

Affordable high-performance Counter/Analyzer

- 250k measurements/s to internal memory, 750k stored measurements results
- Fast GPIB/USB bus speed, 5k meas/sec-block mode
- Resolution: 12 digits/s (freq.), 100 ps (time), 0.001° (phase)
- 14 digits display
- Frequency range: 300 MHz as standard. 3, 8, 14 and 20 GHz optional
- Ease-of-use: Multi-parameter display and graphical presentation of results
- Outstanding performance/price ratio



The CNT-90 timer/counter/analyzer is an ultimate tool for measurement, analysis and calibration of Frequency, Time Interval or Phase. The CNT-90 is a high-performance counter with a fast measurement speed to 250,000 measurements/s, and time interval measurement resolution to 100 ps. The CNT-90 offers ease-of-use including graphical display and improved control over measurement at an outstanding price.

Leading Performance

The basic performance of the CNT-90 is leading compared to competition:

- With 5k measurement results transferred per second (block mode) via GPIB/USB, the CNT-90 can save you up to 90% testing time (and thus money) in test systems by increased throughput.
- High resolution is vital for R&D and production testing. CNT-90 meets this requirement with 100 ps single shot (time) or 12 digits/s (frequency). Obtained values are displayed with up to 14 digits.
- Modulation Domain Analysis is performed by capturing fast frequency changes with up to 250k Sa/s.
- For calibration purposes, the CNT-90 offers very high accuracy through stable internal OCXO time base, low systematic time interval A-B error and high resolution.
- Wide frequency range to 20 GHz covers most CW and burst microwave frequency measurement needs. There's no need to invest in a separate microwave counter.

Outstanding Performance/Price Ratio

The high performance CNT-90 timer/counter/analyzer out-performs all counters on the market (except Pendulum CNT-91), independent of measurement task.

- The graphic presentation of results – histogram, trend line, numerical statistics,

modulation domain – provide a clearer understanding of random signal distribution and measurement changes over time – from slow drift to fast jitter, and modulation.

- 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 emulation mode, for plug-and-play replacement in existing ATE systems.
- Wide frequency range – to 20 GHz – offers microwave CW frequency measurements and very short burst measurements down to 40 ns.
- 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.

Additional Technical Features

CNT-90 does not only offer high-performance, it is an ultimate tool for more specialized measurement. Some great features of the CNT-90 are:

- Zero dead-time technique and continuous time-stamping of trigger events. This feature allows correct measurements of Allan Deviation and is very valuable in mechanical (e.g. rotational encoder testing) and medical (e.g. nerve impulse/respiratory cycles) measurements where every single cycle must be measured.

- Limit qualifying 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.

- Hysteresis compensation in Time Interval measurements reduces trigger level error from the typical 15-20 mV found in most counters on the market today, down to typ. 2.5 mV. This means 6-8 times improved trigger precision in critical time interval measurements.

Battery Option

The CNT-90 has an optional battery pack with 90Wh 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-90 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 $V_{max}/V_{min}/V_{p-p}$ 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 (see fig. 4, 5 & 6).

When adjusting a frequency source to given limits, the graphic display gives fast and accurate visual calibration guidance.



Figure 1: Display showing phase value, frequency, attenuation V_A/V_B , and auxiliary parameters.



Figure 4: Display showing different statistical parameters viewed at the same time.



Figure 2: Measure function selection menu, shown with measured results.



Figure 5: Display showing the trend (signal over time) of sampled data.



Figure 3: Input parameter setting menu shown with measured result.



Figure 6: The same result as in figure 5, now displayed as a histogram.

CNT-90 Technical Specifications

Measuring Functions

All measurements are displayed with a large *main parameter* value and smaller *auxiliary parameter* values (with less resolution). Some measurements are only available as auxiliary parameters.

Frequency A, B, C

Range:

Input A, B: 0.001 Hz to 300 MHz
Input C (option): Up to 3, 8, 14 or 20 GHz

Resolution: 12 digits in 1s measuring time (normal)

Aux. Parameters: Vmax, Vmin, Vp-p

Frequency Burst A, B, C (opt. 14/14B)

Frequency and PRF of repetitive burst signals can be measured without external control signal and with selectable start arming delay.

Functions: Frequency in burst (in Hz)
PRF (in Hz)

Range:

Input A, B, C: See Frequency spec.

Minimum Burst Duration:

Down to 40 ns

Minimum Pulses in Burst:

Input A or B: 3 (6 above 160 MHz)
Input C: 3 x prescaler factor

PRF Range: 0.5 Hz to 1 MHz

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

Aux. Parameter: PRF

Period A, B, C

Mode: Single, Average

Range:

Input A, B: 3.3 ns to 1000 sec. (single, average)
Input C (option): 10 ns down to 330, 125, 70 or 50 ps

Resolution:

CNT-90 100 ps (single); 12 digits/s (average)

Aux. Parameters: Vmax, Vmin, Vp-p

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

Range: (10⁻⁹) to 10¹¹

Input Frequency:

Input A, B: 0.1 Hz to 300 MHz
Input C (option): Up to 3, 8, 14 or 20 GHz

Aux. Parameters: Freq 1, Freq 2

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

Range:

Normal Calculation: 0 ns to +10⁶ sec.
Smart Calculation: -10⁶ sec. to +10⁶ sec.

Resolution:

CNT-90 100 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 10⁶ sec.

Min. Pulse Width: 2.3 ns

Aux. Parameters: Vmax, Vmin, Vp-p

Rise and Fall Time A, B

Range: 1.5 ns to 10⁶ sec.

Trigger Levels: 10% and 90% of signal amplitude

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: -50V to +50V, -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:

CNT-90 3 mV

Uncertainty (5V range, typical):

DC, 1Hz to 1kHz: 1% +15 mV
1 kHz to 20 MHz: 3% +15 mV
20 to 100 MHz: 10% +15 mV
100 to 300 MHz: 30% +15 mV

Aux parameters: Vmin, Vmax, 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:

CNT-90 100 ps

Input and Output Specifications

Inputs A and B

Frequency Range:

DC-Coupled: DC to 300 MHz
AC-Coupled: 10 Hz to 300 MHz

Impedance: 1 MΩ // 20 pF or 50Ω (VSWR ≤ 2:1)

Trigger Slope: Positive or negative

Max. Channel Timing Difference: 500 ps

Sensitivity:

DC-200 MHz: 15 mVrms
200-300 MHz: 25 mVrms

Attenuation: x1, x10

Dynamic Range (x1): 30 mV p-p to 10V p-p within ±5V window

Trigger Level: Read-Out on display

Resolution: 3 mV

Uncertainty (x1): ±(15 mV + 1% of trigger level)

AUTO Trigger Level: Trigger level is automatically set to 50% point of input signal (10% and 90% for Rise/Fall Time)

AUTO Hysteresis:

Time: Min hysteresis window (hysteresis compensation)

Frequency: One third of input signal amplitude

Analog LP Filter: Nominal 100 kHz, RC-type.

Digital LP Filter: 1 Hz to 50 MHz cut-off frequency

Max Voltage Without Damage:

1 MΩ: 350V (DC + AC pk) to 440 Hz, falling to 12Vrms (x1) at 1 MHz

50Ω: 12Vrms

Connector: BNC

Input C (Option 10)

Operating Input Voltage Range:

100 to 300 MHz: 20 mVrms to 12Vrms
0.3 to 2.5 GHz: 10 mVrms to 12Vrms
2.5 to 2.7 GHz: 20 mVrms to 12Vrms
2.7 to 3.0 GHz: 40 mVrms to 12Vrms

Prescaler Factor: 16

Impedance: 50Ω nominal, VSWR < 2.5:1

Max Voltage without Damage:

12Vrms, pin-diode protected

Connector: Type N Female

Input C (Option 13)

Operating Input Voltage Range:

200 to 300 MHz: 40 mVrms to 7 Vrms (typ.)
300 to 500 MHz: 20 mVrms to 7 Vrms
0.5 to 3.0 GHz: 10 mVrms to 7 Vrms
3.0 to 4.5 GHz: 20 mVrms to 7 Vrms
4.5 to 6.0 GHz: 40 mVrms to 7 Vrms
6.0 to 8 GHz: 80 mVrms to 7 Vrms

Prescaler Factor: 256

Impedance: 50Ω nominal, VSWR < 2.5:1

Max Voltage Without Damage: 7V rms

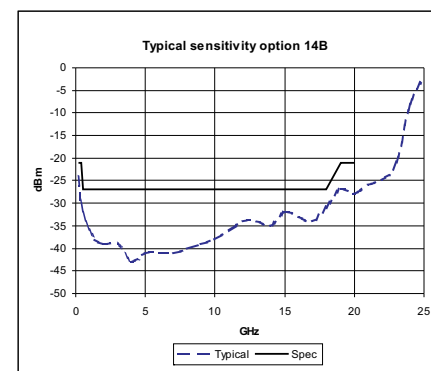
Connector: Type N Female

Input C (Option 14 and 14B)

Freq. Range: 0.2 to 14 GHz (opt. 14)
0.25 to 20 GHz (opt. 14B)

Operating input voltage range :

250 to 500 MHz: -21 to +27 dBm
0.5 to 14 GHz: -27 to +27 dBm
14 to 18 GHz: -27 to +27 dBm (Option 14B only)
18 to 20 GHz: -21 to +27 dBm (Option 14B only)



Prescaler Factor: 128

Impedance: 50Ω nominal, VSWR < 2.0:1

AM tolerance: > 90% within sensitivity range

Max Voltage Without Damage: +27dBm

Connector: Type precision N Female

Rear Panel Inputs and Outputs

Reference Input: 1, 5, or 10 MHz; 0.1 to 5Vrms sine; impedance ≥ 1 kΩ

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

Arming Input: Arming of all measuring functions

Impedance: Approx. 1 kΩ

Freq. Range: DC to 80 MHz

Rear Panel Measurement Inputs: A, B, C (opt. 11/90)

Impedance: 1 MΩ/50 pF or 50Ω (VSWR ≤ 2:1)

Connectors: SMA female for rear input C
BNC for all other inputs/outputs

Auxiliary Functions

Trigger Hold-Off

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

External Start and Stop Arming

Modes: Start, Stop, Start and Stop Arming

Input Channels: A, B or E-rear panel

Max Rep. Rate for Arming Signal:

Channel A,B: 160 MHz
Channel E: 80 MHz

Start Time Delay Range:

20 ns to 2 sec., 10 ns resolution

Statistics

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

Display: Numeric, histograms or trend plots

Sample Size: 2 to 2 x 10⁹ samples

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

Measurement Pacing

Pacing Time Range: 4 μs to 500 sec.

Mathematics

Functions: (K*X+L)/M and (K/X+L)/M. X is current reading and K, L and M are constants; set via keyboard or as frozen reference value (X₀)

Other Functions

Measuring Time: 20 ns to 1000 sec. for Frequency, Burst, and Period Average. Single cycle for other measuring functions

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, plus pulse output connector (CNT-91)

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.

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 199953131A 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 Size:

CNT-90 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

Option 23/90 Battery Unit

Battery Type: Lilon, 90Wh

External DC input:

10 to 18V dc; max 6 A

Operating temp. range:

-20 to 40 degrees C

Storage: -20 to +60 degrees C

1 month

-20 to +45 degrees C

3 months

-20 to +20 degrees C

1 year

Battery operating time (at 25 degrees 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

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-30°C)

5%-75% (30°C-40°C)

5%-45% (40°C-50°C)

Altitude: 4,600 meters

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

Shock: Half-sine 30G per MIL-PRF-28800F Bench handling

Transit drop test: Heavy-duty transport case and soft carrying case tested according to MIL-PRF-28800F

Reliability: MTBF 30,000 hours (calculated)

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

Power Requirements

Max. configuration:

90 to 265V rms, 45 to 440 Hz, <40W

Dimensions and Weight

Width x Height x Depth:

210 x 90 x 395 mm

(8.25 x 3.6 x 15.6 in)

Weight:

Net 2.7 kg (5.8 lb),

Shipping app. 3.5 kg (app. 7.5 lb)

Ordering Information

Basic Model

CNT-90 300 MHz, 100 ps Timer/Counter including Standard Time Base

Included with Instrument:

18 months product warranty, line cord, user documentation on CD, and Certificate of Calibration

Input Frequency Options

Option 10 3 GHz Input C

Option 13 8 GHz Input C

Option 14 14 GHz Input C

Option 14B 20 GHz Input C

Optional Accessories

Option 11/90 Rear Panel Inputs

Option 22/90 Rack-Mount Kit

Option 23/90 Battery Unit

Option 27 Carrying Case - soft

Option 27H Heavy-duty Hard Transport Case

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

Option 90/01 Calibration Certificate with Protocol; Standard oscillator

Option 90/06 Calibration Certificate with Protocol; Oven oscillator

Option 90/00 Calibration Certificate with Protocol; Hold-over frequency ageing/week

Option 95/03 Extended warranty from 18 months to 3 years

Option 95/05 Extended warranty from 18 months to 5 years

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

Specifications subject to change without prior notice

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- Experts in time & frequency calibration, measurement and analysis

Pendulum Instruments is a company of the Orolia Group

Time Base Options

Option model:	std	19/90	30/90	40/90
Time base type:	Standard	OCCO	OCCO	OCCO
Uncertainty due to:				
-Ageing. per 24h	n.a.	<5x10 ⁻⁹ (1)	<5x10 ⁻¹⁰ (1)	<3x10 ⁻¹⁰ (1)
per month	<5x10 ⁻⁷	<6x10 ⁻⁸	<1x10 ⁻⁸	<3x10 ⁻⁹
per year	<5x10 ⁻⁶	<2x10 ⁻⁷	<5x10 ⁻⁸	<1.5x10 ⁻⁸
-Temperature variation: 0°C-50°C	<1x10 ⁻⁵	<5x10 ⁻⁸	<5x10 ⁻⁹	<2.5x10 ⁻⁹
20°C-26°C (typ. values)	<3x10 ⁻⁶	<2x10 ⁻⁸	<1x10 ⁻⁹	<4x10 ⁻¹⁰
Short term stability: τ = 1s	not specified	<1x10 ⁻¹⁰	<1x10 ⁻¹¹	<5x10 ⁻¹²
(root Allan Variance) τ = 10s		<1x10 ⁻¹⁰	<1x10 ⁻¹¹	<5x10 ⁻¹²
Power-on stability				
-Deviation vs final value after 24h on time, after a warm-up time of:	n.a.	<1x10 ⁻⁷	<1x10 ⁻⁸	<5x10 ⁻⁹
	30 min	30 min	10 min	10 min
Typical total uncertainty, for operating temperature 20°C to 26°C, at 2σ (95%) confidence interval:				
- 1 year after calibration	<7x10 ⁻⁶	<2.4x10 ⁻⁷	<0.6x10 ⁻⁷	<1.8x10 ⁻⁸
- 2 years after calibration	<1.2x10 ⁻⁵	<4.6x10 ⁻⁷	<1.2x10 ⁻⁷	<3.5x10 ⁻⁸

1) After 1 month of continuous operation