

Microwave Frequency Counters 3000-series

The ideal counters for Telecommunications Applications

High performance-small portable package

Frequency Counters from **XL Microwave** with built-in Power Meter, provide simultaneous measurement of both frequency and power. These instruments are lightweight, portable, rugged, and combine reliability, durability, and small size. Frequency measurement extends from 10 Hz to the end of the model bandwidth. Simultaneous frequency and power measurement spans 120 MHz (or 200 MHz) to the end of the model bandwidth, using a single input. No external mixers or power sensors are required.

These counters are available with internal Battery power option and various high-stability internal time base standards, including a Rubidium Frequency Standard.

These counters have high sensitivity and fast acquisition time (<60 ms). In addition to power measurement, standard features include computer bus control (GPIB IEEE 488), 0.5 inch high-intensity LED display (visible in all lighting conditions), 115/230 VAC MAINS, and all counters come with a Five-Year Warranty.

All these features, along with the following specifications, make these instruments ideal for telecommunications applications that require high performance and accurate measurement of frequency and power - and all at a very attractive price!

Applications

The microwave counter offers both bench units and battery operated units which may be used in a variety of applications, such as:

- Fixed digital microwave links
- Synchronization of low frequency digital clocks and references (10 Hz-120 MHz)
- Accurate frequency and power monitoring
- Microwave transmitter frequency, power and time base verification

All counters allow up to 50 VDC on the Band 2 microwave input for composite measurements.



Figure 1: Model 3600 showing simultaneous frequency and power display.

Rubidium Frequency Standard Option

Telecommunication professionals often have a requirement to measure and verify microwave base station reference oscillators at remote sites. These base station oscillators require very accurate and precise measurement. The optional internal Rubidium Frequency Standard (with an accuracy of 5×10^{-10}), along with the standard 0.01 Hz resolution in Band 1 (displayed in only 10 seconds!) meets this requirement.

The Rubidium option counters require four minutes of warm-up time and provide measurements only when fully stable - accuracy and reliability you can count on!

Time Base Option

A wide choice of internal time base oscillators are available, in place of the standard TCXO oscillator, including three high stability OCXO oscillators, and a Rubidium Frequency Standard - all internal.

Truly portable with Battery Operation

With the internal battery option, the microwave counters offer true portability, and include a durable Weather-Resistant Instrument Back-Pack. The internal battery typically provides over 3 hours of continuous operation. Combined with its light weight (less than 5 kg/11 lbs including battery and carrying case), the battery powered counters are ideal for field maintenance and test applications. The battery is readily available worldwide, automatically charges whenever the counter is connected to the AC MAINS, and is easily replaced through the rear panel battery access door on the back of the instrument.

Technical data

BAND 1 Specifications

Band 1 INPUT	BAND 1/1 MOhm	BAND 1/1 MOhm	BAND 1/50 Ohm
	<i>(Models below 40 GHz)</i>	<i>(40 GHz and above: models 3400A, 3460A&3600)</i>	
Frequency range:	10 Hz to 120 MHz	10 Hz to 100 MHz	50 MHz to 250 MHz
Sensitivity:	25 mVrms	25 mVrms	-25 dBm
Dymanic range:	25 mV to 1Vrms	25 mV to 1 Vrms	-25 dBm to +10 dBm
Coupling:	AC	AC	AC
Impedance:	1 MOhm/25 pF	1 MOhm/25 pF	50 Ohm nom.
Damage level:	250 VAC+DC to 400 Hz, decreasing to 5V at 1 MHz; 5V from 1 MHz to 120 MHz	250 VAC+DC to 400 Hz, decreasing to 5V at 1 MHz; 5V from 1 MHz to 100 MHz	+25 dBm
Connectors:	BNC female	BNC female	BNC female

BAND 2 Specifications (continuing on the lower part of the next page...)

Band 2 INPUT	3120 (12.4 GHz)	3200 (20 GHz)	3260 (26.5 GHz)
Frequency range:	120 MHz to 12.4 GHz	120 MHz to 20 GHz	120 MHz to 26.5 GHz
Sensitivity:	-30 dBm	-25 dBm	-25 dBm
Dymanic range:	Min. sens. to +10 dBm.	Min. Sens. to +10 dBm	Min. Sens. to +10 dBm
Overload Indicator:	On at +10 dBm nom.	On at +10 dBm nom.	On at +10 dBm nom.
Coupling:	AC	AC	AC
Impedance:	50 Ohm nom.	50 Ohm nom.	50 Ohm nom.
Damage Level:	+25 dBm	+25 dBm	+25 dBm
Connectors:	N female	N female	SMA female plug
Automatic Amplitude Discrimination:	10 dB separation between 2 signals within 30 MHz, 20 dB otherwise	10 dB separation between 2 signals within 30 MHz, 20 dB otherwise	10 dB separation between 2 signals within 30 MHz, 20 dB otherwise
Integ. Kickback Noise:	-50 dBm typical	-50 dBm typical	-50 dBm typical
AM Tolerance:	Any modulation index, provided the minimum signal is not less than the sensitivity spec.		
FM Tolerance:	20 MHz P-P	20 MHz P-P	20 MHz P-P
VSWR (typical):	2:1 typical.	2:1 typical.	2:1 typical.
Signal Acquisition Time:	<60 ms	<60 ms	<60 ms

Oscillator Options Available

	Standard TCXO (Note 1)	Option 112 OCXO	Option 115 OCXO	Option 120 OCXO	Option 125 Rubidium (Note 2)
Short term stability:	$1 \times 10^{-10}/\sqrt{\tau}$ (Allan deviation)	$5 \times 10^{-10}/\sqrt{\tau}$ (Allan deviation)	$1 \times 10^{-11}/\sqrt{\tau}$ (Allan deviation)	$5 \times 10^{-12}/\sqrt{\tau}$ (Allan deviation)	$1.4 \times 10^{-11}/\sqrt{\tau}$ (Allan deviation)
Aging/day:	5.1×10^{-9}	3×10^{-9} after 30 days	5×10^{-10} after 72 hours	4×10^{-10}	5.1×10^{-10} after 4 min 1×10^{-10} after 10 min 2×10^{-11} after 60 min 5×10^{-11} after 30 days
Aging/year:	7.6×10^{-7} after 45 days	5×10^{-7}	1.5×10^{-7} after 7 days	5×10^{-8} 1×10^{-7} after 30 days	2×10^{-9}
Warm-up (time): @ 25°C	4×10^{-7} in 5 min. (Ref. to freq. @ 1 hour)	1×10^{-8} in 20 min.	2×10^{-8} in 30 min. (ref. to freq. @ 3 hrs)	5×10^{-8} in 5 min.	5×10^{-10}
Retrace: @ 25°C	3×10^{-7} after 24 hrs. ON: 24 hrs. OFF, 1 hr. ON (ref. to previous ON freq.)	2×10^{-8} after 72 hrs. ON, 24 hrs. OFF, 12 hrs. ON	2×10^{-8} after 72 hrs. ON, 24 hrs. OFF, 1 hrs. ON	5×10^{-9} after 72 hrs. ON, 24 hrs. OFF, 5 min. ON	5×10^{-11} ref. to freq. reached after 72 hrs. ON, 24 hrs OFF, 1 hr. ON
Temperature: (0°C to 50°C)	1×10^{-6}	1×10^{-8}	1×10^{-8}	7×10^{-9}	3×10^{-11}
MAINS change: ($\pm 10\%$)	5×10^{-9}	1×10^{-9}	1×10^{-9}	2×10^{-9}	N/A
Recommended Calibration:	1 year	1 year	1 year	1 year	N/A
Note 1:	The standard TCXO oscillator is installed in the basic unit unless an optional oscillator is selected.				
Note 2:	Selection of Rubidium Oscillator Option 125 extends the counter chassis depth from 333 mm (13.1 in.) to 368 mm (14.5 in.). Rubidium Oscillator Option 125 is not available with Battery Option 150 counters.				

Band 2 INPUT	3400 (40 GHz)	3460A (46 GHz)	3600 (60 GHz)
Frequency range:	200 MHz to 40 GHz	200 MHz to 46 GHz	200 MHz to 60 GHz
Sensitivity:	-30 dBm to 26.5 GHz -25 dBm to 40 GHz	-30 dBm to 26.5 GHz -20 dBm to 46 GHz	-25 dBm to 40 GHz -15 dBm at 60 GHz (-20 dBm at 60 GHz typical)
Dymanic range:	Min. sens. to +10 dBm	Min. sens. to +10 dBm	Min. sens. to +10 dBm
Overload Indicator:	On at +10 dBm nom. to 26.5 GHz, increasing to +15 dBm at 40 GHz	On at +10 dBm nom. to 26.5 GHz, increasing to +15 dBm at 46 GHz	On at +10 dBm nom. to 26.5 GHz, increasing to +15 dBm at 40 Gz, to +20 dBm at 60 GHz
Coupling:	AC	AC	AC
Impedance:	50Ω nom.	50Ω nom.	50Ω nom.
Damage Level:	+25 dBm	+25 dBm	+23 dBm
Connectors:	2.92 mm female plug	2.92 mm female plug	1.85 mm female plug
Automatic Amplitude Discrimination:	10 dB separation between 2 signals within 30 MHz, 20 dB otherwise	10 dB separation between 2 signals within 30 MHz, 20 dB otherwise	10 dB separation between 2 signals within 30 MHz, 30 dB otherwise
Integ. Kickback Noise:	-50 dBm typical	-50 dBm typical	-50 dBm typical
AM Tolerance:	Any modulation index, provided the minimum signal is not less than the sensitivity spec.		
FM Tolerance:	20 MHz P-P	20 MHz P-P	20 MHz P-P to 40 GHz, decreasing to 10 MHz at 60 GHz
VSWR (typical):	3:1 typical	3:1 typical	3:1 typical
Signal Acquisition Time:	<60 ms	<60 ms	<60 ms

Additional Technical Data

General:

Accuracy:	± 1 count, ± time base accuracy
Gate Time:	1 s, 0.1 s, 0.01 s, & 1.0 ms.
Frequency Resolution:	1 MHz, 100 kHz, 10 kHz, 1 kHz, 100 MHz, 10 Hz, 1 Hz, 0.1 Hz, & * 0.01 Hz.
Display Time:	0.3 s, 3.0 s, Infinite, & Min.
Self-Test:	All digits segments, all LED's, 10 MHz clock, & GPIB address.
Display:	11 digits/0.5" high LED, Overload, decimal point, & sign.
Display Legend:	Hz, kHz, MHz, GHz, & dBm.
Status Indicators:	BAND 1 (or BAND 1/1MΩ, BAND 1/50 Ω), BAND 2, EXT REF, DISPLAY TIME, REMOTE, GATE, ΔF, OVERLOAD (band 2 only), POWER METER (band 2 only), & STANDBY.
ΔF:	Difference between stored and measured frequency. * (Note: 0.01 Hz resolution is frequency dependent)

GPIB (IEEE 488 Std-1978):

Programmable:	BAND 1 (or BAND 1/1MΩ, BAND 1/50 Ω), BAND 2, RESET, TEST, ΔF
Functions/Controls:	DISPLAY TIME, POWER METER, STANDBY, & RESOLUTION

Environmental:

Operating Temperature:	0°C to 50°C (std CW) / -0°C to 40°C (battery operation).
Storage Temperature:	-40°C to 71°C (std CW) / -10°C to 40°C (battery operation).
Relative Humidity:	95% ±5%, 10°C to 30°C; 75%±5%, to 40°C; 45% ±5%, above 40°C.
Vibration Limits:	2g.
Burn-In:	Failure-free burn-in of no less than 100 hours at 40°C.
Pollution Degree:	1 (no pollution) (EN 61010-1)
Transient Overvoltage:	Installation Cat II (EN 61010-1)
Cooling:	Microwave counters do not contain nor require a cooling fan.

Mechanical:

Power DC:	11-28 VDC; 20 VA (Std. CW); 12-28 VDC (Opt. 150); 18-28 VDC (Opt. 125).
Power AC MAINS:	90/130 VAC or 180/265 VAC, 45 Hz-440 Hz; 25 VA.
Power AC MAINS Fuse:	(115V) ½ A/250V SLO-BLO (3AG)(1/4" x 1-1/4). (230V) ¼ A 'T'/250V (IEC 127-III-T Time-lag)(5x20 mm)
Weight Net:	3.6 kg (8 lbs.)/Battery Option 5 kg. (11 lbs).
Weight Shipping:	5.5 kg (12 lbs.)/Battery Option 6.8 kg. (15 lbs).

Accessories Furnished:

1. One (1) Operating/Maintenance Manual.
2. One (1) AC power cord, 2 meters (conforms to IEC 320-3:1987/EN 60 320 and CEE color coding).

Power Meter (Band 2 only):

Frequency Range:	120 MHz (or 200 MHz) to end of band (model specific).
Power range:	-35 dBm (or counter sensitivity), whichever is greater, to +10 dBm max.
Damage Level:	+25 dBm (+20 dBm/model 3600).
Accuracy:	±1 dBm to 26.5 GHz, typical, ±2 dBm to 26.5-40 GHz, typical, ±3 dBm at 60 GHz, typical,
Resolution:	0.1 dBm.
Measurement Time:	Frequency measuring time +15 ms.
Display:	Simultaneous displays Frequency (with 0.1 MHz resolution) and Power.

Internal/External Reference Oscillator:

10 MHz REF OSC OUT:	10 MHz, 1 Vrms into 50 Ohm.
EXT REF OSC IN:	1, 2, 5 or 10 MHz/>0.2 Vrms/1 kΩ
Connectors (IN/OUT):	BNC female (rear panel).

Reliability:

MTBF:	>32,000 hours (MIL-HDBK-217E).
MTTR:	30.92 minutes (MIL-HDBK-472).

Standards Compliance:

EC (European Union):	EMC Emissions:	Certified to EN 55022:1987 Class B
	EMC Immunity:	Certified to EN 50082-1:1992.
	Safety (LVD):	Complies with EN 61010-1.
VDE (Germany):	EMC Emissions:	Certified to VDE 0871/6.78 Class B.
ISO 9001:	The Quality System for design and manufacture is registered and certified by TUV Essen to ISO 9001.	
Montral Protocol:	Nil return.	

Other Options

150 - Battery Option AC MAINS and Internal Battery Powered CW counter. This option includes a Weather-Resistant Instrument Back-Pack and a 12 VDC/2.3 Ah Rechargeable sealed Lead/Acid Battery (approx. 3 hour operating time per full charge). The battery will recharge whenever the counter is connected to AC Mains.

Note: In addition to the standard TCXO oscillator, OCXO oscillators (Options 112&120) are also available with the Battery Option. (Battery and Back-Pack are excluded from instrument's warranty.)

170 - Rack Ears RETMA (H x W) 88.9 mm x 482.6 mm (3.5 in. x 19 in.)

Services

213 Factory Calibration of microwave counters with TCXO oscillators.

214 Factory Calibration of microwave counters with OCXO oscillators.

Accessories

302 Case: Hard shell

326 Case: Watertight, for severe environmental conditions

336 Back Pack: Weather-Resistant Instrument Back-Pack

320 Battery: Spare, 12V/2.3 Ah Rechargeable

305 Manual: Spare Operating and Maintenance Manual

315 Adapter: V (m) to K (f) (model 3600 only)

316 Adapter: V (f) to WR15 (model 3600 only)

317 Adapter: V (f) to WR19 (model 3600 only)

318 Cable: Coax, 0.5 meter, V (m) to V (m) (for use to 60 GHz)

319 Cable: Coax, 1.0 meter, V (m) to V (m) (for use to 60 GHz)

Specifications subject to change without notice

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Experts in time & frequency calibration, measurement and analysis