CNT-91 & CNT-91R
Timer/Counter/Analyzer & Calibrator

- Continuous Data Streaming over the bus during, not after, measuring
- Zero-dead-time frequency/period measurements
- Fast GPIB/USB bus speed; 4k meas/sec in talker only mode 15k meas/sec in block mode
- High resolution 50 ps-time; 12 digits/sec-frequency
- Graphic display; numerical statistics, histogram, trend & modulation domain
- 250k meas/sec to internal memory 3.75M stored measurement results
- Programmable Pulse Output from 0.5 Hz to 50 MHz
- Integrated Rubidium atomic clock (model CNT-91R)

Highest Performance Ever
- High GPIB/USB bus speed reduces test time in ATE test systems. Individual measurements up to 4k meas/sec in talker only mode. Fast Block measurements with continuous data streaming.
- Zero-dead-time counting provides period/frequency back-to-back measurements and the correct calculation of Allan Deviation.
- High resolution is critical for R&D and production testing. 50 ps single shot (time) or 12 digits/sec. (frequency) resolution allows capturing very small time and frequency changes, displayed to 14 digits.
- Modulation Domain Analysis (MDA). With TimeView™ SW, the CNT-91 becomes a high-performance MDA. Thanks to the high measurement speed (250k meas/sec.) and large memory depth (3.75M) of these, very fast frequency changes in real time can be captured.
- CNT-91’s integrated programmable pulse output offers 0.5Hz to 50 MHz fast rise time signals as a reference frequency output, external pacing/trigger source, or general purpose pulse source.

Outstanding Measurement Tool
The CNT-91 timer/counter/analyzer outperforms every counter on the market, 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 53131/53132 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.

The high-performance CNT-91 is the only tool you need for time & frequency measurement, analysis, and calibration.
**CNT-91R Frequency Calibrator/Analyzer**

The CNT-91R Frequency Calibrator/Analyzer is an all-inclusive high performance calibrator of frequency sources, that combines the high resolution measurements and advanced analysis of CNT-91, with a built-in ultra-stable Rubidium atomic reference clock. Its compact format, and its short warm-up time, makes the CNT-91R an ideal transportable one-box frequency calibrator/analyzer.

**Excellent Graphical Presentation**

One of the great features of the CNT-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\text{max}/V\text{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 figure 4, 5 & 6).

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

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**CNT-91/91R vs CNT-90 selection chart**

<table>
<thead>
<tr>
<th>Feature</th>
<th>CNT-91/91R</th>
<th>CNT-90</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graphic display of trend, histogram, modulation domain</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Frequency resolution</td>
<td>12 digits/sec</td>
<td>12 digits/sec</td>
</tr>
<tr>
<td>Time resolution (single shot)</td>
<td>50 ps</td>
<td>100 ps</td>
</tr>
<tr>
<td>Voltage resolution</td>
<td>1mV</td>
<td>2.5mV</td>
</tr>
<tr>
<td>Measurement speed to internal memory</td>
<td>250k meas/sec</td>
<td>3.75M results</td>
</tr>
<tr>
<td>Talker only output (GPIB/USB)</td>
<td>4k meas/sec</td>
<td>no</td>
</tr>
<tr>
<td>Individually triggered measurements</td>
<td>650/sec</td>
<td>500/sec</td>
</tr>
<tr>
<td>Block transfer speed</td>
<td>15k meas/sec</td>
<td>5k meas/sec</td>
</tr>
<tr>
<td>Freq, period, time, phase, volt, duty c, pulse w, rise time</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Totalize, TIE</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>Programmable pulse output</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>Continuous measurements</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>Timebase CNT-91</td>
<td>OCXO [opt]</td>
<td>OCXO [opt]</td>
</tr>
<tr>
<td>Timebase CNT-91R</td>
<td>Rubidium</td>
<td>OCXO [opt]</td>
</tr>
</tbody>
</table>

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**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.
### Measuring Functions

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

**Frequency A, B, C**

- **Mode**: Normal, back-to-back
- **Range**: Input A, B: 0.002 Hz to 400 MHz  
  Input C (option): Up to 3, 8, 15 or 20 GHz
- **Resolution**: 12 digits in 1s meas. time (normal), 11 digits in 1s meas. time (back-to-back)
- **Aux. Parameter (A, B)**: 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/stop 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**: 125, 70 or 50 ps

**Input Frequency**: 0.1 Hz to 400 MHz

**Input C (option)**: Up to 3, 8, 15 or 20 GHz

**Resolution**: 10 ps

**Input A or B**:

- **Range**: 3 (above 160 MHz)
- **Resolution**: 5 ps

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

**Input Frequency**: Input A, B: 0.1 Hz to 400 MHz

**Input C (option)**: Up to 3, 8, 15 or 20 GHz

**Aux. Parameters**: Freq 1, Freq 2

**Input Frequency**: Input A, B: 0.1 Hz to 400 MHz

**Input C (option)**: Up to 3, 8, 15 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: Ons to +10^6 sec.

**Smart Calculation**: 10^6 sec. to +10^9 sec.

**Resolution**: 50 ps (single)

**Input C (option)**: Up to 3, 8, 15 or 20 GHz

**Aux. Parameters**: Freq 1, Freq 2

**Positive and Negative Pulse Width A, B**

**Range**: 2.5 ns to 1000 sec.

**Resolution**: 10 ps

**Input A or B**:

- **Range**: 3 (above 160 MHz)
- **Resolution**: 5 ps

**Aux. Parameters**: Freq 1, Freq 2

**Time Interval Error (TIE) A, B**

- Normalized period back-to-back measurements, calculated as TIE(k) = kTREF - kT, when T = individual period back-to-back and TREF = reference period value

**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

- **TIE(k)**: 1 to 10^6 counts

- **Freq. Range**: up to 160 MHz

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

**Input C (Opt. 10)**

**Operating Input Voltage Range**: 100 to 300 MHz: 20 mVrms to 12 Vrms  
0.3 to 2.5 GHz: 10 mVrms to 12 Vrms  
2.5 to 2.7 GHz: 20 mVrms to 12 Vrms  
2.7 to 3.0 GHz: 40 mVrms to 12 Vrms

**Prescaler Factor**: 24

**Impedance**: 50 Ω nominal, VSWR <2.5:1

**Max Voltage Without Damage**: 7 Vrms

**Connector**: Type N Female

**Input C (Opt. 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**: 50 Ω nominal, VSWR <2.5:1

**Max Voltage Without Damage**: 7 Vrms

**Connector**: Type N Female

**Input C (Option 14 and 14B)**

**Freq. Range**: 0.25 to 15 GHz (opt. 14)  
0.25 to 20 GHz (opt. 14B)

**Operating input voltage range**: 250 to 300 MHz: -21 to +27 dBm  
0.5 to 15 GHz: -27 to +27 dBm  
15 to 18 GHz: -27 to +27 dBm (Option 14B only)  
18 to 20 GHz: -21 to +27 dBm (Option 14B only)

**Input C (Option 11/90)**

**Rear Panel Inputs and Outputs**

- **Connector**: SMA female for rear input C  
  BNC for all other inputs/outputs

**Reference Input**

- **Freq**: 1, 5, or 10 MHz; 0.1 to 5 Vrms sine; impedance ≥1kΩ

**Reference Output**

- **Freq**: 10 MHz; +1 V rms sine into 50 Ω

- **Amplitude**: ≥90% within sensitivity range

**Max Voltage Without Damage**: >27 dBm

**Connector**: Type precision N Female

**Rear Panel Inputs and Outputs**

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

**Reference Output**

- **Freq**: 10 MHz; +1 V rms sine into 50 Ω

- **Amplitude**: ≥90% within sensitivity range

**Max Voltage Without Damage**: >27 dBm

**Connector**: Type precision N Female

**Typical Sensitivity (dBm)**

- **Frequency**: 20 to 80 MHz

**Pulse Output**

- **Programmable via front/GPLB/USB**

- **Mode**: Pulse out, Gate open, Alarm out

- **Period**: 20 ns – 2sec., in 10 ns increments

- **Pulse width**: 10 ns to 2sec., in 10 ns increments

- **Output**: TTL-levels in 50 Ω, rise time 2ns

**Rear Panel Measurement Inputs**

- **A, B, C (opt. 11/90)**

- **Impedance**: 1MΩ/50 pF or 50 Ω (VSWR <2:1)

**Connectors**: SMA female for rear input C  
BNC for all other inputs/outputs
Technical Specifications: CNT-91 & CNT-91R

**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:** 20 MHz to 100 MHz, 10 ns resolution

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

**Statistics**

**Functions:** Maximum, Minimum, Mean, MeanMin, Standard Deviation and Allan Deviation 
**Display:** Numeric, histograms or trend plots

**Sample Size:** 2 to 2 x 10^11 samples

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

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

**Mathematics**

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

**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 Alarms:** Graphical indication on front panel and/or SRQ via GPIB, plus pulse output connector

**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:** 320x97 pixels

**GPIB Interface**

**Compatibility:** IEEE 488.2:1987, SCP1 1999, 53131A/53132A compatibility mode

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

**Max. Measurement Rate:** GPIB: 15 readings/s [block mode]

**Sample Size:** 20 instrument setups can be stored in local memory for later downloading.

**USB Interface**

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

**Calibration**

**Mode:** Closed case, menu controlled

**Calibration 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 (CNT-91) 
0°C to +45°C (CNT-91R)

**Storage Temp:** 40°C to +71°C

**Humidity:** 5%-95% (10°C to 30°C)

**Altitude:** 0-4,600 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)

**Power Requirements**

**Basic Version:**

**Version:** 90 to 265 Vrms, 45 to 440 Hz, <40 W

**CNT-91R:** Warm-up (12 minutes):

**Version:** 90 to 265 Vrms, 45 to 440 Hz, <60 W

**Operating:** 90 to 265 Vrms, 45 to 440 Hz, <50 W

**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 (approx. 7.5 lb)

**Ordering Information**

**Basic Model**

**MCN-91:** 400 MHz, 50 ps Timer/Counter including Standard Time Base

**MCN-91R:** 400 MHz, 50 ps Timer/Counter including Rubidium Time Base

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

**Input Frequency Options**

**Option 10:** 3GHz Input C

**Option 13:** 8GHz Input C

**Option 14:** 15 GHz Input C

**Option 14B:** 20 GHz Input C

**Time Base Options (CNT-91 only)**

**Option 19/90:** Medium Stability Oven Time Base; 0.06 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

**Option 11/90:** Rear Panel Inputs (replaces front 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 family

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

**Option 90/06:** Calibration Certificate with Protocol; Oven oscillator

**Option 90/07:** Calibration Certificate with Protocol; Rubidium oscillator

**Option 90/08:** Calibration Certificate with Protocol; Hold-over frequency aging/week

**Option 95/03:** 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-EN:** Getting Started English

**GS-90-FR:** Getting Started French

**GS-90-DE:** Getting Started German

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