SODIMAT

Model 9073

Instruction manual

03/2001

621=190=073
Rev. D

This instrument conforms to the European Directives:

- 89/336/CEE modified by the directive 93/68/CEE
- 73/23/CEE modified by the directive 93/68/CEE

CE

Polymetron S.A.

Polymetron S.A. can take no responsability for installation and/or use of its equipment if this is not done in accordance with the appropriate issue and/or amendment of the relevant manual.

The user of this manual should ensure that it is appropriate in all details to the exact equipment to be installed and/or operated. If in doubt, the user should contact Polymetron S.A. for advice.

WARNING

To maintain safety standards, regular maintenance, calibration and operation of this equipment by qualified personnel is essential. Read and understand Instruction manual completely before operating or servicing. If any further details are required which do not appear in this manual contact Polymetron S.A. or their agent.

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Chapter 1 : Introduction

1.1 Introduction

The SODIMAT - Model 9073 permits the measurement of sodium in industrial ultrapure waters.

The measurement is based on a direct potentiometric technique using a highly sensitive sodium glass electrode. The difference of potential between the glass electrode and the reference electrode is directly proportional to the sodium concentration as shown by the Nernst law:

$$E = E_0 + \frac{R*T}{F} * Ink\ C_{Na} +$$

1.2 Applications

Modern high-pressure power plants require feedwater of very high purity. Safety in that sector is of great importance and the sodium measurement plays a specific role compared to pH, conductivity and silica trace.

Actually, sodium cations and anions are always linked. Most cations have a corrosive influence in water and vapor cooling circuits.

Because of this chemical link between sodium ions and anions, sodium measurement presents particularly important risks of corrosion and other effects.

The presence of chlorides, for example, involves corrosion under power and when it exceeds allowable concentration limits.

Main features of the SODIMAT - Model 9073

- Sample flow rate control
- A microprocessor controlled temperature compensation
- Panel or cabinet mounting possibilites
- Two versions depending on the calibration method chosen :

- AUTOCAL : automatic calibration by addition of sodium known concentration solution

- CARCAL : calibration using calibration cartridges of 20 and 200 ppb.

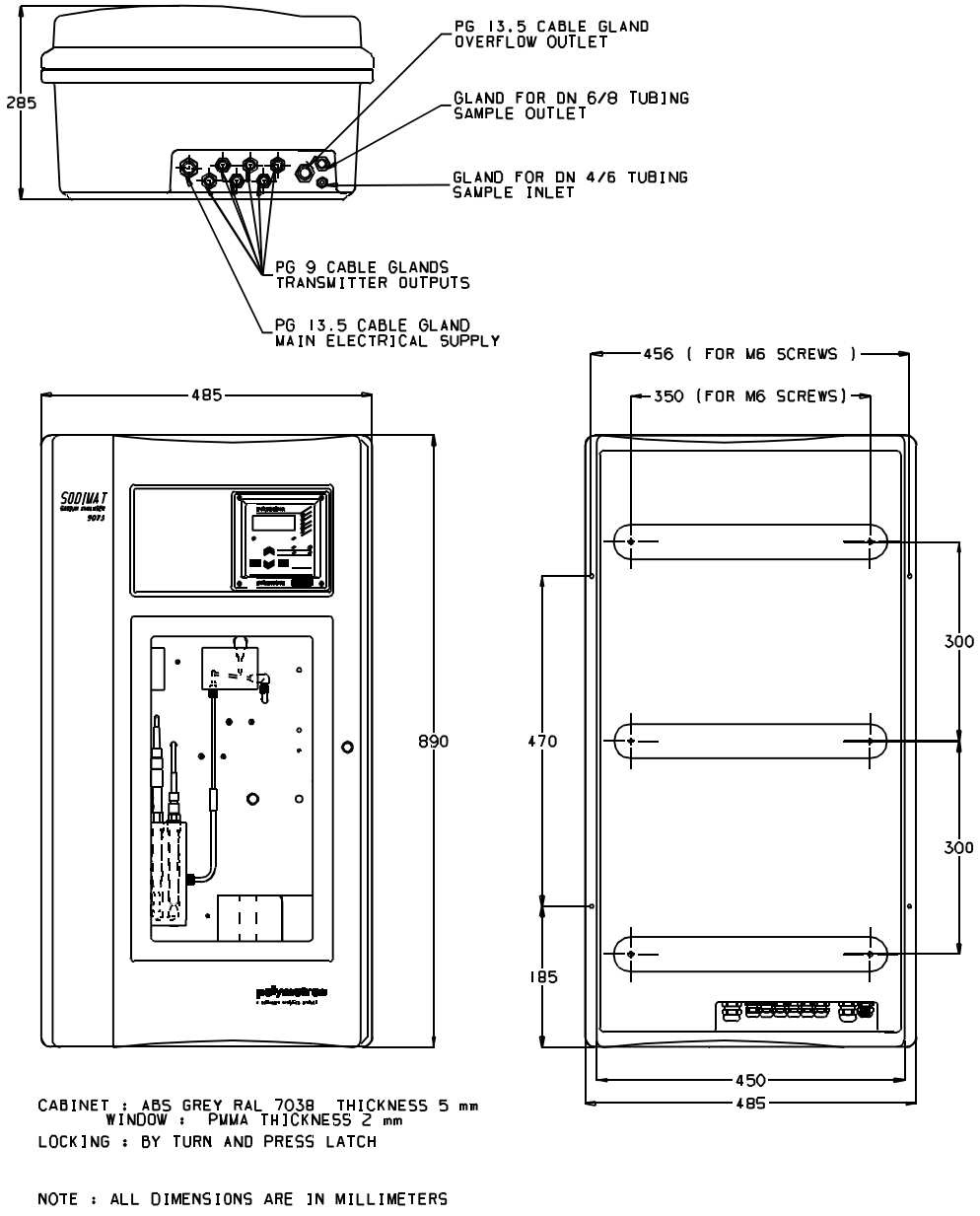
1.3 Technical characteristics

SAMPLE	
Number of channels	1
Insolubles	Free of undissolved matter : turbidity < 2 NTU
Temperature	5...45 °C (41...113 °F)
Pressure	0,5-6 bar (1-6 bar in CARCAL version)
Output	Atmospheric pressure
Flow rate	3-6 l/h
CONNECTIONS	
Mains	240 - 220 - 110 - 24 V - 15% to +10%, 50-60 Hz
Power consumption	50 VA
Terminal	- Screw terminal (1 mm^2 cable) for the input and output signals - Spring loaded terminal (1 mm^2 cable) for mains, alarm, limits and alarm quit
Sample	4/6 mm tubing
ANALYSIS	
Measuring range	0,01 ppb to 10,000 ppm programmable
Accuracy	± 5% or <±0.05 ppb whichever is greater
Reproducibility	± 3% or <±0.03 ppb whichever is greater
Response time	1 ppm to 1 ppb (90%) < 10 min 100 ppb to 10 ppb (90%) < 2 min
Ambiant temperature	5...50 °C
Conditioning reagent	Gaseous : diisopropylamine advised, ammoniac accepted Liquid : éthanolamine 30 to 50%
Diisopropylamine consumption	1 l/month approx.
Calibration solution consumption	6 calibrations per bottle (if 20 minutes by calibration point)

Calibration	- Manual by 2 known concentration solutions - Process on one point 2 versions possible : - addition 1 or 2 points (CARCAL 20 and 200 ppb cartridges) - automatic by dosing pump with a known concentration solution (1 or 2 additions)
TRANSMITTER	
Display	4 digit digital LCD , 18 mm-height, backlit Display of the measurement unit : ppb, ppm, mV, °C or l/h, LED and the instrument status : error, calibration, programming.
Output current	2 analogue outputs : 2 x 0/4... 20 mA isolated from input signal, 900 Ohms load maximum
Relays	2 isolated contacts, minimum or maximum switchable 1 isolated contact for system alarm 250 VAC max., 5A max. or 1200 VA on a resistive load
Temporisation	On the concentration limits adjustable from 0 to 9999 seconds
Interface for computer	RS 232/V24C ; 300, 600, 1200, 2400, 4800, 9600 bauds (programmable)
TRANSMITTER ENCLOSURE	
Material	ABS
Tightness	IP65, according to norm IEC 529
Dimensions	H 144 mm, W 144 mm, D 152 mm
Glands	4 x PG9 - 1 x PG13,5 Material : polyamide
Storage temperature	-20...+70 °C
Weight	1,7 kg
ENCLOSURE (OPTIONAL)	
	Standard 19" width for wall or panel mounting
Material	ABS with PMMA window
Connections	1 gland DN 6/8 for outlet 1 gland DN 4/6 for water input 1 x PG13,5 for mains 1 x PG13,5 for overflow output 6 x PG9 for different connections

Weight	10,6 kg
ELECTROMAGNETIC COMPATIBILITY	
Immunity to electromagnetic interferences	EN 50082-2 and 50082-1
Electromagnetic emission	EN 50081-1 and 50081-2
OPTIONS	
	Demineralization cartridge (mixed bed)
	Kit K (liquid conditioning for high acidity water)
	Nota : Kit K and mixed bed are incompatible together
ANALYSER WEIGHT	
Analyser without enclosure	17,2 kg

1.4 Drawing



Fixations :
- wall-mounting : 6 M6 screws
- 19" panel-mounting : 4 M6 screws

Figure 1-1 : Dimensions for the 9073 fixation

Chapter 2 : Description of the analyser

2.1 Principle of operation

The SODIMAT 9073 uses a sodium-sensitive glass electrode to measure sodium in a sample which has been previously conditionned to a pH > 10. Sample conditionning is necessary because sodium glass electrodes are not perfectly specific sensors, but are subject to interferences by other ions, especially ions H+. Low-level sodium measurements, therefore, require that the H+ of the sample water be adjusted to a level several orders of magnitude below the level of sodium. For this reason, the SODIMAT 9073

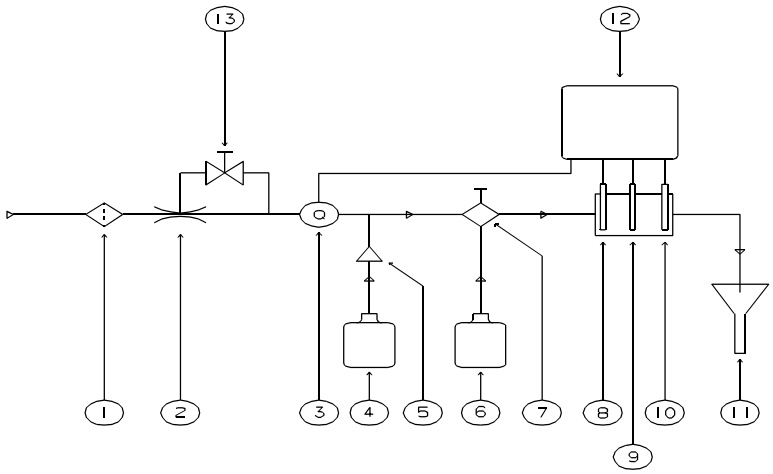


Figure 2-1 : Principle of operation of the 9073 - AUTOCAL version

1 : Filter	8 : Temperature sensor
2 : Flow rate regulator	9 : Measuring electrode
3 : Electronic flowmeter	10 : Reference electrode
4 : Calibration solution	11 : Output drain
5 : Calibration pump	12 : Transmitter MONEC 8941
6 : Conditioning reagent	13 : Adjusting valve
7 : Conditioning block	

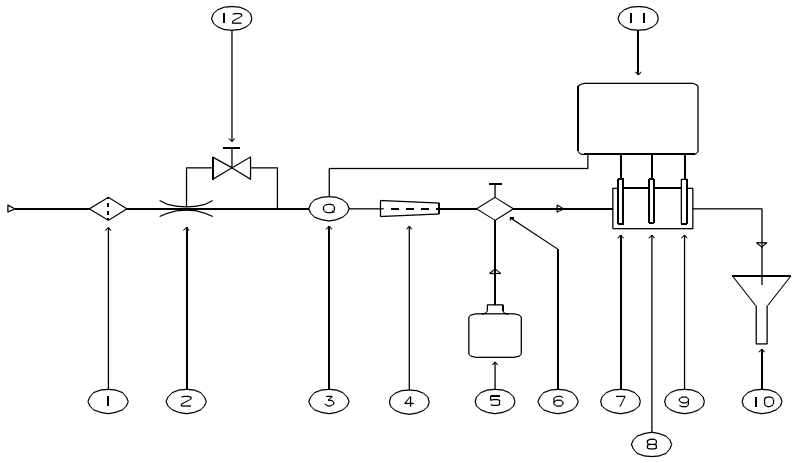


Figure 2-2 : Principle of operation of the 9073 - CARCAL version

1 : Filter	7 : Temperature sensor
2 : Flow rate regulator	8 : Measuring electrode
3 : Electronic flowmeter	9 : Reference electrode
4 : CAR4CAL calibration solution	10 : Output drain
5 : Conditioning reagent	11 : Transmitter MONEC 8941
6 : Conditioning block	12 : Adjusting valve

2.2 Analytical part - AUTOCAL version

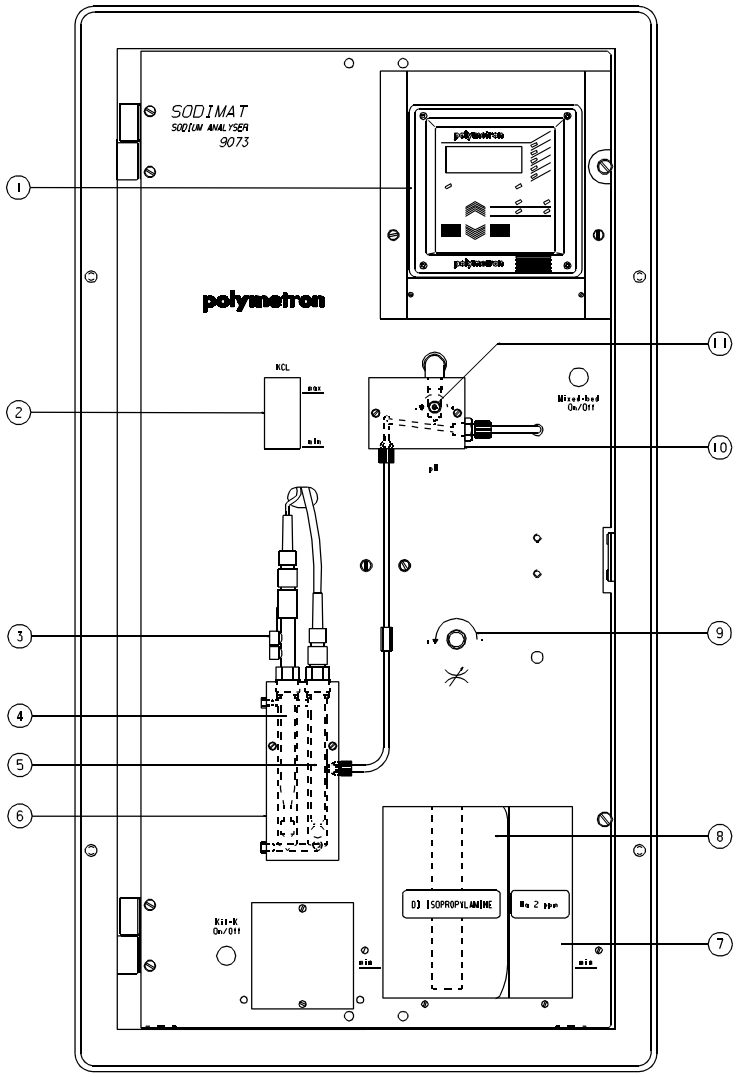


Figure 2-3 : 9073 - Front panel - AUTOCAL version

1 : Transmitter MONEC 8941	7 : Calibration solution
2 : Electrolyte container	8 : Conditioning reagent
3 : Reference filler neck	9 : Flowrate adjustment valve
4 : Reference electrode	10 : Conditioning block
5 : Measuring electrode	11 : pH adjustment screw
6 : Measuring cell	

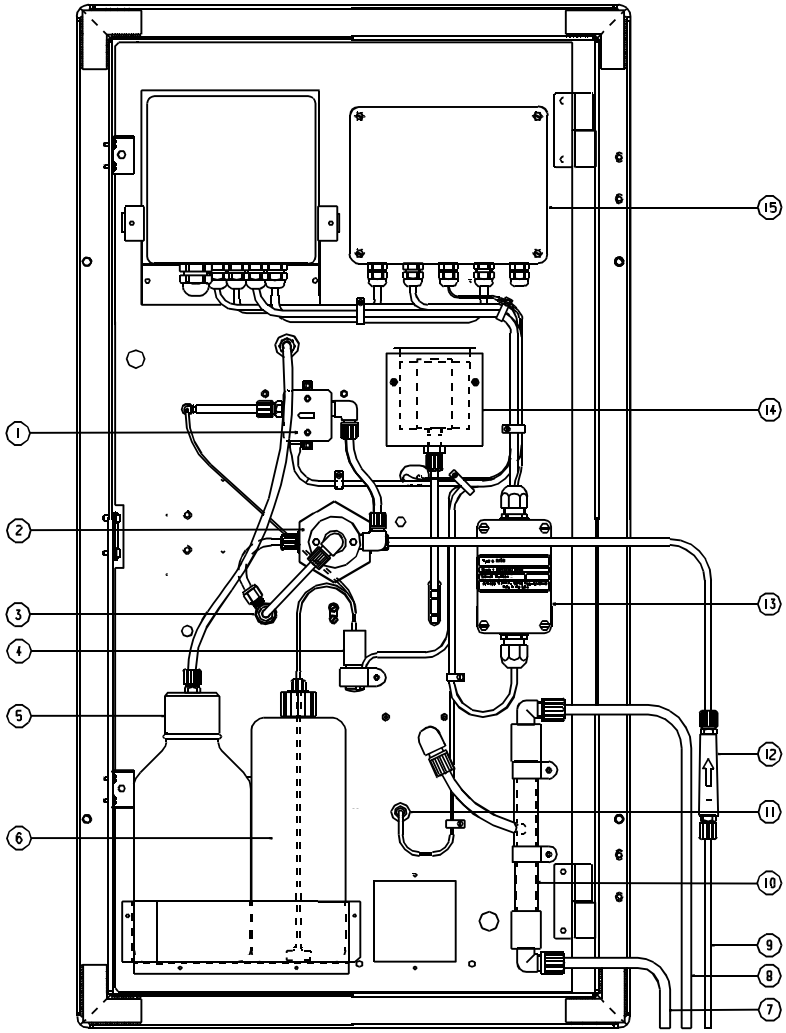


Figure 2-4 : 9073 rear view - AUTOCAL version

1 : Electronic flowmeter
2 : Flowrate regulator
3 : Flowrate adjusting valve
4 : Calibration pump
5 : Conditioning reagent
6 : Calibration solution
7 : Outgoing pipe
8 : Overflow tubing
9 : Inlet sample tubing
10 : Output collector
11 : Temperature sensor
12 : Filter
13 : Measuring preamplifier
14 : Electrolyte container
15 : Interface box

2.3 Analytical part - CARCAL version

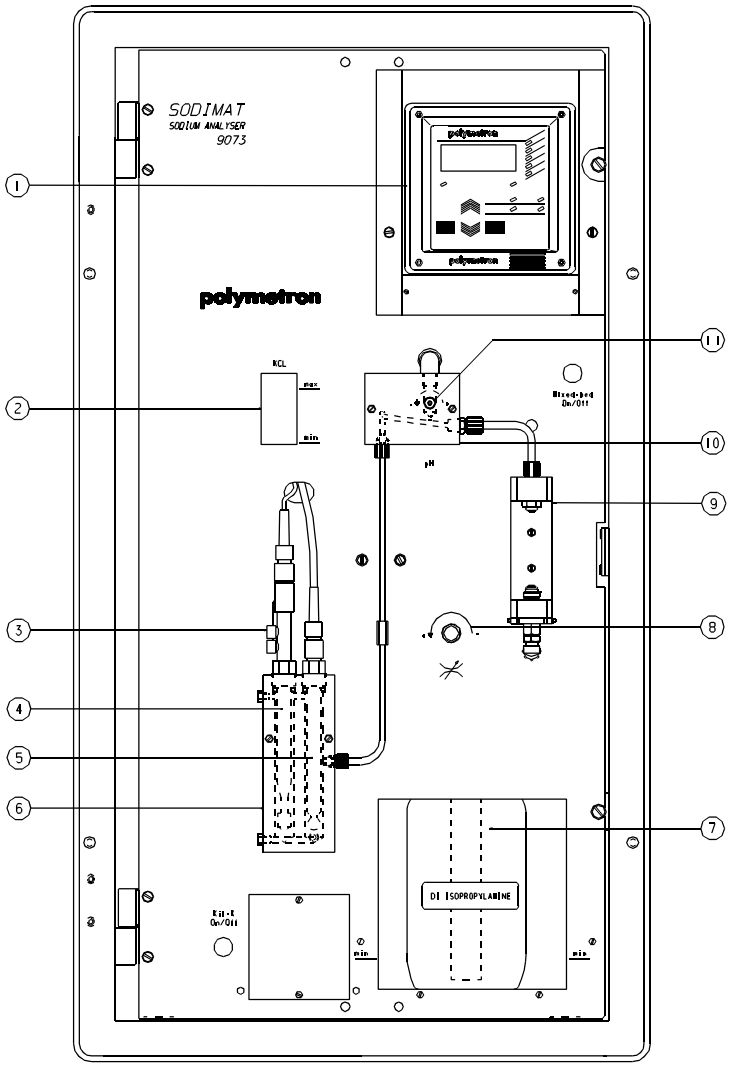


Figure 2-5 : 9073 front view - CARCAL version

1 : Transmitter MONEC 8941	7 : Conditioning reagent
2 : Electrolyte container	8 : Flowrate adjustment valve
3 : Reference filler necks	9 : Calibration cartridge holder (CARCAL)
4 : Reference electrode	10 : Conditioning block
5 : Measuring electrode	11 : pH adjustment screw
6 : Measuring cell	

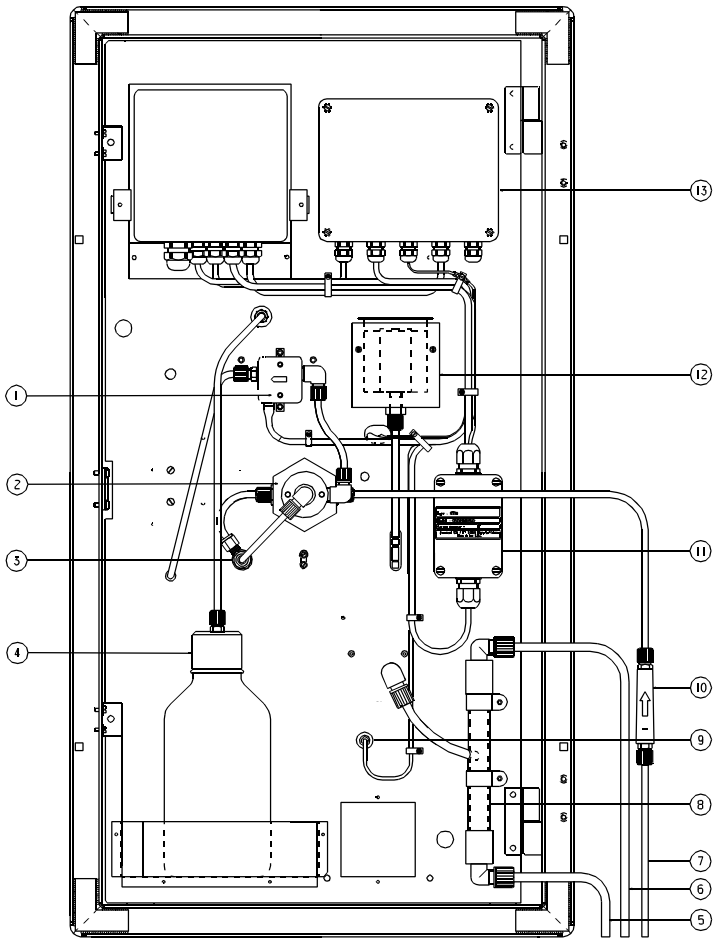


Figure 2-6 : 9073 rear view - CARCAL version

1 : Electronic flowmeter	8 : Output collector
2 : Flowrate regulator	9 : Temperature sensor
3 : Flowrate adjusting valve	10 : Filter
4 : Conditioning reagent	11 : Measuring preamplifier
5 : Outgoing pipe	12 : Electrolyte container
6 : Overflow drain	13 : Interface box
7 : Inlet sample tubing	

2.4 Electronics

To reach the interior of the instrument (for electrical wirings, EPROM removal, power supply control), remove the 4 front panel screws, fixed to the microprocessor's board.

The electronics of the SODIMAT hold 3 printed circuits, 2 of them are located behind the front panel :

■ The display board with a liquid crystal display, status LEDs, control keys and the microprocessor.

■ The analogue board including the measurement module (sensors input) and the analogue/numeric conversion unit.

■ The third one is located behind the protective cover in the main enclosure. It includes the power module, the outputs, the relays and the RS232 interface. In addition it includes the terminal board connections from 1 to 29.

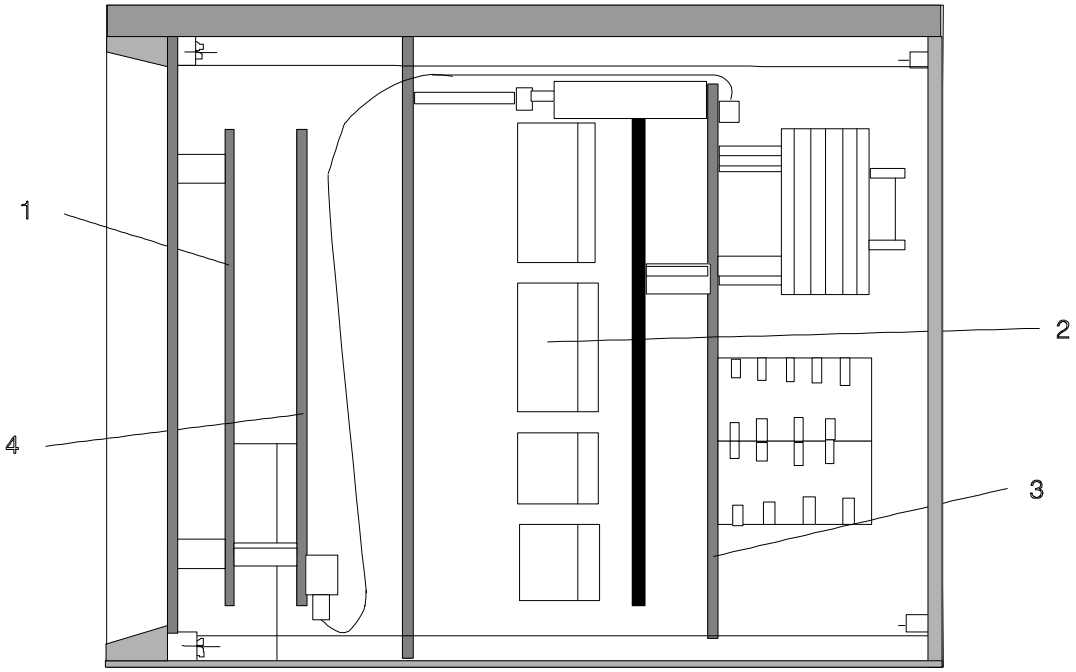


Figure 2-7 : Circuit location in the MONEC 8941

1 : Display board
2 : Terminals
3 : Power supply board
4 : Measuring board

Chapter 3 : Installation

3.1 Unpacking

The analyser is shipped with all its sub-units factory-adjusted and programmed with default values. Accessories and options worth the analyser are factory-mounted within the appropriate unit.

3.2 Inspection

The SODIMAT 9073 has been inspected and tested prior to shipment. However, it is advisable to inspect all parts immediately upon receipt for any damage which may have occured during shipment. A damaged shipping container may indicate internal damage which may not be immediately obvious. If there is any evidence of damage, keep the shipping container.
Any shortage of parts or accessories should be reported to the authorized Polymetron distributor or to :

Polymetron S.A.
33, rue du Ballon
93160 Noisy-le-Grand
FRANCE

3.3 Mounting

The instrument requires the following connections :
- Sample
- Drain
- Power supply

CAUTION !

Mounting should be done by qualified service personnel only. Any damage on the instrument by a non qualified person cancels the warranty.

3.4 Location

The analyser should be placed in any convenient location, e.g., installation onto the sampling rack. The location should be easily accessible to facilitate the checking and the regular maintenance.

Before any electrical or hydraulic connection, check the environment corresponds to the instrument configuration :

- voltage
- frequency
- sample supply pressure
- sample temperature
- ambient temperature

Choose a dry site for your instrument if it is a panel-mounting type instrument. Check also the quality of the conditioning reagent : diisopropylamine for the gaseous conditioning and ethanolamine or ammonia for the liquid conditioning. These chemical products should be of “per analysis” quality.

3.5 Hydraulic connections

3.5.1 CARCAL version (see figure 2-4)

- Fill in the conditioning reagent bottle and connect it to the circuit.

- Put a filter cartridge on the CARCAL holder respecting the flow direction shown on the cartridge.

- Set the sample drain. Caution ! The outlet is gravitary, it shoud be as direct as possible (avoid tubing twist).

3.5.2 AUTOCAL version (see figure 2-2)

- Fill in the conditioning reagent bottle and connect it to the circuit.

- Set the sample drain. Caution ! The outlet is gravitary, it shoud be as direct as possible (avoid tubing twist).
- Fill in the calibration solution bottle with the adequat and fresh solution and put the strainer (see table in paragraph 6.2.2 for the concentration used).

Caution ! The calibration solution should be free of solid body which may damage the calibration pump.

Avoid any direct handling of parts in contact with the calibration solution : it may cause pollution.

3.5.3 Mixed bed option

Installing this option requires a qualified Polymetron technician.
☞ ***See Chapter 9 : Options***

3.5.4 Liquid conditioning option (kit K)
☞ ***See Chapter 9 : Options***

3.6 Electrical connections

◘ MONEC

Never attempt to switch on the instrument before all the connections have been realised.
Before connecting the instrument check the selected power supply corresponds to your power supply.
Remove the front panel and the protective cover to reach the main selection bridges.
An aluminuim plate shows the terminal function and its connection with the external elements from the monec.

Power supply (V)	Min. range allowed - 10 %	Max. range allowed + 10 %	Bridges' location	Fuses mA
24	20,4	26,4	X1, X3	T1,25 A
110	94	121,0	X2, X4, X6	T250 mA
127	115	146,0	X1, X4, X6	T250 mA
220	187	242,0	X2, X5	T125 mA
240	207	268,0	X1, X5	T125 mA

Install as many cable glands as necessary. Start with the ground connection.

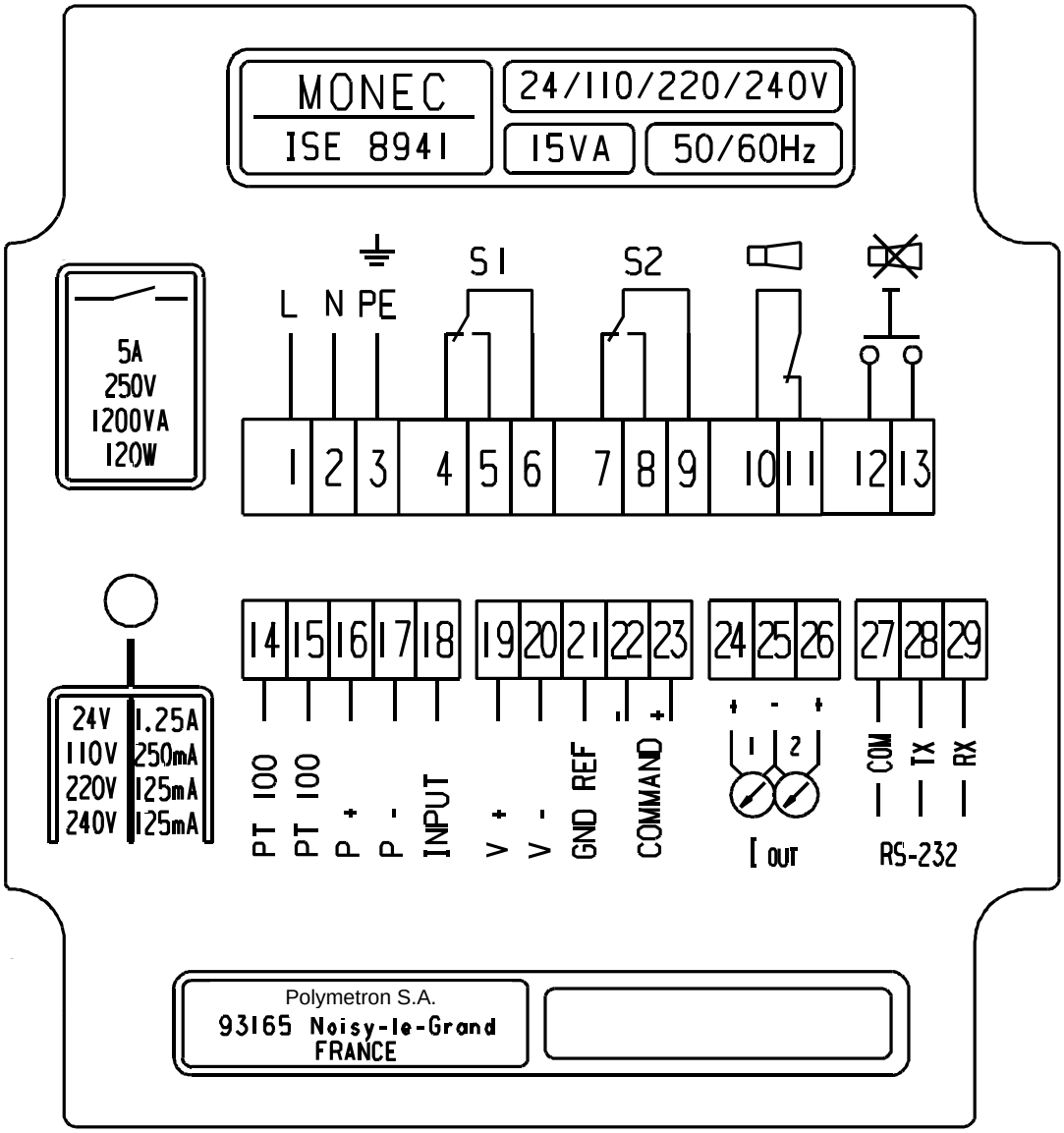


Figure 3-1 : 8941[1] terminal description plate

[1] See figure 3-2 for the legend

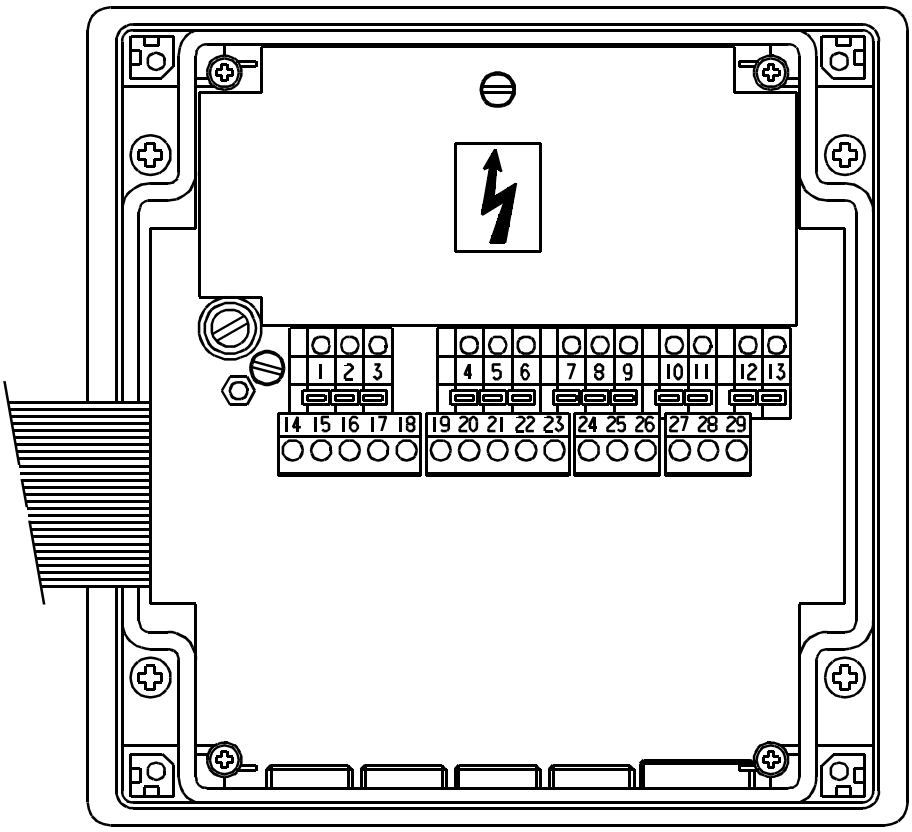


Figure 3-2 : 8941 terminals

1/2/3 : Mains (linked to B2 of interface box, see figure 3-3)	18 : Measure
4/5/6 : Setpoint 1	19 : +12V preamplifier and flowmeter supply
7/8/9 : Setpoint 2	20 : -12V preamplifier and flowmeter supply
10/11 : System alarm	21 : Reference
12/13 : Alarm remote acquit (single pole contact) and remote automatic calibration (close contact during 3 seconds)	22/23 : Interface link
14/15 : Temperature sensor Pt100	24/25/26 : Analogue outputs
16/17 : Flowrate measurement	27/28/29 : RS232 link

RS232 connection

PLUG 9 CONTACTS	**MONEC C**
Terminal 5 GND	COM (27)
Terminal 2 RXD	TXD (28)
Terminal 3 TXD	RXD (29)
PLUG 25 CONTACTS	**MONEC C**
Terminal 7 GND	COM (27)
Terminal 2 RXD	TXD (28)
Terminal 3 TXD	RXD (29)

◘ Interface box

Power supply (V)	**Min. range allowed - 10 %**	**Max. range allowed + 10 %**	**Bridges' location**	**Fuses mA**
24	20,4	26,4	X1, X3	T2A
110	94,0	121,0	X2, X4, X6	T500 mA
134	120,6	147,4	X1, X4, X6	T315 mA
220	187,0	242,0	X2, X5	T200 mA
244	207,0	268,0	X1, X5	T200 mA

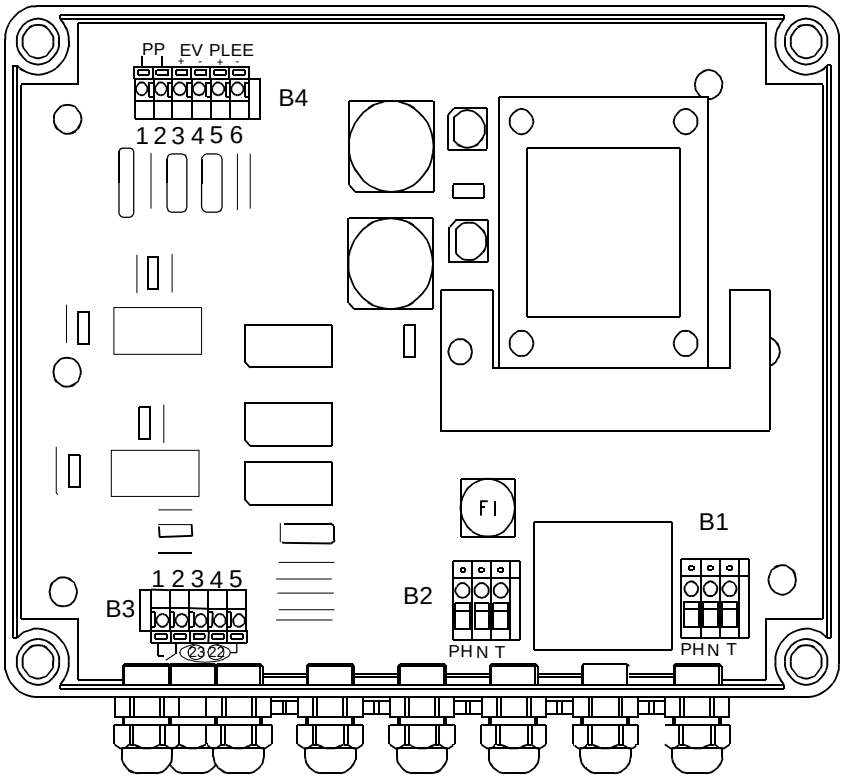


Figure 3-3 : Interface box terminals

B1 : Analyser power supply	B3 5 : Shielded connecting cable for communication with the transmitter
B2 : Transmitter power supply	B4 1/2 : Conditionning peristaltic pump connection (see kit K option)
B3 1/2 : Push-button for mixed bed (see mixed bed option)	B4 3/4 : Valve connection (see mixed bed option)
B3 3/4 : Communication with the transmitter	B4 5/6 : Dosing pump connection (AUTOCAL)

◘ PREAMPLIFIER

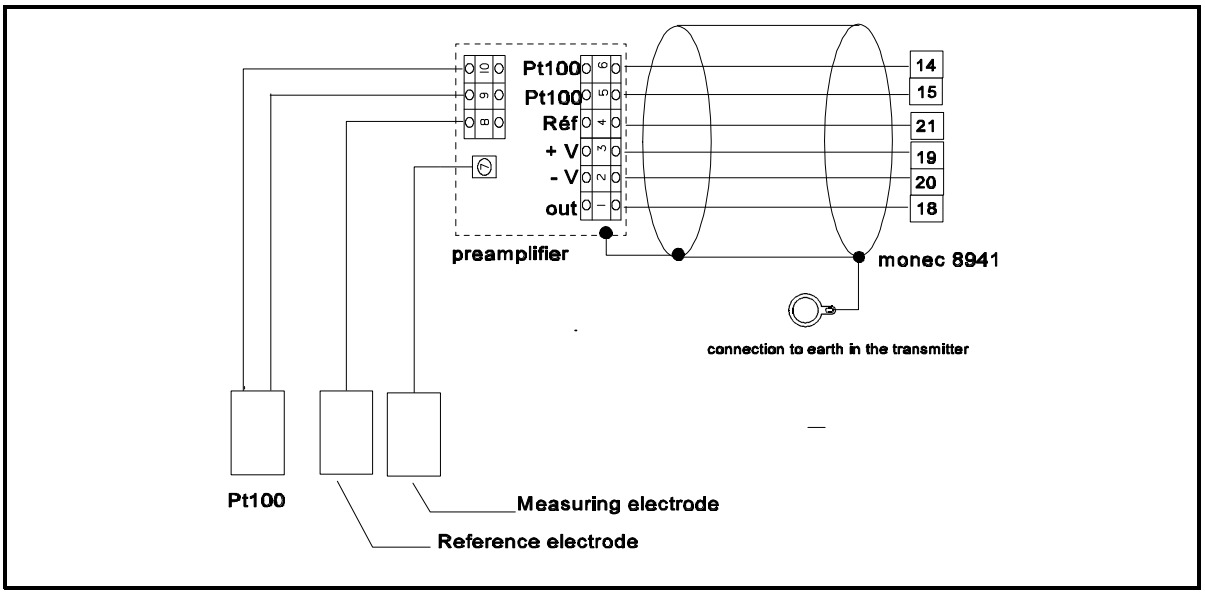


Figure 3-4 : Preamplifier connections

3.7 Mounting the electrodes

3.7.1 Measuring electrode

- Take out the measuring electrode from its box and pull out carefully the protective cap.

- Check the electrode bulb is filled with electrolyte. If there is any bubble, shake the electrode straight up.

- Screw the measuring electrode in its compartment (right side of the cell). The electrode tightness should ensure a slight squashing of the washer (0.5 mm maximum).
Never force it.

- Remove the connector cap and connect the cable (thick wire with AS9 connector) by screwing till tightness on the washer.

Caution ! The connector should never be wet (high impedance).

3.7.2 Reference electrode

❶ Take out the reference electrode from its box and remove carefully its protection cap.

- Remove both caps from the electrolyte compartments.

- Drain and rinse the electrolyte compartments by shaking it slightly.

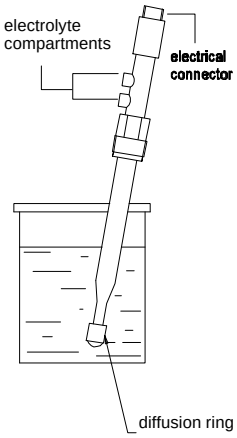


Figure ❶

- If the diffusion ring is clogged (electrolyte crystals), plunge and rinse the electrode in a water with low sodium content. (See Figure ❶).

❷ Fill in both compartments with the electrolyte supplied with the instrument (see reference in appendix A). This handling should be done with the electrode slightly inclined for the electrolyte to current regularly without any air blocked in the electrode.(see Figure ❷).

- If there is any bubbles trapped, obturate both inlets with the caps removed in step ❶ and shake slightly the electrode to remove the air.

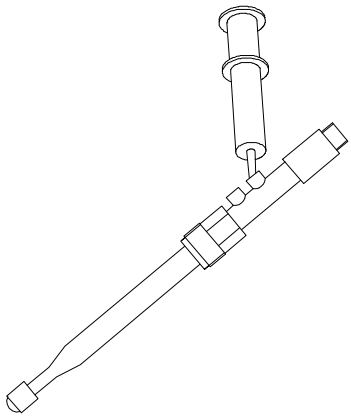


Figure ❷

❸ Put the electrode into its compartment ; Do not block the diffusion ring in the cell. (see Figure ❸).

- Screw the reference electrode in its place. The electrode tightness should ensure a slight squashing of the washer (0.5 mm maximum).
☞ ***Never force it*** !

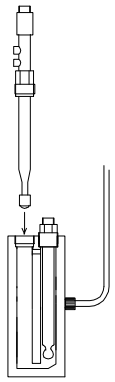
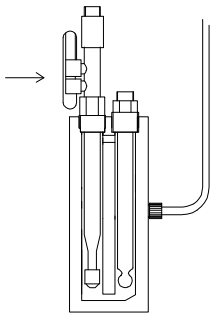


Figure ❸

Remove the connector cap and connect the cable (thin wire with AS7 connector) by screwing till tightness on the washer.

- Mount the electrolyte feeding pipes (see Figure).

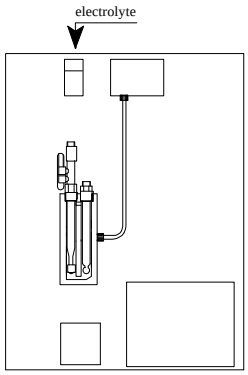


Figure

Fill in half the container with electrolyte (See Figure).

-Open very slightly the lower feeding pipe and squeeze it to let the electrolyte current down to the electrode (use absorbent paper to sponge the electrolyte).

-Open very slightly the upper feeding pipe and squeeze it to let the electrolyte current down to the electrode (use absorbent paper to sponge the electrolyte).



Figure

- If necessary add electrolyte (3/4 of the container) and put its cap back..

3.8 Floading and starting the analyser

Before flooding, check the adjusting valve is closed (clockwise) (Figure 2-1 or 2-3).

Flooding should be done before grounding

Flood the instrument, adjust the flowrate to 4 l/h and check the following points :

- regular sample drain (no output sealing)

- sample height in the measuring cell (output side on the left side) sufficient to ensure a regular drain.

If the evacuation is stopped for any reason, turn off immediately the supply valve.

If the levels in the cell are unstable, check the electrode adjustment is correct and ensures tightness.

After 15 minutes, check :

- the sample level in the cell is stable.

- the regular generation of bubbles in the conditioner (if the gaseous conditioning is chosen). If there is any problem, refer to chapter 7 : maintenance.

3.9 pH adjustment

In the case of an instrument equipped with a diisopropylamine gaseous conditioning system, it is possible to adjust the conditioning flowrate to avoid any overconsumption of reagent.

This adjustment may be realised when the instrument is stabilised using the screw (12) located on the conditioning block.

The rotation direction is indicated on the panel :
- clockwise : decrease of conditioning reagent (pH>)
- anticlockwise : increase of conditioning reagent (pH<)

WARNING ! The adjustment with the screw is sensitive. Proceed by step of 1/10 of turn approx.).

As an indication, the pH values according to the sodium measured are :

Concentration	**pH**
[Na] > 10 ppb	>9
1 < [Na] < 10 ppb	>10
[Na]< 1 ppb	>10.5

pH should be measured with electrodes (never use paper pH test).

In the case of an instrument equipped with a liquid conditioning system (Kit K), the adjusting screw should remain closed.

When the instrument is stabilized, switch on the analyser, the following messages are displayed :

- "8 8 8 8" : auto test, all the LEDs are alight
- "ISE" : for yhe selective ion electrode
- " v X.XX" or X.XX is the software version programmed in the instrument.

This sequence lasts approximately 30 seconds, then the instrument goes to the measuring mode (concentration).

After this start-up, it is required to let the instrument run about 6 hours before calibrating. During this time, the instrument should stabilize and reach a concentration value close to the sample one thanks to the standard parameters factory-programmed.

A calibration can then be launched and the instrument calculates its parameters according to your sample characteristics.

Chapter 4 : Operating the instrument

4.1 Front panel displays

The operational status of the instrument is indicated by the LCD display and the 11 status LEDs. The LCD can be switched to display :

- Sample concentration
- Sample temperature
- Command codes
- Programming options
- Sample flow rate in l/h
- mV electrode potential

The software version installed is displayed for about 30 seconds following the switching on the power.

The LEDs display : ppb-µg/l, ppm-mg/l, mV, l/h, °C, measure, CAL, limit S1, limit S2, program, error.

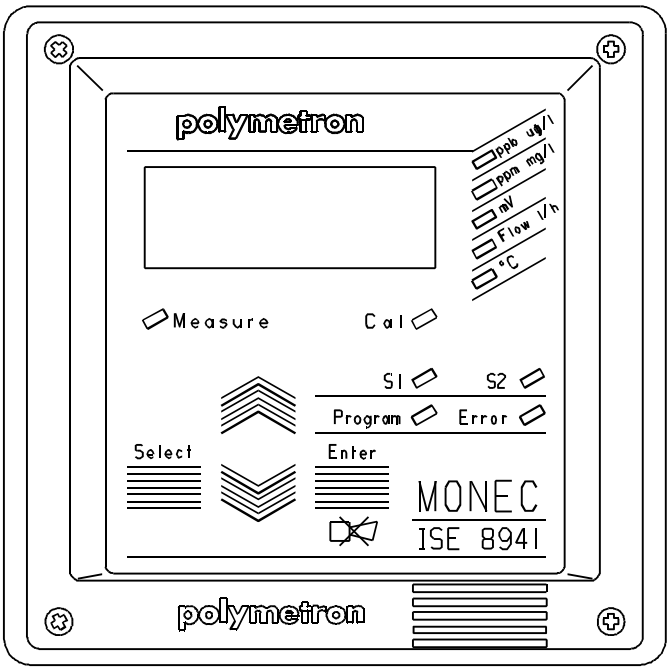


Figure 4-1 : 8941 front panel

4.2 Front panel keyboard

Four keys ensure the MONEC operation :

■ **SELECT** : enables to go from the programming mode to the measuring mode and vice versa.

■ ***SCROLL/UP AND DOWN :*** scroll through the parameters being measured or, while in the programming mode, set or change the value of various parameters.

■ **ENTER** : invokes a command or acknowledges validity of data input.

4.3 Rollkeys in the measurement mode

Five parameters are simultaneously displayed (3 are measured) The parameters are selected with the scroll up/down keys and the following parameters can be displayed :

Concentration
Temperature
Electrode potential in mV
Flowrate in l/h
CAL (calibration)

4.4 Displaying or altering programmed parameters

Pressing SELECT accesses the programming mode ; the corresponding LED PROGRAM lights up. Using SCROLL UP/DOWN keys allows the list of commands to be scannedd through. When the desired command appears, press ENTER.

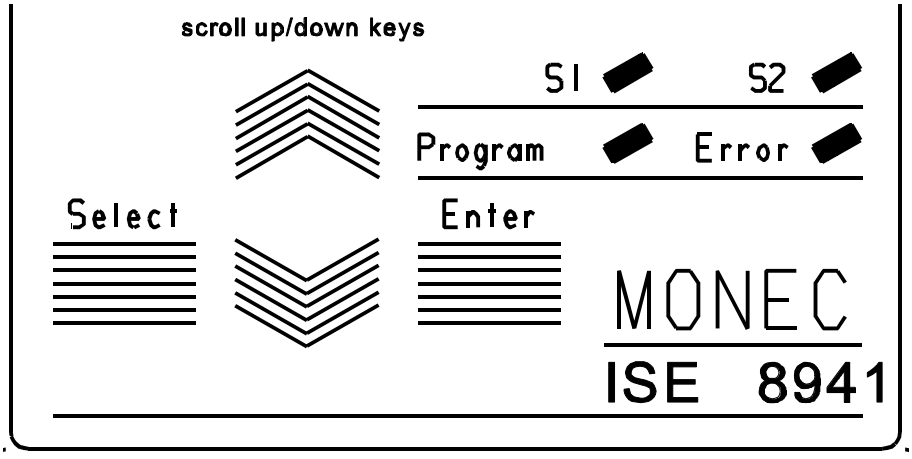


Figure 4-2 : 8941 front panel controls

IMPORTANT

If the PROGRAMMING protection is chosen (command 910 "argument 1"), it is impossible to modify these values.

The display indicates the argument programmed, the first figure flashes.

Pressing ENTER allows you to go to the second figure.

Pressing SELECT allows you to leave this command without storing the change.

Follow the same procedure to program the 4 figures.

After the programming it is possible to enter the sign (+ , -, point or unit) with the scrolling keys.

After the last ENTER, the option is stored and the instrument goes to the next command.

Returning to the measuring mode is possible by pressing SELECT.

Chapter 5 : Programming

In the following pages, we explain in details the commands of the SODIMAT model 9073.

Any option followed by "*" corresponds to the default value of the considered parameter. These default values can be programmed with the command 900. The analyser is also shipped from the factory with these values.
[ ] : numeric value

Command	Option	Effect
900	none	Loading of default values

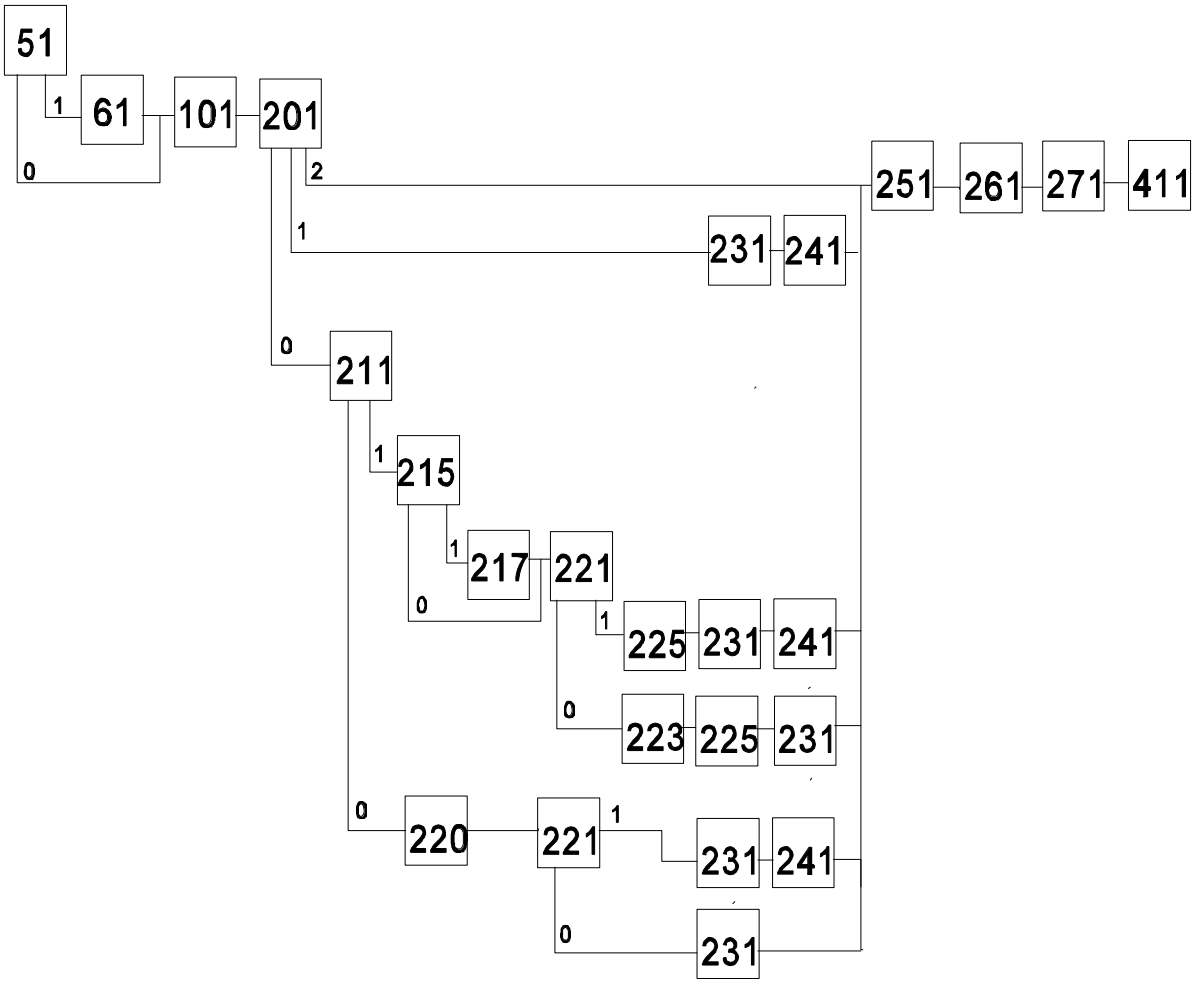
Note :

To avoid any unintentional modification, it is required to press ENTER during 5 seconds to execute command 900.

Also, to avoid any unintentional modification of the parameters, there is a protection code :

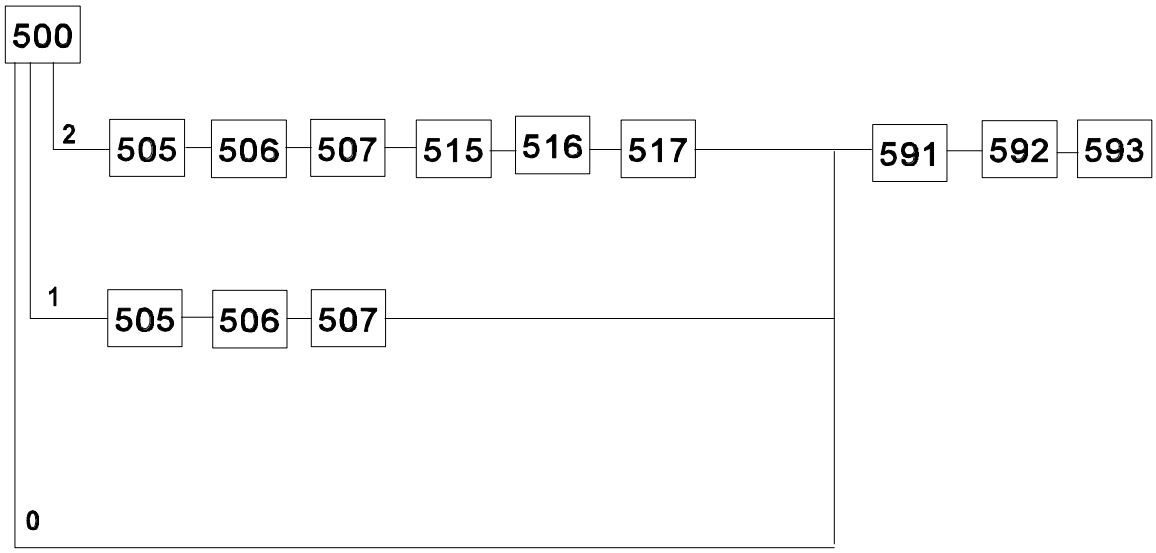
Command	Option	Effect
910	0*	Modification of the parameters possible
	1	Modification of the parameters impossible
	2	POLYMETRON menu

5.1 General configuration and calibrations



Command	Option	Function
51	0* 1	Automatic temperature compensation with a Pt100 Manual temperature compensation
61	------	Manual temperature compensation value
101	------	**Flow rate calibration in l/h** The flow rate value displayed can be adjusted to correspond to a reference value. Press ENTER when stable. Adjust digit by digit the value of the flow rate desired.
201	0 1 2*	By addition calibration (CARCAL, AUTOCAL) Manual calibration "Process" calibration
211	0 1	Utilizing calibration cartridges (CARCAL) Utilizing calibration solutions (AUTOCAL)
215	0* 1	Deactivates the automatic calibration mode Activates the automatic calibration mode
217	[168*]	**Interval between two automatic calibrations** To visualize the duration before the calibration, enter value "0000". When the duration is inferior to 100 hours, the instrument displays the delay before the calibration under the following format : "Hour:Minutes" (27:04). Otherwise, only the hours are displayed.
220	[7.0*]	Sample pH value to correct the CAR-CAL value (see §6.3.1)
221	0 1	1 calibration point 2 calibration points
223	0* 1	Low frequency of the calibration pump for 1 point solution calibration. High frequency of the calibration pump for 1 point solution calibration.
225	[2 ppm*]	**Value of the calibration solution concentration**. It is necessary to validate this command to execute the automatic calculation to determine the concentration values in C231 and C241. (See paragragh 6.2.2 to determine the concentration value needed with your application).
231	-----	Concentration value of addition 1 calculated for 4 l/h and 25°C.
241	-----	Concentration value of addition 2 calculated for 4 l/h and 25°C.
251	[0.0*]	Drift of the normality voltage to 25°C (in mV).
261	[100*]	Slope value at 25 °C in % of the theoritical slope (59,16 mV per decade).
271	[20*]	**Maximum time for each calibration point in minutes.** After this time, the measurement is automatically memorized. The user can interrupt the calibration cycle at any time by pressing *SELECT* or validate the measurement by pressing ENTER.
411	-----	**Temperature calibration**. The temperature value can be tuned to correspond to a reference value ; the transmitter allows tuning on a 10 °C range.

5.2 Alarm configuration

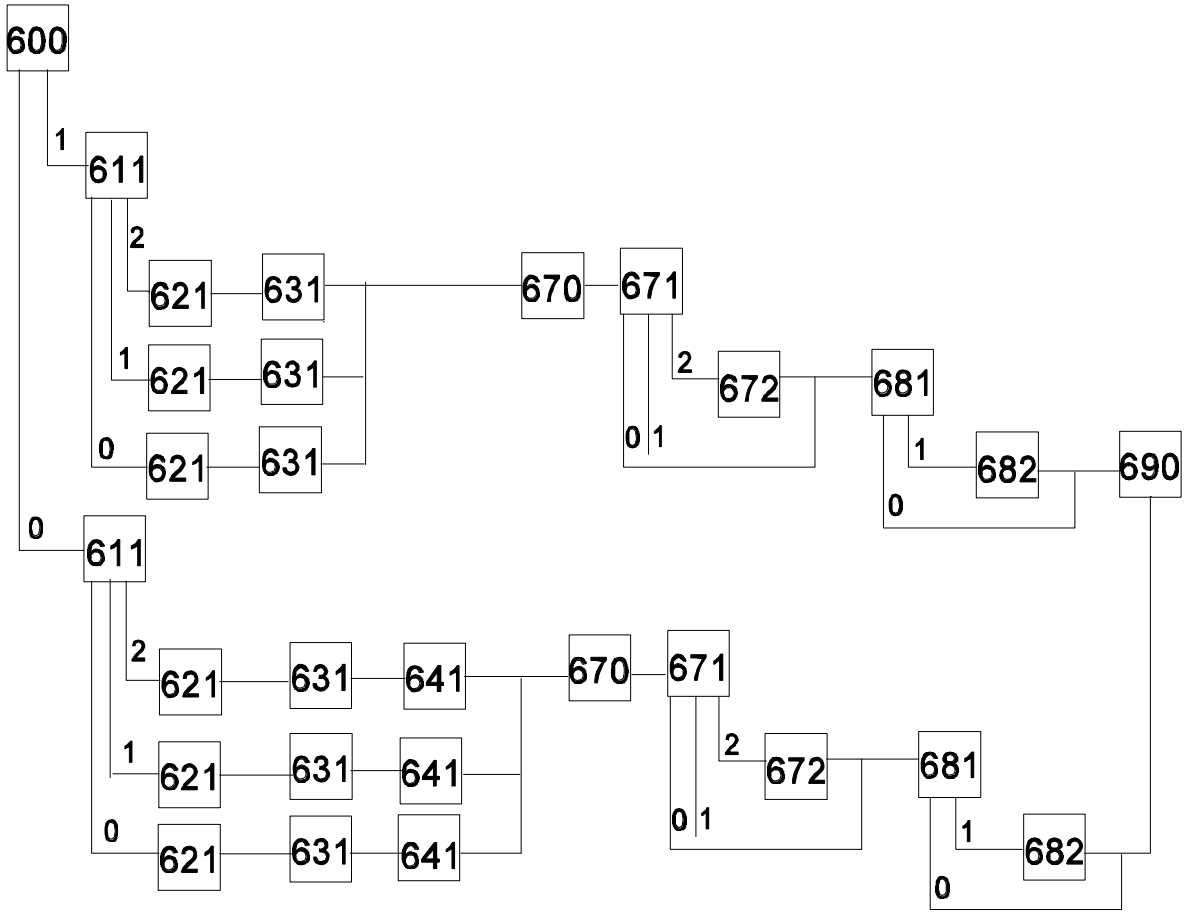


Command	Option	Function
500	0 1 2*	Limits S1 and S2 not active Limit S1 active and limit S2 not active Limits S1 and S2 active
505	0* 1	S1 defined as low limit setpoint S1 defined as high limit setpoint
506	[0.01*]	S1 value in ppb or ppm
507	[0*]	Delay time between 0...9999 seconds
515	0 1*	S2 defined as low limit setpoint S2 defined as high limit setpoint
516	[999.9*]	S2 value in ppb or ppm
517	[0*]	Delay time between 0...9999 seconds
591	0* 1	Relay S1 normally open if no alarm condition Relay S1 activated if no alarm condition
592	0* 1	Relay S2 normally open if no alarm condition Relay S2 activated if no alarm condition
593	0 1* 2	Relay S3 off Relay S3 activated by an alarm system with manual reset Relay S3 activated by an alarm system with automatic reset

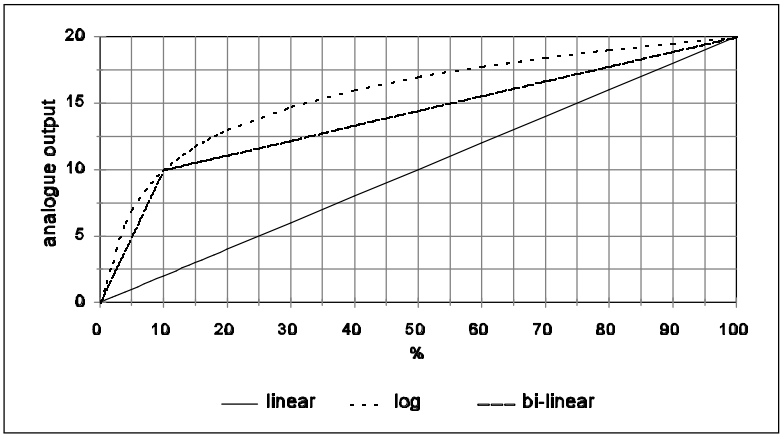
Two different ways to acquit manually the alarm system :

1. By pressing ENTER.
2. Remotely by the single pole contact (see figure 3-2)

5.3 Analogue output configuration

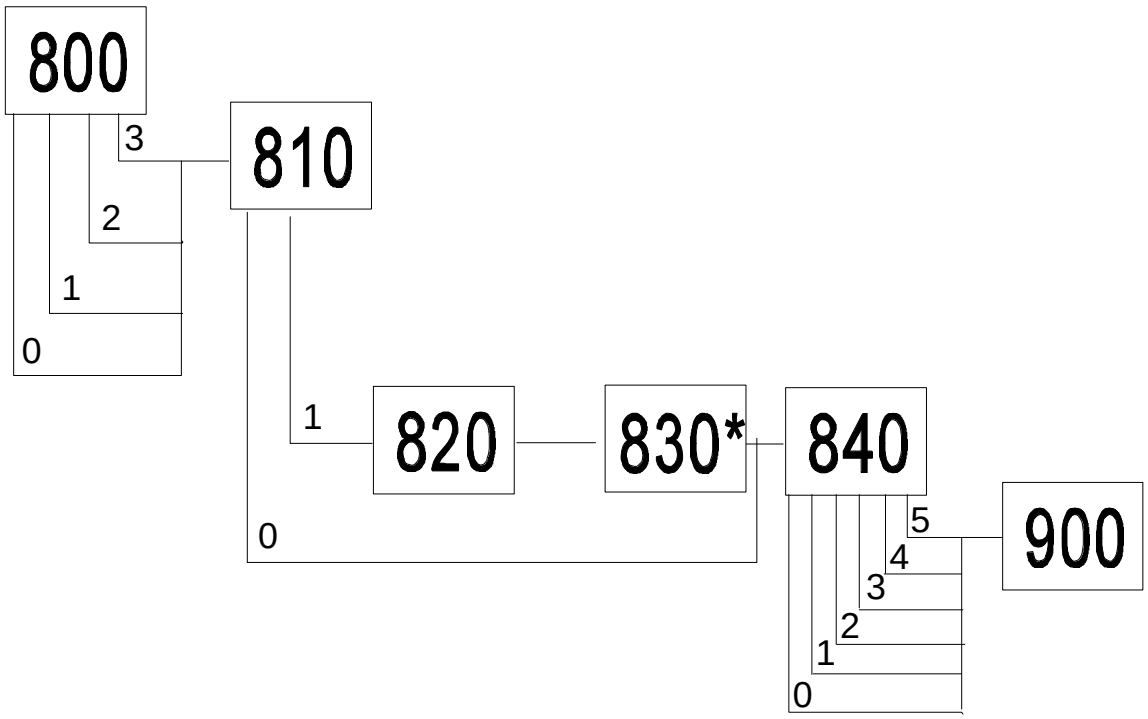


Command	Option	Function
600	0* 1	Concentration measurement allocated to output signal 1 Temperature measurement allocated to output signal 2 Concentration measurement allocated to output signals 1 & 2
611	0* 1 2	Linear output signal Logarithmic output signal Bilinear output signal
621	[0.01 ppb*]	Lower end if C611 with option 0 or 1 In the case of a bilinear output signal, the lower end is always 0, this command allows to choose the inflexion point value.
631	[999.9 ppm*]	Upper end Remark : It is required to program the lower and upper end (C621 and C631) when modifying one of these values.
641	0 1*	Temperature range 0...50 °C Temperature range 0...100 °C
670	0* 1	Channel 1, output signal 0..20 mA Channel 1, output signal 4..20 mA
671	0* 1 2	Follow the measurements on the output signals when calibrating Memorize the last measured value before entering the calibrating mode Force the analogue outputs to a programmed value in command 672 when calibrating
672	------	Programmed value of the analogue outputs when an error occurs (programmable from 0 to 3 mA).
680	0* 1	Channel 2, output signal 0..20 mA Channel 2, output signal 4..20 mA
681	0* 1	Memorize measured value when error messages displayed. Force the analogue outputs to a programmed value in command 682 when an error occurs.
682	------	Programmed value of the analogue outputs when an error occurs (programmable from 0 to 3 mA).
690	0* 1 2	0/4 mA value generated on analogue output 10 mA value generated on analogue output 20 mA value generated on analogue output



Output current specification

5.4 Serial interface configuration



Command	Option	Function
800	0* 1 2 3	No transmission of alarm limits Transmission of S1 and S2 limits Transmission of the alarm system Transmission of the S1 and S2 limits and the alarm system
810	0* 1	RS232 inactive RS232 active
820	0 1	Continuous transmission of measuring data Transmission on request only
830*	----------	Transmission of the data measurement (if C820 = 1)
840	0* 1 2 3 4 5	300 baud 600 baud 1200 baud 2400 baud 4800 baud 9600 baud

* : Command accessible only via RS232. It is not displayed..

Remark
In order to receive only "one" transmission of the measurement data, select command 820 (1) and print the following command : "R830".

5.5 Use of the interface RS232

The following codes enable the RS232 interface. Specifications of these codes :

- Speed in baud (Command 840)
- 1 stop bit
- No parity bit
- 8 bits per word

The data are in ASCII form :

M1 : 23.00 ppm 25.0 °C -360.0 mV

The transmitter sends back the data received to allow the reception control.

TRANSFERED CONTROL OF THE SODIMAT

2 characters allow the transfered control : "@" and "!"

the "@" character transfers the control to the computer. The "!" character passes the control to the Monec keyboard. The control transfer to a remote computer deactivates the transmitter keyboard.

REMOTE CONTROL

If the monec is microprocessor operated, the "!" character comes before each command set with the computer. 4 available commands with the computer :

- **W** - Choose the display of a parameter (Window)
- **S** - Program the transmitter commands (Set)
- **R** - Read the programmed value of the parameter (Read)
- **Q** - Reset remote alarm system

NOTE : The command characters (W, S, R, Q) can be written in capital or small letters.

"WINDOW" COMMAND

This command plays the same role as the scroll keys on the Monec keyboard.

4 options available :

- ":W0 ENTER": selects the value of the concentration measured
- ":W1 ENTER": selects the temperature value
- ":W2 ENTER": selects the potential value
- ":W3 ENTER": selects the flowrate measured

"SET" COMMAND

The SET command allows the Monec remote programming :

":S command number, selected value ENTER"

Select an integer value for "SELECTION" type argument (command 51, 201, 211...).

Example: :S1,1"ENTER""

For arguments type "limits, upper/lower end, ...", select a real value with the point and the exponent '"E" : 10 basis exponent).

Example: ":S506,+5.000E-6"ENTER""

CAUTION : A space corresponds to the ENTER key.

"READ" COMMAND

The READ command allows the reading of a parameter programmed value. You could read :!

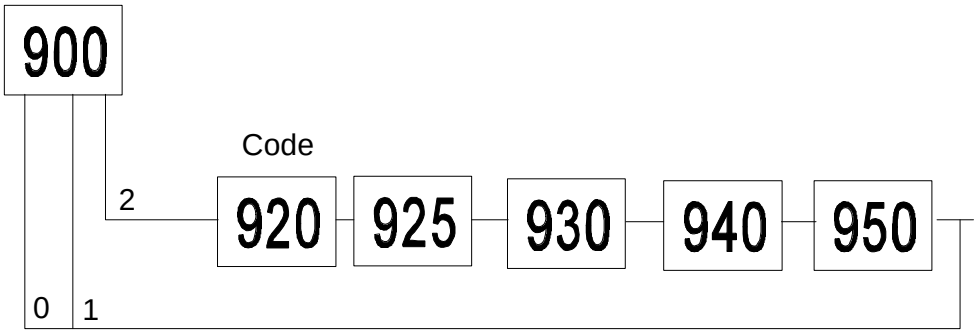
":R, command number"

The Monec displays the programmed arguments for the specific command.

"RESET" COMMAND

The RESET command allows the alarm system reset with "Q"".

5.6 Function parameter configuration



Command	Option	Function
900	------	Loading the default values
920[1]	------	Enter the Polymetron code
925	0	Sodium application
930	+20.0 mV	Isothermal point
935	1 ppb	Reference point concentration
940	-100 mV	Reference point voltage
950	0* 1	Without mixed bed With mixed bed

NOTE
Access to the functional parameters is protected by the code : 1493.
The instrument parameters should not be modified in normal operation.

[1] This command is not displayed

Chapter 6 : Calibrating the instrument

NOTE
See chapter 5 for Programming the analyser.

REMARK
Any result (calibration or measurement) is always brought back to the reference temperature (25 °C, 77 °F). If the sample temperature is different from the reference temperature, it is required to execute a manual or automatic temperature compensation.

6.1 Calibration of the flowmeter

Calibrate the flowmeter before any other operation. It is also required to adjust the flow measurement which has been already factory-preadjusted but which should be adjusted on site.
Procede as follows :

- Measure the output flowrate (weighing of water to drain during 10 minutes, for instance)
- Enter the programming mode and scroll up to command C101 : flowrate calibration, enter the value. (See chapter 5 : programming for further information).

6.2 Calibration of the temperature sensor

The temperature sensor is located 1 cm under the measurement electrode. It is factory-preadjusted but needs to be calibrated in the sample on site. This calibration must be realised before the sodium measurement calibration.
To execute this calibration remove carefully the measurement electrode and replace it by a precision thermometer in order to obtain a reference value.

6.2.1 Temperature automatic compensation

The sensor measures continuously the sample temperature. The concentration values are automatically calculated according to the reference temperature (25°C) by a pre-programmed law in the transmitter.

The procedure is as follows (you can also check the commands in Chapter 5) :

Command	Argument	Function
51	0	Automatic temperature compensation
411	XX.X	Enter the sample temperature value in °C. Press ENTER to adjust the temperature displayed with the sample temperature.

6.2.2 Temperature manual compensation

This temperature compensation mode should be used when your sample temperature is constant.

Command	Argument	Function
51	0	Automatic temperature compensation
61	XX.X	Enter the sample temperature value in °C.

6.3 Measurement calibration

Three calibration principles available with the SODIMAT 9073 :

- Addition calibration

The slope and offset are calculated by means of measurements realised after one or two sodium additions in the sample.
These additions are of two types :
- cartridges (9073 - CARCAL version) which enable a known quantity of sodium to diffuse in the water to analyse.
- injection, via a precision pump, of a known concentration sodium solution in the water to analyse (9073 - AUTOCAL version).

- Process calibration

In this method, the value given by the analyser is adjusted to a laboratory value by a reference method.

- Manual calibration

The user injects one or two known concentration solutions at 4 l/h. The values have been previously programmed in commands C231 and C241.

6.3.1 CARCAL calibration

To use both 20 and 200 ppb CARCAL cartridges, the sample should not exceed 6 ppb of sodium. If not, the use of a mixed-bed cartridge is required. However, a one point calibration at 200 ppb is possible without a mixed-bed cartridge ; then enter in command 261 the value of the slope indicated in the certificate given with the sodium selective electrode (in % of the theoric slope).

Note on command 220 :
- In case of gaseous conditionning, sample pH before it enters the analyser, has to be programmed.
- In case of liquid conditionning (kit K), sample pH has to be measured in the measuring cell.

Command	Argument	Function
201	0	Calibration by known additions (carcal/autocal)
211	0	Use of CARCAL calibration cartridge
220	---	Sample pH value for the correction of the CARCAL value
221	0 1	One point calibration Two point calibration
231	---	Value of the concentration addition 1 calculated for 4 l/h and 25°C
241	---	Value of the concentration addition 2 calculated for 4 l/h and 25°C
251	[0.0*]	Drift value of the normality voltage at 25°C
261	[100*]	Slope value at 25°C in % of the theoric slope (59,16 mV per decade)
271	[20*]	Maximum time by calibration point in minutes

To launch the calibration,adjust the sample flowrate at 4.0 l/h. Press SELECT to leave the PROGRAMMATION mode, press the lower key till CAL is displayed. Press ENTER, --- appears and then CAR1. Remove the filter from the carcal holder and replace it by the first CARCAL (200 ppb).
Press ENTER. After the time programmed in C271, the measurement of the first calibration point is taken into account.
CAR2 is then displayed.
Remove the first CARCAL from the holder and insert the second CARCAL (20 ppb). Press ENTER. After the time programmed in C271, the measurement of the second calibration point is taken into account.

Warning : do not forget to put back the filter after the calibration is completed.

The analyser is then able to calculate the new offset and slope.
If any big difference after the calculation compared to the theoric values, the following error message is displayed.

Note 1 :
- Pressing SELECT interrups the calibration
- Pressing ENTER validates the measurement before the required time (if the measurement is considered stable).
Note 2 :
- C251 and C261 permit to control the new offset and slope values.
- It is possible to take a note of these values in Appendix B to check the electrode evolution.

6.3.2 AUTOCAL calibration

The sodium concentration of the calibration solution to be prepared depends of the sodium contained in the water to analyse. The values advised below will ensure a utmost accuracy :

Water to analyse (ppb Na*)	Calibration solution	Addition 1 generated (ppb) flow rate = 4 l/h	Addition 2 generated (ppb) flow rate = 4 l/h
< 0.5 ppb	10 ppm	954	87.1
< 1.9 ppb	1 ppm	95.4	8.71
< 3.8 ppb	2 ppm	190.8	17.42
< 9 ppb	5 ppm	477	43.56
< 38 ppb	20 ppm	1908	174.2
< 90 ppb	50 ppm	4770	435.6

➥ Preparation of a 2 ppm Na calibration solution :

❶ Prepare a stock solution 1 g/l Na (1000 ppm) :
Weigh 2.541 g of NaCl dry and dissolve it in one litre demineralised water, free of sodium.
This solution should be kept in a cool and dry place, its lifetime is 6 months.

❷ From the stock solution :

Take 2 ml of the stock solution and dilute it in one litre demineralised water to obtain a 2 ppm Na calibration solution.

Warnings :

- It is required to use a magnetic stirrer for a better stirring when preparing the stock solution.

- Make sure anything used with the solutions are sodium-free :
beaker, water, stirrer. (Frequent rinsing with demineralised water).

- The accuracy of the Sodium concentration in the calibration solution depends on the weighing instruments, their accuracy in the measuring range used should have been checked.

If your sample contains very low quantities of sodium (< 0,5 ppb), an electrode desensitization may occur. It is then required to increase the calibration frequency so that the additions will ensure the reactivation of the electrode.

Water to analyze (ppb Na^+)	**Required calibration frequency (C217)**
< 0.2 ppb	48 H
between 0.2 and 0.5 ppb	72 H

Water to analyze (ppb Na^+)	**Required calibration time per point (C271)**
< 0.5 ppb	25-30 minutes
> 0.5 ppb	20-25 minutes

Programming :

Command	**Argument**	**Function**
201	0	Calibration by known additions (carcal/cal sol)
211	1	Use of calibration solution
215	0 1	Desactivate the automatic calibration mode Activate the automatic calibration mode
217	---	Time between two automatic calibrations
221	0 1	One point calibration Two point calibration

223	0 1	Low frequency of the calibration pump for the calibration with one point solution High frequency of the calibration pump for the calibration with one point solution
225	---	Concentration value of the calibration solution
231	---	Value of the concentration addition 1 calculated for 4 l/h and 25°C. The value taken into account is the value of the real addition measured by the instrument
241	---	Value of the concentration addition 2 calculated for 4 l/h and 25°C. The value taken into account is the value of the real addition measured by the instrument
251	[0.0*]	Drift value of the reference potential at 25 °C
261	[100*]	Slope value at 25 °C in % of the theoric slope (59,16 mV per decade)
271	[20*]	Maximum time by calibration point in minutes

Calibration procedure

a) Automatic desactivated calibration (C215 = 0) :

To launch the calibration manually, press SELECT to leave the programmation mode, press the lower key till CAL is displayed. Press ENTER, SOL1 appears (first addition), press ENTER to validate. The pump injects the calibration solution in the sample.
After the time programmed in C271, the measurement of the first calibration point is taken into account. SOL2 is displayed. Press ENTER.
After the time programmed in C271, the measurement in C271 of the second calibration point is taken into account.

The analyser is then able to calculate the new offset and slope. If any big difference appears after the calculation compared to the theoric values, one of the error messages ER24/25/26 is displayed.

b) Automatic activated calibration (C215 = 1)

To launch the calibration, press SELECT to leave the programmation mode. The analyser executes automatically the calibration cycle with a frequency programmed in C217.

Note 1 : - Pressing SELECT interrups the calibration
- Pressing ENTER validates the measurement before the required time (if the measurement is considered stable).

Note 2 : - C251 and C261 permit to control the new offset and slope values.
- It is possible to take a note of these values in Appendix B to check the electrode evolution.

6.3.3 Manual calibration

The water to analyse should be replaced by 2 known concentration solutions and injected in the analyser at a 4 l/h rate.

Command	Argument	Function
201	1	Manual calibration
231	---	Concentration of the first calibration solution
241	---	Concentration of the second calibration solution
271	20*	Maximum time by calibration point in minutes. The measurement is automatically savec after this time. The user can interrupt the calibration cycle at any time by pressing SELECT or validate the curent measurement by pressing ENTER.

Calibration procedure

Start the injection of the first solution. Adjust the flowrate at about 4 l/h with help of the flowrate measurement.
To launch the calibration, press the down key till CAL is displayed.
Press ENTER. SOL1 appears (first solution), press ENTER to validate.
After the time programmed in C271, the measurement of the first calibration point is taken into account. SOL2 then appears. Press ENTER.
After the time programmed in C271, the measurement of the second calibration point is taken into account.
The analyser is then able to calculate the new offset and slope.
If any big difference appears after the calculation compared to the theoric values, on of the following error messages ER24/25/26 is displayed.

Note 1 : - Pressing SELECT interrups the calibration
- Pressing ENTER validates the measurement before the required time (if the measurement is considered stable).

Note 2 : - C251 and C261 permit to control the new offset and slope values.
- It is possible to take a note of these values in Appendix B to check the electrode evolution.

6.3.4 Process calibration

By this method, the value displayed on the transmitter is adjusted to correspond to the laboratory measurement on the sample.
It is a one point calibration ; the offset is modified to adjust the new calibration curve. The slope value is not modified.

Command	Argument	Function
201	2	Process calibration
271	20*	Maximum time by calibration point in minutes. The measurement is automatically savec after this time. The user can interrupt the calibration cycle at any time by pressing SELECT or validate the curent measurement by pressing ENTER.

Calibration procedure

A process calibration occurs when the measure is stable.
To launch the calibration, press SELECT to leave the PROGRAMMATION mode and press the lower key till CAL is displayed. Press ENTER. With the scroll keys adjust the value displayed to the laboratory value. Press ENTER to return to the measurement mode.

Note 1 : - Pressing SELECT interrups the calibration
- Pressing ENTER validates the measurement before the required time (if the measurement is considered stable).

Note 2 : - C251 and C261 permit to control the new offset and slope values.
- It is possible to take a note of these values in Appendix B to check the electrode evolution.

Chapter 7 : Maintenance

7.1 Normal operating maintenance

◘ *Weekly*

- Check the levels and complete if necessary :
⇦ the calibration solution
⇦ the conditioning reagent
⇦ the electrolyte (KCl)

◘ *Monthly*
-Check visually the filter cartridge. Change it if saturated.

◘ *Half yearly*
- Check the flowmeter calibration : weigh the liquid drained during 10 minutes.

- Check the temperature sensor calibration : with a precision thermometer placed in the measuring electrode side.

7.2 Specific operating maintenance

7.2.1 Electrode slope loss

The sodium selective electrode may lose part of its sensitivity naturally or because of clogging (for instance, metallic oxides).

The following procedure permits to recover part of the electrode sensitivity. However, the electrode may not recover enough characteristics (slope < 80% of the theoric slope), it is then required to change the electrode.

How to reactivate your electrode

❶ Immerse half of the measuring electrode in a demineralized solution with 2% of hydrofluoric acid for 5 to 10 seconds.

☞ ***Be careful when using acids. See the security datasheet in appendix C, § C-2.***

❷ Rinse immediately and abundantly the electrode with demineralized water.

❸ Put the electrode in a NaCl solution for a couple of hours before putting it back into the cell.

Chapter 8 : Error messages and acknowledgement

8.1 Error messages

- In measuring mode

Er 11 + LED error	Temperature superior to + 45 °C (The pt100 cable may be cut)
Er 12 + LED error	Temperature inferior to °C (The pt100 may be short-circuited)
Er 13 + LED error	Temperature compensation impossible (Er11 or Er12)
LED error (without error message)	Flowrate < 3l/h or > 6 l/h

- Flashing display

"0" - Concentration inferior to the measuring range (alarm system active)
"9999" - Potential or concentration superior to the measurinf range (alarm system active)

- In calibrating mode

Er 21 + LED error	The first solution value is too close to the sample original concentration (C_{Sol2} >3*C_{Sample})
Er 22+ LED error	The second solution value is too close to the sum of the original sample and solution 1 concentrations (C_{sol1} > 3*$C_{(sample + Csol2)}$)
Er 23+ LED error	The solution 1 concentration value is too close to the solution 2 (C_{sol1} > 5*C_{sol2})
Er 24+ LED error	Offset and slope calculation impossible
Er 25+ LED error	Offset error (> 3 decades)
Er 26+ LED error	Slope error (<50% or >150%)
Er 27+ LED error	Flowrate error (<3l/h or >6 l/h)

8.2 Acknowlegement

Press ENTER in measuring mode to acknowledge the error message. If the error remains active (flowrate, temperature...) Then the error message flashes again.

Chapter 9 :Troubleshootings, causes and solutions

WARNING !

Never attempt servicing before disconnecting the instrument from the main power line.

MALFUNCTION	POSSIBLE CAUSE	REMEDIES
No indication No LED is illuminated No LCD backlighting	No power ; instrument is not connected correctly	Check for power, then check if connected properly
	Defective fuse	Check fuse
	Instrument's power supply set for wrong line voltage	Check jumpers on power-supply board for correct voltage settings
	Ribbon cable connecting power with CPU board not properly plugged in	Check that the ribbon plugs are properly plugged in.
	Connection between CPU board and measurement module loose	Secure plug connections
	Short circuit in power-supply board	Visually check power-supply board for shorts
	Hardware is defective	Call the Service Technician
LCD displays undefined characters	Malfunctionning CPU board or processor	Using the Instruction manual, program the instrument to load the default values
	CPU hardware	RESET the instrument by temporarily interrupting the power (5-10 secs.)
		Call the Service Technician
Keyboard does not operate ; all keys are inactive	CPU malfunctioinning, external interferences	Sequentially press the keys UP, DOWN, ENTER, SELECT.. If there is no response, RESET the instrument by temporarily interrupting the power (5-10 seconds.). Check each key again. If there is no change, call the Service Technician.

Measurement not correct	Instrument not programmed properly	Check the programming parameters.
		Reprogram the instrument checking it corresponds to the probe characteristics
	System with probe not calibrated properly	Calibrate the system with probe connected.
	Probe not connected properly	Check the connection
	Probe not operating properly, may be impossible with this application	Check the probe visually. Check the probe specifications with the application
	CPU board malfunctionning	If problem persists, call the Service Technician.
Measurement not stable	Probe malfunctionning	Check the probe
	Probe not connected properly	Check the connection
	Interferences Cable shield not correctly connected	Check there in no chemical, external temperature or pressure interference source Check and connect again.
	Lack of conditioning reagent	Add reagent
	Lack of electrolyte in the reference electrode	Add electrolyte .
Temperature measurement not correct	Probe not properly connected	Check it
	Temperature not calibrated	Calibrate for temperature
	CPU board malfunctionning	If problem persists, call the Service Technician.
Reading blocked, can not be changed	CPU board and/or other part of transmitter	Check the probe is correctly connected
		Zeroing
		Program the instrument again
		If it still does not work : reset and switch off the instrument
		Program again
		If problem persists, call the Service Technician.
ERROR displayed	Probe malfunctionning	Check for dirt or electrode
	Probe not connected properly	Check the connections
	No contact between the probe and the sample	Check the sample flowrate
	CPU board malfunctionning	If problem persists, call the Service Technician.
Relay not energised	Instrument was programmed incorrectly	Check whether the correct relay parameters and setpoints have been programmed.
	Hardware is defective	Check that the programmed setpoints are compatible with the programmed measuring range.

		The setpoints must be above and below the upper and lower end, respectively, of the measurement span.
		Check the relay characteristics for proper functionning using an ohmmeter.
		If problem persists, contact the Service Technician.
Wrong output current, output current remains locked at 0 or 20 mA	Instrument was incorrectly programmed	Check the programmed output-current parameters
	Connection of the Monec with peripherals (recorder, etc.) are faulty, loose or defective.	Check the cables
	Hardware is defective	Compare the measured value with the output-current range
		If problem persists, call the Service Technician
Response time too long	Conditioning reagent lacking or polluted	Check the quality of the reagent Check the pH at the output
	Bubbles in the electrodes	See § 3.7.1
	No flowrate	Check the sample supply or the flowmeter calibration
	Pollution of one or some parts	Leave the instrument rinsing
	Measuring electrode desactivated	See § 7.2.1
	Lack of reference electrolyte	See § 3.7.2

Chapter 10 : Options

10.1 Mixed bed option

WARNING !
Mounting this option requires qualified personal (Aftersales people or Polymetron agents)

◘ ***Utilization :***

This option is required when the background (sodium concentration in the sample when calibrating) value is too high for the calibration to be performed.

◘ ***Functioning*** **:**

Automatic calibration version (AUTOCAL) :

When launching the calibration, the selective valve lets the sample flow through a ion exchanger resin cartridge (mixed bed) which absorbes Na+ ions to obtain a sample with low sodium content.

Considering the time required for the sample to go through the resin cartridge, the valve is released 5 minutes before the sodium addition by the calibration system ("CAL" is flashing during this time).

After this time, the sodium level contained in the sample is stabilized and is low : the calibration starts..

CARCAL cartridge calibration version :

The principle remains the same as the AUTOCAL version, but before launching the calibration the operator should activate the mixed bed by pressing the push button on the analyser front panel.

◘ ***start up*** **:**

In any configuration (AUTOCAL or CARCAL) , the presence of the mixed bed should be indicated by entering 1 in command 950 ("PROGRAMMATION" mode).
You don't need to program it if the mixed bed has been factory-mounted.

Automatic calibration version (AUTOCAL) :
The operator has nothing to do.

Calibration with CARCAL cartridge :

The calibration sequences are as follows :

1) Press the push button to activate the mixed bed. Wait 5 minutes for the sodium concentration to decrease and stabilize. Prepare a 200 ppb calibration cartridge.

2) Calibrate as indicated in paragragh 6.2.1.

3) When the calibration is validated, switch off the calibration cartridge by pressing the push button.

◘ ***maintenance*** **:**

Check frequently (once a month) the resin. The colour of the resin indicates its consumption :

- Black or dark green : resin active
- Brown or orange : resin exhausted

When a resin is exhausted, the sodium decrease is longer and the background sodium level obtained may remain too high.

Replacing the mixed bed cartridge (see reference in appendix A) :

Replacing the mixed bed cartridge is easy and quick :
- switch off the analyser
- turn off the sample inlet (turn the adjusting valve clockwise)
- Disconnect the input and output tubes
- Open the clamping collar and remove the old cartridge
- Mount the new cartridge (no particular orientation to respect)
- Proceed in the reverse order for the reassembling.

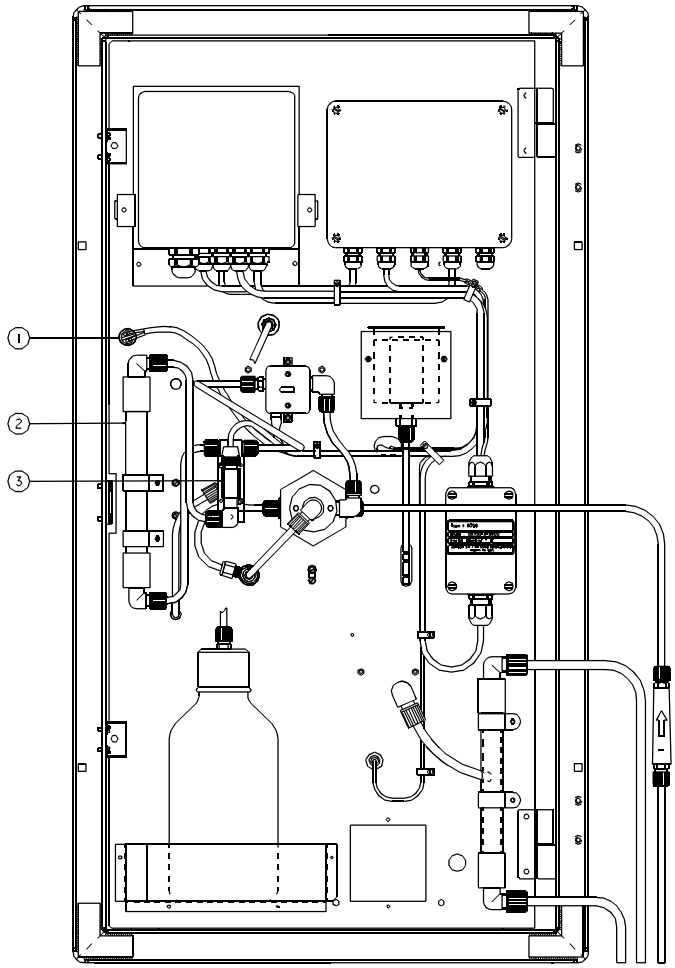


Figure 10-1 : Mixed bed for CARCAL version

1 : Control push button	3 : Mixed bed control valve
2 : Mixed bed cartridge	

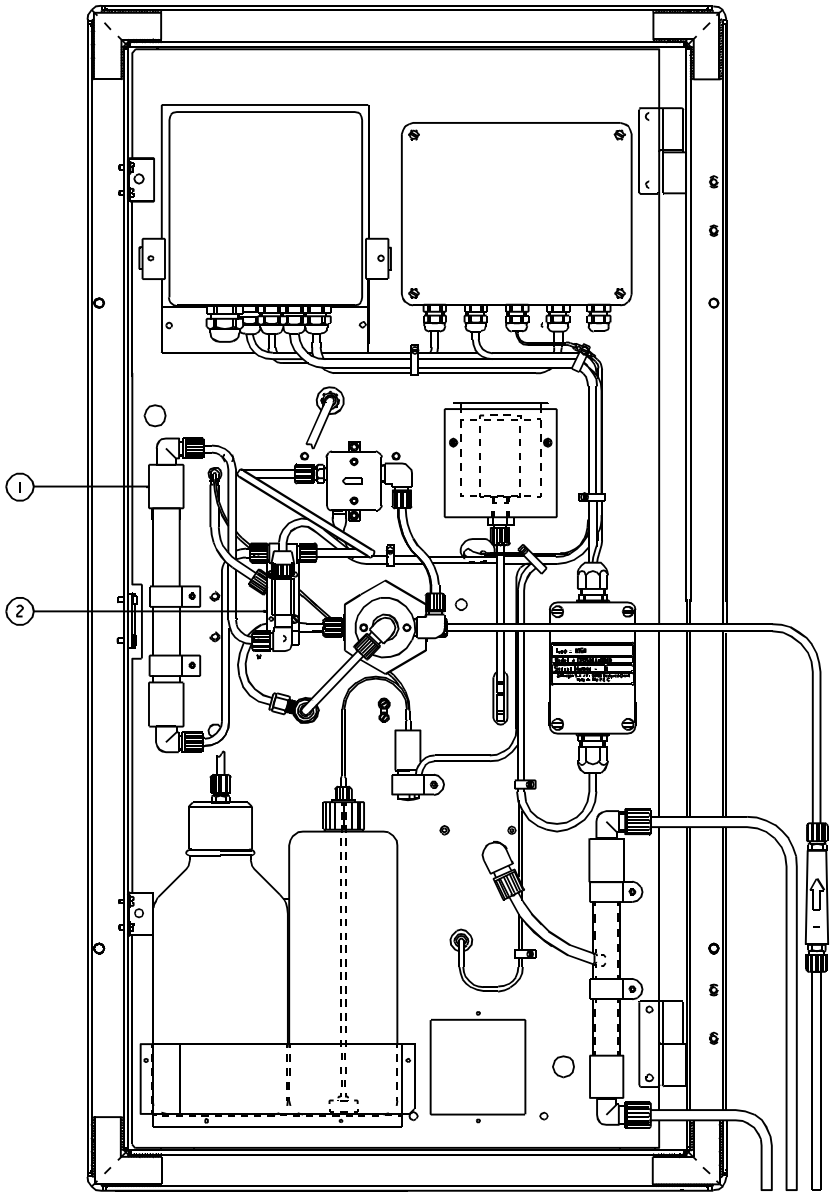


Figure 10-2 : Mixed bed for AUTOCAL version

1 : Mixed bed cartridge	2 : Control valve

10.2 Liquid conditioning option (Kit K)

10.2.1 Generality

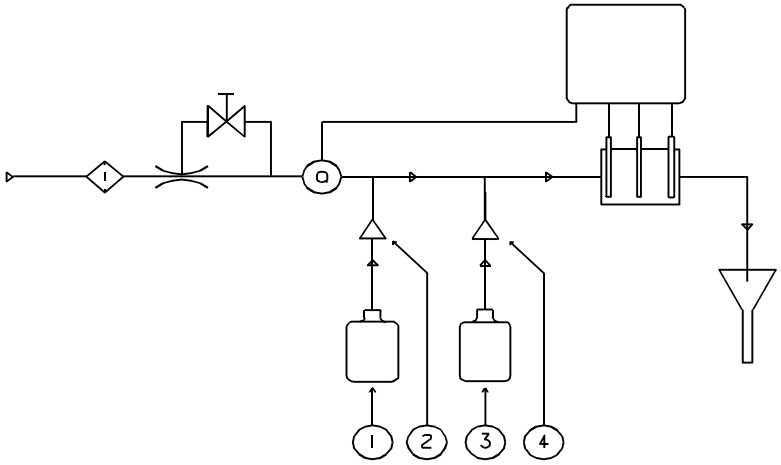


Figure 10-3a : kit K + AUTOCAL principle diagram

1 : Conditioning reagent	3 : Calibration solution
2 : Conditioning pump	4 : Calibration pump

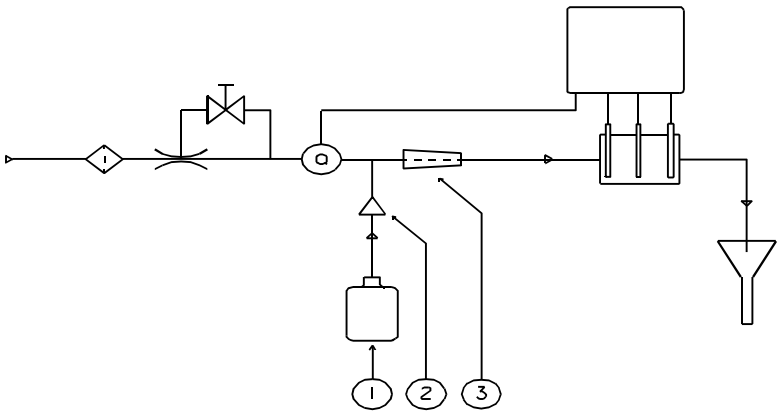


Figure 10-3b : kit K + CARCAL principle diagram

1 : conditioning reagent	3 : CARCAL calibration cartridge
2 : Conditioning pump	

This option is required when the gaseous conditioning is unsufficient to reach high pH (>10) necessary for a correct sodium measurement (H+ ion interferences).

This problem occurs when the sample is acid and acting like a buffer (for instance, cation exchanger resins).

This option solves the problem by ensuring an extremely efficient liquid conditioning which permits to obtain the necessary pH value.

Functioning :

The conditioning reagent is pumped by a peristaltic pump from the bottle supplied with the kit. The reagent is then injected in the sample circuit.

Ethanolamine and ammoniac are the required conditioning reagents.

10.2.2 Putting into service

❶ Preparation of the ethanolamine reagents

- Dilute ethanolamine (30% concentrated, quality “per analysis”) with demineralised water with a low sodium content.
After starting up the liquid conditioning (see explanation below) measure the pH at the output. Check the pH value corresponds to the following requirements :

Sodium concentration [Na+] of the sample	**output pH**
> 10 ppb	**> 9**
> 1 ppb	**>10**

If the pH is unsufficient, increase the ethanolamine concentration up to 50%.

Starting up :

The conditioning reagent injection starts with the pump when pressing the push button. The pump priming is done automatically.

❷ Pump tubing and cassette

The peristaltic pump is a one-channel unit powered by a synchronous motor. The dosage is adjustable by selecting appropriately sized pump tubing. The pump is designed to handle small rates of flow accurately and reproducibly, thus making it especially suitable for very demanding liquid-dosing tasks. It turns at a rate of 20 turns per minute.

The cassette is adjustable and of plug-in-type ; the bottom part (tubing bed) is equipped with two machined notches which position the flexible tubings securely in order to prevent excessive stretching or slacking.

The pump tubing should be tightened correctly on the rollers to avoid any sample return in the conditioning bottle.

The cassette is made of Delrin ; it is susceptible to chemical attack by strong acids and bases.

The pump tubing is designed especially for the cassette pump.

Tubings with a very small bore are equipped with special adaptator sleeves to facilitate connecting with nipples.

Each pump tubing is equipped with three coloured position markers. These serve to define the position of the tubing within the machined notches of the casstte ; in addition, the colour code of the marker identifies the size (ID/bore) of the corresponding tubing, hence its flowrate (ml/min). The tubing is reversible , each side lasting 90 days.

❸ Tubing replacement

Follow the procedure described below :

1. Press the push button to stop the pump.. (See Figure 9-1 for visual help).

2. Disconnect both tubing endings and let drain into a beaker.

3. Relax the cassette by pressing the cam lever down..

4.Release the cassette by pressing gently the snap lever sideways towards the pump roller.

5. Remove the cassette from the pump and then the old tubingd from the cassette.

6. Position a new pump tubing or the old one in the reverse side ; both markers must point upwards.

7. Press the right-hand side down until the lock snaps into position.

8. Connect the downstream tubing end to the corresponding nipple.

9. Connect the upstream tubing to the reagent bottle.

10. Press the push button to switch the pump on.

11. Increase the roller pressure stepwise by moving the cam lever upwards until the pump tubing draws water smoothly and evently.

12. Move the cam lever one additional step upwards to ensure optimal roller pressure.

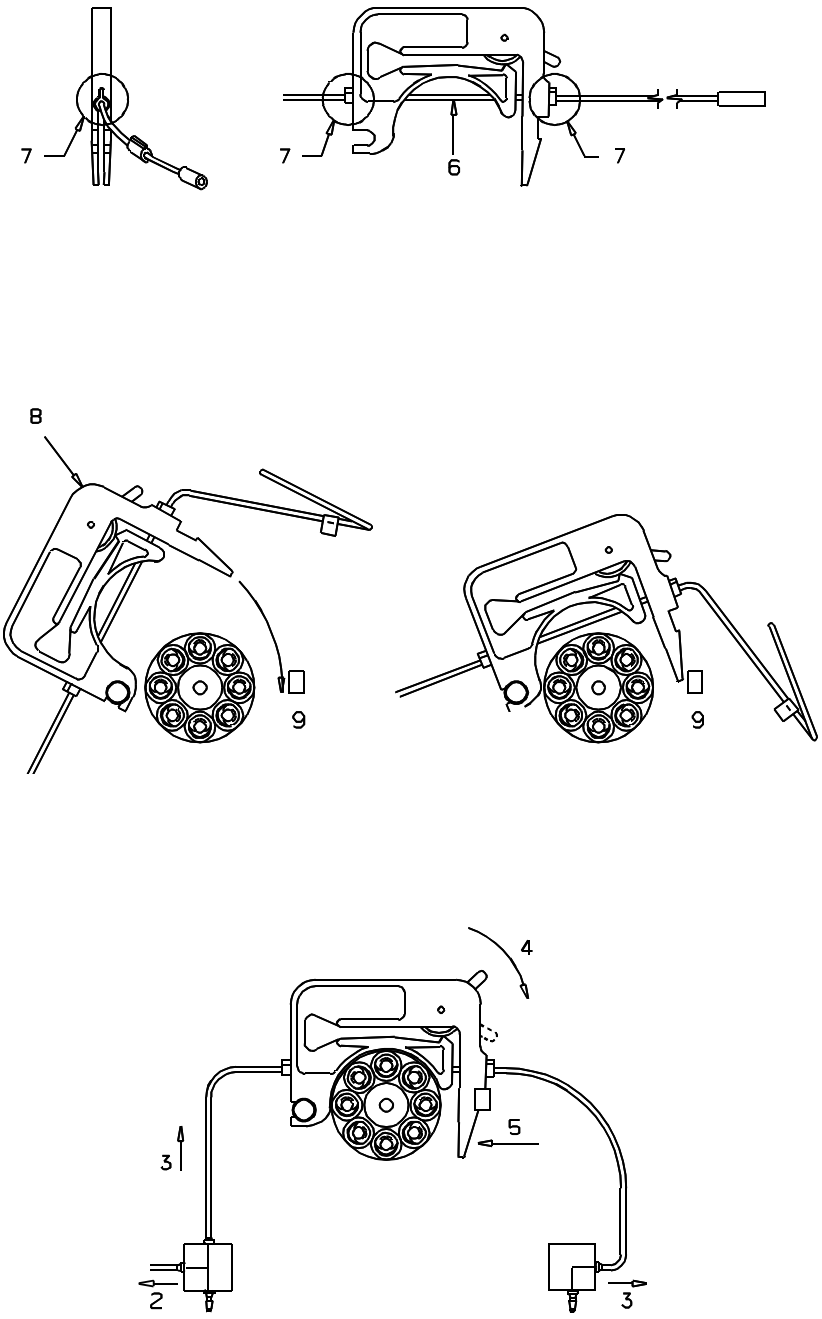


Figure 10-4 : Changing the pump tubing

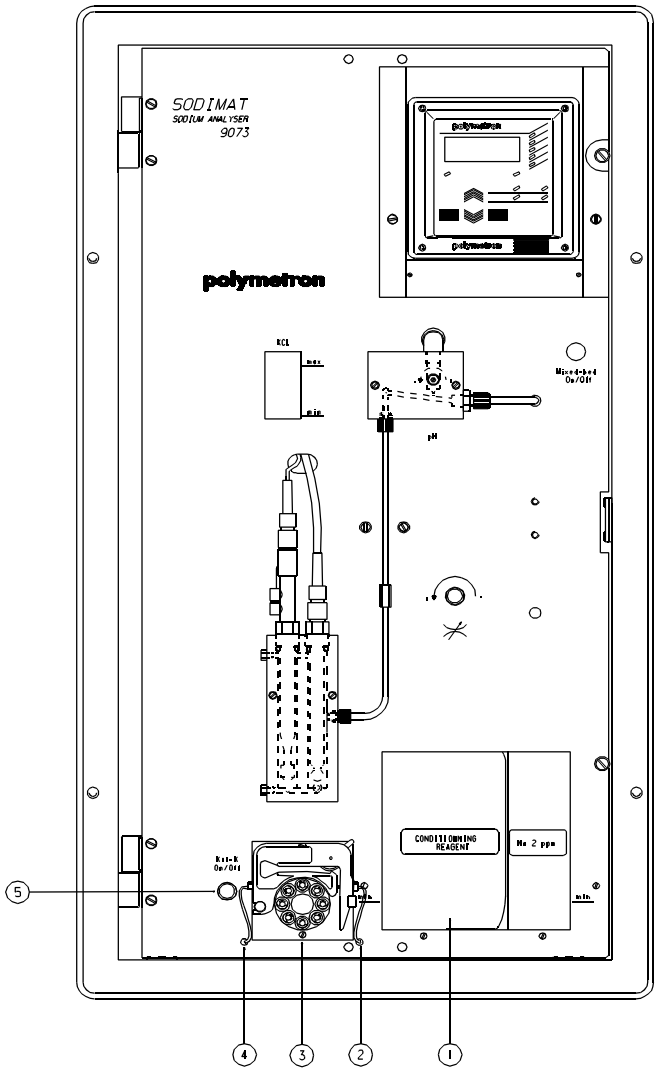


Figure 10-5 : Liquid conditioning AUTOCAL version - front view

1 : Conditioning reagent	4 : Suction tubing
2 : Pressure tubing	5 : Push button for the conditioning pump control
3 : Conditioning pump	

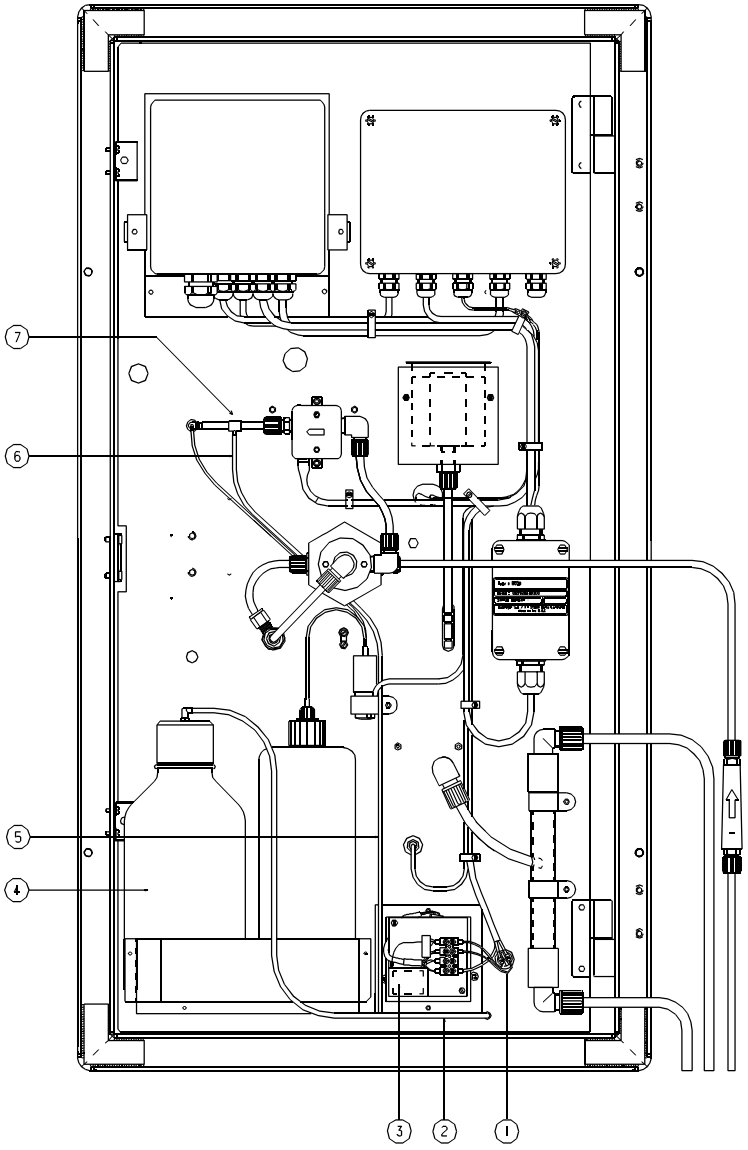


Figure 10-6 : Liquid conditioning AUTOCAL version - rear view

1 : Push button for conditioning pump control	4 : Conditioning reagent
2 : Suction tubing	5/6 : Pressure tubing
3 : Pump	7 : Injection tee for the conditioning reagent

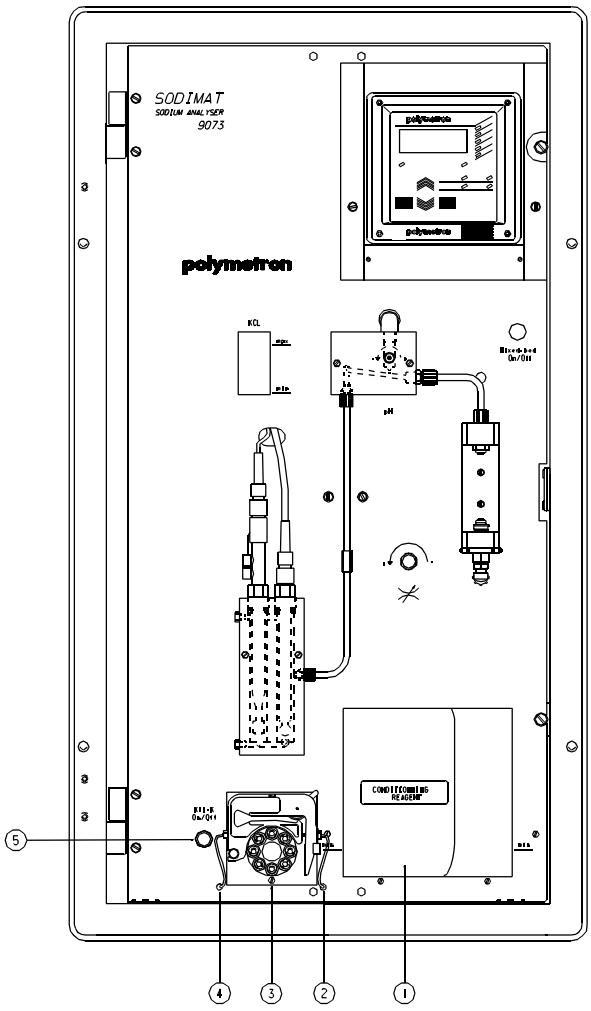


Figure 10-7 : Liquid conditioning CARCAL version - Front view

1 : Conditioning reagent	4 : Suction tubing
2 : Pressure tubing	5 : Push button for the conditioning pump control
3 : Pump	

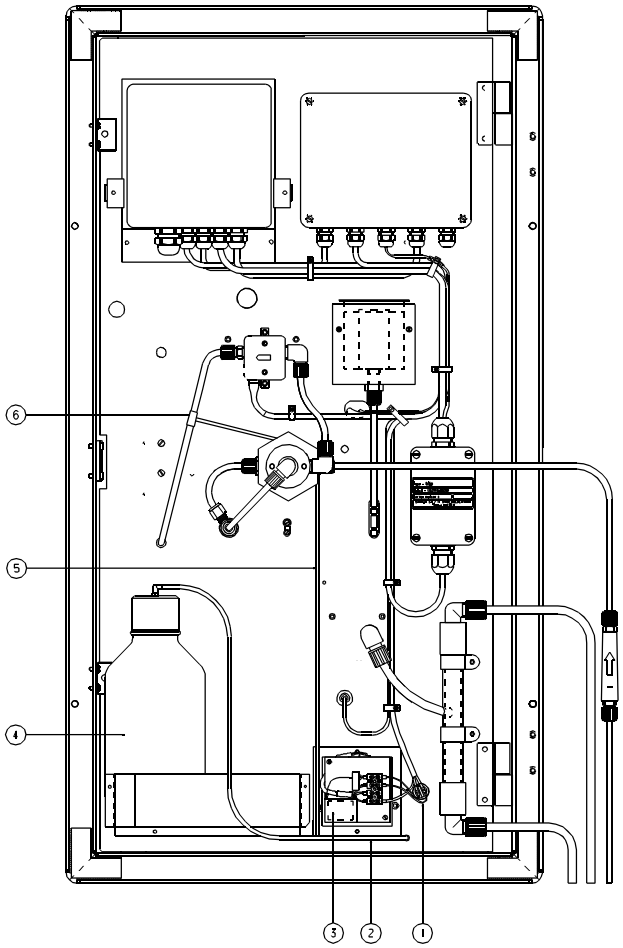


Figure 10-8 : Liquid conditioning CARCAL version - Rear view

1 : Push button for conditioning pump control	4 : Conditioning reagent
2 : Suction pipe	5 : Pressure tubing
3 : Pump	6 : Injection tee for the conditioning reagent

Appendix A : Spare parts list

Designation	Reference
2-year operation kit	**09073=A=8000**
FLOW METER	
Flow rate controller	09073=A=9803
Valve	696=146=001
MEASUREMENT	
Reference electrode	125=020=003
Measuring electrode	125=010=004
Cell	09073=A=9801
Temperature sensor	09073=C=0035
Transmitter	08941=A=0000
Measurement preamplifier	08350=A=8000
fitting for electrolyte supply	359016,00020
Electrolyte container cap	09073=A=0042
KCL 3 M reference electrolyte, 1 litre bottle	363140,01000
Electrode (reference or measuring) gasket	356207,00000
Temperature sensor gasket	356099,15055
Filter	363877,06000
GAZEOUS CONDITIONING	
"DIPA" equipped container	09073=A=9809
Non equipped bottle	09073=A=0310
Stainless steel tubing	09073=C=0015
Stainless steel tubing gasket	359099,15055
Float	09073=C=0025

LIQUID CONDITIONING (KIT K)	
50 Hz peristaltic pump	**08810=A=7050**
60 Hz peristaltic pump	**08810=A=7060**
Set of 6 pump tubings	**590=620=025**
Equipped canister	**09073=A=0445**
Non-equipped canister	**09073=A=0440**
AUTOMATIC CALIBRATION (AUTOCAL)	
Calibration micro-pump	**09073=A=9807**
Bulkhead pipe fitting for cap	**588=004=254**
Injection Te	**589=010=041**
CALIBRATION WITH CARTRIDGES (CARCAL)	
Box of CARCAL 20ppb	**359090,20020**
Box of CARCAL 200 ppb	**359090,20200**
Box of 12 filters	**359090,20000**
MIXED BED	
Mixed bed cartridge	**09073=A=0750**
Valve	**687=137=020**
ELECTRONICS	
Interface board	**08941=A=4000**
Interface complete	**09073=A=5000**
DOCUMENTATION	
French manual	**621=090=073**
English manual	**621=190=073**
German manual	**621=290=073**
Italian manual	**621=490=073**

Appendix B : Configuration table for the user

			User's configuration	
Command	**Function**	**Default value**	**Date**	**Date**
51	Type of temperature compensation	0		
61	Temperature value in manual compensation	-----		
101	Flowrate calibration	-----		
201	Calibration type	2		
211	Use of CARCAL cartridges			
215	Activates the calibration mode	0		
217	Time between two automatic calibrations	168		
220	pH value	7.0		
221	Number of calibration points	-----		
223	Frequency of calibration pump	0		
225	Concentration value of the calibration solution	2 ppm		
231	Concentration value of addition 1	------		
241	Concentration value of addition 2	------		
251	Drift value of the normality voltage	0.0		
261	Slope value	100		
271	Maximum time by calibration point	20		
411	Temperature value	------		
500	Activates limits	2		
505	Limit 1	0		

			User's configuration	
Command	**Function**	**Default value**	**Date**	**Date**
506	Limit 1 value	0.01		
507	Temporisation limit 1	0		
515	Limit 2	1		
516	Limit 2 value	999.9		
517	Temporisation limit 2	0		
591	Relay S1	0		
592	Relay S2	0		
593	Relay S3	1		
600	Analogue output	0		
611	Type of analogue output 1	0		
621	Lower end	0.01 ppb		
631	Upper end	999.9 ppm		
641	Temperature scale	1		
670	Output signal channel 1	0		
671	Measurement tracking	0		
672	Value chosen by the user	-----		
680	Output signal channel 2	0		
681	Memorization of the measured value	0		
682	Value chosen by the user	-----		
690	Generation on the analogue output	0		
800	Alarm transmission	0		
810	Use of RS232	0		
820	Type of data transmission	-----		
830	Data transmission for a measurement	-----		
840	Transmission speed	0		
900	Loads the default values	-----		
920	Access to Polymetron menu possible or impossible	---		
925	Sodium application	0		

930	Isothermal point	+20.0 mV		
935	Reference point concentration	1 ppb		
940	reference point voltage	-100 mV		
950	Mixed bed option	0		

Appendix C : Safety data sheet

C.1 DIISOPROPYLAMINE

IDENTIFICATION OF THE SUBSTANCE
Catalogue No : 803646 Product name : diisopropylamine for synthesis
COMPOSITION/INFORMATION ON INGREDIENTS
Cas no : 108-18-9 Molar mass : 101.19 Molecular formula : $C_6H_{15}N$ EC index no : 612-048-00-5 EINECS number : 203-558-5
HAZARDS IDENTIFICATION
Highly flammable. Irritating to eyes, respiratory system and skin.
FIRST AID MEASURES
After skin contact : wash off with plenty of water. Remove contaminated clothing. After eye contact : rinse out with plenty of water for at least 10 minutes with the eyelid held wide open. Summon eye specialist. After inhalation : fresh air. If swallowed : give plenty of water to drink, induce vomiting. Summon doctor.
FIRE FIGHTING MEASURES
Suitable extinguishing media : water, CO_2, foam, powder Special risks : combustible. Vapours heavier than air. Formation of explosivee mixtures possible with air. Keep away from sources of ignition. The following may develop in event of fire : NO_X.
MESURES EN CAS DE DISPERSION ACCIDENTELLE
Récupérer avec un absorbant pour liquides, par exemple le Chemizorb (R), le Rhonesec (R). Nettoyer la zone contaminée.
HANDLING AND STORAGE
Handling : no further requirements. Storage : store tightly closed, cool, dry, protected from air. Take measures to prevent electrostatic charging.
EXPOSURE CONTROLS/PERSONAL PROTECTION
Personal protective equipment : respiratory protection : required when vapours/aerosols are generated. Filter K (acc. to DIN 3181) for NH3 Eye protection : required Hand protection : required Industrial hygiene : change contaminated clothing. Application of skin-protective barrier cream recommended. Wash hands after working with substance.

PHYSICAL AND CHEMICAL PROPERTIES

Form : liquid
Colour : colourless
Odour : amine-like
Ph value: not available
Melting temperature: -96 ° C
Boiling temperature : 83 - 84 ° C
Ignition temperature: 295 ° C DIN51794
Flash point : - 17 ° C DIN51755
Explosion limits:
Lower : 1,5 vol%
Upper : 8,5 vol%
Vapour pressure : (20 ° C) 100 hPa
Density : (20 ° C) 0.72 g/cm^3
Solubility in :
water (20 ° C) soluble
organic solvents (20 ° C) soluble

STABILITY ET REACTIVITY

Conditions to be avoided : none
Substances to be avoided : oxidizing agents, acids
Hazardous decomposition products : none information available
Further information : hygroscopic, sensitive to air

TOXICOLOGICAL INFORMATION

Acute toxicity : DL50 (oral, rat) = 770 mg/kg
Further toxicological information :
After skin contact : severe irritations
After eye contact : severe irritation
After inhalation : irritations of the mucous membranes, coughing, and dyspnoea. Danger off skin absorbtion.

ECOLOGICAL INFORMATION

Do not allow to enter drinking water supplies, waste water, or soil !

DISPOSAL CONSIDERATIONS

Product : there are no uniform EC regulation for the disposal of chemicals or residues. Chemical residues generally count as special waste. The disposal of the latter is regulated in the EC member countries through corresponding laws and regulations, and in the federal republic of germany also by the individual federal states. We recommend that you contact either the authorities in charge or approved waste disposal companies which will advise you on how to dispose of special waste.
Packaging : disposal in accordance with local legal provisions.

The information contained herein is based on the present state of our knowledge. It characterizes the product with regard to the appropriate safety precautions. It does not represent a guarantee of the properties of the product.

C.2 HYDROFLUORIC ACID 40%

IDENTIFICATION OF THE SUBSTANCE

SIGMA ALDRICH product reference : 47590
Product name : hydrofluoric acid 40%

COMPOSITION/INFORMATION ON INGREDIENTS

Cas no : 7664-39-3
EC index no : 009-003-00-1

HAZARDS IDENTIFICATION

Highly toxic by inhalation, contact with skin and ingestion. Provokes severe burns. Possibility of reversible effects. Gene mutation possible.
Organs : liver - kidneys

FIRST AID MEASURES

After skin and eye contact, rinse immediately and abundantly with water and soap at least 15 minutes. Remove contaminated clothing and shoes Check the eyes have been rinsed by seperating the eyelids with the fingers.
After inhalation : fresh air. In case of asphyxia, put the patient on artificial respiration and put under oxygen if the patient has difficulty breathung. Do not vomit. If the patient is conscious, dilute 125 to 250 ml of milk or water.
Wash the contaminated clothing. Throw away the contaminated shoes.

FIRE FIGHTING MEASURES

Suitable extinguishing media : chemical dry powder
Methods to extinguish fire :
- Wear a respiratory apparatus and protective chlothing to avoid any contact with skin and eyes.
Possible fires and explosition dangers :
- toxic fumes liberated in contact with fire. Containers may explode if in contact with fire.

MEASURES IN CASE OF SPILLING

Leave the site. Wear an autonom respiratory apparatus, thick rubber boots and gloves. Absorbe with sand or vermiculite and store in closed containers for evacuation. Aerate the site and wash the place where it has been spilled.

HANDLING AND STORAGE

See next section.
Further information :
Any contact with glass, contrete or any other products containing silicium liberates silicon tetrafluoride. Any contact with cyanide and sulfides provokes cyanide and hydrogen sulphide highly toxic gas. A reaction with carbonates provokes an energic liberation of carbon dioxide. Violent reaction with N-piperidinphenyl, potassium manganate, bismuthic acid, fluoride, metallic oxides and any product reacting to water. Any contact with standard metals will liberate hydrogen which may cause fire or explosion. Mixtures (1:1) of hydrofluoric and nitricacids with glycerol, lactic acid or propylene glycol let the pressure ncrease in the containers and explode -ration time between 30 minutes to 12 hours).

EXPOSURE CONTROLS/PERSONAL PROTECTION

Wear respiratory mask required by the NIOSH/MSHA, resistant gloves against chemical products, security goggles and protective clothing. Use this product only under a hood for chemical vapours.
Showers and ocular fontains required.
Facial screen (20 cm minimum).
Avoid any contact with skin, eyes and clothing. Avoid prolonged or repeated exposition. Wash carefully after manipulation.
Poison; Corrosive. Gene mutation possible.
Keep the bottle closed and in a dry, fresh room.

PHYSICAL AND CHEMICAL PROPERTIES

Form : liquid
Colour : colourless
Flash point : none
Vapour pressure : 25 MM (20°C)
Vapour density : 1,27
Specific weight : 1.150

STABILITY ET REACTIVITY

Incompatibilities :
acids
Do not use glass to pack
Avoid any contact with metals
Sensitive to light
Keep away from sun and heat
Alkaliferous metals
Combustion or dangerous decomposition of products :
Hydrofluoric gas

TOXICOLOGICAL INFORMATION

Severe effects :
- lethal by inhalation, ingestion or contact with skin. This product destructs seriously mucous membrane, respiratory, eye and skin tissues.
Inhalation provokes spasms, inflammations, larnx and bronchi oedema , chemical pneumonia and pulmonary oedema.
After exposition, the effects are : a burning sensation, cogh, difficult breathing, laryngitis, short of breath, headache, nausea and vomiting.
As far as we know, the chemical, physical and toxocogical properties of this product have not been deeply researches.

Chronic effects :
- laboratory test have revealed gene mutation effects.
Organs : liver, kidneys

ECOTOXICOLOGICAL INFORMATION

No data available yet.

DISPOSAL CONSIDERATIONS

dissolve carefully the product with water. Neutralize immediately with sodium carbonate or if the product is not entirely disssolved, add calcium chloride in quantity to precipitate the fluoride or the carbonate. Filter the precipitation and dispose it in a discharge for dangerous waste.

TRANSPORT INFORMATION

Contact Fluka Chemical company for information.

The information contained herein is based on the present state of our knowledge. It characterizes the product with regard to the appropriate safety precautions. It does not represent a guarantee of the properties of the product. Polymetron is not responsible for any damage caused by the use of this product.

C.3 AMMONIA SOLUTION (about 35% NH_3)

PHYSICAL PROPERTY	
SPECIFIC GRAVITY	0.88
SOLUBILITY IN WATER	Miscible
VAPOUR PRESSURE	330 mm Hg at 0◦C
VAPOUR DENSITY (air = 1)	0.6
	pungent odour
FIRE AND EXPLOSION HAZARD	Not applicable
HEALTH HAZARDS	
	Classification of risk-corrosive Irritating to eyes Irrritating to respiratory system Irritating to skin Causes severe burns Causes severe internal damage if swallowed minimum lethal dose (LD50) = 350mg/kg oral rat. Occupational exposure standard, long term exposure limit (8hour TWA) 18mg m^{-3} (25ppm). Keep out of reach of children.
SAFETY PRECAUTIONS - FIRST AID	
EYES	In case of contact with eyes rinse immediately with plenty of water and obtain medical attention.
LUNGS	Remove from exposure, rest and keep warm. In severe cases, or if exposure has been great obtain medical attention.
MOUTH	Wash out mouth thoroughly with water and give plenty of water to drink. Obtain medical attention.
SKIN	Drench the skin thoroughly with water and give plenty of water to drink. Obtain medical attention.

CHEMICAL HAZARD AND STABILITY	
	Avoid contact with acids and oxidising agents. May react violently with oxygen and oxidising reagents. Reacts violently with boron halides and mercury. Reacts violently or produces explosive materials with halogens and their compounds.
PROTECTIVE MEASURES	
RESPIRATOR	Self contained breathing apparatus**.**
GLOVES	Rubber or plastic
EYE PROTECTION	Goggles or face shield. If handling large quantities use plastic apron, sleeves and boots. Use a fume cupboard.
SPILLAGE HANDLING	
WARNING **Wear appropriate clothing. Evacuate area as necessary.**	
	If local regulations permit, mop up with plenty of water and run to waste, diluting greatly with running water. Otherwise transfer to container and arrange removal by disposal company. Wash site of spillage thoroughly with detergent and water. For large spillages liquids should be contained with sand or earth and both liquids and solids transferred to salvage containers. Any residues should be treated as for small spillages. If material has entered surface drains it may be necessary to inform Local Authorities, including fire services if flammable.
STORAGE AND HANDLING REQUIREMENTS	
	Store in a cool place, cool containers before opening. It is advisable to place a cloth over the closure before attempting to open the bottle. UK labelling requirements include those for schedule 2 poisons under the Pharmacy and Poisons Act 1933.

The information on this sheet is believed to be correct at the time of collation. The details should be reviewed periodically and should be checked for special uses.

C.4 : ETHANOLAMINE

PHYSICAL AND CHEMICAL PROPERTIES	
Form **Colour** **Odor**	**Liquid** **Colourless** **Ammoniac weak**
Ph value at 100 g/l H_2O (20°C)	**~ 12.3**
MELTING POINT	**10°C**
BOILING POINT	**167-173 °C**
IGNITION TEMPERATURE	**420 °C**
FLASH POINT	**93 °C**
EXPLOSION LIMITS	**NOT AVAILABLE**
VAPOR PRESSURE (20°C)	**0.5 mbar**
DENSITY (20°C)	**1.02 g/cm^3**
SOLUBILITY IN WATER (20°C)	**soluble**
HAZARDS IDENTIFICATION	
	Harmful if inhaled. Irritating for eyes, respiratory organs and skin.
FIRST AID MEASURES	
	After inhalation : fresh air. Summon doctor. **After skin contact : Wash off with plenty of water. Remove contaminated clothing.** **After eye contact : Rinse out with plenty of water with the eyelid held wide open. Summon eye specialist.** **After ingestion : Make victim drink plenty of water, induce vomiting, summon doctor.**
STABILITY AND REACTIVITY	
Conditions to be avoided	**High heating**
Substances to be avoided	**Strong acids and oxidizing agent**
Hazardous decomposition products	**nitrous gas**
Other information	**sensitive to air, hygrospic**
FIRE FITHING MEASURES	
Suitable extinguishing media	**water, CO2, foam , powder**
Special risks	**Combustible. In case of fire, risk of harmful vapors. In case of fire, risk of nitrous gas.**

ACCIDENTAL RELEASE MEASURES	
Person-related precautionary measures	**Do not inhale vapors.**
Procedures for cleaning/absorption	**Use a liquid absorbant tissue, par example Chemizorb. Clean up affected area.**
EXPOSURE CONTROLS/PERSONAL PROTECTION	
Personal protective equipment	**respiratory protection required if vapors are generated.**
Eye protection	**required**
Hand protection	**required**
Industrial hygiene	**Change contaminated clothing. Application of skin-protective barrier cream recommended; Wash hands after working with substance.**
TOXICOLOGICAL INFORMATION	
Acute toxicity	**DL50 (oral, rat) : 2100 mg/kg**
Further toxicological information	**in case of vapor inhalation : mucous irritation, coughing and .breathing troubles In case of skin contact : irritation. In case of eye contact : irritation in case of ingestion of high quantities : vomiting, nausea**
ECOLOGICAL INFORMATION	
Ecotoxic effects	**Toxicity on fish CL50 : 525 mg/l**
Further ecologic data	**Biodegradable. Easily removable. In case of appropriate evacuation, there should be no perturbations in the sewerage plants biologicallly adapted.**
DISPOSAL CONSIDERATIONS	
Product	**There are no uniform EC Regulations for the disposal of chemicals or residues. Chemical residues generally count as special waste. The disposal of the latter is regulated in the EC member countries through corresponding laws and regulations. We recommend that you contact either the authorities in charge or approved waste disposal companies which will advise you on how to dispose of special waste.**
Packaging	**Disposal in compliance with official regulations. Handle contaminated packaging in the same way as the substance itself. If not officially specified, non-contaminated packaging may be treated like household waste or recycled.**

The information containedherein is based on the present state of our knowledge. It characterizes the product with regard to the appropriate safety precautions. It does not represent a guarantee of the properties of the product.