

BAMOPHOX 451 LOG

Dissolved Oxygen monitor for AQUAPLUS™ Probe



INSTRUCTIONS MANUAL

BAMO MESURES

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Dissolved oxygen monitor
BAMOPHOX 451 LOG

13-12-2013

451 M1 02 C

MES

451-02/1

Dissolved Oxygen monitor BAMOPHOX 451 LOG / E & M

Content

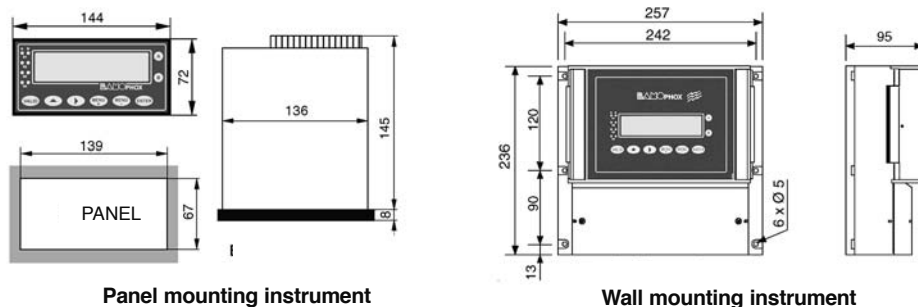
1. TECHNICAL FEATURES	3
2. DIMENSIONS	3
3. WIRING	4
4. FRONT PANEL	7
PRESENTATION & SCROLLING MENU	8
ABOUT BAMOPHOX	9
CONSULTATION / MODIFICATION	9
PARAMETRE MESURE	10
ATM PRESSURE	10
ADJUST ALARM 1	11
ADJUST ALARM 2	11
ADJUST ALARM 3	12
RELAY REGULATION	13
PID REGULATION	14
OUTPUT mA Dissolved Oxygen	15
OUTPUT mA TEMP	15
ADJUST PROBE	16
FORCED RELAYS	17
ADJUST ALARM	17
CLEANING PROBE	17
LANGUAGE	18

1. TECHNICAL FEATURES

Displayed parameters:	Measurement values - Configuration Menu - Temperature value
Display:	Back lighted - 2 lines of 16 alphanumeric characters ; 9.2 mm high
Indication:	LED alarms status
Programming:	8 push buttons keyboard on front face - Keyword protected
Measuring range:	0 to 500% or mg/L
Accuracy	Input DO: $\pm 0.1\%$ from 0 to 200 % ; $\pm 1\%$ from 200 to 500 % Input temperature: $\pm 0.3\%$
Input signal:	For sensor AQUAPLUS, screw connectors
Temperature compensation:	Automatic: input for 1 sensor Pt 100 Ohm/0°C, range 0 ...+100°C Manual: programming in the menu temperature between 0 and 100°C
4 output relays:	4 closing contacts (Silver alloy), voltage free Initial resistance 100 mΩ 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 life time (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
3 Relays S1, S2 & S3	Thresholds: 3 programmable independent thresholds - with adjustable hysteresis 0...100% and adjustable timer from 0 to 9999 s On/Off Regulation: High and low proportional bandwidth, high and low dead zones PID regulation: proportionality 0...200%, - Integrant and Derivative: 0...999 second
Output relay (S4):	Common alarm signal for: - System malfunction - Temperature out of range - Pt 100 Ω dysfunction or probe cleaning function - Signal, over-range or opened loop
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 Ω), galvanic insulated
Temperature output/ PID:	0/4-20 mA (max 600 Ω), scalable on 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 Wall mounting, IP65, cable glands, connections on screw terminal
Data-Logger:	Cycle average measurement record, with a programmable period, 150000 records maxi on Memory card / External driver necessary

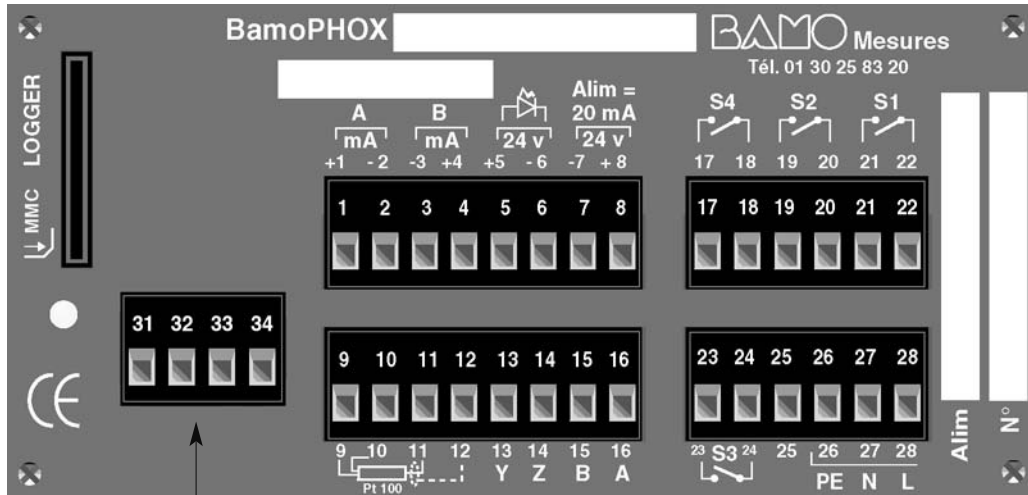
2. DIMENSIONS

Extension terminal:
identical to the panel
or wall mounting
BAMOPHOX



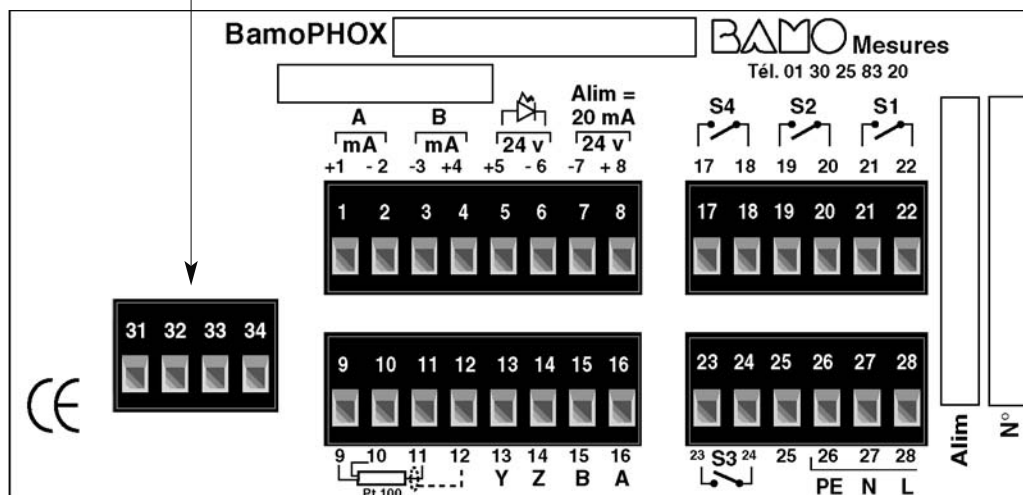
3. WIRING

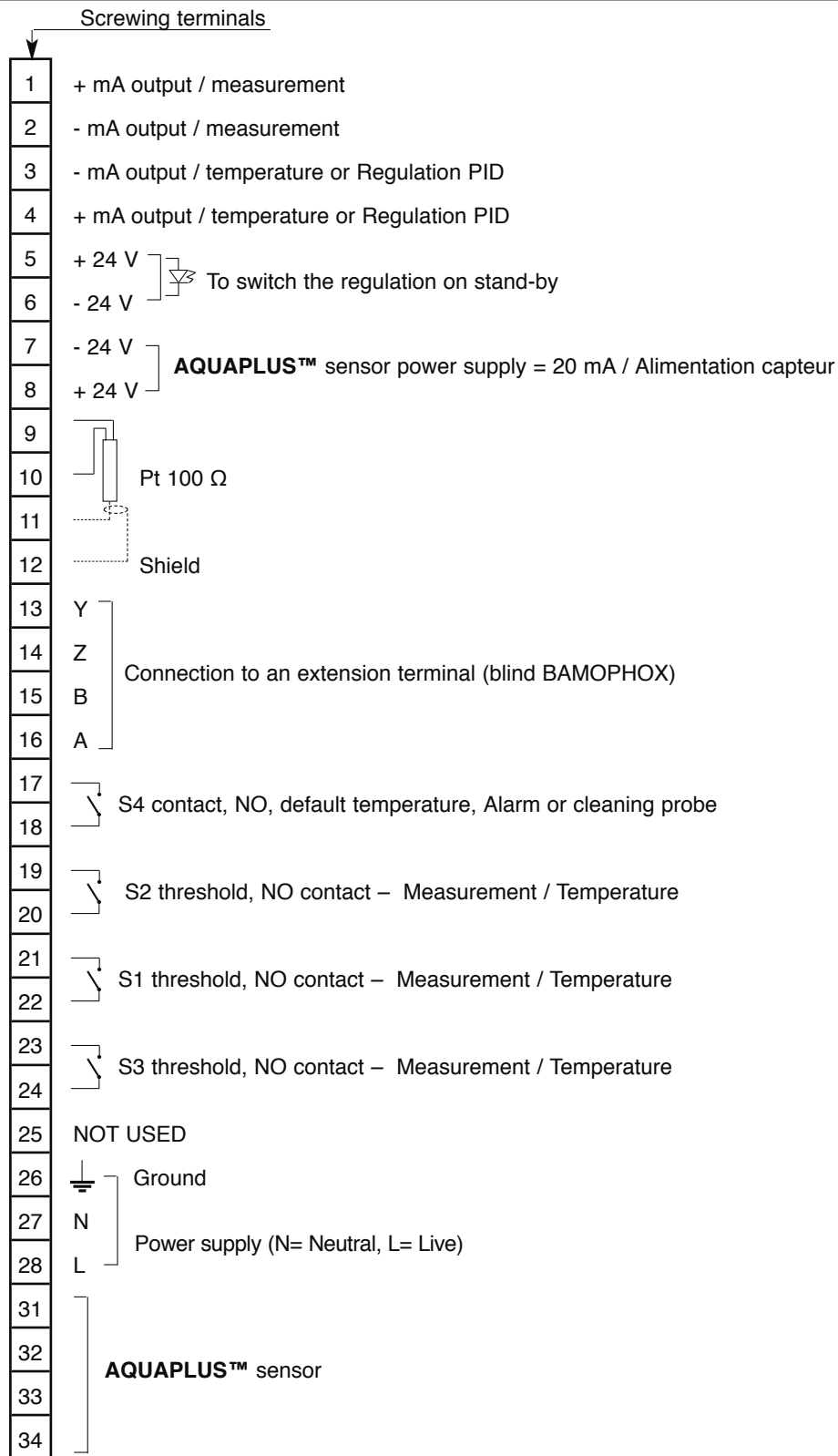
WALL MOUNTING PANEL



INPUT AQUAPLUS™ sensor

PANEL MOUNTING MODEL

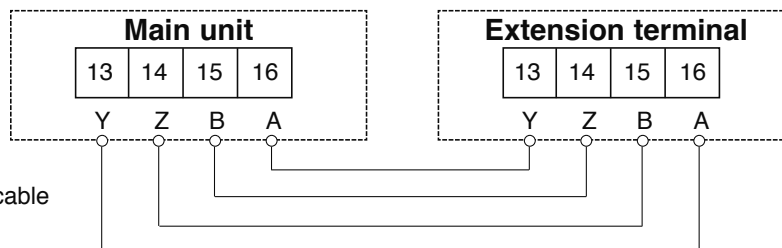




Wiring from wall or panel mounting BAMOPHOX to an Extension terminal BAMOPHOX

- Maximum length cable
500 m

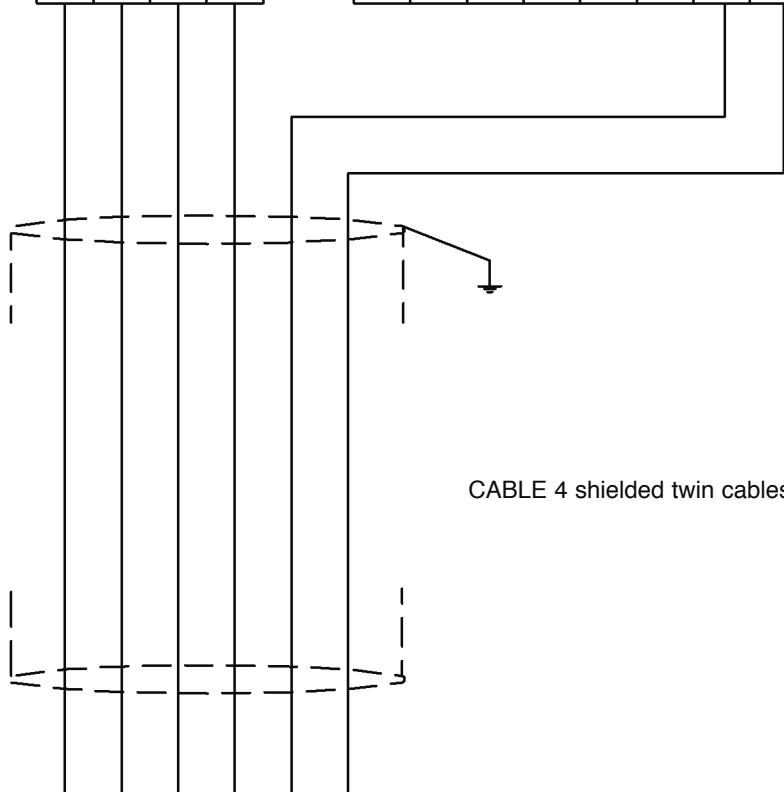
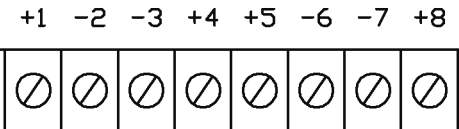
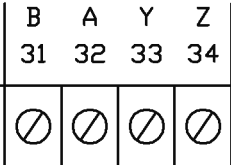
- Wire specifications:
Mains cable or 4 wires shielded cable
≥ 0,25 mm² cross section



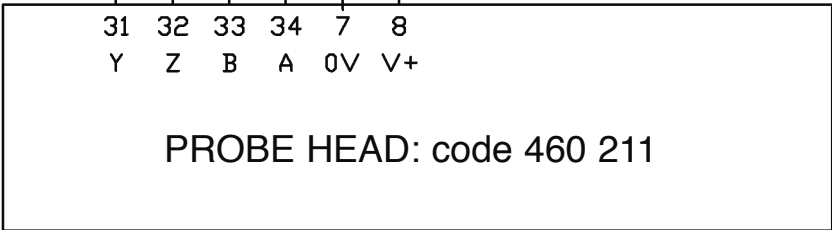
SENSOR TERMINALS

Power=
24 V

BAMOPHOX



CABLE 4 shielded twin cables



4. FRONT PANEL

S1, S2, S3, and S4

indicate relays status:

LED lighting = contact ON

LED OFF = contact OFF

LED flashing = Timer in use

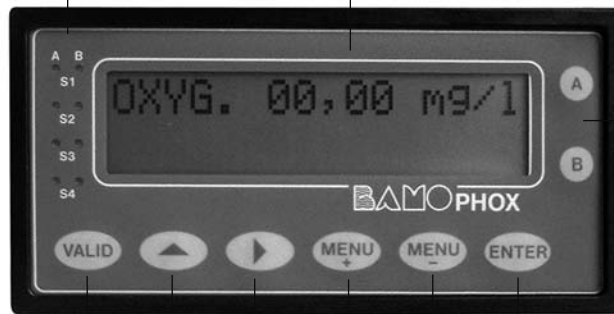
2 lines /16 alphanumeric characters
9.22 mm high - Back lighted

Key "A"

To display the parameters of upper line.
(main BAMOPHOX)

Key "B"

To display the parameters of lower line.
(Extension blind BAMOPHOX)



"VALID" key

To save the parameters on EPROM
when it asks:

VALIDATION ?

Caution, when you press this key,
all parameters are saved.
(previous data programming
will be overwritten).

If you are not sure of any modification,
do not press the VALID key,

To change parameters of data capture:

Numeric 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.

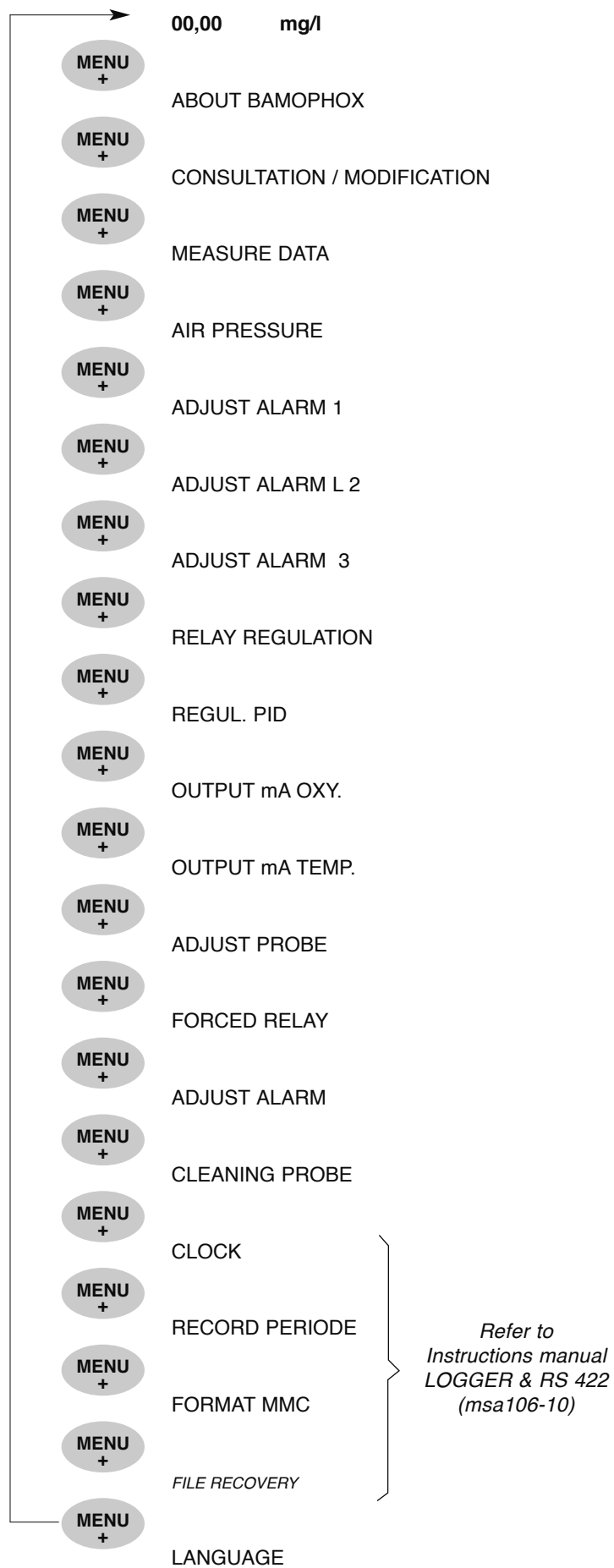
"MENU +" key

To go to the next menu.

Pushing simultaneously both keys

"MENU +" and "ENTER"
allows a fast return to measurement display.

SCROLLING MENU



ABOUT Bamophox

ENTER

ABOUT BAMOPHOX

ENTER

VERSION 2.04

ENTER

SERIAL N°

ENTER

20451 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

FORCED MEASURE

ENTER

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

FORCED PID

ENTER

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.

MEASURE DATA

ENTER

DISPLAY



% / mg / l

Choose the unit, confirm with **ENTER** then save.

ENTER

SAVING ?

VALID

AIR PRESSURE

ENTER

P = 1013 hPa



The blinding digit has to be modified, according to the day value. Confirm with **ENTER** then save.

ENTER

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 ON/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 ON/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

ENTER

SAVING ?

VALID

ADJUST ALARM 3

MENU +

RELAY REGULATION

ENTER

ALARM 3 ON/OFF ▲

ENTER

ALARM 3 MEASURE/TEMP ▲

ENTER

ALARM 3 LOW/HIGH ▲

ENTER

ON 00,00 mg/l / °C ▲ ▶

ENTER

OFF 00,00 mg/l / °C ▲ ▶

ENTER

DELAY UP ON/OFF ▲

ENTER

TIME 0000 SEC ▲ ▶

ENTER

DELAY DOWN ON/OFF ▲

ENTER

TIME 0000 SEC ▲ ▶

ENTER

SAVING ?

VALID

MEASURE= Threshold against pH/mV measured value
TEMP= Threshold against temperature measured value

HIGH= Contact closes when value goes over the limit
LOW= Contact closes when the value goes under the limit

To close the contact S3 at this value

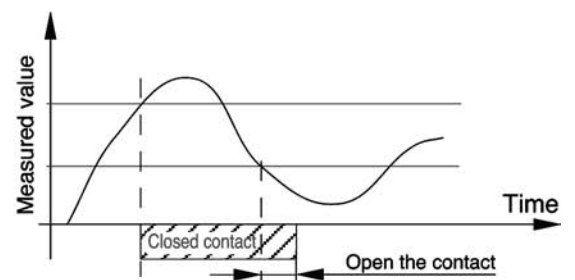
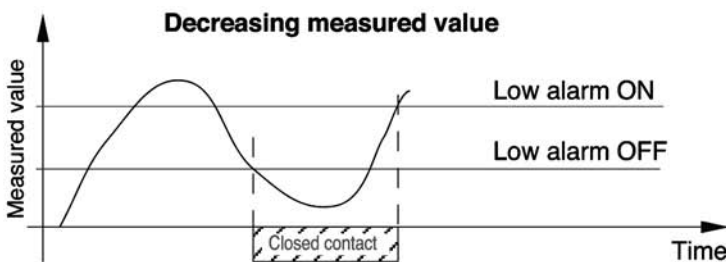
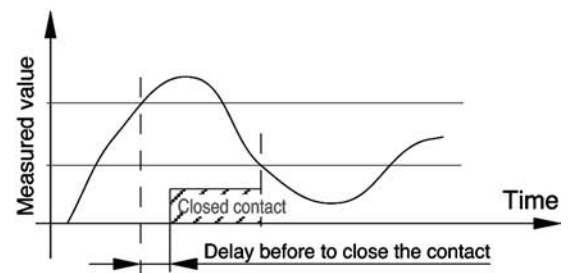
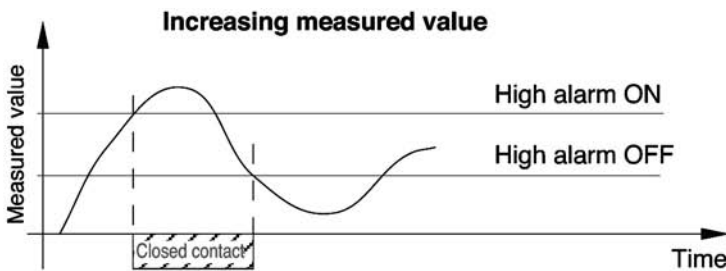
To open the contact S3 at this value

Delay (or no delay) before to close the contact S3

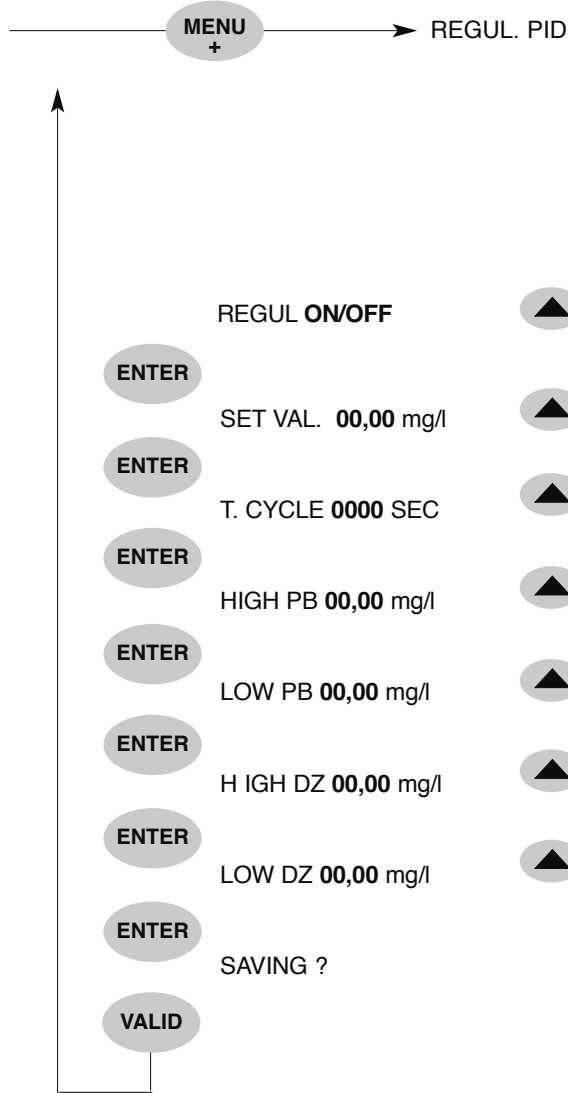
Delay time to close the contact S3

Delay (or no delay) before to open the contact S3

Delay time to open the contact S3



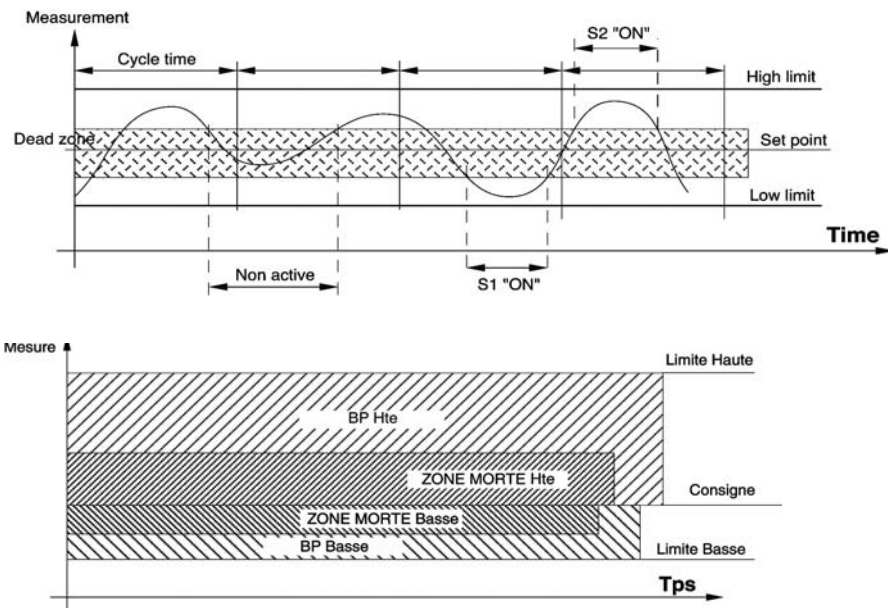
RELAY REGULATION



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

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



REGUL. PID

MENU
+

Output mA Oxygen

This operating mode allows a PID regulation with an analogic output 0/20 or 4/20 mA (terminals 3 and 4). This output is no more available for temperature output.

ENTER	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 below ADJUST PID PARAMETERS)
ENTER	T.i : 0050 Sec	▲	▲	Integrant setup
ENTER	Td : 0012 Sec	▲	▶	Derivative setup
ENTER	ACTION: DIRECT/REVERSE	▲		
VALID	OUTPUT 4/20 mA / 0/20 mA	▲		
	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 and T :
 - t = delay of response
 - T = Time corresponding to the same variation in % of measurement (Δm) and the analogic output (ΔCde), $\Delta m = \Delta Cde$. This value may be found out on the slope.
- Modify the PID parameters as following:

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

→ **OUTPUT mA Oxygen**

MENU
+

→ **Output mA TEMP.**

Measurement signal copy on the analog output

ENTER

HIGHER 0000 mg/l



Value corresponding to 20,00 mA

ENTER

LOWER 0000 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
+

→ **ADJUST PROBE**

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

ADJUST PROBE

MENU
+

FORCED RELAY

ENTER

ZERO ADJUST YES/NO

CAUTION: check and modify if necessary atmospheric pressure value inside the controller, if value is different from one of calibration day.

Note: Zero is factory done. It is not necessary to do it again. Zero has to be done only when a new endcap has to be changed.

ENTER

CAL BUFFER

Put the probe into the calibration solution
Rapidcal 300 (code number: 471 072)

ENTER

OXYG. +000.0

Wait for the steady display 0,000%.

ENTER

CALIBRATION ON

Sensor and controller communicate

CALIBRATION OK

Wait for the steady display "CALIBRATION OK"

ENTER

The 0,000% of the sensor is done.

PROBE IN AIR

ENTER

Rinse the probe, wipe out water drops on the endcap of the sensor and surround the probe with a clean wet tissue.

OXYG. +000.0

ENTER

Wait for the steady display 100,0%.
The more it takes time, the better it will be.

CALIBRATION ON

Sensor and controller communicate

CALIBRATION OK

Wait for the steady display "CALIBRATION OK"

ENTER

The 100,0% of the sensor is done.

DELAY 0015 Sec

ENTER

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

SAVING ?

VALID

FORCED RELAY

ENTER

ALARM 1 ON/OFF

ENTER

ALARM 2 ON/OFF

ENTER

ALARM 3 ON/OFF

ENTER

ALARM 4 ON/OFF

VALID

MENU +

ADJUST ALARM



} Diagnostic mode to test the threshold configurations

ADJUST ALARM

ENTER

WITH / WITHOUT ALARM

ENTER

TIME. S1 0005 Sec

ENTER

TIME. S2 0000 Sec

ENTER

SAVING ?

VALID

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.



Overtime on S1 closed contact (maximum time for active relay)



Overtime on S2 closed contact (maximum time for active relay)

CLEANING PROBE

ENTER

CLEANING YES / NO

ENTER

PERIOD 0000 Sec

ENTER

TIME 0000 Sec

ENTER

DELAY 0000 Sec

ENTER

SAVING ?

VALID

MENU +

CLOCK

(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).



Set up the time after witch a cleaning sequence will begin



Cleaning time



Delay after cleaning, before to restart the regulation mode

LANGUAGE

MENU
+ → *Go back on display*

ENTER

FRENCH / **ENGLISH**
ITALIAN / GERMAN

▲ Choose

ENTER

SAVING ?

VALID