



# DATASHEET APMSYN22 Specification v1.13

Ultra-Agile Frequency Synthesizer

100 kHz to 22 GHz



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## DEFINITIONS

- The specifications in the following pages describe the warranted performance of the instrument for  $23 \pm 5$  °C after a 30-minute warm-up period (unless otherwise stated).

**Min/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.

**Typical:** Expected mean values, not warranted performance.

## INTRODUCTION

- The APMSYN22 is a compact-size, low phase noise, ultra-fast hopping frequency synthesizer for signals in both CW and pulse form. It covers a frequency range of 100 kHz to 22 GHz, switches at 5 us, and offers a power range from -30 to +25 dBm. The phase noise at 1 GHz and 20 kHz offset is -132 dBc/Hz.

The synthesizer is excellently shielded and in a very compact flange-mountable form of 134 x 95 x 25 mm, weighs less than 0.5 kg, and consumes barely 17 W. It features an ETH communication port for local and remote connection to a PC for control over GUI software or SCPI commands.

## FACTS & FIGURES & SPECIFICATIONS

### Signal Specifications

PARAMETER	MIN	TYPICAL	MAX	NOTE
<b>Frequency range</b>	100 kHz		22 GHz	
Resolution		0.001 Hz		GUI SW setting resolution
Phase resolution		0.1 deg		0 to 360 deg
Switching speed in sweep mode		500 $\mu$ s 5 $\mu$ s	10 $\mu$ s	Option FS

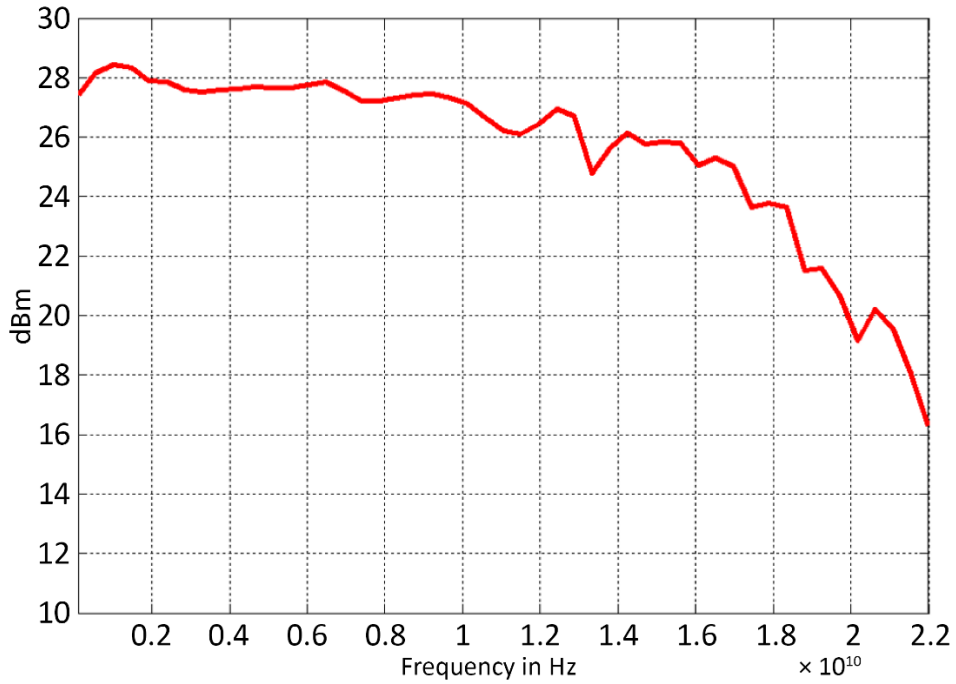
### Frequency Reference

PARAMETER	MIN	TYPICAL	MAX	NOTE
<b>Reference frequency input</b>	100 MHz, 1 GHz			
Reference input level				
100 MHz	-3 dBm		+10 dBm	
1 GHz	-5 dBm		+10 dBm	
Reference input impedance		50 $\Omega$		
<b>Reference frequency output</b>				
Power	2 dBm		8 dBm	1 GHz
Calibrated accuracy of int. reference		$\pm$ 30 ppb		calibrated at 23 $\pm$ 3 $^{\circ}$ C
Temperature stability (0 to 50 $^{\circ}$ C)			$\pm$ 100 ppb	
Aging 1 <sup>st</sup> year		0.5 ppm		
Aging per day			5 ppb	After 30 days operation
Warm-Up time		5 min		
Reference output impedance		50 $\Omega$		

### Level Performance

PARAMETER	MIN	TYPICAL	MAX	NOTE
<b>Output Power level</b>				See plot below
Range				settable from -30 to +30dBm
0.1 – 1 GHz	-20 dBm		+25 dBm	
1 – 10 GHz	-30 dBm		+26 dBm	
10 – 18 GHz	-20 dBm		+23 dBm	
18 – 20 GHz	-30 dBm		+21 dBm	
>20 GHz	-30 dBm		+16 dBm	
Resolution		0.5 dB		

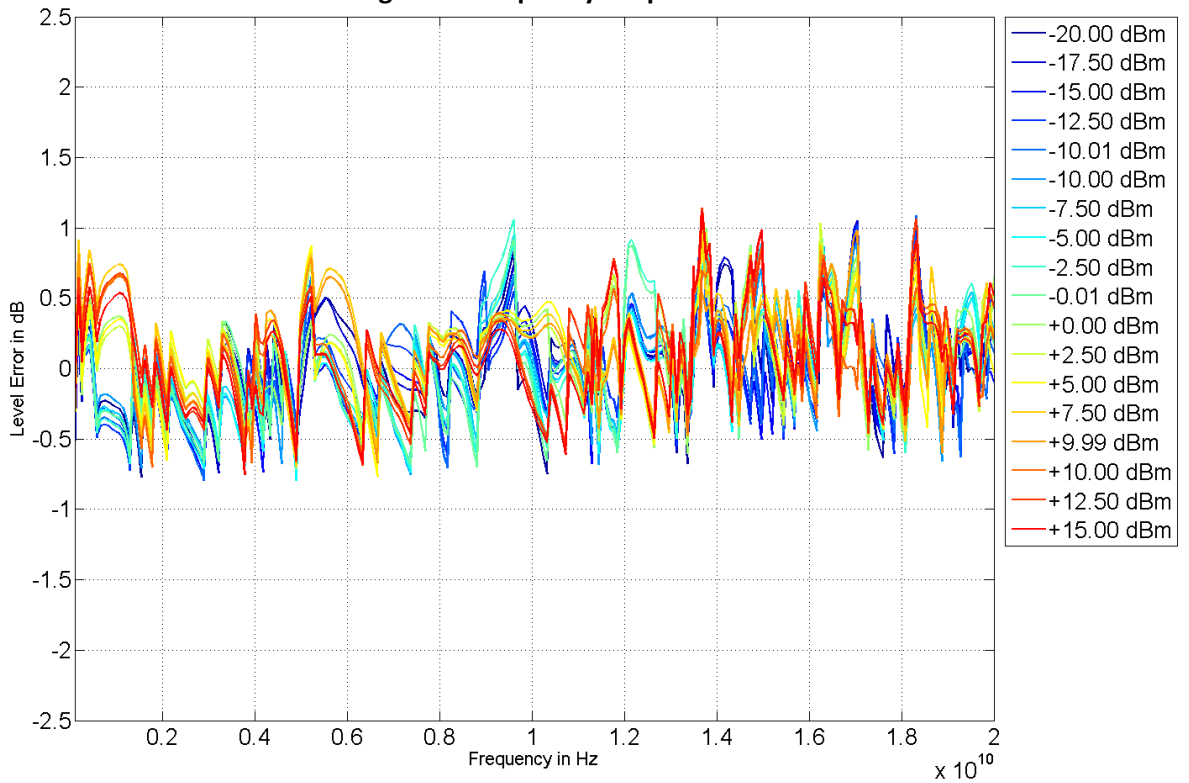
Figure 1: Typical Maximum Output Power



**Level Uncertainty**

PARAMETER	MIN	TYPICAL	MAX	NOTE
Power Level uncertainty 0.1 GHz to 20 GHz < 0.1 GHz or > 20 GHz		±1.5 dB ±1.5 dB	±2 dB	-20 dBm to + 20dBm

Figure 2: Frequency Response



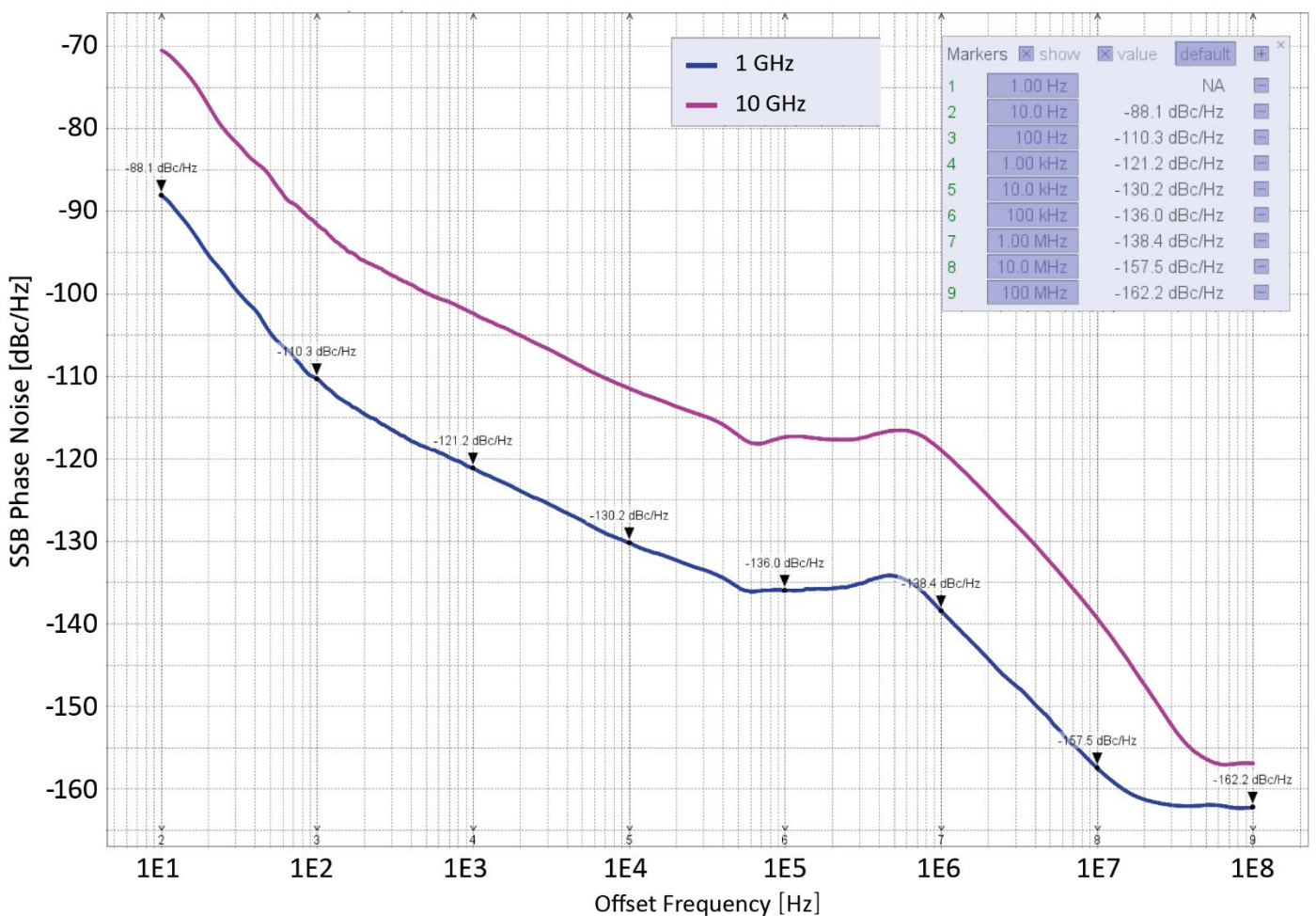
## Reverse Power Protection and VSWR

PARAMETER	MIN	TYPICAL	MAX	NOTE
Output impedance		50 Ω		
VSWR		1.7		
Reverse power protection				
DC voltage			7 V	
RF power			23 dBm	

## Phase Noise

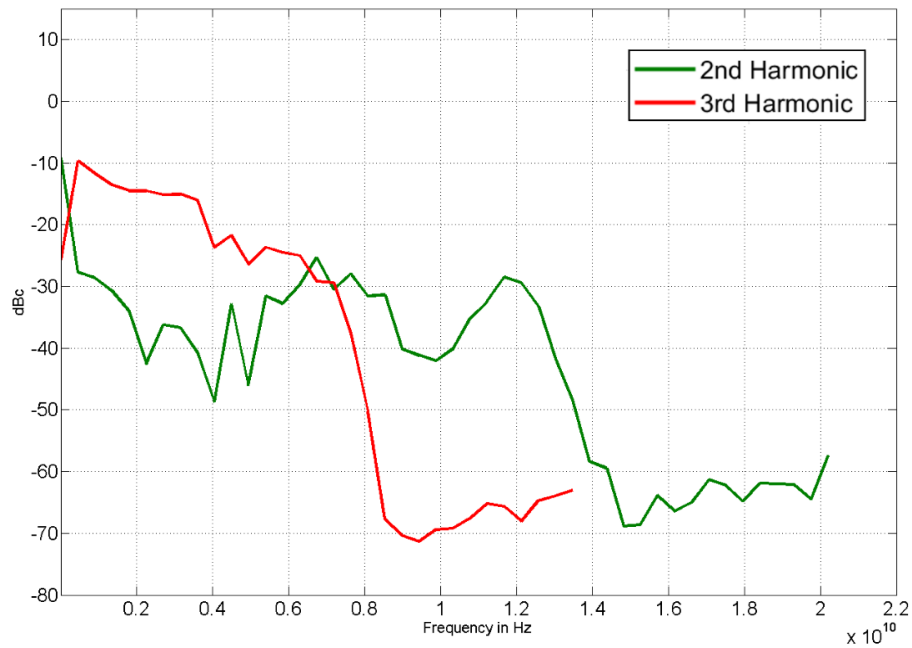
PARAMETER	MIN	TYPICAL	MAX	NOTE
SSB Phase noise at 1 GHz				See also plots
at 10 Hz from carrier		-83 dBc/Hz	-78 dBc/Hz	
at 1 kHz from carrier		-120 dBc/Hz	-115 dBc/Hz	
at 20 kHz from carrier		-131 dBc/Hz	-126 dBc/Hz	
at 10 MHz from carrier		-154 dBc/Hz	-149 dBc/Hz	
SSB Phase noise at 10 GHz				
at 10 Hz from carrier		-70 dBc/Hz	-65 dBc/Hz	
at 1 kHz from carrier		-102 dBc/Hz	-98 dBc/Hz	
at 20 kHz from carrier		-112 dBc/Hz	-107 dBc/Hz	
at 10 MHz from carrier		-140 dBc/Hz	-135 dBc/Hz	

Figure 3: SSB Phase Noise Performance



PARAMETER	MIN	TYPICAL	MAX	NOTE
Output harmonics <4.0 GHz 4.0 – 14 GHz >14.0 GHz		-15 dBc -27 dBc -60 dBc	-5 dBc -20 dBc -40 dBc	$P_{out} = 10$ dBm
Sub-harmonics < 11.0 GHz 11.0 – 20.0 GHz >20.0 GHz		-80 dBc -70 dBc -65 dBc	-70 dBc -60 dBc	$P_{out} = 10$ dBm
Non-harmonic spurious		-65dBc	-55dBc	>10 kHz offset

**Figure 4: Harmonics at 10 dBm Output**



**Figure 5: Wideband Spectrum at 21 GHz output**



## Modulation Capabilities

PARAMETER	MIN	TYPICAL	MAX	NOTE
<b>Pulse modulation</b>				
Modulation source		Internal External		Trigger port can be reconfigured as external modulation port.
On/off ratio				At 10 dBm
< 1 GHz	75 dB	85 dB		
1 GHz to 10 GHz	60 dB	70 dB		
10 GHz to 19 GHz	55 dB	65 dB		
> 19 GHz	50 dB	60 dB		
Repetition frequency	DC		10 MHz	
Pulse width	30 ns		20 s	
Pulse rise/fall time		9 ns		
Pulse train length (pulses)	1		4096	
External input voltage range	-0.5 V		+5.5 V	TTL compatible
External input hysteresis		60 mV		
Delay (to RF)		20 ns	40 ns	

## Sweeping Capability

PARAMETER	MIN	TYPICAL	MAX	NOTE
<b>Sweep parameters</b>	Frequency, power, list			
<b>Sweep type</b>	Linear, logarithmic, random			
Step time	500 $\mu$ s 5 $\mu$ s		20 s 20 s	Option FS
Timing resolution		10 ns		
Timing accuracy per point		20 ns		

### **Generalized list sweep**

Allows for individual setting of frequency, power, step-time, for each point



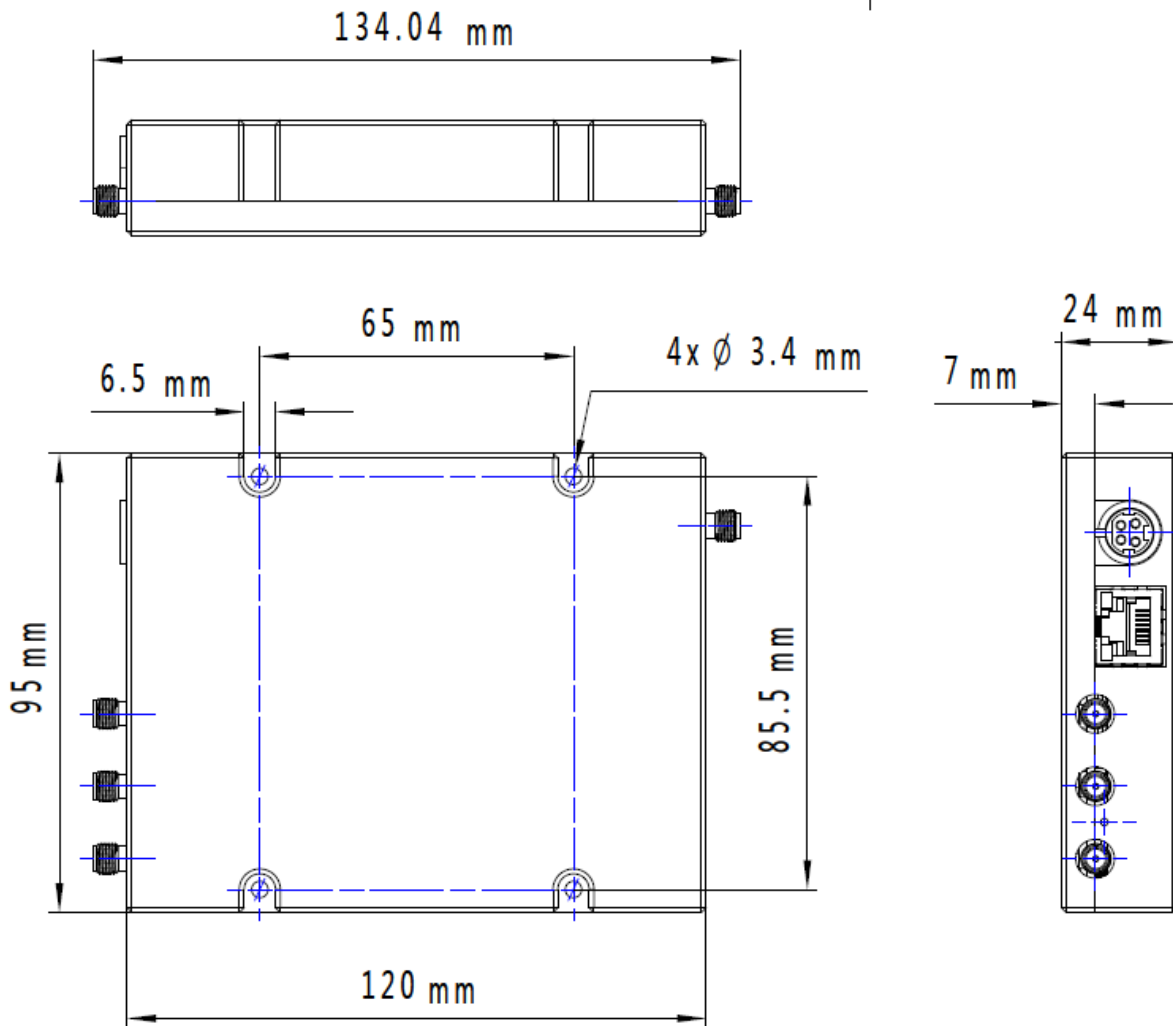
## Trigger (TRIG)

PARAMETER	MIN	TYPICAL	MAX	NOTE
<b>Trigger types</b>		Continuous Single (point) Gated Gated direction		
<b>Trigger source</b>		External		
<b>Trigger modes</b>		Continuous free run Trigger and run Reset and run		
External trigger latency		140 ns		
External trigger uncertainty		20 ns		
External trigger delay	0 s		20 s	Settable
External delay resolution		10 ns		
<b>Trigger modulo</b>	1		255	Execute only on Nth trigger event
<b>Trigger polarity</b>		Rising Falling		
<b>External trigger input threshold</b>	0.85 V	0.9 V	0.95 V	TTL compatible
<b>External trigger input voltage range</b>	-0.5 V		+5.5 V	TTL compatible
<b>External trigger input hysteresis</b>		60 mV		

# MECHANICAL SPECIFICATIONS

## Dimensions & Weight

Dimensions / Weight	
Including connectors	W x L x H = 134 x 95 x 24 mm / 0.45 kg



## Installation Instructions

The module relies on passive cooling. It is mandatory to mount the device on a heatsinking surface. Make sure the synthesizer operates under the conditions specified in this datasheet. Otherwise, the thermal protection will turn off the RF output.

# CONNECTORS

## Front Panel

LABEL	TYPE	DESCRIPTION
1. PWR	LED	Power ON/OFF indicator
2. REM	LED	Remote connection status indicator
3. RF	LED	RF output ON/OFF indicator
4. RF OUT	SMA	RF output



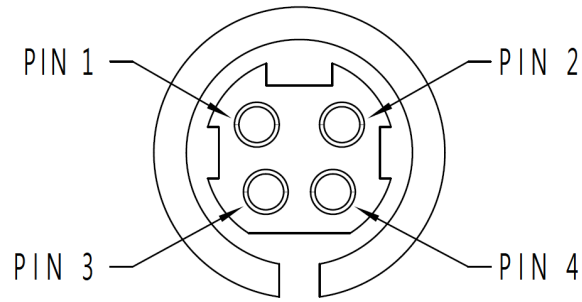
## Rear Panel

LABEL	TYPE	DESCRIPTION
1. DC IN	KPJX-4S (Kycon)	DC input (see also chapter “Power Connector Assembly”)
2. ETH	RJ-45	Ethernet port
3. REF IN	SMA	Reference Signal input
4. TRIG	SMA	Trigger Signal input
5. RST	Button	Reset Button
6. REF OUT	SMA	Reference Signal output



## Power Connector Assembly

The PIN	ASSIGNEMENT
1	GND
2	DC Supply (see also “Power requirements”)
3	GND
4	DC Supply (see also “Power requirements”)



The power connector is a 4 pin, snap and lock receptacle. AnaPico recommends Kycon manufactured plugs KPPX-4P from its KPPX series.

## Reset Functionality

The reset functionality of the device can be used if the device has a wrong configured IP address and cannot be found in the local area network anymore. While pressing the reset button (>2 s), the device will be reconfigured to auto IP addressing mode (DHCP/Zero-conf) and restarts itself. After the device is up and running again, it gets a new IP address and can be discovered by the AnaPico Signal Generator UI.

## ORDERING INFORMATION

HOST MODEL	PRODUCT	DESCRIPTION
APMSYN22	APMSYN22	22 GHz wideband frequency synthesizer module
APMSYN22	Option FS	Fast switching option
APMSYN22	Option NOXO	No internal reference
APMSYN22	Option DATA	Commercial Calibration Certificate with test data
APMSYN22	Option WE	One year warranty extension (standard: 2 years)
APMSYN22	Option ReCal	Recalibration with certificate (recommended: 2 years interval)

## GENERAL CHARACTERISTICS

### Remote programming interfaces

Ethernet interface

Control language: SCPI Version 1999.0

**Power requirements:** 24±6 VDC; 17 W maximum

**Mains adapter supplied:** 100-240 VAC in / 24 V, 2.7 A DC out

**Storage temperature range:** – 40 to 70 °C

**Operating temperature range:** 0 to 45 °C; non-condensing

**Operating and storage altitude:** up to 15,000 feet



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

**Recommended calibration cycle:** 24 months



