Agilent U2020 X-Series USB Peak and Average Power Sensors

User's Guide

Agilent Technologies

Notices

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http://regulations.corporate.agilent.com/DoC/search.htm

NOTE If you are unable to search for the respective DoC, contact your local Agilent representative.

Environmental Conditions

This device is designed for indoor use only.

Environmental condition	Requirements
Temperature	Operating condition: • 0 °C to 55 °C Storage condition: • –40 °C to 70 °C
Humidity	Operating condition: • Maximum: 95% RH at 40 °C (non-condensing) • Minimum: 15% RH at 40 °C (non-condensing) Storage condition: • Up to 90% RH at 65 °C (non-condensing)
Altitude	Operating condition: • Up to 3000 m (9840 ft) Storage condition: • Up to 15420 m (50000 ft)

Regulatory Information

The U2020 X-Series USB peak and average power sensors comply with the following EMC requirements:

- IEC 61326-1:2005 / EN 61326-1:2006
- Canada: ICES/NMB-001: Issue 4, June 2006
- Australia/New Zealand: AS/NZS CISPR11:2004

Contents

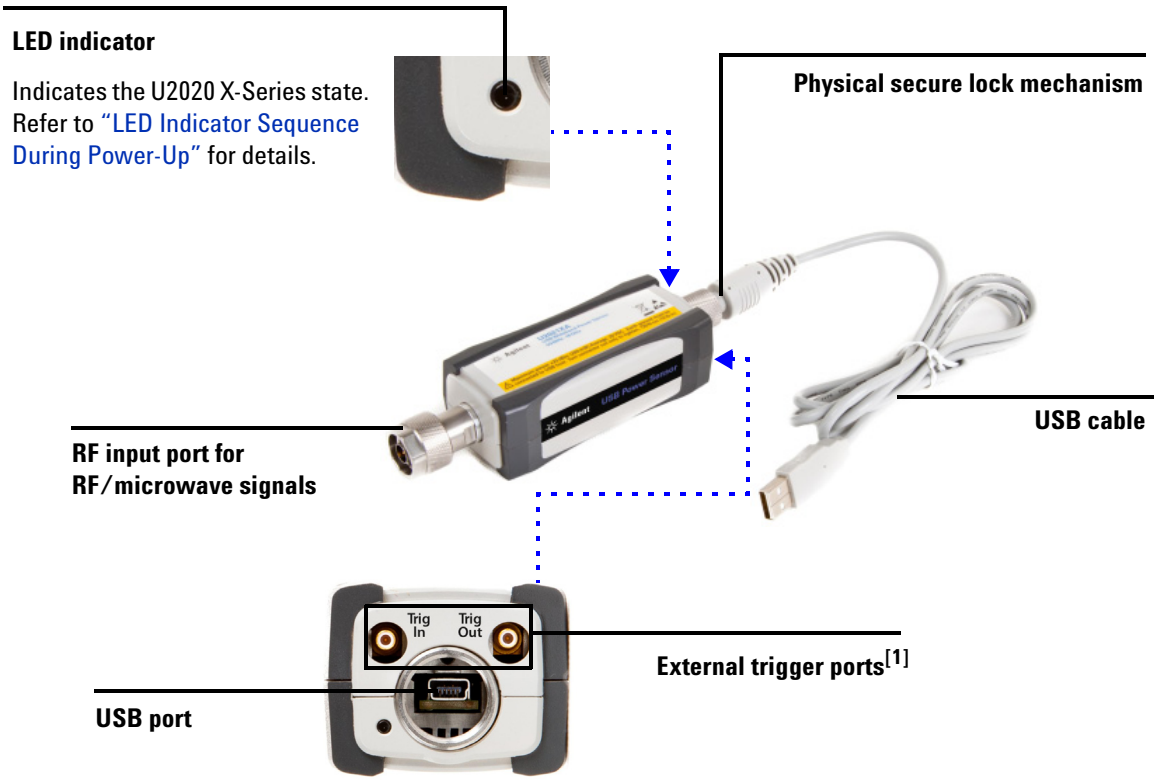
1 Getting Started

This chapter gets you started with the U2020 X-Series USB peak and average power sensors.

Overview

The U2020 X-Series is a USB-based standalone peak and average power sensor and meter. The U2020 X-Series consists of two models; U2021XA (50 MHz to 18 GHz) and U2022XA (50 MHz to 40 GHz).

The U2020 X-Series is capable of measuring the average and peak power of modulated, pulsed, and continuous wave (CW) signals in 50 MHz to 40 GHz frequency range and –45 dBm to 20 dBm power range.



[1] The recorder and video output share the same port as the trigger output.

Initial Inspection

1. Inspect items for damage.
2. Verify that your order is complete.

- If there is mechanical damage or any missing item, notify the nearest Agilent Sales and Service office.
- Keep the damaged shipping material.
- Refer to the contact list for Agilent Sales and Service offices on the last page of this guide.

Standard Purchase Items

2 × Trigger cable, BNC male to SMB female, 50 Ω, 1.5 m

Sensor cable, 1.5 m

Certificate of Calibration

Documentation CD-ROM

Automation-Ready CD-ROM

N1918A CD-ROM

Hardware Installation and Configuration

Prior to using the U2020 X-Series, ensure that the following minimum requirements are met:

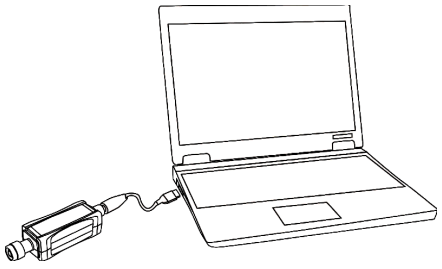
- PC with a USB host capability
- Agilent IO Libraries Suite 15.5 or higher installed
- Agilent N1918A Power Analysis Manager installed[1] *(Option 100 Power Analyzer is bundled with purchase of the U2020 X-Series)*[2]

[1] If you need help with installation, refer to the *N1918A Installation Guide.*

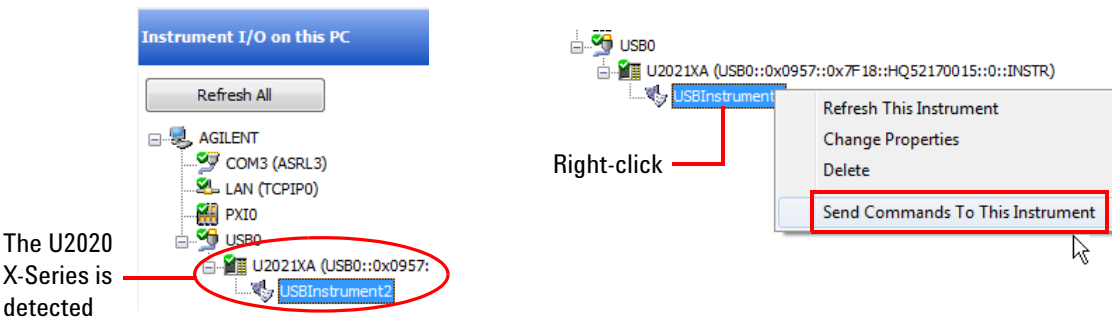
[2] Refer to the *N1918A Data Sheet (5989-6612EN)* or the *Power Analyzer help documentation* for more information on the Power Analyzer functions/features.

Install and verify the U2020 X-Series

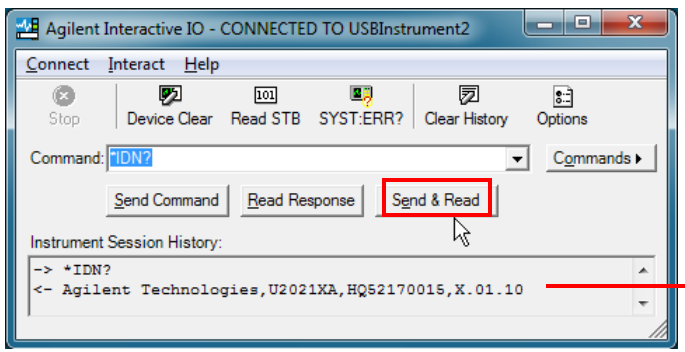
1 Connect the U2020 X-Series to the PC. The U2020 X-Series driver is detected and installed automatically.



2 Go to **Start > All Programs > Agilent IO Libraries Suite > Agilent Connection Expert**.

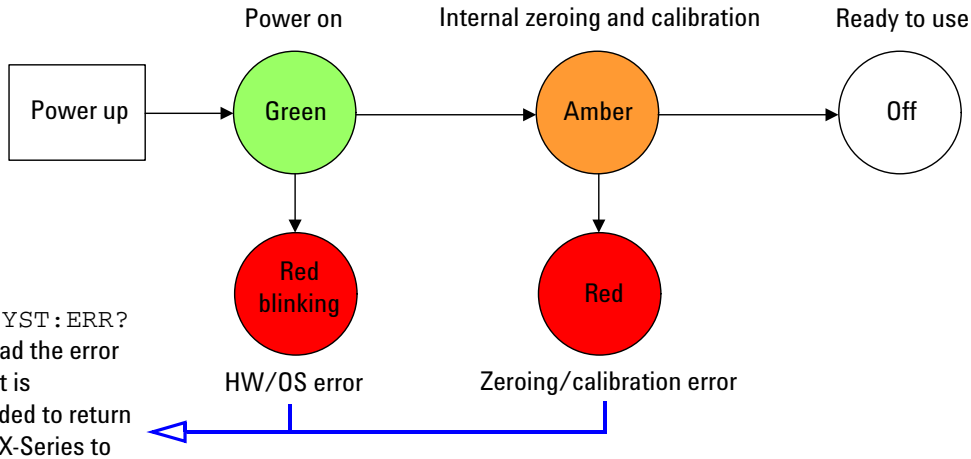


3



This verifies that the U2020 X-Series has been connected and properly installed on the PC.

LED Indicator Sequence During Power-Up



Send the `SYST:ERR?` query to read the error message. It is recommended to return the U2020 X-Series to Agilent if this condition persists after power cycle.

Other LED indicators

Amber blinking	Secure erase, flash formatting, or firmware update in progress.
Red	An error is present in the SCPI error queue including input overload. If the error queue is cleared (via the `*CLS` command) or the last error is read from the queue (via the `SYST:ERR?` query), the indicator will turn off.
Green blinking	USB activity in progress.

Firmware Upgrade

To download the latest firmware version for the U2020 X-Series, go to www.agilent.com/find/pm_firmware. The latest firmware includes the executable file and help file for installing the Firmware Upgrade Utility application in order to upgrade the U2020 X-Series.

2
General Operating Information

This chapter describes the general operating information of the U2020 X-Series.

Using the U2020 X-Series with the N1918A Power Analysis Manager

The Power Analyzer application of the N1918A Power Analysis Manager provides a virtual operating interface for the U2020 X-Series. This chapter describes the U2020 X-Series functions available in the Power Analyzer application.

NOTE For details on how to configure each function of the U2020 X-Series, refer to the *N1918A Power Analyzer help documentation*.

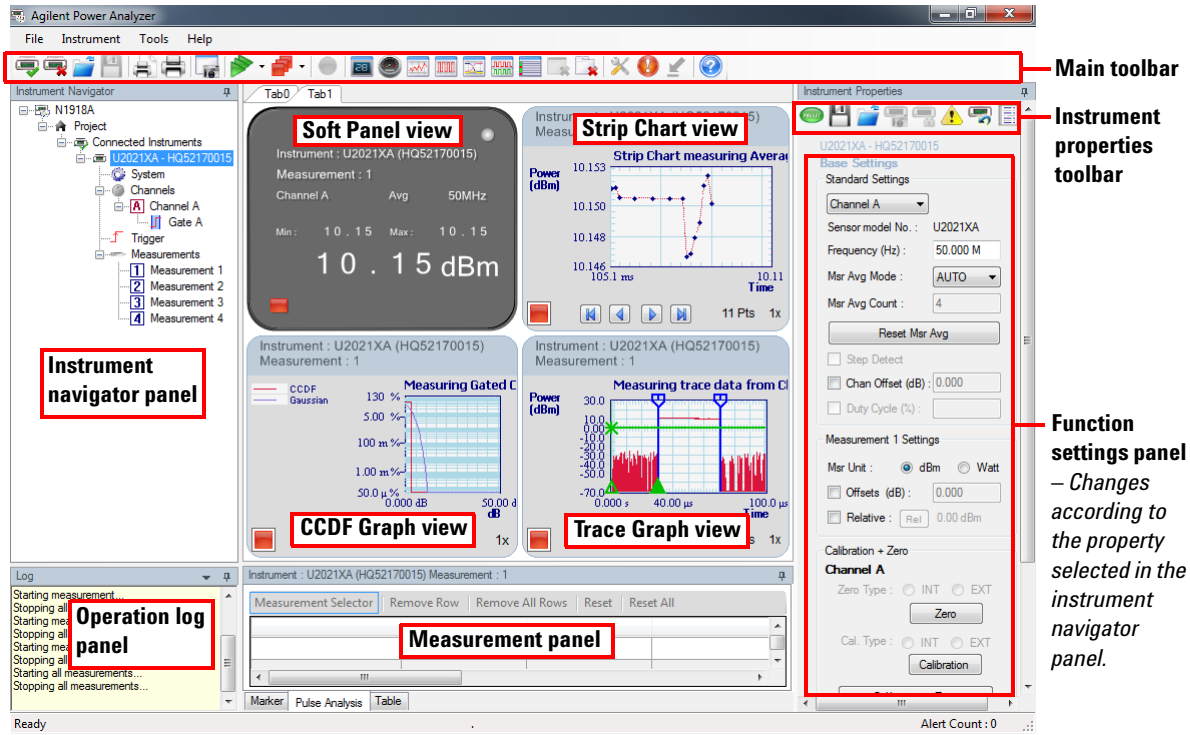


Figure 2-1 General overview of the Power Analyzer user interface

Main Toolbar Functions

Icon	Function
	Connect to the U2020 X-Series.
	Disconnect the U2020 X-Series.
	Open any CSV-supported files.
	Save measurement data as a CSV-supported file.
	Preview a screenshot of the application prior to printing.
	Print a screenshot of the application.
	Save a screenshot of the application as an image file.
	Start the acquisition of all measurements on created tabs/views.
	Stop the acquisition of all measurements on created tabs/views.
	Record and save measurement data in a CSV-supported file.
	Create a new soft panel display view[1].
	Create a new gauge display view[1].
	Create a new strip chart display view[1].
	Create a new trace graph display view[1].

Icon	Function
	Create a new Complementary Cumulative Distribution Function (CCDF) graph display view or a new gated CCDF graph display view[1]. CCDF curves characterize the higher level power statistics of a digitally modulated signal, and are defined by how much time the waveform spends at or above a given power level. • CCDF is applicable in the free-run, internal trigger, and external trigger modes. • Gated CCDF is applicable in the internal trigger and external trigger modes only. You can view traces for Channel A, Gaussian, and Reference.
	Create a new overlay graph display view[1].
	Create a multilist display view[1].
	Remove the currently selected view from the application.
	Remove the currently selected tab (including the views in the tab).
	Provide application options and settings configuration.
	Display the alert summary dialog.
	Switch between compact mode and full mode display.
	Provide quick access to the help documentation.

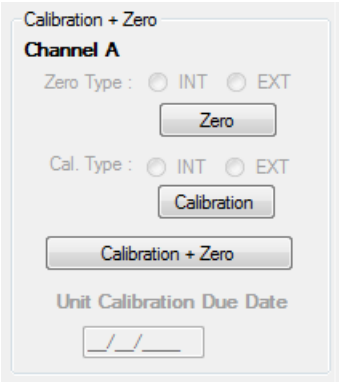
[1] When this icon is selected, corresponding function icons will appear on the toolbar. Refer to the *Power Analyzer help documentation* for details.

Instrument Properties Toolbar Functions

Icon	Function
	Offer a list of preset options for the U2020 X-Series properties settings. The data stored in the FDO tables, the selected FDO table, and the zeroing and calibration data are not affected by a preset.
	Save the U2020 X-Series states.
	Recall any saved U2020 X-Series states.
	Display the error list.
	Reset the U2020 X-Series to its default settings.
	Set the frequency-dependent offset (FDO) (refer to "Simplified measurement path") which compensates for frequency-related changes in the response of your test system. The U2020 X-Series can store 10 FDO tables with 512 frequency points each.

Function Settings

Auto-calibration and auto-zeroing



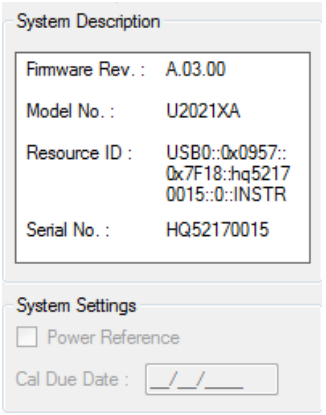
Auto-calibrate the U2020 X-Series without having to connect it to a power reference, or auto-zero the U2020 X-Series with or without the RF/microwave signal present.

Zeroing is recommended:

- when connection to the U2020 X-Series is established.
- every 24 hours.
- prior to measuring low-level signals.

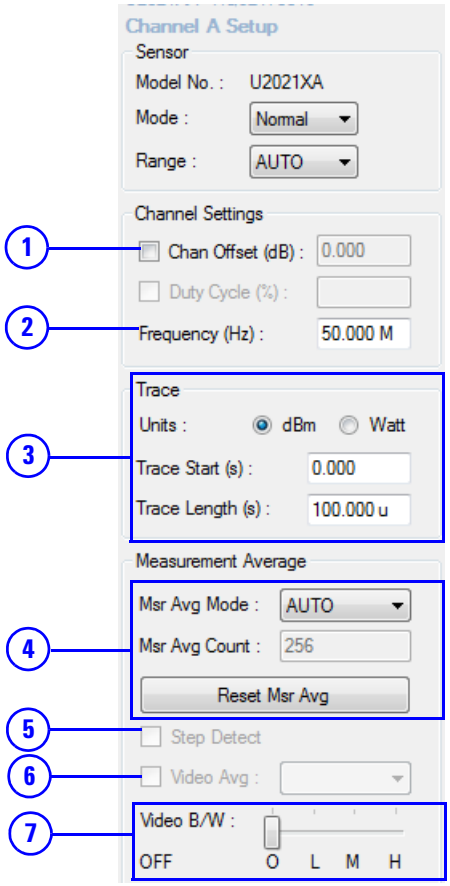
The U2020 X-Series will perform auto-zeroing and auto-calibration every time it is powered up.

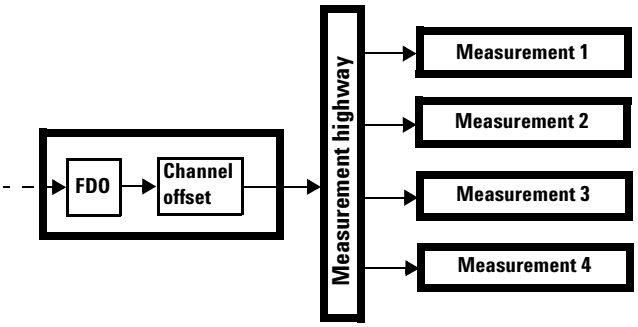
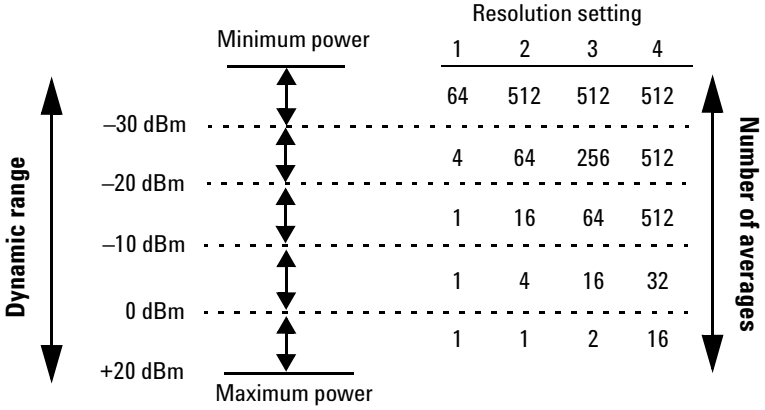
System-related function



Display the system information (firmware revision, model number, instrument identity, and serial number) of the U2020 X-Series.

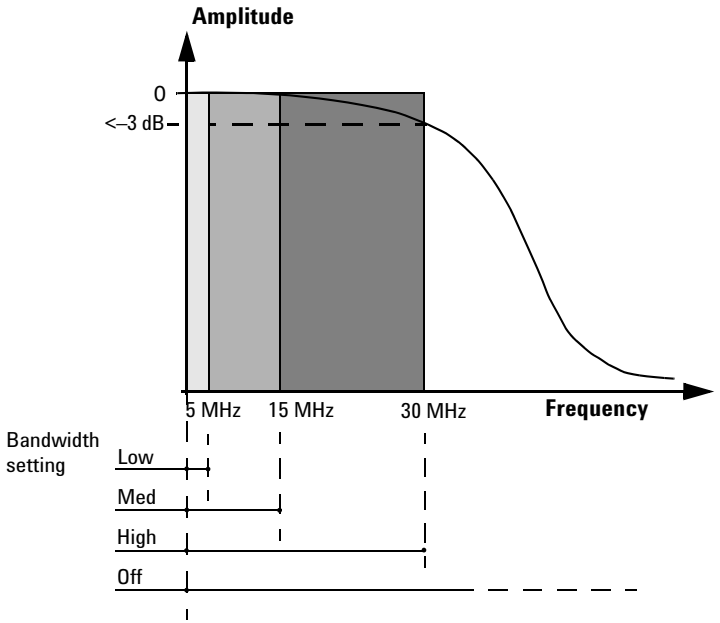
Channel setup functions



No.	Function
1	Set the channel offset which is applied to the measured power prior to any mathematical functions. **Simplified measurement path** 
2	Set the measurement frequency.
3	Set the trace unit, start time, and length.
4	Set the automatic or manual measurement average mode. The number of readings averaged can range from 1 to 1024. Increasing the value of the measurement average reduces measurement noise, but increases measurement time. The measurement average filter can also be reset. Below shows the typical number of averages for each range and resolution when the U2020 X-Series is in the auto-average mode and set to the normal speed mode.  The four resolution levels represent: • 1, 0.1, 0.01, 0.001 dB respectively if the measurement suffix is dBm or dB. • 1, 2, 3, or 4 significant digits respectively if the measurement suffix is W or %.

No.	Function
5	Enable step detection in both manual and automatic average modes. The filter can be set to re-initialize upon detection of a step increase or decrease in the measured power to reduce the filter settling time after a significant step in the measured power.
6	Set the video averaging to average repetitions of a triggered signal, with a count of 1 to 256 in multiples of 2^n. With video averaging, the average of a number of acquisitions is calculated to smooth the displayed trace and reduce apparent noise. The measurement requires a continuously repeating signal.
7	Set the video bandwidth. The Low, Medium, and High pass band shapes achieved by the video bandwidth settings provide flat filter responses with very sharp cut-off points by applying digital signal processing techniques to ensure accurate power measurement within the specified band. When the video bandwidth is set to Off, it removes all digital signal conditioning. This provides less than 3 dB roll-off at ≥500 MHz, and is best suited for capturing an accurate trace, minimizing overshoot, and removing any ringing effects caused by the sharp cut-off filters used in the Low, Med, and High settings.

Bandwidth filter shapes (for ≥500 MHz)

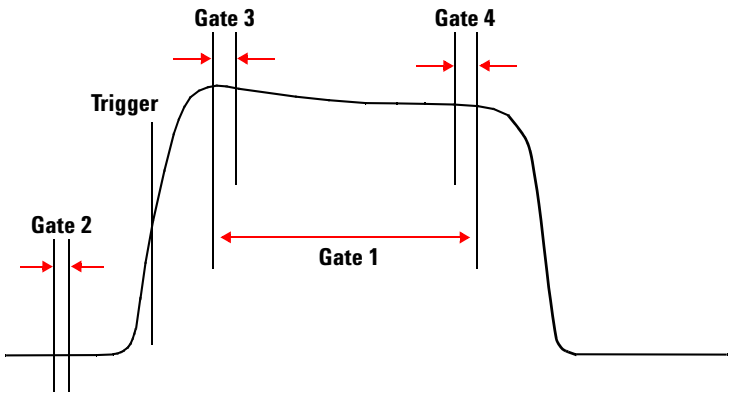


Measurement gates

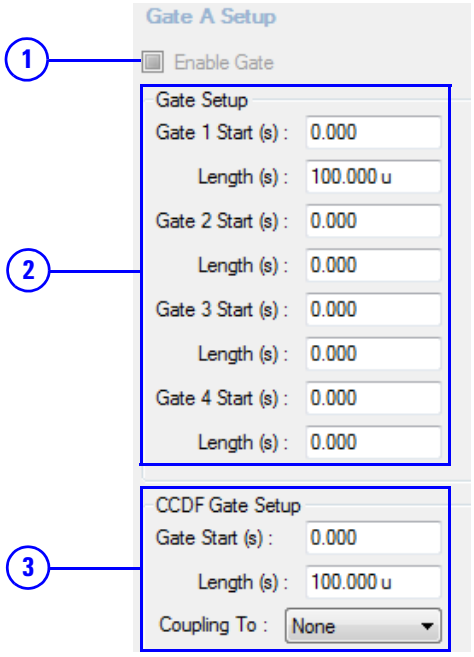
A measurement gate allows measurements to be performed on particular sections of the input signal. The gate is defined by a start time relative to the trigger instant and a duration. Signal samples acquired during the time interval specified by the gate are used for the measurements in that gate. A system of up to four independent gates is provided.

Below is an example of a 4-gate setup to perform the following measurements simultaneously:

Average power level of the pulse	Gate 1, average measurement
Average "off" power level ahead of the pulse	Gate 2, average measurement
Peak-to-average ratio	Gate 1, peak-to-average measurement
Pulse droop	Gate 3, average measurement, minus Gate 4, average measurement

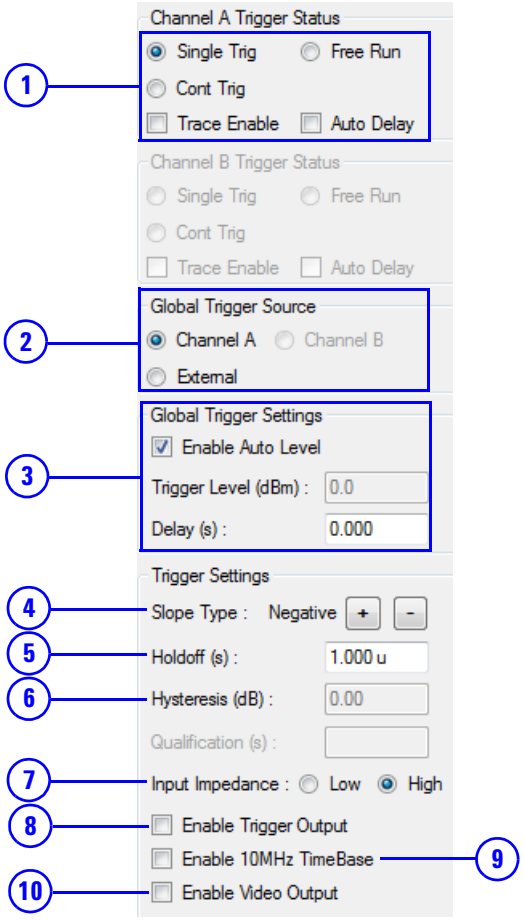


Measurement gate functions



No.	Function
1	**Enable Gate** is always checked and grayed out.
2	Set the gate start time and length. The gate start time is relative to the trigger event. Positive values set a measurement gate, to a maximum time of 1 second, after the trigger. Negative values set a measurement gate, to a maximum time of 1 second, before the trigger.
3	The CCDF gate does not allow a gate start time before the trigger event. For this reason, it has a separate definition and control section in the menu. For greater usability, any of the standard gates can be coupled to the CCDF gate (start time and length are shared).

Trigger functions

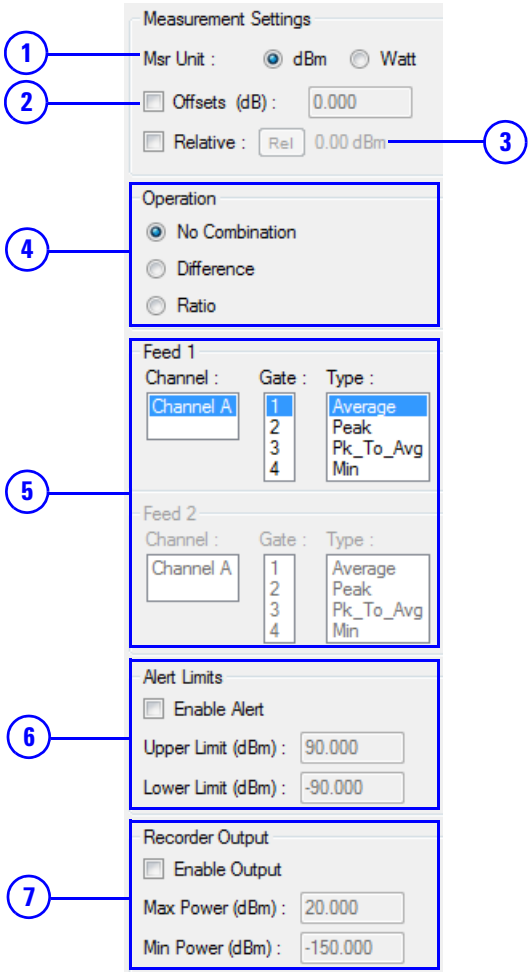


No.	Function
1	Set the single, free run, or continuous trigger mode. Select to enable trace and auto trigger delay for the single and continuous trigger modes. For the free run mode, only auto trigger delay can be enabled.
2	Set the global trigger source to channel A or an external source.
3	Enable auto level or manually set the trigger level if the channel A global trigger source is selected. Set the delay time to be applied between the trigger event and all the gate start times. This allows you to time-shift all the gates by the same amount with one setting change.

No.	Function
4	Select the positive or negative slope type to determine if the trigger event is recognized on the rising or falling edge of a signal respectively.
5	Set the holdoff time to disable the trigger mechanism after a trigger event occurs.
6	Set the hysteresis to help generate a more stable trigger by preventing triggering unless the RF power level achieves the trigger level and the additional hysteresis value. It can be applied to both rising and falling edge trigger generation. Hysteresis is only available for the channel A global trigger source and manual trigger level.
7	Set the input impedance for the external TTL trigger to Low (50 Ω) or High (100 kΩ).
8	Enable the trigger output where a TTL level high is produced at the Trig Out connector when the U2020 X-Series is triggered.[1]
9	Enable the 10 MHz timebase.[1]
10	Enable the video output which provides a DC voltage proportional to the measured input power through an SMB connector.[1]

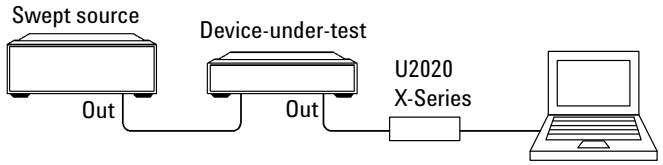
[1] You can only enable either the trigger output or the 10 MHz timebase or the video output at a time.

Measurement functions



No.	Function
1	Set the logarithmic (dBm) or linear (Watt) measurement unit for the currently selected measurement.
2	Set the measurement offset factor. The U2020 X-Series corrects every measurement by this factor to compensate for the gain/loss.
3	Enable the relative mode, which computes the measurement result relative (as a ratio) to a reference value. When enabled, the reference value can be set using the <**Rel**> control. The relative reading is displayed in either dB or %.

No.	Function
4	Enable the difference or ratio measurement, or disable all operations between feed 1 and feed 2.
5	Configure the gate and acquired measurement type for the feed.
6	Enable alerts to detect when a measurement has crossed over a predefined upper and/or lower limit value. Below shows an example of a limits checking application.



The limits have been set at +4 dBm and +10 dBm for the above application. A fail occurs each time the output power is outside these limits as shown below.

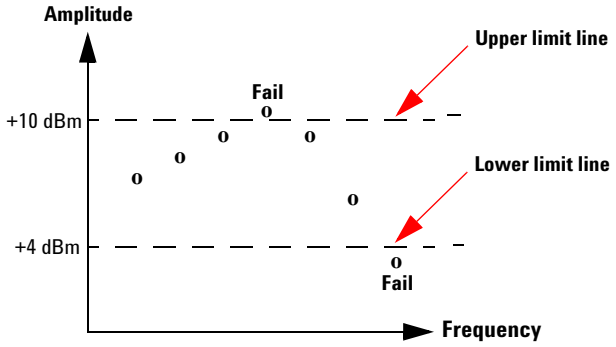


Table 2-1 Range of values for limits

Unit	Maximum	Minimum	Default maximum	Default minimum
dB	+200 dB	–180 dB	60 dB	–120 dB
dBm	+230 dBm	–150 dBm	90 dBm	–90 dBm
%	10.0 Z%	100.0 a%	100.0 M%	100.0 p%
W	100.000 EW	1.000 aW	1.000 MW	1.000 pW

7	Enable the recorder output which produces a DC voltage (0 to 1 VDC) that corresponds to the power level in Watts of the channel. The output impedance is typically 1 kΩ . Channel and display offsets have no effect on the recorder output.

U2020 X-Series Features

List mode

List mode is a mode of operation where a predefined sequence of measurement steps can be programmed into the power sensor and repeatedly executed as many times as required. This mode is suitable for power and frequency sweeps which normally require changing the parameters via the appropriate SCPI commands before performing a measurement. The hardware handshaking communication between the power sensor and the signal source provides the fastest possible execution time in performing the test sequences.

Trigger and gating parameters control which part of the waveform to be included or excluded from the measurement. The list mode helps to analyze modulated signals with regular and time-slotted or frame structure. For example, eight time-slotted GSM bursts, LTE-FDD and LTE-TDD frames and sub-frames, WCDMA frames and slots, and time-slotted measurements are supported in this mode. The desired number of slots and their duration and exclusion intervals can be easily programmed.

NOTE Refer to the *U2020 X-Series Programming Guide* for more information.

Variable aperture size

In average only mode and at normal measurement speed, the time interval length used to measure the average power of the signal can be adjusted by setting the aperture size to between 2 ms and 200 ms. This is useful for CW signals and noise-like modulated signals such as FDD-LTE and WCDMA by performing measurements over the full frames or sub-frames.

Decreasing the aperture size will improve the measurement throughput but reduce the signal-to-noise ratio of the measured signal. However, increasing the aperture size will improve the signal-to-noise ratio of the measured signal but reduce the measurement throughput.

Table 2-2 Aperture size

Measurement speed	Default aperture size	Adjustable
NORMal	50 ms	Yes
DOUBle	26 ms	No
FAST	2 ms	No

Auto burst detection

Auto burst detection helps the measurement setup of the trace or gate positions and sizes, and triggering parameters on a large variety of complex modulated signals by synchronizing to the RF bursts. After a successful auto-scaling, the triggering parameters such as the trigger level, delay, and hold-off are automatically adjusted for optimum operation. The trace settings are also adjusted to align the RF burst to the center of the trace display.

20-pulse measurements

The U2020 X-Series can measure up to 20 pulses. The measurement of radar pulse timing characteristics is greatly simplified and accelerated by performing analysis simultaneously on up to 20 pulses within a single capture. Individual pulse duration, period, duty cycle and separation, positive or negative transition duration, and time (relative to the delayed trigger point) are measured.

High average count reset

When high averaging factors have been set, any rapid adjustments to the amplitude of the measured signal will be delayed due to the need to allow the averaging filter to fill before a new measurement can be taken at a stable power level. The U2020 X-Series allows you to reset the long filter after the final adjustment to the signal's amplitude has been made.

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3 Specifications and Characteristics

This chapter contains the specifications and characteristics of the U2020 X-Series.

Specifications

NOTE

- Warranted specifications are specifications which are covered by the product warranty and apply over a range of 0 to 55 °C unless otherwise noted.
- Characteristic specifications are specifications that are not warranted and are shown in *italics*.

Key specifications		
Frequency range	U2021XA	50 MHz to 18 GHz
	U2022XA	50 MHz to 40 GHz
Dynamic power range	Normal mode	*–35 dBm to 20 dBm (≥ 500 MHz)* *–30 dBm to 20 dBm (50 MHz to 500 MHz)*
	Average only mode[1][2]	–45 dBm to 20 dBm
Damage level	23 dBm (average power) 30 dBm (< 1 µs duration) (peak power)	
Rise/fall time	≤13 ns[3]	
Maximum sampling rate	*80 Msamples/sec, continuous sampling*	
Video bandwidth	*≥ 30 MHz*	
Single-shot bandwidth	*≥ 30 MHz*	
Minimum pulse width	*50 ns[4]*	
Average power measurement accuracy	U2021XA	≤ ±0.2 dB or ±4.5%[5]
	U2022XA	≤ ±0.3 dB or ±6.7%
Maximum capture length	*1 s (decimated)* *1.2 ms (at full sampling rate)*	
Maximum pulse repetition rate	*10 MHz (based on 8 samples/period)*	
Connector type	U2021XA	N-Type (m)
	U2022XA	2.4 mm (m)

[1] Internal zeroing, trigger output, and video output are disabled in average only mode.

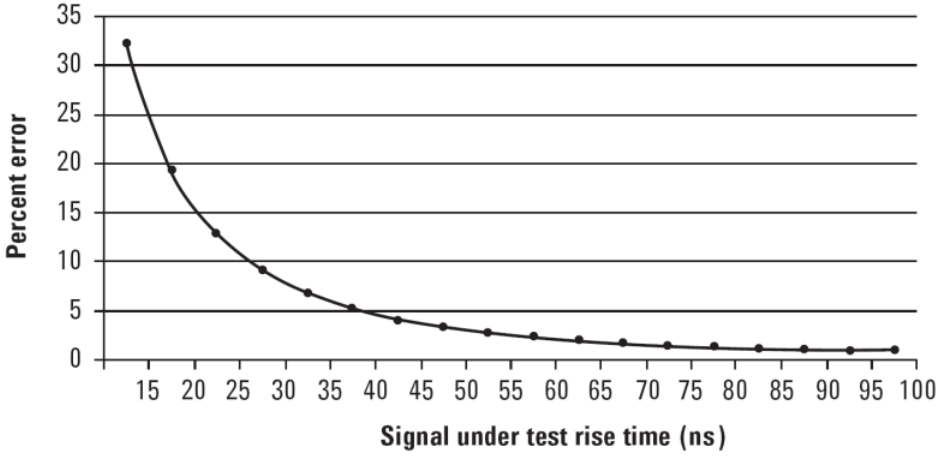
[2] It is advisable to perform zeroing when using the average path for the first time after power on, significant temperature changes, or long periods since the last zeroing. Ensure that the power sensor is isolated from the RF source when performing external zeroing in average only mode.

[3] For frequencies ≥ 500 MHz. Only applicable when the Off video bandwidth is selected.

[4] The minimum pulse width is the recommended minimum pulse width viewable, where power measurements are meaningful and accurate, but not warranted.

[5] Specification is valid over a range of –15 to +20 dBm, and a frequency range of 0.5 to 10 GHz, device-under-test (DUT) max. SWR <1.27 for the U2021XA, and a frequency range of 0.5 to 40 GHz, DUT max. SWR <1.2 for the U2022XA. Averaging is set to 32 in the Free Run mode.

Measured rise time percentage error versus signal-under-test rise time



Although the rise time specification is ≤13 ns, this does not mean that the U2020 X-Series can accurately measure a signal with a known rise time of 13 ns. The measured rise time is the root sum of the squares (RSS) of the signal-under-test (SUT) rise time and the system rise time (13 ns):

Measured rise time = $\sqrt{((\text{SUT rise time})^2 + (\text{system rise time})^2)}$

and the % error is:

% Error = ((measured rise time – SUT rise time)/SUT rise time) × 100

Power linearity

Power range	Linearity at 5 dB step (%)	
	25 °C	0 to 55 °C
–20 dBm to –10 dBm	*1.2*	*1.8*
–10 dBm to 15 dBm	*1.2*	*1.2*
15 dBm to 20 dBm	*1.4*	*2.1*

Video bandwidth

The video bandwidth in the U2020 X-Series can be set to High, Medium, Low, and Off. The video bandwidths stated below are not the 3 dB bandwidths, as the video bandwidths are corrected for optimal flatness (except the Off filter). Refer to "Characteristic peak flatness" on page 27 for information on the flatness response. The Off video bandwidth setting provides the warranted rise time and fall time specifications and is the recommended setting for minimizing overshoot on pulse signals.

Video bandwidth setting		Low: 5 MHz	Medium: 15 MHz	High: 30 MHz	Off
Rise time/fall time[1]	<500 MHz	*<93 ns*	*<75 ns*	*<72 ns*	*<73 ns*
	≥500 MHz	*<82 ns*	*<27 ns*	*<17 ns*	<13 ns
Overshoot[2]	—	—	—	—	*<5%*

[1] Specified as 10% to 90% for rise time and 90% to 10% for fall time on a 0 dBm pulse.

[2] Specified as the overshoot relative to the settled pulse top power.

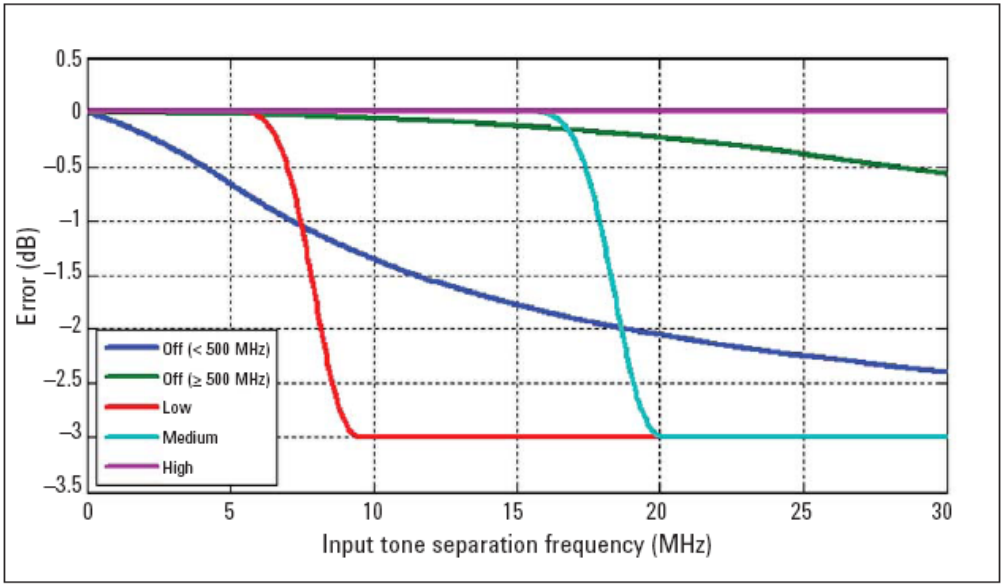
Recorder output and video output

The recorder output produces a voltage proportional to the selected power measurement and is updated at the measurement rate. Scaling can be selected with an output range of 0 to 1 V and impedance of 1 kΩ.

The video output is a buffered version of the uncorrected detector signal from the sensor diode, with no correction applied. The video output provides a DC voltage proportional to the measured input power through an SMB connector. The DC voltage can be displayed on an oscilloscope for time measurements. The video output impedance is 50 Ω and the level is approximately 500 mV at 20 dBm CW. The trigger output and the recorder/video output share the same port.

Characteristic peak flatness

The peak flatness is the flatness of a peak-to-average ratio measurement for various tone separations for an equal magnitude two-tone RF input. The figure below refers to the relative error in peak-to-average ratio measurements as the tone separation is varied. The measurements were performed at –10 dBm.



Noise and drift							
Mode	**Zeroing**	**Zero set**		**Zero drift[1]**	**Noise per sample**		**Measurement noise**
		<500 MHz	**≥ 500 MHz**		**<500 MHz**	**≥ 500 MHz**	
Normal	No RF on input	200 nW		*100 nW*	*3 µW*	*2.5 µW*	*100 nW[2]* (*Free run*)
	RF present	*200 nW*	200 nW				
Average only	No RF on input	10 nW		*6 nW*	*3 µW*	*2.5 µW*	4 nW[3]

[1] Within 1 hour after zeroing, at a constant temperature, after a 24-hour warm-up of the U2020 X-Series. This component can be disregarded with the auto-zeroing mode set to ON.

[2] Measured over a 1-minute interval, at NORMal speed, at a constant temperature, two standard deviations, with averaging set to 1.

[3] Tested with averaging set to 16 at NORMal speed and 32 at DOUBle speed.

Measurement average setting		1	2	4	8	16	32	64	128	256	512	1024
Normal mode	Free run noise multiplier	*1*	*0.9*	*0.8*	*0.7*	*0.6*	*0.5*	*0.45*	*0.4*	*0.3*	*0.25*	*0.2*
Average only mode	NORMal speed noise multiplier	*4.25*	*2.84*	*2.15*	*1.52*	*1.00*	*0.78*	*0.71*	*0.52*	*0.50*	*0.47*	*0.42*
	DOUBle speed noise multiplier	*5.88*	*4.00*	*2.93*	*1.89*	*1.56*	*1.00*	*0.73*	*0.55*	*0.52*	*0.48*	*0.44*

Video bandwidth setting		Low: 5 MHz	Medium: 15 MHz	High: 30 MHz	Off
Noise per sample multiplier	<500 MHz	*0.6*	*1.3*	*2.7*	*1*
	≥500 MHz	*0.55*	*0.65*	*0.8*	*1*

For average only mode with aperture size of ≥ 12 ms and averaging set to 1, the measurement noise is calculated as follows:

Measurement noise = 120/√(aperture size in ms) nW

For average only mode with aperture size of <12 ms and averaging set to 1, the measurement noise is equal to 50 nW.

For example, if the aperture size is 50 ms and averaging set to 1,

Measurement noise = 120/√(50) nW = 17 nW

Effect of video bandwidth setting

The noise per sample is reduced by applying the video bandwidth filter setting (High, Medium, or Low). If averaging is implemented, this will dominate any effect of changing the video bandwidth.

Effect of time-gating on measurement noise

The measurement noise for a gated average measurement is calculated from the noise per sample specification. The noise for any particular gate is equal to Nsample/√(gate length/12.5 ns). The improvement in noise limits at the measurement noise specification of 100 nW.

Maximum SWR

Frequency band	U2021XA	U2022XA
50 MHz to 10 GHz	1.2	1.2
>10 GHz to 18 GHz	1.26	1.26
>18 GHz to 26.5 GHz	—	1.3
>26.5 GHz to 40 GHz	—	1.5

Calibration uncertainty

Definition: Uncertainty resulting from non-linearity in the U2020 X-Series detection and correction process. This can be considered as a combination of traditional linearity, calibration factor and temperature specifications, and the uncertainty associated with the internal calibration process.

Frequency band	U2021XA	U2022XA
50 MHz to 500 MHz	4.2%	4.3%
>500 MHz to 1 GHz	4.0%	4.2%
>1 GHz to 10 GHz	4.0%	4.5%
>10 GHz to 18 GHz	4.5%	4.5%
>18 GHz to 26.5 GHz	—	5.3%
>26.5 GHz to 40 GHz	—	5.8%

Timebase and trigger specifications

Timebase	
Range	*2 ns to 100 ms/div*
Accuracy	±25 ppm
Jitter	*≤1 ns*
Trigger	
Internal trigger	
Range	*–20 to 20 dBm*
Resolution	*0.1 dB*
Level accuracy	*±0.5 dB*
Latency[1]	*225 ns ± 12.5 ns*
Jitter	*≤5 ns rms*
External TTL trigger input	
High	*>2.4 V*
Low	*<0.7 V*
Latency[2]	*75 ns ± 12.5 ns*
Minimum trigger pulse width	*15 ns*
Minimum trigger repetition period	*50 ns*
Maximum trigger voltage input	*5 V EMF from 50 Ω DC (current <100 mA), or* *5 V EMF from 50 Ω (pulse width <1 s, current <100 mA)*
Impedance	*50 Ω , 100 kΩ (default)*
Jitter	*≤8 ns rms*
External TTL trigger output	Low to high transition on trigger event
High	*>2.4 V*
Low	*<0.7 V*

Latency[3]	*50 ns ± 12.5 ns*
Impedance	*50 Ω*
Jitter	*≤5 ns rms*
Trigger delay	
Range	*±1.0 s, maximum*
Resolution	*1% of delay setting, 12.5 ns minimum*
Trigger holdoff	
Range	*1 µs to 400 ms*
Resolution	*1% of selected value (to a minimum of 12.5 ns)*
Trigger level threshold hysteresis	
Range	*±3 dB*
Resolution	*0.05 dB*

[1] Internal trigger latency is defined as the delay between the applied RF crossing the trigger level and the U2020 X-Series switching into the triggered state.

[2] External trigger latency is defined as the delay between the applied trigger crossing the trigger level and the U2020 X-Series switching into the triggered state.

[3] External trigger output latency is defined as the delay between the U2020 X-Series entering the triggered state and the output signal switching.

General specifications

Inputs/Outputs	
Current requirement	450 mA max. (approximately)
Recorder output	Analog 0 to 1 V, 1 kΩ output impedance, SMB connector
Video output	0 to 1 V, 50 Ω output impedance, SMB connector
Trigger input	Input has TTL compatible logic levels and uses an SMB connector
Trigger output	Output provides TTL compatible logic levels and uses an SMB connector
Remote programming	
Interface	USB 2.0 interface, USB-TMC compliance
Command language	SCPI standard interface commands, IVI-COM, IVI-C, and LabVIEW drivers
Maximum measurement speed	
Free run trigger measurement	25000 readings per second[1]
External trigger time-gated measurement	20000 readings per second[2]

[1] Tested under normal mode and fast mode, with buffer mode trigger count of 100, output in binary format, unit in watt, auto-zeroing, auto-calibration, and step detect disabled.

[2] Tested under normal mode and fast mode, with buffer mode trigger count of 100, pulsed signal with PRF of 20 kHz, and pulse width at 15 µs.

General Characteristics

ENVIRONMENTAL COMPLIANCE

Refer to "Environmental Conditions" on page IV.

REGULATORY COMPLIANCE

Refer to "Regulatory Information" on page IV.

DIMENSIONS (Length × Width × Height)

140 mm × 45 mm × 35 mm

WEIGHT

- Net weight: *≤ 0.25 kg*
- Shipping weight: *1.4 kg*

CONNECTIVITY

USB 2.0, with the following cable lengths:

- Option 301: 1.5 m
- Option 302: 3 m
- Option 303: 5 m

RECOMMENDED CALIBRATION INTERVAL

1 year

WARRANTY

3 years

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Contact us

To obtain service, warranty, or technical assistance, contact us at the following phone or fax numbers:

United States:
(tel) (800) 829 4444 (fax) 800 829 4433
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(tel) 31 20 547 2111
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