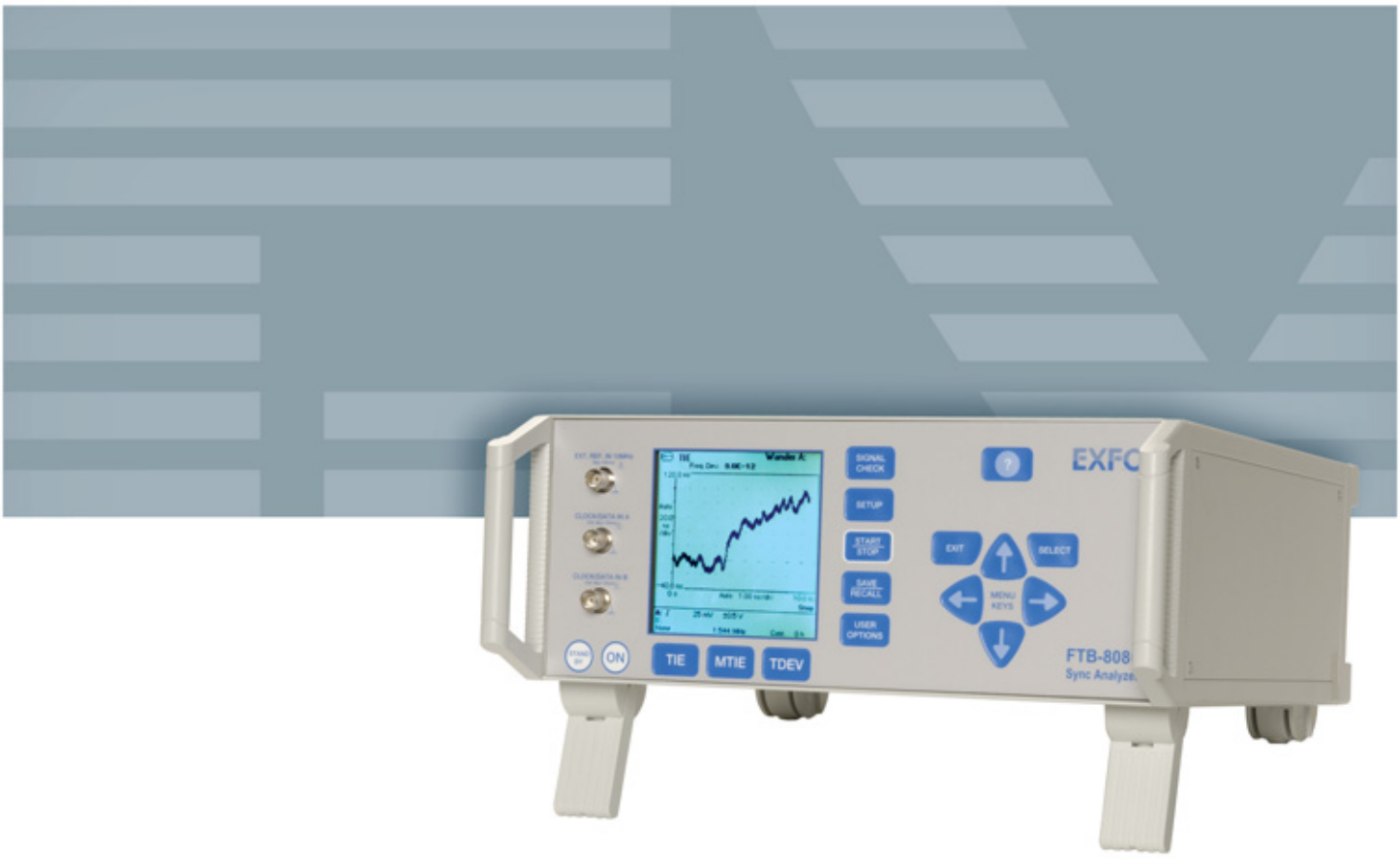
8080

NETWORK TESTING

SYNC ANALYZER

FTB-8080



Fast, Easy Synchronization Testing for SDH, PDH and SONET Networks

- Measures wander on transmission rates from 4 kHz to 52 Mb/s–the most cost-effective wander measurement tool available
- The easiest tool in its category: fool-proof operation
- Frees up your expensive, all-inclusive testers for more complex applications
- Control the unit and retrieve data from anywhere (Ethernet access)
- MTIE and TDEV masks
- Portable 2.048/1.544 MHz clock generator

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Telecommunications Test and Measurement

EXFO

EXPERTISE REACHING OUT

Speeding Up Synchronization Testing of Telecom Networks

Incorrect synchronization in digital communication networks can cause severe transmission problems. Voice calls (fixed or cellular) will be lost, fax machines will misprint, and data will be lost or frequently retransmitted. In any case, network performance is degraded, the operators' service costs are increased and revenues are down.

The main cause for synchronization problems in transport networks is wander of the synchronization clock. Quality control of the synchronization clock requires monitoring of wander over a long period (hours or days), using an ultra-stable clock as a reference.

To date, wander measurement has involved bulky, complex and very expensive instrumentation. Until now, viewing MTIE and TDEV wander parameters specified in international standards often required external rubidium standards and/or external computers.

EXFO's FTB-8080 advanced synchronization analyzer solves this problem. It enables multi-application synchronization testing at a multitude of data rates in SDH, PDH, SONET, wireless video and frequency reference distribution networks.

The FTB-8080 enables synchronization testing at various data rates in SDH, PDH, SONET, video and frequency reference distribution networks.

Wander Measurement: Network Applications

- Confirmation of network synchronization during installation and commissioning
- Verification of clock quality when sync services are sold
- Synchronization qualification after network topology changes
- Preventive monitoring installations

Wander Measurement: Lab/Manufacturing Applications

- Network simulation, device characterization and production testing
- Quality control and incoming inspection of network hardware

KEY FEATURES

- Display of TIE, MTIE and TDEV, as well as comparison with standard masks
- E1 clock/data signals (2 Mb/s)
- Transmission rates from 4 kHz to 52 Mb/s (E3, DS-1, DS-3, STS-1, STM-0)
- 2048 kHz portable synchronization E1 clock; 1544 kHz portable synchronization T1 clock
- Internal rubidium reference with GPS input for field calibration
- No external PC needed
- Ethernet interface for remote control and data access
- 110, 220 AC and –48 V DC supply
- Differential and absolute wander measurement
- Displays frequency offset of local clocks

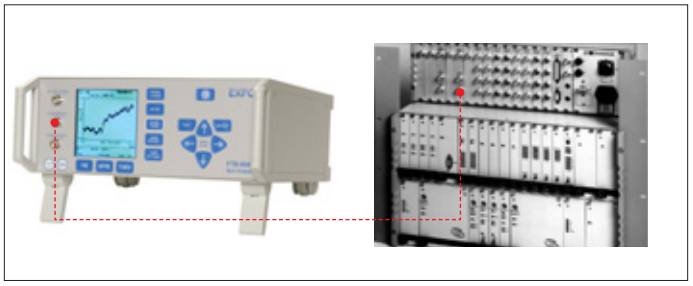
Performing Standardized Measurements

EXFO's FTB-8080 Sync Analyzer is designed to measure wander according to ITU and ANSI standards of various signals in SONET, SDH or PDH network nodes, with graphical presentation of TIE, MTIE and TDEV and comparison to standard masks (e.g., PRC, SSU, SEC). It enables the creation of user-defined masks, according to new or changed standards, for easy recall during measurements.

The FTB-8080 can measure both "absolute" and "differential" wander. In the first case, the measured signal (clock or data) is compared to the ultimate stability of the internal rubidium "atomic" clock or an external 10 MHz reference. In the second case, the relative wander between two signals (e.g., ingoing and outgoing E1 signal from a network element) is measured. This makes it possible to verify wander tolerance and the amount of "extra wander" created by the device under test.

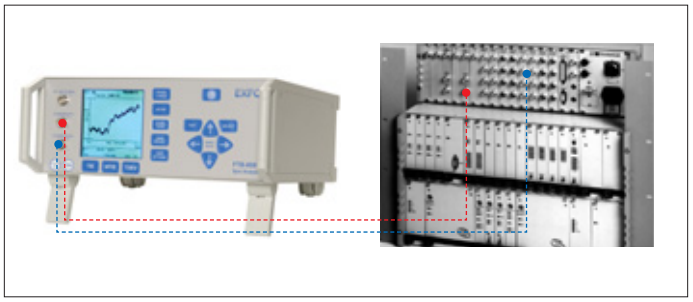
Absolute Wander

- Measure absolute wander in sync equipment and network elements
- Use the internal rubidium clock as a reference, or...
- Use GPS satellite synchronization to compare multiple sites with a single reference; correlate with SyncView software



Differential Wander

- Measure differential wander in/out of sync equipment and network elements
- Using the incoming sync signal as reference for the outgoing sync signal
- Pinpoint wander added by equipment or network elements



Supported Input Rates

SONET/SDH

52 Mb/s	STM-0E/STS-1

PDH/DSn

2.048 MHz/Mb/s	E1
34 Mb/s	E3
64 Kb/s	DS0
1.544 MHz/Mb/s	DS1 / T1
45 Mb/s	DS3

Other Rates

- 4 kHz
- 8 kHz

Video

- 27 MHz
- 15.750 kHz NTSC H-sync
- 15.625 kHz PAL H-sync

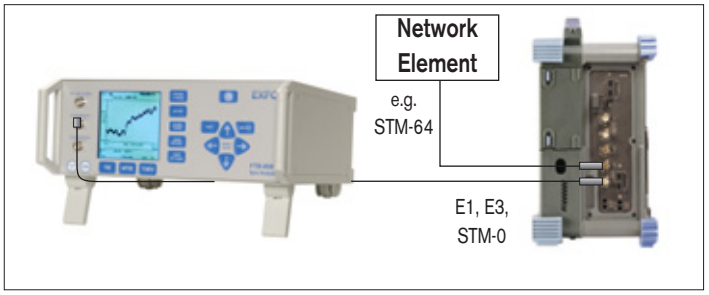
Reference Frequencies

- 10 MHz Calibration input/output
- 2.048 MHz E1 clock output
- 1.544 MHz T1 clock output

Connecting the FTB-8080 with EXFO's FTB-8000/ FTB-8100 SONET/SDH Analyzers

Use the FTB-8000 or FTB-8100 SONET/SDH Analyzers for measuring wander at rates not supported by the the Sync Analyzer

- The sync clock is common at all rates within a payload
- The wander measured from a dropped rate is the same as the original (e.g., when extracting E1 from an STM-64, the wander on E1 and STM-64 are the same)



Remote Control Via Internet

EXFO's FTB-8080 is a compact, lightweight, self-contained instrument that features a built-in rubidium reference clock and a graphical display. There is no need to carry around an external frequency standard or a separate PC to make and view the measurement. A PC cable and 120 W to 75 W transformers come standard, to enable measurement on any kind of cable system, whether 75 W unbalanced or 120 W balanced. An Ethernet interface, a 1.544/2.048 MHz clock and a –48 V DC voltage supply also come standard.

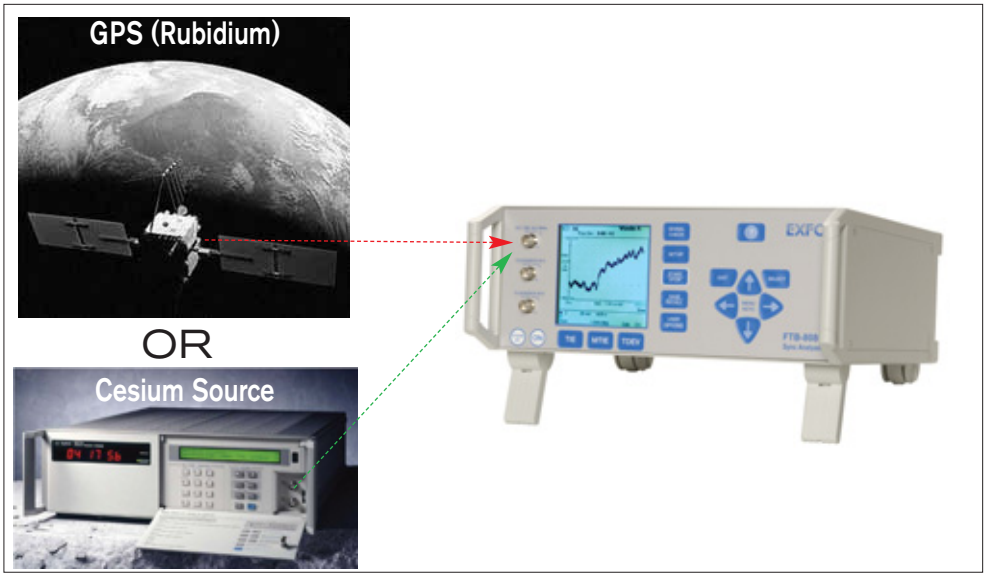
Easy to Operate and Calibrate

The FTB-8080 is very easy to use and can be easily operated by unskilled personnel. For standard measurements, only a few keystrokes are required. Once the measurement is started, the unit can be left unattended for automatic measurements, and can be configured to automatically start and stop at preset times.

A fully automatic signal check informs the user whether he/she has connected the right signal from the rack. Online context-sensitive help is also available.

The calibration and adjustment of the internal rubidium clock is simple and fully automated. Connect a known reference signal from a cesium or a GPS-controlled rubidium clock, enter the calibration mode of the Sync Analyzer, and leave the unit overnight. The next morning, the FTB-8080 is perfectly adjusted, without any manual trimming required.

EXFO's FTB-8080 Sync Analyzer is easy to carry, with side handles and a flight-proof transport case (extra accessory).



Automatic Adjustment of the Rubidium Clock

- Connect to a frequency reference
- Leave FTB-8080 alone overnight, and…
- The internal rubidium clock is perfectly adjusted!

Built for User-Friendliness

Automatic signal check

- Eliminates measurement on wrong signal

Unattended operation

- Starts and stops as programmed

Graphical display

- Immediate, easy-to-read visual feedback

Context-sensitive help

- No need to read the user guide

Ethernet connection

- Fast, easy retrieval of test data

A Complete Unit

Once you have installed the FTB-8080 at one network node location to perform measurements, you do not need to travel back to get the results from individual wander measurements. Via the Ethernet port, you can connect the Sync Analyzer to the Internet. From a central PC running SyncView, you can control the downloading of measurement data and the setup of new measurements.

Working Principle

EXFO's FTB-8080 Sync Analyzer is built in an EMI-proof metal cabinet and contains a rubidium reference and a special in-house-developed time interval error (TIE) measurement circuitry, which phase-compares the connected signal with the rubidium reference. The FTB-8080 communicates its results to the user via a graphical display, and to a PC via an RS-232 port or an Ethernet port.

The FTB-8080 operates in two different modes:

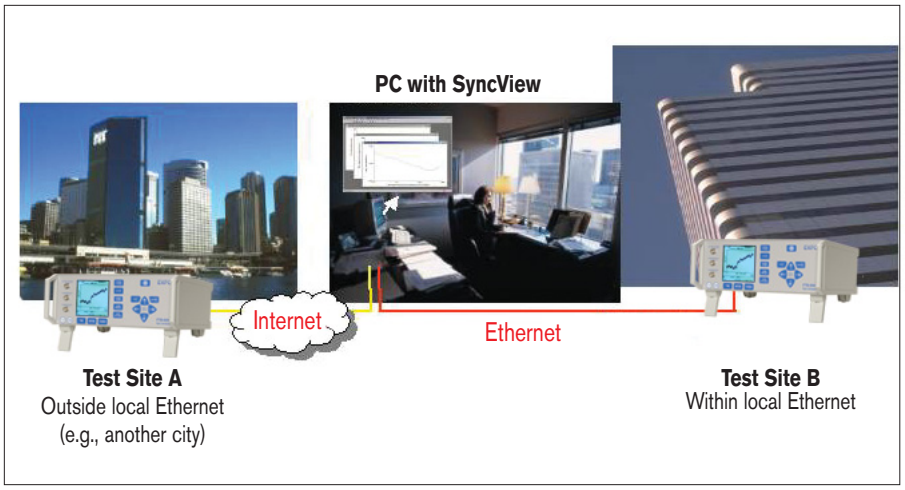
Local mode operation

This is the stand-alone operation mode. During the measurement, the TIE curve on the display is continuously updated, showing the performance of the sync clock "so far". This mode is intended for fully automated diagnosis and/or fault-finding measurement "on-site", with real-time, direct visual feedback. The sampling rate is approximately 1 Sa/s. The Sync Analyzer calculates and presents the MTIE or TDEV curves after the completed TIE measurement, and compares to stored masks.

Remote (PC-controlled) operation

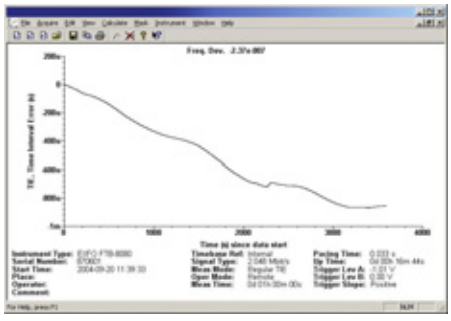
The FTB-8080 can be operated/controlled from the RS-232 port of a PC, running the SyncView PC software. In this mode, the Sync Analyzer acts as a sampling front-end and transfers the TIE values one by one to the PC. The local display of the Sync Analyzer is not updated. There is also an Ethernet port available for the same purpose.

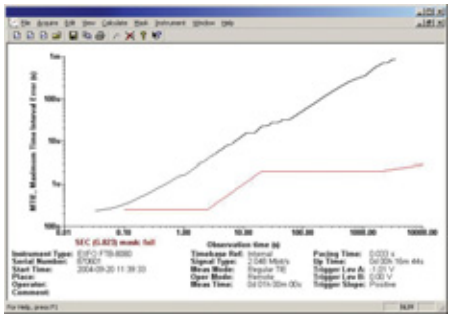
Sampling speed is > 30 TIE values/s, and the storage is only limited by the PC, which means that the fast sampling rate can be maintained during a 24 h period (or longer if required). The PC software calculates and presents MTIE or TDEV curves after completed measurement period, and compares to the defined masks. This mode is intended for verification of conformance to ETSI or ANSI standards.



SyncView Companion Analysis Software

- Windows 95/98/NT/XP
- Reads TIE data from FTB-8080 Sync Analyzer–high-speed, large storage in PC
- Displays and prints calibration records–TIE, MTIE and TDEV graphs
- Programmable user-defined masks–add new/changed MTIE and TDEV standards, or request updated masks from EXFO support
- Remote control–read data via Internet/Ethernet from anywhere in the world





Why Measure Wander?

Too much wander can create various problems, depending on which type of signal it occurs. The result is unreliable network services and reduced, which in turn means higher costs and lower revenues. Here are a few examples of problems caused by high wander:

- Fax ⇨ Unreadable characters
- Voice ⇨ Sudden click sounds
- Data ⇨ Retransmission (lower throughput)
- GSM ⇨ Lost calls
- ATM ⇨ Lost data

Wander vs. Jitter

Wander measurement and jitter measurement are different applications. One is carried out during network testing, the other during equipment testing. Wander and jitter test functions therefore don't need to be combined in the same unit.

Wander: a network parameter

- Propagates through the network path and increases
- Longer measurement time (typically 24 h)
- May cause total loss of synchronization
- Main cause for synchronization problems

Jitter: an equipment parameter

- Does not propagate in the network and is reduced in network nodes
- Spot measurements
- May cause minor transmission problems

The bottom line: It is wander, not jitter, that is crucial for network synchronization.

SPECIFICATIONS[1]

Presentation modes		
Time interval error (TIE)	Displayed and continuously updated in Local mode operation.	
MTIE	Calculated from the measured and stored TIE values and displayed after completed measurement in Local mode operation.	
TDEV	Calculated from the measured and stored TIE values and displayed after completed measurement in Local mode operation.	
Test modes (MTIE and TDEV masks)		
The internal rubidium clock is used as reference in all modes except "Differential". Mask applies for MTIE and TDEV graphs.		
Draft	No masks	
PRC	Masks for G811 clock (ETS 300 462-3)	
SSU	Masks for G812 clock (ETS 300 462-3)	
SEC	Masks for G813 clock (ETS 300 462-3)	
SSU (locked mode)	Masks for G812 clock (ETS 300 462-4)	
SEC (locked mode)	Masks for G813 clock (ETS 300 462-5)	
ANSI standards	To be defined	
Video	To be defined	
Differential	Relative wander (TIE, MTIE and TDEV) between two clocks or data signals.	
Input signal characteristics		
Frequency	4 kHz, 8 kHz, 64 kb/s, 1.544 MHz, 1.544 Mb/s, 2.048 MHz, 2.048 Mb/s, 10 MHz, 27 MHz, 34 Mb/s, 45 Mb/s, 52 Mb/s, 15.750 kHz (NTSC), 15.625 kHz (PAL)	
Amplitude	Between –5 V and +5 V	
Signal type	Symmetrical pulse (clock signal)	HDB3-coded data (data signal)
	Unsymmetrical repetitive pulse (clock signal)	AMI B8ZS, B3ZS (data signal)
Time interval error (TIE)		
Reference clock	Built-in rubidium clock or an external 10 MHz clock signal connected to external reference input	
Measuring time	30 min, 2 h, 4 h, 24 h or continuously (Local mode)	
Local mode update rate		
30 min, 2 h, 4 h	approx. 1 Sa/s	
24 h	approx. 0.2 Sa/s (1 Sa/6s)	
Continuously	16 000/time Sa/s; max. approx. 1 Sa/s. Data compression after approx. 4 h.	
Remote mode update rate		
Any measuring time	up to 30 Sa/s	

SPECIFICATIONS[1]

Internal data storage

Size	16 000 stored TIE values	Type	Non-volatile storage

Measuring time

Time	Short (30 min, 2 h, 4 h), long (24 h) and continuous
Start/Stop	Via Start/Stop key
Warmup time	Selectable delay before measurement starts, to allow the instrument to warmup properly (0, 30 minutes, 4 h or 24 h).

Signal check

Measures and displays the following parameters

Signal type (clock, data or unknown)	Pulse width (for data signals)
Frequency (for clock signals)	Voltage peak-peak (min. 120 mVp-p)

Save/recall

No. of instrument setups	5
No. of screen images	3 (TIE, MTIE or TDEV)
Stored TIE-value array	16 k values (1 set)
Write protection	Saved setup, screen image or TIE-value array can be protected against accidental overwriting.

Graph display

Display modes	TIE, MTIE or TDEV
Vertical scale	Displayed TIE, MTIE or TDEV value in ns or ms. Auto-scaled.
Horizontal scale	Real-time axis (TIE) or "t"-axis (MTIE/TDEV). Auto-scaled (continuous measurement and differential test mode) or fixed-scaled (2 h/24 h full scale).
No. of divisions	8 x 10 (vert. x horiz.)
Masks	MTIE and TDEV masks according to selected test mode.

Clock/data inputs A and B

Connector	BNC
Coupling	DC coupled
Voltage range	± 5.00 V
Sensitivity	60 mVpp
Impedance	75 Ω, VSWR < 2:1
Maximum input voltage without damage	12 Vrms up to 2 MHz, decreasing to 6 Vrms at 10 MHz
Trigger level	Automatically set via Signal Check; can be manually adjusted
Range	± 5.00 V
Resolution	10 mV

External reference input

Connector	BNC
Input frequency	10 MHz
Voltage range	0.5 Vrms to 6 Vrms
Impedance	approx. 500 Ω
Coupling	AC coupled
Maximum input voltage without damage	30 Vrms up to 1 kHz, decreasing to 6 Vrms at 10 MHz

Reference frequency output

Connector	BNC
Ref. frequency	10 MHz square-wave
Frequency stability	See internal timebase stability spec.
Output levels	Fixed TTL: low < 0.4 V, high > 1.8 V into 50 W

2.048 MHz clock output

Connector	BNC
Ref. frequency	2.048 MHz square-wave
Freq. stability	See timebase oscillator specification
Jitter	< 0.01 UI
Wander	MTIE < 15 ns + t (freq. offset)–1
Output level	According to G703:10; ± 1.2 V ± 10 % in 75 W

1.544/2.048 MHz clock output

Connector	BNC
Ref. frequency	1.544/2.048 MHz square-wave
Frequency stability	See internal timebase stability specification
Jitter	< 0.01 UI
Wander	MTIE < 15 ns + (freq. offset)–1
Output level	According to G703:10; ± 1.2 V ± 10 % in 75 W

RS-232 data in/output

Connector	9-pin male D-Sub connector
Baud rate	9600 b/s
Data format	8 data bits, 1 stop bit, no parity

Ethernet

Communication port	Connector: RJ45	Protocol: 10Base-T
Configuration port	Connector: Dsub9, RS232	

SPECIFICATIONS[1]

SyncView software

Operating system	Windows 95 / 98 / NT / 2000
Data transfer	TIE values (real-time or stored values) Stored graphs Instrument id Setup information
Calculate functions	MTIE, TDEV
Instrument control functions	Local or Remote mode Auto-adjustment of rubidium oscillator Instrument setup
Custom mask editor	Unlimited user-defined MTIE+TDEV mask
File functions	Document printout, file save/retrieve

Calibration

Principle	Closed-case calibration with automatic adjustment of the rubidium timebase
Calibration reference	Cs-oscillator or GPS-controlled rubidium
Calibration reference frequency	100 kHz, 1, 1.544, 2.048, 5 or 10 MHz
Calibration uncertainty (typical)	$< 2 \times 10^{-12}$ + calibration reference frequency uncertainty

Internal timebase stability

Aging rate per	24 h	$< 2 \times 10^{-12}$ (typ.)
	Month	$< 5 \times 10^{-11}$
Short-term stability per	1 s	$< 3 \times 10^{-11}$
	10 s	$< 1 \times 10^{-11}$
Warmup stability	10 min	$< 4 \times 10^{-10}$
Factory adjustment uncertainty (+23 °C)	± 0.0005 Hz at 10 MHz	

Display

Type	Super-twisted liquid crystal
Size	84 x 84 mm, 4.7" diagonal
Resolution (pixels)	240 x 240
Backlight	Cold cathode fluorescent (CCFL) tube; brightness approx. 50 cd/m²
Contrast ratio	User-adjustable, max. 1:15 (typical at 20 °C)

General Specifications

Size (H x W x D)		34.2 cm x 17.7 cm x 30.5 cm
Weight	Net	5 kg (11 lb)
	Shipping	7 kg (15 lb)
Environmental data		
Temperature	operating	0 °C to 50 °C
	storage	–20 °C to 70 °C
Humidity	operating	20 °C to 30 °C, 90 % RH non-condensing 30 °C to 50 °C, 70 % RH non-condensing
	storage	95 % RH
Altitude	operating	3000 m (10 000 ft)
	storage	12 000 m (40 000 ft)

Safety

EN 61010-1:1997, CAT II, pollution degree 2, CE
EMC: EN 55022B, EN 61000-6-2, CE

Power supply

Line voltage	100 to 240 Vrms ± 10 % 47 Hz to 63 Hz, < 60 W
–48 V DC voltage	38 V to 72 V DC, < 60W

Standard Accessories

Sync Analyzer software for general clock or data signals, AC line power cord, two 120 W to 75 W transformers (BNC mounted), RS-232 PC connection cable, user guide, Certificate of Calibration.

Optional Accessory

Heavy-duty hard carrying case (GP-10-065).

Ordering Information

FTB-8080 Sync Analyzer

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