



1294 Impedance Interface





1294 - Opening up powerful new techniques for materials investigation

Electrical impedance is a well-proven, powerful technique for analyzing the physical and chemical properties of a wide range of materials (see Applications).

Until now, use of the technique with high impedance, low loss materials has been limited by a number of factors, such as the ability to measure accurately the very low currents involved, particularly when high electrode impedances are present.

The new 1294 Impedance Interface has been designed specifically to overcome these difficulties, and to meet the present and future needs of materials analysts everywhere.

Used in conjunction with Solartron's 1260 or 1255 frequency response analyzers, the 1294's advanced measurement technology offers:

Improved accuracy

- True differential 4-terminal connections minimize the effects of localised disturbances at the current injection points
- Balanced generator
- Driven shields

Safety compliant

 IEC 601 connections - for in-vivo investigations into a wide range of applications including cosmetics, skin hydration, tissue impedance and tooth decay.

Wide measurement range

- 1μV, 1pA sensitivity
- Impedance range 10⁻² to >10⁹Ω (>1GΩ) to cover virtually all materials
- Up to 750kHz frequency range

Temperature control

 1294 system interfaces with standard temperature controllers, cryostats and furnaces



Applications

Civil Engineering

- Cement paste research
- Content/strength of concrete mixes

Adhesives

- Epoxy resin curing
- Thermoset polymers

Biomaterials

- Ischemia and tumour research
- Tooth decay
- Dermatological studies
- Research in fruit and plants

Ceramics/Composites

- Gas sensors
- Gas separation membranes

Impedance measurement

Any material is able to pass current when a voltage is applied to it. If a variable (ac) voltage is applied to the material, the ratio of voltage to current (V/I) is known as the impedance. In many materials the impedance varies with the frequency of the applied voltage, in a way that is related to the physical structure of the material, to chemical processes within it, or to a combination of both.

Accurate measurement of the impedance of materials, by applying a low level signal over a wide frequency range, can yield valuable information about the properties of the material. For example, measuring the impedance of a sample of organic tissue - anything from a piece of fruit to a human kidney - can reveal its condition and suitability for storage, freezing or transplant. Samples of concrete or cement can be analyzed to predict strength, or water/cement/binder mix, and complex curing cycles for composite structures such as aircraft wings can be monitored and controlled.

Impedance is

- non-invasive: impedance can often be measured with surface electrodes.
- non-destructive: low level stimuli required typically have no (or minimal) effect on material being investigated.
- repeatable: many impedance tests compare the state of a material over a period of time, or under varying conditions, e.g. adhesive curing. Consistent measurements are essential for a true indication of these changes.





Specification

PC control connections to 1294: to FRA:

1294 measurement connections to FRA: to sample: Normal: IEC601:

Generator output

Voltage Mode			
	Normal connections	IEC601 connections	
Max. DC voltage	±10V	±10V*	
Max. AC voltage	7V rms	7V rms*	
Max. AC + DC	±10V peak	±10V peak*	
Current Mode			
	Normal connections	IEC601 connections	
Transconductance	10mA/V	10mA/V*	
Max. DC current	±45mA	±10µA*	
Max. AC current	30mA rms	10mA rms*	
Max. AC + DC	±45mA peak ±14mA peak*		

* subject to IEC601 current limits

Balanced generator capability in voltage mode only.

Generator input (from FRA Gen connector)

Rear connection:	single BNC
Max. input voltage:	10V peak from 50Ω source
Switchable attenuator:	x1 / x0.01
Switchable gain:	x1 / x2
nput impedance:	50Ω for x1
	25kΩ for x2
Switchable attenuator: Switchable gain: Input impedance:	x1 / x0. x1 / 50Ω for 25kΩ for :

Voltage buffers

Driven shield connections to sample	
Amplifier gain:	
Common mode range:	±
Bias current:	1nA
Input resistance, to ground:	>
Input capacitance:	10pF to gro
Input capacitance:	1pF (differen
and the second	

Voltage buffer output (to	FRA V1Hi & V1Lo)
Rear connections:	
Maximum output:	

Output resistance:

Current to voltage converter

Rear panel Selector	Current range	Resolution	FRA Range	Range Resistor
1V/100mA	30mA	1μA	300mV	40.0
	3mA	100nA	30mV	100
1v/10mA	300µ.A	10nA	30mV	100Ω
1V/1mA	30µ A	1nA	30mV	1kΩ
1v/100µA	ЗµА	100pA	30mV	10kΩ
1v/10μA	300nA	10pA	30mV	100kΩ
1w/1µÅ	30nA	1pA	30mV	$1M\alpha$

 Current to voltage converter output (to FRA V2 Hi)

 Rear connection:
 single BNC

 Maximum output:
 300mV rms

 Output resistance:
 50Ω

PC Software

<u>iinimimini</u>

Parallel interface

IEEE488 interface

Gen, V1 Hi, V1 Lo, V2 Hi

4-terminal connections

4-terminal connections

Provides control of FRA, 1294 and optional temperature controller. Result parameters: Result formats: Z*, Y*, E*, M*, C* real, imaginary, magnitude,

plotted vs: plotted on:

General Power supply:

Power consumption: Weight: Operating temperature: General safety: Medical safety: 90Vac to 264Vac (47Hz to 440Hz) 18W 6.5kg (14.5lb) 5° to 40°C (40° to 104°F) EN61010 IEC601, EN60601-1 (Power supply: 47 to 65Hz)

frequency, time, temperature, bias, ac level

phase, tan_δ

Bode, complex plane

Medical safety

x1

10V

max

Passive circuits in the drive and sense lines of the IEC601 connections protect live subjects from excess current in accordance with the IEC601 standard.

1294 Typical measurement accuracy 4-terminal measurements assume simulated electrode impedance of 10x sample impedance.









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System Requirements

Frequency response analyser: Minimum PC requirements: 1260, 1255, 1250 or 1253 IBM compatible 486DX running Microsoft Windows[™] 3.1, 95, NT4 8 Mbyte RAM, hard disk, mouse

VGA display ISA or PCMCIA expansion slot

National Instruments PCMCIA or

National Instruments USB-GPIB

Oxford Instruments ITC503 or

Controller cable

Lakeshore 340

Parallel Printer Port (for control of 1294) National Instruments PCI-GPIB card or

IEEE488 interface card:

Options:

Temperature controller:

Ordering Information

1294A 1294A Impedance Interface includes 129601S software, user manual, power cord, test module, parallel interface cable

Connection cables (included)

- 12942A IEC601 connection cables
- 12942B Normal connection cables



Solartron has been a market leader in supplying precision measurement solutions for research and manufacturing in the oil, gas, power, aerospace and process industries for 50 years.

Part of the Roxboro Group PLC, Solartron manufactures a range of laboratory instrumentation specifically for electrochemistry and materials characterization which, together with our data acquisition and density and viscosity transducer products, have a global reputation for excellence in performance, reliability and support.



Solartron's Quality System is approved to BS EN 9001: 1994.

All our products carry the CE mark, showing that they are fully compatible with EC Directive 89/336/EEC.

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