BAMOPHOX 450 E - M

Dissolved Oxygen monitor and controller

INSTRUCTION MANUAL

Dissolved Oxygen monitor and controller

BAMOPHOX 450 E & M

(Technical information and Manual for LOGGER /RS422 version are on a specific document)

Content

1. TECHNICAL FEATURES

Displayed parameters:	Measurement values - Configuration Menu - Temperature value
Display:	Back lighted - 2 lines of 16 alphanumerical characters; 9.2 mm high
Indication:	LED alarms status
Configuration:	8 push buttons keyboard on the front - Keyword protected
Scales:	0 to 100% – or mg/L
Accuracy/measurement:	± 0.3%
Accuracy/temperature:	± 0.3°C
Probe input:	Screw connectors, IP40
T° compensation:	Automatic with an input for a 3 wires Pt 100 Ohm/0°C, range 0…100°C
	Manually from 0 to 100°C
Relay outputs:	4 closing contacts (Silver alloy), voltage free
Thresholds:	3 programmable independent thresholds - with adjustable hysteresis 0…100%
	and adjustable timer from 0 to 9999 sec
Output relay (S4)	Common alarm signal for:
	- Too long injection – temperature...
	- over scale measurement or open loop
	- Pt 100 Ohm dysfunction
	- or probe cleaning function
Contact:	Initial resistance 100 milliOhm as a maximum (voltage drop 6 V DC 1 A)
	Rated at 831 V AC / 3 A / 277 V AC ; 90 W / 3 A / 30 V DC
	Switching capacity (minimum) 100 mA, 5 V DC
	(depending of switching frequency, ambient conditions, accuracy)
	Mechanical lifetime (minimum) 5×10^6 operations (180 commutation/min)
	Electrical life time (minimum) 2×10^5 (20 comm./min) [3 A, 125 V AC], [3 A, 30 V DC]
	and 10^5 (evaluated charge) for 3 A, 125 V AC
ON/OFF Regulation:	Pulse time 0…9999 sec - High and low proportional bandwidth, high and low dead zones
PID Regulation:	Proportionality 0…200%, - Integrant and Derivative: 0…999 second
Calibration sequence:	Regulation on standby, relay outputs inhibited, analogical outputs stand on last values
Self-cleaning program:	Frequency and duration settings, with regulation inhibited and analogical outputs standing on last values
Measurement output:	0/4-20 mA (maxi 600 _) proportional to measurement, galvanic insulated
T° output / PID:	0/4-20 mA (max 600 _), scaling 0…100°C, galvanic insulated
Program testing:	Simulation through the menu on measurement, temperature, PID and relay outputs
Main power supply:	230 V AC / 50-60 Hz [other on request] - Consumption 10 VA
Models:	Panel mounting, IP65, 72 x 144 mm, connections on screw terminal IP40
	DIN Rail mounting, connections on screw terminal IP40, only for blind monitor
	Wall mounting, IP65, cable glands, connections on screw terminal

OPTION (RS 422 + Logger)

Communication:	RS422 output, J-BUS link, binary slave mode, 2400 to 9600 bauds
Data Logger:	Cycle average measurement record, with a programmable period,
	150000 records on MMC (multi media card) / External driver necessary for reading

2. DIMENSIONS

Extension terminal:
identical to the panel
or wall mounting
BAMOPHOX
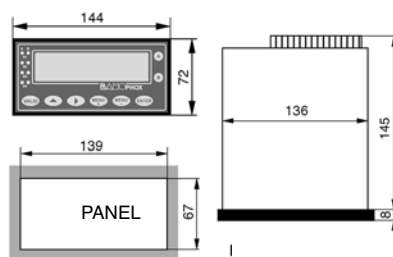
Panel mounting instrument
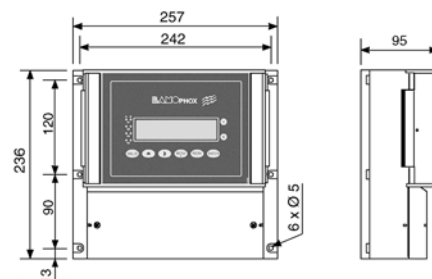
Wall mounting instrument

3. WIRING

WALL MOUNTING MODEL

OPTION :
LOGGER
&
RS 422

PANEL MOUNTING MODEL

OPTION :
LOGGER
*(access by the
upper cover)*
&
RS 422

RS 422

Screwing terminals

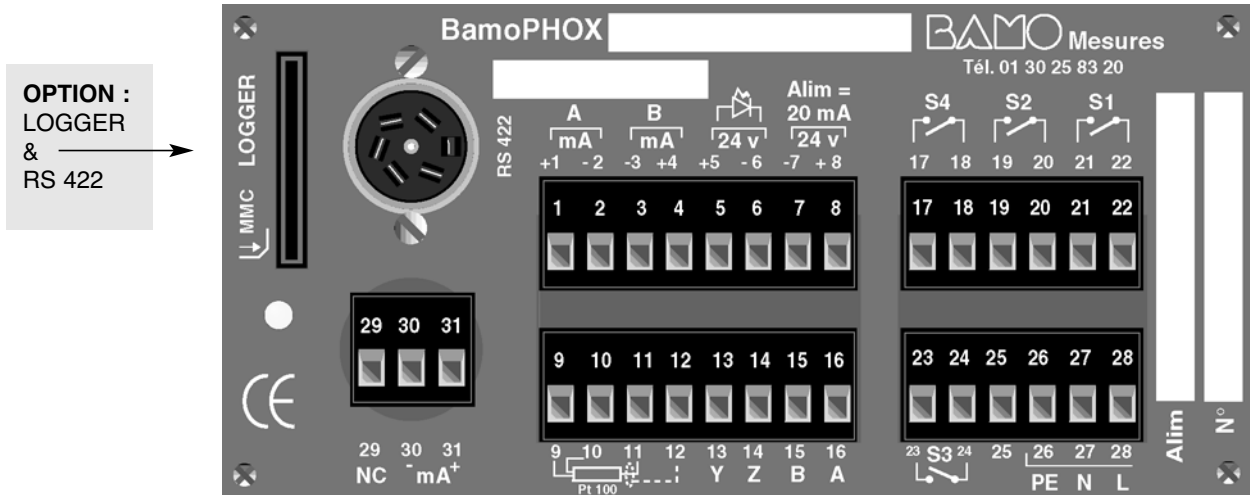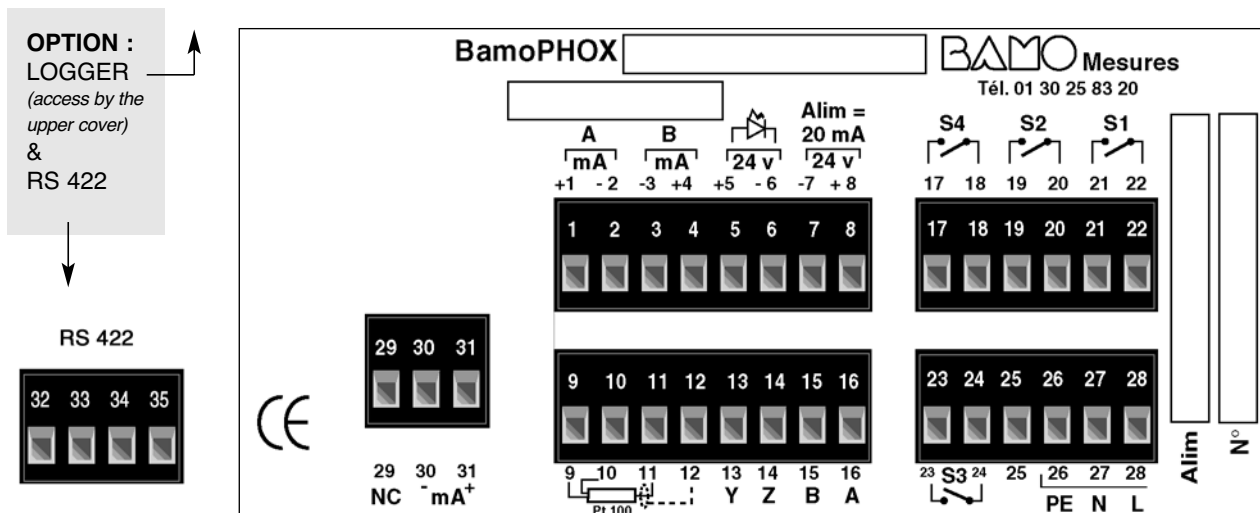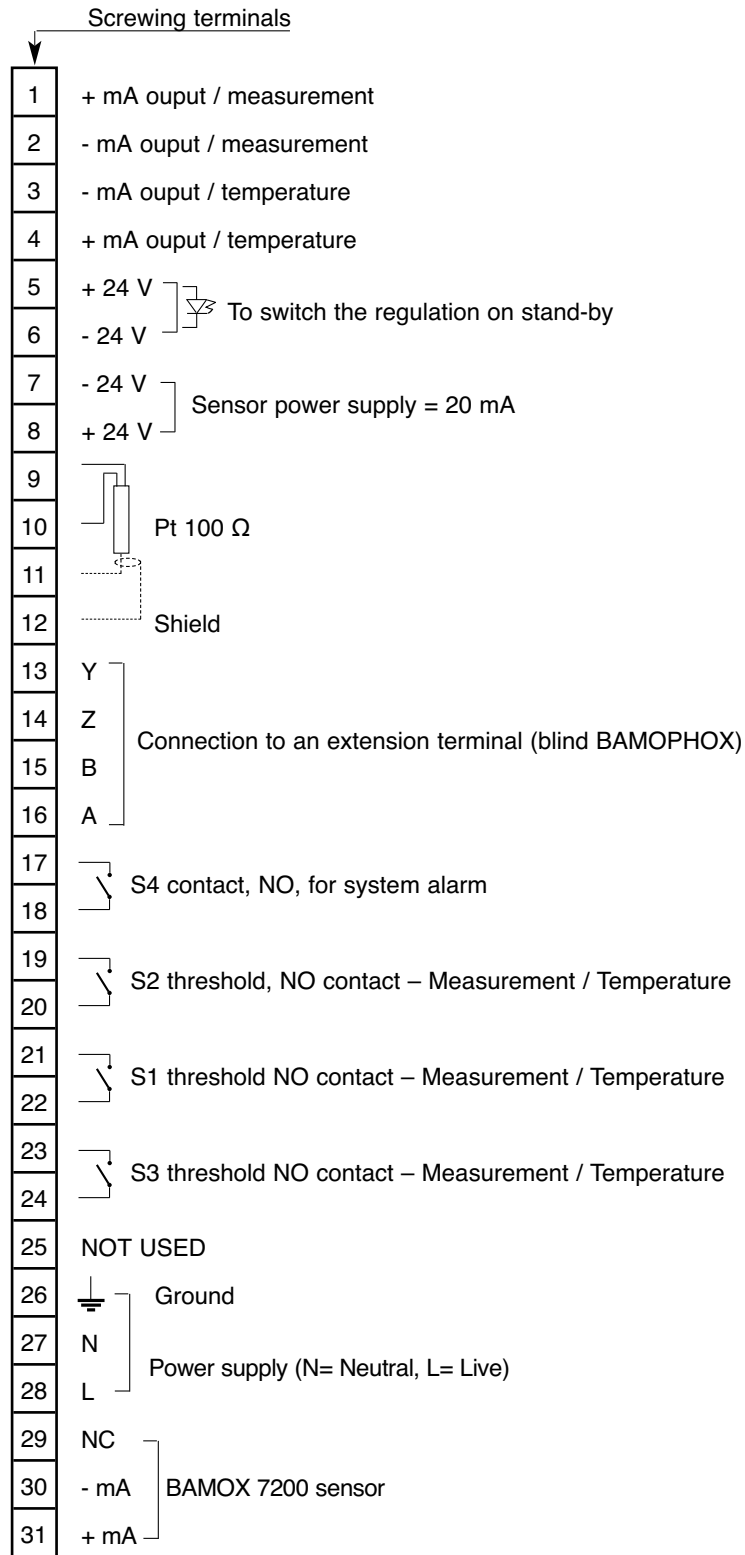|	
1	+ mA ouput / measurement
2	- mA ouput / measurement
3	- mA ouput / temperature
4	+ mA ouput / temperature
5	+ 24 V ⌉
6	- 24 V ⌋ To switch the regulation on stand-by
7	- 24 V ⌉
8	+ 24 V ⌋ Sensor power supply = 20 mA
9	⌉
10	⌋ Pt 100 Ω
11	
12	Shield
13	Y ⌉
14	Z	
15	B	Connection to an extension terminal (blind BAMOPHOX)
16	A ⌋
17	⌉
18	⌋ S4 contact, NO, for system alarm
19	⌉
20	⌋ S2 threshold, NO contact – Measurement / Temperature
21	⌉
22	⌋ S1 threshold NO contact – Measurement / Temperature
23	⌉
24	⌋ S3 threshold NO contact – Measurement / Temperature
25	NOT USED
26	⏚ ⌉ Ground
27	N	
28	L ⌋ Power supply (N= Neutral, L= Live)
29	NC ⌉
30	- mA	BAMOX 7200 sensor
31	+ mA ⌋

Wiring from wall or panel mounting BAMOPHOX to an Extension terminal BAMOPHOX

- Maximum length cable
  500 m

- Wire specifications:
  Mains cable or 4 wires shielded cable
  ≥ 0,25 mm^2 cross section

Main unit			
13	14	15	16
Y	Z	B	A

Extension terminal			
13	14	15	16
Y	Z	B	A
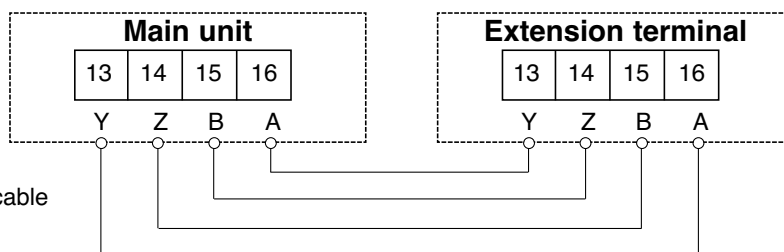
4. FRONT PANEL

S1, S2, S3, and S4
indicate relays status:

LED lighting = contact ON
LED OFF = contact OFF
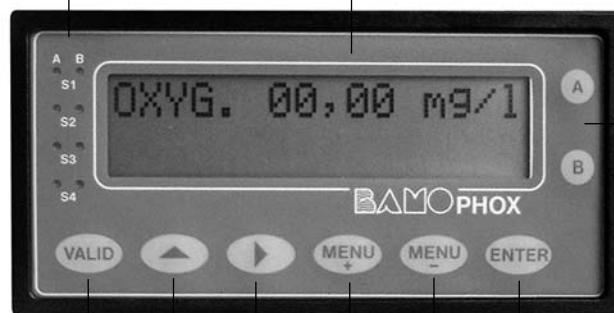LED flashing = Timer in use

2 lines /16 alphanumeric characters
9.22 mm high - Back lighted

Key **"A"**
To display the parameters of upper line.
(main BAMOPHOX)

Key **"B"**
To display the parameters of lower line.
(Extension blind BAMOPHOX)

OXYG. 00,00 mg/1

BAMOPHOX

"VALID" key
To save the parameters on EPROM
when it asks:

VALIDATION ?

Caution, when you press this key,
all parameters are saved.
(previous data programmation
will be overwrited).
If you are not sure of any modification,
do not press the VALID key,

To change parameters of data capture:

Numéric input increase the
flashing digit (loop 0 after 9).

Reverse the choice Yes / No,
Up/Down, 0-20 mA / 4-20 mA etc.

To go to the next display or to change a
value.

"ENTER" key
To change the step displayed menu.
At the last step, it comes back to the
first line.

"MENU - " key
To move the cursor during configuration.
At the last digit, comes back on the first
one.

"MENU +" key
To go to the next menu.

Pushing simultaneously both keys
"MENU +" and **"ENTER"**
allows a fast return to measurement display.

SCROLLING MENU

00.00   m/L (Display during measurement)

MENU +

ABOUT BAMOPHOX

MENU +

CONSULTATION / MODIFICATION

MENU +

MEASUREMENT PARAMETERS

MENU +

ATMOSPHERIC PRESSURE

MENU +

SALINITY

MENU +

ADJUST ALARM 1

MENU +

ADJUST ALARM 2

MENU +

ADJUST ALARM 3

MENU +

RELAY REGULATION

MENU +

REGUL. PID

MENU +

OUTPUT mA Oxygen

MENU +

OUTPUT mA TEMP.

MENU +

TEMPERATURE

MENU +

FORCED RELAY

MENU +

ADJUST ALARM

MENU +

CLEANING PROBE

MENU +

LANGUAGE

MENU +

ABOUT Bamophox

ENTER ABOUT BAMOPHOX

ENTER VERSION 2.04

ENTER SERIAL N°

ENTER 20|451 05|

CONSULTATION / MODIFICATION

CONSULTATION

▲

MODIFICATION

ENTER CODE ? 0000   ▲   ▶

ENTER CODE ? 5105

ENTER TIME : 30 mn

MENU +

Last 4 digits (of serial number) are the key code to access the MODIFICATION menu.
When wrong code is entered, a message **"ERROR"** appears during 3 seconds.

After 30 minutes, the display returns automatically to the measurement mode.

From this mode MODIFICATION it is easy to return back to measurement for testing the relay outputs and regulation mode.
Once in modification mode, **reach measurement display and press ENTER**

ENTER

ENTER FORCED MEASURE

00,00 mg/l +20°C   ▲   ▶   (one digit is flashing) Modify the value. Immediately the instrument acts within the configuration (thresholds, regulation, analog outputs ...).

When PID regulation is activated, the display shows the PID %

ENTER

ENTER FORCED PID

00,00 mg/l 0,000%   ▲   ▶   (one digit is flashing) Modify the value. Immediately the instrument acts within the configuration.

To test the analog output (mA) on PID mode: the PID should be active and in MANUAL mode.

ENTER

Press ENTER to cancel the test mode and to go back to the measurement mode.

MEASUREMENT PARAMETERS

ENTER

ENTER

DISPLAY   ▲   **% / mg /l**
                           Choose the right scale, confirm with "Enter" then save.

                    ▲   ▶   (OFFSET TEMPERATURE)
                           Enter the difference between real value
                           and reference temperature
OT   +00,00 °C   Example: Real value 22 °C
                                         Reference   20 °C
                                         Entry   **+2,00** °C

ENTER

SAVING ?

VALID

ATMOSPHERIC PRESSURE

ENTER

P = 1013 hPa   ▲   ▶   The blinding digit has to be modified, if necessary.
                           Confirm with "Enter" then save.

ENTER

SAVING ?

VALID

SALINITY

ENTER

g/kg = 00,00   The blinding digit has to be modified, if necessary.
                           Confirm with "Enter" then save.
ENTER   Salinity is expressed in [g/ kg] NaCl solution

SAVING ?

VALID

ADJUST ALARM 1 ————————→ MENU + ————→ ADJUST ALARM 2

ENTER

ALARM 1 **ON/OFF** ▲

ENTER

ALARM 1 **MEASURE/TEMP** ▲ **MEASURE**= Threshold against pH/mV measured value
TEMP.= Threshold against temperature measured value

ENTER

ALARM 1 LOW/HIGH ▲ **HIGH**= Contact closes when value goes over the limit
LOW= Contact closes when the value goes under the limit

ENTER

ON **00,00** mg/l / °C ▲ ▶ To close the contact S1 at this value

ENTER

OFF **00,00** mg/l / °C ▲ ▶ To open the contact S1 at this value

ENTER

DELAY UP **ONI/OFF** ▲ Delay (or no delay) before to close the contact S1

ENTER

TIME **0000** SEC ▲ ▶ Delay time to close the contact S1

ENTER

DELAYDOWN **ON/OFF** ▲ Delay (or no delay) before to open the contact S1

ENTER

TIME **0000** SEC ▲ ▶ Delay time to open the contact S1

ENTER

SAVING ?

VALID

ADJUST ALARM 2 ————————→ MENU + ————→ ADJUST ALARM 3 ➔ please, see page 11

ENTER

ALARM 2 **ON/OFF** ▲

ENTER

ALARM 2 **MEASURE/TEMP** ▲ **MEASURE**= Threshold against pH/mV measured value
TEMP.= Threshold against temperature measured value

ENTER

ALARM 2 LOW/HIGH ▲ **HIGH**= Contact closes when value goes over the limit
LOW= Contact closes when the value goes under the limit

ENTER

ON **00,00** mg/l / °C ▲ ▶ To close the contact S2 at this value

ENTER

OFF **00,00** mg/l / °C ▲ ▶ To open the contact S2 at this value

ENTER

DELAY UP **ONI/OFF** ▲ Delay (or no delay) before to close the contact S2

ENTER

TIME **0000** SEC ▲ ▶ Delay time to close the contact S2

ENTER

DELAYDOWN **ON/OFF** ▲ Delay (or no delay) before to open the contact S2

ENTER

TIME **0000** SEC ▲ ▶ Delay time to open the contact S2

VALID **SAVING ?**

ADJUST ALARM 3 ——————— (MENU +) ———➤ RELAY REGULATION ➤

(ENTER)

ALARM 3 **ON/OFF** ▲

(ENTER)

ALARM 3 **MEASURE/TEMP** ▲   **MEASURE**= Threshold against pH/mV measured value
TEMP.= Threshold against temperature measured value

(ENTER)

ALARM 3 LOW/HIGH ▲   **HIGH**= Contact closes when value goes over the limit
LOW= Contact closes when the value goes under the limit

(ENTER)

ON **00,00** mg/l / °C ▲ ▶   To close the contact S3 at this value

(ENTER)

OFF **00,00** mg/l / °C ▲ ▶   To open the contact S3 at this value

(ENTER)

DELAY UP **ONI/OFF** ▲   Delay (or no delay) before to close the contact S3

(ENTER)

TIME **0000** SEC ▲ ▶   Delay time to close the contact S3

(ENTER)

DELAY DOWN **ON/OFF** ▲   Delay (or no delay) before to open the contact S3

(ENTER)

TIME **0000** SEC ▲ ▶   Delay time to open the contact S3

(ENTER)

SAVING ?

(VALID)

Increasing measured value

Measured value — High alarm ON / High alarm OFF / Time — Closed contact

Measured value — Time — Closed contact — Delay before to close the contact

Decreasing measured value

Measured value — Low alarm ON / Low alarm OFF / Time — Closed contact

Measured value — Time — Closed contact — Open the contact

RELAY REGULATION → **MENU +** → REGUL. PID →

ENTER

ON/OFF MODE
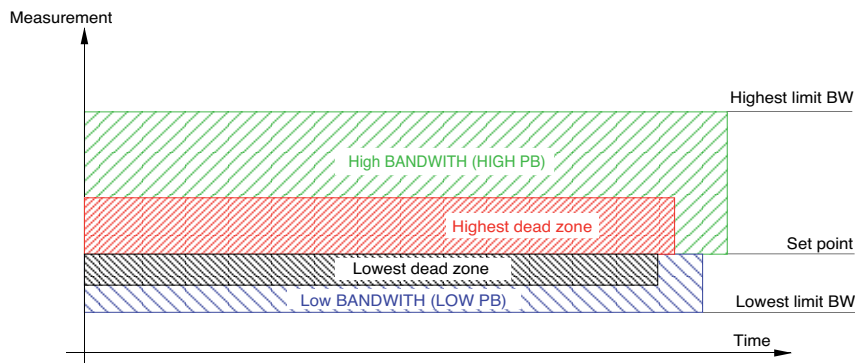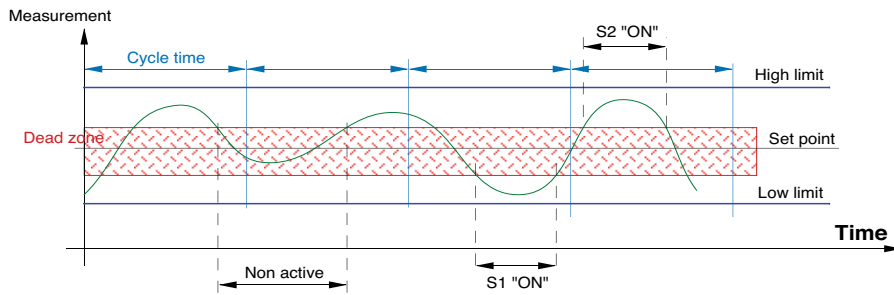
ENTER

ENTER

REGUL. PID

ENTER
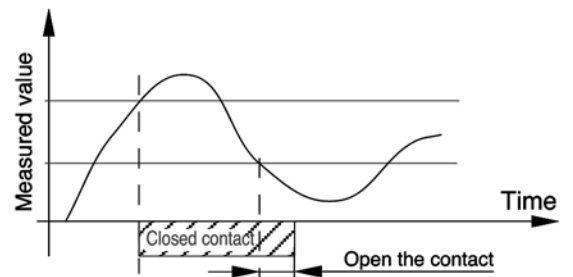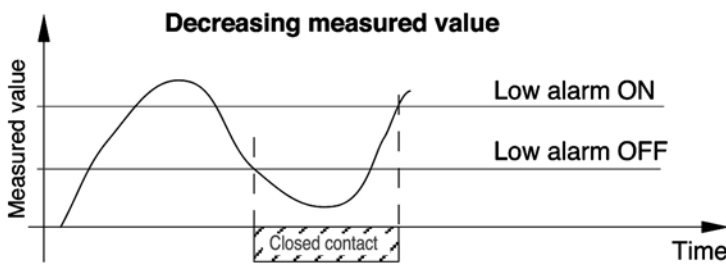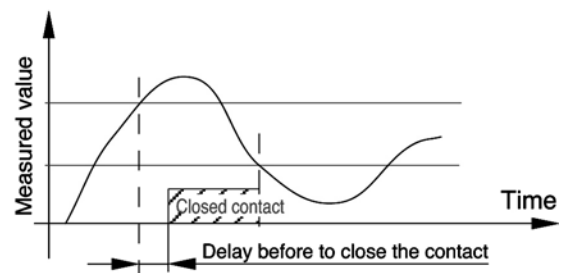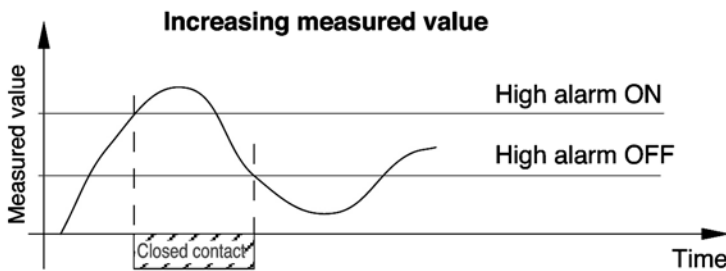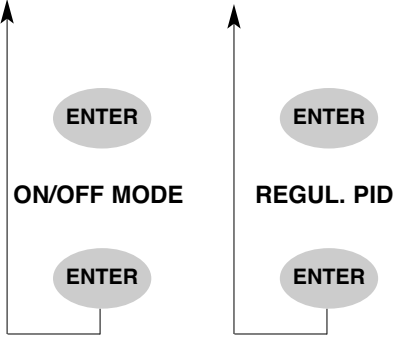
Indicates when S1 or S2 are "ON"
Back to "ADJUST ALARM" to switch
OFF S1 or S2

Indicates when "REGUL. PID" is
operating
Back to "REGUL. PID" menu
to switch it OFF

REGUL **ON/OFF** ▲

ENTER

SET VAL. **00,00** mg/l ▲ ▶ Set point

ENTER

T. CYCLE **0000** SEC ▲ ▶ Cycle time

ENTER

HIGH PB **00,00** mg/l ▲ ▶ Highest limit for proportional bandwith

ENTER

LOW PB **00,00** mg/l ▲ ▶ Lowest value for dead zone

ENTER

H IGH DZ **00,00** mg/l ▲ ▶ Highest value for dead zone

ENTER

LOW DZ **00,00** mg/l ▲ ▶ Lowest value for dead zone

ENTER

SAVING ?

VALID

Caution: On S1 you set up the lowest value for proportional bandwith and respectively S2 for the highest value.

Measurement

Cycle time   S2 "ON"
                                      High limit
Dead zone   Set point
                                      Low limit
                            Time
Non active   S1 "ON"

Measurement

Highest limit BW
High BANDWITH (HIGH PB)
Highest dead zone
                    Set point
Lowest dead zone
Low BANDWITH (LOW PB)   Lowest limit BW
                    Time

REGUL PID ——— MENU + ———→ Output mA Oxygen ——→ Please see page 14

This operating mode allows a PID regulation with an analogic output 0/20 or 4/20 mA

REGUL **ON/OFF** ▲ To switch ON or OFF the regulation mode

ENTER

REGUL **AUTO/MANU** ▲ MANU=MANUAL to be able to check the relays output

ENTER

SET VAL **00,00 mg/l** ▲ ▶ Set point value

ENTER

GAIN : **0,000** ▲ ▶ Gain setup (see also ADJUST PID PARAMETERS)

ENTER

T.i : **0050** Sec ▲ ▲ Integrant setup

ENTER

Td : **0012** Sec ▲ ▶ Derivative setup

ENTER

ACTION: **DIRECT/REVERSE** ▲

ENTER

OUTPUT **4/20 mA** / **0/20 mA** ▲

VALID

SAVING ?

To switch the PID regulation on stand-by, please input 24 V= 20 mA on terminals 5(+) and 6(-).

ADJUST PID PARAMETERS

In order to determinate the setup values for PID regulation, we recommend to use the Ziegler-Nichols open loop method

Proceed as following:

- Connect a recorder to the analogic measurement output or write the reading measurement values for then to draw the graph $f_{(time)}$
- Switch on the PID regulation in MANUAL mode
- Reach to and keep close the measurement value to the set point, adjusting the PID output
- Apply on ΔCde a step of 10 % (for instance) on the analogic output (Cde).

Example: if the value is 30,00 %, apply 40,00 %

- Note on the graph the corresponding timing.
- Determinate on this graph both t ant T:
  - t = delay of response
  - T = Time corresponding to the same variation in % of measurement (Δm) and the analogic output (ΔCde), Δm = ΔCde. This value may be found out on the slope.

- Modify the PID parameters as following:

Regulation	Gain	Ti(s)	Td(s)
PID	1,2 x T/t	2 x t	0,5 x t
PI	0,9 x T/t	3,3 x t	0
P	T/t	9999	0

Output mA Oxygen → (MENU +) → Output mA TEMP.

Measurement signal copy on the analog output

ENTER

HIGHER **00,00** mg/l ▲ ▶ Value corresponding to 20,00 mA

ENTER

LOWER **00,00** mg/l ▲ ▶ Value corresponding to 00,00 or 04,00 mA

ENTER

OUTPUT **4/20 mA** / **0/20 mA** ▲ Output type

ENTER

SAVING ?

VALID

Output mA TEMP. → (MENU +) → TEMPERATURE

Caution: If PID regulation is active, this step menu would not appears

ENTER

HIGHER **0000** °C ▲ ▶ Value corresponding to 20,00 mA

ENTER

LOWER **0000** °C ▲ ▶ Value corresponding to 00,00 or 04,00 mA

ENTER

OUTPUT **4/20 mA** / **0/20 mA** ▲ Output type

ENTER

SAVING ?

VALID

TEMPERATURE → (MENU +) → CALIBRATION → Please see page 15

ENTER

AUTO: A Pt 100 probe should be connected

MEASURE : **AUTO / MANUAL** ▲ **MANUAL**: Without Pt 100 probe
Manualy entered temperature value

ENTER

FLUIDE T. + **0000** °C ▲ ▶ (MANUAL mode)

ENTER

SAVING ?

VALID

CALIBRATION — (MENU +) ⟶ FORCED RELAYS ⟶

(ENTER)

SOL ZERO

Immerse the sensor in a solution of 17 g of sodium sulphite anhydrous (Na2SO3) in distilled water.
See also the probe manual.

(ENTER)

PROBE IN AIR

Let the probe in the air, moving it to have a better exchange.
See also the probe manual

(ENTER)

COEF **0000**

Display of the gain

The value should be close to the full-scale value

(ENTER)

ERROR

Error message appears when the gain value is too high or too small.

(MENU)

When Error message occurs:
- press "MENU" to be back to CONFIGURATION

Proceed to a new calibration sequence.

If the ERROR message appears again:
- cancel the calibration sequence, go back to measurement
- check the dirtiness of the sensor
- replace the membrane if necessary
See also the probe manual

95 %

If the error message disappears:
When gain value is correct (from 70% to 110%)
Confirm the calibration sequence with "ENTER"

(ENTER)

DELAY **0000** Sec

(▲) (▶)

Choose the stand-by period, all regulation and measurements are on stand-by (same values blocked as they were beginning the calibration) during this timing

(VALID) SAVING ?

FORCED RELAY   ⟶ **MENU +** ⟶ ADJUST ALARM

ENTER

ENTER   ALARM 1   **ON/OFF**   ▲

ENTER   ALARM 2   **ON/OFF**   ▲

ENTER   ALARM 3   **ON/OFF**   ▲   Diagnostic mode to test the threshold configurations

VALID   ALARM 4   **ON/OFF**   ▲

ADJUST ALARM   ⟶ **MENU +** ⟶ LANGUAGE

When in use the S4 contact is active.
This mode allows to detect a malfunction on S1
and S2 contacts ; an overtime contact could be set up.

ENTER

WITH / WITHOUT ALARM   ▲

ENTER

TIME. S1 **0005** Sec   ▲ ▶   Overtiming on S1 closed contact
(maximum time for active relay)

ENTER

TIME. S2 **0000** Sec   ▲ ▶   Overtiming on S2 closed contact
(maximum time for active relay)

ENTER

SAVING ?

VALID

CLEANING PROBE   ⟶ **MENU +** ⟶ LANGUAGE

(Contact S4)
In order to protect the regulation, all measurements are on
stand-by during the cleaning process (plus a delay before
to restart the operating mode).

ENTER

CLEANING **YES / NO**   ▲

ENTER

PERIOD **0000** Sec   ▲ ▶   Set up the time after witch a cleaning sequence will begin

ENTER

TIME **0000** Sec   ▲ ▶   Cleaning time

ENTER

DELAY **0000** Sec   ▲ ▶   Delay after cleaning, before to restart the regulation mode

ENTER

SAVING ?

VALID

LANGUAGE   ⟶ **MENU +** ⟶ Back to display

ENTER

ENGLISH, ITALIAN, FRENCH   ▲

ENTER

SAVING ?

VALID