



Thunderbolt E GPS Disciplined Clock

Precise GPS Clock for Wireless Infrastructure

Protempis Thunderbolt® E GPS Disciplined Clock is Trimble's latest offering for GPS synchronization devices targeting the wireless infrastructure. This fifth-generation GPS clock combines a 12-channel GPS receiver, control circuitry, and a high quality double-ovenized oscillator on a single board, providing increased integrity and reliability at a lower size and cost.

The Thunderbolt E's level of integration makes it a perfect solution for precise timing applications in the wireless industry. Among its uses are synchronizing the E911 positioning infrastructure, and providing precise time and frequency for WiMax and LTE-TDD applications, along with digital broadcast applications.

The architecture is comparable to systems currently used to maintain the tough CDMA, WiMax, and LTETDD holdover specification. The Thunderbolt E is available in its enclosure, or as an OEM board.

The Thunderbolt E GPS clock outputs a 10 MHz reference signal and a 1 PPS signal with an over-determined solution synchronized to GPS or UTC time. The PPS output accommodates applications requiring sub-microsecond timing.

The Protempis T-RAIM (Time-Receiver Autonomous Integrity Monitor) algorithm is used to monitor satellites to ensure signal integrity.

Matching the Thunderbolt E GPS Clock with the Protempis Bullet™ antenna creates a system that provides reliable performance in hostile R/F environments. The system can be easily calibrated for different cable lengths.

The high level of integration and volume production techniques make the Thunderbolt E GPS Disciplined Clock an extremely cost-competitive timing solution for volume synchronization applications.



Key Features

- Double-ovenized quartz oscillator provides stable 10 MHz and 1 PPS output to maximize bandwidth
- Combined GPS receiver and 10 MHz oscillator on one board
- High volume manufacturing provides reliable low-cost products
- Meets holdover specifications of 8 μs over 24 hours

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Performance Specifications

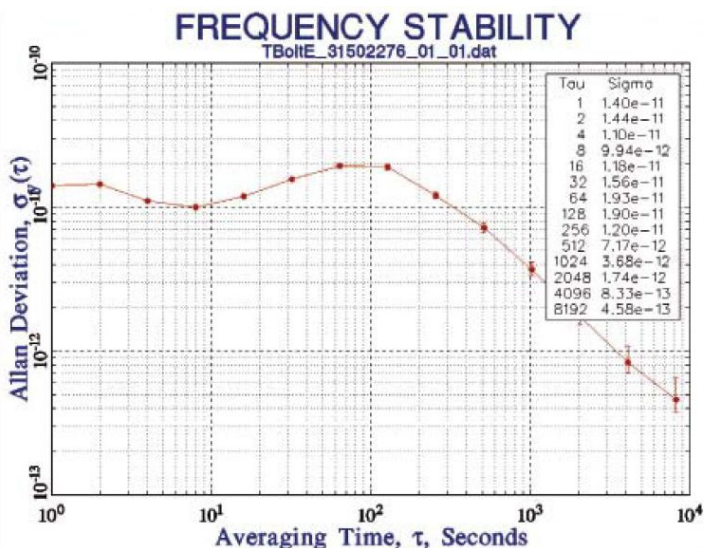
General.....L1 frequency, CA/code (SPS), 12-channel continuous tracking receiver

Update rate.....1 Hz

PPS accuracy.....UTC 15 nanoseconds (one sigma)

10 MHz accuracy..... 1.16×10^{-12} (one day average)

10 MHz stability.....See graph below



Harmonic level-40 dBc/Hz max
 Spurious-70 dBc/Hz max
 Phase noise10 Hz -115 dBc/Hz
 100 Hz -130 dBc/Hz
 1 kHz -135 dBc/Hz
 10 kHz -145 dBc/Hz
 100 kHz -145 dBc/Hz

Environmental Specifications

Operating temp-20 °C to +75 °C

Storage temp-40 °C to +85 °C

Operating humidity95% (non-condensing)

Please go to www.protempis.com for the latest documentation and tools, part numbers and ordering information.

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Interface Specifications

Prime power+24 V and return using DC to DC power supply (19 V-34 V)

Mechanical connection uses a two-pin locking connector.

1 PPS Interface Specification

- BNC Connector 0 V to 2.4 V $\pm 10\%$ into 50 Ω 10 microseconds-wide pulse with the leading edge synchronized to UTC within 15 nanoseconds (one sigma) in static, time only mode.

- The rising time is <20 nanoseconds and the pulse shape is affected by the distributed capacitance of the interface cable/circuit.

10 MHzBNC connector.

Waveform is sinusoidal

7 dBm ± 2 into 50 Ω

5 dBm = 1.125 Vpp

7 dBm = 1.416 Vpp

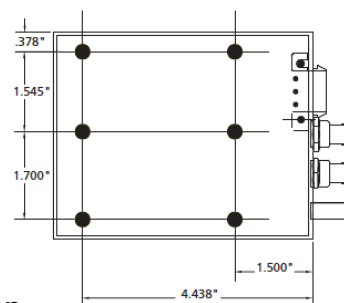
9 dBm = 1.783 Vpp

Serial interface.....RS-232 through a DB-9/M connector

RF antenna connectorBNC

Serial protocolTrimble Standard Interface

Protocol (TSIP) binary protocol @ 9600, 8-None-1



Physical Characteristics

Power consumption

12 watts cold; 8 watts steady state

Dimensions

5 in L x 4 in W x 2 in H (127 mm x 102 mm x 40 mm)

Mounting

Six mounting holes for M3 screws. Max. depth 3/8"

Weight

0.628 lb (0.285 kg)

Power connector

Molex 39-30-1020

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