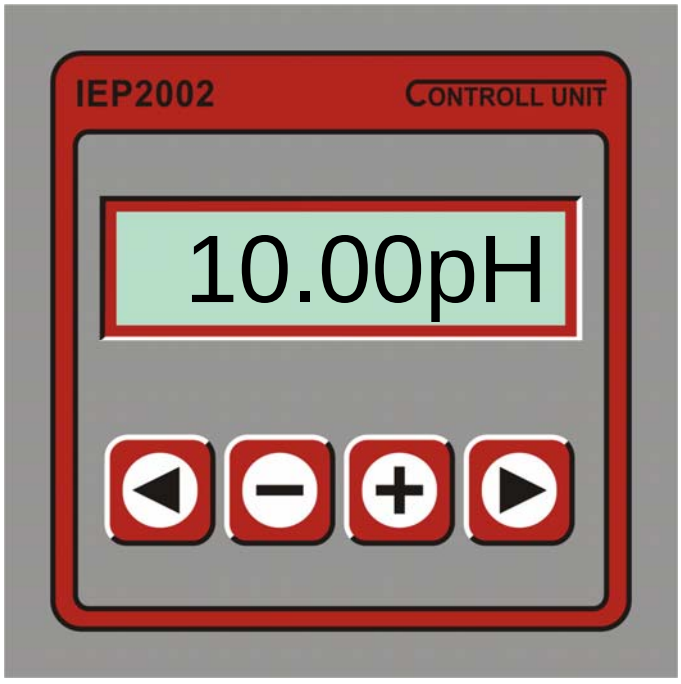
pH-1 V2.0

Instrument to measure and control chemical reaction



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1. Principle of operation

The pH probe transforms the pH value of the liquid to be measured into an electric voltage signal. This analog signal is transformed in a digital signal and after a correction and amplification is shown on display.

The measured value is compared with the preset value and if necessary modifies the pH value of the solution by adding alkali or acid until the pH value goes between the two limits. This intervention is made only if enabling inputs enables the instrument outputs. The O1 output can be enabled by E1 input and O2 by E2 but in ON and OFF mode this is ineffective.

2. User guide

After turning on the instrument the software ID number can be seen for several seconds on display. During this time the instrument tests itself and if everything is OK the display shows the measured pH value. This is the default state of the display. If any of the set values exceeds the set limit and the output is enabled the display shows the symbol of adequate output.

Several modes can be displayed pressing the “<” and “>” buttons. By short pressing you can move in the same mode.

By long pressing (*approx. 2.5 sec*) of “<” button you can step into the “Calibration mode”.

The long pressing (*approx. 2.5 sec*) of “>” button enters the user in “Service mode”.

From both modes you can return to “Basic mode (*pH*)” by pressing (*approx. 2.5 sec*) the opposite arrow.

2.1. Basic display modes

In basic mode the measured pH value is displayed. Pressing one time the „<” button we move in Temperature mode. Pressing again the button the display shows the actual values of E1 and E2 inputs (*L=LOW, H=HIGH*).

In basic mode (*pH*) by pressing the „>” button one time we can set the limits of O1 output and pressing it again we can do the same with O2 output.

So by pressing the „<” and „>” buttons we can move between the display modes.

If the buttons are not pressed for several minutes the display changes into the basic (*pH*) mode.

2.2. Setting the output limits

The „+“ and „-“ buttons can set the chosen output. Pressing the buttons one time the value changes one by one but keeping them pressed the value increases / decreases continuously. Keeping the buttons pressed (*after approx. 2.5 sec*) the value increases / decreases continuously but slow, then (*after approx. 10 sec*) faster.

The two limits can have any value between 0 and 14 pH. When in an application it is possible to add alkali and acid too, it is highly recommended to set a distance high enough between the limits to avoid an unnecessary dosing.

In case of through-flow systems to provide a continuous dosing it is recommended to set a narrower interval because of the proportional (*PULSE type*) control.

The set data are stored in an EEPROM so they are non-volatile.

3. Calibration

In basic mode pressing the „<” button a longer time (*approx. 2.5 sec*) the instrument goes into the calibration mode.

First of all the measuring mode has to be set (*C° calibration or C° measuring*). Then by pressing the „<” button for several times the 7pH, XpH, 0°C, X°C calibrations can be done.

In calibration mode by pressing simultaneously the „+” and „-” buttons the parameter under calibration (*pH, °C, mA*) is set to its default value. This feature is a great help when an unauthorized person had done a bad calibration before.

The calibration has to be always started by calibrating the 7pH, 0°C, 4mA values because these values modifies at the same time the XpH, X°C, 20mA values as well. Then by modifying the 7pH, 0°C, 4mA values, the measured value can be shifted in a linear + / - direction (*fine-tuning*) by keeping the amplification unmodified.

During the calibration the outputs (*evidently*) are inactive. The supervisor PC is informed about (*2mA*) the calibration through the 4-20mA line. Finishing the calibration the „>” button has to be pressed a longer time (*approx. 2.5 sec*) ant the instrument returns into the basic mode.

Leaving the instrument in calibration mode for a few minutes returns automatically in basic mode (*pH*).

3.1. Setting the measuring mode

MEAS

In this mode the thermostat only measures the temperature but does not influence the pH value.

This mode is usually used for solutions with constant temperature.

For solutions with changing temperature the authentic pH value must be calculated as follows:

The deviation from 7pH (***deviation***) must be multiplied by the following ratio ant the result (***value***) has to be applied to 7pH.

$$\textbf{value} = \textbf{deviation} \times \frac{273 + \textbf{CALC°}}{273 + \textbf{KIJC°}}$$

Where **CALC°** is the temperature of the solution used for calibration (*practical 25C°*).

Where **KIJC°** is the displayed temperature (*value measured by PT100 probe*).

COMP

In this mode the thermostat measures the solution's temperature and in function of this temperature modifies the pH value.

This mode is used for measuring solutions with changing temperature.

3.2. Calibrating the pH measuring circuit

pH probes must be calibrated time to time. This can be done by using pH etalon and buffer solutions. You need two pH buffers. The first one has 7pH value ant the other one has an optional value but distant from 7pH (*preferably outside from the interval 6-8 pH and similar to the pH value of the solution to be controlled).* The probe has to be cleaned before calibration.

Introduce the probe into the solution with 7pH and adjust the displayed value to 7 by „+" and „-" buttons. Then introduce the probe into the second solution and adjust the XpH to the known value. These steps are recommended to be done for few times.

3.3. Calibrating the °C measuring circuit

This mode is applicable only in applications that use temperature compensation. If the temperature compensation was without any effect the Pt100 sensor has to be replaced by a 110 Ohm (*for 25°C)*, / 1% metal-layer resistor.

The calibration is made at 0°C and X°C temperatures (*the second one is preferably to be a value far enough from the 0°C*). As far as the used Pt100 sensor's characteristic is a standard one the calibration can be done by using resistors (*always place them in place of the probe)*. At first connect the resistor of 100 Ohm / 1% and in 0°C mode you must see a 0 on display then connect a resistor of 140 Ohm / 1% and must be set a value of 100°C in X°C mode. Finally reconnect the probe Pt100.

3.4. Calibrating the 4-20mA current output

In calibration mode press a longer time (*approx. 2.5 sec*) the „<” button to get into the 4-20mA calibration mode.

This is necessary only when the current output will be used (*for example as a PLC input*). The 4mA must be fit to 0.00pH and the 20mA to 14.00pH. For the authentication you must connect an electronic instrument of 200mA to the instrument’s current output. At first set 4mA value by „+” „-” buttons in CAL mode then after pressing the „<” button in 20 mA CAL mode set 20 mA.

4. Service mode

In basic mode press the „>” button for a longer time (*approx. 2.5 sec*) and you enter into the service mode. Service mode generally is used at start-up or at periodical supervision. The OUT1 and OUT2 outputs can be set by pressing the „>” button and then the „+” and „-” buttons.

During the service mode outputs (*evidently*) are inactive. The supervisor PC is informed about (*2mA*) the service settings through 4-20mA line. Ending the service, the „<” button has to be pressed a longer time (*approx. 2.5 sec*) ant the instrument returns to the basic mode.

Leaving the instrument untouched in calibration mode for a few minutes returns automatically in basic mode (*pH*).

4.1. Output function mode

The outputs' function can be defined by the functional modes.

DIR

This mode defines the outputs as simple limit switches. The output is active while the measured value exceeds the limit and becomes inactive only when the measured value falls under the limit by a hysteresis value. This mode is used generally for control pumps or for error warning.

PULSE

PULSE mode is ideal for operating electromagnetic valves. Operates the valve's coils with an impulse of max. 120 imp / min until the measured value rises over the limit by hysteresis value. If the value exceeds the limit by a value less then the hysteresis the impulse changes proportionally with the exceeded value between 0 and 120 imp / min. The period of ON state is always the half of maximal set imp / min value.

Ex: Set imp/min = 120.
In this case the ON period is always 0.25 sec.

ON

The outputs are always active. This mode is useful to indicate for example a power cut state.

OFF

The outputs are always out of use in this mode.

4.2. Output limits exceeding

We can set by a parameter the time when the outputs to be active.

OVER

The output is active if the measured value exceeds the limit and in any other cases is inactive.

UNDER

The output is active if the measured value is under the limit and in any other cases is inactive.

4.3. Setting the output's imp / min

This parameter is senseless if the instrument is not in ***PULSE*** mode. We can determine the maximal number of impulses per minute of an output by this parameter.

This value can take values between 6 and 120 imp / min.

4.4. Setting the output's hysteresis value

By this parameter we can determine the difference between the upper and lower control points of an output (*max. 9pH in function of limit*).

4.5. Setting the direction of output's hysteresis

This parameter determines the upper and lower control points of an output which once reached the output's state changes. Within these values changes the number of imp/min in ***PULSE*** mode.

UPPER

The set value is the upper control limit and the value that comes from this limit by subtracting from it the hysteresis gives the lower control limit.

MID

Values that come by adding and subtracting to the set value the half of hysteresis gives the upper and lower control limits.

LOWER

The set value is the lower control limit and the value that comes from this limit by adding to it the hysteresis gives the upper control limit.

4.6. Setting the active state of inputs

We get to this mode by pressing a longer time (*approx. 2.5 sec*) the “>” button in service mode. This mode is necessary only at set up or periodical checking. The parameters of E1 and E2 inputs can be set by “+” and “-“ buttons.

The outputs work from internal +5V and operate on TTL levels.

HIGH

In this case the input is active and enables the adequate output if the output is not short-circuited (*has at least +2.3V*).

LOW

In this case the input is active and enables the adequate output if the output is short-circuited (*has max 0.9V*).

4.7. Setting the delay time of inputs

By this parameter we can set the delay time of output from the moment when the input goes active.

This can have values from 0.1 to 99.9 seconds.

At the end of service or calibration mode (*change to basic mode)* outputs become active only after the delay time.

5. Putting into operation

The pH probe (*or the preamplifier unit and the probe*) must be connected in accordance with attached electrical drawing then the instrument can be plugged into the socket. This order is very important because if not the instrument's input circuit can be damaged by a static impulse.

Only the probe's own cable can be used. If it is not long enough a preamplifier has to be used.

In case of temperature compensation the Pt100 thermostat must be connected. If it is not possible or this feature is not used the Pt100 can be replaced by a 110 Ohm *(for 25°C)* / 1% metal layer resistor.

Warning:

The probe's cable and preamplifier's cable shielding has to be connected to the instrument's GND point but this point must not be connected to earth!

The instrument's GND point can have contact with the solution only through the probe!

6. Technical data

Supply voltage	230V AC, max. 5VA
Relay contacts maximum current	250V AC, max. 2A
4-20mA outputs max. impedance	max. 300 Ohm
pH probe input impedance	1G Ohm
Temperature compensation (*probe option*)	Pt100 –5 - +125C
Probe cable length	max. 10m
Cable length between preamp. and instrument	max. 50m
Measuring resolution	0.01pH
Measuring precision	0.05pH
Measuring interval	0 - 14pH
Instrument execution	Table instrument
Size	96x96x125mm
Protection	From front IP54
Ambient temperature	-5 - +55C
Preamp. size	130x90x60mm
Protection	IP56
Ambient temperature	-5 - +55C

7. Connection plan