
1-4. GENERAL DESCRIPTION

1-4.1. The 3000 Series Microwave Frequency Counters are high-performance, system-oriented, bench or rack mounted microprocessor-based counters. Frequency measurements to 3, 8, 12.4, 20, and 26.5 GHz (model dependent) and input power (amplitude) measurements are operational at the front panel or via the rear panel GPIB interface.

1-4.2. The 3000 Series counters are continuous wave microwave frequency counters with measurement ranges of 10 Hz to 3, 8, 12.4, 20, 26.5 GHz. Signals in the frequency range of 10 Hz to 10 kHz are measured by a reciprocal count method. Signals in the frequency range of 10 kHz to 120 MHz are counted by the direct count technique. Signals in the frequency range of 120 MHz to 3, 8, 12.4, 20, 26.5 GHz (model dependent) are down-converted to an intermediate frequency (IF) by a harmonic heterodyne down-conversion technique. The IF count is added to or subtracted from a multiple of the local oscillator frequency to determine the input frequency.

1-4.3. Frequencies above 120 MHz are measured with automatic amplitude discrimination and a power meter is provided to provide amplitude measurements from -35 dBm or the minimum sensitivity of the counter...whichever is greater, to + 10 dBm [-45 dBm (3030); -35 dBm (3080); -30 dBm (3120); -25 dBm (3200/ 3260)].

1-4.4. Resolution and display storage time are selected in steps via front panel controls. An internal microprocessor performs all measurement calculations, taking into account the selected resolution. Measurements are displayed with correctly placed decimal point and unit of measurement on the front panel display.

1-4.5. The front panel is self-explanatory, with well-defined controls and indicators for selecting power, bands, and resolution using push-button toggle switches. Remote GPIB operation is also indicated on the front panel.

1-5. SPECIFICATIONS

1-5.1. Table 1-1 lists the 3000 Series counter specifications; procedures for acceptance testing and calibration make reference to these specifications as a tolerance guide.

Table 1-1. Specifications

INPUT:	BAND 1	BAND 2
Frequency Range:	10 Hz to 120 MHz 10 Hz to 120 MHz 10 Hz to 120 MHz 10 Hz to 120 MHz 10 Hz to 120 MHz	120 MHz to 3 GHz (Model 3030) 120 MHz to 8 GHz (Model 3080) 120 MHz to 12.4 GHz (Model 3120) 120 MHz to 20 GHz (Model 3200) 120 MHz to 26.5 GHz (Model 3260)
Sensitivity:	25 mVrms	-45 dBm to 3 GHz (Model 3030) -35 dBm to 8 GHz (Model 3080) -30 dBm to 12.4 GHz (Model 3120) -25 dBm to 20 GHz (Model 3200) -25 dBm to 26.5 GHz (Model 3260)
Dynamic Range:	25 mV to 1 Vrms	Minimum sens. to + 10 dBm
Overload Indicator:		ON at + 10 dBm nom.
Coupling:	AC	AC
Impedance:	1 megohm/25 pF	50Ω nom
Damage Level:	250 VAC+ DC to 400 Hz decreasing to 5 V at 1 MHz; 5 V from 1 MHz to 120 MHz	+ 25 dBm
Auto. Amp. Discrim:		10 dB separation between 2 signals within 30 MHz, 20 dB otherwise.
AM Tolerance:		Any modulation index, provided the minimum signal is not less than the sensitivity spec.
FM Tolerance (worst case):		20 MHz P-P to 24 GHz; 10 MHz to 26.5 GHz.
VSWR:		2:1 typical.
Connectors:	BNC female	N female (Models 3030, 3080, 3120, and 3200) SMA female super sparkplug (Model 3260).
Signal Acquisition Time:	N/A	< 60 ms.

GENERAL SPECIFICATIONS:

Accuracy:	± 1 count, ± time base accuracy.
Gate Time:	10 sec, 1 sec, 0.1 sec, .01 sec., 1.0 ms.
Resolution:	1 MHz, 100 kHz, 10 kHz, 1 kHz, 100 Hz, 10 Hz, 1 Hz, 0.1 Hz, 0.01 Hz (0.01 Hz is frequency dependent). 0.1 dBm (power).
Display Time:	0.3 sec, 3.0 sec, Infinite & Min.
Self-Test:	All digit segments, all LED's and 10 MHz clock.
Display:	11 digits, LED 0.5" high, Overload, decimal point, sign.
Display Legend:	Hz, kHz, MHz, GHz, dBm.
Status Indicators:	BAND 1, BAND 2, EXT REF, GATE, DISPLAY TIME, REMOTE, ΔF, POWER METER (band 2 only), OVERLOAD (band 2 only), STANDBY.
DF:	Displays difference between stored reading and current reading.

General Specifications contd.

POWER METER (Band 2 only):

Frequency Range:	120 MHz to 3 GHz (Model 3030) 120 MHz to 8 GHz (Model 3080). 120 MHz to 12.4 GHz (Model 3120). 120 MHz to 20 GHz (Model 3200). 120 MHz to 26.5 GHz (Model 3260).
Power Range:	-35 dBm or counter sensitivity, whichever is greater to +10 dBm max.
Damage Level:	+25 dBm
Accuracy:	±1 dBm to 26.5 GHz (typical).
Resolution:	0.1 dBm
Measurement Time:	Frequency measuring time + 15 ms.
Display:	Simultaneously displays frequency (with 0.1 MHz resolution) and Power.

TIME BASE (Standard TCXO. See Options 110, 115, 120, and 125 for other):

Frequency:	10 MHz
Aging Rate/second:	$\leq \pm 1$ part in $10^{-10}/\sqrt{\tau}$ (root Allen variance).
Aging Rate/day:	$\leq \pm 5.1$ parts in 10^{-9} .
Aging Rate/year:	$\leq \pm 7.6$ parts in 10^{-7} after 45 days.
Warm Up stability:	$\leq \pm 4$ parts in 10^{-7} in 5 minutes (ref. freq. @ 1 hour).
Retrace:	$\leq \pm 3$ parts in 10^{-7} after 24 hrs. ON, 24 hrs. OFF, 1 hr. ON (ref. to previous ON freq.).
Temperature stability:	$\leq \pm 1$ part in 10^{-6} (0°C to 50°C).
MAINS change (±10%):	$\leq \pm 5$ part in 10^{-9}
Calibration Schedule:	One (1) year.

INTERNAL/EXTERNAL REFERENCE OSCILLATOR:

10 MHz REF OSC OUT:	10 MHz, 1 Vrms into 50 Ω, AC coupled.
Connector:	BNC female (rear panel).
EXT REF OSC IN:	External time base accepts 1 MHz, 2 MHz, 5 MHz or 10 MHz time base signal, 0.2 Vrms to 5 Vrms. Automatically disconnects internal time base if external signal is > 0.2 Vrms.
Connector:	BNC female (rear panel); 1 kΩ impedance.

GPIB / IEEE 488:

Programmable Functions/Controls:	BAND 1, BAND 2, RESET, STANDBY, POWER METER, ΔF, DISPLAY TIME, RESOLUTION.
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ENVIRONMENTAL: Designed to meet MIL-PRF-28800F Type III, Class 3, Style E and IEC 1010-1, Specifically:

Operating Temperature:	0°C to 50°C (standard CW) / 0°C to 40°C (Battery Option)
Storage Temperature:	-40°C to 71°C (w/o battery) / -10°C to 40°C (w/battery).
Relative Humidity:	95% ± 5% 10°C to 30°C; 75% ± 5% to 40°C; 45% ± 5% above 40°C.
Altitude:	4600 m (15,092 ft.).
Vibration (random):	5–500 Hz.
Burn In:	Failure-free burn in of no less than 100 hours at 40°C (w/o battery).
Pollution Degree:	1 (no pollution)(IEC 1010-1/3.7).
Transient Overvoltage:	Installation Category II (IEC 1010-1/J)

The XL Model 3000 series counters do not contain nor require a cooling fan.

RELIABILITY:

MTBF:	Mean Time Between Failure = > 32,000 hours (MIL-HDBK-217E).
MTTR _{ACM} :	Mean Active Corrective Maintenance Time = 30.92 minutes (MIL-HDBK-472).

General Specifications contd.

SUPPLEMENTAL SPECIFICATIONS:

ISO 9001	XL Microwave's Quality System for design and manufacture of millimeter wave, microwave, and RF control, test and measurement equipment is registered and certified to ISO 9001-1994 by TUV Essen.
Montreal Protocol:	Nil Return.
EC (European Comm.):	EMC Emissions: Certified to EN 55022 Class B EMC Immunity: Certified to EN 50082-1 Low Voltage Directive: complies with EN 61010-1.
VDE (Germany):	EMC Emissions: Certified to VDE 0871/6.78 Class B.
BS (United Kingdom):	Complies with BS 4743:1979 (IEC 348) (Safety Requirements) and Defense Standard 59-41/Issue 3 (EMC) for the following classes: Ship use: parts 1, 2, and 3 for Type 1 equipment (Below Decks) Land Service use: Class F. <i>This Equipment complies with the environmental requirements of British Defense Standard 66-31/2 for Category III equipments.</i>

BATTERY CHARACTERISTICS (*Battery Option Counters only*):

Manufacture:	Panasonic.	
Manuf. Part No.:	LC-SA122R3U, Rechargeable Lead/Acid Battery.	
Nominal Voltage:	12 VDC.	
Nominal Capacity:	2.3 Ah.	
Capacity affected by Temperature:	40°C (104°F)	102%
	25°C (77°F)	100%
	0°C (32°F)	85%
	-15°C (5°F)	65%
Self-Discharge 25°C (77°F):	Capacity after 3 month storage-	90%
	Capacity after 6 month storage-	80%
	Capacity after 12 month storage-	60%

MECHANICAL:

Power:	DC:	11 VDC to 28 VDC; 20 VA (18 VDC to 28 VDC; 20 VA, Option 125 only). Battery Option: 12 VDC/2.3 Ah Rechargeable Sealed Lead/Acid Battery (Panasonic part number LCS-2312NC).
	AC MAINS:	90/132 VAC or 180/265 VAC, 45 Hz to 440 Hz; 25 VA.
	AC MAINS Fuse:	(115 V) 1/2 A/250 V SLO-BLO (3AG)(1/4" x 1-1/4"). (230 V) 1/4 A 'T'/250 V (IEC 127-III-T Time-lag)(5 x 20 mm).
Weight:	Net:	Standard CW: 3.6 kg (8 lbs.) Battery Option: 5 kg (11 lbs.)(including battery and Instrument Back-Pack).
	Shipping:	Standard CW: 5.5 kg (12 lbs.) Battery Option: 6.8 kg (15 lbs.).
Dimensions (HxWxD):		89 mm x 213 mm x 333 mm (3.5 in. x 8.375 in. x 13.1 in.).

ACCESSORIES FURNISHED:

	One (1) Operating/Maintenance Manual.
	One (1) AC power cord (EN 60 320 and CEE color coding), 6 ft. (2 meters) UL listed type SVT, 3 conductor Vinyl with NEMA, type 5-15p plug and IEC 320-3:1987/EN 60 320 end termination.
Battery Option only:	One (1) Weather-Resistant Instrument Back-Pack with Field Reference Card. One (1) Panasonic LCS-2312NC, 12 VDC/2.3 Ah, Rechargeable, Sealed Lead/Acid Battery.

1.6. OPTIONS

1-6. Table 1-2 lists the options that are available for the 3000 Series counters.

Table 1-2. Options

Oscillator Options Available:				
OPTION:	112 OCXO	115 OCXO	120 OCXO	125 RUBIDIUM (see Note)
Aging/second:	$5 \times 10^{-10}/\sqrt{\tau}$ root Allan variance	$1 \times 10^{-11}/\sqrt{\tau}$ root Allan variance	$5 \times 10^{-12}/\sqrt{\tau}$ root Allan variance	$1.4 \times 10^{-11}/\sqrt{\tau}$ root Allan variance
Aging/day:	3×10^{-9} after 30 days	5×10^{-10} after 72 hours	4×10^{-10}	5×10^{-10} after 4 min. 1×10^{-10} after 10 min. 2×10^{-11} after 60 min. 5×10^{-11} after 30 days.
Aging/year:	5×10^{-7}	1.5×10^{-7} after 7 days 1×10^{-7} after 30 days	5×10^{-8}	2×10^{-9}
Warm-up (time): @ 25°C	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} in 4 min.
Retrace: @ 25°C	2×10^{-8} after 72 hrs. ON, 24 hrs. OFF, 12 hrs. ON	2×10^{-8} after 72 hrs. ON, 24 hrs. OFF, 12 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^{-8}	1×10^{-8}	7×10^{-9}	3×10^{-11}
MAINS change: (± 10%)	1×10^{-9}	1×10^{-9}	2×10^{-9}	N/A
Calibration Schedule:	1 year	1 year	1 year	N/A

Note : Election of Rubidium Osc. Option 125 extends counter chassis depth from 13.1 in. (333 mm) to 14.5 in. (368 mm). Rubidium oscillator, option 125, is not available with Battery Option 150 counters.

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 (Option 112 & 120) are also available with the Battery Option. OCXO Option 115 and Rubidium Oscillator Option 125 are not available with Battery Option 150 counters. Battery and Back pack are excluded from instrument's warranty.

152: Dual Battery Operation. 2nd Battery, with cable, for dual battery operation to extend operating time** (requires Option 150).

160: OCXO Oven Always ON. Provides constant power to OCXO oven circuitry with Battery operation (shortens battery operating time**)(requires Options 150 & 112 or 120 OCXO).

170: Rack Ears: 3.5 in. x 19 in. (88.9 mm x 482.6 mm) (H x W) (EIA RS-310).

NOTE: ALL OPTIONS ARE INSTALLED BY FACTORY ON ORIGINAL INSTRUMENT ORDER.

***Operating times with Options 152 & 160, consult Factory.*