1140B
1141B

Phase Matrix, Inc.™
Instruments You Can Count On

VXIbus Synthesized Signal Generators

High-Performance Microwave Signal Generation for VXIbus Systems

- 0.01 to 20 GHz Frequency Range
- +16 to -90 dBm Leveled Output Power
- Excellent Spectral Purity, Low Phase Noise
- Fast Switching Speed
- 1 Hz Frequency Resolution
- AM, FM, Pulse and I/Q Modulation
- Complex IF Up-Conversion

Phase Matrix has moved. Our new Address is:
4600 Patrick Henry Drive
Santa Clara CA 95054
Tel: 408-610-6810

Phase Matrix / EIP VXIbus Synthesized Signal Generators

High-Performance Microwave Signal Generation for VXIbus Systems

Model 114XB Specification Summary

- *0.01 to 20 GHz Frequency Range*
- *1 Hz Frequency Resolution*

- *<-60 dBc Spurious*
- *<-85 dBc/Hz SSB Phase Noise (10 kHz offset from 10 GHz)*

- *+16 to -90 dBm Leveled Output Power*
- *0.1 dB Power Resolution*

- *Pulse Modulation*
- *dc to 10 MHz PRF*
- *50 ns Minimum Pulse Width*
- *>80 dB On/Off Ratio*
- *<10 ns Rise/Fall Time*

- *Amplitude Modulation*
- *DC to 100 kHz Rates*
- *0% to 90% Depth*

- *Frequency Modulation*
- *5 kHz to 10 MHz Rates*
- *25 MHz peak Deviation*

- *I/Q Modulation*
- *DC to > 40 MHz*

- *External IF Input for Complex Modulation*
- *40 MHz Instantaneous Bandwidth*

- *VXIbus Revision 1.3/1.4*
- *C-Size, 3 Slots Wide*

114XB - Ideal Synthesizer for ATE Applications

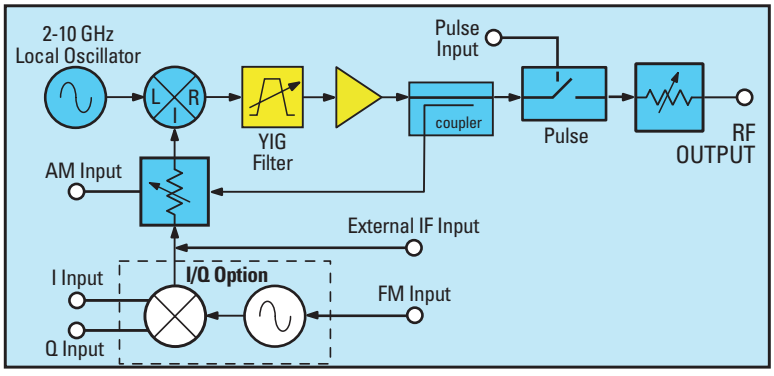
Phase Matrix/EIP VXIbus synthesized signal generators are designed to be ideal for ATE applications. The 114XB family synthesizers occupy only three VXI slots, yet cover the entire 0.01 to 20 GHz or, depending on the model chosen, a more limited 2.0 to 20 GHz frequency spectrum with 1 Hz resolution. All models feature unique complex modulation capability and outstanding spectral purity. And all are fully compliant with Revision 1.3/1.4 of the VXIbus Specification for message based instruments and with Standard Commands for Programmable Instruments (SCPI) Version 1993.

Superb Spectral Purity

The 114XB family of synthesizers is designed to function in the VXIbus environment with no compromise in microwave performance. Despite the small size, full modular shielding and post regulation with double filtering are utilized to ensure outstanding performance even when sharing a system with digital instruments. With spurious signals below -60dBc, the 114XB is an excellent choice as a local oscillator in radar/EW testing, narrow band device characterization and general communications system testing.

Unmatched Complex Modulation Performance

An IF Modulation input is standard on the 114XB and provides the means to up-convert complex digital signals or sophisticated jamming scenarios to microwave frequencies. The 40 MHz instantaneous bandwidth of the IF input supports wideband frequency, phase and amplitude modulation as well as noise injection in any combination. Hence, the complex signals needed to test digital receivers may be easily produced, co-channel and adjacent channel interference simulated and sub-microsecond frequency hopping up to a 40 MHz instantaneous bandwidth (fast enough to simulate many spread-spectrum sources) generated.



Simplified Block diagram of the 114XB.

High Performance Amplitude, Frequency, Pulse and I/Q Modulation

The 114XB family offers three independent modulation channels which may be used separately or simultaneously. Amplitude modulation (AM) at up to 90% modulation at modulating frequencies from DC to 100 kHz make the 114XB ideal for antenna scan pattern or satellite beacon simulation or other power control applications as well as for conventional AM. The extremely fast pulse modulation (PM) characteristics of the 114XB synthesizers allow for pulse widths of as little as 50 ns and pulse repetition frequencies as high as 10 MHz, enabling them to simulate virtually any radar or to serve as a highly versatile source for pulsed device characterization. Option 02

substitutes internal frequency modulation (FM) for the IF modulation channel. Modulation rates of up to 10 MHz and deviations of up to 25 MHz peak facilitate the testing of FM video and telemetry receivers as well as satellite communications systems. Option 05 overlays an I/Q modulator onto the FM channel, giving the 114XB the capability of generating complex (quadrature) modulation consisting of any combination of amplitude and phase modulation at modulating frequencies ranging from DC to in excess of 40 MHz across the complete synthesized frequency output range.

Simultaneous use of the 114XB AM, FM, Pulse and I/Q modulators in conjunction with a multi-channel Arbitrary Waveform Generator allows the creation or replication of virtually any form of modulated signal. The principal limitation on the application of the 114XB family is the imagination of the user.

Plenty of Power

The Phase Matrix/EIP 114XB with Option 06 provides +16 dBm of leveled output power across the entire band. This extra power coupled with the 114XB's Custom Calibration feature, enables you to provide leveled power at any point in your system. This powerful feature plus the 114XB's excellent close-in phase noise make it the premier choice to serve as a local oscillator in a VXIbus test system.

Flexible Programming

Full compliance with VXIbus Specification Revision 1.3/1.4 and Standard Commands for Programmable Instruments (SCPI) Version 1993.0 ensures ease of programming. And to further ease system integration and reduce programming time, Phase Matrix supports the 114XB with software drivers for most popular development environments. The 114XB synthesizers provide synchronization and trigger capability that can be as simple or as complex as your system requires. The unique Triggered List Function, for example, allows you to step through more than 200 ordinary instrument functions triggered from a single trigger input. The flexibility of the 114XB software ensures easy integration into any system, regardless of its complexity.

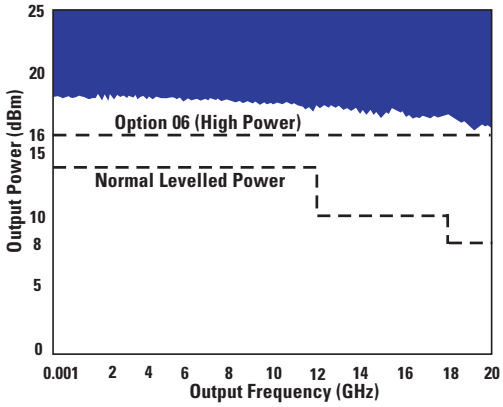
Small Size and Light Weight

No other products combine small size and light weight with uncompromised high performance as effectively as the Phase Matrix/EIP 114XB family. Less than one-fourth the size of comparable "rack and stack" microwave synthesizers, the 114XB family is the perfect solution in portable and flight-line VXIbus automatic test systems or in any other application where small size, light weight and high performance are important.

Accessory Modules Enhance the 114XB's Capability

A host of accessory modules, including pulse generators, down converters, power amplifiers, etc. are readily available to complement the 114XB synthesizers. Phase Matrix, in partnership with other proven manufacturers of high quality, industry standard VXIbus equipment, can supply all of your automated microwave testing needs.

The microwave synthesizer is a key component in complete VXIbus RF/microwave stimulus/response test suites.



Phase Matrix / EIP 114XB typical maximum available output power. High output level compensates for ATE system cable losses and provides adequate LO drive signal.

The 114XB series of synthesized signal generators are ideal for mobile or portable test suites and flight line systems.

1140B/1141B SPECIFICATIONS

	1141B	1140B[7]
Frequency Range	2 to 20 GHz	0.01 to 20 GHz
Power Range (leveled)		
10 MHz to 2 GHz	----------	+13 to -90 dBm (+16 dBm Option 06)
2 to 12 GHz	+13 to -90 dBm	+13 to -90 dBm (+16 dBm Option 06)
12 to 18 GHz	+10 to -90 dBm	+10 to -90 dBm (+16 dBm Option 06)
18 to 20 GHz	+10 to -90 dBm	+8 to -90 dBm (+16 dBm Option 06)
Source Impedance	50 ohms	50 ohms
Output Connector Type	APC 3.5mm Female	APC 3.5mm Female
VSWR (typical)	2:1	2:1
Reverse Power Tolerance	1 watt	1 watt

	Frequency	Power	
Resolution	1 Hz	0.1 dB	
Accuracy	Same as time base	>-50 dBm:	1 dB[2]
		-50 dBm to -80 dBm:	1 dB[2]
		<-80 dBm:	2 dB typ.
Switching Time[3]	<25ms	Without Atten Change	<25 ms
Switching Time (IF Input)[4]	<100 ns	With Atten Change	<150 ms

Spectral Purity (Specifications apply at +10 dBm CW output level, Modulation off)

Spurious

	1141B/1140B			
	0.01 to 2 GHz	2 to 4.84 GHz	4.84 to 10 GHz	10 to 20 GHz
Harmonic	<-40 dBc typical	<-40 dBc typical	<-40 dBc typical	<-40 dBc typical
Power Line Related	<-45 dBc	<-51 dBc	<-45 dBc	<-45 dBc

Non-Harmonically Related Spurious

		1141B/1140B			
Offset Frequency		0.01 to 2 GHz	2 to 4.84 GHz	4.84 to 10 GHz	10 to 20 GHz
<100 kHz		<-60 dBc	<-60 dBc	<-60 dBc	<-60 dBc
100 kHz to 1 MHz		<-60 dBc	<-60 dBc	<-60 dBc	<-60 dBc
1 MHz to 100 MHz		<-60 dBc	<-60 dBc	<-60 dBc	<-60 dBc
>100 MHz		<-60 dBc	<-65 dBc	<-65 dBc	<-60 dBc

Residual Modulation (50 Hz to 15 kHz bandwidth)

		1141B/1140B			
		0.01 to 2 GHz	2 to 4.84 GHz	4.84 to 10 GHz	10 to 20 GHz
FM		<150 Hz rms	<75 Hz rms	<150 Hz rms	<300 Hz rms
AM		<0.1% peak	<0.1% peak	<0.1% peak	<0.1% peak

Single Side Band Noise (dBc/Hz) (Specifications apply at +10 dBm CW output level, Modulation off)

Offset From Carrier	Frequency (GHz)									
	≤2	4	6	8	10	12	14	16	18	20
100 Hz	-81	-85	-84	-81	-80	-78	-78	-77	-77	-75
1 kHz	-82	-90	-88	-87	-85	-83	-82	-80	-80	-80
10 kHz	-80	-90	-88	-88	-85	-82	-82	-80	-80	-80
100kHz	-110	-110	-110	-110	-108	-108	-105	-105	-100	-100
1MHz	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120
10MHz	-125	-125	-130	-130	-130	-130	-130	-130	-125	-125

1140B/1141B SPECIFICATIONS

Internal Time Base

Frequency	10 MHz
Aging Rate	<1 x 10^{-9}/day at 25°C after 72 hour warm-up
Temperature Stability	<1 x 10^{-7}/change over 0°C to 50°C

Pulse Modulation (external)

Pulse Repetition Frequency	DC to 10 MHz
Minimum Pulse Width	50 ns
On/Off Ratio	>80 dB
Rise/Fall Time	<10 ns, 10% to 90%
Pulse Overshoot, Ringing[8]	<10% for PRF's <1 MHz Typical
Pulse Width Compression	<10 ns at 50% points (<5 ns typical)
Video Feedthrough	<20 mV peak to peak (<10 mV peak to peak typical)
Delay Time	<55 ns, 50% TTL to 50% RF (<30 ns typical)
Peak-to-CW Level Accuracy	<0.5 dB change (>50 ns pulse widths excluding leading edge overshoot/ringing)
Input Level	TTL compatible
Input Level Tolerance	<-0.5 ≤ Vin ≤+7 VDC Continous
Polarity	RF output is ON with TTL logical "1" input
Connector	BNC Female

Amplitude Modulation (external)

Rate[6]	DC to 100 kHz (3 dB bandwidth)
Depth	0 to 90% minimum
Distortion	<5% (50% depth, 1 kHz rate)
Sensitivity	Programmable from 0 to 100%. 2.0V peak-to-peak input gives full scale modulation
Modulation Index Accuracy	±10% (50% depth, 1 kHz rate 2.0V peak-to-peak modulating input)
Modulation Overdrive Threshold	±2 VDC ±10%
Average Power Output	-20log[1+(Modulation Index)/100]± 2 dB relative to set CW level with AM OFF
Input Impedance	10 kohm ±10%
Input Level Tolerance	±20 VDC continuous
Connector	BNC female

IF (Complex Modulation) Input[(1)]

Input Frequency	300 MHz to 1 GHz, programmable
Input Level	-6 dBm nominal
Instantaneous 3 dB Bandwidth	>40 MHz typical (ALC OFF)
Spurious Output (+10 dBm output level, ALC On, -6dBm input level)	

IF Input	Level
300 to <750 MHz	<-30 dBc
750 MHz to 1 GHz	<-60 dBc

Input Impedance	50 ohms nominal
Input VSWR	<2.0:1 typical
Input Level Tolerance	+10 dBm max.
Connector	BNC female

Frequency Modulation (external) Option 02[(1)]

Rate	5 kHz to 10 MHz (3 dB bandwidth)	Input Impedance	600 Ohms nominal (AC Coupled)
Deviation	25 MHz p-p, f_0 0.05 - 20 GHz	Input VSWR	<2.0:1 typical
	10 MHz p-p f_0 10 - 50 MHz	Input Level Tolerance	±7.5V max.
Distortion	<5% typical	Connector	BNC female
Sensitivity	5 MHz p-p per volt fixed, 5VDC maximum		

I/Q Modulation (external) Option 05[(1)(5)]

I/Q Bandwidth	DC to > 40 MHz	Max. Input Level	1 V rms
I/Q Sensitivity	0.5 Vp for 100% Modulation Drive Level	Connector	BNC female
I/Q Input Impedance	600 Ohms nominal (DC Coupled)		

10 MHz Input/Output

Frequency	10 MHz	Input Impedance	50 ohms nominal
Level	0 dBm ± 3 dB, sinewave	Connector	BNC female

Programming

Conforms to SCPI Version 1993.0	List Mode	1500 points, seperate control of Frequency, Power, AM depth, CM State, Pulse Mod State

General (Tested to MIL-PRF 28800F, Class III)

Temperature Range	
Operating	0° to 50° C
Non-operating	-40° to 70° C
Relative Humidity	0 to 95 % non-condensing
EMI	
Below 1 GHz	Complies with VXIbus Revision 1.3/1.4 specification
Above 1 GHz	Complies with RE02 of MIL-STD-461C
Certifications	CE Certified for EMC to EN50011 and EN50082-1, CE Certified for Safety to IEC1010-1 (1990)
Warm-up Time	<15 minute at 25°C ambient temperature
Weight	<16 lbs / 7.3 kg
Shipping Weight	<26 lbs / 11.8 kg Typical

1140B/1141B SPECIFICATIONS

VXIbus Specification

	Complies fully with Revision 1.3/1.4 of VXIbus Specification for message-based instruments
Module Size	C-size, 3 slots wide
Device Type	Message-based instrument
Protocol	Word Serial
Address/ Data Mode Supported	A16/D16
Local Bus	Not Used
ECLTRG Utilization	Available for triggered functions (Source and Receive)
TTLTRG Utilization	Available for triggered functions (Source and Receive)
CLK10 Utilization	Not Used
Cooling	1.2mm H_2O @ 9 liters/sec for <25˚C internal temperature rise

1141B/1140B Power Requirements

	Power	I_{peak} (Amperes)						
		+5V	+12V	+24V	-2V	-5.2V	-12V	-24V
1141B	<155 Watts	2.0	2.8	2.3	0.2	0.2	0.8	2.5
1140B	<160 Watts	2.5	2.8	2.7	0.2	0.2	1.5	2.7

[1] Adding Option 02 and/or Option 05 removes IF Input
[2] Model 1140B accuracy is degraded by 1 dB from 0.01 to 2 GHz
[3] Switching time is locked and settled, for <1 GHz step without band crossing, Triggered List Mode
[4] IF input less than 40 MHz deviation
[5] Option 05 (I/Q Modulation) includes Option 02 (FM Modulation)
[6] AM Rate is specified with ALC off and running Power:Search routine. With ALC on, Rate is limited to 100Hz to 100KHz typical
[7] Adding OPTION 06, High Power, Limits low frequency range to 10 MHz.
[8] Optimum overshoot/ringing performance can be achieved by turning off and running Power Search routine.
*Typical, means appromimately 2/3 of all units will meet these characteristics.

ORDERING INFORMATION

MODEL 1140B	0.01 - 20 GHz VXIbus Synthesized Signal Generator
MODEL 1141B	2 - 20 GHz VXIbus Synthesized Signal Generator

Option 02[1]	FM Modulation (external)
Option 03	APC 3.5mm Male Connector (replaces standard female type)
Option 05	I/Q and FM Modulation (external)[1]
Option 06[7]	High Power Output (+16 dBm min.)

Related Products	Model 1313B	1 to 26.5 GHz VXIbus Microwave Downconverter
	Model 1911A	4 Channel VXIbus Pulse Generator
	Model 1355A	1 to 20 GHz VXIbus Microwave Power Amplifier

Warranty Phase Matrix, Inc. has a proven commitment to quality and reliability in instrumentation. This commitment is demonstrated in the 114XA family of synthesizers with a full 1 year standard warranty. Parts, labor, and even shipping are all included at no cost to you.

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Instruments You Can Count On

VXIbus Synthesized Signal Generators

High-Performance Microwave Signal Generation for VXIbus Systems

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1313B

Phase Matrix, Inc.™
Instruments You Can Count On

VXIbus Microwave Downconverter

High-Performance Downconversion For Analysis of Microwave Signals

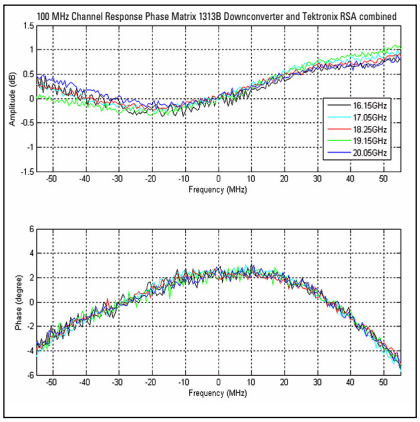
- 1 MHz to 26.5 GHz Frequency Range
- -135 to +30 dBm Dynamic Range
- Up to 350 MHz Wide IF Bandwidth
- <-135 dBm Average Noise Density
- 21.4 MHz Auxillary IF Option
- NIST Traceable Power Meter Option

Phase Matrix Model 1313B
VXIbus Microwave Downconverter

High-Performance Downconversion
For Analysis of Microwave Signals

Model 1313B
Specification Summary

- *1 MHz to 26.5 GHz Frequency Range*
- *1 Hz Frequency Resolution (with appropriate external LO)*
- *<-135 dBm Noise Floor*
- *+30 dBm Input Power Protection*
- *20dB Maximum Noise Figure (<8.5 GHz)*
- *Auxillary IF Output*
- *3 LO inputs for multiple downcoversion*
- *Onboard Power Meter Option*
- *Onboard 1mW 50MHz Power Reference*
- *Agilent 8480 Power Sensor Compatible*
- *VXIbus Revision 1.3/1.4*
- *C-Size, 1 Slot Wide*
- *SCPI Version 1993.0*



Amplitude and phase flatness for a Phase Matrix Model 1313B/RSA 100MHz bandwidth solution.

1313B - Overview

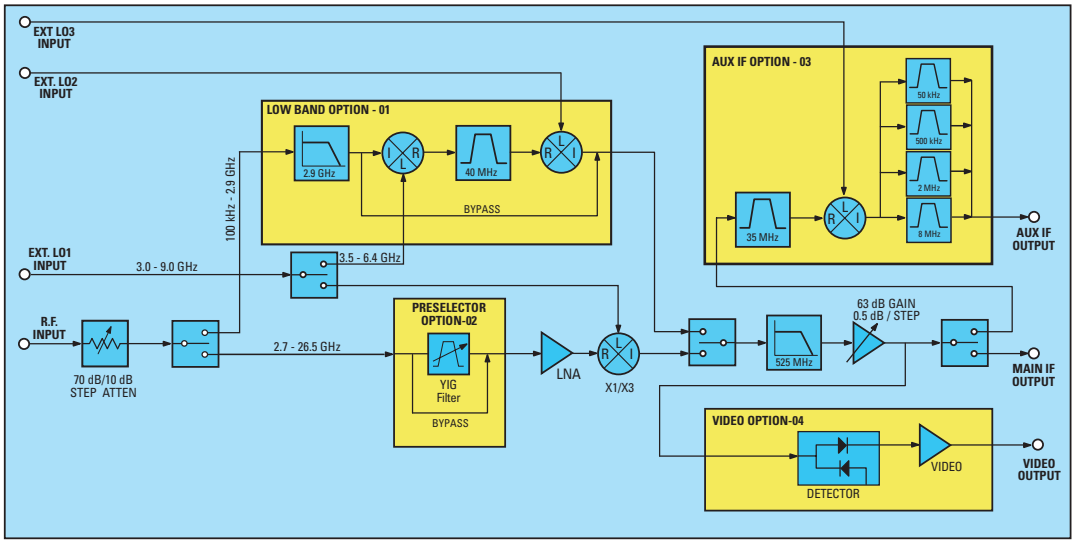
The Phase Matrix Model 1313B microwave downconverter translates microwave signals to RF frequencies with minimal distortion. The 1313B is the latest generation of modular, VXIbus based, broadband, downconverters optimized for synthetic instrumentation applications. The Model 1313B provides the user with basic microwave front end conditioning building blocks to extend VXIbus signal analysis into the microwave range. In conjunction with an appropriate external local oscillator module and commercially available digitizer, this single slot downconverter solution can provide the functions of several stand-alone instruments.

- Spectral Analysis
- Power Measurement
- Frequency Measurement
- Modulation Analysis
- Pulse Parameter Analysis

With instantaneous IF Bandwidths of up to 350 MHz the 1313B can assure the integrity of even the most complex modulated signals through the downconversion process. The standard I.F. output of 250 MHz (other options available) makes the Model 1313B ideally suited for extending the input frequency range of several lower frequency test systems such as the Tektronix RSA Spectrum Analyzers, NI PXI Signal Analyzer and Agilent 89600 series of vector signal analyzers.

Modular Construction

The Model 1313B is designed to offer the user the most flexibility in configuring a microwave Automated Test System (ATE) system. Whether you require wideband signals for fast acquisition or narrowband, high dynamic signal analysis, the modular architecture, built on our years of experience in designing downconverters, allows you to configure an ATE solution and optimize speed, space and cost at the same time. By removing the Local Oscillator (LO) function in a separate module the user can choose parameters important to the application at hand. Standard LO configuration uses a YIG based, 3-9 GHz synthesized LO (Model 20309) for X1 and X3 harmonic mixing. If switching speed is critical, VCO based sources can be substituted or custom, user provided, LO configurations can be utilized. Microwave performance is not compromised for VXIbus compliance. Modular shielding and double regulation is used to ensure outstanding performance and >80dB typical spur free dynamic range.



Simplified Block Diagram of the Phase Matrix Model 1313B

RF Input

The 1313B can be utilized to acquire and analyze a wide range of conventional as well as complex signals from <-135dBm to +30dBm (digitizer dependent), and provides 70dB of input attenuation that is selectable in 10dB steps. In addition, when multi-signal environments are encountered, YIG tuned front end pre-selection can be used to eliminate image frequency and erroneous measurements; similar to conventional spectrum analyzer architectures. With the standard microwave LNA, signals below –135dBm can be brought out off the noise.

LO Input

By having the LO externally provided, the 1313B allows for the most flexibility in configuring your microwave ATE system. The standard configuration uses the classic X1/X3 LO input for harmonic, heterodyne conversion to a 250 MHz 1st Intermediate Frequency (IF). Additional LO's for low-end coverage and auxiliary low frequency IF outputs are also externally provided. The LO sources can be provided by Phase Matrix or the user from other resources within the ATE system.

IF Output

Flexible IF architecture assures your downconverter choice can work with today's as well as tomorrow's leading edge digitizers. Precision 0.5 dB variable IF step attenuation is temperature stabilized and compensated to correct for frequency dependent conversion loss variations. In addition to the wideband (1st IF) and optional (2nd IF) a video option is provided for video/level triggering, RSSI measurements and AM/Pulse demodulation analysis.

Accuracy

Let the 1313B help improve the accuracy of the rest of your test system. By adding up to five sets of correction curves versus frequency (main path loss, step attenuator loss, YIG loss, residual IF loss, IF filter shape loss) Amplitude correction can be used to compensate for gains, losses in cables, antennas, amplifiers etc. Every 1313B is factory calibrated with N.I.S.T. traceable and certified equipment. Corrections are provided in electronic format for embedding within the control software.

Power Meter Option

In addition to the spectrum analysis and downconverter functions, the 1313B downconverter series features an optional integral power meter compatible with the Agilent 8480 power sensor series. The power meter option will interface to your already-fielded power sensors and transfer the NIST traceable power measurement results over the VXIbus. NIST traceability is maintained via the integral 50 MHz calibrator, factory set to within ±0.7%. The built-in power measurement also allows for field calibration of the spectrum analyzer display and power measurements below –100 dBm at 26.5 GHz, utilizing the power meter/receiver transfer method. The combination of these capabilities in a 1-wide VXI package offers unparalleled signal analysis computing power in a small package that is ideal for field or factory operation.

Programming

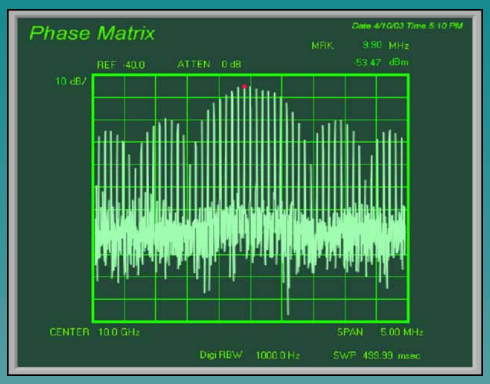
The 1313B is fully compliant with VXIbus Specification Revision 1.3/1.4. Register based communication through plug & play drivers allows for the fastest data transfer and control. Phase Matrix supports the 1313B with software drivers for most popular development environments. In addition, LabView compatible analysis tools are provided to quickly come up to speed on basic spectral analysis and downconverter controls.

Accessory Modules Enhance the 1313B's Capability

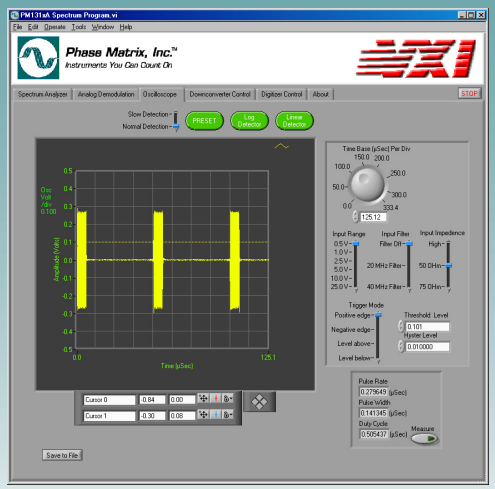
A host of accessory modules, including pulse generators, microwave synthesizers, frequency counters, power meters and power amplifiers, are readily available to compliment the 1313B downconverter. Phase Matrix, in partnership with other proven manufacturers of high quality, industry standard VXIbus equipment, can supply all of your automated microwave testing needs.

The Phase Matrix Model 1313B series of downconverters can be configured with an optional integral power meter option function compatible with the Agilent 8480 power sensor series.

The addition of multiple IF outputs adds flexibility for an optimum combination of sampling and digitizing bandwidths for any measurement combination.



With Phase Matrix's suite of personal computer software tools, utilizing the LabView™ Analysis Suite and commercially available digitizers, the designer can leverage the increasing power associated with consumer based technologies.



1313B SPECIFICATIONS

Input Specifications

RF Input Frequency Range	1 MHz to 26.5 GHz (OPT-01) (useable to 100 kHz)
RF Input Compression Point (@0dB Atten.)	-30dBm min.
RF Input Level, continuous, without damage	+30dBm min. (@10dB Atten)
RF Input Return Loss (50 Ohms)	0.1 - 1 MHz <-10dB
	1 MHz - 12 GHz <-14dB
	12.5 GHz - 18 GHz <-10dB
	18 GHz - 26.5 GHz <-8dB
Noise Figure (no preselection)	<8.5 GHz, 20dB max.
	<26.5 GHz, 30dB max.
Noise Figure (preselection)	<8.5 GHz, 28dB max.
	<26.5 GHz, 38dB max.
RF Input IP3 (@0dB Atten.)	-10dBm min (1.0 MHz test signal spacing)
Spurious Single Tone Signals @ Input	-90 dBm max. (preselection)
(LO leakage at input)	-50 dBm max. (no preselection)
Input Step Attenuator	0 to 70 dB in 10dB Steps

Suggested Step Atten. Setting for linear operation. [Note1]	RF Input	Input Step Atten. Setting
	+30dBm	70dB
	+20dBm	60dB
	+10dBm	50dB
	0dBm	40dB
	-10dBm	30dB
	-20dBm	20dB
	-30dBm	10dB
	-40dBm	0dB

Note 1: Unit can be operated at higher input levels by adjusting the IF attenuation accordingly. However, the –2dBm(500mVp-p) IF output should always be maintained for linear response.

Output Specifications

RF to IF Gain (0dB Atten.)	40dB typical	
IF Output Levels (0dB Step Atten)	RF Input	IF Output (50 Ohms) minimum
	-40dBm	-2dBm (500mVp-p)
	-60dBm	-22dBm (50mVp-p)
	-80dBm	-42dBm (5mVp-p)
	-100dBm	-62dBm (0.5mVp-p)
Output IF Center Frequency	250 MHz (settable via LO1)	
Output IF Frequency BW	350 MHz minimum (1dB BW)	
Output IF Level Variation	±1 dB max.	
Output IF Second Harmonic Distortion	Main IF (250 MHz) >60dB	
	Aux IF (21.4 MHz) >80dB	
LO2 Leakage@Main IF (250 MHz)	+10dBc max. (RF In <80 MHz)	
Output Level Variation (any 50 MHz IF segment)	0.7 dB max.	
IF Gain Control	63 dB in 0.5 dB steps	
Spurious Single Tone Signals @ IF	-80dBm max. (residual spurs, input terminated, measured with SA)	

Local Oscillator Specifications

Ext LO1	3-9 GHz, +10 dBm min.
Ext LO2	3.25 GHz (factory set), 0 dBm min.
Ext LO3 (OPT-03)	228 MHz (factory set), 0 dBm min.

Downconverter Available Options

OPT01	Low Band Input Frequency Range	1 MHz to 2.9 GHz (useable to 100 kHz)
	Low Band Input BW (Instantaneous)	40 MHz (1dB) min.
OPT02	YIG Preselector Frequency Range	2.7-26.5GHz
	3dB BW	40MHz min., 120MHz max
	Topology	4 pole, nominal 24dB/oct
	Tuning speed	< 5mS @ 50MHz step
	Tuning accuracy	± 35MHz uncorrected
OPT03	Aux IF Output Center Frequency	21.4 MHz
	Aux IF Frequency BW (0.5 dB)	50kHz / 500kHz / 2MHz / 8MHz (user selectable)
	Aux. IF level	same as main IF
	Aux. IF Filter - Filter Level Variation	1.0 dB max.
	Topology	5 Pole min.

1313B SPECIFICATIONS

Downconverter Options (Continued)

OPT04	Video detected output	
	Input frequency bandwidth	50 MHz min
	Output bandwidth (no presselection)	10 nSec. risetime minimum at >250 MHz IF input to detector
	Output IF level	Det. Sens. to 0dBm
	D/C Output level @ -2dBm IF out	1Vmin. polarity positive
	D/C Output level error over temperature	1 dB maximum (0 to +55° C)

OPT10 Power Meter Specification

The power meter option adds National Institute of Standards and Technology (NIST) traceable power measurement capability to the Downconverter module. The option contains all the necessary interfaces as well as reference standard for interfacing to the Agilent[2] 8480 series of power sensors. The power and frequency ranges of the power measurement option are dependent on the power sensor model used.

Parameter	Specification
Frequency Range	100 kHz to 50 GHz, sensor dependent (refer to Agilent sensor specification)
Power Range	–70 to +44 dBm
Power Sensors Supported	Agilent Models 8487A, 8485A, 8482A, 8481D, 8481A, 8481B, 8482B, 8481H, 8482H, 8485D, 8487D
Resolution	0.01 dB in log mode, 0.1% of full scale in linear mode
Data units	
Absolute	dBm or Watts
Relative	dB or %
Accuracy	
Instrumentation	±0.02dB or ±0.5%. add power sensor linearity specification to overall system accuracy
Zero Set	Sensor dependent (refer to Agilent sensor specification)
Power Reference Output	1.00mW, factory set to ±0.7%, traceable to NIST
Power Reference Accuracy	±1.2% worst case (±0.9% RSS) for one year
Power Reference Frequency	50 MHz nom.
Connector	N-Type female

Note 2: Agilent is a trademark of the Agilent Corporation.

General Specification

Temperature Range		
	Operating	0° to +55° C
	Non-Operating	-40° to +70° C
Relative Humidity		0 - 90%, Non Condensing
EMI	Below 1 GHz	Complies with VXIbus Rev. 1.3/1.4
	Above 1 GHz	Complies with RE02 of MIL-STD-461C
Weight		6 lbs./2.7kg. max. (all options installed)

VXIbus Specification

Module Size:	1 C-Size slot
Device type:	Register-Based (A24)
Protocol:	Not Used
Local Bus:	Not Used
ECLTRG	Not Used
TTLTRG	Not Used
CLK10 Utilization	Not Used
Cooling:	1mm H_2O @ 5 liters / second for 15° C rise in temperature.
Warm-up Time:	15 Min. max. @ +25°C ambient temperature.
Power Dissipation:	55W max., 40W typ. (all options installed)

Power Requirements

	Power	I_{peak} (Amperes)						
		+5V	+12V	+24V	-2V	-5.2V	-12V	-24V
1313B	<55 Watts	0.8	1.5	0.5	N/A	0.1	N/A	1.2

*Typical, means approximately 2/3 of all units will meet these characteristics.
Specifications are subject to change without notice.

ORDERING INFORMATION

MODEL 1313B	1 MHz - 26.5 GHz VXIbus Microwave Downconverter	
Options	M1313B-OPT01 Low Band Frequency Extention 1 MHz - 2.9 GHz (useable to 100kHz) M1313B-OPT02 YIG Tuned Preselector M1313B-OPT03 Auxillary IF M1313B-OPT04 Video Output M1313B-OPT10 Power Meter	
Related Products	Model 20309 Model 1140B	VXIbus Local Oscillator Synthesized Microwave Signal Source

Warranty

Phase Matrix, Inc. has a proven commitment to quality and reliability in instrumentation. This commitment is demonstrated in all VXIbus products with a full 1 year standard warranty. Parts, Labor, even shipping are all included at no cost to you.

During the life of electronic equipment, components may fail. When they do, you need the fastest, easiest, and least expensive repair possible. To meet this need, Phase Matrix offers a variety of services designed to minimize equipment down time. Please contact Phase Matrix's Customer Service Department for details. Quality, reliability and support, all designed to minimize your cost of ownership.

1313B

Phase Matrix, Inc.™
Instruments You Can Count On

VXIbus Microwave Downconverter

High-Performance Downconversion For Analysis of Microwave Signals

For More Information Contact:

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FAX: +1 (408) 428-1500
TOLL FREE: +1 (877) 4PhaseM
EMAIL: sales@phasematrix.com
WEB: www.phasematrix.com

Specifications and ordering information subject to change without notice.

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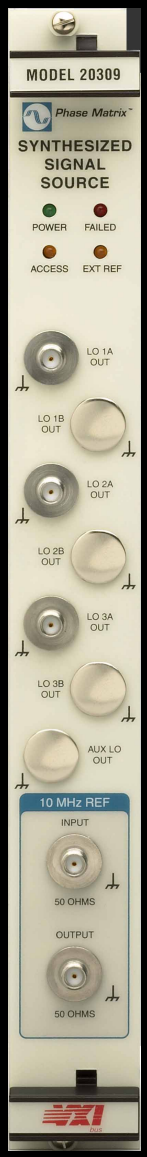
Sonic Imagery Labs

20309

Phase Matrix, Inc.™
Instruments You Can Count On



VXIbus Local Oscillator

High-Performance Microwave Local Oscillator Generation for VXIbus Systems

- 3 to 9 GHz Frequency Range
- Multi-Stage Downconversion Support
- +10 dBm Output Power
- 1 Hz Tuning Resolution
- < 100 dBc/Hz Phase Noise @ 10kHz Offset
- High Stability 10 MHz System Reference

Phase Matrix Model 20309
VXIBus Local Oscillator

High-Performance Microwave Local Oscillator Generation for VXIbus Systems

Model 20309 Specification Summary

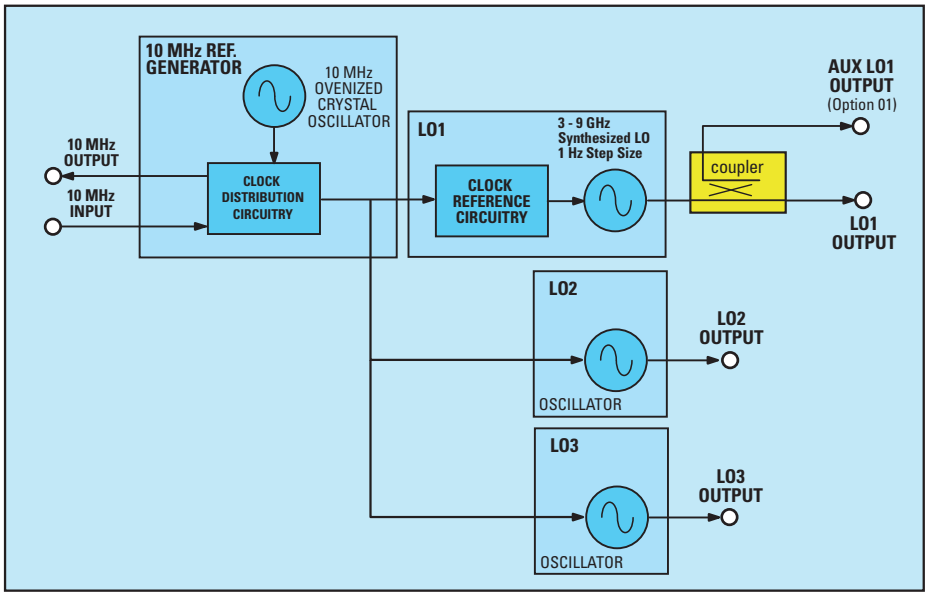
- *3 to 9 GHz Frequency Range*
- *1 Hz Frequency Resolution*
- *<-70 dBc Spurious*
- *<-100 dBc/Hz SSB Phase Noise (10 kHz offset from 3 GHz)*
- *+10 dBm Output Power*
- *Second Coherent Output Available*
- *VXIbus Revision 1.3/1.4*
- *C-Size, 1 Slot Wide*
- *Register Based Instrument*

20309 - Ideal Local Oscillator System for Downconverter Applications

The Phase Matrix Model 20309 VXIbus Local Oscillator (L.O.) is a combination of compact synthesized signal sources optimized for use in downconverter and synthetic instrumentation applications. Downconverters are essential front-end elements of any microwave signal analysis system. In only 1, C-Size, VXI slot the 20309 combines a 3-9 GHz main L.O. as well as additional lower frequency synthesized sources. The 20309 is a complete L.O. solution whether you are utilizing single or multiple stage downconversion. The 20309 is fully compliant with VXIbus specification 1.3/1.4 for register based instruments.

Superb Spectral Purity

Microwave performance is not compromised for VXIbus compliance. The 20309 utilizes full modular shielding and post regulation with double filtering to ensure outstanding performance, even when sharing a system with digital instruments. The 20309 does not sacrifice spurious and phase noise performance for small size. Based on fundamental YIG resonator technology, spurious signals are kept below -70dBc. Phase noise of better than –100dBc/Hz at a 10kHz offset make the 20309 the ideal L.O. for radar/EW testing, narrowband device characterization as well as communication system analysis.



Simplified Block diagram of the Phase Matrix Model 20309.

Phase Matrix Model 20309 VXIBus Local Oscillator

High-Performance Microwave Local Oscillator Generation for VXIbus Systems

Plenty of Power

The 20309 can provide up to +10 dBm of fixed output power. Sufficient power to drive most commonly utilized, industry standard, mixer architectures. Optional second channel outputs, for two channel phase coherent downconversion, are also available. In addition an optional AUX main L.O. output is available to drive external mm-wave mixers for frequency extension beyond the microwave range.

Programming

The 20309 is fully compliant with VXIbus Specification Revision 1.3/1.4. Register based communication through plug & play drivers allows for the fastest data transfer and control. Phase Matrix supports the 20309 with software drivers for most popular development environments.

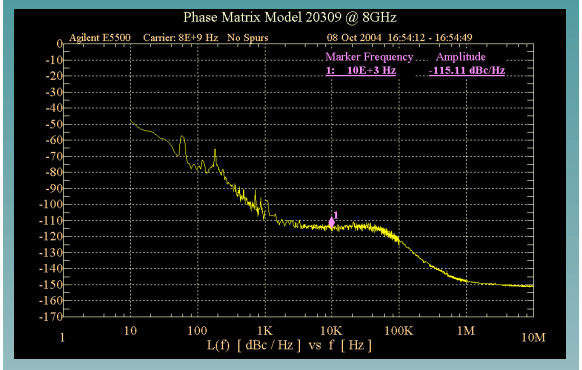
Small Size and Light Weight

No other products combine small size and light weight with uncompromised high performance as effectively as the Phase Matrix VXI product family. Less than one-eighth the size of comparable "rack and stack" microwave products, the 20309 family is the perfect solution in portable communications, flight-line or signal analysis VXIbus automatic test systems or in any other application where small size, light weight, and high performance are important.

Accessory Modules Enhance the 20309's Capability

A host of accessory modules including pulse generators, downconverters, frequency counters, power meters, and power amplifiers, are readily available to complement the 20309 local oscillator. Phase Matrix, in partnership with other proven manufacturers of high quality, industry standard VXIbus equipment, can supply all of your automated microwave testing needs.

The addition of multiple LO outputs adds flexibility for an optimum combination of sampling and digitizing bandwidths for any measurement combination.



Phase Noise at 4 GHz and 8 GHz. Phase noise of better than –100dBc/Hz at a 10kHz offset make the 20309 the ideal L.O. for radar/EW testing.

20309 SPECIFICATIONS

Output Specifications

LO1 Frequency Output	3.0 to 9.0 GHz
LO2 Frequency Output	3.25 GHz (Factory set)
LO3 Frequency Output	228 MHz (Factory set)
LO1 Frequency Step Size	1Hz (true 1 Hz, binary type steps)
LO2 Frequency Step Size	N/A (Factory set)
LO3 Frequency Step Size	N/A (Factory set)
LO1 Frequency Switching Speed	25 mSec. max. (<15 mSec. typical)
Output Power (fixed)	
LO1	+10 dBm min. (> +11 dBm typical)
LO2	+1 dBm min.
LO3	+1 dBm min.
Output Impedance (LO1, LO2, LO3)	50 Ohm nom.

Spectral Purity

Harmonics (LO1, LO2, LO3)	15 dBc min.
Non Harmonically Related Spurious (LO1, LO2, LO3)	
0.1 - 100 kHz from Fo	70 dBc min.
> 100 kHz	75 dBc min.
Power Line Related Spurious (LO1, LO2, LO3)	40dBc min.
Residual Modulation (50 Hz to 15 kHz bandwidth) (LO1, LO2, LO3)	
FM	<200 Hz rms
AM	<0.1% peak
Phase Noise (SSB, Offset from Fo) (LO1, LO2, LO3)	
100 Hz	-75 dBc/Hz max.
1 kHz	-85 dBc/Hz max.
10 kHz	-100 dBc/Hz max.
100 kHz	-120 dBc/Hz max.
1 MHz	-145 dBc/Hz max.

Internal Time Base Output

Frequency	10 MHz
Aging Rate (after 72 hour warm-up)	$<1x10^{-9}$/day @ +25°C
Temperature Stability	$<1x10^{-7}$ over 0°C to 50°C
Output Level	0dBm ±3dB
Output Impedance	50 Ohm nom.
Connector	SMA F

External Time Base Input

Frequency (will automatically lock to ext. applied:)	1/2/5/10 MHz
Input Level	-3dBm min.
Input Impedance	50 Ohms nom.
Connector	SMA F

20309 SPECIFICATIONS

General Specifications

Temperature Range	
Operating	0 to +55°C
Non-Operating	-40° to +70°C
Relative Humidity	0 to 90%, Non Condensing
EMI	
Below 1 GHz	Complies with VXIbus Rev 1.3/1.4
Above 1 GHz	Complies with RE02 of Mil-Std-461C
Weight	5 lbs./2.6kg. max (all options installed)
Output Connectors (LO1, LO2, LO3)	SMA F

VXIbus Specification

Module Size:	1 C-Size slot
Device type:	Register-Based (A24)
Protocol:	Not Used
Local Bus:	Not Used
ECLTRG	Not Used
TTLTRG	Not Used
CLK10 Utilization	Not Used
Cooling:	1mm H_2O @ 5 liters / second for 15° C rise in temperature.
Warm-up Time:	15 Min. max. @ +25°C ambient temperature.
Power Dissipation:	50W max., 37W typ. (all options installed)

Power Requirements

	Power	I_{peak} (Amperes)						
		+5V	+12V	+24V	-2V	-5.2V	-12V	-24V
20309	<38 Watts	1.8	0.8	1.5	N/A	0.1	N/A	N/A

*Typical, means appromimately 2/3 of all units will meet these characteristics.
Specifications are subject to change without notice.

ORDERING INFORMATION

MODEL 20309	VXIbus Local Oscillator	
Options	M20309-OPT01	Aux LO1 Output Connector 0dBm minimum output power
	M20309-OPT02	2nd Channel Coherent LO1, LO2, LO3 Outputs
	(Requires ACC001, ACC002, ACC003, ACC005, ACC006, ACC007)	
Accessories	M20309-ACC001	Cable Assy, Coax, Semirigid, SMA, LO1A
	M20309-ACC002	Cable Assy, Coax, Semirigid, SMA, LO2A
	M20309-ACC003	Cable Assy, Coax, Semirigid, SMA, LO3A
	M20309-ACC004	Cable Assy, Coax, Flexible, LO1, LO2, LO3 (See Note 1)
	M20309-ACC005	Cable Assy, Coax, Semirigid, SMA, LO1B
	M20309-ACC006	Cable Assy, Coax, Semirigid, SMA, LO2B
	M20309-ACC007	Cable Assy, Coax, Semirigid, SMA, LO3B
	Note 1: ACC004 Cable can be used for LO1, LO2 or LO3	
Related Products	Model 1313B	1MHz to 26.5 GHz VXIbus Microwave Downconverter

Warranty

Phase Matrix, Inc. has a proven commitment to quality and reliability in instrumentation. This commitment is demonstrated in all VXIbus products with a full 1 year standard warranty. Parts, Labor, even shipping are all included at no cost to you.

During the life of electronic equipment, components may fail. When they do, you need the fastest, easiest, and least expensive repair possible. To meet this need, Phase Matrix offers a variety of services designed to minimize equipment downtime. Please contact Phase Matrix's Customer Service Department for details. Quality, reliability and support, all designed to minimize your cost of ownership.

Phase Matrix, Inc.

Instruments You Can Count On

1230A
1231A

VXIbus Pulse/CW Microwave and Millimeter-Wave Frequency Counters

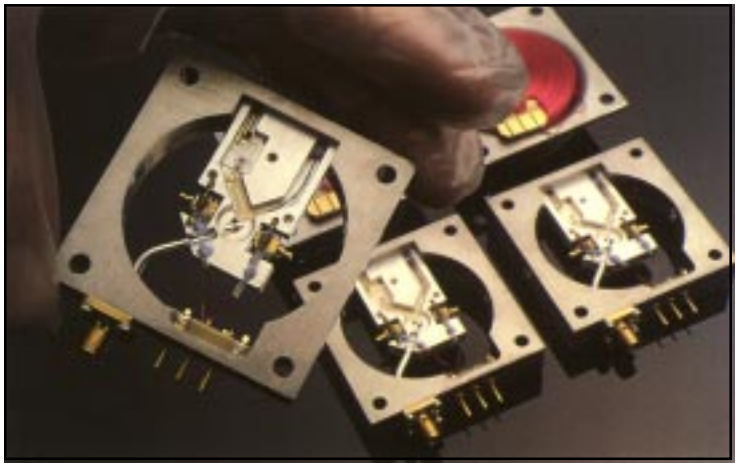
- Pulse/CW Frequency Measurement to170 GHz
- Measure Pulse Parameters
- Profile Time-Varying Frequencies
- Exceptional Frequency Selectivity
- 200 Watt (+53 dBm) Burnout Protection

Pulsed and CW Frequency Measurements in VXIbus

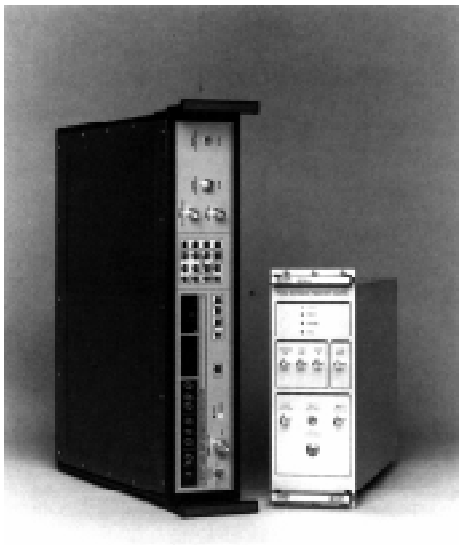
Welcome to VXIbus . . . .

VXIbus (VMEbus Extensions for Instrumentation) is the latest development in high-performance instrumentation architectures. Based on the VMEbus, VXIbus offers a standardized modular environment for automatic test and measurement systems. This environment is designed to provide better system performance through tighter coupling of instrumentation modules, greater flexibility in system configuration through standardization and interoperability, and reduced size through resource sharing.

The EIP/Phase Matrix 123XA brings new capabilities to VXIbus with pulse and CW microwave frequency counters. In only 3 VXI slots, these counters can measure pulsed and CW signals as high as 170 GHz. All are fully compliant with VXIbus specification Revision 1.3/1.4. With the ability to measure pulse widths, pulse periods and time varying frequencies, the 123XA series add high-performance microwave and millimeter-wave measurements to your VXIbus system.



Both the 1230A and 1231A feature Phase Matrix's unique YIG preselected heterodyne down-converter, which provides 10 watts CW burnout protection.



Reduced size realized using VXIbus

and the Phase Matrix 1230A and 1231A Pulse/CW Frequency Counters

The Phase Matrix/EIP 1230A and 1231A are the ultimate pulse/CW microwave frequency counters. Designed for demanding applications in R&D, on the production floor, and in maintenance and calibration facilities, these counters bring new levels of measurement capability to your high performance VXIbus applications. Only Phase Matrix counters feature a YIG-preselected microwave input, which provides unparalled frequency selectivity, amplitude discrimination, and burnout protection. These counters also feature the ability to make frequency measurements at a specific point in time on the repetitive signals, simplifying frequency profiling of signals whose frequencies vary with time.

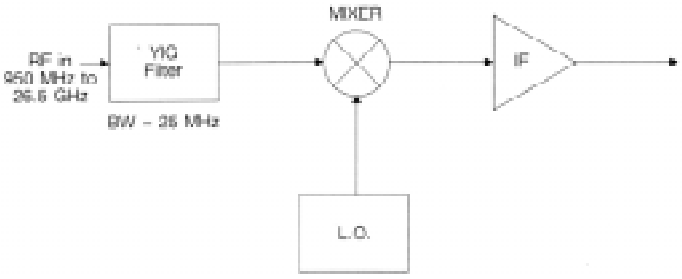
The Phase Matrix/EIP 1231A measures pulsed and CW frequencies up to 20 GHz, and the 1230A extends that range to 26.5 GHz. With options for high-stability time bases and millimeter-wave frequency coverage (up to 170 GHz), these high performance counters are ideally suited for applications such as:

- Pulse Profiling
- Carrier Frequency Measurement
- Pulse Parameter Measurements
- Automatic VCO Characterization
- Frequency Agile System Analysis

Unsurpassed Performance, Accuracy and, Capability

Automatic Pulsed and CW Frequency Measurements

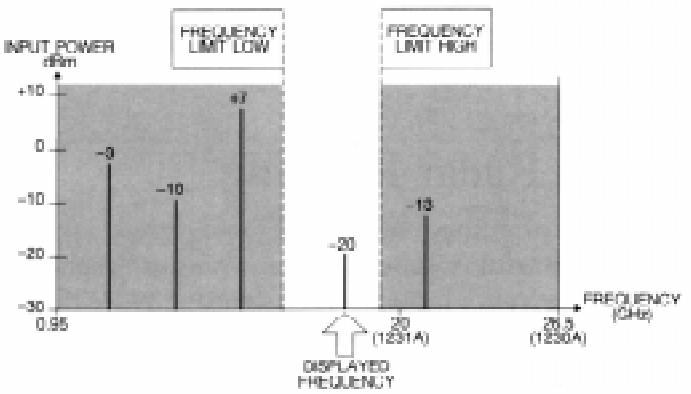
Just connect the signal under test to the 123XA input and read the result. The counter will automatically detect and measure the CW, FM, AM, or pulsed RF signals with pulse widths as narrow 50 ns. Limited frequency search modes, such as Center Frequency and Frequency Limits, provide faster acquisition and measurement of low PRF signals.



Phase Matrix's frequency selective heterodyne technique with unique YIG filter front end offers benefits not available in any other counter

Exceptional Frequency Selectivity

Like modern microwave spectrum analysers, Phase Matrix counters are preselected. The YIG-preselector prevents harmonics and other out of band spurious signals from interfering with the measurement of the desired signal. Phase Matrix counters can quickly and reliably select any desired signal in a multi-signal environment, even if it is not the highest amplitude signal, eliminating false readings and reducing measurement time.

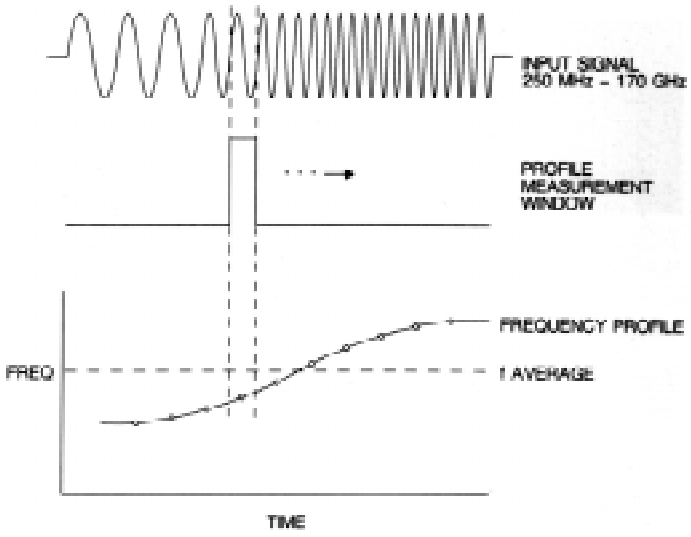


Frequency High/Low Limit allows the measurement of a lower amplitude signal in the presence of higher amplitude signal.

Flexible Frequency Profiling

The 1230A and 1231A feature flexible external gating for applications requiring more information than the average frequency of the pulse. External gating is the ability of these counters to measure frequency at a specific point in time. By controlling the point in in time at which the counter makes its measurement, frequencies which vary in time may be characterized. The counter measurement window is controlled by an enable pulse (or external gate) which is applied to the counters's INHIBIT INPUT connector.

Measurements of frequency shift across a pulse, as in a radar chirp, or characterization of VCO settling time and post tuning drift, can be made easily. A delaying pulse generator may be used to supply external gates, providing frequency samples as narrow as 15 ns for high-resolution profiles.



Frequency Profiling with samples as small as 15 nanoseconds can be accomplished with the use of an enabling pulse.

High Stability Time Bases

Optional high-stability time bases provide higher accuracy, reducing the need for frequent calibration. With aging rates better than $5x10^{-10}$/day, the calibration cycle can be extended to two years and still maintain kHz accuracy for a 20 GHz frequency measurement.

Versatility For Your Most Demanding Applications

Carrier Frequency Measurement

Measuring the carrier frequency of a pulse, amplitude or frequency modulated RF signal is automatic, even in a multiple signal environment. When the desired signal is not the largest signal present, Frequency Limits or Center Frequency Mode may be used to select the desired signal. The YIG-preselector not only allows measurements in a multi-signal environment , it also filters out lower frequency signals, providing immunity to video interference on the incoming RF (see photo below). When measuring pulsed signals, the counter ignores the first and last 15 ns of the pulse to minimize distortion resulting from transients on the leading and trailing edges. Whatever the signal conditions - multiple signals, AM, FM or pulsed - the Phase Matrix 123XA series can measure accurately and reliably.

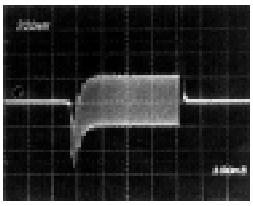


Photo 1

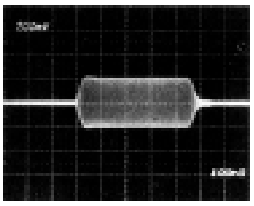


Photo 2

Photo 1 shows extreme video interference on incoming RF. Photo 2 shows the same RF signal after processing by the 1230A/31A's YIG preselected heterodyne down-converter, with error causing video component removed.

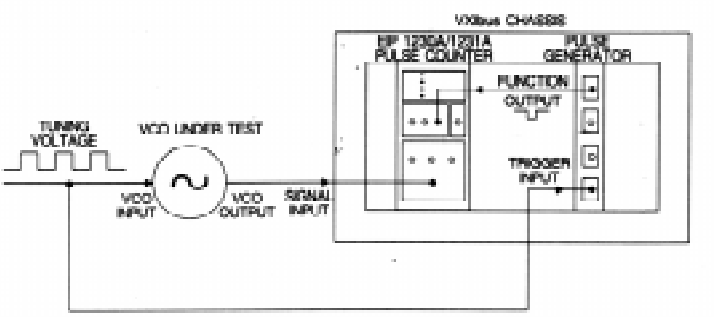
Pulse Parameter Measurements

In addition to frequency measurements, the Phase Matrix 1230A/31A can also accurately measure pulse width and pulse period. Even at 170 GHz, the 1230A can measure pulse widths as narrow as 50 ns and PRF's as low as 1 Hz with ease.

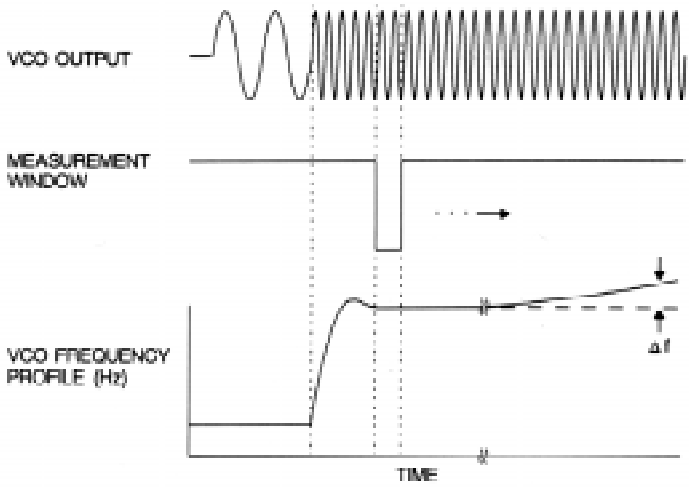
Automatic VCO Measurements

With their flexible external gating, the Phase Matrix 123XA series is ideally suited for VCO characterization. These counters bring high accuracy and performance to measurements of:

- Settling Time
- Post Tuning Drift
- Linearity
- Transfer Characteristics.



Typical test set-up for VCO characterization using the Phase Matrix 1230A/31A.



The flexible frequency profiling capability of the Phase Matrix 1230A/31A simplify VCO settling time and post tuning drift measurement.

Chirp Radar Profiling

The high profiling resolution of these counters makes them powerful solutions for measuring frequency variations across a pulse. With a delaying pulse generator, measurment windows as narrow as 15 ns can be "walked" through the RF pulse to fully profile the frequency variation.

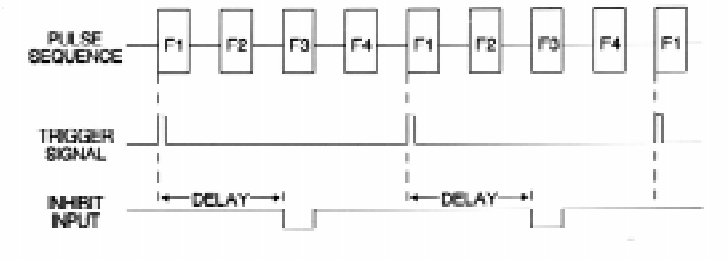
VXIbus For High-Performance Systems

Frequency Agile System Analysis

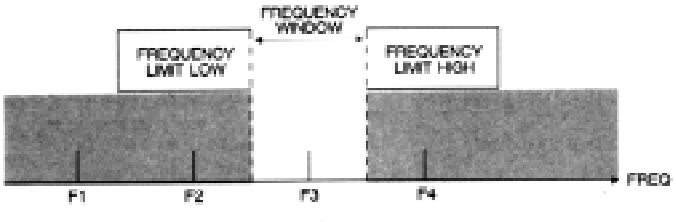
The Phase Matrix 1230A and 1231A are able to measure repetitive sequences of pulses differing in frequency, as in a frequency agile communications system. Either of two techniques may be used: time windowing or frequency windowing.

In the time windowing technique, external gates are used to discriminate between pulses as narrow as 50 ns. By setting the Min PRF function in the counter to the minimum repetition frequency of the pulse of interest, the counter will wait for the appropriate amount of time between measurement windows. By shifting the time delay of the measurement, each RF pulse in the sequence may be measured.

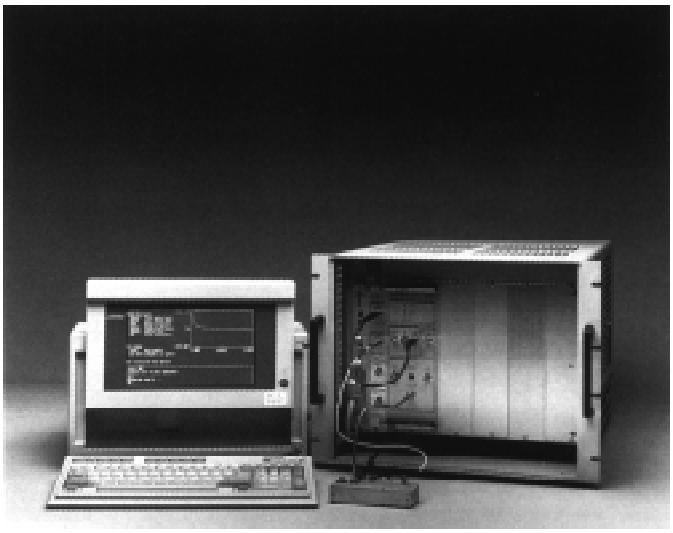
In the frequency windowing technique, the counters YIG-preselector is used to select the pulse frequency of interest. Frequency Limits or Center Frequency Mode is used to set the approximate frequency of the pulse, and Min PRF is set to prevent counter time out. By moving the frequency window, each different frequency in the sequence may be measured.



Time windowing of a frequency agile signal.



Frequency windowing of a frequency agile signal using the 1230A / 31A Frequency Limits feature.



VXIbus Revision 1.3/1.4 Compatibility

The Phase Matrix 1230A and 1231A are fully compatible with the VXIbus specification. These units are message based instruments featuring simple, GPIB-like programming mnemonics. Both counters utilize VXIbus system resources, like CLK10 and ECLTRG. While the 1230A and 1231A can use the VXIbus CLK10 as a time base reference, you may instead want to take advantage of the counters high stability time base as the CLK10 for the system. The counter provides a 10 MHz output on the front panel that may be used for for this purpose. The counter will also accept an external reference through the front panel. External gating for frequency profiling measurements may be applied through a front panel connector or through the VXIbus ECL trigger lines.

Proven Reliability

The Phase Matrix 1230A and 1231A are based on the Phase Matrix 585/588, introduced in 1985. These counters have become the standard in reliability, achieving more than 40,000 hours (19.2 years) of field proven MTBF. Many of the proven components assemblies in the 585/588 and 595/598 are common to the Phase Matrix 1230A and 1231A.

SPECIFICATIONS

	BAND 1	BAND 2	BAND 3 (Option 002)
Frequency Range	0.25 -1 GHz	1231A: 0.95 - 20 GHz 1230A: 0.95-26.5 GHz	26.5-170 GHz
Sensitivity	-15dBm	0.95 - 20 GHz: -20 dBm 20 - 26.5 GHz -15 dBm	-20 dBm (26.5 to 110 GHz) -15 dBm (110 to 170 GHz)
Connector	BNC	1231A: Precision N 1230A: APC 3.5	Depends on remote sensor (See Table)
Impedance	50 Ω nominal	50 Ω nominal	50 Ω nominal
Maximum Input **Damage Level**	+7 dBm +24 dBm	+7 dBm +45 dBm CW +53 dBm peak pulsed (≤1μS pulse, 0.1% duty cycle)	+ 5 dBm +10 dBm
Amplitude **Discrimination**	10 dB (>100 MHz separation)	15 dB (>50 MHz separation)	20 dB
Frequency Limits	N/A	Instrument will ignore signals outside of Frequency Limits[1] Resolution: 10MHz Accuracy: ±50MHz	N/A
Center Frequency	N/A	Instrument will lock on signals ≤50 MHz from entered Center Frequency. Resolution: 10MHz	Instrument assumes any signal present to be in the range ±2 GHz from the specified center frequency.
FM Tolerance **(up to 10 MHz rate)**	Carrier must remain in band	20 MHz P-P	Auto Mode: 20MHz P-P Center Freq: 150 MHz P-P[2]
Acquisition Time[3] **Pulse**	$AQ = \{\frac{1}{MinPRF}\} + 0.055$	Frequency Limits (default): $AQ=0.35+(2x10^{-5})(PP)/GW+60/MinPRF$ $+2\ (FH)(4x10^{-12})[1+(10^4/MinPRF)]$ Center Frequency: $AQ=0.2+(2x10^{-5})(PP)/GW+72/MinPRF$	Automatic: $AQ = \frac{70}{MinPRF} + \frac{(6x10^{-3})(PP)}{GW} + 0.25$ Center Frequency: $AQ = \frac{70}{MinPRF} + \frac{(8x10^{-4})(PP)}{GW} + 0.25$
CW	$AQ = \{\frac{1}{MinPRF}\} + 0.055$	Frequency Limits (default): $AQ = 2(FH)\left[(4x10^{-12}) + \frac{(4x10^{-8})}{MinPRF}\right] + \frac{60}{MinPRF} + 0.3$ Center Frequency: $AQ=0.2+72/MinPRF$	$AQ = \frac{70}{MinPRF} + 0.25$
Measurement Time[3] **Pulse**	$MT = \frac{(4)(PP)}{(GW)(RES)} + 0.1$	$MT = \frac{(PP)}{(GW)(RES)} + 0.2$	$MT = \frac{(4)(PP)}{(GW)(RES)} + 0.15$
CW	$MT = \frac{4}{(GW)(RES)} + 0.1$	$MT = \frac{1}{(RES)} + 0.2$	$MT = \frac{4}{(RES)} + 0.15$
Gate Error[3]	$GE = \pm\frac{0.15}{GW}$	$GE = \pm\frac{0.02}{GW}$	$GE = \pm\frac{0.07}{GW}$
Distortion Error[3]	$DE = \pm\frac{0.03}{PW - (3x10^{-8})}$	$DE = \pm\frac{0.07}{PW - (3x10^{-8})}$	$DE = \pm\frac{0.02}{PW - (3x10^{-8})}$
Averaging Error[3]	$AE = \pm 5 \times \sqrt{\frac{RES}{(GW)(AVG)}}$	$AE = \pm 2.5\sqrt{\frac{RES}{(GW)(AVG)}}$	$AE = \pm 5 \times \sqrt{\frac{RES}{(GW)(AVG)}}$
Accuracy[3] **Pulse** **CW**	$TE_P = \pm AE \pm GE \pm DE \pm TimeBaseError$ $TE_{CW} = TimeBaseError \pm 5$ count	$TE = \pm AE \pm GE \pm DE \pm TimeBaseError$ $TE_{CW} = TimeBaseError \pm 5$ count	$TE = \pm AE \pm GE \pm DE \pm TimeBaseError$ $TE_{CW} = TimeBaseError \pm \left(\frac{freq}{5x10^{-9}}\right)^2$ counts
Maximum Video **Feed-through**	20 dB below signal level. For Video Freq. <250MHz, tolerance is further reduced by 10log(250MHz/fvideo)[4]	20 dB above signal level.	15 mV P-P

[1] Unwanted signals must be greater than 100 MHz from either limit.

[2] Measured frequency is a function of average frequency and geometric center frequency when FM is greater than 150 MHz and nonsymetrical

[3] AE = RMS averaging error (Hz)
AQ = Aquisition time (seconds)
AVG = Number of averages
DE = Distortion error (Hz)
FH = Difference between Frequency Limit High and Low (Hz)
GE = Gate error (Hz)
TE = Total error (Hz)
GW = Logical AND of inhibit input and pulse width -3 x 10^{-8} (seconds)
MinPRF = Minimum PRF counter setting (Hz); for MinPRF>1.2 kHz, use MinPRF = 1200
MT = Measurement Time (seconds)
PP = Pulse period (seconds)
PW = Pulse width (seconds)
RES = Counter resolution setting (Hz); for RES>1MHz, use RES = 10%

SPECIFICATIONS

BAND 0 (CW only)

Frequency Range	10 kHz - 250 MHz (usable to 10 Hz)
Sensitivity	-15dBm
Connector	BNC
Input Impedance	50 ohms nominal
Maximum Input	+7 dBm
Damage Level	+20 dBm
FM Tolerance	Carrier must remain in band
Measurement Time	(1/RES) + 85 ms
Accuracy	ACC = Time Base ± 5 Count

BAND 3

Model 1230A Frequency extended, in bands, up to 170GHz. This requires Option 002, a frequency extension cabling kit (890), and one or more of the following remote sensors:

Remote Sensor	Frequency Range	WaveGuide Size	WaveGuide Flange
091	26.5 - 40 GHz	WR-28	UG-599/U
092	40 - 60 GHz	WR-19	UG-383/U
093	60 -90 GHz	WR-12	UG-387/U
094	90 - 110 GHz	WR-10	UG-387/U
095	50 - 75 GHz	WR-15	UG-385/U
096	33 - 50 GHz	WR-22	UG-383/U
097	26.5 - 50 GHz	K - Conn.*	Coaxial
098	110 - 170 GHz	WR - 6	UG-387/U

STANDARD TIME BASE

Crystal Frequency	10MHz (TXCO)
Stability	
Aging Rate	<1 x 10^{-7}/month
Short Term	<1 x 10^{-9} RMS, 1s average
Temperature	<1 x 10^{-6}, 0° to 50°C
Line Variation	<1 x 10^{-7},± 10% Line voltage change
Warm-Up Time	30 Minutes
Output Frequency	10 MHz sine wave, 1V p – p minimum into 50 ohms.
External Time Base	Requires 10 MHz sine wave, 1V p – p minimum into 300 ohms.

OPTIONAL HIGH-STABILITY OVENIZED TIME BASE

Option	**006**
Aging Rate per 24 hrs (after 24 hours warm-up)	<5 x 10^{-10}
Short Term Stability 1s Average (RMS)	<1 x 10^{-10}
Temperature Stability (0° - 50°C)	<3 x 10^{-9}
±10% Line Voltage Change	<2 x 10^{-10}

*K-Connector is a registered trademark of Wiltron Company

Specifications subject to change without notice.

PULSE PARAMETERS

Pulse Width	100 ns - CW
Minimum Profile Sample	15 ns
Pulse Repetition Frequency (PRF)	1 Hz - 4 MHz
Minimum Off Time	200 ns (will count CW)
Minimum On/Off Ratio	15 dB

PULSE PARAMETER MEASUREMENT

	Pulse Width	Pulse Period
Range	100ns - 1 s	300 ns - 1 s
Resolution	10 ns	10 ns
Measurement Points	-6 dB ± 1.5 dB <peak	-6 dB ± 1.5 dB
Accuracy	±20 ns(Timebase Error)(PW)	

GENERAL

VXIbus Specifications:

Compatibilty	Fully compatible with VXIbus Specification Revision 1.4.
Device Type	Message-based Instrument
Protocol	Word serial.
Module Size	C-size, three slots wide
Net Weight	12.5lbs (Add 1.2lbs for Option 002 and 0.5lbs for Option 006)
Shipping Weight	17.5lbs (Add 1.2lbs for Option 002 and 0.5lbs for Option 006)
Peak Module Current	1.9A (+5v) 1.0A (+12V) add 0.6A for Option 002 and 0.7A for Option 006. 0.2A (-12V) Add 0.6A for Option 002. 1.0A (+24V) 2.0A (-5.2V)
Certifications	Certified for EMI/RFI to EN50011 and EN50082-1 Certified for Safety to IEC 11010 (1990)
Cooling	1mm H_2O @4.7 liters/sec
Warranty	1 year standard (extendable to 3 years)
Resolution	1kHz - 1 GHz (100 Hz in Band 0)
Gate Time	10ms - 1us (dependent upon resolution)

ORDERING INFORMATION

Model 1231A	VXIbus Pulse/CW Microwave Frequency Counter, 20 GHz
Model 1230A	VXIbusPulse/CW Microwave Frequency Counter, 26.5 GHz

OPTIONS

002	Band 3 Frequency Extension Module Available on Model 1230A only.
006	Ovenized High Stability Timebase (Aging Rate: <5 x 10^{-10}/day)
011	Extra Operations Manual (one supplied at no cost)
012	Maintenance and Service Manual (includes operations information)
14	2 Year Warranty Extension (to 3 years total)
15	MIL-STD 45662A Data and Certification

VXIbus Pulse/CW Microwave and Millimeter-Wave Frequency Counters

For More Information Contact:

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20309

Phase Matrix, Inc.™
Instruments You Can Count On

VXIbus

VXIbus Local Oscillator

High-Performance Microwave Local Oscillator Generation for VXIbus Systems

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CE

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