CNT-90XL
Microwave Counter/Analyzer

- Frequency range to 27, 40, 46 or 60 GHz
- Speed: 250k measurements/s to internal memory
- Frequency, power, CW or burst to 60 GHz
- Resolution: 14 digits display
- Statistical analysis including histogram, trend & modulation domain display
- Unique ease-of-use: Multiparameter display & graphical presentation of results
- USB & GPIB as standard
- 2 instruments in one - Microwave Counter/Analyzer & 400 MHz general-purpose timer/counter

The Fastest Microwave Counter
The CNT-90XL Microwave Counter/Analyzers has set new milestones for microwave frequency counting and outperforms any microwave counter on the market regarding resolution, speed and acquisition time. The CNT-90XL is the worlds fastest Microwave counter with integrated power meter and offers a unique ease-of-use with graphical display and improved control over measurement at an outstanding price. The measurement speed is up to 250 000 frequency samples/s, for advanced statistical analysis.

In addition to being a Microwave Counter/Analyzer, the multi-functional CNT-90XL also serves as a 400 MHz general purpose timer/counter. Now, for the first time, the variations in signal power can be seen, collected, and analyzed in the same manner as frequency: both numerically and graphically.

Applications and Features
The CNT-90XL is intended for several applications, such as:

- Microwave link carrier calibration
- Satellite communication equipment testing
- YIG and VCO testing
- RF and microwave instrumentation calibration
- RF components and modules testing

Product Features And Benefits
- Fast high-resolution frequency or power measurements, very short acquisition time of 25 ms (Auto) or zero (Manual)
- Burst measurements via Ext. arming
- High sensitivity (-33 dBm)
- Statistical processing and graphical histogram, trend and modulation display
- Affordable microwave frequency counting

Leading Performance
- High resolution is vital for R&D and production testing. CNT-90XL meets this requirement with 100 ps single shot (time) or 12 digits/s (frequency). Obtained values are displayed with up to 14 digits.
- For calibration purposes, the CNT-90XL offers very high accuracy through stable internal OCXO time base, low systematic time interval A-B error and high resolution.
- Both USB and GPIB interfaces are standard. With USB you won’t need to invest in a GPIB interface card for your PC. The GPIB operates in either SCPI/GPIB or 53131/53132 emulation mode, for plug-and-play replacement in existing ATE systems.
- Menu-oriented settings reduce the risk of mistakes. Valuable signal information, given in multi-parameter displays, removes the need for other instruments like DVM’s and Scopes.
Limit qualifying is a handy tool for making correct calculation of statistical parameters e.g. to verify the jitter of digital pulses that appear in discrete clusters (e.g. in CD-players or in HDB3-coded data). By setting limits you can isolate one cluster in the calculation.

Battery Option
The CNT-90XL has an optional battery pack with 90 Wh capacity, capable of mains-free operation for at least 4.5 hours. In stand-by mode the battery pack can keep an OCXO warm and running for over 24 hours. Battery operation of a frequency counter/ analyzer is valuable in three different applications:

- Mains-free operation in the field
- Transportation of high-stability OCXO to maintain stability, which gives instant use at destination without any warm-up time
- Battery backup acting as a built in UPS (Uninterrupted Power Supply)

Excellent Graphical Presentation
One of the great features of the CNT-90XL is the graphical display and the menu oriented settings. The non-expert can easily make correct settings without risking costly mistakes. The multi-parameter display with auxiliary measurement values such as Vmax/Vmin/Vp-p in frequency measurements, and frequency/attenuation/phase, eliminates the need for extra test instruments and provides direct answers to frequently asked questions, like “What is the attenuation and phase shift of this filter?”

Measurement values are presented both numerically and graphically. The graphical presentation of results (histograms, trends etc.) gives a much better understanding of the nature of jitter. It also provides you with a much better view of changes vs time, from slow drift to fast modulation (trend plot). Three statistical views of the same data set can be viewed: Numerical, Histogram and Trend. It is very easy to capture and toggle between views of the same data.

When adjusting a frequency source to given limits, the graphic display gives fast and accurate visual calibration guidance. The graphical displays below shows frequency changes over time directly on-screen, e.g. Doppler frequency shift in speed radar sensors, fast power switching or FM. Built-in statistical processing presents numerical stability data and also frequency distribution histograms on-screen for analysis of frequency stability or modulation.

Figure 1: 1kHz FM with 12 ppm modulation depth

Figure 2: Pulse modulated frequency

Figure 3: Generator start-up power settling

Figure 4: Very small AM on carrier is visualized

Figure 5: Numeric statistics screen of the previous AM signal

Figure 6: Power step from generator (-30 to -5dBm in 5dBm steps)
NOTE: output is turned off shortly betw. power steps

Figure 7: Power step (close up)
Measuring Functions

Frequency A, B, C

Range:
- Input A: 0.002 Hz to 400 MHz
- Input C: 300 MHz to 27, 40, 46 or 60 GHz

Resolution: 12 digits in 1s measuring time

Acquisition: Auto or Manual

Acquisition time: 25 ms in Auto (typ.)

Aux. Parameters:
- Input A: Vmax, Vmin, Vp-p
- Input C: Power C in dBm or W

Frequency Burst, A, B

Range:
- Input A, B: 0.001 Hz to 400 MHz

Minimum Burst Duration: Down to 40 ns

Minimum Pulses in Burst:
- Input A or B: 3 (above 160 MHz)

PRF Range:
- 0.5 Hz to 1 MHz

Start Delay:
- 10 ns to 2 sec., 10 ns resolution

Aux. Parameters: PRF

Period A, B (single or average), C (average)

Mode: Single, Average

Range:
- Input A, B: 2.5 ns to 1000 s
- Input C: 3.3 ns down to 37, 25, 22 or 17 ps

Resolution: 100 ps (single); 12 digits/s (avg)

Acquisition C: Auto or Manual

Acquisition time: 25 ms in Auto (typ.)

Aux. Parameters:
- See Freq. A, B, or C measurements

Ratio A/B, A/C, B/C

Range: (10%) to 100%

Input Frequency:
- Input A, B: 0.1 Hz to 300 MHz
- Input C: 300 MHz to 27, 40, 46 or 60 GHz

Aux Parameters: Freq 1, Freq 2

Time Interval A to B, B to A, A to B, B to B

Range:
- Normal Calculation: Ons to +10^4 sec.
- Smart Calculation: +10^4 sec. to +10^9 sec.

Resolution: 100 ps

Min. Pulse Width: 1.6 ns

Smart Calculation: Smart Time Interval to determine sign [A before B or A after B]

Positive and Negative Pulse Width, A, B

Range: 2.3 ns to 10^5 sec.

Min. Pulse Width: 2.3 ns

Aux. Parameters: Vmax, Vmin, Vp-p

Rise and Fall Time, A, B

Range: 1.5 ns to 10^5 sec.

Trigger Levels: 10% and 90% of signal Vp-p

Min. Pulse Width: 1.6 ns

Aux. Parameters: Slew rate, Vmax, Vmin

Positive and Negative Duty Factor, A, B

Range: 0.000001 to 0.999999

Freq. Range: 0.1 Hz to 300 MHz

Aux. parameters: Period, pulse width

Phase A Relative B, B Relative A

Range: -180° to +360°

Resolution: Single-cycle: 0.001° to 10 kHz, decreasing to 1° >10 MHz. Resolution can be improved via averaging (statistics)

Freq. Range: up to 160 MHz

Aux. Parameters: Freq [A], Va/Vb [in dB]

Vmax, Vmin, Vp-p A, B

Range: -50 V to +50 V, -5V to +5V

Range is limited by the specification for max input voltage without damage [see input A, B]

Freq. Range: DC, 1 Hz to 300 MHz

Mode: Vmax, Vmin, Vp-p

Resolution: 2.5 mV

Uncertainty (5V range, typical):
- DC, 1Hz to 1kHz: 1% +15 mV
- 1kHz to 20 MHz: 3% +15 mV
- 20 to 100 MHz: 10% +15 mV
- 100 to 300 MHz: 30% +15 mV

Aux parameters: Vmax, Vmin, Vp-p

Time stamping A, B, C

Raw time stamp data together with pulse counts on inputs A, B or C, accessible via GPIB or USB only.

Max Sample Speed: See GPIB specifications

Max Frequency: 160 MHz

Timestamp Resolution: 70 ps

Power C

Range:
- Power: -35 dBm to +10 dBm
- Frequency: 300 MHz to 27, 40, 46 or 60 GHz

Display units: dBm (default) or W

Resolution: 0.01 dBm @100 ms measuring time

Accuracy (typ.): <1 dBm to 27 GHz; <3dBm to 40 GHz; <3dBm to 60 GHz

Acquisition:
- Auto or Manual (within ±40 MHz)

Acquisition time: 20 to 30 ms in Auto (typ.)

Aux. Parameters: Frequency C

Input and Output Specifications

Inputs A and B

Frequency Range:
- DC-Coupled: DC to 400 MHz
- AC-Coupled: 10 Hz to 400 MHz

Impedance:
- DC-Coupled: 50 Ω nominal, AC coupled

VSWR:
- A, B or E (Ext. Arming input)

Maximum Channel A, B: ±27 dBm (27, 40, 46 GHz models)

Max Voltage Without Damage: ±25 dBm (60 GHz model)

Overload indication:
- ON when input power >+10 dBm

Connector:
- SMA: 27 GHz
- SMA: 40 and 46 GHz: 2.92 mm sparkplug female
- SMA: 60 GHz: 2.4 mm sparkplug female

(All connectors are field replaceable)

AM impedance:
- Reference Input: 50 Ω nominal, AC coupled

Reference Input:
- Reference Output: 10 MHz; ±1 Vrms sine; impedance ≥1kΩ

Reference Output:
- Reference Output: 10 MHz; ±1 Vrms sine into 50 Ω

Arming Input:
- Arming of all measuring functions

Impedance: Approx. 1kΩ

Freq. Range: DC to 80 MHz

Connectors: BNC

Auxiliary Functions

Trigger Hold-Off

Time Delay Range:
- 20 ns to 2 sec., 10 ns resolution

External Start and Stop Arming

Arming can be used to synchronize the frequency and power measurements with the start of a burst signal. Minimum burst length must exceed 100 μs.

Modes: Start and Stop Arming

Input Channels:
- A, B or E (Ext. Arming input)

Max Rep. Rate for Arming Signal:
- Channel A, B: 160 MHz
- Channel E: 80 MHz
General Specifications

Environmental Data

Class: MIL-PRF-28800F, Class 3

Operating Temp: 0°C to +50°C

Storage Temp: -40°C to +71°C

Humidity: 5%-95% (10°C to 30°C)
5%-75% (30°C to 40°C)
5%-45% (40°C to 50°C)

Altitude: 600 m

Vibration: Random and sinusoidal according to MIL-PRF-28800F, Class 3

Shock: Half-sine 3G per MIL-PRF-28800F

Bench handling

Transit drop test:
According to MIL-PRF-28800F

Safety:
EN 61010-1, pollution degree 2,
meas cat I, CSA C22.2 No 1010-1, CE
EMC: EN 61326 (1997); A1 (1998),
increased test levels according to EN 50082-2,
Group 1, Class B, CE

Mains power: 90 to 265 Vrms, 45 to 440 Hz, <40 W, <60 W if battery option

Dimensions and Weight

Width x Height x Depth: 210x90x395 mm (8.25x3.6x15.6 in)

Weight: Net 2.7 kg (5.8 lb), Shipping app. 3.5 kg (app. 7.5 lb)

Ordering Information

Basic Models
CNT-90XL-27G:
27 GHz Microwave Counter/Analyzer

CNT-90XL-40G:
40 GHz Microwave Counter/Analyzer

CNT-90XL-46G:
46 GHz Microwave Counter/Analyzer

CNT-90XL-60G:
60 GHz Microwave Counter/Analyzer

Time Base: Medium Stability Time Base; 0.06 ppm/month as standard

Included with Instrument: 3 years product warranty,
line cord, user documentation on CD, and Certificate of Calibration

Time Base Options

Option Model:
Standard

40/90

Time Base Options

Option 30/90: Very High Stability Oven Time
Base; 0.01 ppm/month

Option 40/90: Ultra High Stability Oven Time
Base; 0.003 ppm/month

Option 23/90 Battery Unit

Battery Type: LiIon, 90 Wh

External DC input: 10 to 18 Vdc; max 6A

Operating temp. range: 0°C to 40°C

Storage: -20°C to +60°C, 1 month
-20°C to +45°C, 3 months
-20°C to +20°C, 1 year

Battery operating time (at 25°C):
ON: >4.5 hours
Stand-by: >24 hours

Charging: Automatically when AC or ext DC is connected

Battery status indicator:
On-screen with Low battery warning

Weight: 2.3 kgs

Optional Accessories

Option 22/90: Rack-Mount Kit

Option 27: Carrying Case - soft

Option 27H: Heavy-duty Hard Transport Case

Option 29/90: TimeView Modulation domain
Analysis SW for CNT-90XL

Option 90/01: Calibration Certificate with
Protocol; Standard oscillator

Option 90/02: Cal. Cert.; Oven oscillator

Option 90/03: Extended warranty from 3 to 5 years

OM-90: Users Manual English (printed)

PM-90: Programmers Manual English (printed)

SM-90: Service Manual English

GS-90-DE: Getting Started German

GS-90-EN: Getting Started English

GS-90-FR: Getting Started French

SM-90:

Service Manual English

OM-90:

Users Manual English (printed)

PM-90:

Programmers Manual English (printed)

SM-90:

Service Manual English

GS-90-EN:

Getting Started English

GS-90-FR:

Getting Started French

GS-90-DE:

Getting Started German

Technical Specifications: CNT-90XL

Start Time Delay Range:
20 ns to 2 sec., 10 ns resolution

Statistics

Functions: Maximum, Minimum, Mean,
σmax-Min, Standard Deviation and Allan
Deviation

Display: Numeric, histograms or trend plots

Sample Size: 2 to 2 x 10^8 samples

Limit Qualifier: Off or Capture values
above/below/inside or outside limits

Measurement Pacing:
Pacing Time Range: 4μs to 500 sec.

Mathematics

Functions: (K*X+L)/M, (K/X+L)/M or X/M-1.
X is current reading and K, L and M are
constants; set via keyboard or as frozen
reference value [X]

Other Functions

Measuring Time: 20 ns to 1000 s for
Frequency, Burst, and Period Average. Single

Timebase Reference:
Internal, External or Automatic

Display Hold: Freezes result, until a new
measurement is initiated via Restart

Limit Alarm: Graphical indication on front
panel and/or SRQ via GPIB

Limit Values: Lower limit, Upper limit
Settings: OFF or Alarm if value is above/below/
inside or outside limits

On Alarm: STOP or CONTINUE

Display: Numeric + Graphic

Stored Instrument Set-ups: 20 instrument
setups can be saved/recalled from internal non-
volatile memory. 10 can be user protected.

Result Storage: Up to 8 measurements
of max 32k samples can be stored in local
memory for later downloading.

Display:
Backlit LCD Graphics screen for menu control,
numerical read-out and status information

Number of Digits: 14 digits in numerical mode

Resolution: 320*97 pixels

GPIB Interface

Compatibility: IEEE 488.2-1987, SCPI 1999
or 53131A/53132A compatibility mode

Interface Functions:
SH1, AH1, T6, L4, SR1, RL1, DC1, DT1, E2

Max. Measurement Rate:
GPIB: 5k readings/s [block mode]
500 readings/s [individual GET trig’ed]

To Internal Memory: 250k readings/s

Internal Memory Sizes: Up to 750k readings.

USB Interface

USB Version: 2.0 Full speed (11 Mbits/s)

Calibration

Mode: Closed case, menu controlled
Cal. Frequencies: 0.1, 1, 5, 10, 1.544 and
2.048 MHz

Other Functions

Max. Measurement Rate:
Display: SH1, AH1, T6, L4, SR1, RL1, DC1, DT1, E2

Sample Size: 2 to 2 x 10^8 samples

Limit Qualifier: Off or Capture values
above/below/inside or outside limits

Measurement Pacing:
Pacing Time Range: 4μs to 500 sec.

Mathematics

Functions: (K*X+L)/M, (K/X+L)/M or X/M-1.
X is current reading and K, L and M are
constants; set via keyboard or as frozen
reference value [X]

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