


# pH

pH measurements are important in many processes. There is almost no application where the pH value does not play a dominant role. All biological processes depend on the activity of enzymes because they show a pH optimum and lose their functionality if the pH is too low or too high.

The pH value is measured in most processes using a glass electrode. This pH glass forms a thin gel layer in aqueous solutions that is highly selective to H<sup>+</sup> ions. The pH dependent potential of the gel layer is measured against a built-in reference electrode with a constant potential. This reference electrode may be a silver wire in contact with solid silver chloride or a calomel electrode.

In general, the pH value is a measure of the acidity or the basicity of an aqueous solution. In technical terms, pH is the negative logarithm of the activity of the solvated protons H<sup>+</sup>. It's mostly explained as the measure of the proton concentration which is correct for dilute aqueous solutions.

Segment	Application	Sensor	Feature
Bio Pharma	Fermentation	EasyFerm Plus	Hygienic  Autoclavable CIP / SIP
	Single-Use	FermoTrobe	
Brewery / Beverage	Fermentation	OneFerm pH	Dry Storage / Low Drift
	Bottle washer	EasyFerm Bio	
Chem Pharma		Polilyte Plus H	Organic solvents
		ChemoTrobe	
		IonoTrobe	Refillable
		InchTrobe	
Water / Wastewater		Polyplast	Low Conductivity
		MecoTrobe	
		Easycontrol	Plastic Shaft
		Polilyte Plus HF	
	Liq-Glass PG	HF	
			Low Temperature



# Polilyte Plus family



The outstanding success of the Polilyte Plus in chemical and wastewater applications gave the inspiration for transferring the good features to a whole family of sensors. The expanded portfolio widens the range of applications that can be covered.

All members have the same reference electrolyte Polisolve Plus, use the Single Pore technology but will have different pH glasses. A new member with the HB glass will be established.

### Benefits

- ▶ More applications with HB pH glass
- ▶ Better overview of the portfolio
- ▶ There's always at least one family member that suits the different applications
- ▶ Resistant against solvents, strong acids and bases

### Typical applications

- ▶ Sugar industry
- ▶ Microelectronics
- ▶ Industrial wastewater
- ▶ Downstream processes
- ▶ Fermentation



#### How to choose the sensor

	New sensor	pH glass	Electrolyte	Predecessor
HF in the media, low temperature	<b>Polilyte Plus HF</b>	HF	Polisolve Plus	ClaryTrode
Low conductivity	<b>Polilyte Plus H</b>	H	Polisolve Plus	Polilyte HT
CIP, SIP, autoclavations, chemical robustness	<b>Polilyte Plus PHI</b>	PHI	Polisolve Plus	Polyclave
CIP, SIP, autoclavations, fast response time	<b>Polilyte Plus HB</b>	HB	Polisolve Plus	
High pressure	<b>Polilyte Plus XP</b>	H	Polisolve Plus	Polilyte Plus XP

#### Specifications

Measuring range	0 to 14 pH
Process temperature	See table on page 158/159
Pressure range (relative to ambient)	See table on page 158/159
Hygienic aspects	Autoclavable: H, HB, PHI CIP: HB, PHI SIP: H, HB, PHI
pH glass	See table on page 18
Electrolyte	Polisolve Plus
Reference system	Everef-L
Diaphragm	Single Pore
O-ring	EPDM: HB, PHI FKM: H, HF

For more specifications see [www.hamiltoncompany.com](http://www.hamiltoncompany.com)

### Ordering Information

#### Polilyte Plus Family Structure

242428	Basic number = Polilyte Plus VP 120 (old Ref)		
	Code	pH glass	
	1	H	
	2	HB (not for MS)	
	3	HF	
	4	PHI	
	Code	Electrical Connector	
	1	VP	
	2	S8	
	3	Arc	
	4	Memosens	
	Code	a-length (mm)	
	1	120	
	2	225	
	3	325	
	4	360 (not for Arc, MS only with H glass)	
	5	425	
	Code	Temperature sensor	
	1	Pt100 (VP) (not applicable for Arc)	
	2	Pt1000 (VP) (not applicable for Arc)	
	3	none (S8) or given (Memosens, Arc)	
<b>242428 -</b>			<b>← Order Code</b>
<b>238811</b>	<b>Polilyte Plus XP S8 120</b>		
<b>242415</b>	<b>Polilyte Plus XP VP 120 Pt1000</b>		



Accessories

**pH buffers** see page 106

**Cables** see page 112

**Housings** see page 127

# EasyFerm Plus family




Specifications	
Measuring range	0 to 14 pH
Process temperature	0 to 140 °C (Arc: analog 0 to 110 °C, digital 0 to 140 °C)
Pressure range (relative to ambient)	0 to 6 bar
Hygienic aspects	Autoclavable, SIP, CIP
pH glass	HB, PHI
Electrolyte	Phermyte
Reference system	Everef-F
Diaphragm	HP Coatramic
O-ring	EPDM

For more specifications see [www.hamiltoncompany.com](http://www.hamiltoncompany.com)

The EasyFerm Plus family of pH sensors is designed to withstand demanding applications in the Pharmaceutical and Chemical industries. All family members have the same reference electrolyte Phermyte, the same type of diaphragm HP Coatramic but different pH glasses. The standard EasyFerm Plus, with its PHI glass, is directed at the BioPharm and Pharmaceutical industries because the glass has an excellent chemical robustness and provides best results in applications where sterilization either in an autoclave or an SIP is performed frequently. The new versions with the HB glass show a very fast recovery after CIP and SIP cycles leading to a shortened set-up time.

The LEVP (LE = Liquid Earth) versions have a stabilized sensor signal and an extended sensor diagnosis.

  
*“Did you know... that with a pre-pressurized reference system the life time of a sensor is extended?”*






- Benefits**
- ▶ Pre-pressurized reference electrolyte ensures a clog-free diaphragm
  - ▶ Almost drift-free measurement
  - ▶ Stable measurement signals after steam sterilization, autoclavation and CIP cleanings

- Typical applications**
- ▶ Bioreactors
  - ▶ Industrial processes
  - ▶ Downstream processes



How to choose the sensor	New sensor	pH glass	Electrolyte	Predecessor
CIP, SIP, autoclavations, chemical robustness	<b>EasyFerm Plus PHI</b>	PHI	Phermyte	EasyFerm Plus
CIP, SIP, autoclavations, fast response time	<b>EasyFerm Plus HB</b>	HB	Phermyte	

### Ordering Information

EasyFerm Plus Family Structure				
238633	<b>Code</b>	<b>pH glass</b>		
	1	PHI (recommended pH glass type)		
	2	HB		
		<b>Code</b>	<b>Electrical Connector</b>	
		1	VP 	
		2	S8 	
		3	Arc	
		4	Memosens 	
		5	K8 	
		6	LEVP (only for 120 and 225 mm length) 	
		<b>Code</b>	<b>a-length (mm)</b>	
		1	120	
		2	160	
		3	200	
		4	225	
		5	325	
		6	360 (not for Arc and only PHI glass)	
		7	425	
		8	275	
		<b>Code</b>	<b>Temperature sensor</b>	
		1	Pt100 (VP, LEVP) (not applicable for Arc)	
		2	Pt1000 (VP, LEVP) (not applicable for Arc)	
		3	none (S8, K8) or given (Memosens, Arc)	
238633 -			← Order Code	

 Accessories  
**pH buffers** see page 106      **Cables** see page 112      **Housings** see page 127



# EasyFerm Bio family



Specifications	
Measuring range	0 to 14 pH
Process temperature	0 to 140 °C (Arc: analog 0 to 110 °C, digital 0 to 140 °C)
Pressure range (relative to ambient)	0 to 6 bar
Hygienic aspects	Autoclavable, SIP, CIP
pH glass	HB, PHI
Electrolyte	Foodlyte
Reference system	Everef-F
Diaphragm	HP Coatramic
O-ring	Silicone

For more specifications see [www.hamiltoncompany.com](http://www.hamiltoncompany.com)

The EasyFerm Bio family of pH sensors is designed for applications in the Pharmaceutical, Biotechnology and Food & Beverage industries. All family members have the same reference electrolyte Foodlyte, with its certified bio-compatibility. The standard EasyFerm Bio, with its HB glass, is directed at the Food & Beverage industry where CIP and SIP cycles occur frequently because the glass shows a very fast recovery leading to a shortened set-up time. The new versions with the PHI glass show an excellent chemical robustness at high pH values.

The LEVP (LE = Liquid Earth) versions have a stabilized sensor signal and an extended sensor diagnosis.



“Did you know... that you may even eat the Foodlyte?”

### Benefits

- ▶ Specifically designed for sterile applications in Pharma and Biotechnology (Biocompatibility)
- ▶ Highly reliable measurements after steam sterilization, autoclavation and CIP cleanings
- ▶ Drift free measurements
- ▶ Ceramic diaphragm is an improved barrier of the electrode

### Typical applications

- ▶ Bioreactors
- ▶ Downstream processes
- ▶ Brewhouse
- ▶ Gelatine manufacturing



#### How to choose the sensor

	New sensor	pH glass	Electrolyte	Predecessor
CIP, SIP, autoclavations, fast response time	<b>EasyFerm Bio HB</b>	HB	Foodlyte	EasyFerm Bio
CIP, SIP, autoclavations, chemical robustness	<b>EasyFerm Bio PHI</b>	PHI	Foodlyte	

### Ordering Information

#### EasyFerm Bio Family Structure

243632

Code	pH glass
1	PHI
2	HB (recommended pH glass type)
Code	Electrical Connector
1	VP
2	S8
3	Arc
4	Memosens
5	K8
6	LEVP (only for 120 and 225 mm length)
Code	a-length (mm)
1	120
2	160
3	200
4	225
5	325
7	425
Code	Temperature sensor
1	Pt100 (VP, LEVP) (not applicable for Arc)
2	Pt1000 (VP, LEVP) (not applicable for Arc)
3	none (S8, K8) or given (Memosens, Arc)

243632 -

← Order Code



Accessories

**pH buffers** see page 106

**Cables** see page 112

**Housings** see page 127

# OneFerm pH **new**



Specifications	
Measuring range	3 to 10 pH
Process temperature	4 to 50 °C
Pressure range (relative to ambient)	0 to 1 bar
Hygienic aspects	Gamma irradiation up to 45 kGy (for the OneFerm sensors and the pH-port)
Diaphragm	HP Coatramic
O-ring	Silicone

For more specifications see [www.hamiltoncompany.com](http://www.hamiltoncompany.com)

The OneFerm family of pH sensors is designed for applications in the single-use (SU) Pharmaceutical and Biotechnology Industries. Hamilton OneFerm sensors are the next step in the evolution of single-use measurement. Their design solves some of the issues that commonly occur with reusable pH sensors that are inserted into the bag.

Specifically, Hamilton's single-use sensors combine the reliability and measurement stability of our long-term proven conventional sensors with the ease of use as an integral part of the bioreactor. The sensors retain the high accuracy performance even after gamma irradiation and a sufficient shelf life making it the ideal single-use solution.



“Did you know... that with the reusable Arc Module SU pH a very stable digital signal can be achieved?”

- Benefits**
- ▶ Specially designed for sterile application in SU Pharma and Biotechnology
  - ▶ Highly reliable measurements after gamma sterilization and dry storage even after short wet-in time (<30 min)
  - ▶ Very low drift (<0.1 pH per week)
  - ▶ Biocompatible materials (ISO 10993-5 and USP <87>)

- Typical applications**
- ▶ SU bioreactors (bag application)
  - ▶ SU bioreactors (rigid containers)
  - ▶ SU mixer
  - ▶ SU downstream processes

### Ordering Information

OneFerm pH*	a-length	VP 6 / Pt100	VP 6 / Pt1000	VP 6 / NTC22	K8
	70	243216	243266	243235	-
	120	243217	243267	243236	243271
	160	10064894	10108674	10065001	10106075
	225	243218	243268	243237	243272
	325	243219	243269	243238	243273
	425	10101065	10089592	243239	243274

\*Only for OEM integration available



Arc Module SU pH  
Ref 243233



pH Port  
Ref 243462

### Accessories



**Cables** see page 112



# ChemoTrode / P ChemoTrode Bridge



Specifications	
Measuring range	0 to 14 pH
Process temperature	0 to 130 °C
Pressure range (relative to ambient)	0 to 6 bar
Hygienic aspects	SIP, CIP
pH glass	PHI
Electrolyte	ChemoTrode: Viscous 3 M KCl-LR ChemoTrode Bridge: Skylyte ChemoTrode P: Protelyte
Reference system	ChemoTrode: Everef-F ChemoTrode Bridge: Everef-B ChemoTrode P: Everef-F
Diaphragm	ChemoTrode: HP ceramic ChemoTrode Bridge: Platinum ChemoTrode P: HP ceramic
Temperature sensor	Pt1000 in VP version

For more specifications see [www.hamiltoncompany.com](http://www.hamiltoncompany.com)

The ChemoTrode is the most robust sensor to measure pH in demanding applications in pharmaceutical and chemical industries.

The ChemoTrode has a refill hole which allows refilling of the electrolyte and pressurization of the reference system. Its Everef-F reference cartridge ensures that the reference electrolyte remains free of silver and precipitation of proteins.



“Did you know... that the ChemoTrode Bridge has an extended life time due to its special reference system?”

### Benefits

- ▶ Liquid electrolyte ensures fast response time and high precision
- ▶ Longer lifetime thanks to refillable electrolyte
- ▶ Everef-F reference cartridge extends electrode life in aggressive media

### Typical applications

- ▶ Industrial processes
- ▶ Mining Industry
- ▶ Pulp and Paper industry
- ▶ Fermentations

### Ordering Information

	a-length	S7	VP 6 / Pt1000	VP 6 / Pt100
<b>ChemoTrode</b>	120	238760	242700	-
	150	238762	242701	-
	200	238764	-	-
	250	238766	242703	10069903
<b>ChemoTrode P</b>	120	238761	243252	-
	150	238763	243253	-
	250	238767	243254	-
<b>ChemoTrode Bridge (Non Ex)</b>	120	238770	-	-
	150	238772	-	-
	250	238776	-	-



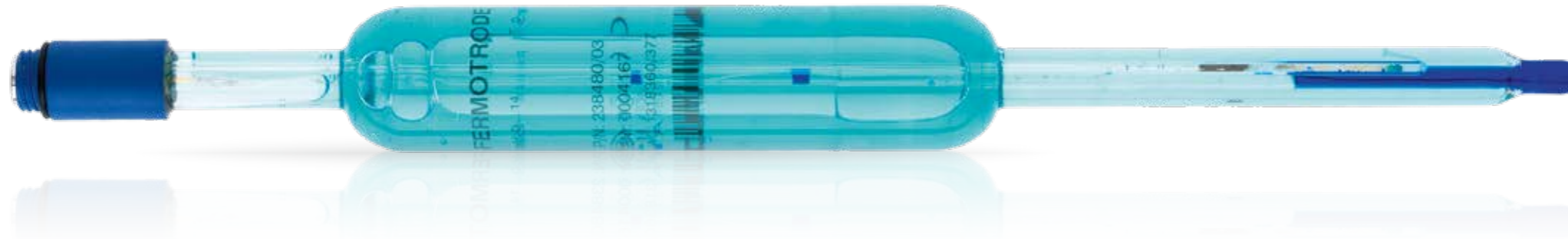
### Accessories



- pH buffers** see page 106
- Cables** see page 112
- Housings** see page 127



# FermoTrode



The maintenance free FermoTrode sensors are designed for measuring pH in pharmaceutical and biotechnological industries and fit in the MasterFit and RetractoMaster housings. The Everef-F reference cartridge ensures that the reference electrolyte Skylyte remains free of silver and precipitation, and withstands steam sterilization.

It is not suited for contact with caustic soda like in CIP-cleanings or for use in media containing citric acid.

**Benefits**

- ▶ No air pressure required, no risk of empty reference electrolyte compartment
- ▶ 3 Coatramic diaphragms prevent clogging due to proteins
- ▶ Very long lifetime, stable calibration after sterilization and practically drift-free signals

**Typical applications**

- ▶ Biotechnology
- ▶ Pharmaceutical Industry

**Specifications**

Measuring range	0 to 14 pH
Process temperature	0 to 130 °C
Pressure range (relative to ambient)	0 to 4 bar
Hygienic aspects	SIP
pH glass	PHI
Electrolyte	Skylyte
Reference system	Everef-F
Diaphragm	Coatramic

For more specifications see [www.hamiltoncompany.com](http://www.hamiltoncompany.com)

## Ordering Information



	a-length	S7
FermoTrode	120	238480
	150	238482
	200	238484
	250	238486

## Accessories



- pH buffers** see page 106
- Cables** see page 112
- Housings** see page 127

# IonoTrode



“Did you know...

*that the IonoTrode is designed for ion weak media with a low conductivity of only 0.2  $\mu\text{S}/\text{cm}$ ?”*

The IonoTrode sensor is designed for applications in ion weak media. The F glass membrane has a very low resistance, therefore the sensor can be used in samples with low conductivity, where it offers highest accuracy over a long period of time.

If there is a storage container with 3 M KCl attached via a tube to the side-arm of the IonoTrode, the flow-out of the electrolyte can be controlled with the sleeve diaphragm.

## Benefits

- ▶ Offers highest accuracy over a long period of time
- ▶ Stable measurements in samples with low conductivity of at least 0.2  $\mu\text{S}/\text{cm}$
- ▶ Removable PTFE sleeve diaphragm to check electrolyte outflow
- ▶ Side-arm attachment via tube to storage vessel containing 3 M KCl, and control of electrolyte flow with PTFE diaphragm ring

## Typical applications

- ▶ Drinking Water Plants
- ▶ Boiler Feed Water

## Specifications

Measuring range	0 to 14 pH
Process temperature	-10 to 40 °C
Pressure range (relative to ambient)	0 to 0.5 bar or higher if pressurization by side-arm
pH glass	F
Electrolyte	3 M KCl
Reference system	Everef
Diaphragm	Sleeve
O-ring	EPDM

For more specifications see [www.hamiltoncompany.com](http://www.hamiltoncompany.com)

## Ordering Information

	a-length	S7
IonoTrode	120	238525

## Accessories



**pH buffers** see page 106

**Cables** see page 112

**Housings** see page 127



# InchTrode



## Specifications

Measuring range	0 to 14 pH
Process temperature	-10 to 130 °C (flat membrane) 0 to 130 °C (cylindrical membrane)
Pressure range (relative to ambient)	0 to 10 bar (25 °C) 0 to 6 bar (130 °C)
pH glass	HF (flat membrane) PHI (cylindrical membrane)
Electrolyte	Polisolve
Reference system	Everef-L
Diaphragm	Single Pore
Temperature sensor	Pt1000 in VP version Pt100 in fix cable version

For more specifications see [www.hamiltoncompany.com](http://www.hamiltoncompany.com)



“Did you know... that the InchTrode is available in two different sizes and with different membrane shapes?”

The InchTrode sensors are designed to measure pH in demanding applications in the paper making as well as in the chemical industries. The Single Pore liquid junction guarantees the best and fast measuring results because of direct contact between the sample and the Polisolve electrolyte.

The InchTrode sensors are easy to install without additional housing and have a robust PEEK shaft.

### Benefits

- ▶ Single Pore for direct sample contact with Polisolve electrolyte – no clogging
- ▶ Very long-lasting reference system
- ▶ Robust PEEK shaft
- ▶ Simple installation without additional housing

### Typical applications

- ▶ Pulp and Paper industry
- ▶ Water and Wastewater

## Ordering Information



	Type	a-length	VP 6	fix cable
InchTrode	N75F	143	238346	–
	N75P	150	238342	–
	N75FC10	143	–	238364
	N75PC10	150	–	238359
	N100F	140	238352 (non Ex)	–

F = Flat membrane  
P = Cylindrical membrane  
C = Fix cable

## Accessories



**pH buffers** see page 106

**Cables** see page 112

**Housings** see page 127



# MecoTrode



The maintenance free MecoTrode sensor is designed for processes in the chemical industry with extreme pH values. The H glass type membrane glass provides a low alkaline error and stable measurement even at high temperatures.

Three high-performance ceramic diaphragms reduce the effect of flow potential in pipe mounting.



“ Did you know...  
that the MecoTrode is already  
25 years in the market? ”

## Benefits

- ▶ 3 high performance ceramic diaphragms for reduced flow potentials when mounted in pipes
- ▶ «H» glass for most accurate readings at high pH values or high temperatures
- ▶ Very good precision at low pH values (pH < 2)

## Typical applications

- ▶ Water and Wastewater
- ▶ Industrial processes



## Specifications

Measuring range	0 to 14 pH
Process temperature	0 to 130 °C
Pressure range (relative to ambient)	0 to 16 bar (25 °C) 0 to 6 bar (130 °C)
pH glass	MecoTrode: H MecoTrode HF: HF
Electrolyte	Viscous 3 M KCl-Pharma, blue
Reference system	Everef
Diaphragm	HP ceramic
Temperature sensor	Pt100 in VP version
O-ring	EPDM

For more specifications see [www.hamiltoncompany.com](http://www.hamiltoncompany.com)

## Ordering Information

	a-length	S8	VP 6	MS
MecoTrode	120	238801	238437	242837
MecoTrode HF	120	-	-	242839
	225	-	-	242840



## Accessories



**pH buffers** see page 106

**Cables** see page 112

**Housings** see page 127

# Polilyte Pro Polyplast Pro



Specifications	
Measuring range	0 to 14 pH
Process temperature	Polilyte Pro: -10 to 60 °C Polyplast Pro: -10 to 40 °C
Pressure range (relative to ambient)	0 to 6 bar
pH glass	Polilyte Pro: HF Polyplast Pro: V
Electrolyte	Polisolve
Reference system	Polilyte Pro: Everef-B Polyplast Pro: Ag/AgCl
Diaphragm	Single Pore
Temperature sensor	Pt1000 in VP version
O-ring	Polilyte Pro: EPDM Polyplast Pro: EPDM

For more specifications see [www.hamiltoncompany.com](http://www.hamiltoncompany.com)

The maintenance free Polilyte Pro and Polyplast Pro sensors are designed for pH measurement in water applications, especially in low conductivity samples, e.g. wastewater, fish farming, ground water, etc.

The Single Pore liquid junction guarantees best measurement results because of direct contact between the sample and the Polisolve electrolyte – clogging is nearly impossible. The Polyplast Pro sensor comes with a robust plastic shaft and glass bulb protection.



“Did you know...  
that the Polilyte Pro has the  
HF resistant pH glass?”

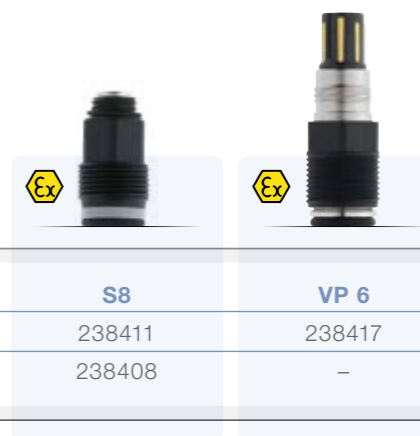
### Benefits

- ▶ Single Pore for direct sample contact with Polisolve electrolyte
- ▶ No clogging
- ▶ Fast response even in low conductivity media
- ▶ Easy maintenance due to non-refillable electrolyte

### Typical applications

- ▶ Wastewater applications
- ▶ Fish farming
- ▶ Ground water

### Ordering Information



	a-length	S8	VP 6
Polilyte Pro	120	238411	238417
Polyplast Pro	120	238408	-

### Accessories



- pH buffers** see page 106
- Cables** see page 112
- Housings** see page 127



# Liq-Glass PG EasyControl



“ Did you know...

*that the EasyControl is also available as ORP sensor? ”*

The maintenance free Liq-Glass PG and the EasyControl sensors are entry level sensors for chemical or waste water applications and low process temperatures. They show good behaviour in samples with low conductivity.

## Benefits

- ▶ Suitable for low conductivity media
- ▶ Easy maintenance due to non-refillable electrolyte
- ▶ Liq-Glass PG has 3 ceramic diaphragms for reduced flow potentials

## Typical applications

- ▶ Wastewater applications
- ▶ Fish farming
- ▶ Ground water
- ▶ Swimming Pools



## Specifications

Measuring range	Liq-Glass PG: 1 to 12 pH EasyControl: 0 to 14 pH
Process temperature	Liq-Glass PG: -5 to 60 °C EasyControl: 0 to 60 °C
Pressure range (relative to ambient)	0 to 2 bar
pH glass	Liq-Glass PG: F EasyControl: HF
Electrolyte	Liq-Glass PG: Viscous 3 M KCl-LR EasyControl: Gel electrolyte
Reference system	Liq-Glass PG: Everef EasyControl: Ag/AgCl
Diaphragm	Ceramic
O-ring	Liq-Glass: EPDM EasyControl: EPDM

For more specifications see [www.hamiltoncompany.com](http://www.hamiltoncompany.com)

## Ordering Information



	a-length	S8
<b>Liq-Glass PG</b>	120	238515
<b>EasyControl (Non Ex)</b>	120	238522

## Accessories



**pH buffers** see page 106

**Cables** see page 112

**Housings** see page 127