TimeView™ 3
Modulation Domain Analysis

- View dynamic frequency changes over time
- Emulation of Agilent 53310A MDA
- Accurate FM analysis on carriers up to 20 GHz
- Sample frequency changes every 4 µs in real time
- Analyze frequency in burst signals, hopping, chirp radar, frequency droop, etc
- Powerful analysis: Statistics (histogram), FFT, smoothing, ADEV and MADEV vs τ
- Zero dead-time measurements, detect phase jumps

Background – What’s a Modulation Domain Analyzer?
An MDA (Modulation Domain Analyzer) could be thought of as a frequency sampler analogous to a digital oscilloscope that is a voltage sampler. An MDA displays frequency vs time, just like an oscilloscope displays voltage vs time. You could think of a Modulation Domain Analyzer as a “Frequencyscope”. For example for an FM signal, the MDA would show the modulation frequency (f vs t), whereas an oscilloscope would show the carrier frequency (V vs t).

Dynamic Signal Analysis of Amplitude and Frequency
Amplitude and frequency contents are the two most important signal properties of any signal. Oscilloscopes are used to analyze changes in amplitude but not changes in frequencies. The traditional tool for analyzing the frequency contents of a signal is the Spectrum Analyzer. This can find static frequency components or give an averaged view of dynamic (changing) frequencies. To view also changing frequencies a third type of tool is needed; the Modulation Domain Analyzer (MDA).

To analyze all dynamic properties of a signal, three basic tools are needed, see figure 1:
- Oscilloscope (Voltage vs. time - the time domain)
- Spectrum or FFT-analyzer (Voltage vs. frequency - the frequency domain)
- Modulation Domain Analyzer (Frequency vs. time - the modulation domain)

The modulation domain is the “missing domain” that complements the time and frequency domains. TimeView™ 3 is a piece of SW that works with the Pendulum Timer/Counter/Analyzers CNT-91 and CNT-91R (via USB or GPIB) and converts the Timer/Counter/Analyzer into a Modulation Domain Analyzer.

TimeView™ - an MDA Solution
The Pendulum Modulation Domain Analyzer TimeView 3 consists of two parts:
- Fast sampling front-end CNT-91
- Standard PC with USB or GPIB-interface running TimeView 3

The signal to be characterized is connected to the front-end input (CNT-91 Timer/Counter/Analyzer), which samples the frequency (or time, or phase, or voltage if selected). The data is transferred to the PC and post-processed. All setting controls are made from the PC. Graphs can be printed on the PC-printer and settings and results are stored as ASCII-files, that are easily imported in various programs, e.g. MS-Excel for further analysis.

TimeView 3 is a further refinement of the current TimeView 2 SW, with some extra functionality and a slightly different User Interface. To make use of the extra functionality, TimeView 3 requires the models CNT-91 or CNT-91R as front-ends. The TimeView 2 software can use any CNT-9x counter (CNT-90, CNT-90XL, CNT-91 or CNT-91R).
Modulation Domain Analysis Examples

**Figure 1:** The modulation domain (f vs. t) complements the time (V vs. t) and the frequency (V vs. f) domains.

**Figure 2:** Jitter (rms and peak-peak) and noise is quantified in distribution histograms.

**Figure 3:** The FFT-diagram reveals the modulation frequency, whether intended or unwanted.

**Figure 4:** 10 MHz with 1kHz FM -Modulation domain view with panorama view.

**Figure 5:** ADEV vs τ (Zero-dead-time measurement) reveals poor performance of a synthesised function generator.

**Figure 6:** Frequency hopping in high quality military troop radio with panorama view.

**Figure 7:** Frequency hopping in low cost commercial radio channel scanner with panorama view.

**Figure 8:** Frequency hopping in 2.4 GHz WLAN (FHSS).

**Figure 9:** Frequency settling of VCO after step change of input voltage.

**Figure 10:** Frequency sweep of an analog sweep generator.

**Figure 11:** Frequency sweep of a digital low-cost sweep generator with panorama view.

**Figure 12:** Jitter of optical CD-pulses T3 through T11 in CD player.

**Figure 1:** The modulation domain (f vs. t) complements the time (V vs. t) and the frequency (V vs. f) domains.
Cross-reference table TimeView 3 versus TimeView 2

<table>
<thead>
<tr>
<th>Version:</th>
<th>TimeView 3</th>
<th>TimeView 2</th>
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<td>Waveform capture</td>
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**HW and SW Requirements**

**Measurement HW**

Pendulum CNT-91 or CNT-91R

**Operating System**

MS Windows 2000, XP, Vista or Windows 7

**PC interfaces**

USB (CNT90-family only)

GPIB [National Instruments, Agilent or Keithley/CEC]

**Measurement & Speed**

**Measurement Functions**

Frequency (normal, BtB, burst, PRF, ratio)

Period (average, BtB, single shot)

Time interval

Phase

Duty factor

Frequency ratio

Voltage max/min/p-p, ratio

Pulse width

Rise/fall time

Slew rate

TIE

**Speed**

Sample speed to internal memory:

Up to 250 000 samples/s

Result memory

1.9M results (result plus timestamps)

**Technical Specifications: Timeview**

**TIE**

TIE (time back-to-back values) are sampled and displayed. Various post-processing alternatives gives ADEV, MADEV for short term stability measurements and MTIE, MRTIE, TDEV for Wander analysis

**Input A, B:** DC to 250 kHz (capture and timestamp ALL trigger events)

DC to 160 MHz (count all trigger events, timestamp events with set pacing interval)

**Input C:** Full input C freq. range (see specification for actual input used)

**Sample interval:** 4µs to 500 s

**Single-shot measurements**

Measurements are captured as quickly as possible and stored in internal memory

**Zero dead-time:** Frequency and Period BtB, TIE

**4µs dead-time:** All other functions, except voltage

**Repetitive Sampling**

Measurements are repeated with a delayed start that is incremented for each new measurement. The results are combined into a resulting graph (similar to repetitive sampling DSO:s). This capture mode requires a repetitive signal

**Equivalent sample time:** down to 10ns delay between measurements (effective 100 MSa/s)

**Waveform Measurements**

This capture mode requires a repetitive signal. Voltage resolution is 1.0 mV

**Burst**

This capture mode shows frequency vs time for pulsed RF signals

**FM**

This capture mode measures accurately all FM parameters

- Carrier frequency up to 20 GHz

- Modulation frequency up to 125 kHz

- Frequency deviation up to 10 GHz

**Limited by measurement range**

**Analysis Modes**

**Statistical distribution (histogram)**

**Statistical numerical analysis**

- max value

- min value

- mean value

- standard deviation

- Allan deviation

**Dual cursor readout in graphs with calculation of dx, dy and dy/dx**

**FFT analysis (detect modulation frequencies)**

**Window functions:** Hamming, Hanning, rectangular

**Smoothing:** (digital LP-filter via a moving average of data points)

**TIE analysis:** ADEV vs τ, MADEV vs τ, MTIE vs τ, MRTIE vs τ, TDEV vs τ

**Ordering Information**

**Option 29/91:** TimeView 3 for CNT-91 or CNT-91R. Software for PC. One license per user. The program will be delivered on a CD-ROM.

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