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1250 Series Frequency Response Analyzers



1250 series

Measurement capability

The 1250 series - Frequency Response Analyzers that will meet your needs today and in the future. Using the 'Single Sine' measurement technique they provide precise measurement of gain and phase between any points in a dynamic or electrical system. This technique is recognised as the one which can implement the most searching analysis with which to assess performance, or characterise both simple and complex systems.

The 1250 Series Frequency Response Analyzers apply the power and sophistication of modem measurement technology; simple in concept, fast and precise in performance.

PHYSICAL INTERPRETATION

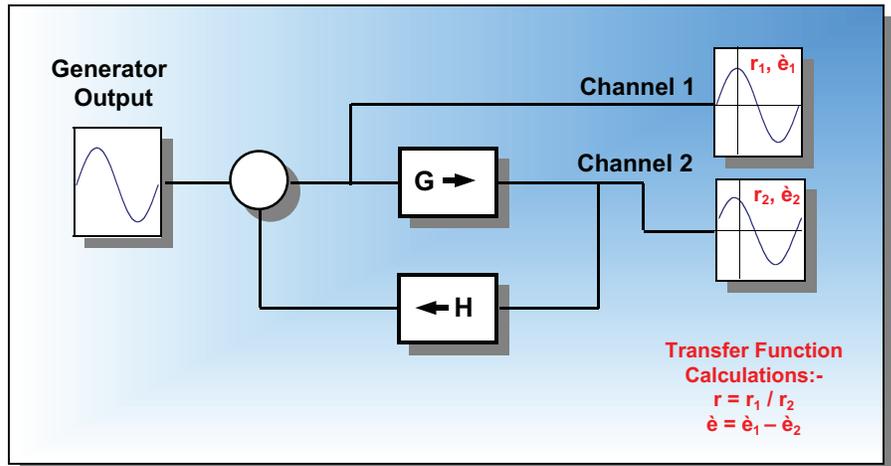
The resulting gain and phase parameters are easily related to physical features, thus enabling performance to be optimised with minimum trial and error.

DYNAMIC RANGE

The large dynamic range of the analysis system together with the high frequency resolution of the generator allow measurements to be made on filters with sharp cut-offs and high attenuation characteristics for out of band signals.

NON-LINEAR SYSTEMS

The correlation technique which is part of the analysis process enables distorted signals, or non-linear systems, to be analysed both accurately and efficiently.



ACCURATE MEASUREMENT

The device under test is stimulated by a sinewave and the response analysed at one, two or more points in the system. These responses are correlated with the stimulus to determine the amplitude and phase relative to the generator. The ratio of the two measured signals can then be calculated to provide the system transfer function.

This process rejects all harmonics and, by increasing the integration time, even signals which are buried in noise can be measured accurately.

1250 series

The complete range of Frequency Response Analyzers.....

1250 / 1250B / 1254 FRAs

For testing the design of servo systems, hydraulic actuators, power supplies, modems, acoustic devices, rotating machinery, cables, amplifiers, filters and other electronic devices.

- ⇒ Frequency Range 10 μ Hz to 65kHz
- ⇒ 0.2%, 0.2deg accuracy
- ⇒ two voltage measurement input channels (the 1254 version has four input channels)
- ⇒ 1250B is designed for operation from computer and has the same specification but no display and keyboard
- ⇒ Options:- synchroniser, mod/demod, auxiliary generator



1253 FRA

For lower frequency production tests on servo systems, power supplies, modems, acoustic devices and electronic applications.

- ⇒ Frequency Range 1mHz to 20kHz
- ⇒ 1%, 1deg accuracy
- ⇒ Two voltage measurement input channels
- ⇒ Built in synchroniser and mod/demod
- ⇒ Low cost frequency response analyser

1255A / 1255B FRAs

For high frequency electronic applications, for example in the design of electronic filters or switch mode power supplies.

- ⇒ Frequency Range 1255 – 10 μ Hz to 20MHz
- ⇒ Frequency Range 1255B – 10 μ Hz to 1MHz
- ⇒ Unrivalled 0.2%, 0.2deg accuracy to 1MHz
- ⇒ two voltage measurement input channels
- ⇒ synchroniser and mod/demod are not available on this unit
- ⇒ 1255B is designed for operation from computer and has the same specification but no display and keyboard



PC Software for electronic applications

“FRA” – Windows™ software package for use with any Solartron FRA. Requires Windows 3.1 or 95 and a National Instruments IEEE card.

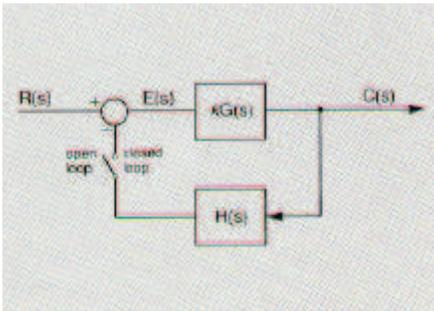
- ⇒ Easy to operate
- ⇒ Sweeps frequency and collects results from 1,2, or 4 channel FRAs.
- ⇒ Plots transfer function magnitude and phase on frequency or time x-axis
- ⇒ Results can be printed on any Windows™ printer
- ⇒ Stores results in text format ready to export to other software packages

1250 series

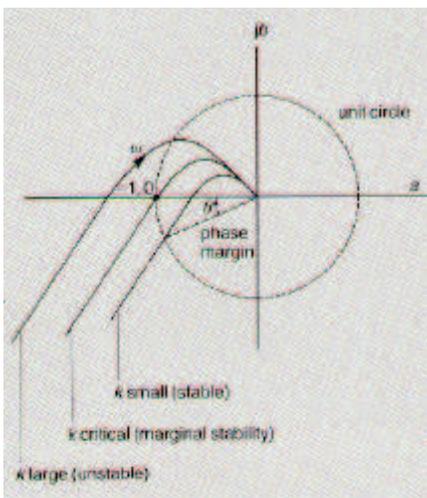
Servo control systems

DESIGN

The response of the servo to a sinusoidal input can tell us a great deal about its characteristics and performance. It indicates the range of stability and allows an estimate of the gain and phase margins to be made to ensure that these are within acceptable limits.



The 1250 Series Frequency Response Analysers are designed to provide the control systems design engineer with an optimised measurement system to analyse the performance parameters of servo systems, hydraulic actuators, electromechanical components, etc. Its unique method of single sine correlation ensures that the fundamental components of the system response are analysed, without corruption by associated harmonic and noise signals.



The control system can be analysed throughout its entire frequency range, including the very low frequencies required to establish the zero phase shift point. The parallel input channels of the 1250 enable multiple points within the system to be analysed simultaneously, allowing analysis of the complete system and its sub-assemblies at the same time. Measurements of all input channels can be completed within one period of the stimulating frequency or 10ms, whichever is the longer.

Modulator Demodulator

The optional modulator/demodulator interfaces the 1250 to ac carrier systems. Individual switching of either the modulator or demodulator, and full control of the analysis channels that are being demodulated, ensure the multi-channel flexibility. The response of the systems, ac components, dc components, and indeed the integral system modulators and demodulators can all be measured at the same time.

Synchroniser

If it is required to measure the phase shift in the carrier system itself, then it is necessary that the generator of the frequency response analyser is locked to the carrier in both frequency and phase. This is accomplished using the optional synchroniser, which operates over the full frequency range of the instrument. The synchroniser also enables the generator to be locked to a rotating or reciprocating component, and measurements can then be made relative to this.

PRODUCTION

Frequency response testing of control system components has been proved to be fast and efficient. Measurements taken at five or six selected frequencies will confirm the components conformance to specification, or otherwise. This type of testing tends to be less demanding on the specification of the instrument than the design role, but requires a simple front panel layout and straightforward operation. The price of the instrument is also important. For effective production use it must prove cost effective when used at a number of work stations. The 1253 Gain/ Phase Analyzer was designed to meet these requirements. Its unique front panel programming, with test routines permanently stored in EEPROM, can simplify operation to a single front panel control. Comprehensive test programs can easily be setup, and then protected, which will operate either in a completely automatic mode or with varying degrees of manual intervention. Alternatively, the 1253 can be used in conjunction with a controller for completely automatic operation, via the IEEE 488 interface.

MAINTENANCE

The requirements of an instrument in the maintenance environment are similar to those of production. However, there is more emphasis on simplicity of operation. A great deal of time is wasted if the operating manual must be consulted each time before the instrument can be used. The 1253 has proved itself to be ideal for use in maintenance areas, either in manual test units or automatic test systems.

1250 / 1254

SPECIFICATION:

GENERAL

The 1250B is exactly the same as the 1250, except that the 1250B has no built in display and front panel control keys.

The 1250 and 1250B have two analyzer channels and the 1254 has four channels.

GENERATOR

Identical specifications apply to the optional additional sine (12506B and C) and cosine (12506A) generators.

Waveform sine, square, triangle

Frequency

Range: 10 μ Hz to 65kHz
 Resolution: 1 in 65535
 Error: <0.01 %
 Sweep: logarithmic, up or down
 linear, up or down, harmonic

Amplitude

Range: 10mV to 10.23V
 (Triangle: 5.11V)
 Resolution: 1 in 1023
 Error: <1 % \pm 1 digit

Bias

Range: -10.23 to +10.23V
 Resolution: 1 in 1023
 Error: <1% \pm 1 digit

Distortion:

<2%

Maximum output

(bias + signal): 15V peak
 (1250N): 20V peak

Output impedance: 50 Ω +2%
 (1250N): <1 Ω

Maximum voltage, Lo to ground: 150V
 Impedance, Lo to ground: 100k Ω , 100pF
 Stop control: Immediate, or at
 0 $^\circ$, 90 $^\circ$, 180 $^\circ$, 270 $^\circ$

Stop input: contact closure or TTL logic 0
 Connection

Rear: floating, BNC

Output is short-circuit proof

ANALYZER

| Nominal Range | Sensitivity | Full scale pk input | Com. mode rejected |
|---------------|-------------|---------------------|--------------------|
| 30mV | 1 μ V | 45mV | 30V |
| 300mV | 10 μ V | 500mV | 30V |
| 3V | 100 μ V | 5V | 30V |
| 30V | 1mV | 50V | 500V |
| 300V | 10mV | 500V | 500V |

Sensitivity is for integration time >100ms
 Maximum input, Hi or Lo to ground:

500V peak, 300V rms

Coupling: dc or ac (< 1 dB at 2.5Hz)

Input configuration

Connection Rear: differential, BNC
 Impedance, Hi or Lo to ground: 1M Ω / $<$ 100pF
 Common mode rejection, dc coupling, up to 100Hz:
 up to 50V peak: >65dB
 over 50V peak: >60dB
 Cross channel isolation, 1 k Ω across inputs up to 10kHz: >100dB

Integration time

minimum: the longer of 1 cycle or 10ms
 maximum: 10⁶ cycles or 10⁵s

Auto-integration

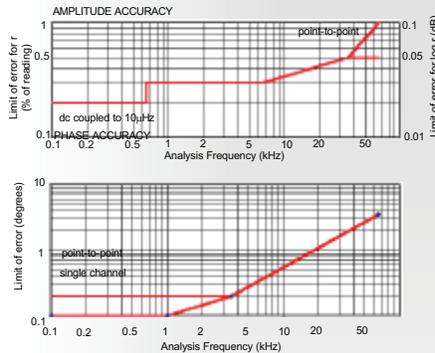
minimum: the longer of 3 cycles or 1.5s
 maximum: the programmed int. time
 Variance in results, at 90% confidence:
 long int. (signal >0.02% range): <1%
 short int. (signal >0.2% range): <10%

Measurement delay

Variable from zero to 10⁶ cycles or 10⁵s

LIMIT OF ERROR

Input > 10% full scale
 Integration time >200ms
 Valid for 1 year



DISPLAY

Presentation: a+jb or r, θ or logr, θ
 Resolution: a,b and r: 5 digits + exp
 logr: 0.01dB
 θ (degrees): 0.01 $^\circ$
 θ (radians): 0.1mrad

INTERFACES

GPIB: compatible with IEEE 488 (1978)
 Switch selectable Talker / Listener or Talk only

SYNCHRONISER Option 12501

Input configuration

Connection: differential, rear terminals
 Coupling: dc or ac (<3dB at 3Hz)
 Impedance, Hi / Lo to gnd: >200k Ω , <100pF
 Common mode rejection, dc coupling, up to 100Hz: >50dB
 maximum rejected: 20V
 Maximum input, Hi or Lo to ground: 350V peak, 250V rms

Synchronisation

Frequency range: 1 mHz to 65kHz
 Sensitivity: 0.25V
 Level adjustment: \pm 5V in steps of 0.02V
 Time to synchronise: the longer of 4 cycles or 500ms

MODULATOR-DEMODULATOR

Option 12502

Input configuration

Two independent carrier inputs.
 Connections: differential, rear terminals
 Coupling: ac
 Impedance, Hi or Lo to ground: >100k Ω
 <100pF
 Common mode rejection, up to 100Hz: >50dB
 Maximum common mode: 300V
 Maximum input, Hi or Lo to ground: 350V peak, 250Vrms

Carriers 1 and 2

Frequency range: 48Hz to 20kHz
 Voltage range: 6V to 250V rms

Generator output

May modulate either carrier 1 or carrier 2.
 Carrier phase shift, 50Hz to 300Hz: <3 $^\circ$
 300Hz to 3kHz: <1 $^\circ$
 3kHz to 20kHz: <6 $^\circ$

Analyzers

Either carrier may demodulate any analyzer.
 Quadrature rejection, 1250 and 1254: >26dB
 1251: >14dB

Additional errors when demodulating:

Mod frequency = 0.05 x carrier.

Input > 10% full scale, int. time 200ms
 r: <0.5% / <0.05dB
 θ single channel: <0.5 $^\circ$
 θ point to point: <1 $^\circ$

GENERAL

Power supply, switch selectable:
 90 to 127V, 188 to 265V
 Supply frequency: 45 to 440Hz
 Consumption: with no options: 130VA
 with all options: 210VA
 height: 176mm (6.93ins)
 width: 432mm (17ins)
 depth: 573mm (22.56ins)
 weight: 18kg (40lbs)
 rack size: 19in. 4U

1255

SPECIFICATION:

1255A / 1255B

The 1255A and 1255B FRAs have the same specification, except that 1255B can only be controlled from a computer (it does not have a built-in display and keyboard), and the 1255B is limited to 1MHz frequency range.

GENERATOR

Waveform: sine

Frequency range (1255): 10µHz to 20MHz

Frequency range (1255B): 10µHz to 1MHz

Resolution,

| | |
|------------------------|--------|
| 10µHz to 655.36Hz | 10µHz |
| 655.36Hz to 6.5536kHz | 100µHz |
| 6.5536kHz to 65.536kHz | 1mHz |
| 65.536kHz to 655.36kHz | 10mHz |
| 655.36kHz to 6.5536MHz | 100mHz |
| 6.5536MHz to 20MHz | 1Hz |

Frequency Error: <0.01%
 Frequency stability (24hrs, ±1°C): 10ppm
 Amplitude, 10MHz: 0 to 3Vrms
 >10MHz: 0 to 1Vrms
 Resolution: 5mV

Error, (driving open circuit): ±(5%+1%/MHz+5mV)
 Distortion: <2%

Bias

Range: ±40.95V
 Resolution: 10mV
 Error, (driving open circuit): <1%± 1 digit

Sweep

Types: frequency (log and linear)
 amplitude (linear)
 bias (linear)

Resolution, frequency: >10,000pts
 amplitude or bias: >200pts

Maximum Current: ±100mA

Maximum voltage, Lo to ground: ±0.4V

Output impedance: 50Ω±2%

Impedance, Lo to ground: 100kΩ, 10nF

Connection:

single BNC, outer floating to ±0.4V

Output is short-circuit proof

Output disable:

contact closure or TTL logic 0

ANALYZER

Two independent analyzers operating in parallel

| Range | Sensitivity (dyn range) | Full scale peak input | Com mode rejected |
|-------|-------------------------|-----------------------|-------------------|
| 30mV | 1µV (90dB) | 45mV | 5V |
| 300mV | 10µV (90dB) | 500mV | 5V |
| 3V | 100µV(90dB) | 5V | 5V |

Input protected to: ± 46V peak
 Connections: separate Hi and Lo BNC connectors

Configurations:

differential, BNC outers floating
 differential, BNC outers s/c to ground
 single ended, BNC outers floating
 single ended, BNC outers s/c to ground

Coupling: dc or ac (-3dB at 1Hz)

Impedance, Hi to outer: 1MΩ±2%, <35pF
 Outer to ground: 10kΩ, <330pF

Common mode rejection (at 1MHz): >50dB
 Cross channel isolation (at 1MHz): >100dB

Integration time: 0.01s to 10⁵s, or auto

DISPLAY

Functions

variable: frequency, amplitude, dc bias
 measured: V1, V2, V1/V2, V2/V1

Parameters: a, jb, r, r(dB), θ, group delay

Resolution: r(dB) 0.001
 θ 0.01°

all others 5 digits + exponent

INTERFACES

Serial Output: suitable for use with printers compatible with RS232 and RS423

Selectable baud rates: 110, 150, 300, 600, 1200, 2400, 4800, 9600

Parallel: complies with IEEE488 (1978)

Fully programmable talker / listener

Switch selectable talk only for plotting

Maximum data rate: 1000 bytes/s

Functions implemented:

SH1, AH1, T5, TE0, L4, LE0,

SR1, RL1, PP2, DC1, C0, DT0

Data format complies with IEEE754 for 4 byte wide data transfer

GENERAL

Power supply, switch selectable:

90 to 126V, 198 to 252Vac

Supply frequency: 48 to 65Hz

Consumption: 200VA

Dimensions:

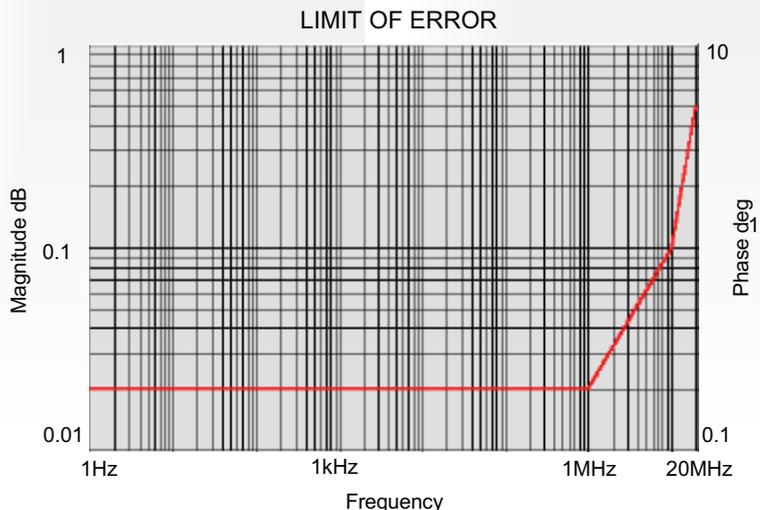
height: 176mm (6.93ins)

width: 432mm (17ins)

depth: 573mm (22.56ins)

rack size: 4U, 19ins

weight: 18kg (40lbs)



1253

SPECIFICATION:

GENERATOR

Waveform: sine, square.

Frequency

Range: 1mHz to 20kHz
 Resolution: 1 in 4000
 Sweep type: logarithmic, up or down
 Points per sweep: 2 to 9999

Amplitude

Range: 10mV to 10.23Vrms
 Resolution: 10mV
 Error (driving open circuit): $\pm 1\% \pm 10\text{mV}$

Bias

Range: $\pm 10.22\text{V}$
 Resolution: 20mV
 Error (driving open circuit): $\pm 1\% \pm 20\text{mV}$
 Maximum output, Hi to Lo
 (bias + ac): $\pm 15\text{V}$
 Distortion: $< 2\%$

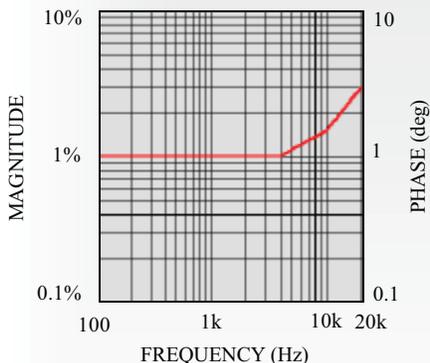
Output impedance (Hi to Lo): $50\Omega \pm 10\%$
 Maximum voltage (Lo to ground): $\pm 15\text{V}$
 External stop input: contact closure or TTL logic 0 to kill or freeze

Connection

Front: floating, 4mm
 Rear: floating, single BNC

Maximum current: 300mA

Output is short-circuit proof



ANALYSER

Two independent, autoranging Input channels, with common analyzer.

| Range | Sensitivity | Full Scale | Com.mode |
|-------|-------------------|------------|-----------|
| | | pk input | rejection |
| 30mV | 1 μV | 45mV | 30V |
| 300mV | 10 μV | 500mV | 30V |
| 3V | 100 μV | 5V | 30V |
| 30V | 1mV | 50V | 30V |
| 300V | 10mV | 500V | 30V |

Maximum input
 Hi to ground: $\pm 500\text{V peak, 300V rms}$
 Lo to ground: $\pm 30\text{V peak}$
 Coupling: dc
 Connections rear: differential, single
 BNC Impedance, Hi to Lo (grounded): $1\text{M}\Omega \pm 2\%$ Capacitance
 Rear inputs, Hi to Lo (grounded): $< 100\text{pF}$
 Common mode rejection, up to 100Hz: $> 60\text{dB}$

Integration time
 Range: 0.1 to 10^5
 Cross channel isolation, $< 1\text{kHz}$, $1\text{k}\Omega$ across inputs, Lo grounded: $> 100\text{dB}$

LIMIT OF ERROR

Input $> 10\%$ full scale
 integration time $> 200\text{ms}$

INTERFACES

Serial output: suitable for use with printers and keyboards compatible with RS232 and RS423
 Selectable baud rates: 110 to 9600

GPIB: compatible with IEEE488 (1978)
 Fully programmable Talker/Listener
 Switch selectable Talk only
 Maximum data rate: 1000 bytes / sec
 Functions implemented:
 SH1, AH1, T5, TE0, L4, LE0, SR1, RL1, PP2, DC1, C0, DT0

SYNCHRONISER

Connection: differential, BNC
 Impedance, Hi or Lo to ground: $> 200\text{k}\Omega$
 $< 100\text{pF}$
 Maximum input
 Hi to ground: $\pm 350\text{V peak}$
 250V rms
 Lo to ground: $\pm 30\text{V}$
 Trigger point: positive zero crossing
 Minimum signal to trigger ($< 1\text{kHz}$): < -0.6 to $> +0.1\text{V}$
 Maximum time to synchronise:
 $< 12\text{Hz}$ 6 cycles
 $> 12\text{Hz}$ 500ms
 Accuracy of period measurement: $\pm 1\mu\text{s}$
 Additional analyzer error (stable trigger signal), transfer function mode:
 Gain: $1\% + 0.2\%/kHz$
 Phase: $1^\circ + 0.2^\circ/kHz$

MODULATOR/DEMULATOR

Input: differential, single BNC
 Impedance, Hi or Lo to ground: $> 100\text{k}\Omega$
 $< 100\text{pF}$
 Maximum input
 Hi to ground: $\pm 350\text{V peak, 250Vrms}$
 Lo to ground: $\pm 30\text{V peak}$
 Common mode rejection, up to 100Hz: $> 50\text{dB}$
 Carrier frequency range: 48Hz to 10kHz
 Phase shift, carrier input to generator output
 48Hz to 300Hz: $< 3^\circ$
 300Hz to 1kHz: $< 1^\circ$
 1 kHz to 10kHz: $< (1^\circ + \frac{1}{2}^\circ/kHz)$
 Additional analysis error when demodulating:
 mod freq - 0.05 carrier freq: $< 1\%$, $< 1^\circ$
 Analyzer quadrature rejection: $> 26\text{dB}$

1253 GENERAL

Power supply, switch selectable:
 90 to 110V,
 108 to 132V
 198 to 242V
 216 to 264V
 Supply frequency: 48 to 65Hz
 Consumption: approx 150VA
 Dimensions:
 height: 108mm (4.25in)
 width: 432mm (17in)
 depth: 472mm (18.5in)
 weight: 10kg (22lb)
 rack size: 19in, 2U

1250 series



1250 OR 1254 ORDERING INFORMATION

Accessories included:

operating manual
spare fuses
rack mount ears
power cable
3 x 4mm test leads

Options: maintenance manual 12502041
rack mount slider kit 12505B
Jonathan slide kit 12505C
Synchroniser 12501A
Mod Demod 12502A
Analogue Plotter Int 12503A
Auxiliary Generators:
Cosine 12506A
In Phase 12506B
Anti Phase 12506C

1253 ORDERING INFORMATION

Accessories included:

operating manual
spare fuses
rack mount ears
power cable
3 x 4mm test leads

Options: maintenance manual 12530010
rack mount slider kit

1255 / 1255B ORDERING INFORMATION

Accessories included:

operating manual
Spare fuses
rack mount ears
3 x 1M BNC leads

Options: maintenance manual 12550007
Accuride rack mount kit
Jonathan slide mounting kit

ENVIRONMENT

(Common to all instruments) Temperature

Operating: 0 to 50°C (32 to 122°F)
Storage: -30 to 70°C (-22 to 158°F)
Specification limits: 10 to 30°C
(50 to 86°F)

Humidity, non-condensing: 95% @40°C

Vibration: tested in accordance with
IEC68 (BS2011)

Safety: designed to comply with
IEC348 (BS4743)

FRA PRODUCT RANGE

| | |
|-------|--|
| 1255 | 20MHz 2 channel FRA |
| 1255B | 1MHz 2 channel FRA |
| 1250A | 65kHz 2 channel FRA |
| 1250E | 65kHz 2 channel FRA (CE compliant) |
| 1250B | 65kHz 2 channel FRA (blank front panel) |
| 1254 | 65kHz 4 channel FRA |
| 1253 | 20kHz 2 channel FRA |



Certificate No. 1709

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B 125001

For details of agents in other countries
please contact our Farnborough, UK office.

Solartron pursues a policy of continuous development
and product improvement. The specifications in this
document may therefore be changed without notice.

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