STA-61 and STA-61G

Sync Tester/Analyzer

pendulum

- **Synchronization test platform for Next Generation Networks (NGN)**
- **Modular multi-input measurements: 2, 4 or 6 channels simultaneously**
- **Measures E1/T1, SyncE and PTP clocks**
- **Comparison with standard masks**
- **Very accurate built-in Rubidium reference with GPS control**
- **Portable and cost-effective**
- **User-friendly**

Shown with stand

The Pendulum STA-61 marks a new generation of instruments allowing the user to test and analyze sync in various types of networks. Where traditional instruments on the market are designed specifically for SDH/SONET or are dedicated SyncE or PTP testers, the STA-61 can do it all. This is a Sync Tester/Analyzer developed for Next Generation Networks (NGN), incorporating a mix of both traditional SDH/SONET core networks and IP-based backhaul networks.

Portable and Cost-Effective

Lightweight, with a handle and a size that fits as carry-on luggage on aircrafts, the STA-61 is designed to make it easy to bring wherever you want to use it. Place the sync tester/analyzer on a work-bench or use the stand for comfortable viewing when the instrument is placed on the ground. All these functions are packed together in an instrument that is still much less than the price of traditional testers on the market, makes STA-61 the most cost effective solution for field synchronization test.

Truly User-Friendly

Equipped with a large color LCD touch screen, showing TIE, TDEV, MTIE, RTIE, MRTIE, ADEV or FDEV results in real-time during measurement, and combined with intuitive menus, this sync tester/analyzer is a truly user-friendly unit. All it takes to start measuring is a simple 3 step operation:

1) Connect your signal(s) to test
2) Press SIGNAL CHECK to identify signal type
3) Press START

Within a few minutes anyone could learn how to operate the STA-61. No time or cost needs to be spent on training and the risk for operator mistakes is eliminated.

Modular and Future Proof

Sequential testing is no longer necessary if you want to measure wander on several access points in a station, the STA-61 can measure on up to 6 different test points simultaneously. Thanks to the modular input design in a generic measurement platform, it is easy to expand the STA-61 with more measurement input modules in the future. The E1/T1/1PPS Input Module measures all standard telecom clocks, the 125 MHz or 156.25 MHz, 1GigE or 10GigE, SyncE reference clock as well as the typical 1-pps physical output from a termination PTP slave. Or, set-up user-defined clocks from 0.5 Hz to 180 MHz.

The modular design makes STA-61 future proof, buy your new sync tester/analyzer today and expand it with more input modules when you need it.

Two Models

Choose between two models: The basic STA-61 model has slots for up to three input modules with two inputs each, and a wide range of input/outputs, incl. 1, 5 or 10 MHz reference in/out plus 1PPS out. The STA-61G model also includes an integrated GPS-receiver and external 1-pps input. Both models offer an optional E1/T1 clock/data output.

Always Accurate

The STA-61 includes a built-in high performance Rubidium oscillator which allows making sync measurements in places where no accurate frequency/time reference is available. This is key to field commissioning or trouble-shooting operations. In addition, the STA-61G has a built-in high sensitivity GPS receiver which slaves the internal reference to provide a few tens of nanoseconds absolute UTC time accuracy as well as sub10^{-11} frequency accuracy. No external calibration, and no calibration down-time, is needed with the STA-61G.

Common Mode or Differential Wander Measurements

You can compare all your signals under test to the integrated stable Rubidium atomic clock, or to an external high-stability standard, to show the absolute phase variations of all signals under test relative to the common reference clock. You can also define one of the input signals as the reference for all other input signals (differential TIE). This

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enables for example comparisons of outgoing vs. incoming sync clock in Network elements, and comparisons between a Grandmaster PTP and one or several PTP-slaves. For in-depth analysis, you can also read out cursor data and perform statistical analysis of your measurement.

Remote Operation – Sync Probe Mode

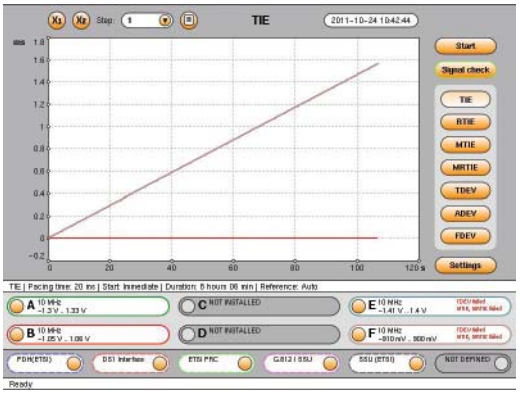
The STA-61 can be used as a sync probe when connected to an IP network for a virtually infinite measurement duration.Thanks to the WanderView™ for STA-61 free companion software, powerful and user-friendly functions like remote control, data acquisition, post-processing, graph display, and report generation are available on a remote PC.

Remote Operation

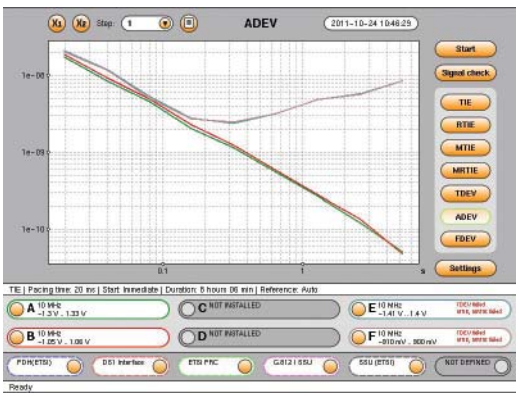
Remote operation of the STA-61 can be facilitated in many ways. The STA-61 has a built-in web server including a VNC server. That means you could monitor and control the STA-61 via Ethernet in a standard VNC client anywhere in the world, running in a PC, or even in a smart phone. You can view the screen and the current measurement progress, and you can control the measurement by clicking the on-screen controls in the remote VNC client. You can also connect to the PC program WanderView™ via Ethernet. From WanderView™ you have full control of the STA-61 including continuous data streaming of measurement data, report generation and advanced post-processing and analysis.

Examples of Measurement Screens

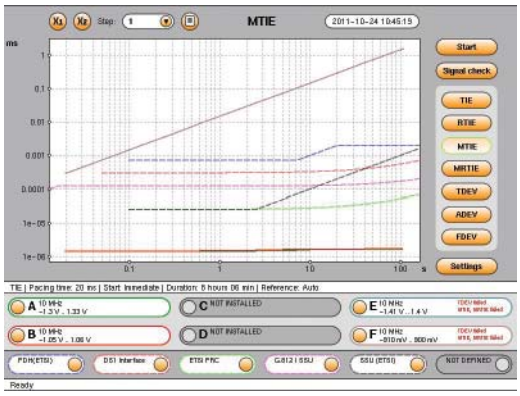
Multiple TIE Measurements: The screen shows simultaneous measurement of 2 master clocks (horizontal line) and 2 slave clocks (lines with a slope), vs the built-in Rubidium reference. The slave clocks has a high frequency offset.



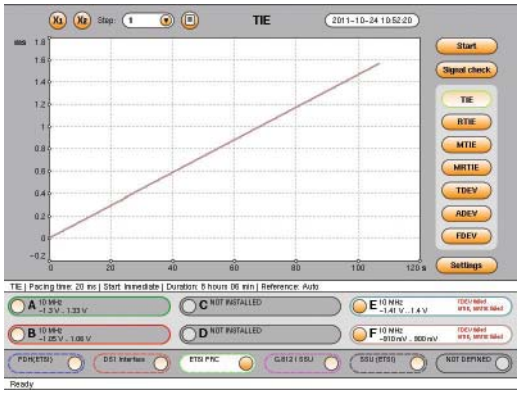
ADEV of Multiple Signals: Here the short-term stability of all four connected signals is measured and displayed.



Multiple Signals with Multiple MTIE Masks: Here the MTIE of the two master and the two slave clock outputs are measured. The bottom solid lines are the master clocks, the top solid lines are the slave clocks. The dashed lines are color coded selected masks. The master clocks are well below all masks, and the slave clocks with the offset are above all masks, due to high frequency offset.



Differential TIE: One input channel is used as reference to all others. This screen shows a slave clock phase variation vs. the master clock, and not vs. the Rubidium reference:



RTIE Display: A high frequency offset is hiding the smaller phase variations of the slave clock. Using RTIE removes the offset and shows the wander:

Signal Types

Predefined

- 1 PPS (PTP slave clock output)
- 8 kHz (frame clock)
- 64 kHz /64 kbit/s (E0 / DS0)
- 1.544 MHz /1.544 Mbit/s (T1/DS1 clock/data)
- 2.048 MHz / 2.048 Mbit/s (E1 clock/data)
- 5 MHz /10 MHz (Freq. reference)
- 25 MHz /125 MHz /156.25 MHz (SyncE)
- 34 Mbit/s (E3)
- 45 Mbits/s (DS3)
- 155.52 MHz /155 Mbit/s (STM-1 clock/data)

Clock Signal Types

User defined signal types from 0.5 Hz to 200 MHz in 1Hz steps. Note: The signal under test must be a symmetrical, unipolar clock-type signal

Measurement Modes

Common Mode: Signals measured against the selected frequency reference (internal or external)
Differential: One input signal is selected as reference, and all other signals are measured against this reference input.
Absolute TIE (STA-61G only): 1PPS from DUT is measured against absolute 1PPS internal time reference, when GPS is locked (also called TOD measurement)

Test Modes (MTIE and TDEV Masks)

Masks can be applied for MTIE and TDEV graphs.
Draft: No mask
PRC/SSU/SEC: Masks for G811/G812/G813-clocks (ETS 300 462-3)
Networks: According to G.823/G.824
SyncE: According to G.8261, G8262
ANSI-standard: DS1 and OC-N masks
User-defined: Defined by the user

Time Interval Error (TIE)

Reference Clock: Built-in Rubidium reference or ext. reference input 1, 5 or 10 MHz
Resolution: 200 ps rms
Sample Rate: up to 100 Sa/s depending on number of parallel measurements
Internal Data Storage: up to 5M TIE values
External Data Storage: on USB memory stick
Start/Stop: via START/STOP key.
Signal Check Parameters: Signal type (Clock, Data or Unknown); Frequency (for clock signals); Pulse width (for data signals); Voltage peak-peak (min. 120 mVp-p)

Graph Display

Display Modes: TIE, MTIE, TDEV, ADEV, FDEV, RTIE, MRTIE
Update Rate: approx. once/second
Number of Graphs: Up to 6 graphs of the same type can be over-laid on screen. Color coded.
Masks on Screen: Up to 6 MTIE, MRTIE and TDEV masks according to selected test mode. Pass/Fail result available for each mask
Display: Color TFT, 8.4", 800x600 pixels, resistive touchscreen

Input Modules

E1/T1/1PPS Input Module

Number of Channels: 2 per module
Connector: BNC
Frequency: 1PPS/2s to 200 MHz
Impedance: 75 ohm, VSWR <2:1 or 1M ohm
Voltage Range: ±5.00 V
Sensitivity: 60 mVpp
Signal Type:

- Symmetrical pulse (Clock signal)
- Unsymmetrical repetitive pulse (Clock signal)
- HDB3-coded data (Data signal)
- AMI B8ZS, B3ZS (Data signal)

External References

Frequency Reference Input (standard)

Input Frequency: 10 MHz, 5MHz or 1MHz
Voltage Range: 0.1 Vrms to 5 Vrms
Impedance: approx. 50 ohm

External 1PPS Timing Input (STA-61G)

Voltage Range: TTL in 50 ohm
Required Accuracy: ± 100 ns to UTC

GPS Timing Reference (STA-61G)

Antenna Input: N-type connector
DC-feed: +5V on center pin to active GPS antenna

Output References

Reference Frequency Output

Ref. Frequency: 10 MHz sine-wave
Output Levels: 1Vrms in 50 ohm
Impedance: approx. 50 ohm

1PPS Output

Source: Internal Rubidium oscillator
Output Logic Levels: TTL levels in 50 ohm

E1/T1 Output Module

Connector: Clock: BNC; Data: Isolated BNC
Frequency: 2.048/1.544 MHz
Output Level: Acc. to G703:10; ±1.2 V ±10% in 75 ohm

Interfaces

USB Device Port

Connector: Std USB type B
USB Version: 2.0

USB Host Port

Connector: Std USB type A
Max Supply Current: 400 mA
USB Version: 2.0

Ethernet

Communication Port: RJ45, 10/100 Base-T
Protocol: DHCP, HTTP, FTP, VNC

WanderView™ for STA-61

The STA-61 companion software provides full remote operation over IP networks.
Operating System: Windows 2000/XP/Vista/Windows 7, 32 or 64 bit OS
Instrument Settings: All local instrument settings can be controlled
Data Transfer: TIE-values in real-time transfer; stored TIE values; measurement settings; Instrument id

- Continuous data streaming acquisition on remote PC, allowing unlimited measurement duration coupled with continuous connection
- Dump mode data transfer at the end of mesurement, if connection is not continuously available

Stored File Format: CSV, for easy export to other programs, like Time Monitor, Stable 32 or MS-Excel
Metrics: MTIE, RTIE, MRTIE, TDEV, ADEV, MADEV, FDEV; all calculated functions are displayed in own graph windows
Analysis: Cursor readouts, cursor delta, zooming in graphs, mean value, max value, min value, peak-peak value, std dev in any graph, either on full data set or data between cursors
Custom Mask Editor: User defined MTIE, MRTIE, and TDEV masks
Event Log: On screen log of measurement start/stop, duration, alarms, loss of data, loss of communication link, etc. Log can be saved as text file.
Multiple Graphs: Up to 6 measurements can be overlaid in the same graph for easy comparison
Multiple Masks: Up to 6 masks can be overlaid in the same graph, with fass/fail indication
Report Generation: Printable, custom designed measurement report in pdf format
Security: Password secured access to STA-61

Calibration

Principle: Closed Case Calibration with automatic adjustment of the Rubidium timebase, using Cs-based, or GPS-controlled Rb-based, 10 MHz reference.
Calibration Uncertainty: $<2\times10^{-12}$ + Cal. Ref. Freq. Uncertainty

GPS-disciplining of Internal Timebase

Model STA-61G Only

Built-in GPS Module: 12 channels, TRAIM GPS receiver, high sensitivity
Time Accuracy to UTC: ± 25 ns at 1σ, after 24 hours lock
Frequency Accuracy: 2.10^{-12} averaged over 24 hours
GPS Disciplining Modes: Always disciplining, always in holdover, disciplining only between measurements

Internal Time Base Stability (hold-over)

Stability Versus Temperature:
20° to 26°C: $<1\times10^{-11}$ (typ.)
0° to 50°C: $<1\times10^{-10}$
Ageing Rate: *24h:* $<5.10^{-11}$ per month
Warm-up Stability: 12 min to $<1\times10^{-9}$

General Specifications

Environmental Data

Temperature: *Operating:* 0°C to 40°C
Storage: -20°C to 70°C
Safety: EN 61010-1:2011, CAT II, Pollution degree 2, Measuring category I, CSA C22.2 No 61010-1-04, UL 6010-1:2004
EMC: EN61326 (1997) + A1 (1998), CE

Power Supply

Line Voltage: 100 to 240 Vrms ±10%, 47 Hz to 63 Hz, <60 W

Mechanical Data

The cabinet is suitable for field use, and can be operated on a bench (lying down) or on a floor (standing up). The cabinet is shock resistant, using bumpers.
Dimensions (w x h x d):
320 x 388 x 126 mm (12.6" x 15.3" x 5")
Weight: Net <6 kg (13 lb); Shipping <7 kg (15 lb)

Ordering Information

STA-61 Sync Tester/Analyzer, basic. Multi-channel synchronization tester/analyzer. Needs one or more input module options (Option 610).
STA-61G Sync Tester/Analyzer, with built-in GPS receiver and 1-pps input. Multi-channel synchronization tester/analyzer. Needs one or more input module options (Option 610).
Included with Shipment: User manual on CD, line power cord, Calibration certificate, 3-year warranty

Built-in Options

Option 610: 1-pps to 200 MHz input module

Optional Accessories

Option 01: GPS antenna (STA-61G)
Option 01/50: GPS antenna mounting kit (STA-61G)
Option 02: GPS antenna cable, 20m (STA-61G)
Option 27/61: Heavy Duty Hard Transport Case
Option 31/01:
SyncE-tap for 1310 nm, Single mode, LC
Option 31/02:
SyncE-tap for 850 nm, Multi-mode, LC
Option 31/09: 19" rack to hold 1, 2 or 3 SyncE-taps (opt 31/01 or opt 31/02)
Option 90/61: Calibration certificate with protocol – Rubidium timebase
Option 95/05: Extended warranty to 5 years
OM-61: Printed User Manual

STA-61 right-side panel for input modules

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