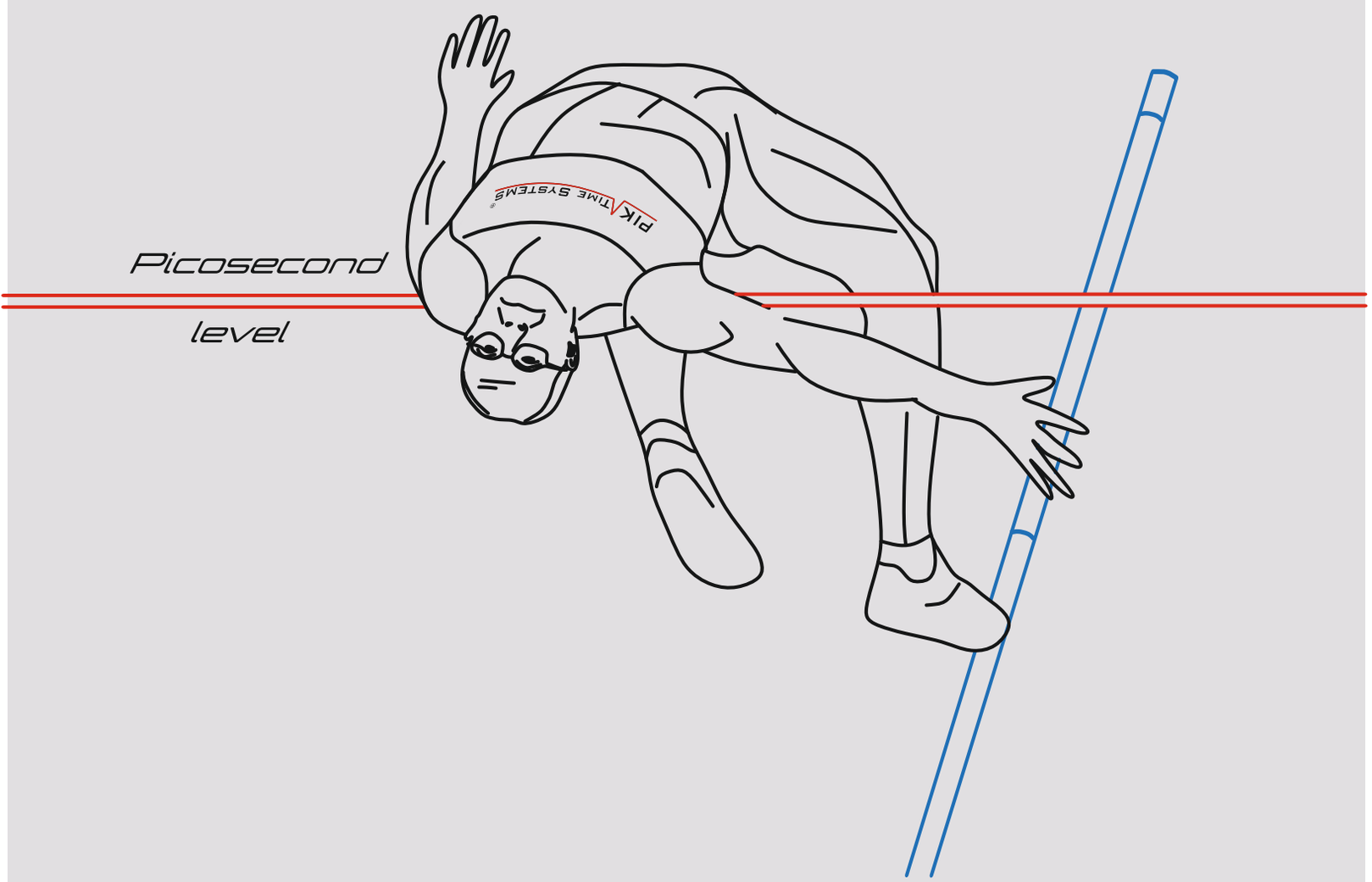
PIK TIME SYSTEMS®

PRECISE TIME AND FREQUENCY COMPANY

Fiber-optic solutions

GNSS time transfer

Time & frequency measurement



Product catalogue 2024

PIK TIME SYSTEMS®

PRECISE TIME AND FREQUENCY COMPANY

Piktime Systems sp. z o.o. – precise time and frequency company.

Since established in 2007 our goal is to explore time and frequency domain. Research, development and manufacturing equipment for measurement and distribution of time and frequency is our core business. Unique know-how in time and frequency domain is our asset.

We support physical laboratories, national measurements offices as well as telecommunication, power engineering, critical infrastructure, banking, security and defence applications.

Products:

- Time transfer systems (presently TTS-5) for a precise, long-distance atomic clocks comparison,
- Fiber-optic time and frequency distribution system (presently OSTT-4) for a dissemination of precise time & frequency signals – using optical fibers. Best (performance) available method of time and frequency transfer.
- Precise time & frequency counters with precision of a few picoseconds,
- Multiplexers/demultiplexers,
- 1 PPS generator.

Services:

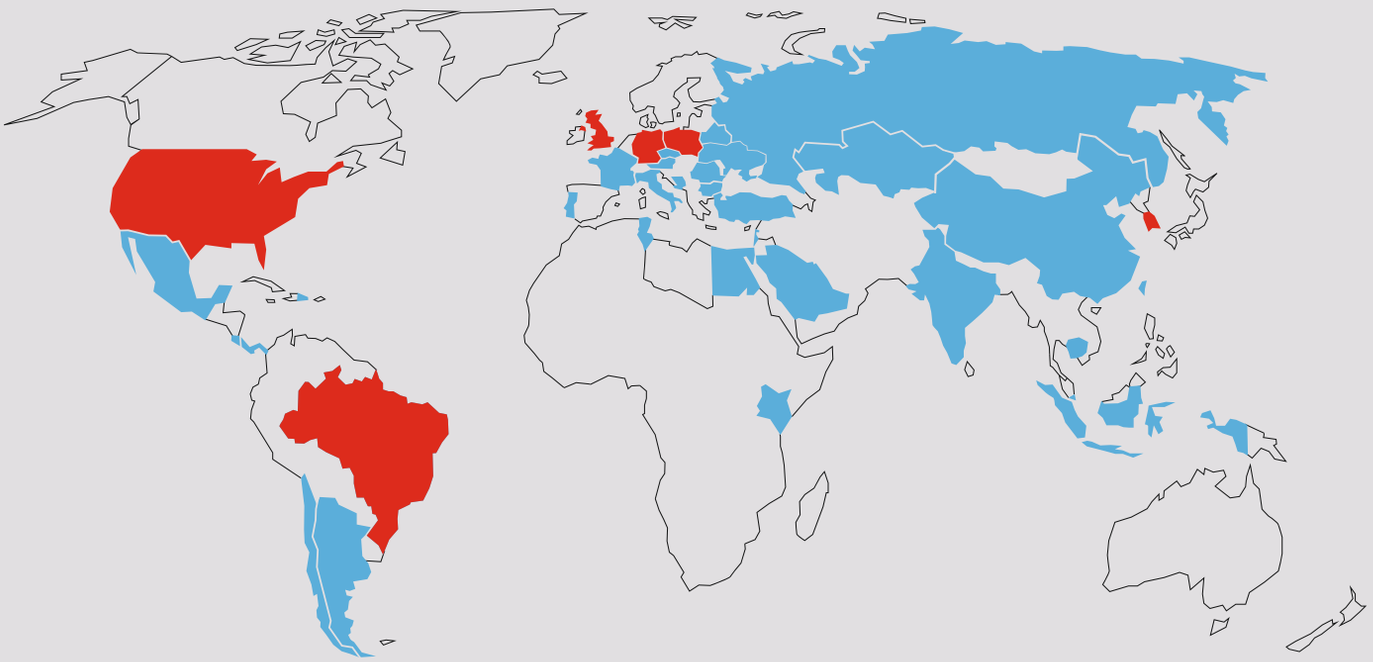
- Development of time related products and services (navigation, security, data and documents exchange, time stamping),
- Advisory on precise time and time scales,
- Time & frequency software and algorithms,
- Designing and execution of time and frequency laboratories on a turn-key basis,
- Scientific researches and co-operation with public and private institutions.

Main markets served:

- Metrology
- Scientific
- Telecommunication
- Power engineering/smart-grids
- TSN/Industry 4.0
- Banking
- Security/law enforcement
- Military

Key partners and customers

Over 160 various time transfer systems delivered to nearly 40 countries.



MAP KEY:

TTS users

OSTT and TTS users

AFRICA: Egypt, Kenya, Tunisia.

AMERICA: Argentina, Brasil, Chile, Costa Rica, Dominican Republic, Mexico, Panama, United States.

ASIA: China, Hongkong, India, Indonesia, Israel, Kazakhstan, Russia, Saudi Arabia, Singapore, South Korea, Taiwan, Turkey.

EUROPE: Austria, Belarus, Bosnia, Bulgaria, France, Germany, Italy, Montenegro, Netherlands, Poland, Portugal, Romania, Ukraine, United Kingdom.

SOME USERS:

CONTROL SEGMENTS OF NAVIGATION SATELLITE SYSTEMS:

- GALILEO (Fucino/Italy, GALILEO Precise Time Facility),
- ISRO (Indian Space Research Organization),
- GLONASS (Russia).

THE LEADING PHYSICAL LABORATORIES AND METROLOGICAL INSTITUTES:

- GUM (Central Office of Measures, Poland),
- BIPM (Bureau International des Poids et Mesures),
- The National Physical Laboratory (NPL) - United Kingdom,
- USNO (United States Naval Observatory),
- INRIM (National Institute of Metrological Research, Italy),
- National Institute of Standards and Technology (NIST) - Boulder, USA,
- The United States Naval Observatory (USNO) - Washington, USA,
- Physikalisch-Technische Bundesanstalt (PTB) - Germany,
- Deutsche Telekom (Germany),
- NPL (National Physical Laboratory, India),
- VNIIFTRI (Russian National Measurement Institute).

PIK TIME SYSTEMS®

Fiber-optic time and frequency distribution system OSTT-4 (L, DI option)

Introduction and key features

OSTT-4 may be used for clock comparisons as well as for delivering the ultimate quality time and frequency signals to the users not maintaining their own clocks and/or timescales. The **local module** of the system accepts the frequency and time signals (10 MHz and 1 PPS) and transmits them via an optical fiber to the **remote module.**
Our solution (in contrary to standard two-way systems) delivers stabilized and calibrated replica of source signals, thus may be described as a **virtual atomic clock** at the end of the fiber.

Specifications

- OSTT-4 consists of a local and remote module for time and frequency transfer,
- Transfers 10 MHz signals (100 MHz as an option), ADEV below $3x10^{-13}$ for 1 s averaging, below $3x10^{-17}$ for 10^5 s averaging,
- Transfers 1 PPS signal (also 100 PPS), phase synchronous with frequency signal, TDEV below 3 ps for 10 s averaging, below 1 ps for 10^5 s averaging,
- OSTT-4 is actively stabilized against fiber induced phase fluctuations; the phase correction range is 2000 ns (fully seamless in OSTT-4L option, 100 ns continuous plus switched extension to 2000 ns in basic OSTT-4),
- Output 1 PPS position may be adjusted with 1 ps resolution, negative delay also possible,
- OSTT-4 operates bi-directionally on a single optical fiber in C band, maximum optical loss 25 dB,
- As an option the system can be enriched with optical amplifiers.

Active delay stabilization

The unique features of the system are based on the concept of **active compensation of variations of the fiber delay.** The signal reaching the remote module is redirected backward to the local module and used for compensation of path delay fluctuations.

Autocalibration

Calibration of the time transfer is based on round-trip delay measurement, which is performed locally at the transmitting side of the system. **After installation and initial calibration, the input to output delay is constant and there is no need for any further measurements or data exchange.**

PPS alignment

1 PPS output signal may be advanced with 1 ps resolution to compensate for the delay introduced by the fiber link. Therefore remote 1 PPS may be aligned exactly with UTC(k), or even with some advance, if needed.

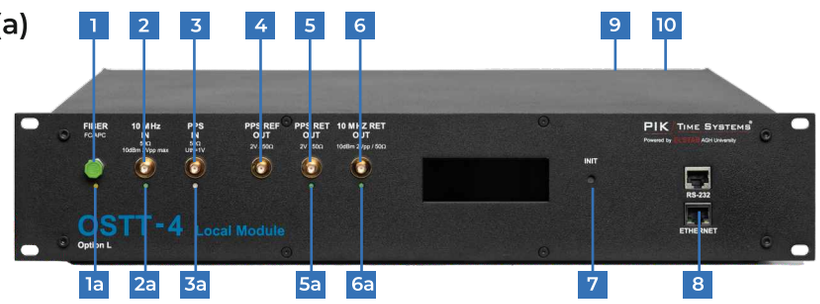
Dispersion Insensitive (DI) option

The Dispersion Insensitive option was introduced to simplify the calibration of time transfer. In the standard version of the OSTT-4 system the chromatic dispersion of the actual fiber link has a significant impact on the link calibration, and therefore must be accurately estimated. In the DI option, thanks to introducing an additional optical signal, the calibration is insensitive to the chromatic dispersion.

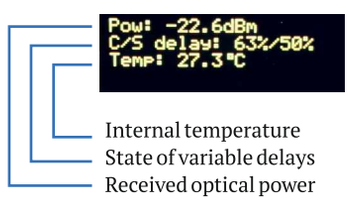
Interfaces description

Connectors location in local module (a) and remote module (b).

(a)

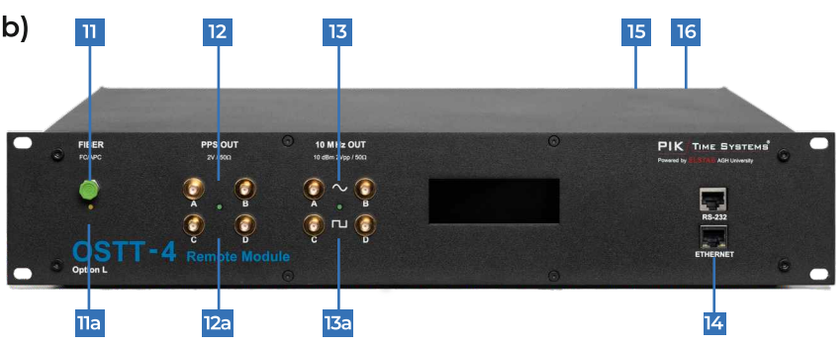


Display

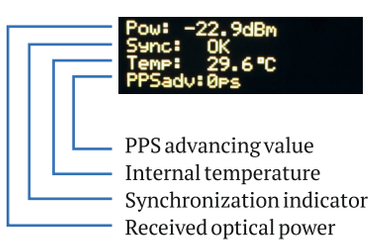


1. Optical input/output connector; FC-APC type.
1a. LED indicating laser transmitter status.
2. 10 MHz input; SMA connector, 50 Ω DC termination, 0 dBm to 10 dBm input signal level, sinus or square wave.
2a. LED indicating synchronization of inner oscillators to the input frequency signal.
3. PPS input; SMA connector, 50 Ω DC termination, 1 PPS or 100 PPS.
3a. LED indicating PPS signal detection.
4. PPS REF(erence) output; SMA connector, 2 V at 50 Ω termination, used for calibration.
5. PPS RET(turned) output; SMA connector, 2 V at 50 Ω termination, used for calibration.
5a. LED indicating returned PPS signal detection.
6. 10 MHZ RET(turned) auxiliary output; SMA connector, 10 dBm at 50 Ω termination.
6a. LED indicating detection of the returned frequency signal.
7. INIT button.
8. Remote control and monitoring ports.
9. Fuse socket (at the rear panel).
10. DC power supply (at the rear panel); 12 V nominal, 10 V to 18 V acceptable, maximum supply current: 2A. 48 V/0.5 A supply option is also available.

(b)



Display



11. Optical input/output connector; FC-APC type.
11a. LED indicating laser transmitter status.
12. PPS outputs; SMA connectors, 2 V at 50 Ω termination.
12a. LED indicating PPS signal detection.
13. 10 MHz outputs; SMA connectors, AC-coupled, 2 Vpp at 50 Ω termination.
13a. LED indicating detection of the frequency signal.
14. Remote control and monitoring.
15. Fuse socket (at the rear panel).
16. DC power supply (at the rear panel); 12 V nominal, 10 V to 18 V acceptable, maximum supply current: 2A. 48 V/0.5 A supply option is also available.

PIK TIME SYSTEMS®

OBA-3
Optical Bidirectional Amplifier for fiber optic time and frequency distribution system

Introduction and key features

Fiber optic systems used to transfer or distribute metrological signals (optical frequency, radio frequency or time) require symmetry for optical signals propagating in both, forward and backward, directions. When the attenuation of the fiber connecting the endpoints of the link exceeds some limit signal regeneration starts to be necessary. The most versatile and simple option is to employ an optical amplifier. The OBA-3 optical bidirectional amplifiers are designed especially to extend the operation distance on the links showing more than 25 dB of attenuation (i.e. the distance exceeding about 50 to 100 km).
The OBA-3 amplifiers are fully compatible with the OSTT series of time and frequency distribution system and optical frequency distribution systems.

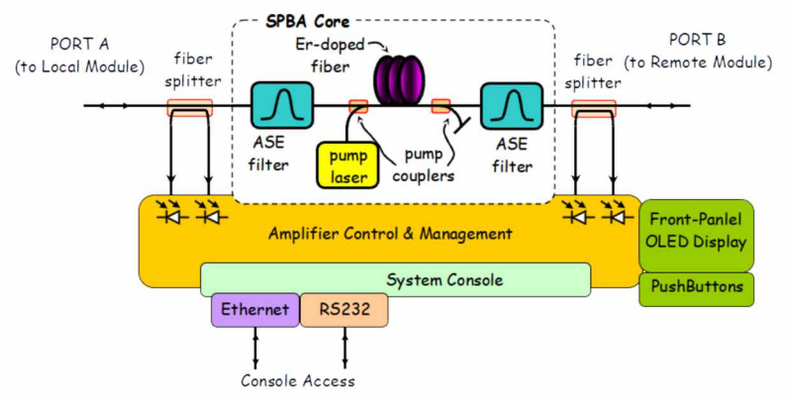
The unique feature of the OBA-3 amplifier is that the optical gain is kept constant independent of the type, number and any specific modulation of the amplified signals.

Key specification

- Optical ports: for singlemode fiber of any type (e.g. G.652, G.655).
- Optical connectors: FC/APC with 8 deg polishing.
- Optical gain: specified by the user in the range 0-25 dB.
- Monitoring of input and output powers in both directions.
- Optical bandwidth: 5.8 nm, compatible with OSTT time and frequency fiber optic distribution system and optical frequency distribution systems.
- Control: remote via Ethernet 10/100 or RS-232 ports, or manual via front panel push buttons.
- Power supply: 48 V DC. A 12 V / 2 A option is also available.
- Power consumption: less than 15 W.

True constant gain and principle of operation

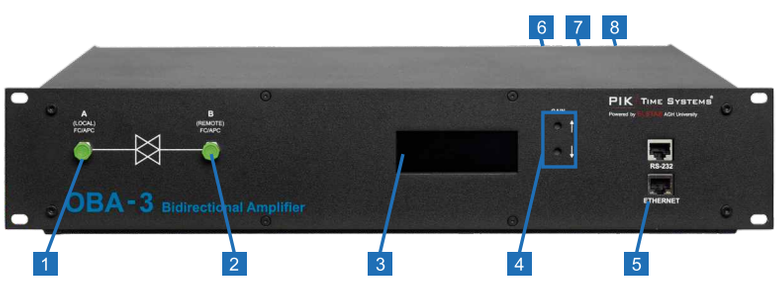
OBA-3 is based on a single-path bidirectional optical amplifier (SPBA) core, featuring perfect symmetry of propagation conditions between the forward and backward directions. The construction of amplifier guarantees that the gain received by the optical signal is kept constant on the value set by the user. It is completely independent of the input powers and of the specific modulation that is applied to the signal.



Block diagram of the OBA-3 amplifier

Interfaces description

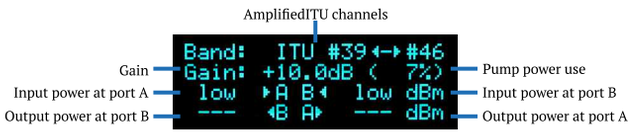
Location of connectors and control ports.

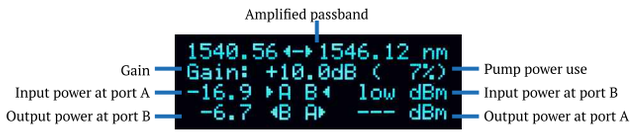


1. Optical bidirectional port A, FC-APC type.
2. Optical bidirectional port B, FC-APC type.
3. Display showing OBA-3 parameters.
4. Pushbuttons for setting OBA-3 optical gain.
5. Remote control and monitoring ports.
6. Fuse socket (at the rear panel).
7. Power supply connector (at the rear panel).
8. Protective earthing conductor (PE) connected with the metal case of the amplifier.

Display

The optical powers entering and leaving the OBA-3 bidirectional amplifier and other parameters are represented on the display installed on the front panel. Available display views are presented below.





PIK Time Systems®

Time transfer system TTS-5

In 2022 we celebrated 30 years since the first, single frequency TTS-1 receiver, the first in the family was introduced, followed by a very successful TTS-2, first multi-channel GPS timing receiver. Then TTS-3, for many years the only GPS & GLONASS receiver on the market. Now TTS-5 continuously improved towards better observation results and deployment of the recent time & frequency progress.
Excellent observation results, long and stable operation, wide configuration possibilities, as well as user friendly solutions are main advantages of the system.
TTS-5 generates data on its own and requires no daily assistance.
The system is working under LINUX providing multitasking and integration with the network.

Access, Operating & Configuration

Immediate access to observations, receiver configuration and main parameters using:

- built-in touch screen
- Web interface
- external USB keyboard

Data characteristics & availability

- data type: Code and Carrier
- data output format: CGGTTS, RINEX. data formats
- meet all requirements.
- data availability:
- CGGTTS: 30 sec after each 13-min. observation session
- RINEX: in real time

Tracking features

Supported navigation systems:
GPS, GLONASS, Galileo, WAAS/EGNOS, Beidou

Supported navigation systems:
GPS, GLONASS, Galileo, WAAS/EGNOS, Beidou

Supported frequencies*:
GPS: L1, L2, L5
GLONASS: L1, L2, L3
GALILEO: E1, E5A, E5B, altBoc, E6
BEIDOU B1,B2,B3

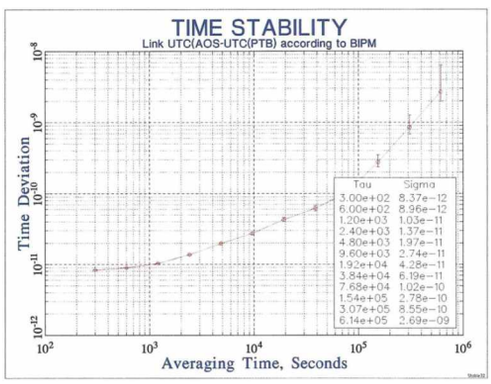
Supported codes*:
GPS: L1C, L1P, L2C, L2P, L5P,CA/LI
GLONASS: L1C, L1P,L2C,L2P,L3
BDS2-B1I, B2, B3
BDS3-B1I, B1C, B2A, B2B, B3, ALTBOC
GALILEO: E1, E5A, E5B, altBoc, E6

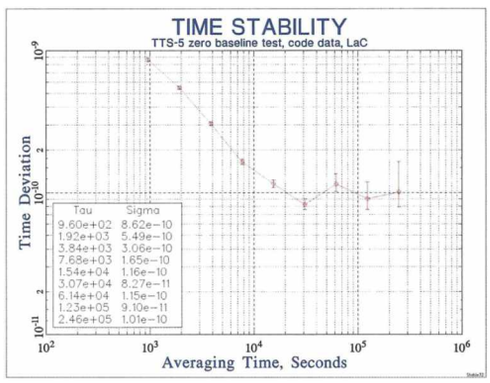
* depends on the options

TTS5
Time Transfer System-5

Time stability

Precision for phase observation: for a short term, short baseline precision 12ps RMS.
Precision for code observation: 0.4ns RMS (receivers connected to the same reference standard)





Data recording & storage

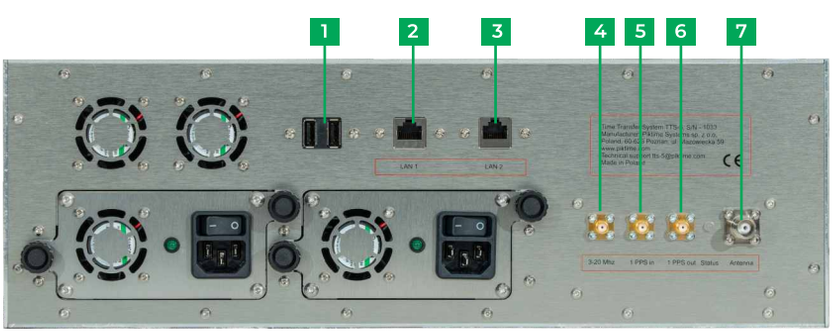
Data can be:

- downloaded using Web interface (using Web browser)
- downloaded using integrated FTP server
- sent to external FTP server (using Web browser)
- saved to USB memory (using console or Web interface)
- 1TB redundant data storage (RAID 1 mirroring, 2x1TB HDD

Input/Output

5/10 MHz frequency input (selected by user)
Local reference 1PPS input
1PPS output
Antenna TNC connector
1000BASE-T Ethernet port
2 USB connectors on the front panel
2 USB connectors on the rear panel

TTS-5 receiver rear panel



1. USB connector
2. Ethernet connector
3. Ethernet connector
4. Auxiliary 5/10 Mhz connector
5. Auxiliary Reference 1 PPS in connector I (Event Marker I)
6. 1 PPS out connector
7. Antenna TNC connector

Physical & Environmental

Main unit dimensions:
410 mm x 298 mm x 133 mm
Rack ready, light aluminium housing
Touch screen - 7" TFT LCD
Display resolution 1024 x 600
Operating voltage: AC 90~ 264V 47 to 63 Hz Power
Consumption < 40W Redundant power supply
Operating temperature: 0°C to +50° C

Our main concern is improvement of TTS-5 performance. In result, every several months, software upgrade is released and all TTS-5 users are notified. Software upgrades are free of charge. We offer free of charge customer assistance.

Time Transfer System TTS-5
is in compliance with requirements
of European Union law.

CE

Time interval and frequency analyzer TIA V110

Introdution and key features

The TIA V110 Time Interval and frequency Analyzer is a technologically advanced, multi-channel measurement instrument, dedicated to demanding applications related to precise time metrology. The analyzer enables continuous registration of physical events (represented at the instrument's inputs as edges of electrical pulses) in the form of time stamps appearing in up to 10 independent measurement channels. Measurement channels use a common time scale, which makes it possible to determine time relationships between any time markers. Measurement data obtained as a result of therecording process allow for accurate and precise determination of input signal parameters, such as: duration of time intervals (delay) and frequency, and can also be used to calculate selected measures such as Allan variance (ADEV), time interval errors (TIE, MTIE) and time deviation (TDEV). High accuracy of long measurement sessions is ensured by a built-in, high-stability reference clock (OCXO, 50 PPB) and the ability to connect a signal from an external reference clock (e.g. an atomic standard).

Specifications

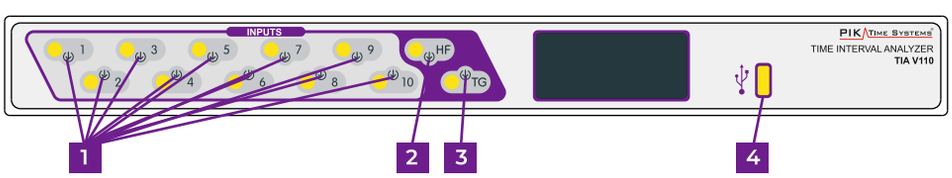
- **Measurement modes:**
  - Measurement of time interval and frequency (up to 6 GHz)
  - Measurement of Allan variance (ADEV) and time interval errors (TIE, MTIE, TDEV)
  - Using linear regression to improve the precision of frequency measurement
- **Number of measurement channels** 6 (max. 10)
- **Resolution (LSB)** 2 ps
- **Time interval measurement precision*** < 7 ps for time intervals up to 1 ms
- **Frequency measurement precision** Up to 12 significant digits
- **Measurement range** quasi unlimited (continuous time scale, overflow approximately every 9h)
- **Dead time** < 50 ns
- **Measurement repetition rate**
  - 20 MSa/s/ channel
  - 50 kSa/s to computer
- **Measurement results memory** 32 MSa

* precision defined as the standard deviation from a series of measurements of the time interval between any two measurement channels

Inputs IN1 - IN10	Impedance:	50 Ω, DC coupled; SMA sockets
	Amplitude:	±5 V
	Active edge:	selectable (rising or falling)
	Threshold:	Selectable in range ±5 V
Input TG	Impedance:	1 kΩ
	Amplitude:	TTL, threshold 1,4 V
	Active edge:	selectable (rising or falling)
Input HF	Impedance:	50 Ω
	Input signal power:	-10 dBm ÷ +10 dBm
	Input frequency:	200 MHz ÷ 6 GHz
Input 10 MHz (external reference clock)	Impedance:	50 Ω
	Input signal power:	-10 dBm ÷ +10 dBm
	Input frequency:	200 MHz ÷ 6 GHz
Output 10 MHz	Impedance:	50 Ω
	Input signal power:	-10 dBm ÷ +10 dBm
	Input 10 MHz external signal copy:	max. +10 dBm

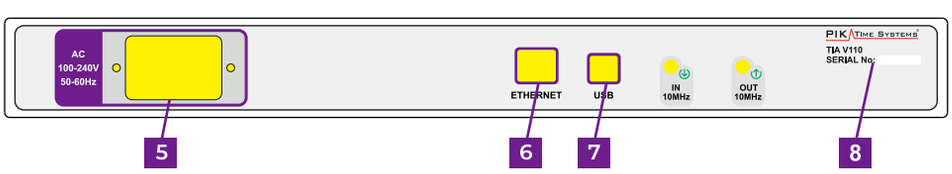
Built-in reference clock	10 MHz, OCXO Stability 5×10^{-8} (-40° to +85° C) Aging 1×10^{-7}/year
Interfaces	USB 2.0, typ A / Ethernet RJ-45
Control	Text commands (description in the Programmer's Guide)
Power Supply	230 V, 50 Hz, 100 W
Size	395 (W) × 45 (H) × 330 (L) mm / Rack 19” 1U
Weight	6 kg

Front panel description



1. Inputs 1 ÷ 10 – SMA sockets for connecting input signals for time relation evaluation.
2. HF – SMA socket for connecting high frequency input signals.
3. TG – SMA socket enabling connection of an optional trigger signal.
4. USB – USB communication connector.

Rear panel description



5. 230 V / 50 Hz – AC power socket.
6. Ethernet, USB – Communication interface connectors.
7. 10 MHz In/Out – Input and output of 10 MHz external reference clock signal.
8. Serial No – Individual analyzer identification number.

Digital multiplexer/demultiplexer DMD V108

Introdution and key features

The DMD V108 Digital Multiplexer/Demultiplexer allows to connect an electrical signal from any selected input to any selected output(s). There are 8 inputs and 8 outputs at the user's disposal. The device is intended primarily for splitting time and frequency signals, in particular with standard values of 10 MHz, 5 MHz as well as 1PPS (Pulse Per Second), from reference clock sources with high stability.

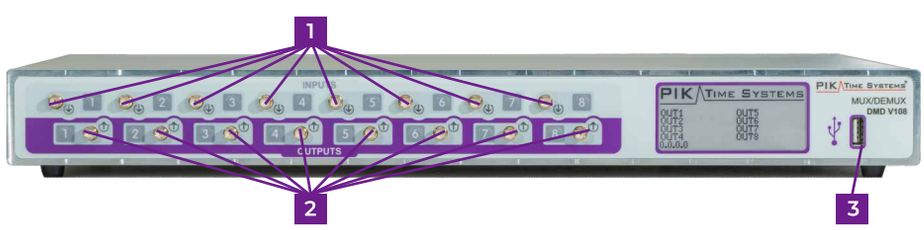
The trigger threshold for input signals can be adjusted in the range from -5 V to +5 V. The device's advantages also include a low level of internal noise (timing jitter < 5 ps) and negligible differences in delays of signals distributed between any inputs and outputs (< 500 ps).

Specifications

- **Number of inputs** 8
- **Number of outputs** 8
- **Timing jitter** < 5 ps
- **Delay** < 20 ns
- **Spread of delays between different pairs of input – output** < 500 ps

▪ **Inputs IN1 ÷ IN8**	Impedance:	50 Ω, DC couped; SMA sockets
	Amplitude:	±5 V
	Threshold level:	Selectable in a range ± 5 V
▪ **Outputs OUT1 ÷ OUT8**	Impedance:	50 kΩ, SMA sockets
	Amplitude:	1,9 V_{pp}, t_r < 250 ps, t_f < 200 ps
▪ **Interfaces**	USB 2.0, typ A Ethernet RJ-45	
▪ **Control**	Text commands (description in the Programmer's Guide)	
▪ **Power Supply**	230 V, 50 Hz, 50 W	
▪ **Size**	395 (W) × 45 (H) × 330 (L) mm / Rack 19” 1U	
▪ **Weight**	6 kg	

Front panel description



1. **Inputs 1 ÷ 8** – SMA sockets for connecting input signals.
2. **Outputs 1 ÷ 8** – SMA sockets outputting signals.
3. **USB** – USB communication connector.

Rear panel description

4. **230 V / 50 Hz** – AC power socket.
5. **Ethernet, USB** – Communication interface connectors.
6. **Serial No** – Individual analyzer identification number.

Precise time counter T3200U

Description

Small box with USB control and supply by notebook, netbook, or PC.
Time interval measurement range: 0 – 4400 seconds.
Precision (standard deviation) < 35 ps at time interval measured from 0 to 200 ms.
Frequency range up to 3.5 GHz.
Frequency sampling up to 2 MSa/s.
Measurement of Allan Deviation (ADEV).
Measurement of Time Interval Error (TIE), MTIE), TDEV.
Totalize mode.
Built-in automatic calibrator.

Functions

Time Interval (between two pulses at two inputs or pulses appearing consecutively at a single, common input), Period, Pulse Width, Frequency, Frequency Sampling, Allan Deviation, Time Interval Error (TIE), Maximum TIE (MTIE), Time Deviation (TDEV), Totalize

Precise time generators T5300U

Description

Small box with USB control and power supply by notebook or PC.
Precisely controlled time interval between the leading edges of output pulses.
Precisely controlled width of pulses at a separate output.
Time interval/width range: 10 ns – 10 seconds.
Time interval/width resolution: 5 ps.
Jitter: < 20 ps rms at time interval from 10 ns to 50 ms.
Output pulses: positive, 2 V amplitude on 50 Ω load, rise- and fall time < 600 ps, selectable width (10, 20, 50 or100 ns) and polarity.
Precisely controlled frequency of rectangular waveform at a separate output.
Internal trigger generator with variable frequency
User-friendly software for Windows.

1 PPS generator„D1PPS”

Introduction

The 'D1PPS' generator is to produce a 1 PPS signal from reference frequency sources, such as a Rubidium clock or stable XSC. It also offers synchronization of the generated signal to reference PPS signals (for example, from TTS-5 GNSS receivers).

Specifications

A. Inputs and outputs

FIN input (frequency input):

- connector: BNC,
- impedance: 50Ω,
- coupling: AC,
- frequency: 10MHz,
- signal level: 0.1...5.0Vpp
- waveform: sinusoidal wave recommended (square, sawtooth, and triangle are acceptable).
- hysteresis: 0.1mV,
- a constant component is permissible, but the instantaneous value of the input signal must always be within the range of -5...+5V.

1PPSIN input (reference 1 PPS):

- connector: BNC,
- impedance: 50Ω,
- coupling: DC,
- frequency: 1Hz,
- duty cycle of a rectangular waveform: any (recommended pulses duration in the high state - 20us),
- signal level 1.5...5.0V,
- switching threshold: 1V,
- hysteresis: 0.1mV.

1PPSO1 output:

- connector: BNC,
- impedance: 50Ω,
- coupling: DC,
- frequency: 1Hz,
- filling of the rectangular waveform: pulses duration in the high state – 20us,
- signal level: typical 2.2V at a 50Ω load,
- signal level control: below 1.5V enables alert.

1PPSO2 output (parameters as for 1PPSO1 output).

Alert output (option)

- Molex 22-05-7035 connector (3 pins),
- NO contact, pins 2 and 3 max. 42V, current 0.5A (the contact is closed when there is no alarm).

B. Power supply

Main power supply:

- socket: USB type A,
- voltage: 5V,
- maximum current: 250mA,
- USB adapter included.

Buffer power supply (option):

- HDD male connector, 4 pins,
- 12VDC voltage,
- galvanic separation,
- 1.5W power, ca. 0.15W in standby mode,
- pin alignment compliant with HDD PC.

PIK TIME SYSTEMS®

PRECISE TIME AND FREQUENCY COMPANY

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