Operator Manual

POLYMETRON 9135
pH/redox measurement

221=191=035 - Revision N - 10/12/2007

HACH ULTRA™

EXCELLENCE IN PROCESS ANALYTICS

This instrument conforms to the European Directives :

- **89/336/CEE modified by the directive 93/68/CEE**
- **73/23/CEE modified by the directive 93/68/CEE**

Warning !

There are no user-serviceable parts in either the transmitter or sensor. Only Hach Ultra Analytics personnel or their authorized representative should attempt repair of the system and only components expressly approved by the manufacturer should be used. Any attempt to repair the instrument in contradiction of these guidelines may result in damage to the instrument and injury to the person making the repair. It will also void the warranty and may compromise the safe operation, electrical integrity or CE compliance of the instrument.

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Note :

This equipment has been tested and found to comply with the limits for Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Precautionary Labels :

Read all labels and tags attached to the instrument. Personal injury or damage to this instrument could occur if not observed.

This symbol, if noted on the instrument, references the instruction manual for operation and / or safety information.

Electrical equipment marked with this symbol may not be disposed of in European public disposal systems after 12 August of 2005. In conformity with European local and national regulations (EU Directive 2002/96/EC), European electrical equipment users must now return old or end-of life equipment to the Producer for disposal at no charge to the user.

***Note** : For return for recycling, please contact the equipment producer or supplier for instructions on how to return end-of-life equipment for proper disposal.*

Important document. Retain with product records.

Restriction of Hazardous Substances

Note:
The following only applies to exports of the product into the People's Republic of China.

Marking 标记

Products contain toxic or hazardous substances or elements.
含有有毒或者危险物质及成分的产品。

Environment Protection Use Period Marking (years).
环保使用期限标记（年）

	Toxic or Hazardous Substances and Elements 有毒或者危险物质和成分					
Part Name 部件名称	**Lead (Pb)** 铅	**Mercury (Hg)** 汞	**Cadmium (Cd)** 镉	**Hexavalent Chromium (Cr VI)** 六价铬	**Polybrom Biphenyls (PBB)** 多溴联苯	**Polybrom Diphenyls (PBDE)** 多溴联苯醚
Transmitter box	X					
CPU PCB	X				O	
Power PCB	X				O	
Relay PCB	X				O	
Module	X					

O: Indicates that this toxic or hazardous substance contained in all homogeneous material for this part is below the limit requirement
表示所有此类部件的材料中所含有毒或危险物质低于限制要求

X: Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement
表示至少有一种此类部件材料中所含有毒或危险物质高于限制要求

Table of contents

1. General presentation of the 9135 transmitter

Presentation of the 9135 transmitter

The 9135 pH transmitter and associated measuring sensors has been designed for measuring and continuous control of pH or redox potential (with possibility of temperature measurement) in industrial process.

An automatic control of the sensor defaults improves the preventive servicing of the measuring chain.

2 analogue outputs (0/4 – 20 mA) may be freely programmed.

Note :

The programming is displayed in 6 languages. To modify this parameter see § 4 Changing the programming language.

Four relays and RS485 are available in option.

Introduction

PH Measurement

Theory

pH is the negative logarithm of the hydrogen ion activity and a measure of the acidity, or alkalinity of a solution.

$$pH = -\log a\,[H+]$$

pH is normally measured using a glass electrode and a reference electrode.

The glass electrode acts as a transducer, converting chemical energy (the hydrogen into activity) into an electrical energy (measured in millivolts). The reaction is balanced and the electrical circuit is completed by the flow of ions from the reference solution to the solution under test.

The electrode and reference solution together develop a voltage (emf) whose magnitude depends on the type of reference electrode, the internal construction of the glass electrode, the pH of the solution and the temperature of the solution. This voltage is expressed by the Nernst equation :

$E = Eo - (2.3\,RT/F) \times \log a[H+]$

$E = Eo - (\text{slope}) \times \log a\,[H+]$

where

E = the emf of the cell

Eo = the zero potential (isopotential) of the system : depends on the internal construction of the glass and reference electrodes

R = gas constant

T = temperature in Kelvin

a[H+] = activity of the hydrogen ion (assumed to be equivalent to the concentration of hydrogen ions)

F = Faraday constant

For every unit change in pH (or decade change in ion concentration) the emf of the electrode pair changes by 59.16 mV at 25°C. This value is known as the Nernstian slope of the electrode.

The pH electrode pair are calibrated using solutions of known and constant hydrogen ion concentration, called buffer solutions. The buffer solutions are used to calibrate both the electrode isopotential and slope.

Redox measurement

The potential which will be measured in a redox system with a measuring chain consisting of a redox electrode and a reference electrode is called the redox potential. It depends on the ratio of activities of the two partners of a redox system and of the numbers of transferred electrons. In many cases the pH of the solution will influence the potential, too.

Peters 's equation can determine the redox potentials.

The stability and reversibility of a redox system strongly influence the reproductibility of the measured redox potential.

Standard potentials of a redox system will be found for aOx = a Red and for pH = 0 which corresponds again to a standardized hydrogen ion activity aH+ = 1 mole per litre.

The half-cell potential εB, of the reference electrode will strongly influence the potential E of the measuring chain. To remove this influence the potential of the measuring electrode can be related to the hydrogen electrode. If εB is the half-cell potential of the reference electrode used, the calculation is made by

$$\varepsilon(H) = \varepsilon + \varepsilon R$$

Such standardized redox potentials to some extent provide information on the oxidizing or reducing power of a redox system. Increasing positive values express an increasing power of oxidation. The more negative the potential, the stronger the reducing power will be. The range of practical interest is between +1500 and -1000 mV.

Features

OPERATING CONDITIONS	
Ambiant temperature	-20°...+60°C
Relative humidity	10...90%
Power supply voltage fluctuation	± 10 %
Over voltage category	2
Pollution degree	2 (as CEI 664)
Altitude	< 2000 m
Measurement category	I (overvoltage less than 1500 V)

MEASURE	
Display range	0 ... 14 pH (possibility to measure up to -3 pH) -1500 mV.... 1500 mV -20°C ... 200°C (-4°F...392°F)
Display resolution	0.01 pH / 0.1 pH (adjustable) 1 mV 0.1°C
Repeatability	± 0.02 pH ± 1 mV ± 0.2°C
Temperature sensor	Pt 100 / Pt 1000
Automatic temperature compensation range	-20 ... 200°C -4 ... 392°F
Temperature compensation range	Nernst ultrapure water different tables
Electrode type	- glass (with or without preamplifier) - antimony - redox - programmable (slope + Uiso + pHiso)
Cable length	0 ... 25 m (high impedance) 0 ... 100 m (low impedance)
Sensor inputs	differential measurement
Input impedance	$> 10^{12}\ \Omega$
Impedance measurement	glass : 5M Ω .... 1G Ω reference: 100 Ω ... 1M Ω

CALIBRATION	
Calibration type	- NIST (4,00 ; 6,88 ; 9,22) - DIN9 (4,00 ; 7,00 ; 9,00) - DIN10(4,00 ; 7,00 ; 10,00) - 2 points (manual) - 1 point process - values (slope and offset)
Slope matching	41 ... 71 mV to 25°C 70 ... 120 %
Zero matching	± 3 pH ± 250 mV
Temperature calibration	- 50°C...+20°C (- 90°F...+ 36°F)
CONTROLLER	
Setpoint	programmable in the range 0...14 pH or -1500 mV ... +1500 mV
Neutral zone	programmable from 0...3 pH or 0...200 mV symetric around the regulating point
Proportional band	programmable from 0...500%
Periodicity	programmable from 3 to 60 seconds (impulse control) or from 1 to 30 seconds (frequency control)
Controller output	2 isolated contacts S1 and S2 S1 : base injection S2 : acid injection
Automatic/manual switch	possible
ANALOGUE OUTPUT	
Output signals	2 galvanicly outputs insulated [ ]
Allocation	pH / redox / temperature
Type	0 ... 20 mA 4 ... 20 mA
Maximum load	800 Ω

Accuracy	0.1 mA
ALARMS	
Alarm number	4
Function	- limits - alarm system - timer
Hysteresis	0 ... 10%
Temporization	0 ... 999 s
Breaking power (on a resistive charge)	250 V AC, 3A max 100 V DC, 0,5A max Use a cable (rated 105°C and AWG22 to 14). The external cable insulation should be cut as close as possible from the terminal block.
Response time	10 ms
Relaxation time	5 ms
RS485	
Baud rate	300 ... 19200 bauds
Insulation	galvanic
Station number	32 max
PROGRAMMING	
Language	French English German Italian Spanish Dutch
Display	icones + graphic zone (80*64 pixels)
Protection codes	calibration programming service

ELECTRIC CHARACTERISTICS

Power supply voltage	• standard version : - 100 V ... 240 VAC 50/60 Hz • low voltage version : - 13...30 VAC 50/60 Hz - 18...42 VDC
Preamplifier	± 9 V DC
Connections	screw terminals 2,5 mm^2
Consumption	25 VA
Fuse	5 x 20 cartridge T2AL - 250V
European standards	- EN 61326-1997 and EN61326 A1-1998 (Industrial level for immunity) - EN 61010 – 1 (low tension main lines)
UL and CSA agreement	- File E226594

MECHANICAL CHARACTERISTICS

Dimensions	144 x 144 x 150 mm
Weight	2 Kg
Material	housing : Polyester coated aluminium screws : stainless steel
Tightness	IP65
Mounting types	wall pipe panel
Cable glands	2 * PG13 and shutter 2 * PG11 and shutter

2. Installation of the transmitter

Unpacking the 9135 transmitter

Inspect the package at the reception to detect an eventual damage due to the transport. Make sure the package contents are not damaged.

Check the package corresponds to your order :

- quantity delivered,
- type of instrument and version accordingly to the instruction plates,
- accessories : 4 cable glands, 2 fittings and 2 mounting screws,
- instruction manual,
- certificate of conformity to specifications.

Advice for installation

Choose a site where :

- vibrations are not too excessive,
- supplay relays or commuters are away,
- la maintenance sera facile,
- the transmitter is not directly exposed to sunlight and is not summited to atmospheric exposure.

Note :

It is preferable to mount the instrument above eye level, allowing an unrestricted view of the front panel displays and controls.

Mounting types

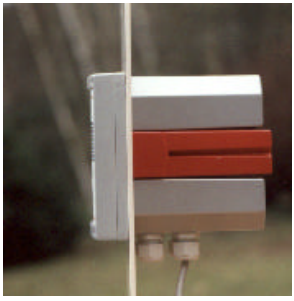
3 possibilities to mount the instrument (use of the red clamping bow) :
The transmitter housing conforms to norm DIN 43700.

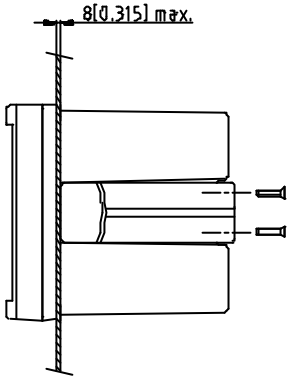
Panel mounting :

Panel cutting : 138 x 138 mm
Front panel dimensions : 144 x 144 mm

- ***2 screws Æ 4 mm lg 16 flat head (provided) for panel thickness 0 to 4 mm***
- ***2 screws Æ 4 mm lg 20 flat head (provided) for panel thickness 4 to 8 mm***

Fig 2.1 Panel mounting



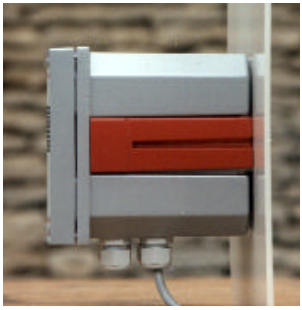


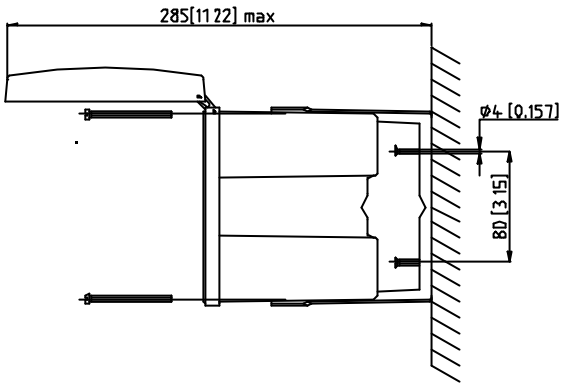
Panel outline	138 x 138 mm (5.4 in. x 5.4 in.)
Front dimensions	144 x 144 mm (5.8 in. x 5.8 in.)
Thickness panel	Inferior to 8 mm

Wall mounting :

- ***2 screws Æ 4 mm lg 60 flat head (not provided)/ 80 mm center distance***

Fig. 2.2 Wall mounting





Pipe mounting :

- *∅ 2" maximum - 2 screws ∅ 4 mm lg 60 (provided)*

Fig. 2.3 Vertical mounting

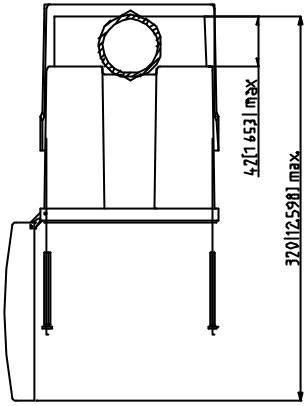
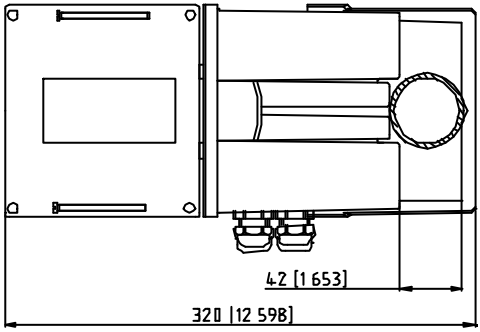


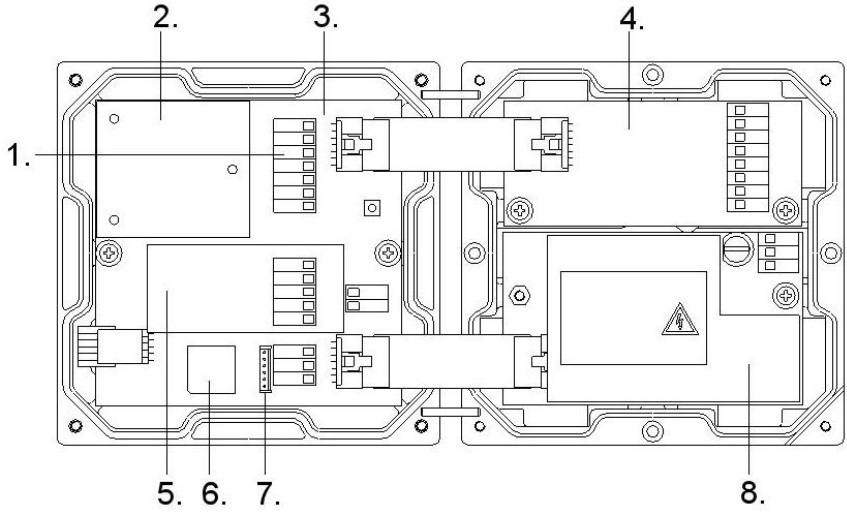
Fig. 2.4 Horizontal mounting



3. Electric connections

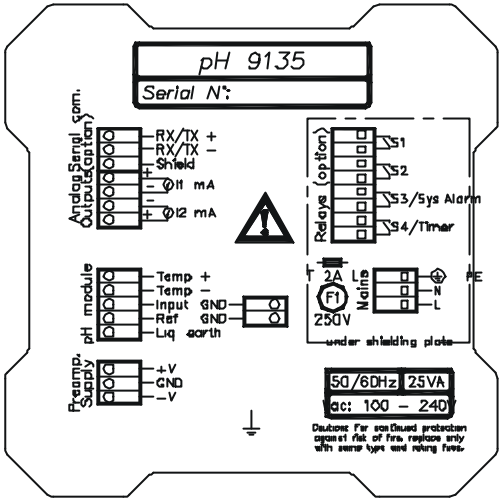
Electronic board lay-out in the 9135 transmitter enclosure

Fig. 3.1 Electronic board lay-out



1. Terminal block 4-20 mA
2. CPU board
3. RS485 board (option)
4. Relay board (option)
5. pH module
6. Programmed EEPROM
7. Program update connector
8. Power supply board

Fig. 3.2 9135 shielded plate



Supply terminals blocks and relays are under the shielded plate.

Note :

Electrical connections should remain dry to ensure a proper operation of the instrument. Check the creeping of the cables when opening the transmitter.

Il is required to use shielded cables. The shield should be linked to the main shielding.

Main connection

Electrical connection should be performed only by qualified personnel. The power supply accepts 100-240 VAC ± 10 %, (50/60 Hz) without changes in configuration. The terminal block for power connections can be lifted from its header for easier installation. For safety reasons, it is required to observe the precautions below :

- Use a three wire mains supply cable (2 core + PE) with a cross section between 0.35 and 2 mm² (AWG 22 to 14) rated at 105°C minimum. The external cable insulation should be cut as close as possible from the terminal block.
- The instrument should be connected to the power supply by means of a breaker located close to the instrument and be identified. The supply shall be fitted with an overcurrent protection device rated at 20 Amp maximum.
- This breaker should switch off phase and neutral in case of electrical problems or when the user wish to service the instrument. However the power supply earth must always be connected.

Note :

Before servicing the instrument, ensure that the power supply is switched off.

Probe connections

Probe/transmitter 9135 pH/redox different links

Sensor/ probe	Sensor/probe connections	Junction box see p. 21	Links with 9135 see p. 22	Distance sensor/ probe-9135
8340/44 P	**8663/AS7/8495**	**internal**	**2666**	**25...100m**
8340/44	**AS9/AS7/8495.6.7**	**internal (HI)**	**2654**	**0...25m (*)**
8346	**AS7 + fixed wires (for antimony electrode and temperature sensor)**	**internal**	**2666**	**0...100m**
8350	**10m integrated**	**"**	**"**	**0...10 m(*)**
8350.0/1/2/4	**10m integrated**	**08350=A=8500 (HI)**	**2654**	**10...25m(*)**
8350.0/1/2/4	**10m integrated**	**08350=A=8000**	**2666**	**10...100m**
8351	**10m integrated**	**"**	**"**	**0...10m**
8351	**10m integrated**	**08350=A=8500 (HI)**	**2666**	**10...100m**
8360.1P	**8663/AS7/8495**	**Internal box**	**2666**	**25...100m**
8360.1	**AS9/AS7/8495**	**Internal box (HI)**	**2654**	**3...25m**
8360	**AS9/AS7/8495**	**"**	**"**	**0...3m**
8361	**10m fixed (for pH and temperature sensor)**	**"**	**"**	**0...10m (*)**
8361	**10m fixed (for pH and temperature sensor)**	**08350=A=8000**	**2666**	**10...100m**
8366	**5 or 15m fixed**	**"**	**"**	**0...15m**
8366	**5 or 15m fixed**	**08366=A=5000**	**2666**	**15...100m**
8370/80	**AS9 (3/10 or 20m)**	**"**	**"**	**0...20m**
8370/80	**AS9 (3/10 or 20 m)**	**08350=A=8000**	**2666**	**20...100m**

LEGEND :

AS7 : Cable for reference electrode

AS9 : Cable for measuring or combined electrode

8663 : Cable AS9 + preamplifier for measuring or combined electrode

2666 : Low impedance cable with 6 conductors + shielding (ref 370=506=025).

2654 : Coaxial cable for high impedance link (ref 358048,00000)

8495 : Pt100 temperature sensor with 3 m of fixed integrated cable

8496 : Liquid earth rod with 2 m of fixed inegrated cable

8497 : Pt100 temperature sensor with liquid earth rod and 3 m of integrated cable

HI : High impedance

(*) : Impedance control with these configurations.

It can only be measured if the probe has a conduction earth rod which can be connected to the Liquid Earth terminal of the instrument. This applies to the probes below :

* 8340/44 : If use of the 8496 earth rod or 8497 stainless steel temperature sensor.

* 8361 : Standard.

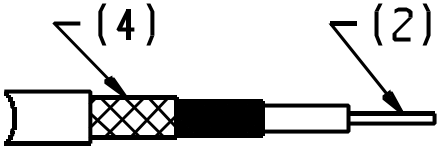
* 8350 : Use of the version :

8350.4 : with platinium liquid earth rod

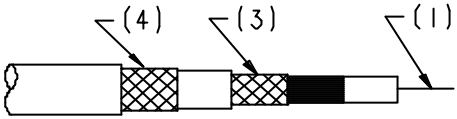
Configurations of the cables

Description of cables used below. Numbers correspond to the table § 2.4.3 where the wire colours and functions are indicated.

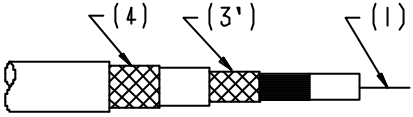
- AS7 used with reference electrode



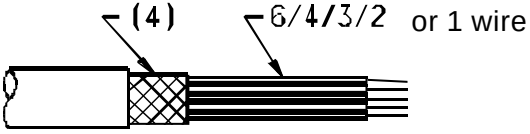
- AS9 used with a non-combined measurement electrode



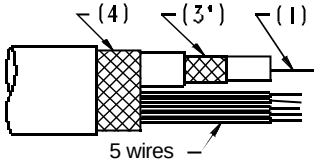
- AS9 used with a combined electrode and a pH/8361 sensor cable



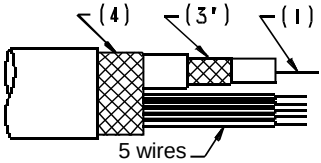
- 2666/8663/8497/ temperature sensor 8361/8495/8496 : shielded cable with 6/4/3/2 and 1 wire (see table colour-function relation)



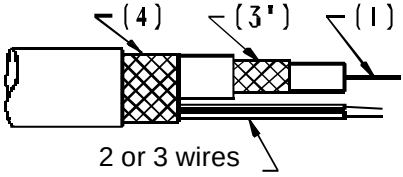
- 2654 high impedance cable used with a non-combined electrode : shielded cable with a AS9 (for non-combined electrode) and 5 wires :



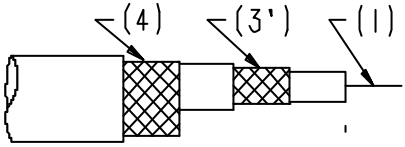
- 2654 high impedance cable used with a combined electrode : shielded cable with a AS9 (for combined electrode) and 5 wires :



- 8350 cable : shielded cable with AS9 for combined electrode and 2 wires (3 wires for 8350.4 for impedance detection).



- 8351 cable : shielded cable with AS9 for combined electrode.



Relation between colour-function

The following table defines the relation between the types of cable and their functions.

NC : for non combined electrodes

C : for combined electrodes

	+ V	- V	Input	Ref	Temp +	Temp-	Liq. Earth	GND	Earth terminal*
2654 NC	-	-	(1)	Red	white	purple	yellow /green	(3)	(4)
2654 C	-	-	(1)	(3')	white	purple	yellow /green	-	(4)
2666	brown	grey	green	yellow	white	pink	-	***	(4)
8366	brown	white	green	yellow	grey	**	**	-	(4)
8350.0/ 1/2	-	-	(1) clear	(3') black	white	red	-	-	(4)yellow /green
8350.4	-	-	(1) clear	(3') black	white	red	blue	-	(4)yellow /green
8351	-	-	(1) clear	(3') black	-	-	-	-	(4)yellow /green
8361 (pH + temp cables)	-	-	(1) black	(3') white	white	red	blue	-	(4)yellow /green
AS9 NC	-	-	(1)	-	-	-	-	(3)	(4)
AS9 C	-	-	(1)	(3')	-	-	-	-	(4)
AS7	-	-	-	(2)	-	-	-	-	(4)
8497	-	-	-	-	white	green	blue	-	(4)
8663	brown	white	green	-	-	-	-	yellow	(4) black

*** The earth terminal located on the shielded plate (see figure 2-1) should be connected to the cable external shield. This connection should be as short as possible.**

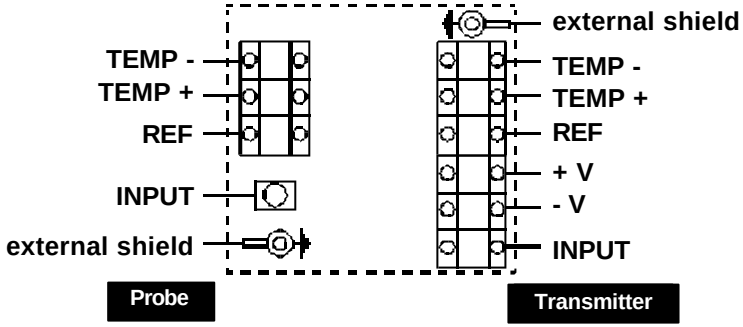
**** In case of direct link between 8366-transmitter, realize a solder bridge GND-TEMP(-)-REF.**

***** Connect GND to REF in the transmitter if connection of the 08350=A=8000 preamplifier.**

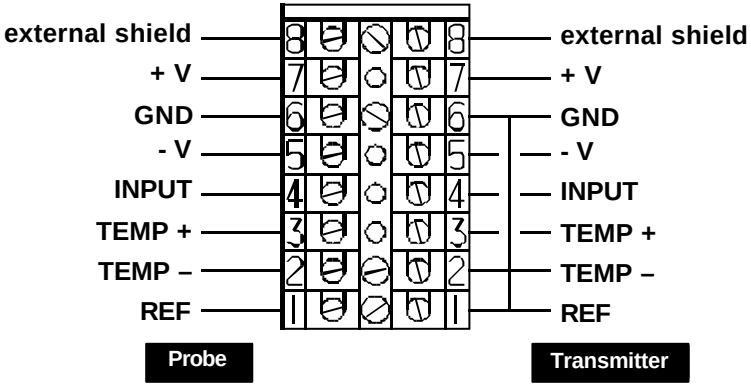
Intermediary connection details (junctions)

WARNING : It is required to cut the wires not used.

- **Connection on preamplifier 08350=A=8000**

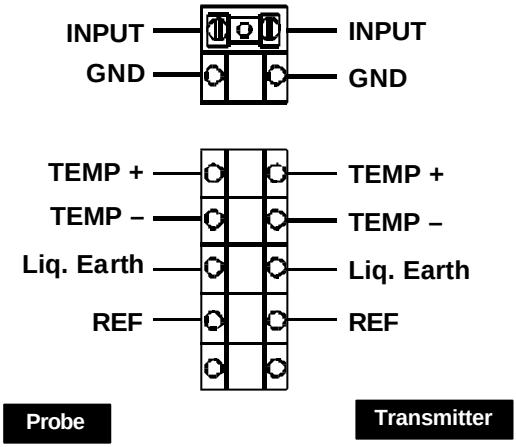


- **Connection for 08366=A=5000 enclosure and internal for probes 8360.1P/ 8340P/ 8344P/8346**

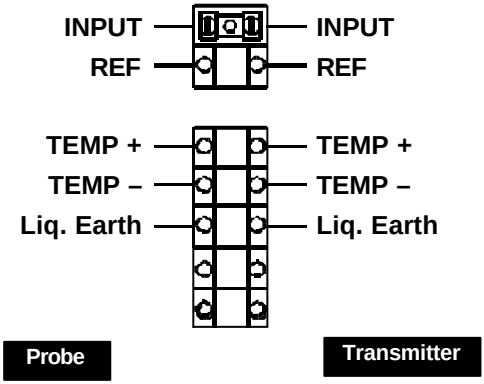


- **Internal for probes 8340/44**

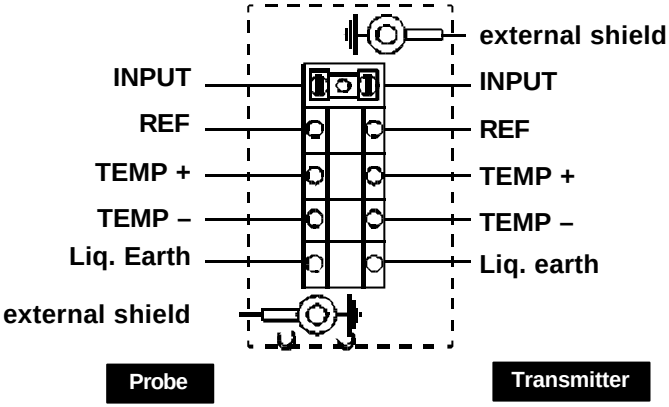
  * For non combined electrode



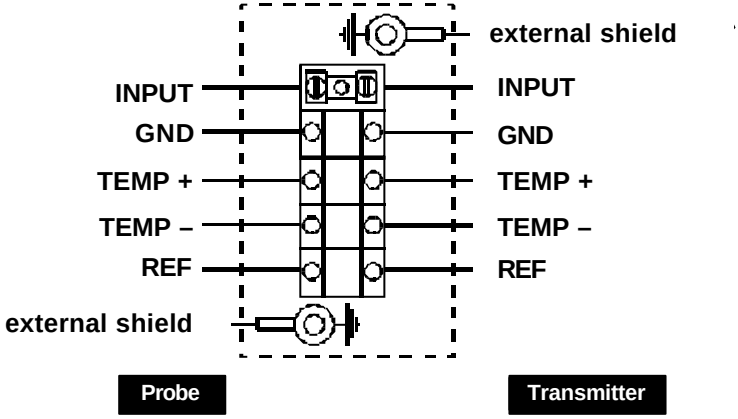
* For combined electrode



- **For 08350=A=8500 enclosure**



- **For 8360.1 internal enclosure**



4. Using the 9135 transmitter

Utilization rules for the menus

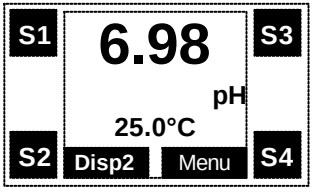
The user interface of the 9135 transmitter is made of a display screen and 4 keys.

The (**Esc**) key is used to go back to the previous menu.

The (**Enter**) key is used to validate the selections and the data.

Both middle keys, right and left function keys, are defined according to the words and symbols which are displayed above each function key.

▲	Modify a parameter
Choice	Choose a menu
Main	Go back to the main display
Menu	Display the main menu
Disp2	Display screen 2
Disp3	Display screen 3
OK	Validate the measure during a calibration
-	Increase a value
+	Decrease a value



Modification of a value

The highlighted digit may be modified with the key . Each digit can be validated by pressing ENTER. Repeat both operations for each digit.

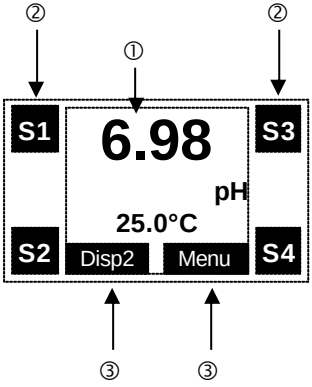
Note :

If you do not use the display for at least 10 minutes, the instrument returns to the measuring mode except for the calibration and maintenance mode.

An access code may be required for the calibration, programming and service menu (see § CODE menu).

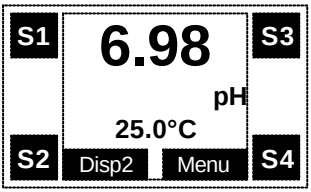
Measures display

Measures display allow to display measures and state of the device. There are three :



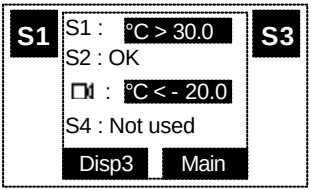
Reference	Description
①	Main display
②	Alarm state
③	Function keys

Main display



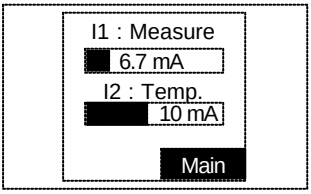
6.98 pH : Ph measurement
25.0 °C : temperature measurement
S1...S4 : alarm state (invisible if alarm inactive)

Display 2



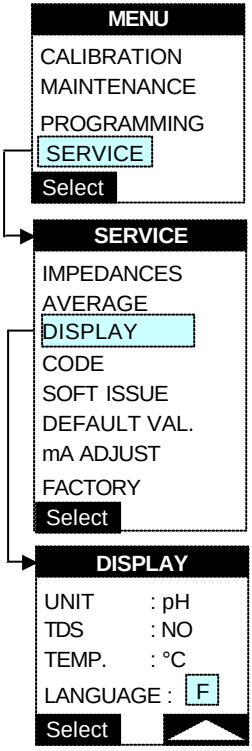
S1...S4 : Alarm state
S1 : activated by a temperature > 30.0°C
S2 : inactive
: S3 in alarm system
S3 unactived for temperature < - 20.0°C
S4 : not used

Display 3



Analogue outputs allocation :
measure or temperature.
Display of each output value with a bargraph +mA indication.

Display options



Choice of the language

English is the default language. You can choose an other language available (French, German, Italian, Spanish or Dutch) by following the procedure below:

- Use the right function key **MENU.**
- Use the left function key **(Select)** to select the menu **SERVICE** and press **(Enter)**.
- In the menu **SERVICE**, use the left function key **(Select)** to select **DISPLAY and press (Enter)**.
- Select the language of your choice with the right function key. Press (**Enter)**.

S/DISPLAY Menu

– UNIT : choice of the pH measurement unit.
  - pH
  - mV (for the redox)

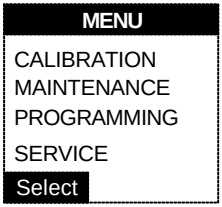
– TEMP. : choice of the temperature measurement unit.
  - °C
  - °F

– LANGUAGE : choice of the message language.
  - French,
  - English,
  - German,
  - Spanish,
  - Italian,
  - Dutch.

- Press **Esc** to go back to the DISPLAY menu.

5. Configuration of the 9135 transmitter

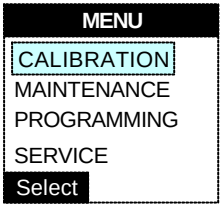
MAIN menu



The main menu gives access to 4 main functions of the instrument :

- The **CALIBRATION menu** enables to adjust the instrument measurement according to the reference measurements.
- The **MAINTENANCE** menu enables to intervene on the instrument.
- The **PROGRAMMING menu** enables to program the instrument according to the application.
- The **SERVICE** menu is reserved to qualified servicing personal.

CALIBRATION menu



pH calibration

In calibration mode, the temperature compensation of the electrodes occurs systematically in the temperature compensation mode according to the Nernst law. The temperature measurement remains active. If the automatic temperature compensation is selected, immerse the Pt100/1000 in the calibration solution.

Buffer solutions

The pH of buffer solutions depends on temperature ; the nominal pH values are referred to a temperature of 20°C. For temperatures different from 20°C, NIST standard buffer solutions, DIN buffers, and pH values are indicated in the table below :

NIST

Delay	Buffer 4,00	Buffer 6,88	Buffer 9,00
0	4,01	6,984	9,464
5	4	6,951	9,395
10	4	6,923	9,332
15	4	6,9	9,276
20	4	6,881	9,225
25	4,01	6,865	9,18
30	4,01	6,853	9,139
35	4,02	6,844	9,102
40	4,03	6,838	9,068
45	4,04	6,834	9,038
50	4,06	6,833	9,01
55		6,833	8,985
60		6,836	8,962
65		6,84	8,941
70		6,845	8,921
75		6,852	8,902
80		6,859	8,884
85		6,867	8,867
90		6,876	8,85
95		6,886	8,833

DIN 9

Delay	Buffer 4,00	Buffer 7,00	Buffer 9,00
0	4,05	7,13	9,24
5	4,04	7,07	9,16
10	4,02	7,05	9,11
15	4,01	7,02	9,05
20	4	7	9
25	4,01	6,98	8,95
30	4,01	6,98	8,91
35	4,01	6,96	8,88
40	4,01	6,85	8,85
45	4,01	6,9	8,82
50	4,01	6,95	8,79
55	4,01	6,95	8,76
60	4,01	6,96	8,73
65	4,01	6,96	8,71
70	4,01	6,96	8,7
75	4,01	6,96	8,68
80	4,01	6,97	8,66
85	4,01	6,97	8,65
90	4,09	6,98	8,64

DIN 10

Delay	Buffer 4,00	Buffer 7,00	Buffer 10,00
0	4,05	7,13	10,26
5	4,04	7,07	10,17
10	4,02	7,05	10,11
15	4,01	7,02	10,05
20	4	7	10
25	4,01	6,98	9,94
30	4,01	6,98	9,89
35	4,01	6,96	9,84
40	4,01	6,85	9,82
45	4,01	6,9	9,78
50	4,01	6,95	9,74
55	4,01	6,95	9,7
60	4,01	6,96	9,67
65	4,01	6,96	9,65
70	4,01	6,96	9,62
75	4,01	6,96	9,58
80	4,01	6,97	9,55
85	4,01	6,97	9,52
90	4,01	6,98	9,49

The temperature of the buffer solution needs to be entered only if the transmitter is operated in the manual temperature-compensation mode.

In the « automatic calibration » mode the transmitter determines the pH value according to the temperature. In the other calibration modes, the nominal pH values must always be taken into account.

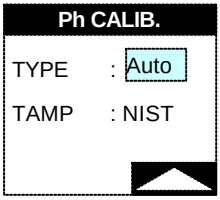
For a precise calibration of the pH electrode, 2 buffer solutions are required one of which should have a pH close to the sample pH. The pH 7 buffer solution (or 6.88 to 25°C) is required for a first standardization and a pH 4 buffer solution (or 4.01 to 25°C) or pH 10 (or 9.22 to 25°C) is required to calibrate the electrode slope.

Choice of the calibration type

Different calibration types may be selected. In the CALIBRATION menu :

- Press CHOICE to select pH standard.
- Press **Enter**.
- Press CHOICE to select PROGRAMMING
- With the right function key, choose the calibration type.

Automatic calibration



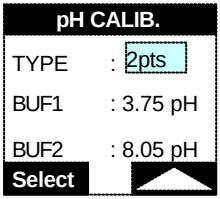
With the right function key, select the buffer type you use so that the instrument determines precisely the buffer value according to the temperature.

You have the choice between three tables : NIST, DIN 9, DIN 10 which corresponds to the standard buffer values whose value varies according to the temperature as indicated in the previous chapter dedicated to the buffer solutions.

The user calibrates the pH measurement with 2 of the 3 standard buffers from the table chosen :

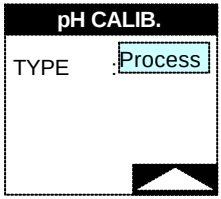
- NIST : 4.00, 6.88, 9.22
- DIN 9 : 4.00, 7.00, 9.00
- DIN 10 : 4.00, 7.00, 10.00

The user does not enter any value during calibration.



2 point calibration

Calibration type used when the user has no standard buffer (4.00/6.88/9.22). The buffer value remains the same to a constant temperature and the user enters them only one time when he programs the calibration.

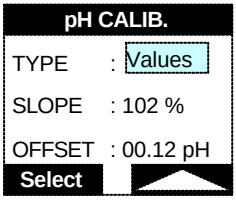


Process calibration

Note :

Warning ! This calibration is only active on the zero shift.

The user calibrates on one point using 1 buffer or the sample to measure. The user needs to enter the buffer or sample value for each calibration.



Values calibration

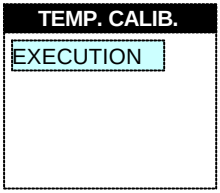
The user has calibrated his electrodes in the laboratory. He programs the slope and zero values (% of 59.16 mV/pH) he has measured in the laboratory.

Slope and offset limits

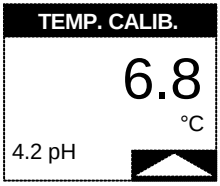
An error message is displayed if the slope is not in-between [70 %, 120 % or offset in-between [-3 pH, + 3 pH].

See Chapter error messages and Troubleshooting

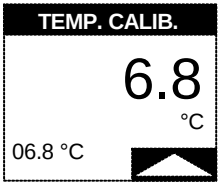
Temperature calibration



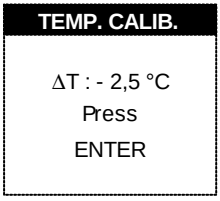
To reach the temperature calibration screen, press the EXECUTION mode with ENTER.



Once the measurement is stable, press **OK**.



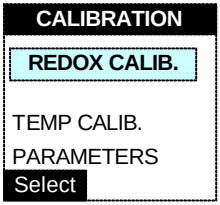
Possibility to change the value.



Display of motion.

Note :

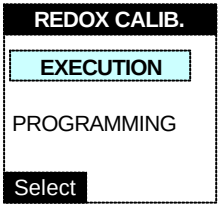
The temperature adjustment limits are between - 50 °C and + 20 °C.



Calibration

This menu is dedicated to the calibration of the electrode used.

Press ENTER to validate the choice.



Redox calibration

Follow the pH calibration procedure in § 4.

Note :

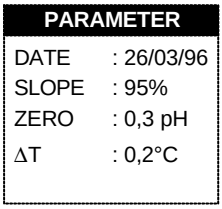
In redox calibration the measure unit is mV.

LIMITS :

- zero shift : ± 250 mV

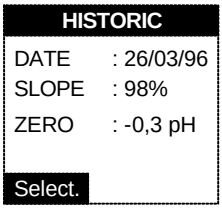
- slope shift : 70 ... 120 %

PARAMETERS Menu



The date, slope and zero of the last calibration may be displayed in the PARAMETER menu.

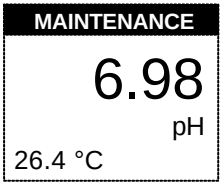
HISTORIC Menu



The slope and zero parameters of the last two calibrations may be displayed in the historic menu.

Press the left function key SELECT to display the next parameters.

MAINTENANCE Menu

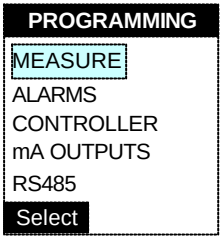


When changing an electrode or servicing the instrument, the transmitter continues to display measures.

Note :

The analogue output value is the value programmed in the mA menu. The relay state is not modified.

Redox PROGRAMMATION Menu

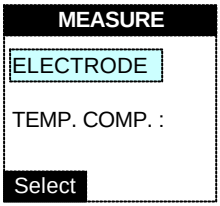


Note :

Warning ! An access code may be required if programmed.

This menu enables the configuration of the instrument according to its application.

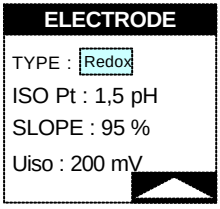
In this operating mode, the measurements, the analogue outputs and alarms remain active.



S/MEASURE Menu

ELECTRODE menu allow to set up the electrode model.

TEMP. COMP. menu allow to set up the temperature compensation.



ELECTRODE

Choice of the electrode.

TYPE **:**
- Glass
- Antimony
- Redox
- Other

ISO Pt **:** XX,XX pH

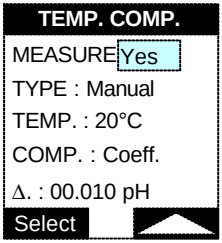
The isothermal point corresponds to the pH value which does not vary according to the temperature.

SLOPE **:** XX %

Indication of the electrode sensitivity in % of the theoric value (59,16 mV/pH at 25°C).

Uiso **:** XXXX mV

Uiso is the potential of the isothermal point.



TEMP. COMP.

This menu allows to set up the temperature compensation.

MEASURE: - No / - Pt — Choice of a temperature measurement with or without Pt100/Pt1000.

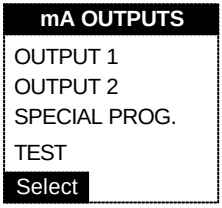
TYPE : - Auto. / - Manual — Choice between an automatic or a manual temperature measurement.

TEMP. : XX °C — Possibility to enter the sample temperature in a manual compensation.

COMP. : Choice of the temperature compensation type :

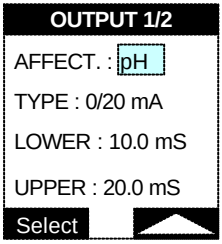
- NERNST — linear compensation (0.1984 mV/°C).
- Pure — compensation according to the ultrapure water curve.
- Matrix 1 — compensation according to the sulphate curve (4.84 mg/l corresponds to a pH 4.0 to 25°C).
- Matrix 2 — compensation according to the ammoniac/hydrazine curve (0.272 mg/l ammoniac + 20 µg/l corresponds to a pH 9.0 to 25°C).
- Matrix 3 — compensation according to the ammoniac / morpholine / hydrazine curve (1.832 mg/l ammoniac + 10 mg/l morpholine + 50 µg/l hydrazine corresponds to a pH 9.6 to 25°C).
- Matrix 4 — compensation according to the phosphate curve (3 mg/l phosphates + 0.3 mg/l ammoniac).
- Coeff. — adjustable coefficient (pH/10°C)

D **:** XX — In the case of a programmable coefficient, possibility to enter the value of the coefficient (value in pH/10°C or pH/18°F).



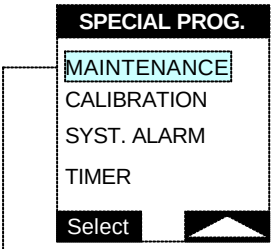
S/mA OUTPUTS Menu

This menu allow to adjust analogue outputs.



OUTPUT 1/2

- AFFECT : choice if the analogue output allocated to measure or temperature.
  - pH/mV
  - °C/°F
- TYPE : choice of the analogue output type.
  - 0/20 mA
  - 4/20 mA
- LOWER : lower limit value programming.
- UPPER : upper limit value programming.



S/SPECIAL PROG. Menu

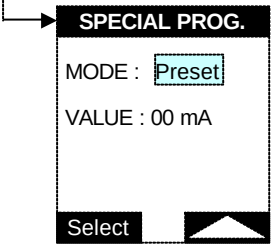
This screen allow to adjust 4..20 mA outputs states in special events.

– MAINTENANCE

– CALIBRATION

– SYST. ALARM

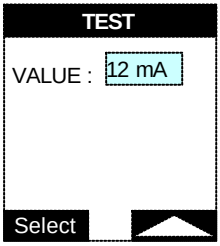
– TIMER



– MODE : choice of a preset value during calibration, alarm system or maintenance.

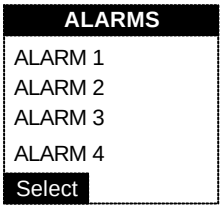
- last
- preset
- live

– VALUE : indication of the preset value 0 to 21 mA.



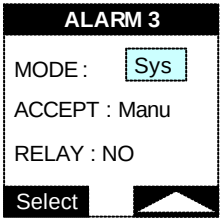
TEST

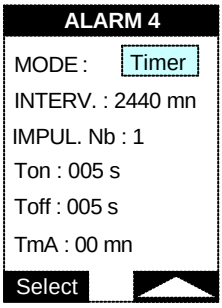
TEST menu test the analogue outputs by step of 1 mA (0...21mA).



S/ALARMS Menu

This sub-menu allows to reach the configuration of alarms 1 to 4.

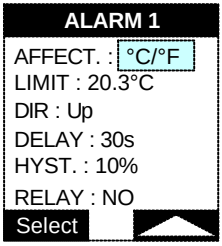


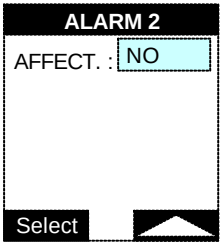


The MODE parameter allows to choose the operating mode of the 4 alarms :

- Lim : alarms 1...4
- System : only alarm 3
- Timer : only alarm 4

MODE :
- No
- Lim
- Syst
- Timer





ALARM 1/2 (limit)

– AFFECT : choice of a limit on the measure or the temperature.

- no
- pH/mV
- °C/°F

– LIMIT : value of the limit.

– DIR : choice of the direction.

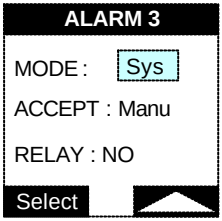
- Up
- Down

– DELAY : definition of the temporization when the relay interlocking.

– HYST : definition of the limit hysteresis thresholds on % (10% max).

– RELAY : choice of the relays normally open or closed.

- NO
- NF



ALARM 3 (Alarm system)

– Choice of a limit on the measure or alarm system with alarm 3.

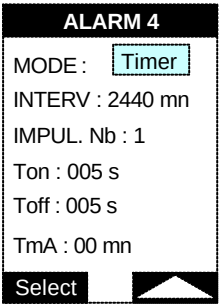
MODE :
- No
- Limit
- Sys

– Manual or automatic acquit possible with the alarm system.

ACCEPT :
- Auto
- Manu

– Choice between relays normally open or closed.

RELAY :
- NO
- NC



ALARM 4 (Timer)

– Choice between a limit on the measure or a timer for the probe cleaning with alarm 4.

MODE :
- No
- Limit
- Timer

– INTERV : interval between 2 cleaning cycles in minutes.

– IMPUL. Nb : number of pulses during a cleaning cycle.

– Ton : time when relay is activated, in secondes.

– Toff : time when relay is desactivated, in secondes.

– TmA : analog output hold time for the analogue outputs in minutes.

S/CONTROLLER Menu

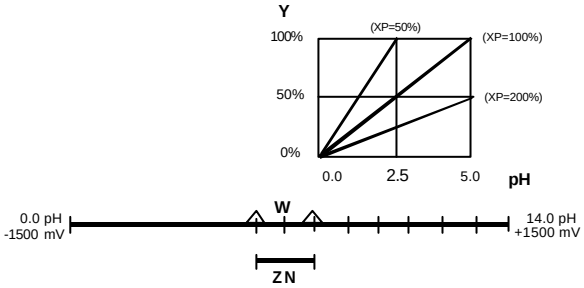
The built-in proportional controller, abbreviation controller P. The controller output Y activates the limit switch relays. Y value may correspond to a control by impulse or a control by frequency. The Y value is determined by the parameters below :

- A setpoint **(W)** : corresponds to the pH value to control.
- A neutral zone **(ZN)** : may be programmed and positioned symmetrically ± 50% about the setpoint. Within this neutral band the control element (valve, dosing pump) is always inactive.
- A proportional band **(XP)** : represents the regulation slope. A XP value equal to 100% is defined as a Y controlling value of 100% for a 5 pH (or 1000 mV in redox) drift according to the neutral zone extremity.
- A power factor **(Exponent)** : which calculates a controlling value from a lineary (exponent = 1) or an exponential function.

The value of Y in pH corresponds to the equation below :

$$Y = \frac{100}{XP} * \frac{[pH-(W+\frac{ZN}{2})]^{Exponent}}{5}$$

Y value is represented as follows :



Different controller modes are available. They enable a frequency, a pulse or a mixed pulse/frequency control. Relay S1 (base injection) and relay S2 (acid injection) ensure the control. The controller parameters are programmable via the programming variables below :

CONTROLLER
CNTRLLR : Yes
MODE : Freq.
POINT : 7.00 pH
NEUT. Z : 2.0 pH
INERTIA : 000 s
CTL TIME : 20 mn
RELAY S1
RELAY S2
MANUAL MODE
Select

CONTROLLER

– Choice to use an integrated controller :

CNTRLLR :
- Yes
- No

– Choice of the control mode :

MODE :
- Pulse : S1 & S2 in pulse control
- Freq. : S1 & S2 in frequency control
- Pul./Frq : S1 in pulse control /S2 in frequency control
- Frq./Pul. : S1 in frequency control /S2 in pulse control

– Value of the setpoint :

POINT : XXXX – In pH or mV

– Neutral zone range : zone around the setpoint where the regulation is not activated.

NEUT Z. : XXX - In pH or mV

– Reaction time after activating relays S1 or S2 : delay time after executing the next period.

INERTIA : XXX – In s

– Maximum time out of the neutral zone .After this period and without returning into the neutral zone, the system alarm “control too long” is activated.

CTL TIME : XX – In mn

Note :

Any default detected by the transmitter stops the controller function.

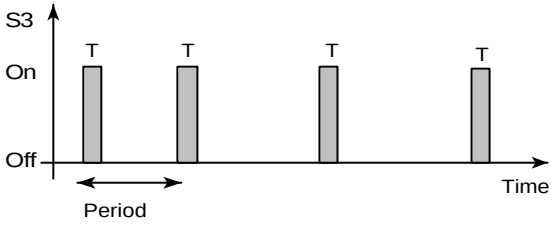
The default "CONTROL TOO LONG" should be manually released by pressing ENTER.

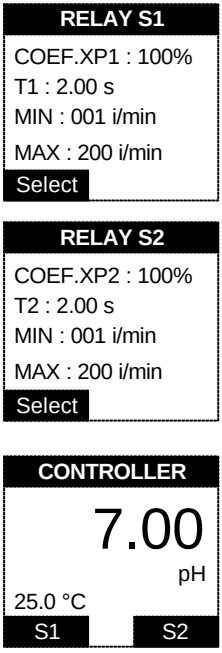
If the TIMER and CONTROLLER functions are activated at the same time, the controller is stopped during the timer cycle.

Any cycle calculated by the transmitter is carried out to the end.

FREQUENCY CONTROL :

The pulse width is constant and programmable (0.1 to 0.7 s). The pulse period varies according to the sample pH value.





S1 & S2 RELAYS

– Proportionality coefficient : slope of regulation.
COEF.XP1/2 : XXX – In %

– Value of the pulse width (0,1 < T < 0,7) :
T1/2 : XXX – In %

– Minimum number of pulses per minute. Program this value according to the control system associated to the relay :
MIN : XXX – In i/min

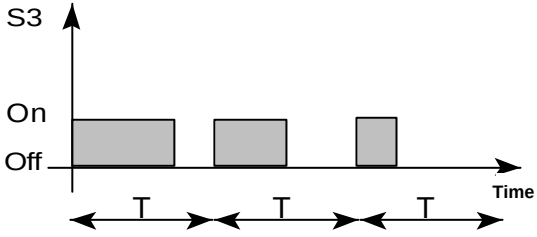
– Maximum number of pulses per minute. Program this value according to the control system associated to the relay.
MAX : XXX – In i/min

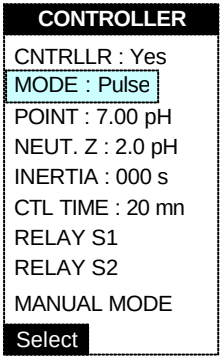
MANUAL MODE

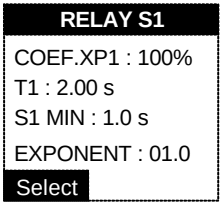
– Force relay S1 or S2. Pressing the function key associated to the relay, the relay is activated till you release the key. The corresponding icon is displayed according to the relay state.

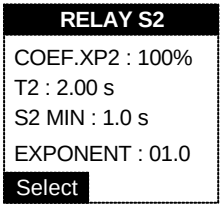
PULSE CONTROL :

The pulse period is constant and programmable (3 to 60 s). It is the cycle quotient (α) which varies according to the sample pH value.









CONTROLLER

– Regulation form select
  MODE : Pulse

S1 & S2 RELAYS

– Value of the pulse period (3 < T < 60) :
  T1/2 : XXX In s
– Minimum activation time of the relay :
  S1/2 MIN : XXX In s
– Value of the power factor. In the case of a non-linear calculation of the control value, modify the exponent value. This modification allows a greater correction of the measurement when it is far from the setpoint.

"PULSE/FREQUENCY" CONTROL OR "FREQUENCY/PULSE" CONTROL

The controller may be programmed in a mixed mode. Use the Mode command for the programming. See paragraphs concerning the frequency control and the pulse control to program the relay S1 and S2.

S/RS485 Menu

This option requires the RS485 kit.

RS485
N° : 4
BAUD : 9600
PARITY : odd
STOP BIT : 1
WORD invs. : YES

N°	Monec number (0...32)
BAUD	300/600/1200/2400/4800/9600/19200 Transmission speed in bauds
PARITY	- Without parity bit : No - With odd parity bit : Odd - With even parity bit : Even
STOP BIT	- 1 bit stop - 2 bits stop

SWAP WORD : - Allow to reverse the "strong weight", "light weight" size during the manipulation of the real variable (float type). Some equipments need this reverse to read correctly the real size data.

The communication protocol is MODBUS/JBUS.

The instrument may be equipped with a RS485 board (optional) (see MODBUS 9100 manual).

SERVICE Menu

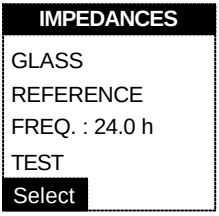
SERVICE
IMPEDANCES
AVERAGE
DISPLAY
CODE
SOFT ISSUE
DEFAULT VAL.
mA ADJUST
FACTORY
Select

Note :

WARNING ! An access code may be required if it has been programmed.

This screen allows to reach the 9135 transmitter configuration screens.

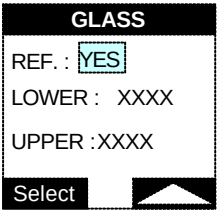
The display options are detailed page 27.



S/IMPEDANCES Menu

Define the lower and upper limits of the electrode impedances for the default detection. They should be defined experimentally.

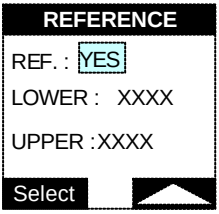
FREQ. : permits to define the impedance measurement frequency (limits : 0,1 H to 24 H).



GLASS

Permits an impedance measurement.

The glass electrode impedance measurement is compensated at 25°C.

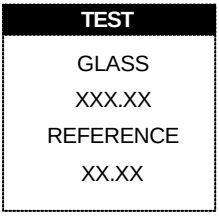


REFERENCE

Permits an impedance measurement.

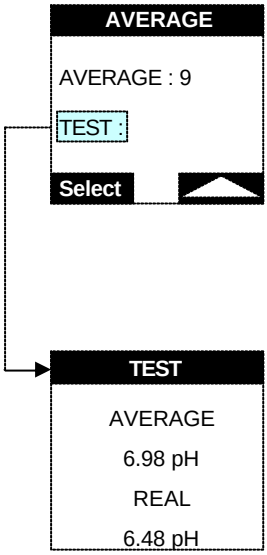
LOWER : defines the lower limit for the impedance measurement. This limit is used for the alarm system and the bargraph DISP4.

UPPER : defines the upper limit for the impedance measurement. This limit is used for the alarm system and the bargraph DISP4.



TEST

Visualizes the impedance measurement value.



S/AVERAGE Menu

Program a sliding average on the pH/redox measurement.

AVERAGE : define the number of measures to calculate the average.

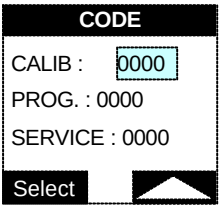
TEST : visualize the difference between a measure done with or without average.

Note :

The measurement cycle lasts 4 seconds if there is a temperature measurement and only 2 seconds without temperature measurement.

S/DISPLAY Menu

This menu options are describes in page 27 of this manual.

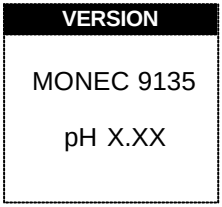


S/CODE Menu

- CALIB. : access code for "temperature and pH calibrations" menu.
- PROG. : access code for "Programming" menu.
- SERVICE : access code for "service" menu.

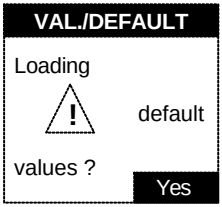
Note :

If you have forgotten your access code, press simultaneously ESC and ENTER to enter into the menu.



S/SOFT ISSUE Menu

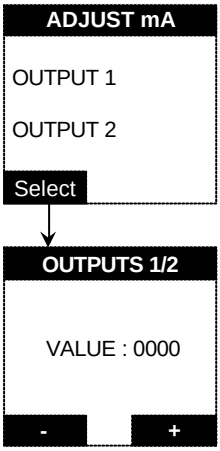
The transmitter displays the type of instrument and the software version installed.



S/DEFAULT VALUES Menu

Note :

If you press YES, you load the default values and you loose the programmed values and the calibration parameters.



S/mA ADJUST Menu

In this menu, adjustment of the analogue outputs to 20 mA with an internal coefficient between -9999...9999.

S/FACTORY menu

Factory code necessary.

The user has no access to this menu.

6. Failures detection and error messages

Failures detection

Symptom	Possible cause	Remedy
Reading out of scale	Faulty transmitter	Check the transmitter by connecting a pH simulator or a voltage generator instead of the electrode
	Faulty electrode	Check the electrode operation with buffer solutions
	Electrode not correctly connected	Check the connections
	Bubbles in the bulb	Remove the electrode, shake it and put it back
Unstable display	Faulty transmitter	Check the transmitter by connecting a pH simulator or a voltage generator instead of the electrode
	solution not earth grounded	Connect the electrode
	Bubbles on the pH bulb	Remove the electrode, shake it and put it back
Slow drift	PH bulb polluted	See cleaning instructions
	Reference clogged	See cleaning instructions
Low slope or slow response	Buffers polluted	Use new buffers
	PH bulb polluted	See cleaning instructions
	Reference clogged	See cleaning instructions
	Faulty electrode	Check the electrode operation

Electrode cleaning

Electrodes which are mechanically undamaged, without any broken part, may be regenerated according to the instructions below :

***Salt deposits*:** Dissolve the deposit by immersing the electrode in 0.1 M from HCL during 5 minutes, following by an immersion of 5 minutes in a 0.1 M of NaOH and rinse abundantly with demineralised water.

***Grease/Oil* :** Clean the electrode bulb with detergent and water. Rinse the extremity of the electrode with demineralised water.

Reference electrode junction clogged : Heat a KCl solution diluted to 60-80°C. Place the clogged part in the hot solution during 10 minutes. Cool the electrode in a cold KCL solution.

If these advice do not ensure a normal response time, change the electrode.

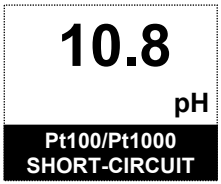
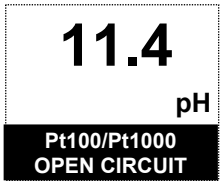
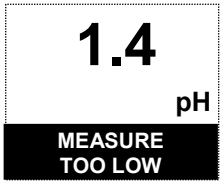
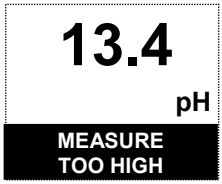
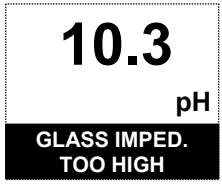
Maintenance

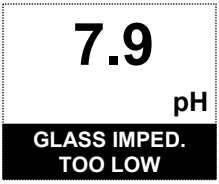
No particular maintenance required. Clean the instrument with a soft tissue and without any aggressive agent.

Error messages

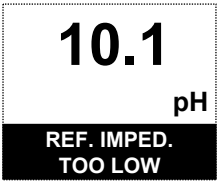
Note :

In manual acquittal, to suppress an error message press ENTER after correcting the default.

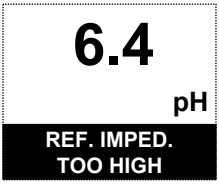
ERROR MESSAGE	DESCRIPTION/POSSIBLE CAUSE
	• Sensor not correctly connected. Temperature sensor damaged Replace it if necessary.
	• Sensor not correctly connected. Temperature sensor damaged Replace it if necessary.
	• The pH value is inferior to -3 pH.
	• The pH value is superior to 14 pH.
	• The glass electrode impedance is superior to the limits set by the user. It is required to : - change the limits (SERVICE / IMPEDANCES / GLASS / UPPER) or, - clean or change the clogged electrode.



The glass electrode impedance is inferior to the limits set by the user. It is required to :
- change the limits (SERVICE / IMPEDANCES / GLASS / LOWER) or,
- change the broken electrode.



The reference electrode impedance is inferior to the limits set by the user. It is required to :
- change the limits (SERVICE / IMPEDANCES / REFERENCE / LOWER) or,
- change the damaged electrode.



The reference electrode impedance is superior to the limits set by the user. It is required to :
- change the limits (SERVICE / IMPEDANCES / REFERENCE / UPPER) or,
- clean the clogged electrode or change the poisoned electrode.

The time out of the neutral zone is superior to the limit programmed by the user. It is required to :
- change the limits
- check the relays S1 and S2.

ERROR MESSAGES DURING A CALIBRATION **NOTE : Press ESC to leave the menu and calibrate again.**	
PH CALIB. **SLOPE : 99,9%** **ZERO : 4.00 pH** **OFFSET** **OUT OF LIMITS**	The zero shift is superior to the limit programmed. **Limits :** **- pH calibration : ± 3 pH** **- redox calibration : ± 250 mV**
PH CALIB. **SLOPE : 130%** **ZERO : 0.1 pH** **SLOPE** **OUT OF LIMITS**	The slope shift is superior to the limit programmed. **Limits : 70...120 %**
PH CALIB. D T : +25.0°C D **T** **OUT OF LIMITS**	The temperature drift is superior to the limit programmed. **Limits : -50°C/+20°C**
ERROR MESSAGES DURING AN IMPEDANCE MEASUREMENT TEST. **NOTE : Press ESC to leave the menu.**	
TEST GLASS **TOO LOW** REFERENCE **TOO LOW**	The impedance measurement is inferior to 5 MΩ for the glass electrode and 100 Ω for the reference electrode.
TEST GLASS **TOO HIGH** REFERENCE **TOO HIGH**	The impedance measurement is superior to 1 GΩ for the glass electrode.

7. Impedance measurement

Electrode impedance : electrode integrity index

A method generally used to detect an electrode default is to calibrate a pH measurement system in pH standards solutions. If the slope or the zero (asymmetry) characteristics are out of the programmed limits., one of the electrodes is considered to be damaged.

An other method consists of the manual measurement of both electrode impedance. This method is easy to use with the reference electrode, but intricate with the glass electrode which has a high impedance.

Besides, for both methods the electrodes need to be withdrawn from the process.

Electrode defaults usually met are as follows :

- A crack of the glass membrane which shows a **low impedance** between the sample and the electrode.
- A contaminated electrode (deposit) which shows a weaker measurement sensibility and an electrode **high impedance**.
- A lack of electrolyte in the reference electrode which shows **a very important impedance.**

a poisoned reference electrode by sulphides which precipitate with silver ions and may clogged the electrolytic junction. This poisoning shows a **high increase of the impedance** .

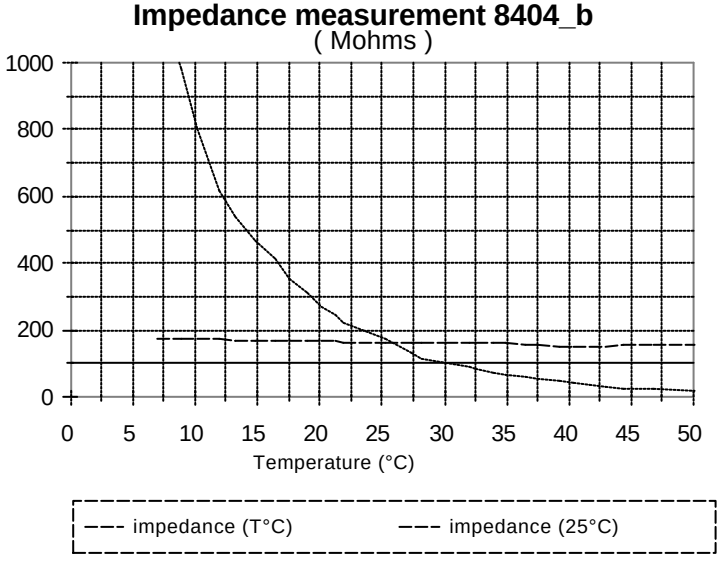
In our system, the electrode impedance measurement results from the measurement system without addition of commutation circuits.

Measurement principle

A non-oxidising electrode permits to set the liquid potential to the zero measured. A very stable voltage (equal to E) is applied to the electrode. Two capacities are loaded through the electrode impedance. After a certain time (which depends on the impedance measured), the system measures the potential variation on each electrode.

The process temperature is measured to compensate the impedance measurement of the glass electrode.

The impedance measurement drift of the glass electrode according to the temperature is represented by the curve below :



Note :

Note that the impedance measured represents the sums of the resistances of the "liquid earth" electrode, reference electrode, glass electrode according to the case.

In pH measurement in ultra pure water, the very high resistivity of the sample, does not allow to determine precisely the reference electrode impedance. In fact, the liquid impedance is 100 KΩ and represents about 10 times the electrode impedance.

8. Analogue outputs and temperature control

Analogue outputs control

An external socket from the transmitter (for certain versions) fixed on the lower part of the front panel allows to measure the value of the analogue output current by inserting a miliampere-meter in the current loop

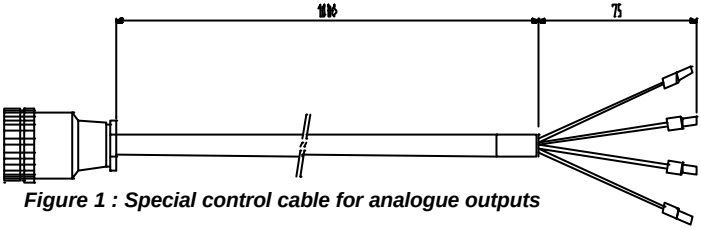


Figure 1 : Special control cable for analogue outputs

A special cable (figure 1, Ref : 09125=A=8010), provided as an option , gives access, when connected, to the following signals :

I1+: brown flex

I1- : yellow flex

I2+ : white flex

I2- : green flex

Reading in mA between the yellow and brown wires gives the current value of output 1.

Reading in mA between the white and green wires gives the current value of output 2.

Pt100 simulator connections

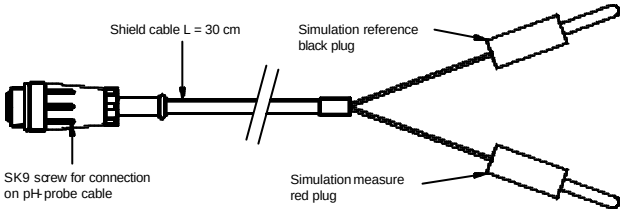
The transmitter can be connected to a Pt100 simulator by means of the cable (Ref : 09125=A=8010) :

Temp + : white flex

Temp - : yellow flex

PH simulator connections

pH simulator can be connected to the electrode connection cable by means of another cable (Ref : 09135=A=8030).



Glass electrode imput :	red plug
Reference imput :	black plug

Appendix A : Default values

CALIBRATION

PH CALIB.
TYPE : Auto

PARAMETERS
DATE : 01/01/01
SLOPE : 100.0%
OFFSET : 0.00 pH
ΔT : 0.0°C

PROGRAMMING

MEASURE

ELECTRODE
TYPE : Glass

TEMP. COMP.
MEASURE : No
TEMP. : 25°C
COMP. : Nernst

ALARMS

ALARMS S1...S4
AFFECT. : pH
LIMIT : 0.00 pH
DIR. : Down
DELAY : 000 s
HYST. : 00%
RELAY : NO

mA OUTPUTS

OUTPUT 1
AFFECT. : pH
TYPE : 0-20
LOWER : 00.00 pH
UPPER : 14.00 pH

OUTPUT 2
AFFECT. : pH
TYPE : 0-20
LOWER : 00.00 pH
UPPER : 14.00 pH

SPECIAL PROG.

MAINTENANCE
MODE : Preset

CALIBRATION
MODE : Last

TIMER
MODE : Last

SYST. ALARM
MODE : Last

RS485

No : 1
BAUD : 19200
PARITY : No
STOP BIT : 1
WORD invs. : YES
NO

SERVICE

IMPEDANCES

FREQUENCE : 24.0 H

GLASS
GLASS : No

REFERENCE
REFERENCE : No

AVERAGE

AVERAGE : 0

DISPLAY

DISPLAY
RES. : 0.01 pH
UNIT : °C
LANGUAGE GB

CODE

CODE
CALIB. : 0000
PROG. : 0000
SERVICE : 0000

Appendix B : Spare parts list

Any other spare parts except those below in the table should be replaced in the instrument.

Part number	Description
09125=A=1001	9135 equipped CPU board
09135=A=1500	9135 complete pH module
09125=A=2000	9135 power supply (standard version)
09125=A=2020	9135 power supply (low voltage version)
09125=A=4000	Relay board (option)
09125=A=1101	RS485 board (option)
09125=A=2485	RS485 kit (JBUS/MODBUS manual + board)
09125=C=3000	Mounted transmitter housing
425=110=002	Shutter PG 11 for P.E
425=110=221	Cable gland PG11
425=130=002	Shutter PG 13,5 for P.E
425=135=222	Cable gland PG13,5
351=007=001	Strap FLEXPAC 7 PTS
621=083=062	French instruction manual
621=991=000	JBUS/MODBUS communication manual
08362=A=2000	pH electrode
359016,10110	pH electrode's 3 m cable
359016,10120	pH electrode's 10 m cable
359016,10122	pH electrode's 20 m cable
09125=A=8010	Pt100/1000's simulator connections cable
09135=A=8030	Low impedance pH's simulator connections cable

08362=A=1001	Pt100’s temperature sensor
08362=A=3001	Pt100’s 3 m cable
08362=A=3002	Pt100’s 10 m cable
08362=A=3003	Pt100’s 20 m cable
08362=A=4000	2 connections (1/8" NPT, 6x8)
363130, 00500	pH 4 solution (500 ml)
363131, 00500	pH 6,88 solution (500 ml)
363132, 00500	pH 9,22 solution (500 ml)

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