product data

Preliminary data

CNT-91 & CNT-90

50 ps Timer/Counter/Analyzer

The new CNT-91 extends the award-winning CNT-90 family

- High resolution: 50 ps (time), 12 digits/s (frequency)
- World's fastest measurements via GPIB/USB: 2.6k/s (talker only) and 15k/s (block mode), plus continuous measurements (stream data while you measure)
- Unique graphic analysis of jitter, trend and modulation
- 250k measurements/s to internal result memory (3.5 M values)
- Built-in programmable pulse output 0.5 Hz to 50 MHz
- Measuring functions include all usual timer/counter functions plus zero-dead-time frequency/period

The world's leading timer/counter analyzer just got better. The new CNT-91 extends the Pendulum CNT-90 family of instruments for measurement, analysis and calibration of Frequency, Time Interval or Phase. The CNT-91offers the highest performance ever in a universal timer/counter, and offers even faster and higher resolution measurements than the current market leader CNT-90 timer/counter/analyzer.

Outstanding Performance/Price ratio

The CNT-90 family of timer/counter/analyzers now consists of two models, the high-performance budget model CNT-90, and the ultra-performance model CNT-91. These instruments outperform any counter on the market, independent of measurement task. They also offer the unique graphic user interface, with statistics processing and display of trend plot, histogram and modulation.

Leading World-Class Performance

★ *Measurement speed* of up to 2.6k individual measurement results/second via GPIB/USB, means that CNT-91 can save 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-91 meets this requirement with 50 ps single shot (time) or 12 digits/s (frequency), thus capturing very small time and frequency changes. Obtained values are displayed with up to 14 digits.

★ *Modulation Domain Analysis* (MDA) by capturing very fast frequency changes in real time, thanks to the high 250k/s measurement speed and the large memory depth of 3.5 M results.The optional TimeView™ program converts the CNT-90/91 to a high-performance MDA.

★ *Wide frequency range* to 20 GHz covers most CW and burst microwave frequency measurement needs.

★ Integrated *programmable pulse output* providing 0.5Hz -100 MHz fast rise time signals as reference frequency output, external pacing/trigger source, or general pulse source.

★ Zero-dead-time counting to provide period back-to-back measurements and the correct input for Allan Deviation calculation

Ease-of-Use

★ *Menu-oriented settings* reduce the risk of mistakes. Valuable signal information given with *multi-parameter display* removes the need for other instruments like DVM's and Scopes.

★ The *graphic presentation* of results (histograms, trends, modulation domain etc) gives a much better understanding of random signal distribution and measurement changes vs time, from slow drift to fast jitter and modulation.

★ Both *USB- and GPIB interfaces are standard*. No need to invest in a GPIB interface for your PC. And the GPIB operates in two different modes; SCPI and *53131 emulation, for plug-and-play replacement* in existing test systems.

Summary

The state-of-art CNT-90 and CNT-91 are revolutionary products - they are the only tools for time & frequency measurement, analysis and calibration you will ever need.

CNT-91 vs CNT-90 selection chart

Feature	CNT-91	CNT-90
Graphic display of trend, histogram, modulation domain	yes	yes
Freq. resolution	12 digits/s	12 digits/s
Time resolution (single shot)	50 ps	100 ps
Voltage resolution	1 mV	3 mV
Meas. speed to internal memory	250k/s (3.5M results)	250k/s (750k results)
Talker only output (GPIB/USB)	2.6k/s	no
Individually triggered measurements	650/s	500/s
Block transfer speed	15k/s	5k/s
Freq/period, time, phase, volt, duty c, pulse w, rise time	yes	yes
Totalize, TIE, zero-dead-time Freq/Period	yes	no
Programmable pulse output	yes	no
Continuous measurements	yes	no
Price	Attractive	Very attractive

pendulum

Incorporating XL Microwave

Revolutionary Graphical Presentation

One of the unique features of the CNT-90/91 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 2: Measure function selection menu, shown with measured results.

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

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

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

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

CNT-90 and CNT-91 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 (smart frequency calculation)

11 digits in 1s measauring time (normal and back-to-back)

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:

40ns

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 2s, 10 ns resolution

Aux. Parameter: PRF

Period A, B, C

Mode: Single, Average,
Back-to-back (91 only)

Range:

Input A, B: 3.3 ns to 1000s (single, average)
4 µs to 1000s (back-to-back)

Input C (option): 10 ns down to 330, 125, 70 or 50 ps

Resolution:

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

CNT-91 50 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 10^{11}

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 $+10^6$s

Smart Calculation: -10^6s to $+10^6$s

Resolution:

CNT-90 100 ps

CNT-91 50 ps (single)

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 10^6s

Min. Pulse Width: 2.3 ns

Aux. Parameters: Vmax,Vmin, Vp-p

Rise and Fall Time A, B

Range: 1.5 ns to 10^6s

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)

Totalize A, B (CNT-91 only)

Mode: Tot A, Tot B, Tot A+B, Tot A-B, Tot A/B

Range: 1-10^{10} counts

Freq range: up to 160 MHz

Start control: Manual, start arming

Stop control: Manual, stop arming, timed

Aux. Parameters: Other Tot functions

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

CNT-91 1 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 input A or B, accessible via GPIB or USB only.

Max Sample Speed: See GPIB specifications

Max Frequency: 160 MHz

Timestamp Resolution:

CNT-90 100 ps

CNT-91 50 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 mV rms

200-300 MHz: 25 mV rms

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 (CNT-90), 1 mV (CNT-91)

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 12V rms (x1) at 1 MHz

50Ω: 12V rms

Connector: BNC

Input C (Option 10)

Operating Input Voltage Range:

100 to 300 MHz: 20 mV rms to 12V rms

0.3 to 2.5 GHz: 10 mV rms to 12V rms

2.5 to 2.7 GHz: 20 mV rms to 12V rms

2.7 to 3.0 GHz: 40 mV rms to 12V rms

Prescaler Factor: 16

Impedance: 50Ω nominal, VSWR <2.5:1

Max Voltage without Damage:

12V rms, pin-diode protected

Connector: Type N Female

Input C (Option 13)

Operating Input Voltage Range:

200 to 300 MHz: 40 mV rms to 7 V rms (typ.)

300 to 500 MHz: 20 mV rms to 7 V rms

0.5 to 3.0 GHz: 10 mV rms to 7 V rms

3.0 to 4.5 GHz: 20 mV rms to 7 V rms

4.5 to 6.0 GHz: 40 mV rms to 7 V rms

6.0 to 8 GHz: 80 mV rms to 7 V rms

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)

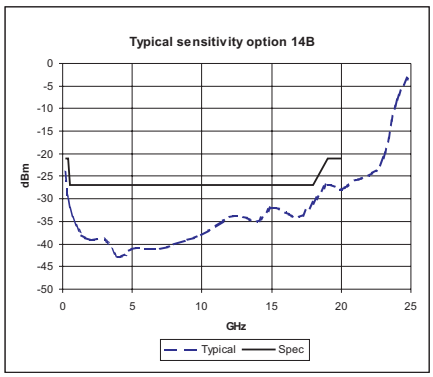
Operating input voltage range :

250 to 500 MHz: -21 to +27dBm

0.5 to 14 GHz: -27 to +27dBm

14 to 18 GHz: -27 to +27dBm (Option 14B only)

18 to 20 GHz: -21 to +27dBm (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 5V rms 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

Pulse Output: Programmable via front/GPIB/USB
Mode: Pulse out, Gate open, Alarm out
Period: 20 ns - 2s in 10 ns increments
Pulse width: 10 ns - 2s in 10 ns increments
Output: TTL-levels in 50Ω, rise time 2ns
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 2s, 10 ns resolution

External Start and Stop Arming

Modes: Start, Stop, Start and Stop Arming
Input Channels: A, B or E
Max Rep. Rate for Arming Signal:
Channel A,B: 160 MHz
Channel E: 80 MHz
Start Time Delay Range: 20 ns to 2s, 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 10^9 samples
Limit Qualifier: OFF or Capture values above/below/inside or outside limits
Measurement Pacing
Pacing Time Range: 4 µs to 500s

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 (X_0)

Other Functions

Measuring Time: 20 ns to 1000s 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
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 (CNT-91): 15k readings/s (block mode)
2600 readings/s in talker only mode
650 readings/s (individual GET trig'ed)
GPIB (CNT-90): 5k readings/s (block mode)
500 readings/s (individual GET trig'ed)
To Internal Memory: 250k readings/s
Internal Memory Size:
CNT-91 Up to 3.5M readings.
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

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 600m
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 000h (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

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

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 Model

CNT-90 300 MHz, 100 ps Timer/Counter including Standard Time Base
CNT-91 300 MHz, 50 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

Time Base Options

Option 19/90 MediumStability Oven Time Base; 0.2 ppm/month
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

Optional Accessories

Option 11/90 Rear Panel Inputs
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-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 3 years extended warranty
Option 95/05 5 years extended warranty

Time Base Options

Option model:	std	19/90	30/90	40/90
Time base type:	Standard	OCXO	OCXO	OCXO
Uncertainty due to:				
-Ageing. per 24h	n.a.	$<4x10^{-8}$ (1)	$<5x10^{-10}$ (1)	$<3x10^{-10}$ (1)
per month	$<5x10^{-7}$	$<2x10^{-7}$	$<1x10^{-8}$	$<3x10^{-9}$
per year	$<5x10^{-6}$	$<6x10^{-7}$	$<5x10^{-8}$	$<1.5x10^{-8}$
-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. 30 min	$<2x10^{-8}$ 30 min	$<1x10^{-8}$ 10 min	$<5x10^{-9}$ 10 min
Typical total uncertainty, for operating temperature 20°C to 26°C, at 2σ (95%) confidence interval:				
- 1 year after calibration	$<7x10^{-6}$	$<0,7x10^{-6}$	$<0.6x10^{-7}$	$<1.8x10^{-8}$
- 2 years after calibration	$<1.2x10^{-5}$	$<1,4x10^{-6}$	$<1.2x10^{-7}$	$<3.5x10^{-8}$

1) After 1 month of continuous operation

Specifications subject to change without prior notice

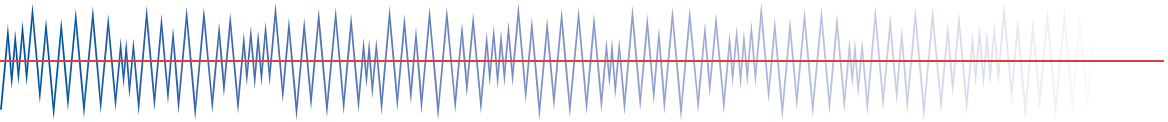
4031 600 91101 - rev. 01 May 2007

US: Pendulum Instruments Inc
5811 Racine Street; Oakland, CA 94609-1519, USA
Voice:(510)-428-9488 Fax: (510)-428-9469

International: Pendulum Instruments AB
PO Box 20020, SE-16102 Bromma, Sweden
Voice: +46 8 598 51057 Fax:+46 8 598 51040

Pendulum Instruments
www.pendulum-instruments.com

- Experts in time & frequency calibration, measurement and analysis



pendulum
Incorporating XL Microwave