Schlumberger Technologies

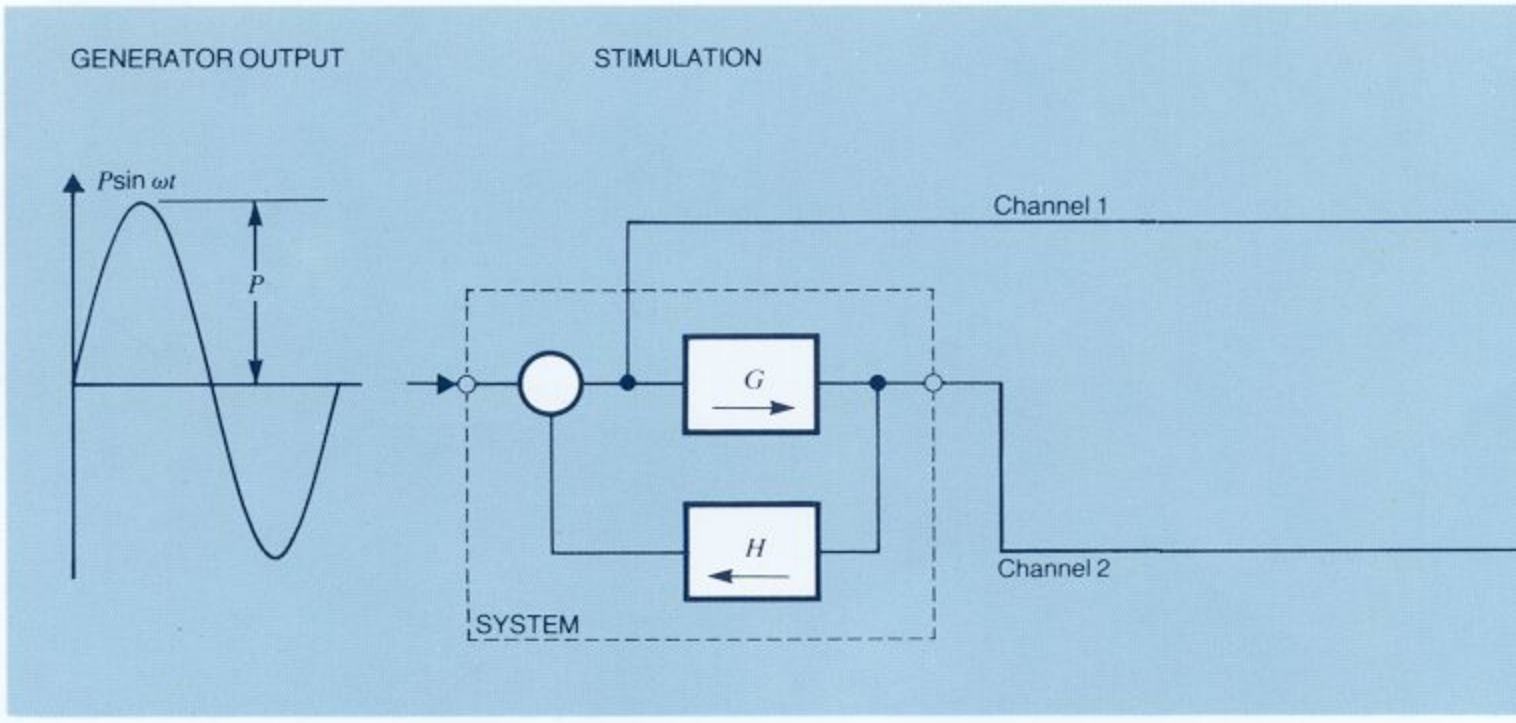
Instruments Division

SI 1250 and SI 1253 FREQUENCY RESPONSE ANALYSERS

1250

The 1250 Series – Frequency Response Analysers 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 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.

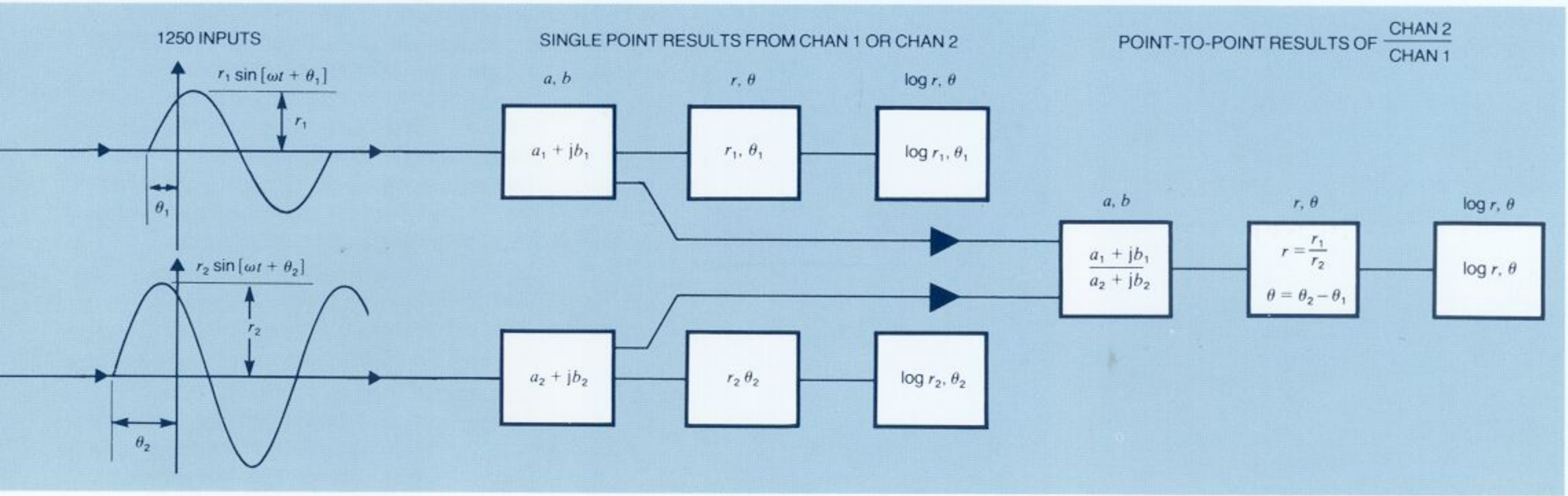
The 1250 Series Frequency Response Analysers apply the power and sophistication of modern measurement technology; simple in concept, fast and precise in performance.



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 then 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.

SERIES



THEORETICAL DESIGN

Sinusoidal response is physically well understood and can be expressed simply in mathematical terms. Thus experimental data can be directly related to mathematical models.

PHYSICAL INTERPRETATION

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

NOISE REJECTION

Because the analysis process filters out unwanted signal components, the results remain accurate and repeatable even in the presence of noise and other disturbances.

NON-LINEAR SYSTEMS

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

MULTIPLE ANALYSIS CHANNELS

Up to 36 parallel analysis channels available for fast, simultaneous measurement of the characteristics of complex systems, or for rapid and precise automated production testing.

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.

FRONT PANEL PROGRAM MODE

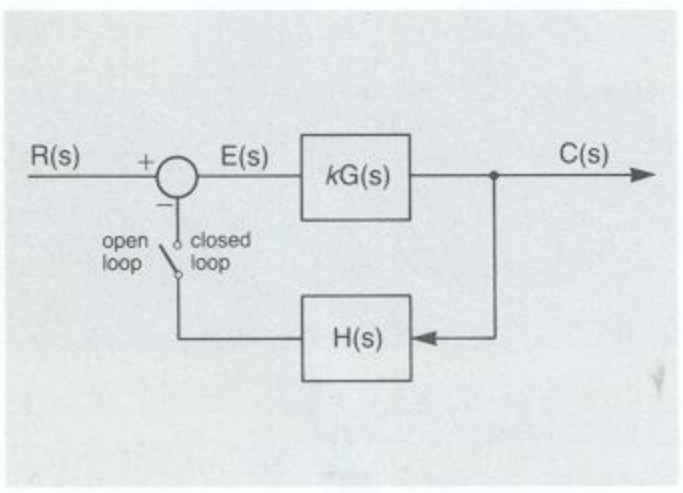
Routine tests can be reliably and repeatedly performed, even by people who are not familiar with the instrument, using the 'learn' mode on the front panel. Programs can be permanently stored in the non-volatile memory.

1250

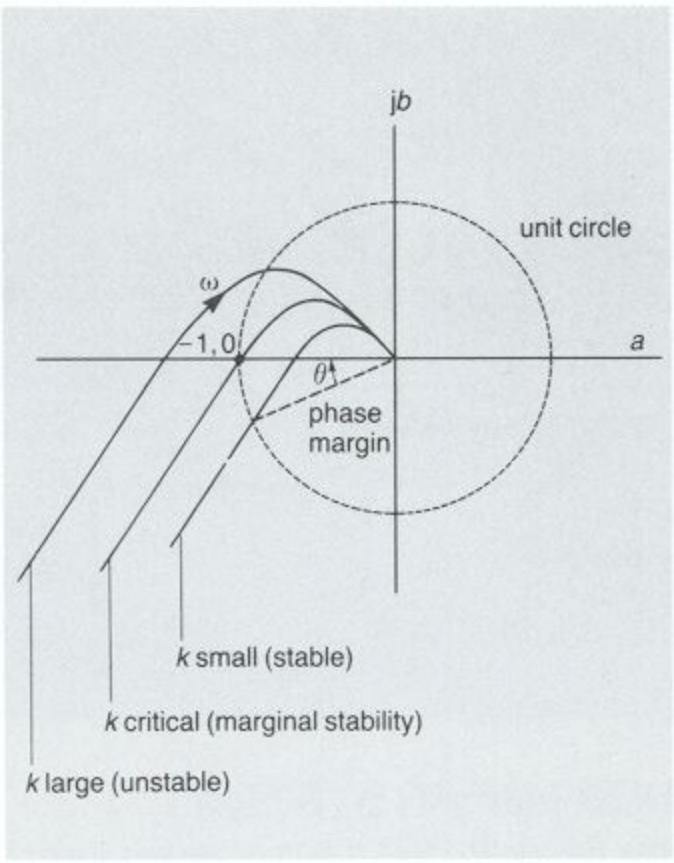
From Design . . . To Production . . . and

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.

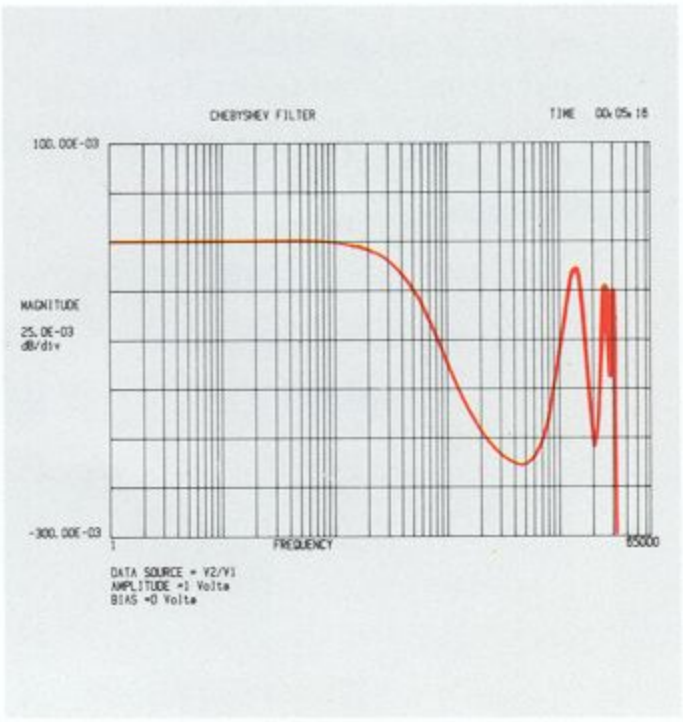
Synchroniser

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.

Broadband Analysis

For the design engineer who requires broadband analysis of his system, or who needs to use excitation signals other than continuous sine, the 1220 spectrum analyser is the answer. The generator of this versatile instrument can produce a wide variety of signals, including continuous or burst sine, swept sine and random noise. Its four input channels allow simultaneous measurement of the feedforward and feedback elements of a control loop. From this data the closed loop response can be displayed.

Convenient graphical outputs can be obtained from the IEEE 488 port onto a digital X-Y plotter. This output operates in



SERIES

Maintenance

'talk only' mode and is compatible with Hewlett Packard's Graphics Language (HPGL). Full computer control of all functions is also available from the IEEE 488 port, and outputs to a printer or visual display unit are available on the RS 423 output.

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. 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 Analyser 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, as the use of the unit is often intermittent, rather than continuous, 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 and 1254 FREQUENCY RESPONSE ANALYSERS

GENERATOR

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

Waveform: sine, square, triangle

Frequency

Range:	10μHz 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% ± 1 digit

Bias

Range:	–10.23 to +10.23V
Resolution:	1 in 1023
Error:	<1% ± 1 digit

Distortion:	<2%
Maximum output (bias + signal):	15V peak
(1250N:	20V peak)
Output impedance:	50Ω+2%
(1250N):	<1Ω
Maximum voltage, Lo to ground:	150V
Impedance, Lo to ground:	100kΩ, 100pF
Stop control:	Immediate, or at 0°, 90°, 180°, 270°

Stop input: contract closure or TTL logic 0

Connection

Front:	floating, 4mm
Rear:	floating, BNC

Output is short-circuit proof

ANALYSER

1250: Two independent analysers operating in parallel

1254: Four independent analysers operating in parallel

Nominal Range	Sensitivity	Full scale pk input	Com. mode rejected
30mV	1uV	45mV	30V
300mV	10uV	500mV	30V
3V	100uV	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 (<1dB at 2.5Hz)

Input configuration

Connection Front:	differential, 4mm
Rear:	differential, BNC
Impedance, Hi or Lo to ground:	1MΩ
front sockets:	<70pF
rear sockets	<100pF

Common mode rejection, dc coupling, up to 100Hz:

up to 50V peak:	>65dB
over 50V peak:	>60dB

Cross channel isolation, 1kΩ across inputs

up to 10kHz:	>100dB

Integration time

minimum:	the longer of 1 cycle or 10ms
maximum:	10^6 cycles or 10^5s

Auto-integration

minimum:	the longer of 3 cycles or 1.5s
maximum:	the programmed integration time

Variance in results, at 90% confidence:

long integration (signal >0.02% range):	<1%
short integration (signal >0.2% range):	<10%

Measurement delay

Variable from zero to 10^6 cycles or 10^5s

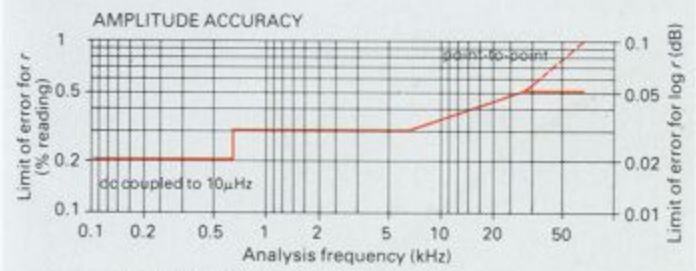
LIMIT OF ERROR

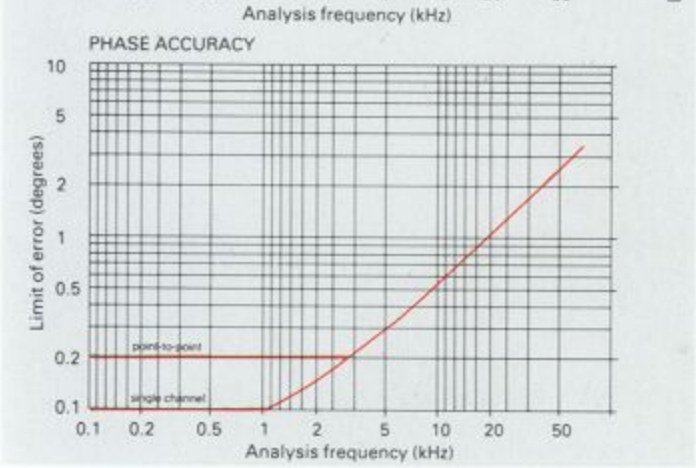
Ambient temperature 20 ± 10°C

Input >10% full scale

Integration time >200ms

Valid for 1 year





1250

RESULTS

Data Processing

Scaling: division by vector
division by last result
multiplication by $(jw)^n$, where $n=\pm1$ or ±2
Limit check

History file maximum size: 470 results
minimum size: 100 results

Battery discharge time: Typically, >1000 hrs.

PROGRAM STORE

Type: battery backed RAM
Maximum number of programs: 9
Maximum number of program steps: 500

Type: permanent, keyswitch protected EEPROM
Maximum number of programs: 9
Maximum number of program steps: 508

Display

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

Note: single channel unprocessed results are displayed as volts or millivolts. When integration is <100ms these are resolved to 4 digits.

Plotting

General

Data source: single channel or ratio
Parameters, X- or Y-axis: a,b or r
log r(dB)
θ (degrees)
f (linear scale)
f (log scale)
Type of plotter: analogue or digital (GPIB)
Type of plot: point (separate points)
vector (joined points)
Plot size: A3 or A4 or adjustable in 0.025mm steps.

Digital plotting

Compatible with Schlumberger or Hewlett Packard graphics languages.
Interface: IEEE 488

Analogue plotting Option 12503

Connector: D-type, 25 way
X, Y drives, bottom left: 0V, 0V
top right: 10V, 10V
Pen drop delay selectable: 0.4, 0.6, 0.8 or 1.2s

SYNCHRONISER Option 12501

Input configuration

Connection: differential, rear terminals
Coupling: dc or ac (<3dB at 3Hz)
Impedance, Hi or Lo to ground: >200kΩ, <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: 1mHz to 65kHz
Sensitivity: 0.25V
Level adjustment: ±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: >100kΩ <100pF
Common mode rejection, up to 100Hz: >50dB
Maximum common mode: 300V
Maximum input, Hi or Lo to ground: 350V peak, 250V rms

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°
300Hz to 3kHz: <1°
3kHz to 20kHz: <6°

Analysers

Either carrier may demodulate any analyser.
Quadrature rejection, 1250 and 1254: >26dB
1251: >14dB
Additional errors when demodulating:
Mod frequency = 0.05xcarrier.
Input >10% full scale, integration time 200ms
r: <0.5%
log r: <0.05dB
θ, single channel: <0.5°
θ point to point: <1°

1253 FREQUENCY RESPONSE ANALYSER

GENERATOR

Waveform: sinewave.

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 10.23V rms
Resolution: 10mV
Error (driving open circuit): ±1%±10mV

Bias

Range: ±10.22V
Resolution: 20mV
Error (driving open circuit): ±1%±20mV
Maximum output, Hi to Lo (bias + ac): ±15V

Distortion: <2%
Output impedance (Hi to Lo): 50Ω±10%
Maximum voltage (Lo to grdn): ±15V
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

MODULATOR/DEMODULATOR

Input: differential, single BNC
Impedance, Hi or Lo to ground: >100kΩ, <100pF

Maximum input
Hi to ground: ±350V peak, 250V rms
Lo to ground: ±30V peak

Common mode rejection, up to 100Hz: >50dB
Carrier frequency range: 48Hz to 10kHz
Phase shift, carrier input to generator output
48Hz to 300Hz: <3°
300Hz to 1kHz: <1°
1kHz to 10kHz: <(1° +½°/kHz)
Additional analysis error when demodulating:
mod freq = 0.05 carrier freq: <1%, <1°
Analyser quadrature rejection: >26dB

SERIES

ANALYSER

Two independent, autoranging input channels, with common analyser.

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

Maximum input
- Hi to ground: ±500V peak, 300V rms
- Lo to ground: ±30V peak

Coupling: dc

Connections
- Front: differential, 4mm
- Rear: differential, single BNC

Impedance, Hi to Lo (grounded): 1MΩ±2%

Capacitance
- Front inputs, Hi to Lo (grounded): <70pF
- Rear inputs, Hi to Lo (grounded): <100pF

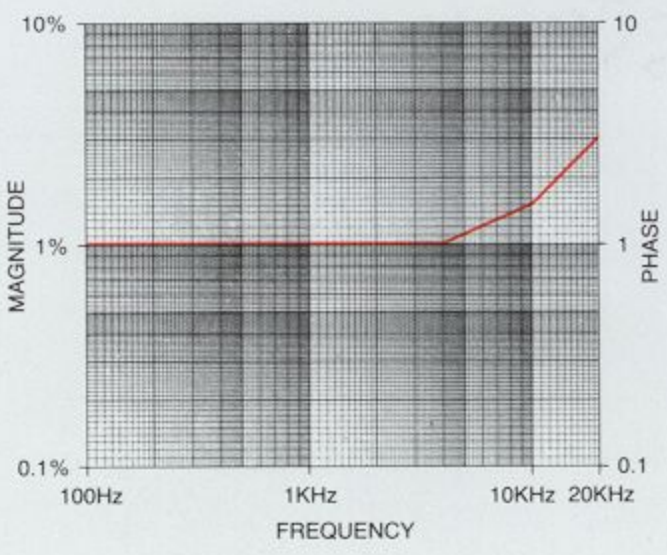
Common mode rejection, up to 100Hz: >60dB

Integration time
- Range: 0.1 to 10^5

Cross channel isolation, <1kHz, 1kΩ across inputs, Lo grounded: >100dB

LIMIT OF ERROR

Input >10% full scale
integration time >200ms



SYNCHRONISER

Connection: differential, BNC

Impedance, Hi or Lo to ground: >200kΩ <100pF

Maximum input
- Hi to ground: ±350V peak 250V rms
- Lo to ground: ±30V

Trigger point: positive zero crossing

Minimum signal to trigger (<1kHz): <−0.6 to >+0.1V

Maximum time to synchronise:
- <12Hz: 6 cycles
- >12Hz: 500ms

Accuracy of period measurement: ±1us

Additional analyser error (stable trigger signal), transfer function mode:
- Gain: 1% + 0.2%/kHz
- Phase: 1° + 0.2°/kHz

DATA PROCESSING

Scaling: division by vector (a+jb, rθ) division by last result, magnitude or vector

History file
- Maximum size: 400 results
- Minimum size: 100 results

Battery discharge time: Typically, >1000 hrs

PROGRAM STORE

Type: battery backed RAM
- Maximum number of programs: 9
- Maximum number of program steps: 400

Type: permanent, keyswitch protected EEPROM
- Maximum number of programs: 6
- Maximum number of program steps: 100

PLOTTING

Type: digital, compatible with Hewlett Packard Graphics Language

Parameters
- X-axis: a, linear scale f, lin or log scales
- Y-axis: b,r, r(dB), lin scale θ, degrees

Plot size: A4 or 8½" x 11"

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: 1000bytes/s
Functions implemented:
SH1, AH1, T5, TE0, L4, LE0, SR1, RL1, PP2, DC1, C0, DT0

Schlumberger Technologies

Instruments Division

1250 and 1254 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

Dimensions:

height:	176mm (6.93ins)
width:	432mm (17ins)
depth:	573mm (22.56ins)
weight:	18kg (40lbs)
rack size:	19in. 4U

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

ENVIRONMENT
(Common to both 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)

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	

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