ABB MEASUREMENT & ANALYTICS | INSTRUCTION MANUAL | IM/2867 REV. Q

2867 series

pH and Redox (ORP) industrial dip electrode systems

Measurement made easy

2867 series
pH/redox (ORP)
electrode systems

For more information

A Data Sheet is also available for free download from:

www.abb.com/analytical

or by scanning this code:

Search for or click on

Data Sheet 2867 series pH and Redox (ORP) industrial dip electrode systems	DS/2867-EN

Electrical safety

This equipment complies with the requirements of CEI/IEC 61010-1:2001-2 ‘Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use’. If the equipment is used in a manner NOT specified by the Company, the protection provided by the equipment may be impaired.

Health and safety

To ensure that our products are safe and without risk to health, the following points must be noted:

- The relevant sections of these instructions must be read carefully before proceeding.
- Warning labels on containers and packages must be observed.
- Installation, operation, maintenance and servicing must only be carried out by suitably trained personnel and in accordance with the information given.
- Normal safety precautions must be taken to avoid the possibility of an accident occurring when operating in conditions of high pressure and/or temperature.
- Chemicals must be stored away from heat, protected from temperature extremes and powders kept dry. Normal safe handling procedures must be used.
- When disposing of chemicals ensure that no two chemicals are mixed.

Safety advice concerning the use of the equipment described in this manual or any relevant hazard data sheets (where applicable) may be obtained from the Company address on the back cover, together with servicing and spares information.

CONTENTS

Contents Page

NOTE. Electrode assemblies:
1980 400
1980 500
have now been replaced with the following assemblies respectively:
1980 430
1980 530.

The former assemblies are now discontinued for environmental reasons, in line with Company policy.

1 INTRODUCTION

This manual describes the Industrial dip electrode system Model 2867. Electrode assemblies for use with the system incorporate electrodes of either glass or antimony for pH measurements, or platinum for redox measurements.

1.1 Description

This system is constructed in plastic throughout and consists of an ABS tube, with a transparent perspex section incorporated in its upper half, supported by a mounting flange or bracket. The electrode assembly is screwed into the lower end of the system and sealed with an 'O'-ring.

The system tube is filled with salt-bridge solution forming an integral reservoir for the reference element mounted in the upper end of the electrode assembly. A liquid junction with the sample solution is made at a ceramic plug fitted in the wall of the system tube at its lower end. The connecting cable to the electrode assembly passes through the system tube and out through a rubber bung closing the upper end of the system.

The system is made in three standard lengths permitting immersion of the electrodes in the solution to be measured to nominal depths of up to 457 mm (18 in), 915 mm (36 in) or 1830 mm (6 ft). On both versions the mounting flange or bracket is located by two rubber 'O'-rings.

The Model 2867 will operate in sample temperatures over the range 0 to 70°C and is specially designed so that temperature variation effects are reduced to a minimum.

1.2 Ancillary Equipment

Electrode Assemblies

Dual electrodes specially designed for use with the Model 2867 system are available as assemblies for direct mounting. The assembly consists of a combined measuring/reference electrode contained in an ABS plastic tube. The membrane of the measuring electrode projects through the lower end of the tube: the reference element projects through the upper end of the tube.

Assemblies available are as follows:

Model No.	Type Application	
1912 400	Glass pH	fitted with BNC coaxial connectors
1980 430	Platinum Redox	
1990 400	Antimony pH	
1912 500	Glass pH	fitted with tagged ends
1980 530	Platinum Redox	
1990 500	Antimony pH	

Note. See **List of Spares** for ordering information.

2 INSTALLATION

2.1 Mounting

a) Dimensions of the flange and fixing holes are shown in Fig. 1 together with overall dimensions of the complete system.

b) Since the associated measuring instrument has to be set up with the electrode immersed in standardising solutions, the electrode system should not be bolted into place until the standardisation procedure (see under OPERATION) has been carried out. Correct alignment of the fixing holes for the installation should however be checked before standardisation.

c) It is important to ensure that the system is so positioned as to ensure a positive head of 300 to 600mm (12 to 24in) of salt bridge solution relative to the liquid being measured.

2.2 Electrical Connections

The connecting cable is fitted with a waterproof coaxial plug or tagged ends.

a) Remove the protecting end cap (supplied with the versions fitted with coaxial connectors) and retain it for future use. It will be required if the electrode assembly is removed or otherwise disconnected from the measuring instrument.

b) Ensure that any dirt or grease in the plug and associated socket connected to the measuring instrument is removed by carefully wiping with a rag moistened with a suitable solvent e.g. propanol.

c) Connect the plug and socket and make watertight by overlapping the rubber sleeves provided.

d) For electrodes with cables terminating in tagged ends, connect the individual tags to the input terminal block of the pH meter, as described in the instruction manual for the pH meter.

3 PREPARATION FOR USE

3.1 Activation of Electrodes

Before use, depending on the type of electrode assembly a period of activation may be required. Full details are given in the booklet provided with the electrode assembly.

3.2 Assembly of the System

a) Remove the split rubber bung from the cap on the upper end of the system.

b) Fit the smaller of the ceramic plugs to the side of the electrode system tube (See Fig. 1) using the special wrench supplied in the accessory kit. If the sample causes blockage of the ceramic, replace the plug with the larger one, which will allow a higher flow of salt bridge solution.

c) Thread the coaxial cable from the electrode assembly up through the bottom end of the system so that it passes out through the cap on the upper end.

d) Remove the neoprene cap from the salt bridge solution entry tube of the reference element (at the upper end of the electrode assembly).

Note. There should be a minimum of delay between carrying out this step and the filling of the system with salt bridge solution (see below).

e) Screw the electrode assembly into the system and tighten firmly until it is flush.

f) Unscrew the cap on the upper end of the system. There is no need to remove it from the coaxial cable.

g) Holding the system upright, fill with salt bridge solution (saturated potassium chloride) until the level can be seen to be near to the top of the transparent section. Add a few grammes of KCl crystals to keep the solution saturated.

h) Place the screw cap on the upper end of the system.

i) Fit the coaxial cable into the split rubber bung and place it in the cap.

3.3 Standardisation pH

This consists of setting up the associated measuring instrument to read correctly with the electrode in the system immersed in suitable standard solutions. The procedure is fully described in the appropriate instrument manual.

Note. When using a glass electrode assembly the check reading to be expected is between 6.7pH and 7.3pH.

When the standardisation procedure has been carried out, complete the installation of the system.

3.4 Standardisation Redox

A method of checking redox electrode pairs

The normal method of checking a redox pair is to immerse the electrodes in solutions of known redox potential. The standards used are quinhydrone/pH solutions prepared by making up standard ABB Kent-Taylor 4 and 7pH buffer solutions and saturating both by adding excess quinhydrone. A redox electrode pair is then immersed in the solutions in turn and the readings noted. The values of the e.m.f. as measured at 25°C are shown below. Readings should be within ±15mV.

Table 3.1 E.m.f. values for Pt vs Ag/AgCl Reference Electrode

Solution	Pt v Ag/AgCl
4pH	+ 259mV
7 pH	+82mV

4 ROUTINE MAINTENANCE

This consists of keeping the system topped up with salt bridge solution, checking the standardisation of the electrodes against buffer solutions, and making periodic checks to ensure that the electrode membrane and ceramic plug are clean.

4.1 Salt Bridge Solution

The saturated KCl salt bridge solution should be topped up weekly. The level must not be allowed to fall below the transparent perspex section, otherwise it could fall undetected below the entry tube of the reference element.

4.2 Standardisation

Standardisation should be carried out at regular intervals. The precise interval will depend on the use of the electrode and cannot be stated definitely, but normally should take place weekly, or more frequently if conditions demand it. At first, carry out daily checks, and then extend the interval in the light of experience.

4.3 Cleaning

a) The need for cleaning the electrode becomes apparent when the response becomes sluggish, with possibly a falling off in calibration.

b) If the cleaning procedures described below do not eliminate these symptoms, the electrode assembly and/or ceramic plug should be changed.

c) During cleaning, avoid rough handling of the electrode membrane. Wiping with a cloth soaked in suitable solvent for the deposit, or washing with a strong jet of water, are preferred methods.

d) Where the cleaning process for the electrode or ceramic plug necessitates soaking for a time, it is advisable to exchange the electrode system with a standby system, so that there is least interruption to the measurements.

Warning. DO NOT USE ORGANIC SOLVENTS THAT MAY ATTACK THE ABS PLASTIC MATERIAL USED IN THE CONSTRUCTION OF THE SYSTEM AND ELECTRODE ASSEMBLY.

4.3.1 Glass Electrodes

Methods of removing various types of deposit are given below:

General sludge and loosely adhering matter:
Direct a strong jet of water onto the glass membrane.

Light Inorganic Deposits:
Wipe the glass with cotton wool soaked in 0.1M HCl and then wash in water before standardising.

Greasy Organic Deposits:
Wipe the glass with cotton wool soaked in a non-ionic detergent and rinse thoroughly. If sluggishness is still observed, soak the electrode for a few hours in 0.1M HCl and then wash in water before standardising.

…4 ROUTINE MAINTENANCE

Heavy Non-Greasy Deposits: (e.g. rust, chalk)
Wipe` with cotton wool soaked in concentrated HCl to remove the deposit, and rinse thoroughly. Soak the electrode for a few hours in 0.1M HCl and then wash in water. An alternative treatment is to wipe the electrode and soak it overnight (or longer if necessary) in a 10% solution of E.D.T.A. followed by reactivation in 0.1M HCl and rinsing in water.
Heavy deposits formed during effluent neutralisation are often removed by using a 1:1 mixture of concentrated HCl and water.

4.3.2 Platinum Electrodes:
In general, the same procedures may be used as for glass electrodes. They may also be cleaned cathodically.

4.3.3 Antimony Electrodes
Emery paper or a file should be used

4.3.4 Ceramic Plug:
The same procedures may be used as for glass electrodes, but lengthy soaking should not be necessary. In general, the ceramic plug need not be removed. A heavily fouled ceramic plug may still perform satisfactorily, but if found to be the source of reduced system performance the plug and seal should be replaced together. The seal is removed by careful easing out with a spanner or the special wrench provided.

4.4 Care of Plugs and Sockets
Plugs and Sockets should be examined every time they are disconnected. Dirt or grease should be removed by wiping with a clean cloth moistened with a solvent e.g. propanol. The centre contact of sockets should also be examined to make sure that the two halves have not spread too far apart to grip the plug contact firmly. Gentle pressure with pliers should be used to bring the contacts together again.

5 SERVICING

5.1 Removal of Electrode Assembly
The procedure is as follows:

a) Disconnect the waterproof plug on the coaxial cable connected to the electrode system from the coaxial socket connected to the measuring instrument.

b) Fit the waterproof cap to the coaxial plug (when supplied)

c) Remove the system tube from the sampling point, ensuring that the process solution is not under pressure. **KEEP TUBE UPRIGHT.**

d) Rinse off the solution so that the electrode assembly may be handled.

e) Remove the split rubber bung holding the coaxial cable in place in the upper end of the system.

f) Unscrew the cap in the upper end of the system and empty the salt bridge solution into a clean vessel (the solution may be kept and used for refilling).

g) Hold the end of the electrode assembly in one hand and the lower part of the system tube in the other. Unscrew the electrode assembly anticlockwise until it is free of the system.

h) Remove the screw cap from the coaxial cable by passing it over the plug end.

i) Gently draw the coaxial cable and plug through the system tube so that the electrode assembly and cable are free.

j) Hold the system tube upside down and wipe the inside, where the electrode assembly fits, with absorbent paper. This prevents a layer of KCl crystals forming as any salt bridge solution left dries out.

5.1.2 Replacement of Electrode assembly
Carry out the procedure described under **3 PREPARATION FOR USE**, removing the cap from the reference element if the assembly is a new one.

5.2 Fault Finding
The location of a fault is best found by fitting a replacement electrode assembly and carrying out a standardisation check. If changing the electrode assembly clears the fault, then the assembly is faulty and should be checked to see if it can be restored to working order. If, after cleaning and reactivating the electrode assembly, cleaning or changing the ceramic plug and refilling with fresh salt bridge solution, there is no improvement, then the old electrode assembly should be discarded.

If the fault is in neither the electrode assembly nor the ceramic plug, it must be assumed that the measuring instrument or its connections are faulty.
The following is a short (and by no means exhaustive) list of fault symptoms and the possible causes due to faulty electrodes.

Table 5.1 Fault Finding

Symptom	Possible Cause
1. Indicator reading drifts aimlessly and possibly settles at one end of the scale	a) Electrode leads open circuit. Check the waterproof plug and socket. b) Salt bridge solution has fallen below the level of the reference electrode. Top up.
2. Indicator reading either settles at check reading, or some other reading.	a) Electrode leads short circuit. Check the waterproof plug and socket. b) Electrode membrane cracked. Fit new electrode assembly.
3. Indicator reading drifts.	a) Ceramic plug blocked or dirty. Clean or change the plug. b) Reference electrode lead earthed. Try a new electrode assembly. c) Reference electrode poisoned. Could be due to insufficient head of salt bridge solution, allowing injurious substances to pass through the ceramic plug. Try new electrode assembly with greater head of salt bridge solution.
4. Indicator reading exhibits sluggish response to changes in parameter level.	a) Electrode membrane dirty or coated. Clean and reactivate. b) At very low temperatures electrode response is sluggish.

6 LIST OF SPARES

When ordering spares always quote the Part No. Spares should be ordered from ABB Limited, Oldends Lane, Stonehouse Gloucestershire, GL10 3TA, England.

	Part Number		
	Coaxial Connector	**BNC Connector**	**Tags**
BNC plug	0238 151	1912 400	1912 500
BNC socket	0238 449	1980 430	1980 530
Screw-in ceramic plug assembly (3.5mm plug)	2867 550	1990 400	1990 500
Screw-in ceramic plug assembly (1.5mm plug)	2867 540		
Wrench for ceramic plug assembly	2867 560		
Mounting flange (surface mounting)	2867 640		
Mounting bracket (wall mounting)	2867 570		
Split rubber stopper	2867 420		

	Part Number
Service pack – containing O-rings and ceramic plugs	2867 041
Potassium chloride crystals	0400 170
Buffer 4pH	0400 110
Buffer 7pH	0400 120
Buffer 9.23pH	0400 130
Mixed box of buffers (4, 7 and 9.23)	0400 135

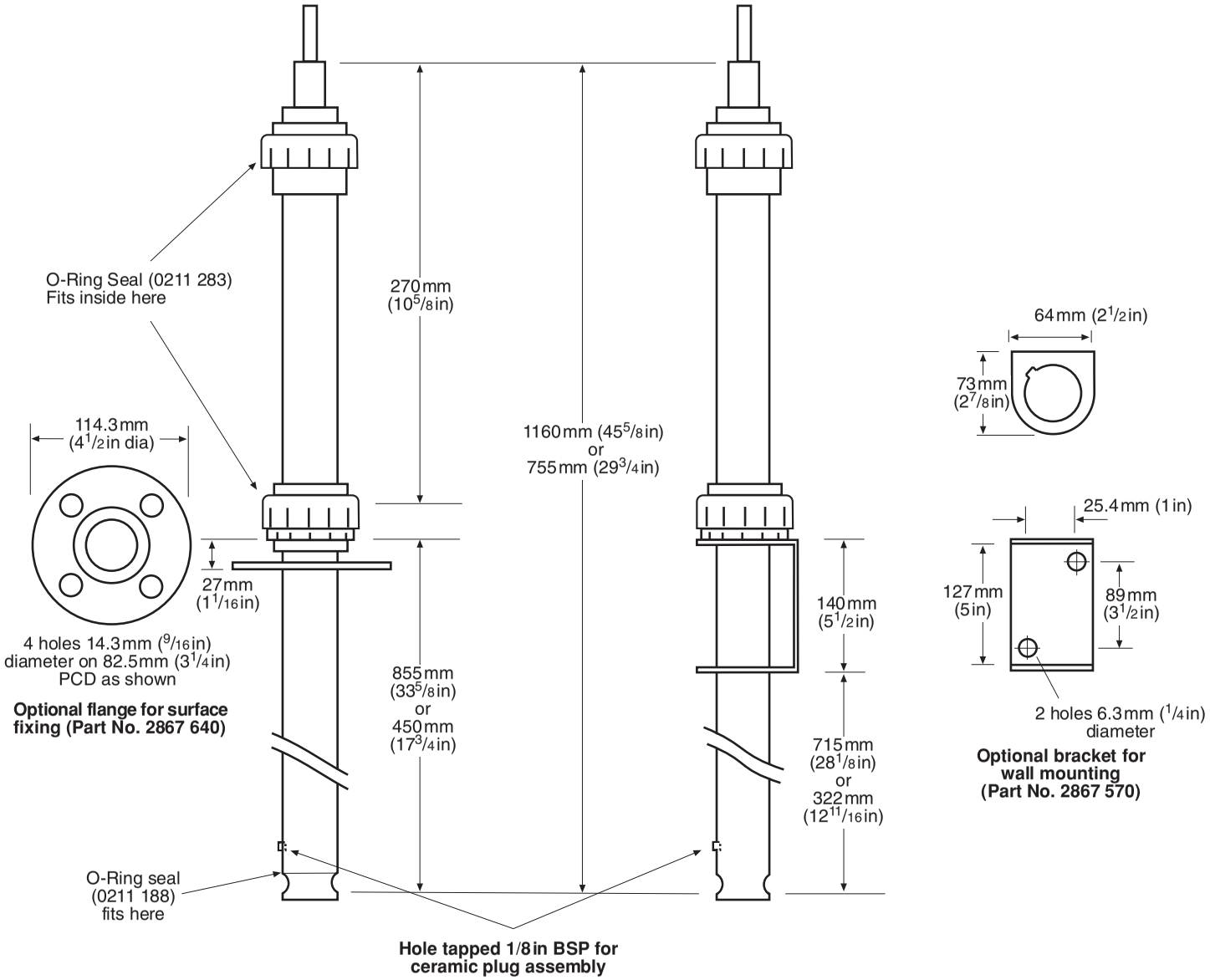

Fig. 1 Model 2867 Installation Diagram

NOTES

Sales

Service

ABB Limited
Measurement & Analytics
Oldends Lane
Stonehouse
Gloucestershire
GL10 3TA
UK
Tel: +44 (0)1453 826 661
Fax: +44 (0)1453 829 671
Email: instrumentation@gb.abb.com

ABB Inc.
Measurement & Analytics
125 E County Line Road
Warminster
PA 18974
USA
Tel: +1 215 674 6000
Fax: +1 215 674 7183

abb.com/analytical

IM/2867 Rev. Q 11.2018