BAMOPHOX 106 E - M

pH/mV meter

INSTRUCTION MANUAL

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pH/mV meter
BAMOPHOX 106
17-09-2010 106 M1 01 E

MES
106-01/1

pH/mV meter
BAMOPHOX 106

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

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1. TECHNICAL FEATURES

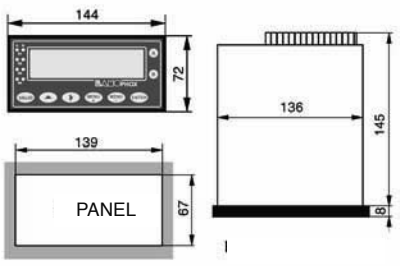
Displayed parameters:	Measurement values pH/ORP - Configuration Menu - Temperature value
Display:	Back lighted - 2 lines of 16 alphanumerical characters ; 9,2 mm high
Indication:	LED alarms status
Configuration:	8 push buttons keyboard on front face - Keyword protected
Scales:	0 to 14 pH pH–meter configuration / ±1000 mV ORP–meter configuration
Accuracy:	± 0,03 pH or ± 3 mV
Input impedance:	$>10^{13}$ Ω
Probe input:	coaxial connector, code 9054
Temperature compensation:	Automatic with an input for a 3 wires Pt 100 Ohm/0°C range, 0…100°C Manually from 0…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 out of range: - pH>14 or open loop - Pt 100 Ω dysfunction or probe cleaning function
Contact:	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 $x10^6$ operations (180 commutation/min) Electrical life time (minimum) 2 $x10^5$ (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 zone.
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 Ω) proportional to measurement, galvanic insulated
Temperature output / PID:	0/4-20 mA (max 600 Ω), scaling 0…100°C, galvanic insulated
Program Testing:	simulation through the menu on measurement, temperature, PID and relays 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 Idem DIN Rail mounting, only for blind monitor Wall mounting, IP65, cable glands, connections on screw terminal

OPTION (RS 422 + Logger)

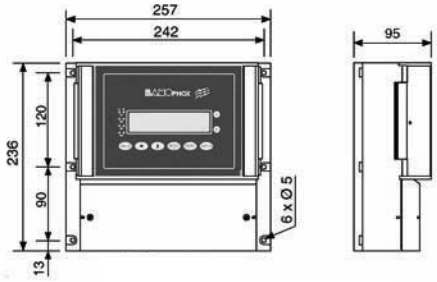
Communication:	RS422 output, J-BUS link, binary slave mode, 2400 to 9600 bauds
Data Logger:	Cycle average measurement record, with a programmable period, 150000 records maxi on MMC (multi media card) / External driver necessary

2. DIMENSIONS

Extension terminal:
identical to the panel
or wall mounting



Panel mounting instrument

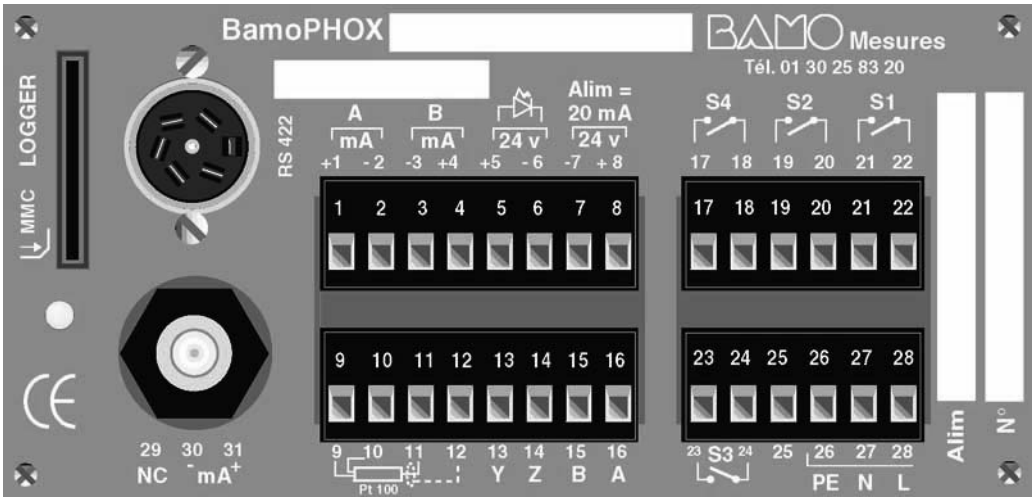


Wall mounting instrument

3. WIRING

PANEL MOUNTING

OPTION:
LOGGER
&
RS 422



pH/mV INPUT

Coaxial connector
(for 9054 CABLE connector)
On any panel mounting models
and on wall mounting models until April 2010
(Code numbers 106700, 106701 & 106750)

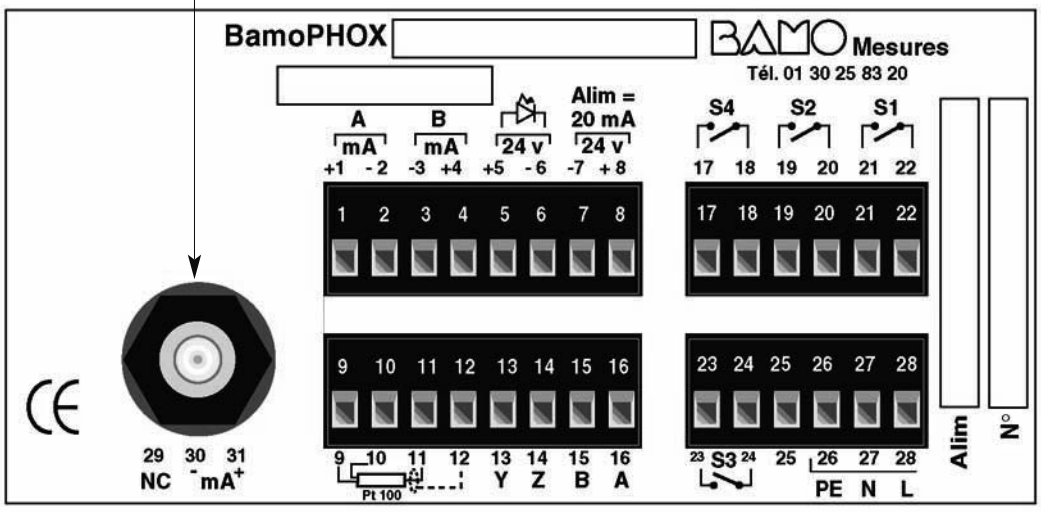
Screw terminal block (details on page 6 and 7)
Since April 2010, for any wall mounting models
(Code numbers 106800, 106801 & 106850)

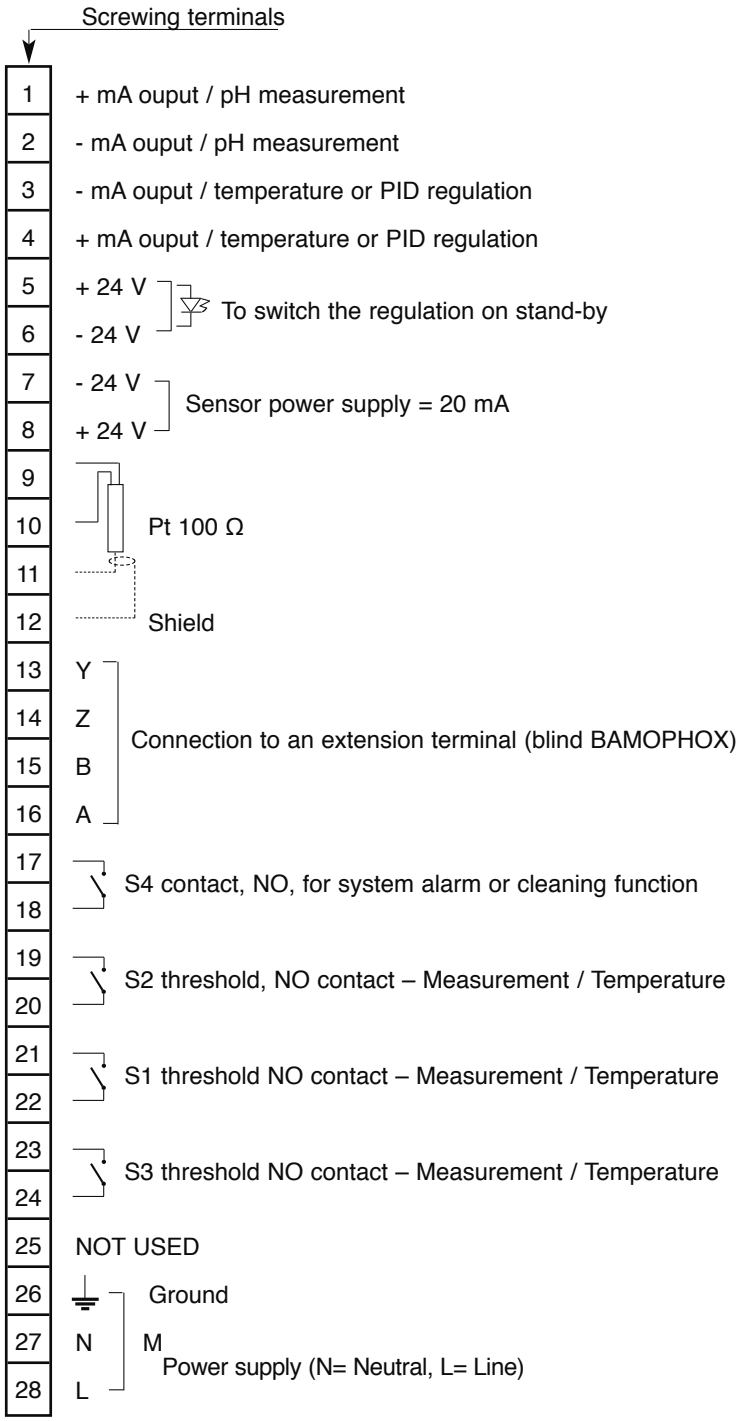
WALL MOUNTING

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

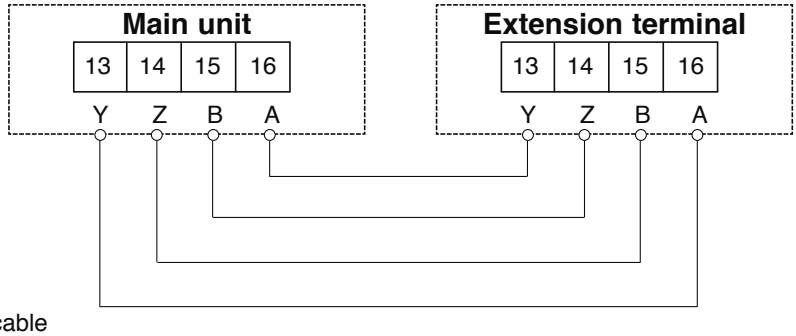
RS 422

32 33 34 35





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

pH cable 9060,
care before connecting it to a screw terminal block

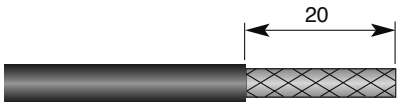
These instructions apply for BAMOPHOX 106, wall mounting type code numbers 106800, 106801 & 106850

A good care, installing the cable and connectors, is a warranty for a long life and reliable service of your pH system monitoring. Please respect all steps.

The special cables 9060 (coaxial) and 9061 (tri-axial) for pH or ORP measurements have a high insulation resistance. This means all the system needs a high electric insulation between the core wire and the shield. Traces of humidity will disqualify the measurement.

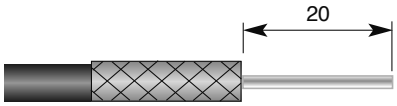
Please note that a short circuit will induce a display of pH 7 (potential 0 mV).

A) - 9060 coaxial cable preparation

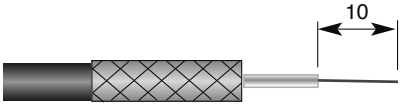


1°) Remove the outer insulation by 20 mm.

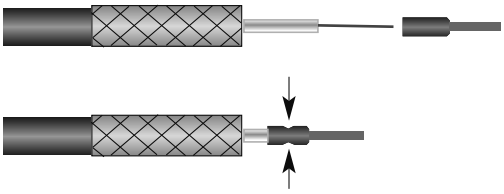
2°) Fold back the shield (copper mesh)



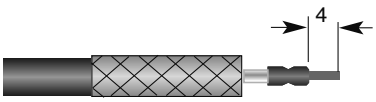
3°) Remove the black layer by 20 mm



4°) Trim back the inner insulation in order to expose 10 mm of core copper wire.

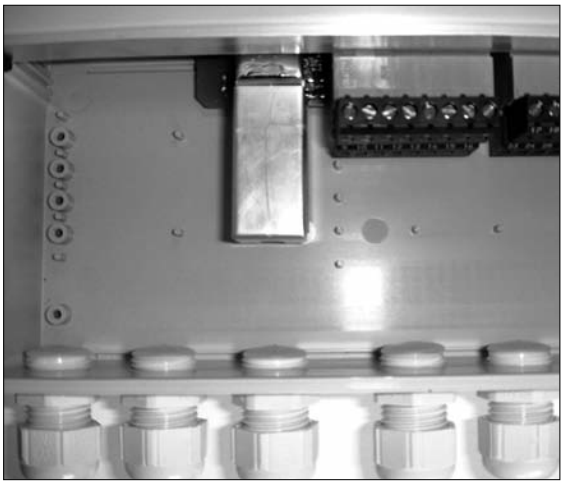


5°) Crimp a solderless insulated spade *(1 mm² , length 8 mm, red colour))*

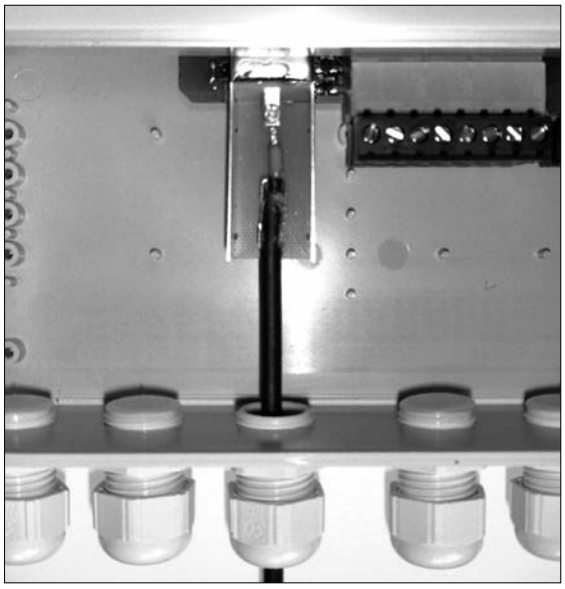


6°) Short the spade *(a length of 4 mm is necessary)*

B) - Connecting the pH cable 9060 on the BAMOPHOX



1°) Open the connection housing.
The terminal block is on the left side.



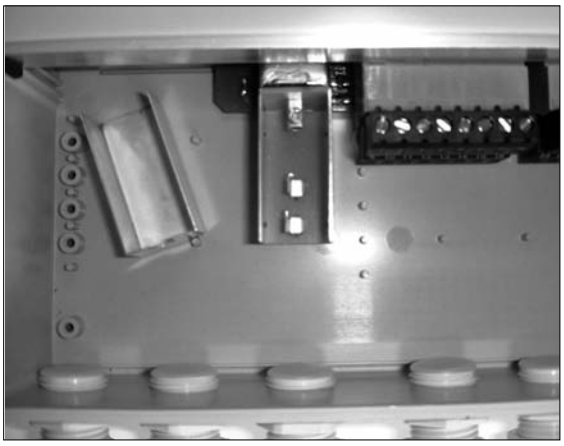
3°) Pass the cable through the cable gland.

4°) Insert the spade in the screw connector

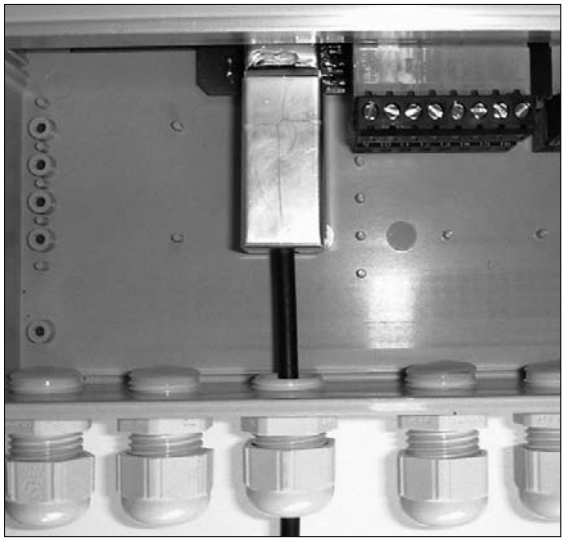
5°) Be sure that the electrical contact between the copper shield and the 2 claps will be perfect.

6°) Press on the cable to insert it properly in the claps.

7°) Screw on tightly to block the core in its connector



2°) Remove the cover of the terminal block by sliding it up or down



8°) Fit back the cover of the terminal block.

9°) Block the cable gland to assure a watertight connection.

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 programmation
will be overwrited).
If you are not sure of any modification,
do not press the VALID key,

"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.

To change parameters of data capture:

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

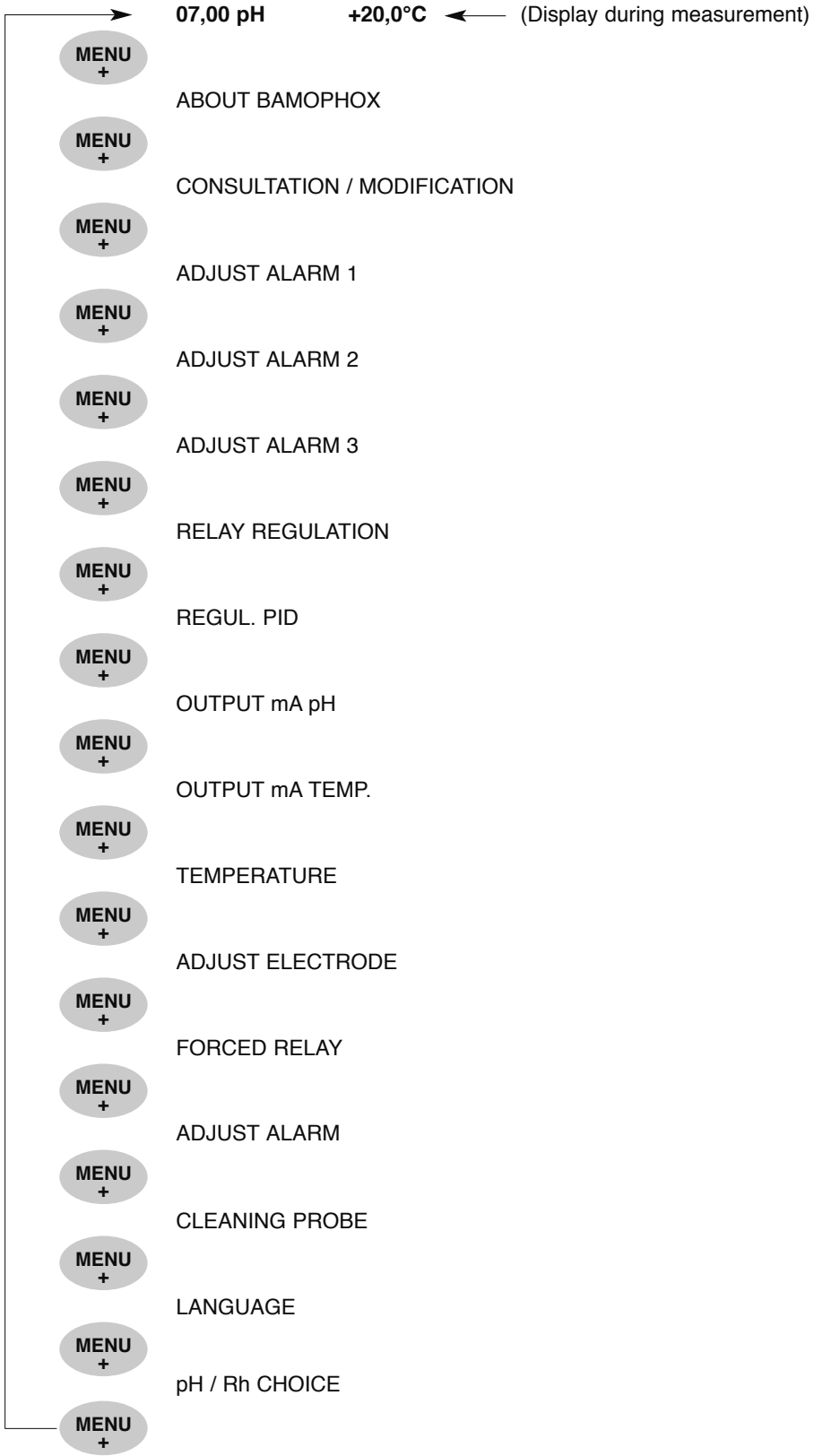
Reverse the choice Yes / No,
Up/Down, 0-20 mA / 4-20 mA etc.

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

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

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

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

0,000 pH +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

0,000 pH 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.

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** pH/ °C ▲ ▶ To close the contact S1 at this value

ENTER

OFF **00,00** pH/ °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

ENTER

MENU + → ADJUST ALARM 3 → please, see next page

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** pH/ °C ▲ ▶ To close the contact S2 at this value

ENTER

OFF **00,00** pH/ °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 + → REGUL REGULATION → please, see next page

ENTER

ALARM 3 **ON/OFF**

ENTER

ALARM 3 **MEASURE/TEMP**

ENTER

ALARM 3 LOW/HIGH

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

ENTER

ON **00,00** pH/ °C — To close the contact S3 at this value

ENTER

OFF **00,00** pH/ °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

DELAYDOWN **ON/OFF** — Delay (or no delay) before to open the contact S3

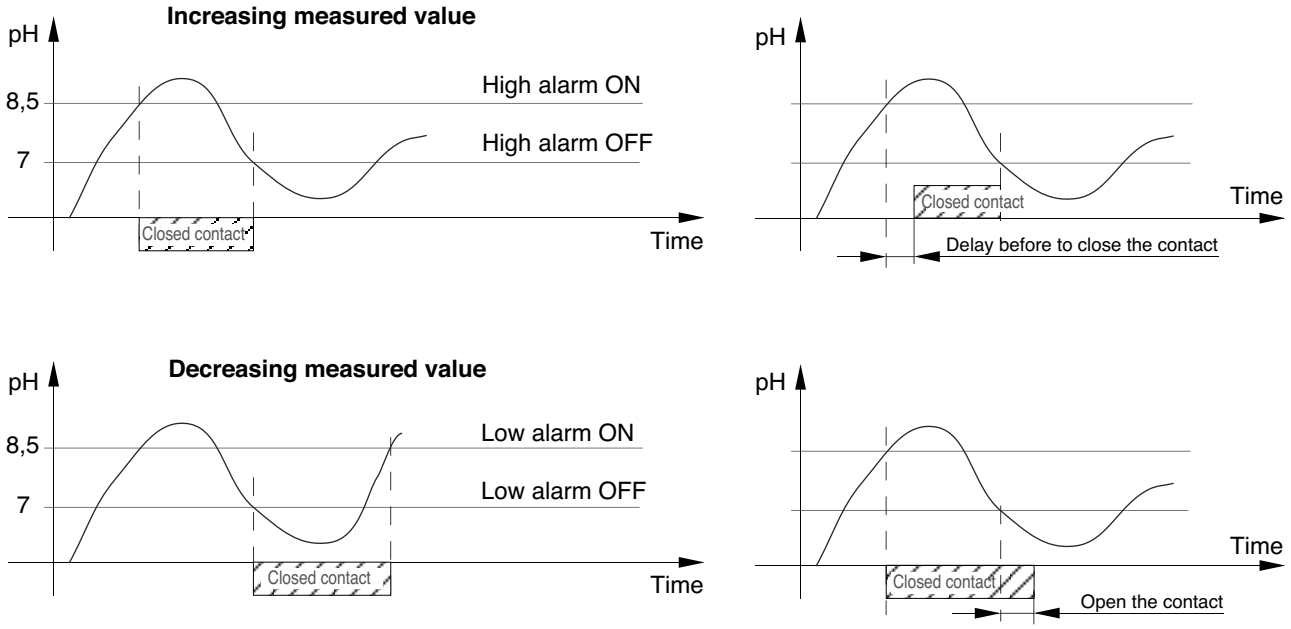
ENTER

TIME **0000** SEC — Delay time to open the contact S3

ENTER

SAVING ?

VALID



RELAY REGULATION

MENU + → REGUL. PID → Please see page 15

ENTER

ON/OFF MODE

ENTER

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

ENTER

REGUL. PID

ENTER

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

REGUL **ON/OFF**

ENTER

SET VAL. **07,00** pH — Set point

ENTER

T. CYCLE **0000** SEC — Cycle time

ENTER

HIGH PB **05,00** pH — Highest limit for proportional bandwith

ENTER

LOW PB **05,00** pH — Lowest value for dead zone

ENTER

H IGH DZ **00,50** pH — Highest value for dead zone

ENTER

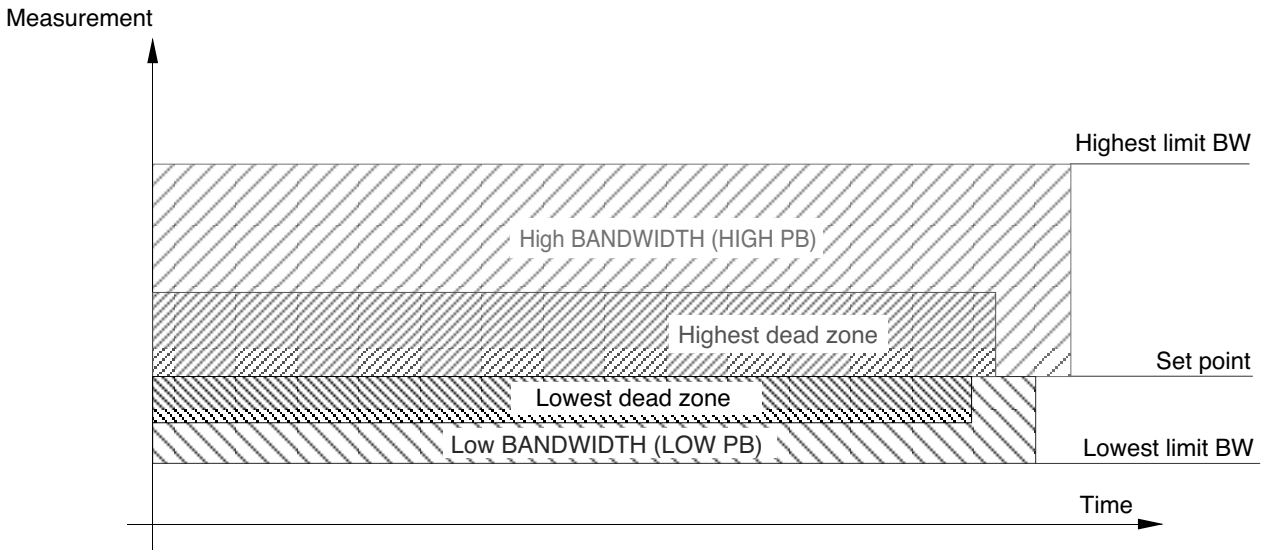
LOW DZ **00,00** pH — Lowest value for dead zone

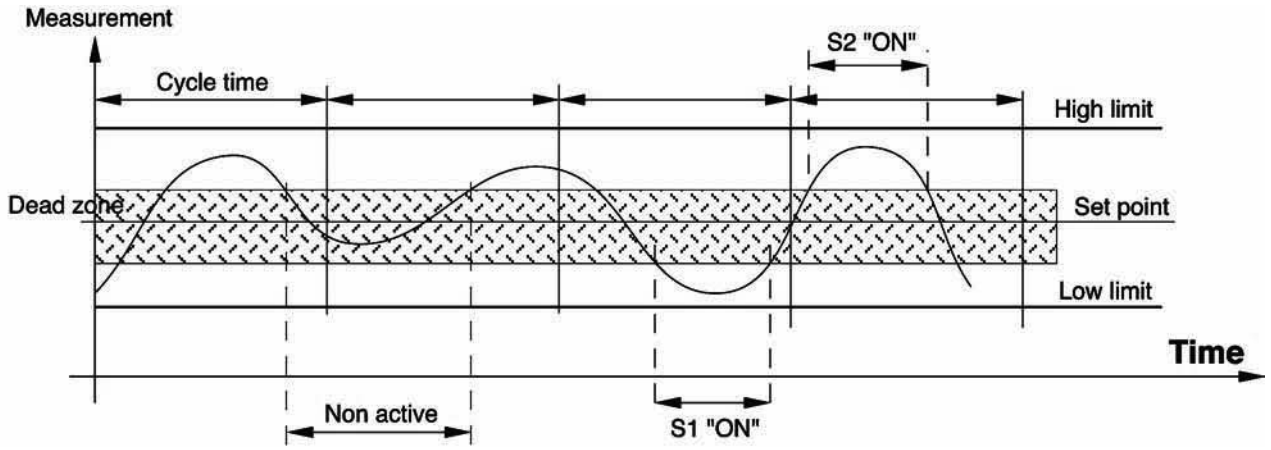
ENTER

SAVING ?

VALID

Caution: On S1 your configure the lowest value for proportional bandwith and respectively S2 for the highest value.





Example

With process configuration:

- Set point: pH 7
- High dead zone: 0,3 pH between 7 and 7,3 pH
- Low dead zone : 0,7 pH between 6,3 and 7 pH
- High BANDWITH: 3 pH (Limit of pH10 as a maximum)
- Low BANDWITH: 1 pH (Limit of pH6 as a minimum)

- Over the highest limit (from ph 10 to 14), S2 is “ON”: permanent injection
- Under the lowest limit (from ph 6 to 0), S1 is “ON”: permanent injection
- Inside the dead zone (from ph 6,3 to 7,3), S1 and S2 are “OFF”
- If the measurement value is between the dead zone and the highest limit (from pH7,3 to 10) or between the dead zone and the lowest limit (from pH 6,3 to 6), the contact S1 or S2 are “ON” only for a time proportional to the step between measurement and desired value.

$$\text{Closing contact time} = \frac{\text{Cycle time x (Measurement - Set point)}}{\text{Proportional BANDWITH}}$$

Caution: The minimum closing time of a relay is 1 second

If the measurement M=7,8 when the cycle time is 10 second, the closing contact time is: $\frac{10 \times (7{,}8-7)}{3} = 2{,}66 = 3$ sec

REGUL PID — MENU + → Output mA pH → Please see page 17

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 **07,00** pH	▲ ▶	Set point value
ENTER			
	GAIN : **4,800**	▲ ▶	Gain setup (see also ADJUST PID PARAMETERS) (voir ci-dessous : METHODE DE REGLAGE ..)
ENTER			
	T.i : **0050** Sec	▲ ▲	Integral timing
ENTER			
	Td : **0012** Sec	▲ ▶	Modification de la valeur du temps de dérivation
ENTER			
	ACID /BASE INJECTION	▲	
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

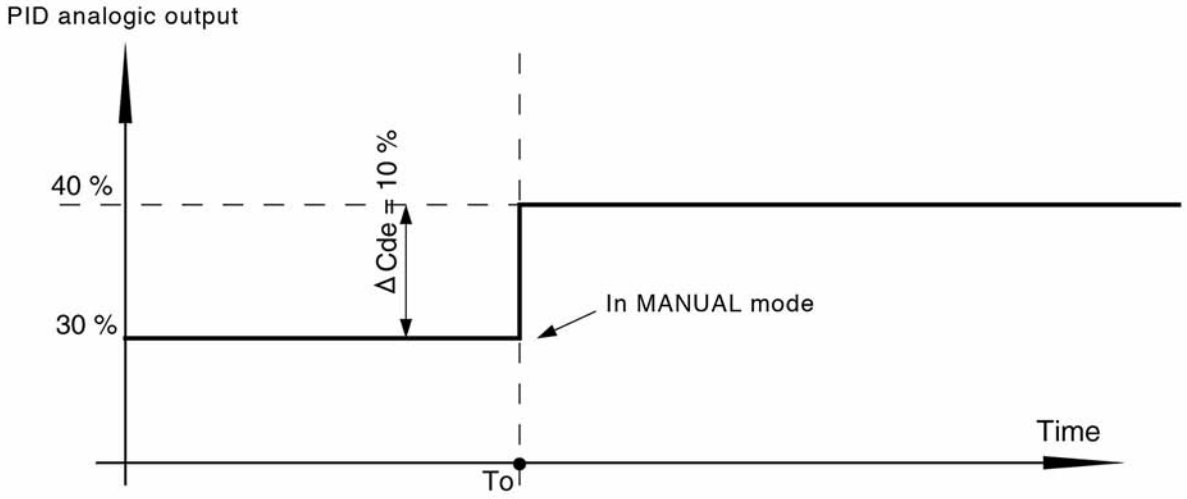
Proceed as following:

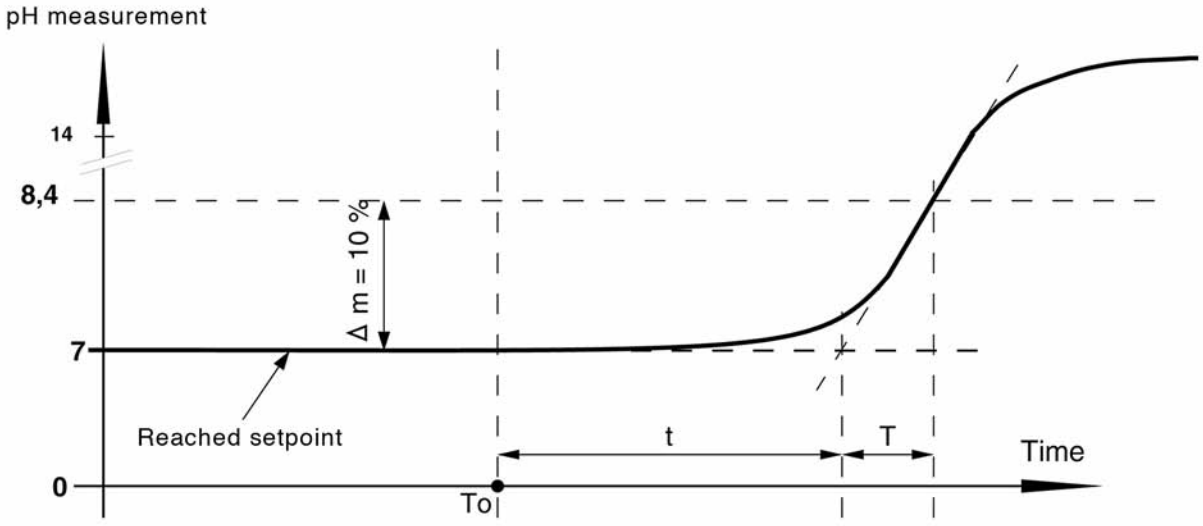
- Connect a recorder to the analogic measurement output or write the reading measurement values for then to draw the graph pH vs. time (pH, mV, etc...)
- Switch on MANUAL mode the PID regulation
- Reach to and keep close the measurement value to the set point, adjusting the PID output
- Apply on ΔCde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

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

- note on the graph the corresponding timing.
- Determinate on this graph both times:
  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:

Régulation	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


PID analogic output
40 %
30 %
Δ Cde = 10 %
In MANUAL mode
Time
To


pH measurement
14
8,4
7
0
Δ m = 10 %
Reached setpoint
t
T
Time
To

Output mA pH — MENU + → Output mA TEMP.

Measurement signal copy on the analog output

ENTER

HIGHER **00,00** pH — ▲ ▶ — Value corresponding to 20,00 mA

ENTER

LOWER **00,00** pH — ▲ ▶ — 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 **+160,0** °C — ▲ ▶ — Value corresponding to 20,00 mA

ENTER

LOWER **+000,0** °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 + → ADJUST ELECTRODE → please, see next page

ENTER

AUTO: A Pt 100 probe should be connected

MEASURE : **AUTO / MANUAL** — ▲

MANUAL: Without Pt 100 probe
Manualy entered temperature value

ENTER

FLUIDE T. + **000,0** °C — ▲ ▶ — (MANUAL mode)

ENTER

SAVING ?

VALID

ADJUST ELECTRODE

MENU + → FORCED RELAY → please, see next page

CAUTION: Set up the instrument on MANUAL mode at 20°C.

ENTER

STANDARD **7,00** pH

Immerge the electrode in the buffer pH 07,00

ENTER

When display stabilizes, press ENTER to fix up the 07,00 pH (electrical zero)

ASYM. +**00,00** pH

The "ASYM" value may be too high, an "**ERROR**" message appears.
- You may then check all the connections and buffer type solution.

If the "**ERROR**" message persists, please replace the electrode with a new one.

ENTER

STAND. **00,00** pH

▲ ▶

When pH 07,00 is fixed up, rinse the electrode with tap water (Never use paper or tissue).
Enter the pH value of the next buffer (04,00 or 10,00)
(it would be better to choose an acidic buffer for an acidic process)

ENTER

SLOPE **000,0** %

Sensor gain is displayed.

If it is too weak (< 70%) an "**ERROR**" message appears.
- Check the buffer solution, if persisting, please replace the electrode.

ENTER

DELAY **0000** Sec

▲ ▶

Set up the time during the measurement values, previous to the calibration, will be displayed after saving the calibration.

ENTER

SAVING ?

VALID

CAUTION: If a PT100 probe is connected, reset the temperature mode on "AUTO"

FORCED RELAY → MENU + → ADJUST ALARM

ENTER

ALARM 1 **ON/OFF** ▲

ENTER

ALARM 2 **ON/OFF** ▲

ENTER

ALARM 3 **ON/OFF** ▲

ENTER

ALARM 4 **ON/OFF** ▲

VALID

Diagnostic mode to test the threshold configurations

ADJUST ALARM → MENU + → CLEANING PROBE → please, see next page

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

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)

VALID SAVING ?

CLEANING PROBE — MENU + → LANGUAGE

ENTER

(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).

CLEANING **YES / NO**

PERIOD **0000** Sec — ▲ — Set up the time after wich 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 + → CHOICE OF THE PARAMETER

ENTER

ENGLISH / ITALIAN / GERMAN
FRENCH — ▲

ENTER

SAVING ?

VALID

CHOICE OF THE PARAMETER — MENU + → Back to measurement mode

ENTER

pH / Rh - METRE — ▲

ENTER

SAVING ?

VALID