ANSELL ELECTRONICS

MDC42 µP Digital readout pH/mV controller

Operating instructions
Important:
Please retain packing for further use.
Read the instructions carefully, to ensure correct operation of instrument.

GENERAL FEATURES

Features:
- display of measured value;
- two independent control points;
- display of solution temperature;
- transmission of measured value.

Programming parameters:
- passcode selection;
- three levels of passcode protection;
- input selection (pH or REDOX);
- temperature selection (C or F);
- buffer calibration;
- control point setup;
- digital filter selection;
- analogue transmission selection.

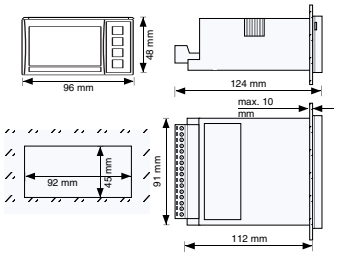
SPECIFICATIONS

ACCURACY (mV): ± 0.5 % F.S., ± 1 dgt (@25°C);
ACCURACY (RTD): ± 0.5 % F.S., ± 2 dgt (@25°C);
TEMPERATURE DRIFT (mV): ± 200 ppm/°C.
TEMPERATURE DRIFT (RTD) ± 400 ppm/°C
SAMPLING RATE: mV measurement: 4 times/second; temperature measurement: 1 time/second.

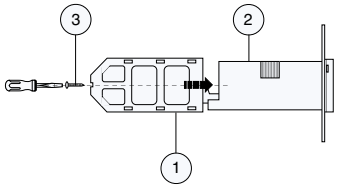
DISPLAY: 7-segment LED, h 14.2 mm
MAXIMUM INDICATIONS: pH: 14.00, REDOX: 1000, C: 100.0, F: 212
MINIMUM INDICATIONS: pH: 0.00, REDOX: -1000,
C: 0.0, F: 32
mV INPUT: range: -1000 mV to 1000 mV; biasing current: <10pA max. overload: 4 V (continuous), 10 V (for max. 1s)
RTD INPUT: range: 0 to 100.0 C / 32 to 212 F; compensation: 3-wire connection, line resistance up to 10
CONTROL SET-POINTS: Two independents set-points. Either on/off or proportional pulse. Selectable for pH/mV rising (uP or uP.P) or pH/mV falling (do or do.P). Relay status: selectable; normally energized/de-energized. Output contacts: 2xSPDT; rating: 5A, 250VAC/VDC, 40W/1200VA, 130.000 cycles. Min. response time: 500 ms (filter excluded). Insulation: 2000VRMS between output and measuring input; power-supply for signal output
DIGITAL FILTER: operating range: in the whole displaying range. Filtering coefficient: from 1 to 255
ANALOGUE TRANSMISSION (ON REQUEST): from 0 to 20mADC / from 0 to 10VDC, programmable within the whole range of transmission. Accuracy and response time: 0.3% F.S. (@ 25 C) / 500ms (filter excluded). Temperature drift: 200 ppm/ C. Load: output 0 to 20mA: 500 , output 0 to 10V: 10k . Insulation: by means of optocouplers, 500VRMS between output and measuring inputs, 4000VRMS between output and power-supply input.
POWER SUPPLY: 230VAC -15% +10% 50/60Hz (standard); 115 VAC -15% +10% 50/60Hz (on request);
48 VAC -15% +10% 50/60 Hz (on request);
24 VAC -15% +10% 50/60 Hz (on request);
Insulation: 2000 VRMS. 9 to 32 VDC, G.I., max. starting current: 1.2A/200 ms (on request); 40 to 155 VDC, G.I., max. starting current: 0.6A /200 ms (on request);
Insulation: 500 VRMS. Self-consumption: 6 VA (basic instrument), 7 VA max. with retransmission.
OPERATING TEMPERATURE: from 0 to +50 C (R.H. <90% non-condensing)
STORAGE TEMPERATURE: from -10 to +60 C (R.H. <90% non-condensing)
REFERENCE VOLTAGE INSULATION: 300VRMS to earth
INSULATION CATEGORY: CAT III (EN61010-1)
DIELECTRIC STRENGTH: 4000VRMS for 1 minute
NOISE REJECTION: NMRR: 40 dB, from 40 to 60 Hz; CMRR: 100 dB, from 40 to 60 Hz; EMC: IEC 801-2, IEC 801-3, IEC 801-4 (level 3)
IN ACCORDANCE WITH THE FOLLOWING STANDARDS: EN 61010-1, IEC 1010-1, VDE 0411.
CONNECTIONS: screw-type, detachable
CASING SIZE / DIMENSIONS / MATERIAL 1/8 DIN / 48 x 96 x 124 mm / ABS, self-extinguishing: UL 94 V-0.
PROTECTION DEGREE / WEIGHT: IP 65 (standard) / 470 g. approximately (included retransmission and packing).

INSTALLATION

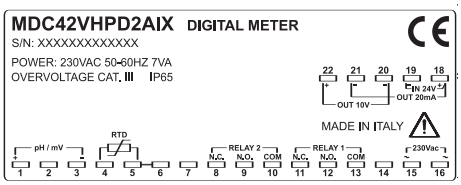
Overall dimensions and panel cut-out



Mounting
Insert the instrument into the panel and fasten it by fixing the two lateral brackets (1) supplied with the instrument to the appropriate location (2), and subsequently locking them by means of the 2 screws (3) supplied with the instrument.

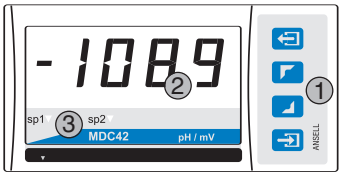


Connections
According to the requirements of EN61010-1 the power supply line to be connected to the power supply input of the instrument must be protected against short circuit by means of appropriate fuses (100 mA T type). Connect the input/output of the instrument as shown in the figure below.
Attention: the pH or REDOX electrodes must be connected across 1 (+) (glass) and 3 (-) (reference) terminals; the temperature "Pt100" probe across 4 and 5/6 terminals. Should this latter probe be only a 2-wire type, the terminals 5 and 6 must be jumped.



Before connecting the power supply, ensure the voltage corresponds to the instrument label.

FRONT PANEL DESCRIPTION



1. Key-pad:
<u>functions available outside the programming phase</u>.
Key to be pressed:
- Displays set-point 1;
- Displays set-point 2;
- For longer than 2 seconds: modification of set-point 1 (passcode between 128 and 255 only);
- For longer than 2 seconds: modification of set-point 2 (passcode between 128 and 255 only);
- + Displays process temperature (manual or automatic);
- + Displays % of "SLOPE" (only pH);
- + For longer than 2 seconds: displays ERROR CODE, additionally:
- displays "pH0";
- displays "SLOPE%";
- displays "ERROR CODE" again;
- displays input variable again (measurement mode).

1. Key-pad:
<u>functions available in the programming phase</u>.
Key to be pressed:
- For longer than 2 seconds: programming phase entry and passcode confirmation;
- Menu selection (from the first to the last);
- Menu selection (from the last to the first);
- Confirmation and entry:
  • in the configuration menus;

• in the secondary menus relating to parameters.

In the selected menu / secondary menu:
• increase of displayed value
• modification of parameter selection;

In the selected menu/secondary menu:
• decrease of displayed value
• modification of parameter selection;

In the menus: exit from the programming phase (message "End" on the display) and return to the measuring and control function; In the secondary menus: exit and return to the main menu (the modification of the selection or programming will not be saved if the key has not been previously pressed)

2. Display

Alphanumeric indication by means of four 7-segment LED's:
• of the measured value;
• of the programming parameters;
• of the abnormal conditions.

3. LED

Indication of the control set-point status.

OPERATION

• Power-on

When you switch the unit on, the display shows for approximately 5 seconds the instrument's software revision: **r.A1**.

• Displaying, control and diagnostics

The instrument shows continuously the value of the input variable as defined in the programming phase.

The value shown on the display is continuously compared with the value of the two control set-points and of the other parameters, thus generating the control function by energizing/de-energizing the output relays.

• Programming

This phase is identified by the blinking of the decimal point on the right side of the display.

To enter the programming phase, press the key until "**PAS**" is shown on the display; then "**0**" is displayed: the correct numerical code (Passcode) is to be entered. The following conditions may occur:

• 1) the operator hasn't entered any Passcode: press the key again to enter the configuration menus of the instrument;

• 2) the operator has already entered a Passcode: select the correct Passcode by means of the key (to increase the value) or key (to decrease it) until the desired value is displayed. Press the key to confirm the value: if the Passcode is correct, then the display will show "PAS" again followed by the relating numerical code; press the key once more in order to display the first configuration menu; if the Passcode is not correct, the display shows "End" and the instrument goes back to the measuring and control phase.

PROGRAMMING OF A NEW PASSCODE AND AUTOMATIC SELECTION OF THE PROTECTION LEVEL OF THE CONFIGURATION DATA.

To enter the new Passcode:
• if the Passcode is "0", press the key when the display shows the "**PAS**" message for the second time; enter the desired numerical code using the or keys, then confirm it by pressing the key: the display will show the first configuration menu ("uSE");
• if the Passcode has already been entered, you can modify it following the procedure described at No. 2); after the "**PAS**" message has been shown a second time, enter the new numerical code using the or keys and confirm it by pressing the key: the display will show the first configuration menu ("uSE").

Data protection levels:
• if the Passcode is "0", the configuration data are not protected by undesired access;
• if the Passcode is a number between "1 and 127", the configuration data are entirely protected against undesired access;
• if the Passcode is a number between "128 and 255", the configuration data are protected against undesired access except for the programming of the values ("SEt") of set-point 1 and/or 2.

It is possible to reset the Passcode by entering the number 3584.

• All programming/configuration steps are shown in the flow chart. The flow chart gives the operator a better understanding of the programming structure of the instrument, indicating the current function with regard to the others. The flow chart also makes it easier to understand the commands used in the programming phase.

• See the chapter "Front panel description" for information regarding the use of the key-pad and the relevant main functions.

• Glossary of displayed symbol:

• **PAS**: access key to programming

• **USE**: menu to select the measuring mode:

• **rE**: selection of the REDOX measurement, direct mode (the proper connection of the REDOX electrode allows to display the proper polarity of the value on the display);

• **-rE**: selection of the REDOX measurement, inverted mode (the wrong connection of the polarity of the REDOX electrode allows to display the right polarity on the display);

• **PH**: selection of the pH measurement mode.

• **t.un**: menu to select the temperature engineering unit (available only for the "PH" measuring mode):

• **C**: in Celsius degrees;
• **F**: in Fahrenheit degrees.

• **t.CO**: menu to select and program the temperature compensation mode (available only for the "PH" measuring mode):

• **nAn**: manual compensation;

• **tPr**: temperature value in case of manual compensation;

• **Aut**: automatic compensation according to the NERNST coefficient.

During the measuring and control phase the calibration straight line is continuously compensated with regards to the measured temperature (manual, automatic).

Note: if no temperature compensation probe is used, the "nAn" mode must be selected.

• **CAL**: menu to select and program the calibration mode and values (available only for the "PH" measuring mode):

• **bu.1**: shows the current value of the buffer being measured (before the true calibration);

• **PH1**: shows the value of "Bu.1" but with the possibility to adjust the measurement according to the buffer value;

• **CA.1**: calibration procedure with only one buffer "Bu.1", the second calibration point is calculated automatically by the instrument using the NERNST coefficient.

Note: using the CA.1 procedure it is possible to calibrate only the asymmetry of the pH electrode and not the slope which remains equal to 100%;

• **CA.2**: calibration procedure with two buffers: "Bu.1" and "Bu.2". Using this procedure it is possible to calibrate in the meantime both asymmetry and SLOPE;

• **bu.2**: shows the current value of the buffer being measured (before the true calibration);

• **PH.2**: shows the value of "Bu.2" but with the possibility to adjust the measurement according to the buffer value.

• **E2P**: shows the storing of the new calibration values into the EEPROM (memory); the values will be stored only if the key is pressed until the display flashes. Whether the key is pressed for a short time (display is not flashing) the following information are available:

- by pressing the key the display shows "E.--" which is the error code (see the error table);
- by pressing the key the display shows the value of the SLOPE % (see the SLOPE table);
- by pressing the key the display shows the value of pH at 0 mV (isopotential point "pH0"), normally it should be 7 pH;
- by pressing the key the instrument goes out from the calibration procedure and back to the "CAL" menu.

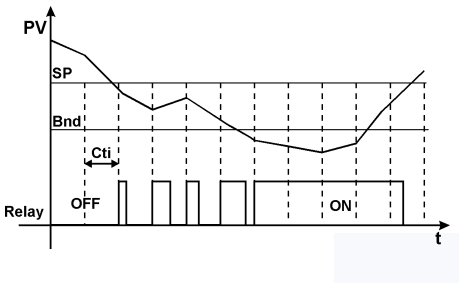
• **SP.1**/**SP.2**: menu to select the programming of the control set-point parameters.

tYP: selection of the type of control.

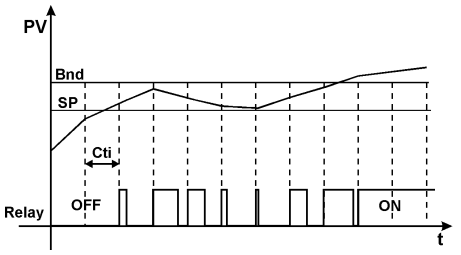
do: down/low control set-point. The relay will be activated when the measured value falls below the set-point value.

uP: up/high control set-point. The relay will be activated when the measured value rises above the set-point value.

do.P: down/Low proportional control. The control relay is managed by cycle time, proportional to the deviation of the measured value, from the set-point value. e.g. if the set point is 8.0pH, the proportional band 1.0pH and the cycle time 10 sec. When the measured value falls to 7.8pH , the control relay will energise for 2 sec. and de-energise for 8 sec. If the measured value falls below the proportional band value (7.0pH), the relay will remain energised.



uP.P: Up/High proportional control. The working principle is the same as for the do.P parameter, except that proportional cycling of the relay begins when the measured value rises above the set-point value.



SEt: value of the control set-point.
bnd: this parameter is the proportional band, a programmable value within the range 0.1pH < bnd < 14.0pH. It automatically replaces the "HYS" parameter if either "do.P" or "uP.P" are chosen.
Cti: This parameter is the cycle time, a programmable value within the range 1sec < Cti < 255sec. It will be added and displayed by the instrument when either "do.P" or "uP.P" are chosen.
The cycle time is the period within which the different duty-cycles between the ON and OFF output times are managed.
HYS: hysteresis value of the set-point. The hysteresis is a numerical value included within the range: 0 < HYS < 14.00 pH / 1000 mV and represents the difference between the value of the ON control status and the value of the OFF control status. The hysteresis modifies the value of the OFF control status not only with regards to the control set-point value, but also with regards to the control type: the hysteresis value is added to the set value if the control type is "do" and subtracted from the set value if the control type is "uP".
Example: "do" control, "SEt"=10.00 (value of the ON control status), hysteresis "HYS"=1.00 resulting OFF value (end of control status): 11.00 (resulting from 10.00 + 1.00).
"uP" control, "SEt"=10.00 (value of the ON control status), hysteresis "HYS"=1.00 resulting OFF value (end of control status): 9.00 (resulting from 10.00 - 1.00).
NOTE: the hysteresis is to be programmed according to the displayed range.
RLY: normal status of the relay coil.
nd: normally de-energized coil.
nE: normally energized coil.
• **FiL**: menu to program the digital filter's parameters.
This function allows you to stabilize the instruments digital display, in order to obtain steady readings and positive control.
Fi.S: activation range of the digital filter. This value is programmable within the range: 0 < Fi.S < 14.00pH / 1000mV.
The programmable numerical value represents the fluctuation range of the value which has been measured and displayed by the instrument. In the first configuration phase this value must be 0 and the right value is to be entered only after the verification of the possible fluctuation.
Example: the measured instantaneous value varies from 10.00 to 10.06, and the value to be entered as "Fi.S" is 0.06 (10.06 - 10.00).
Fi.C: value of the filtering coefficient. Value to be programmed within the range: 1 < Fi.C < 255. The higher "Fi.C", the higher the filtering of the measured value and the longer the updating time of the displayed value, the control set-points and the analogue output.
NOTE: for a correct working of the filter, the relative coefficient must satisfy the following relationship: 1 < Fi.C < (Fi.S x 8) < 255.
Factory set values: Fi.S "0.02" (pH) and "2" (REDOX). Fi.C "2" in both cases.
• **A.ou**: menu to program the parameters relating to the analogue output.
Lo.A: value to be expressed as % of the output range (0/20 mA-0/10 V) to be generated in correspondence with the minimum measured value (zero scale). Value programmable within the range: 0.00 < Lo.A < 99.99.
Example: 0 pH / 1000 mV that must correspond to an analogue output of 4 mA.
"Lo.A" (%) = 100 x ?mA / **20** that in our example corresponds to 100x4 mA/20 = 20%, therefore enter 20.00.
Example: 0 pH / 1000 mV that must correspond to an analogue output of 1V.
"Lo.A" (%) = 100 x ?V / **10** that in our example corresponds to: 100x1V/10 = 10%, therefore enter 10.00.
Hi.A: value expressed as % of the output range (0/20mA-0/10V) to be generated in correspondence with the maximum measured value (full scale). Value to be programmed within the range: 0.00 < Hi.A < 99.99.
Example: 14.00 pH / +1000 mV that must correspond to an analogue output of 18 mA.
"Hi.A" (%) = 100 x ?mA / **20** that in our example corresponds to: 100x18 mA/20 = 90%, therefore enter 90.00.
Example: 14.00 pH / +1000 mV that must correspond to an analogue output of 5V.
"Hi.A" (%) = 100 x ?V / **10** that in our example corresponds to: 100x5V/10 = 50%, therefore enter 50.00.

ERROR TABLE

If the instrument detects one or more abnormal conditions, the display flashes, however the measuring functions are still managed, but the default values are used: temperature reference 25 C; pH1= 14.00 pH / – 412.62 mV; pH2= 0.00 pH / + 412.62 mV
Changing the flashing display to steady is only possible by removing the abnormal condition (error status).

ERROR TABLE (cont.)

ERROR CODE	pH / REDOX		Temperature		SLOPE% (only pH measurment)		
	under-range	over-range	under-range	over-range	under-range	over-range	temper. calibr.
E.--	---	---	---	---	---	---	---
E.02		---	---	---	---	---	---
E.03	---		---	---	---	---	---
E.08	---	---		---	---	---	---
E.0A		---		---	---	---	---
E.0b	---			---	---	---	---
E.0C	---	---	---		---	---	---
E.0E		---	---		---	---	---
E.0F	---		---		---	---	---
E.40	---	---	---	---		---	---
E.50	---	---	---	---	---		---
E.70	---	---	---	---	---	---	
E.42		---	---	---		---	---
E.43	---		---	---		---	---
E.48	---	---		---		---	---
E.4A		---		---		---	---
E.4b	---			---		---	---
E.4C	---	---	---			---	---
E.4E		---	---			---	---
E.4F	---		---			---	---
E.52		---	---	---	---		---
E.53	---		---	---	---		---
E.58	---	---		---	---		---
E.5A		---		---	---		---
E.5b	---			---	---		---
E.5C	---	---	---		---		---
E.5E		---	---		---		---
E.5F	---		---		---		---
E.72		---	---	---	---	---	
E.73	---		---	---	---	---	
E.78	---	---		---	---	---	
E.7A		---		---	---	---	
E.7b	---			---	---	---	
E.7C	---	---	---		---	---	
E.7E		---	---		---	---	
E.7F	---		---		---	---	

Error; --- No error

SLOPE TABLE

The SLOPE % values are a significant indication of the working status of the connected pH electrode

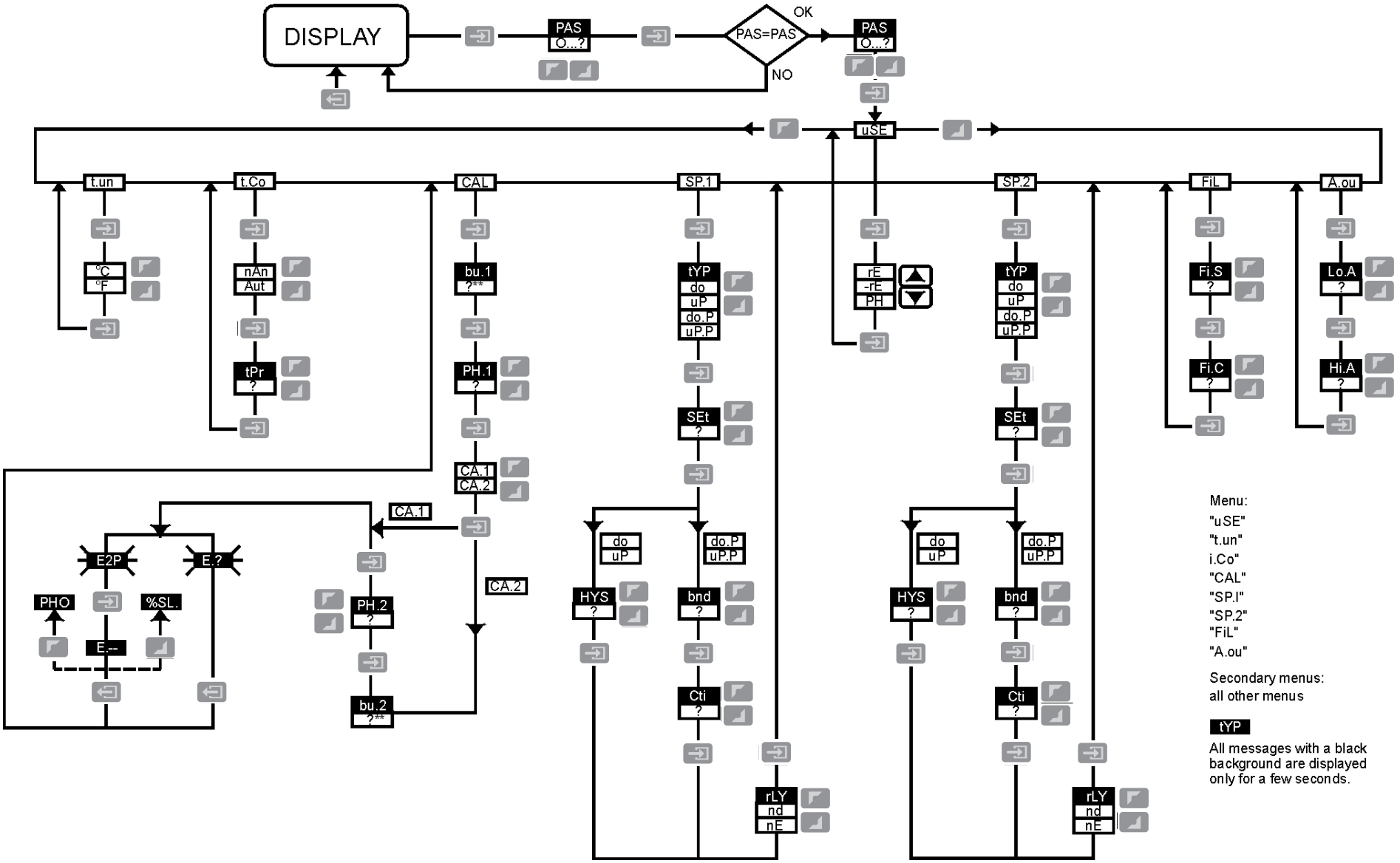
% SL	ACTIONS
>105.0%	•The last calibration straight line is not stored by the instrument.
< 80.0%	•The display is flashing that means it is possible to show the error code. •Into the "DISPLAYING OF ERROR CODE " procedure it is possible to show the asymmetry value of the calibration straight line (PH0) and the value of the SLOPE % referred to the last calibration. •Check the pH electrode.
80.0 % to 105.0 %	•The last calibration straight line is used and therefore stored by the instrument as a new one. •The display is steady.

Note: Ageing of the pH electrode causes a reduction in the SLOPE % (less than 100.0%).
The SLOPE % parameter shows the efficiency of the pH electrode compared to the last calibration. It is advisable to carry out a calibration at regular intervals in order to check its deterioration.
During pH measurement, automatic temperature compensation only changes the NERNST coefficient (slope) and not the asymmetry (E). To compensate for the latter, it is necessary to calibrate close to the solution temperature.

Programming flowchart

In the menus:press the key in order to exit from the programming phase: the display shows "End" and then the measured value.

In the secondary menus:press the key in order to go back to the main menu (the selection or programming modification will not be saved if the key has not been previously pressed).



Menu:
"uSE"
"t.un"
i.Co"
"CAL"
"SP.I"
"SP.2"
"FiL"
"A.ou"

Secondary menus:
all other menus

tYP

All messages with a black background are displayed only for a few seconds.