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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Datasheet

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

FREQUENCY STABILITY
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Tau	Sigma
1	1.40e−11
2	1.44e−11
4	1.10e−11
8	9.94e−12
16	1.18e−11
32	1.56e−11
64	1.93e−11
128	1.90e−11
256	1.20e−11
512	7.17e−12
1024	3.68e−12
2048	1.74e−12
4096	8.33e−13
8192	4.58e−13
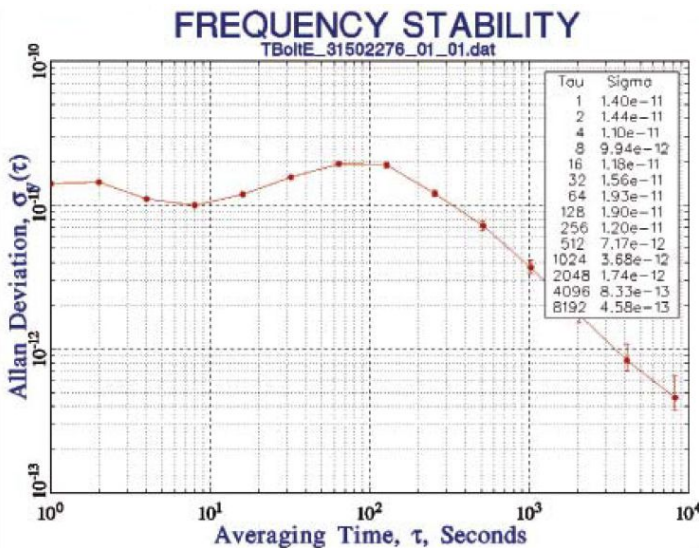
Harmonic level ....–40 dBc/Hz max
Spurious ....–70 dBc/Hz max
Phase noise ....10 Hz –115 dBc/Hz
100 Hz –130 dBc/Hz
1 kHz –135 dBc/Hz
10 kHz –145 dBc/Hz
100 kHz –145 dBc/Hz

Environmental Specifications

Operating temp ....–20 °C to +75 °C
Storage temp ....–40 °C to +85 °C
Operating humidity ....95% (non-condensing)

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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 ±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 MHz ....BNC 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 connector ....BNC
Serial protocol ....Trimble Standard Interface Protocol (TSIP) binary protocol @ 9600, 8-None-1
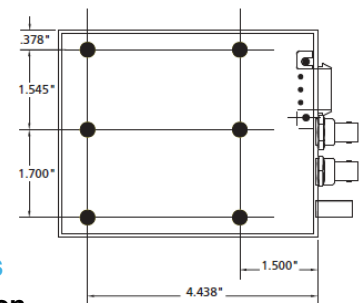
Physical Characteristics

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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