Racal Instruments
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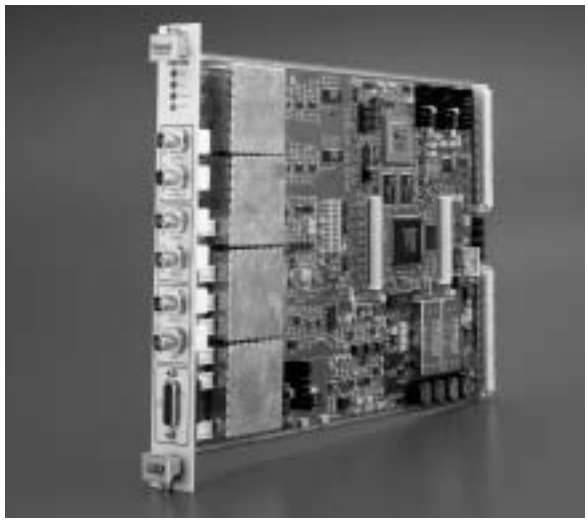
PRODUCT INFORMATION

VXIbus Frequency Response Analyzer Model 2583



- **Two Independent Analyzer Inputs with High Dynamic Range**
- **Single-Sine Correlation Technique**
- **10 µHz to 100 kHz Generator Output**
- **Accurately Measures Relative Phase**
- **Modulator/Demodulator for Compatibility with AC Carrier Systems**
- **Ideal for Avionics, Automotive, Fire Control, Engine, Missile, and Power Supply Testing**

General Description
The Model 2583 Frequency Response Analyzer (FRA) accurately assesses the performance of control and servo systems. It accurately measures the precise periodic content of two independent input channels and computes the phase relationship between them in systems excited by a sinusoidal signal.

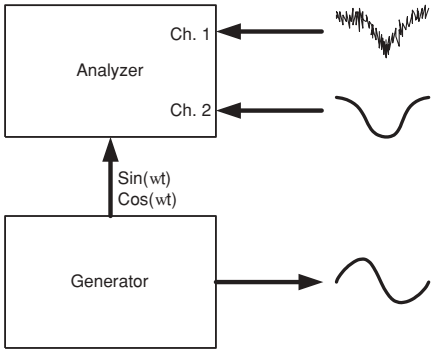
The 2583 incorporates an internal precision sine, square, or triangular waveform generator for system stimulus. It can additionally be synchronized to an external system stimulus source using the built-in synchronizer.

This FRA characterizes a system's transfer function over its complete frequency range, including the µHz region for determining the system's zero phase shift point.

The Model 2583 features independent, dual-channel modulator and demodulator capabilities. The internal waveform-generator output may be used to modulate external carrier inputs. In addition, both analyzer inputs have independent demodulators.

Measurement Technique
The basis of Frequency Response Analysis is to measure the gain and phase of a system, or circuit, at various fundamental frequencies.

The 2583 uses the well-established single-sine correlation technique to accurately measure the gain and phase between any system nodes. This technique, measuring a series of narrow-band, single frequencies, provides superior results over FFT analysis, especially in low signal-to-noise ratio or non-linear systems.



Simple FRA Block Diagram

The Measurement

The 2583 FRA precision signal generator stimulates the system-under-test with a test signal. Two independent analyzers then measure the response using the single-sine correlation technique. Sine and cosine waves simultaneously multiply the acquired signal response, containing fundamental harmonics and wideband noise, at the precise frequency of the stimulus. This technique results in exceptional rejection of harmonic and wideband noise, thereby improving overall accuracy.

The results are then integrated over a complete cycle of the stimulating waveform establishing the Real and Imaginary (quadrature) components of the complex response.

Further integration over additional full cycles of the waveform progressively reduces the wideband noise and harmonic content of the response. The required signal is thereby extracted and its amplitude and phase accurately measured.

This sequential single-frequency stimulus with narrowband analysis enables superior measurement accuracy and repeatability under harsh environmental conditions. Alternative FFT techniques, such as the use of a spectrum analyzer, suffer significant limitations when used to measure dynamic systems where poor signal-to-noise ratios prevail.

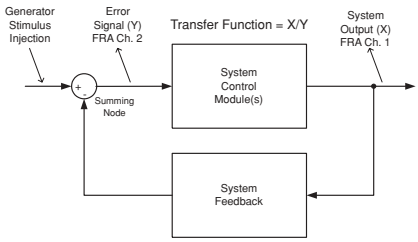
Standard Features

The 2583 FRA features auto-range and auto-integration functions. Selecting these functions automatically configures each channel for optimum input range and measurement speed.

It additionally uses the VXI*plug&play* driver to automate the test setup and execution. This enables the FRA to perform a set of measurements over a sequence of test frequencies.

Control

Closed-loop control of either measurement channel provides amplitude-restricted stimulation. The 2583 automatically controls its generator output in order to maintain the user-defined target input voltage.



Possible FRA Connection to a Control System

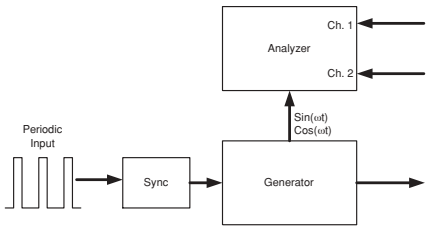
Additionally, the 2583 generator is programmable to immediately switch to the user-defined output level or to ramp up or down slowly.

Harmonic Analysis

Users may select harmonic analysis from the fundamental frequency's 2nd to the 16th harmonic. The 2583's analyzer channels solely measure the value of the selected harmonic of the complex response of the system, or circuit. The fundamental values, and all other harmonic values, are rejected.

Synchronization

Some systems, or circuits, have an inherent stimulus and do not require the 2583's internal generator. For example, a rotating machine providing a speed signal or a sine controller in a vibration test system would not require use of the 2583's internal generator function.



FRA with External Synchronization

All of the 2583's analysis functions are achievable by synchronizing the analyzers to the SUT generated periodic signal. Amplitude and phase measurements are carried out with respect to this signal. A ratio factor may be entered to enable correlation of the two signals where the output frequency is related to, but not necessarily equal to, the input frequency (as in testing a mechanical gearbox).

Connections

Inputs and outputs are via BNC sockets or a 26-way, multi-pole connector selectable through a software command. The unit is a single-slot width, 'C' size, VXIbus instrument module.

Software Driver Support

A VXI*plug&play* Driver Install Disk is supplied for Windows 95/98/NT/2000 platforms, adding support for C, C++, and Visual BASIC programming languages.

2583 FRA SPECIFICATIONS

GENERATOR CHANNEL

Waveform
Sine, square or triangle

Frequency
Range: 10 µHz to 100 kHz
Resolution: 1 in 65,535
Accuracy: ±0.01%
Sweep: Linear, Log, Up, Down
Programmable Stops: At 0°, 90°, 180°, 270° and Instantaneous

Amplitude
Range: 10 mV to 10.3 Vrms
Resolution: 1 in 65,535 (< 0.2mV)
Accuracy: ±1% ± 1 mV

DC Offset
Range: ±10.3 V
Resolution: 1 in 65,535 (< 0.4mV)
Accuracy: ±1% ± 10 mV

Output Impedance
Hi to Gnd: 50Ω (+0% / -2%)
Lo to Gnd: 100 kΩ, < 100 pF

Maximum Voltages
Output (Hi to Lo): 25 Vpk
Lo to Gnd: 150 V max float

Distortion
(sinewave)
< 1%

Output Protection
Short circuit

ANALYZER CHANNELS

(Two independent analyzers)

Frequency Range
10 µHz to 100 kHz

Input Ranges
30 mV, 300 mV, 3 V, 30 V and 300 Vrms
Autorange (20% overrange)

Measurement Parameter Ranges
Integration Time: 1 to 10e5 cycles
Auto Integration: 3 to 10e5 cycles
Delay: 0 to 10e5 Cycles

Input Characteristics
Differential: DC or AC coupling (nominally –3 dB @ 0.5 Hz)
Impedance (Hi or Lo to Gnd): 1 MΩ II 70 pF
Impedance (Hi/Lo to Gnd, D-sub): 1 MΩ II 100 pF
Isolation (channel to channel): > 85 dB @ 1 kHz
Common Mode (Ranges to ≤ 3 V): 30 V
Common Mode (Ranges to ≤ 300 V): 500 V

Accuracy
(20°±10° C, >20cycles, >10% FSR)

Range	Gain	Phase
≤ 50 Hz	±0.2%	±0.1°
≤ 1 kHz	±0.2%	±0.25°
≤ 5 kHz	±0.3%	±0.5°
≤ 20 kHz	±0.5%	±1.0°
≤ 50 kHz	±0.7%	±3.0°
> 50 kHz	±1.0%	±5.0°

Noise Rejection
(DC Coupled)
CMRR (≤ 50 V, ≤ 100 Hz): > 65 dB
CMRR (> 50 V, ≤ 100 Hz): > 60 dB
AC Coupled: Specified to > 50 Hz

Input Protection
300 Vrms

Harmonics
2 to 16

MODULATOR/ DEMODULATOR

(Two independent carrier inputs, AM)

Carrier Frequency Range
48 Hz to 20 kHz

Input Ranges
0.6 to 25.0 Vrms
6 to 250 Vrms

Input Characteristics
Differential: AC coupling
Impedance (Hi or Lo to Gnd): 100 kΩ II 100 pF
Common Mode (max): 300 V
Input (max): 350 Vpk

Phase Shift
(Carrier i/p to generator output)
50 Hz to 300 Hz: < 3°
300 Hz to 3 kHz < 1°
3 kHz to 20 kHz < 6°

Extra Error When Demodulating
(f_{mod} = 0.05xf_c, >10% FSR, Integration = 200 ms)
Magnitude: < 0.5% of Reading
Phase: < 0.5°

Noise Rejection
CMRR (≤ 100 Hz): < 50 dB

Analyzer Quadrature Rejection
> 26 dB

SYNCHRONIZER

Frequency Range
1 mHz to 100 kHz

Ratio Mode Range
0.001 to 1000 x f_{in}

Input Characteristics
Differential: DC or AC coupling (nominally –3 dB @ 3 Hz)
Impedance (Hi or Lo to Gnd): 200 kΩ II 100 pF
Input (max): 350 Vpk

Trigger Characteristics
Level Range: ±25 V
Resolution: 0.1 V
Slope: Positive or Negative

Sync Time (max)
≤ 5 Hz: 4 cycles
5 Hz: 500 ms + 1 cycle

FRONT PANEL I/O
Generator Output: isolated BNC
Analyzer Inputs: isolated BNC (2)
Carrier Inputs: isolated BNC (2)
Sync Input: isolated BNC
Single Cable Interconnect: (alternate connections to above signals)
26-pin D-Sub,

VXIbus INTERFACE DATA

(Single slot, Message-based, VXIbus 1.4 compliant)

Drivers
VXI*plug&play* or LabWindows/CVI, VXI*plug&play* for WIN2000, 98, 95,NT platform Support

Status Lights
Green: POWER
Red: FAILED
Red: OVER RANGE
Yellow: MESSAGE

Cooling (10° C Rise)
3.0 l/s @ 0.5 mm H_2O

Peak Current & Power Consumption

	+24	+12	+5	-12	-24
I_{Pm}(A)	.53	.45	3.0	.05	.53
I_{Dm}(A)	.50	.30	3.0	.05	.50

Total Power: 46 W

ENVIRONMENTAL

Temperature

Operating: 0° C to + 55° C
Spec Compliance: 20° ± 10° C
Storage: -40° C to + 70° C

Humidity
(non-condensing)

: 93.3% at <40° C

Weight

3.15 lbs. (1.43 kg)

MTBF

14,000 hrs.

EMC
(Council Directive 89/336/EEC)

Emission: EN61326-1:1997
+A1:1998, Class B
Immunity: EN61326-1:1997
+A1:1998, Table 1

Safety
(Low-Voltage Directive 73/23/EEC)

BS EN61010-1:1993/A21995

ORDERING INFORMATION		
Model	**Description**	**Part Number**
2583	Frequency Response Analyzer	R-2583

CE The CE Mark indicates that the product has completed and passed rigorous testing in the area of RF Emissions, Immunity to Electromagnetic Disturbances and complies with European electrical safety standards.

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