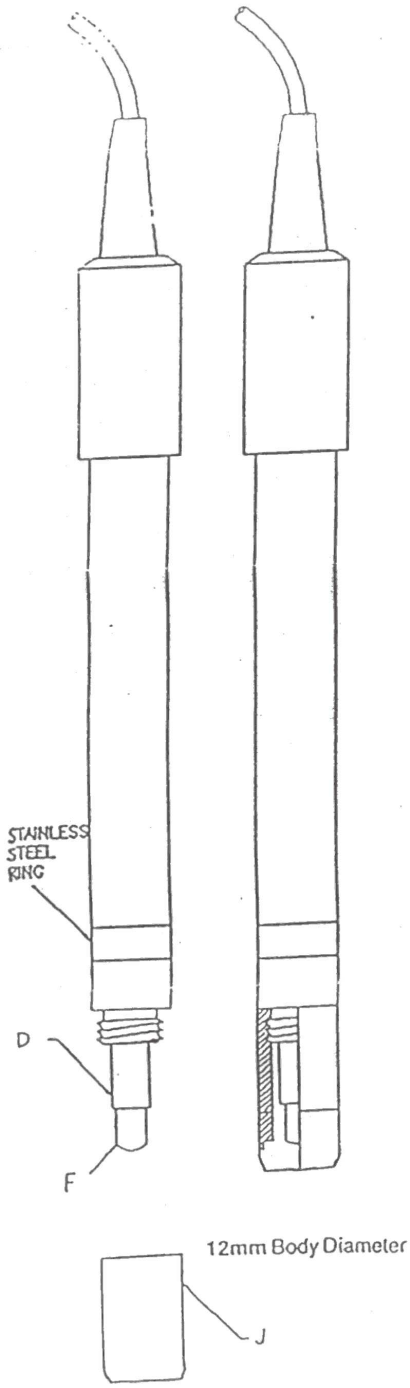
OPERAZIONI

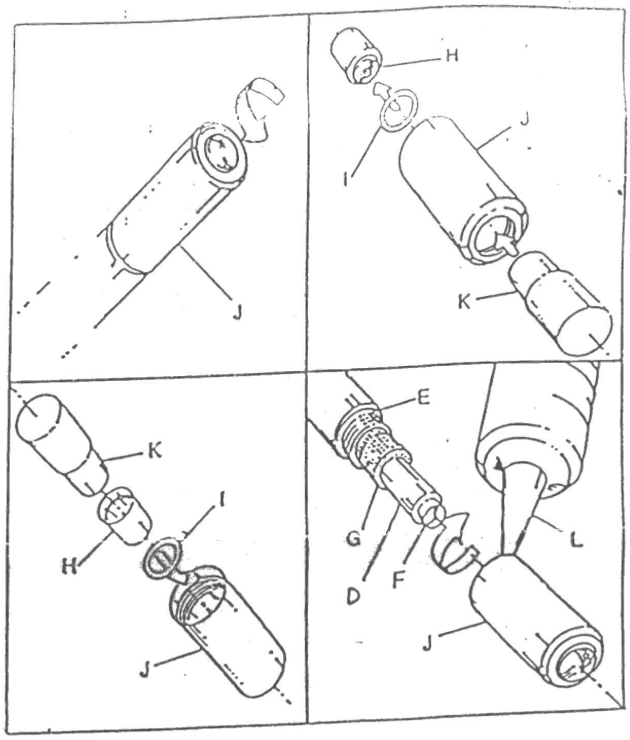
- Svitare il serbatoio
- Svuotare il liquido di riempimento
- Appoggiare l'estremita' dell'attrezzo 14 contro la parte estrema della cartuccia della membrana
- Spingere delicatamente fino a disimpegnare la cartuccia 12 dall'OR interno 13
- Controllare lo stato dell'OR e se necessario sostituirlo
- Posizionare la nuova cartuccia
- Posizionare l'attrezzo e spingere la nuova cartuccia nella sua posizione, in modo che la membrana, sporga dall'estremita' del serbatoio
- Procedere secondo le istruzioni di ripristino del liquido di riempimento

AVVERTENZE

- Durante la misura evitare di immergere il cavo e danneggiare la membrana
- Evitare ai connettori il contatto con i liquidi
- Durante le manutenzioni non toccare gli elettrodi interni

MEMBRANE REPLACEMENT DIAGRAM





D Ag/AgCl Anode
E O-ring, 5-1007 (M00851007)
F Platinum Cathode
G Expansion Foam
H Replaceable teflon/silicone and Stainless steel mesh membrane (M0500P2-M6)
I O-ring, 5-209 (M0085209)
J Membrane Cover
K Membrane Tool
L Syringe

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