DATASHEET RFS40-X
Specification V1.0

Multi-Channel 100 kHz to 40 GHz Wideband Synthesizer System

Document size:

1 (one) title page
11 (Elf) content pages

DEFINITIONS

The specifications in the following pages describe the warranted performance of the instrument for 23 ±5 °C after a 30-minute warm-up period

Typical: Expected mean values, not warranted performance

Min and max: Parameter range that is guaranteed by product design, and/or production tested. Warranted performance specifications include guard-bands to account for the expected statistical performance distribution, measurement uncertainties, and changes in performance due to environmental conditions.

INTRODUCTION

Multi-Output ultra-low Phase Noise Wideband Frequency Synthesizer with USB & LAN Interface

The RFS40-X is a multi-channel wideband low phase-noise synthesizer settable from 100 kHz to 40 GHz.
The unit is available with 1, 2, 3 or 4 fully independently configurable outputs. For each channel, frequency, power, phase and modulation can be set.
The settable output power range is from -5 to +25 dBm.

The module has a mili-Hz frequency resolution and uses a high-stability internal reference. The internal reference can be phase-locked to a user-settable external reference. For highest phase coherence, multiple RFS40-X can be cascaded with just one master reference clock.

The RFS40-X offers dedicated sweeping capabilities with switching speeds of only 500 μs (20 μs with option FS) and internal phase and narrow pulse modulation.

The module has USB and LAN interfaces (optionally also GPIB) and can be controlled using the SCPI 1999 command set.

FACTS, FIGURES & SPECIFICATIONS

Signal Specifications

PARAMETER	MIN	TYPICAL	MAX	NOTE
Frequency Range	100 kHz		40 GHz	Settable from 9 kHz to 43.5 GHz
Resolution		0.001 Hz		
Phase Resolution		0.01 deg		
		1.5 ms		after SCPI command received
Switching Speed		500 µs		
CW Mode		500 µs		
Sweep / List Mode		20 µs		Option FS
SSB Phase noise at 1 GHz				(see also plot)
at 1 kHz from carrier		-140 dBc/Hz		
at 100 kHz from carrier		-150 dBc/Hz		
Wideband noise		-160 dBc/Hz		
SSB Phase noise at 10 GHz				
at 1 kHz from carrier		-120 dBc/Hz		
at 100 kHz from carrier		-130 dBc/Hz		
Wideband noise		-160 dBc/Hz		
Output power level				(see also plot)
10 MHz to 5 GHz	-10 dBm		+20 dBm	
5 GHz to 18 GHz	-5 dBm		+20 dBm	
18 to 33 GHz	10 dBm		+18 dBm	
33 to 40 GHz	0 dBm		+16 dBm	
Resolution		0.5 dB		
Reverse Power Protection				
DC Voltage		7 V		
RF Power			20 dBm	
Output impedance		50 Ohms		
VSWR		1.8		
Spectral purity				
Output harmonics		-15 dBc		
Sub-harmonics		-75 dBc	-45 dBc	< 20 GHz
		-50 dBc	-30 dBc	>20 GHz
Non-harmonic spurious		-75 dBc	-60 dBc	

Modulation Capabilities

PARAMETER	MIN	TYPICAL	MAX	NOTE
Pulse Modulation				
Modulation source		Internal/ External		
External input amplitude		TTL		
Pulse rise/fall time		10 ns		
On/off ratio		40 dB		Pout > +10 dBm, see plot
Pulse overshoot			10%	
Pulse delay		20 ns		
Pulse polarity		Normal, inverse		selectable
Internal pulse generator				
Repetition frequency (PRF)	0.1 Hz		100 MHz	= 1/T
Duty cycle	1 % to 99 % in 1% steps			within specified minimum pulse width
Minimum pulse settling range	30 ns		20 s	
Pulse Pattern Modulation & Staggered PRF				Using internal pattern generator
Pulse width	30 ns		5 s	
Programmable pattern length	2		65536	
Duty cycle	0.05%		99.95%	
Pulse width resolution		5 ns		
Pulse period (T) accuracy		0.00005xT+ 3ns		
Pulse width accuracy		0.00005xT+ 5ns		
Pulse width resolution		5 ns		
Pulse jitter		2 ns	5 ns	
Polarity		selectable		
Frequency Modulation				
Modulation source		Internal		
Maximum Frequency deviation (peak)		N · 400 MHz		< 1.25 GHz (N=1) 1.25 GHz to 2.5 GHz (N=0.125) 2.5 GHz to 5 GHz (N=0.25) 5 GHz to 10 GHz (N=0.5) 10 GHz to 20 GHz (N=1) 20 GHz to 40 GHz (N=2)
Deviation accuracy		0.50%	2%	
Distortion (THD)		< 1 %		1 kHz rate, 10 kHz deviation
Modulation rate	0.1 Hz		80 kHz	
Modulation waveforms	Sine			
Phase Modulation				
Modulation source		Internal		
Phase deviation (peak)	0		300 · N· rad	
Deviation accuracy		0.50%	2%	
Modulation rate	0.1 Hz		80 kHz	
Modulation waveforms		Sine		
Distortion (THD)		< 1%		1 kHz rate & N x rad deviation

Sweeping Capability, Sweep type: linear, logarithmic, random

PARAMETER	MIN	TYPICAL	MAX	NOTE
Frequency Sweep				
Step time (t_{step})	500 µs 20 µs			 Option FS
Dwell time (t_{dwell})	15 µs			

Frequency Reference

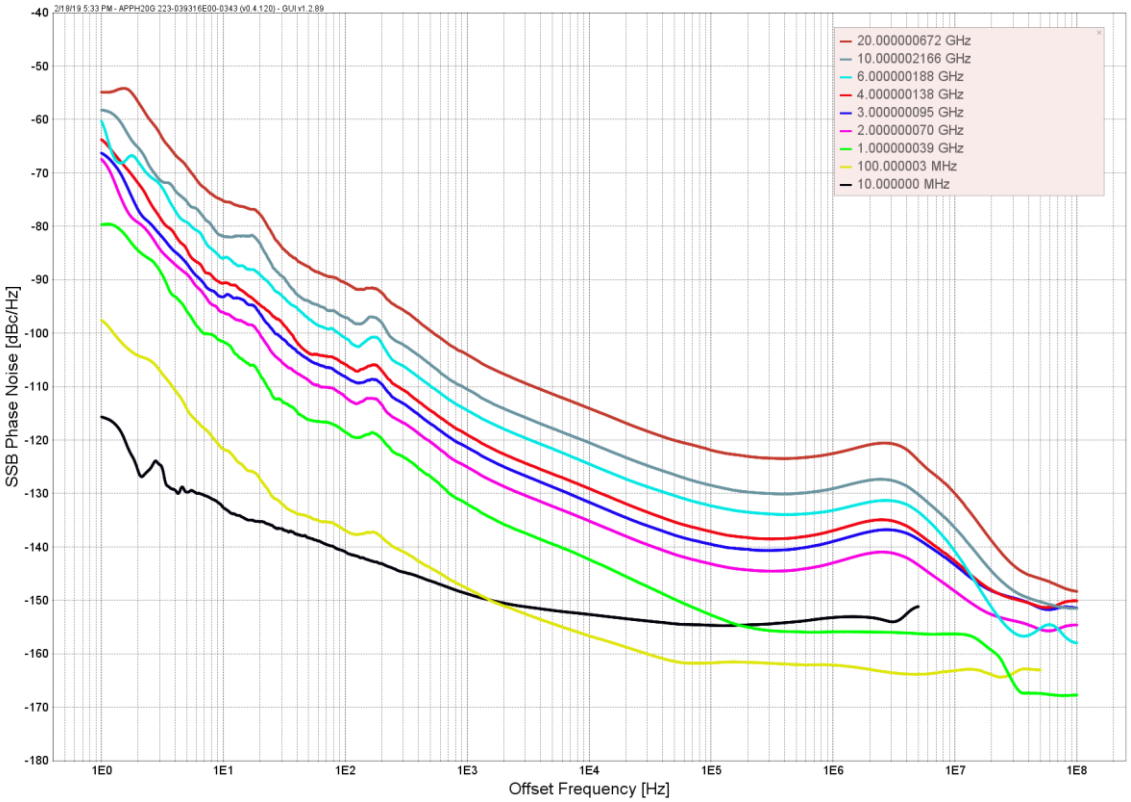
PARAMETER	MIN	TYPICAL	MAX	NOTE
Internal reference frequency		100 MHz 10 MHz		 Option LN
Internal Reference Output Frequency				
Temperature stability			±100 ppb	0 to 50 degC
Aging 1st year			1 ppm 0.3 ppm	 Option LN
Aging per day			5 ppb 0.5 ppb	after 30 days operations Option LN
Warm-up time		5 min		
Output of internal reference		100 MHz		
		10/100 MHz		Option LN
Output power		0 dBm		
Output impedance		50 Ohms		
Bypass Internal reference Input		100 MHz		High phase synchronous mode
Phase Lock to External Reference	1 MHz	10 MHz integer MHz	250 MHz	Option VREF
Reference input level				
10 MHz or 1-250 MHz	-5 dBm	0 dBm	+13 dBm	
Bypass 100 MHz	5 dBm		+15 dBm	
Reference input impedance		50 Ohms		
Lock Range				
10 MHz or 1-250 MHz			±1.5 ppm	
Bypass 100 MHz			>100 ppm	

Trigger (TRIG IN): Input is TRIG IN at front panel

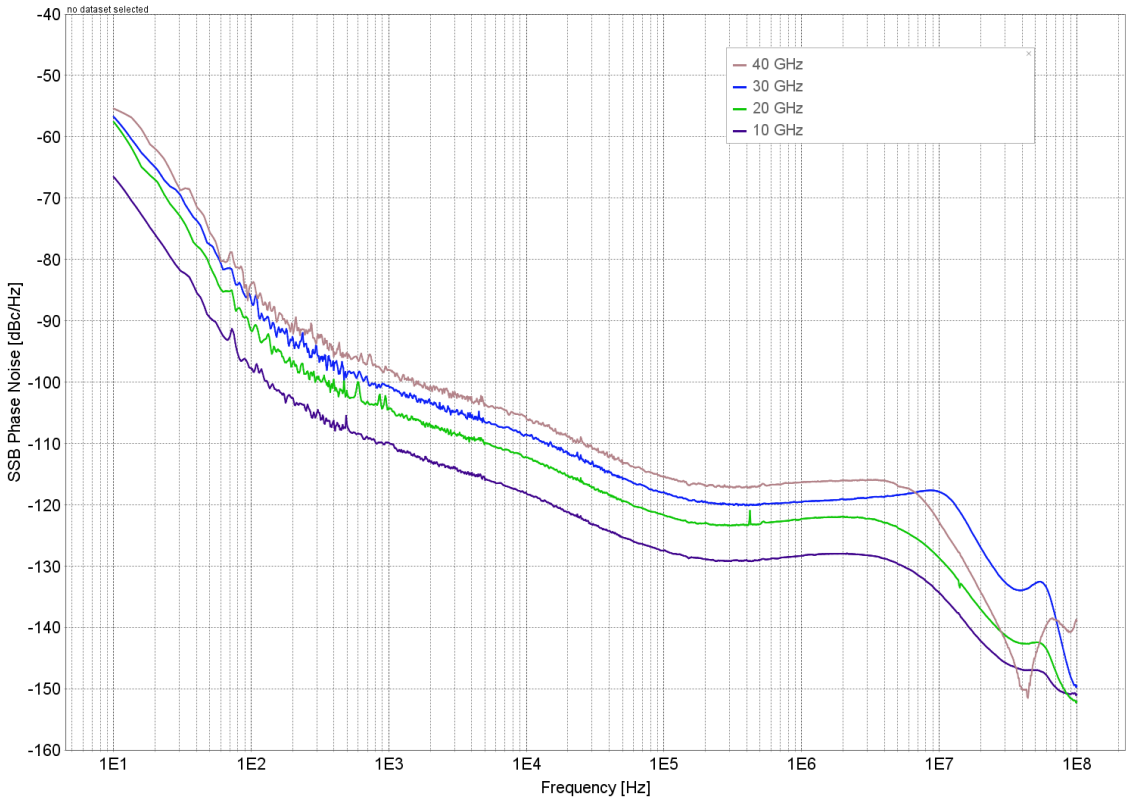
PARAMETER	MIN	TYPICAL	MAX	NOTE
Trigger Types	Continuous, single (point), gated, gated direction			
Trigger Source	external, bus (LAN, USB)			
Trigger Modes	Continuous free run, trigger and run, reset and run			
Trigger latency		5 ns		
Trigger uncertainty		10 ns		
External Trigger delay	50 ns		40 s	
External Delay Resolution		5 ns		
Trigger Modulo	1		255	Execute only on Nth trigger event
Trigger Polarity	Rising, falling			

TYPICAL PERFORMANCE CURVES

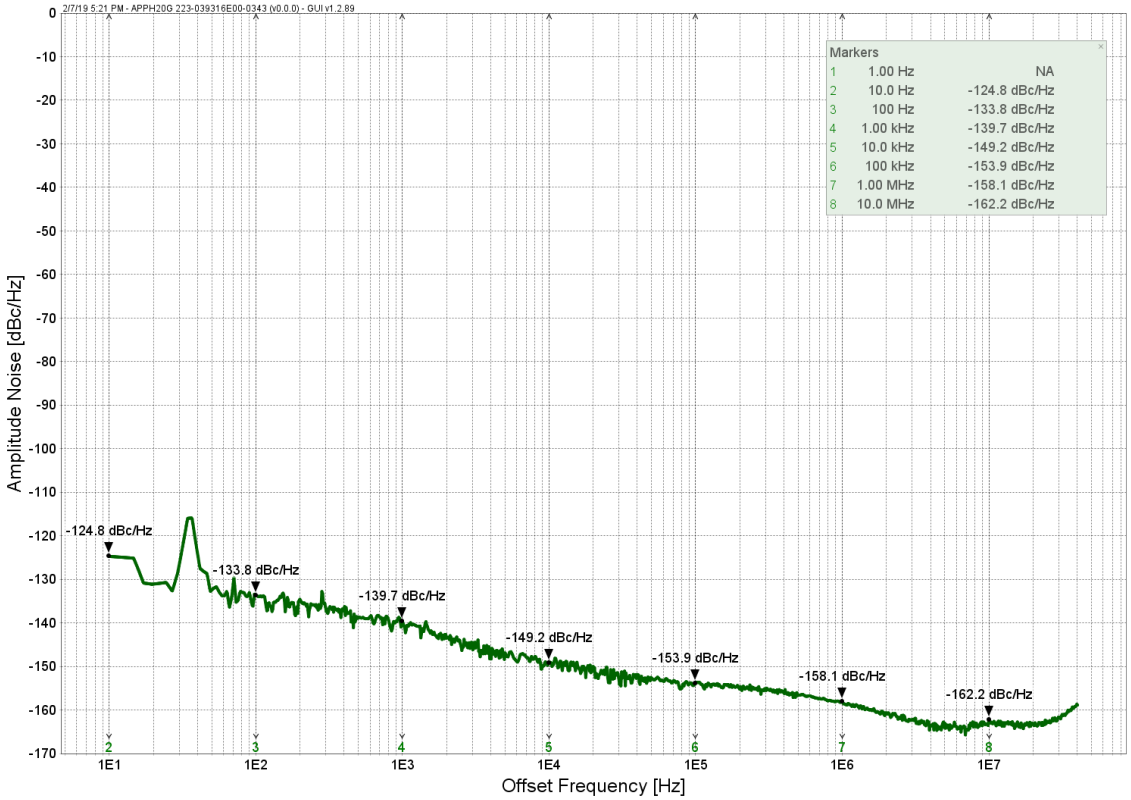
Phase Noise Performance with option LN



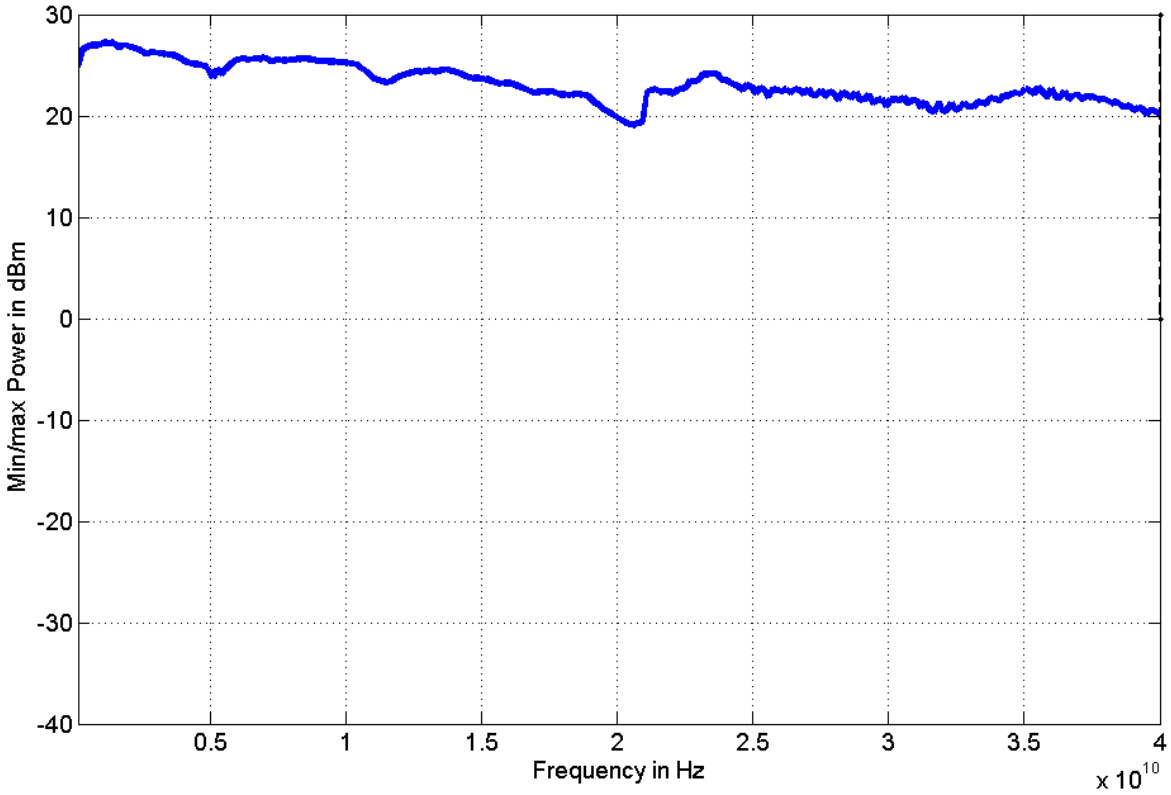
Phase Noise Performance without option LN



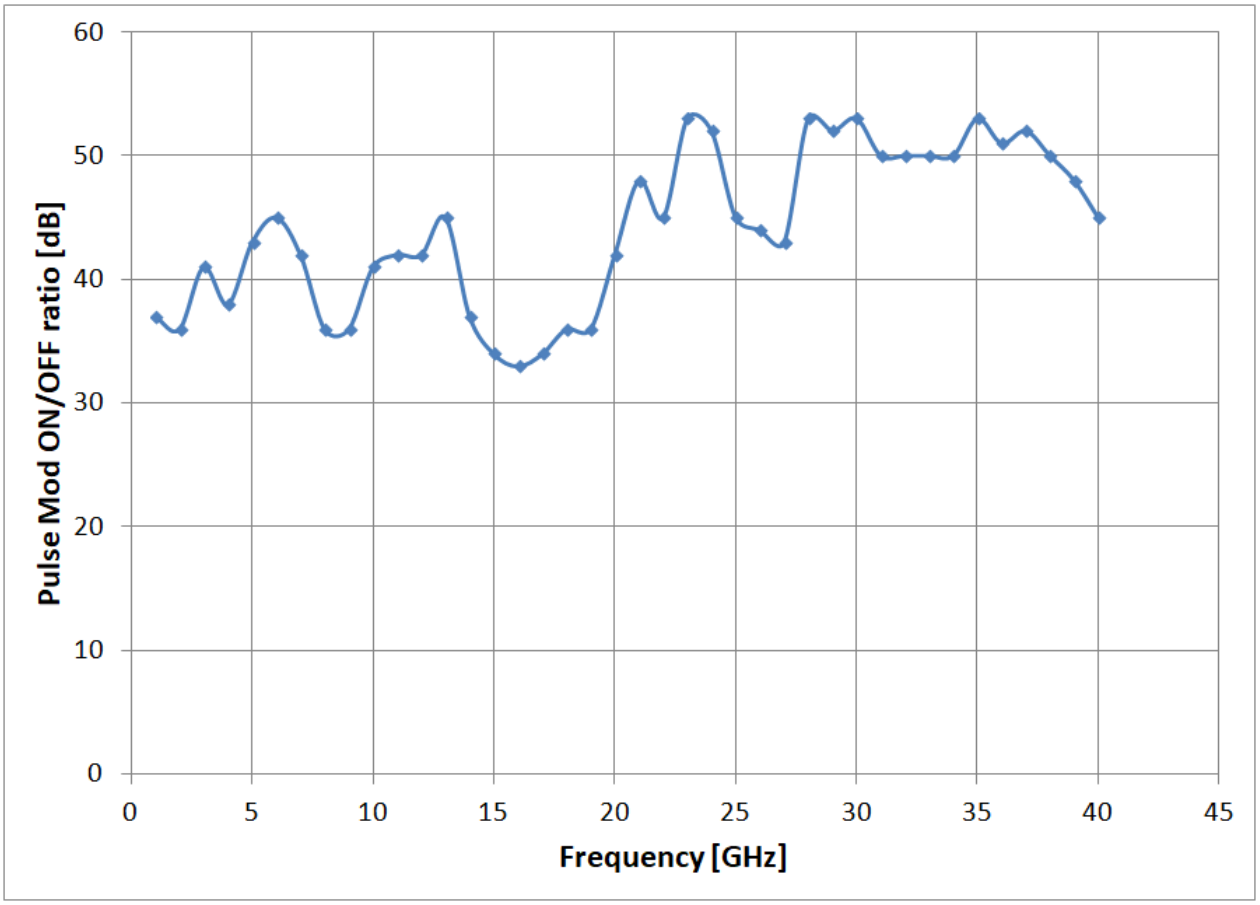
Amplitude Noise at 10 GHz



Maximum Output Power



Pulse Modulation on-off ratio



ORDERING INFORMATION

HOST MODEL	PRODUCT	DESCRIPTION
RFS40-X	**RFS40-1**	Single output, 19" 1HU rack-mount module
RFS40-X	**RFS40-2**	Dual-Output, 19" 1HU rack-mount module
RFS40-X	**RFS40-3**	Triple-Output, 19" 1HU rack-mount module
RFS40-X	**RFS40-4**	Quad-Output, 19" 1HU rack-mount module
RFS40-X	**Option LN**	Enhanced close in phase noise & frequency stability
RFS40-X	**Option FS**	Ultra fast switching speed
RFS40-X	**Option VREF**	Variable external reference
RFS40-X	**Option GPIB**	GPIB interface

GENERAL CHARACTERISTICS

Remote programming interfaces

Ethernet 100BaseT LAN interface, USB 2.0 host & device, GPIB (IEEE-488.2,1987) with listen and talk (optional), Control language SCPI Version 1999.0

Power requirements 24V ± 3.0 VDC; 25 W maximum

Mains adapter supplied: 100-240 VAC in/ 24 V 4.0 A DC out

Environmental (Levels similar to MIL-PRF-28800F Class 3/4)

Operating temperature range 0 to 45 °C

Storage temperature range –40 to 70 °C

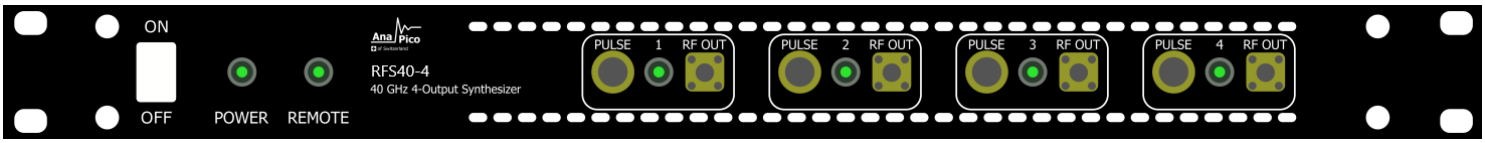
Operating and storage altitude up to 15,000 feet (4600 m)

CE **notice**

Safety/EMC complies with applicable Safety and EMC regulations and directives.

Weight ≤ 10.0 kg (22 lbs) net

Dimensions: 19'' 1HE enclosure: 43 mm H x 426 mm W x 460 mm L [1.7 in H x 16.8 in W x 18.1 in L]



Front view

1. RF outputs: K (2.92 mm) female (1 to 4)
2. External pulse modulation inputs: BNC female (1 to 4)
3. DC power switch

Rear view

1. Internal reference output (SYSREF OUT): BNC female
2. External reference input (SYSREF IN): BNC female
3. Trigger output: BNC female
4. Trigger input: BNC female
5. Internal reference output (REF OUT): BNC female
6. External reference input (REF IN): BNC female
7. GPIB: IEEE-488.2, 1987 with listen and talk (optional)
8.
9. USB 2.0 host and device
10. LAN connection: RJ-45
11. FUSE (3.15 A)

12. AC Power plug

Document History

Version/Status	Date	Author	Notes
V10	2019-02-20	Jk	first release

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