

# 1287

## Electrochemical interface

**The Solartron Analytical 1287 Electrochemical interface is a high accuracy, wide bandwidth potentiostat/galvanostat which offers a full range of ac/dc test capabilities; when coupled with a frequency response analyzer.**

### Measurement Integrity

Central to the measurement capability of 1287 are two high resolution digital voltmeters which provide simultaneous voltage and current measurements. Using Solartron Analytical's patented pulse width conversion technique, they have high accuracy, stability and linearity throughout the entire range of the instrument.

The 1287 has excellent measurement resolution and accuracy down to  $1\mu\text{V}$  for the reference electrodes and  $1\text{pA}$  for the working electrode, which makes it an ideal choice for electrochemical noise applications or measurements where signal levels are extremely low.

The 1287 uses floating measurements on all connections: it is equally at home measuring corrosion rates on grounded oil pipelines as it is in the laboratory. For safety reasons, it is often necessary to ground laboratory equipment such as autoclaves, a major problem if your instrumentation is not capable of floating measurements.

The 1287 offers complete flexibility for cell connection: 2-, 3- or 4-terminal measurements can be made with equal ease.

- 2-terminal techniques for general materials/electrochemical testing
- 3-terminal techniques for corrosion/coating applications
- 4-terminal techniques for accurate characterization of batteries/fuelcells, enabling lead resistance and impedance effects to be minimised

### Impedance

Electrochemical Impedance Spectroscopy (EIS) is widely used to enhance the information about reaction mechanisms available from dc techniques. Designed with impedance testing very much in mind, the 1287's performance is unsurpassed; no other electrochemical interface matches the flatness and linearity of its frequency response.

Solartron Analytical FRAs use a single sine correlation algorithm which offers excellent noise and harmonic rejection. The technique is particularly powerful for electrochemical applications since signal levels are usually very low (of the order of millivolts), and are inevitably buried in noise. With the 1287/1260 combination it is possible to characterize cells with a very wide range of impedances.

When making high frequency impedance measurements, Solartron Analytical's driven shield technology minimizes the unwanted effects of cable impedance enabling 1287 to be used over a full  $10\mu\text{Hz}$  to  $1\text{MHz}$  frequency range.

1287 was designed to carry out both dc tests and ac impedance tests: an externally generated waveform from a frequency response analyzer or spectrum analyzer can be added to the polarization signal.

### Electrochemistry Software

CorrWare and ZPlot packages are specifically designed to run a wide range of electrochemical tests including:

- Impedance
- Potentiostatic/galvanostatic techniques
- Cyclic voltammetry
- Electrochemical noise etc.

CorrWare and ZPlot are an ideal tool for corrosion analysis, battery/fuel cell research, and general electrochemistry. The software provides, real-time analysis, multiple display formats and curve fitting routines.



## 1287 Electrochemical Interface Specification

### Measurement Configuration

Cell connections	2-, 3- or 4-terminal, all floating
Working electrode	current measurement resistor ( $R_S$ ) range: 0.1 $\Omega$ to 1M $\Omega$ full scale current ranges: 2A to 200nA limit of error: 0.1% $\pm$ 0.05% of range
Counter electrode	output voltage, wrt LO: $>\pm 30V$ current, subject to thermal protection limits: 2A slew rate, potentiostatic control: $>10V/\mu s$
Reference electrodes	input impedance: $>10G\Omega$ , capacitance: 50pF current: $<1nA$ limit of error: 0.1% $\pm$ 100 $\mu V$ rejection: $f < 10kHz$ : 75dB, $f < 1MHz$ : 40dB

### Measurement Configuration

dc polarization	voltage range: $\pm 14.5V$ limits of error: $V < 3.2V$ : 0.2% $\pm$ 200 $\mu V$ $V > 3.2V$ : 0.2% $\pm$ 2mV max. resolution: 100 $\mu V$ Current range: $\pm 2A$ limit of error: 0.2% $\pm$ 0.1% of range max. resolution: 100pA
dc sweep: analog ramp	ramp rate (voltage): 6mV/min to 6000V/min segment duration: 10ms to 10 <sup>s</sup>
dc sweep: stepped ramp	step height: 5 $\mu V$ /5pA to 29V/4A step duration: 10ms to 10 <sup>s</sup>
ac input	voltage range: $\pm 10V$ , gain: $\times 1$ , $\times 0.01$ , impedance: 10k $\Omega$
Control loop Bandwidth,	100 $\Omega$ resistive load, unity gain potentiostatic mode, type C stability: $>1MHz$ galvanostatic mode, type B stability: $>100kHz$

### Digital meters

Resolution	3 <sup>1/2</sup> , 4 <sup>1/2</sup> , 5 <sup>1/2</sup> digits
Maximum resolution	1 $\mu V$ /1pA

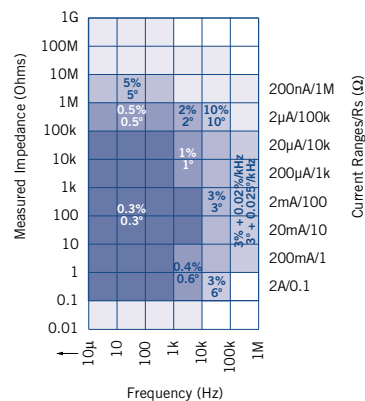
### Bias Rejection

Voltage	range: $\pm 14.5V$ limit of error: 0.2% $\pm$ 10mV resolution: 5mV
Current	ranges (full scale): 200nA to 2A limit of error: 0.2% $\pm$ 1% of range resolution: 1% of range

Power supply	90 to 110V, 108 to 132V, 198 to 242V, 216 to 264V, 48Hz to 65Hz
Power consumption	150VA
Dimensions (w x h x d)	432mm x 108mm x 472mm (17in x 4.25in x 18.5in)
Weight	11kg (24lb)
Operating temp. range	0 to 50°C (32 to 122°F)

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**Impedance Measurement** Limits of error (for a unity gain cell  $Z_C = R_S$ , measured with LO grounded) and no error due to reference electrode bandwidth. RE1 and RE2 input capacitance must be corrected to obtain accuracy at high frequency and impedance.



**Solartron Analytical** is a world leader in instrumentation and software for the characterization of materials and electrochemical systems using precision electrical measurement techniques.

These techniques find particular use in the fields of corrosion, battery and fuel cell research, dielectric analysis and electrochemistry. The product portfolio includes industry standard frequency response analyzers, potentiostats, electrochemical software (Zplot and CorrWare) and battery test equipment.

Arun Technology, an operating unit of Solartron Analytical, provides a range of metal analyzers using optical emission techniques for determining elemental content. The units in static laboratory or mobile format are used in foundries, steelworks, or scrapyards for metals analysis or material identification.



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FM 01709

SA.1287/Iss04/0701