HAMILTON 243187 PH- and ORP Sensors for Process Applications Instruction Manual

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Operating Instructions
For pH- and ORP sensors for process applications
Instruction Manual

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243187 PH- and ORP Sensors for Process Applications

Operating Instructions for pH and ORP sensors for process applications

Introduction

These operating instructions are intended for all Hamilton process pH and ORP sensors. The specifications in Table 1 (temperature, pressure, etc.) must not be exceeded.
These instructions should be read, understood, and followed by all staff using the device. Hamilton assumes no responsibility for damage and operational disruptions arising from failure to observe these instructions.
Liability
The liability of Hamilton Bonaduz AG is detailed in the document «General Terms and Conditions of Sale and Delivery (GTS)», chapter 12.
Hamilton is expressly not liable for direct or indirect losses arising from use of the sensors. This includes malfunctions that can occur from the inherently limited lifetime of sensors contingent upon their application.
The user is responsible for the calibration, maintenance, and regular replacement of the sensors. In the case of critical sensor applications, Hamilton recommends using back-up measuring points in order to avoid consequential damages. The user is responsible for taking suitable precautions in the event of a sensor failure.

Intended Use

These sensors are intended for the measurement of pH or ORP values. If the sensors are used in potentially explosive atmospheres, the instructions in the section «USE IN POTENTIALLY EXPLOSIVE ATMOSPHERES» must be followed.
Sensors with a VP-type connection have a built-in temperature sensor (Pt100 or Pt1000). This temperature sensor is to be used only to compensate the pH signal and not to control process temperature.

Initial operation

Check the sensor for any damage at the time of unpacking. A damaged sensor should be returned to your Hamilton dealer in the original packaging.
Every product for shipment or sent back for repair must be decontaminated. If working with hazardous liquids observe and carry out the maintenance procedures, paying particular attention to cleaning and decontamination. If the product becomes contaminated with biohazardous, radioactive or chemical material, it should be cleaned.

Safety instructions

This sensor is only to be used for the intended purpose and under safe conditions. Improper use or misuse can be dangerous. Assembly and maintenance should only be carried out by trained personnel. Since these sensors are made of glass, they should be handled with care. Sensors with a pressurized reference system (EasyFerm Plus,

EasyFerm Bio) have a risk of spontaneous glass breakage. When working with this kind of sensor we recommend wearing protective glasses. When cleaning or regenerating the sensors with acids/ bases or solvents, protective glasses and gloves are recommended. Take care that the PG13,5 thread and the o-ring are not damaged while the sensor is screwed into the process. O-Rings are subject to wear and tear and should be replaced regularly (at least once per year).
If a high pressure sensor is operated for a considerable period of time above 10 bar, it should not be exposed to high temperatures (> 80° C) immediately afterwards.
Air/gas bubbles may stick to the sensitive area of the sensor. As a consequence, the measurement value might be wrong. In case of a shutdown of the power supply (230 V) the measurement value could be wrong.

Preparing the sensor

Carefully remove the watering cap. Rinse the sensor with water. Check the interior of the pH glass membrane for air bubbles. Allow any bubbles to rise to the top by shaking the sensor gently.
Refillable sensor: Prior to measuring, open the reservoir stopper; close it after measuring. Check level of electrolyte in the sensor.
If the sensor is going to be pressurized in an armature or housing, the pressure should be 0.5 bars above process pressure.

Mounting

pH and ORP sensors perform best when installed at a 15° or more angle from the horizontal, except the Polilyte Plus VP sensors those can also be mounted upside down.
Screw the sensor into the housing with the PG thread. Ensure that the torque of 1.5 Nm will not be exceeded to avoid damaging of the o-ring.

Electrical wiring

The sensors are equipped with an S8, K8, or a VP connector head (see Tab. 4). Before connecting the sensor to the cable, check that the connections are clean and dry. Do not touch the electrical contacts! VP connectors especially should not be disconnected in moisture condensing environments. Unstable signals, low slope, or long response time could indicate a moist or contaminated connector. Clean the VP connector head with a paper towel moistened with ethanol. Dry the connector head after this procedure with a dry paper towel. If the sensor still has the described problems replace the VP cable.
Polilyte Plus VP sensors are equipped with a solution ground. The solution ground is a platinum wire located behind the liquid junction within the reference electrode chamber. It is used to match the electronic ground of the transmitter with the potential of the solution and must be connected to the terminal «potential matching» (E+H, SIEMENS), «auxiliary electrode» (Knick, Mettler-Toledo), or «solution ground» (Yokogawa, Emerson). The solution ground should not be used to ground the solution. The current flowing through the solution ground should not exceed 1 µA. Many transmitters offer additional sensor diagnostics based on a solution ground contact. Polilyte Plus VP sensors do not have a diaphragm. Therefore the signal of the diaphragm or reference resistance is irrelevant.

Calibration and measurement

For calibration always use unused Hamilton DuraCal pH or ORP buffers.

Storing the sensor

Sensors should be stored with the watering cap attached, containing 3M KCl solution (Ref 238036) or storagesolution (Ref 238931). Sensors stored dry exhibit temporary drifting values. If the sensor dries out inadvertently, it can be placed in storage solution overnight to regenerate.

Cleaning

In general, you can use acids, alkaline solutions, and commonly used solvents for brief periods to clean electrodes with a glass shaft. Flush with water after cleaning. After cleaning, electrodes are likely to exhibit sluggishresponse times for a certain period, so place it in storage solution for 15 minutes after cleaning.
PolyPlast type electrodes: Note limited resistance to chemicals, see «General» below.
Ceramic diaphragm (liquid junction): If protein contamination occurs, the electrode should be immersed in a solution of 0.4% HCl + 5 g/l pepsin for several hours. If blackening of the diaphragm is apparent (silver compounds), the electrode should be immersed in a solution of 0.4% HCl + 76 g/l thiourea.
If working with hazardous liquids observe and carry out the maintenance procedures, paying particular attention to cleaning and decontamination.
Cleaning, assembly and maintenance should be performed by personnel trained in such work. Do not use any abrasive tissues or cleaning materials and do not use any cleaning chemicals other then described above.Before removing the sensor from the measuring setup, always make sure that the setup is pressure-less and cold and that no

process medium can be accidentally spilled. When removing and cleaning the sensor, it is recommended to wear safety glasses and protective gloves.

Regenerating
pH: immerse sensor for 10 min in 0.1 – 1M NaOH, then for 10 min in 0.1 – 1M HCl. After regeneration, placethe sensor in storage solution for a further 15 min.
ORP: metal surfaces can be cleaned with slightly abrasive substances, such as toothpaste or very fine scouring powder.

Disposal

The design of Hamilton sensors minimizes environmental impact. According to the EU directive 2012/19/EU (and the local laws), sensors should be disposed of as electrical or electronic waste, and not as municipal waste. Alternatively, it can be sent back to Hamilton for disposal.
Sensors with pressurized reference systems (EasyFerm Plus, EasyFerm Bio), should be disposed in the supplied polystyrene packing. This will help prevent injury should the sensor break.

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General
The life cycle of sensors is determined by requirements regarding response time, zero point, and slope.
Measurement conditions, especially high temperatures and aggressive measurement solutions, can shorten the life cycle. Under favorable conditions, the life cycle may be 1 – 3 years at room temperature and about 1 – 3 months at 90°C. There is also a slight ageing factor during storage. Polyplast types have limited chemical resistance. Extended contact with acidic or alkaline solutions and alcohols should be avoided.
Ethers, esters, ketones, or aromatic and halogenated hydrocarbons attack the shaft material and should therefore not be allowed to come in contact with the sensor.
Tip: High-quality cables increase the length of the life cycle and yield more stable measurement values.
See also «Lab & Process Sensors» at www.hamiltoncompany.com

USE IN POTENTIALLY EXPLOSIVE ATMOSPHERES

ATEX / IECEx marking:	Gas: CE 0035  II 1/2 G Ex ia IIC T4/T5/T6 Ga/Gb Gas (Polyplast only): CE 0035  II 1/2 G Ex ia IIB T4/T5/T6 Ga/Gb Dust: CE 0035  II 1/2 D Ex ia IIIC T x °C Da/Db
Manufacturer:	Hamilton Bonaduz AG, CH-7402 Bonaduz
EC type examination report:	TÜV 03 ATEX 7005 X
IECEx certificate of conformity:	IECEx TUR 14.0001 X

EC type examination report and IECEx certificate of conformity can be downloaded from www.hamiltoncompany.com.
The conditions described in the ATEX / IECEx certficate must be respected.
All ATEX specified pH and ORP electrodes: see Tab. 1

ATTENTION! In case a gas atmosphere and a dust atmosphere are, or could be, present at the same time, the risk of explosion must be examined carefully, and special precautions may be necessary.

Assembly

a) The operator of equipment in potentially explosive atmospheres is responsible for ensuring that all components of the system are certified for that area classification and are compatible with each other.
b) Electrodes may only be used in armatures intended for their specific fitting length (a-length). For installation in gas atmospheres, the following armatures are free to use:
– for all sensors from Tab. 1 with the exception of FermoTrode and ChemoTrode types: see Tab. 2a.
– armatures for FermoTrode and ChemoTrode types: see Tab. 2b.
As a general rule for installation in gas atmospheres, the glass surface in contact with the medium must be no more than 4 cm2 for equipment group IIC; 25 cm2 for equipment group IIB; and 50 cm2 for equipment group IIA. For installations in dust atmospheres, special restrictions may apply when using armatures made of plastic meterial.
ATTENTION: Incorrect fitting or dismantling of the armature or the electrode may lead to unintended release of a potentially explosive atmosphere.
c) O-Rings having a sealing function between Ex-Zone 0 and 1, 20 and 21 respectively must be replaced at each dismantling of the sensor.
d) Sensors, wiring sections, transmitters and other required equipment are to be set up within a single potential equalizing system.
e) When the sensor is assembled, the supplied ATEX / IECEx sticker is to be attached to the cable in an easily visible place near the senor. The sticker indicates that an ATEX / IECEx approved sensor is mounted.
The sticker must not be removed.

Connection to transmitter
The sensors listed in Tab. 1 are suitable for connection to an intrinsically safe electrical circuit with protection level ia. The operator of the equipment must ensure that the allowable electrical values for the sensor all exceed those of the transmitter. None of the values cited for electrical power, voltage, and current may be exceeded in total (measuring and temperature circuit together). Electrical values for the sensors listed in table 1 are as follows:
U = 24 V; I = 173 mA; The maximum process temperature for gas atmospheres is defined in Tab. 3a. for dust atmospheres, the maximum surface temperature of the sensor has to be observed. This surface temperature depends on the maximum electrical power of the transmitter, see Tab. 3b.
The maximum allowable electric power P of the transmitter (measuring and temperature circuit together) depends on the sensor type (Tab. 1) and the desired process temperature.
Attention: The temperature limit given on the sensor must in any case be respected.

Tab. 1 Hamilton ATEX / IECEx approved sensor families

Sensor	pH mV	T [°C]	p [bar]	A/S/ CIP	Ex	Type
Polilyte Pro	0 – 14	-10 – 60	6	—	IIC	7
Polilyte Pro VP	0 – 14	-10 – 60	6	—	IIC	2
Polilyte RX	± 2000	-10 – 60	6	—	IIC	7
Polilyte Plus ***, XP ***	0 – 14	0 – 130*	16, 50	A/S*	IIC	7
Polilyte Plus *** VP, XP *** VP	0 – 14	0 – 130*	16, 50	A/S*	IIC	1, 2
Polilyte Plus ORP	± 2000	0 – 130*	16	A/S	IIC	7
Polilyte Plus RX XP VP	± 2000	0 – 130*	50	A/S	IIC	1, 2
Polyplast Pro	0 – 14	-10 – 40	6	—	IIB	7
Polyplast Pro RX	± 2000	-10 – 40	6	—	IIB	7
EasyFerm Plus ***	0 – 14	0 – 140	6	A/S/CIP	IIC	7
EasyFerm Plus *** VP, LEVP	0 – 14	0 – 140	6	A/S/CIP	IIC	1, 2
EasyFerm Plus ORP	0 – 14	0 – 140	6	A/S/CIP	IIC	7
EasyFerm Bio ***	0 – 14	0 – 140	6	A/S/CIP	IIC	7
EasyFerm Bio *** VP	0 – 14	0 – 140	6	A/S/CIP	IIC	1, 2
MecoTrode	0 – 14	0 – 130	16	—	IIC	7
MecoTrode VP	0 – 14	0 – 130	16	—	IIC	1, 2
OxyTrode	0 – 14	0 – 130	16	—	IIC	7
FermoTrode	0 – 14	0 – 130	4	A/S	IIC	7
ChemoTrode	0 – 14	0 – 130	6	S/CIP	IIC	7
ChemoTrode VP	0 – 14	0 – 130	6	S/CIP	IIC	1, 2
ChemoTrode P	0 – 14	0 – 130	6	S/CIP	IIC	7
ChemoTrode ORP	0 – 14	0 – 130	6	S/CIP	IIC	7
Liq-Glass PG	1 – 12	-5 – 60	2	—	IIC	7

* depends on the pH glass used
*** pH glass
A = Autoclaving; S = Sterilization; CIP = Cleaning in place

Tab. 2a ATEX / IECEx approved armatures (not for ChemoTrodes or FermoTrodes)

	a-length 120	a-length 225
RetractoFit™ Series*	—	✓
RetractoFit™ Bio Series*	—	✓
FlexiFit™ Series*	✓	—
Retractex™ Series*	—	✓

* several part numbers possible

Tab. 2b ATEX / IECEx approved armatures for ChemoTrodes or FermoTrodes

	a-length 120	a-length 150	a-length 200 / 250
MasterFit™ 120 (Ref 237200)	✓	—	—
MasterFit™ 150 (Ref 237225)	—	✓	—
MasterFit™ 200 (Ref 237235)	—	—	✓

Tab. 3a Maximum process temperature for gas atmospheres

Type 1	Pi ≤ 50 mW	Pi ≤ 125 mW	Pi ≤ 230 mW	Pi ≤ 360 mW
T4	125 °C	119 °C	111 °C	100 °C
T5	90 °C	84 °C	76 °C	65 °C
T6	71 °C	58 °C	39 °C	15 °C

Type 2	Pi ≤ 50 mW	Pi ≤ 100 mW	Pi ≤ 150 mW	Pi ≤ 360 mW
T4	125 °C	121 °C	117 °C	100 °C
T5	90 °C	86 °C	82 °C	65 °C
T6	59 °C	41 °C	22 °C	Not allowed

Type 3	Pi ≤ 50 mW	Pi ≤ 125 mW	Pi ≤ 230 mW
T4	123 °C	114 °C	102 °C
T5	88 °C	79 °C	67 °C
T6	71 °C	58 °C	39 °C

Type 7	Pi≤ 250 mW
T4	125 °C
T5	90 °C
T6	75 °C

Tab. 3b Maximum process temperature for dust atmospheres
Table for the calculation of the maximum surface temperature «x» of the sensors, as a function of the maximum electrical power of the transmitter «Pi». «x» must be smaller than the ignition temperature of the dust involved.

Type 1 and 3	Pi ≤ 50 mW	Pi ≤ 125 mW	Pi ≤ 230 mW	Pi ≤ 360 mW
	x = Ta + 9 °C	x = Ta + 22 °C	x = Ta + 41 °C	x = Ta + 65 °C

Type 2	Pi ≤ 50 mW	Pi ≤ 100 mW	Pi ≤ 150 mW
	x = Ta + 21 °C	x = Ta + 39 °C	x = Ta + 58 °C

Type 7	Pi ≤ 250 mW
	x = Ta + 5 °C

Ta: ambient / process temperature

Tab. 4 Pin assignment of connector heads

Signal description	VP	S8	K8
pH glass	A	Core	Core
Reference electrode	B	Shield	Shield
T3	C	–	–
Solution ground	D	–	–
T1	E	–	–
T2	F	–	–
–	Outer shield	–	–

Pt1000: T1 / T2
Pt100: T1 / T2; T3 shorted with T1
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This guide may be available in other languages. Visit www.hamiltoncompany.com for more information.

Documents / Resources

	HAMILTON 243187 PH- and ORP Sensors for Process Applications [pdf] Instruction Manual 243187 PH- and ORP Sensors for Process Applications, 243187, PH- and ORP Sensors for Process Applications, Sensors for Process Applications, Process Applications, Applications

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