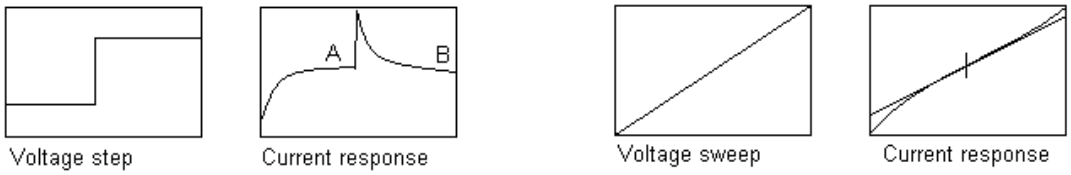
ACM Instruments

Linear Polarisation Resistance

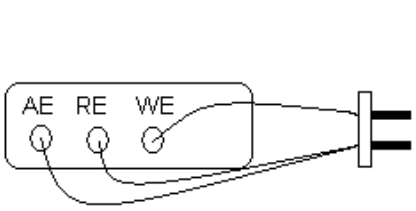
The LPR technique is the most frequently used being both quick and easy. A small sweep from typically -10 mV to +10 mV at 10 mV/min around the rest potential is performed. The resulting current/voltage plot usually exhibits a straight line the inverse slope of which is proportional to the corrosion rate. The Gill AC Gill 8 and 12 the Field Machine the Pocket Machine the LPR meter and the Bubble Test software all use this method.



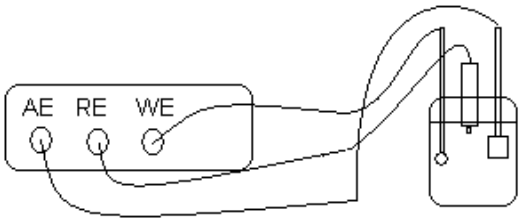
The step method is used in hand held instruments for example the pocket machine. The current is measured at points A and B once the initial current surge has steadied. The voltage sweep results in a response shown above a best fit straight line gives the charge transfer resistance. A variant of the LPR test is the pitting index. This is a measure of the asymmetry between anodic and cathodic current response a feature built into to the portable LPR meter where it is available as a switched option between corrosion rate and pitting index. The LPR method is ideal for plant monitoring offering an almost instantaneous indication of corrosion rate allowing for quick evaluation of remedial action and minimising unscheduled downtime. As an example and guide to allow the new operator to obtain a feeling for the numbers involved the table below gives a qualitative classification of corrosion rates of carbon steel in a water cooling system.

Corrosion rate mm/year	mils/year	Classification
<0.03	1.2	Excellent
0.03 – 0.08	1.2 – 3.2	Very good
0.08 – 0.13	3.2 – 5.2	Good
0.13 – 0.2	5.2 – 8	Moderate
0.2 – 0.25	8 – 10	Poor
>0.25	>10	Very poor

To convert a corrosion current in mA/cm2 to a corrosion rate in mm/year multiply the current by 12.
The sources of error in LPR tests include uncertainty in the parameter B used in the Stern and Geary equation where icorr = B/Rp B = (ba.bc)/(2.3(ba+bc)) choice of a scan rate that is too fast neglect of the solution resistance and non linearity. In practice a value of 20 mV usually works well for B a scan rate of 0.2 mV/sec is often adequate the solution resistance can be compensated by positive feedback and the non-linearity error is only a small percentage of the result. Linear polarisation resistance can be done either three or two electrodes. The two electrode method relies on both electrodes been similar so that when they are coupled and offset the test is still in the linear region. This matching of electrodes is not needed when using the three electrode method as the potentiostat measures the rest potential and offsets the test around that.



Two electrode wiring of Gill AC



Three electrode wiring of Gill AC