



Two Inch System Corrosion Probes Linear Polarization Resistance (LPR) Probes



LPR FLUSH PROBE 2 ELECTRODES



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Linear Polarization Resistance (LPR) corrosion probe is an effective electrochemical method of measuring corrosion. Linear polarization resistance are commonly used in conductive environments such as water or any electrolyte where instantaneous, on-line corrosion rate readings are required. Corrosion rates are determined electrochemically from the measured polarization resistance. LPR probes are therefore recommended for water systems, oil systems with high and continuous water cuts, and for detection of corrosion due to condensation of water. The LPR probe may also be used in combination with other electrochemical techniques such as polarization, AC impedance and electrochemical noise measurements. Linear polarization probes are ideally suited to monitor fluctuations that may occur within a system; for example, these probes can be used to monitor corrosion inhibitor effects on a regular basis. ER probes, in comparison, also function in low or varying water cut, but require an exposure period in order to establish corrosion rates.

The operating principle is based on measuring the flow of current between electrodes. Two basic types of linear polarization probes can be provided to accommodate the two-electrode (working and counter) and three-electrode (working, counter and reference) techniques. The surface may be flush or projecting. Flush type LPR probe with two and three electrode are designed to be installed flush with the pipe wall. These probes are available both with fixed and with adjustable length. Flush type probe, the mounting studs form part of the end cap. In case of damage, the entire probe has to be replaced.

The projecting design reduces the risk for deposits on the electrodes, which may otherwise influence the results, and also offer larger electrode area in the same application. Projecting LPR probe with two or three electrodes, which are mounted at the end of the probe by threaded, insulated studs. Electrodes are replaceable and can be provided by EuropCorr® in any alloy required.

Monitoring the relationship between electrochemical potential and current generated between electrically charged electrodes in a process stream allows the calculation of the corrosion rate. LPR is most effective in aqueous solutions, and has proven to be a rapid response technique. This measurement of the actual corrosion rate allows almost instant feedback to operators. LPR monitoring has seen wide industry use for nearly 50 years.

Linear Polarization Resistance Theory

Electrical conductivity (the reciprocal of resistance) of a fluid can be related to its corrosiveness. A two or three electrode probe is inserted into the process system, with the electrodes being electrically isolated from each other and the process line. A small potential in the range of 20mV (which does not affect the natural corrosion process), is applied between the elements and the resulting current is measured. The polarization resistance is the ratio of the applied potential and the resulting current level. The measured resistance is inversely related to the corrosion rate. The electrical resistance of any conductor is given by:

$$R = \frac{V}{I}$$

Where

R = Effective instantaneous resistance

V = Applied voltage

I = Instantaneous current between electrodes

If the electrodes are corroding at a high rate with the metal ions passing easily into solution, a small potential applied between the electrodes will produce a high current, and therefore a low polarization resistance. This corresponds to a high corrosion rate.



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Advantages

The major advantage to LPR monitoring is the speed in which it can provide a measurement of the corrosion rate. Changes in the corrosion rate can typically be detected in minutes, providing an almost instantaneous measuring system. This fast response allows an operator to evaluate process changes and is particularly useful in monitoring the effectiveness of a prevention program. For example, quick feedback means that inhibitor selection and quantities can be evaluated and fine-tuned in minimal time. LPR monitoring can also give an indication of metal behaviour, for example when an alloy changes from a passive to an active state, thereby resulting in increased susceptibility to corrosion. EuropCorr® LPR probes can often have long lives, depending on the monitoring conditions and maintenance care. For projecting probes, the electrodes are replaceable, which extends probe life and offers options in electrode material types for different monitoring objectives. Probe terminals are metal/glass sealed and can be operated in system rated up to 6000psi and 220°C. The EuropCorr® LPR probes have 6 pin Amphenol connector, supplied with probe packing and probe O-ring, probe diameter 32mm, standard probes are designed for mounting through EuropCorr® hollow plug assembly, can be used with both EuropCorr® two inch high pressure mechanical and hydraulic

system. By using a EuropCorr® retriever and service valve, the probe can be changed/inspected with no interruption to the system. Probe readings/measurements can be taken any time by connecting EuropCorr® MaxiCorr portable instrument to 6 pin Amphenol connector or it can form part of a continuous corrosion monitoring system, when used in conjunction with EuropCorr® MegaCorr data logger.

As all measurements with LPR probes require a conducting electrolyte, consistent results are most easily obtained in water systems. In oil/water conditions and in particular where water conditions vary (slug flow, 2-phase flow), the required electrolyte may be not present or fluctuating, leading to results which are difficult to interpret reliably.

Probe length will be calculated by us based on the following information provided by the client:

- Position: access fitting position and monitoring position (TOL, MOL & BOL)
- Type of access fitting: Hydraulic or Mechanical system and flareweld, Buttweld, Socketweld or flanged
- Dimensions: pipeline size and wall thickness, additionally for flanged fitting: gasket gap and nozzle height (distance from top face of flange to external of pipe wall)

ORDERING INFORMATION:

LPR Probe Type	Element Type		Part No.
Flush Mounted LPR Probe	2 Electrodes	Adjustable	352006
		Fixed	352001
	3 Electrodes	Adjustable	352007
		Fixed	352002
Projecting LPR Probe	2 Electrodes (L=32mm)		352003
	3 Electrodes (L=32mm)		352004

Available length intervals for adjustable probes:

A1: 055 - 075 mm	A6: 190 - 230 mm
A2: 065 - 085 mm	A7: 230 - 270 mm
A3: 085 - 115 mm	A8: 270 - 310 mm
A4: 110 - 150 mm	A9: 310 - 350 mm
A5: 150 - 190 mm	A10: 350 - 390 mm

Spare Parts for LPR Probe	Part No.	Material
Probe packing	350001	PTFE
Probe o-ring	300008	Viton
Electrode/Insulator Kit	352005	C.S./PTFE

Pressure rating: 6000 PSI (420 BAR)

Temperature rating: +220°C, high temperature probes are available on request

Meets NACE MR0175/ISO15156

LPR probes are manufactured from A182 F316L with carbon steel electrode. Probe body and electrodes are available in alternative materials upon request.

