Thunderbolt GPS Disciplined Clock

Precise GPS Clock for Wireless Infrastructure

Key features and benefits

- **Ovenized quartz oscillator provides clean 10 MHz (1 PPS) signal that maximizes bandwidth**
- **Combined GPS receiver and ovenized oscillator minimizes size and cost**
- **High volume manufacturing provides reliable low-cost products**

The Thunderbolt™ GPS Disciplined Clock is Trimble's latest offering for GPS synchronization devices targeting the wireless infrastructure. This fourth-generation GPS clock combines an 8-channel GPS receiver, control circuitry and a high-quality ovenized oscillator on a single board, providing increased integrity and reliability at a lower size and cost.

The GPS clock'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 maximizing bandwidth for wireless local loop.

The architecture is comparable to systems currently used to maintain the tough CDMA holdover specification. This makes the Thunderbolt GPS clock a natural for a CDMA clock, the digital standard for cellular phones.

Trimble's approach is unique. The Thunderbolt 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 10 MHz reference accommodates applications requiring sub-microsecond timing. A single microprocessor performs both the GPS navigation and oscillator disciplining functions. The GPS receiver is driven directly by the 10 MHz output signal of the oscillator. This is calibrated against the incoming GPS signal, with the resulting clock and frequency measurements fed into the oscillator frequency control algorithm.

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

Matching the Thunderbolt GPS Clock with Trimble's Bullet™ II HE antenna creates a system that provides reliable performance in hostile environments. The system can be easily calibrated for different cable lengths.

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

Trimble's Thunderbolt GPS Disciplined Clock in enclosure, and board form.

Thunderbolt GPS Disciplined Clock

GPS Clock for the Wireless Infrastructure

PERFORMANCE SPECIFICATIONS

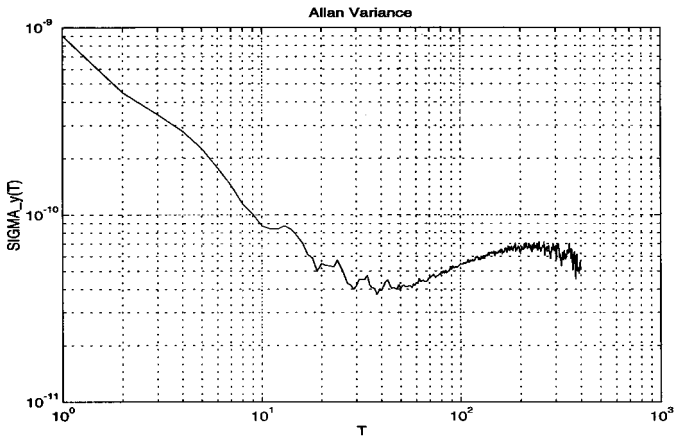
General L1 frequency, CA/code (SPS), 8-channel continuous tracking receiver

Update rate 1 Hz

PPS accuracy UTC 20 nanoseconds (one sigma)

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

10 MHz stability See graph below



Harmonic level –40 dBc max

Spurious –70 dBc max

Phase noise

10 Hz	–120 dBc/Hz
100 Hz	–135 dBc/Hz
1 kHz	–135 dBc/Hz
10 kHz	–145 dBc/Hz
100 kHz	–145 dBc/Hz

Holdover ±1 microsecond over 2 hours with a maximum ±15°C temperature change
Some customers, such as CDMA manufacturers, have historically mandated tighter holdover requirements than specified on this datasheet. For increased holdover performance, please contact your local Trimble representative.

ENVIRONMENTAL SPECIFICATIONS

Operating temp 0°C to +60°C

Storage temp –40°C to +85°C

Operating humidity 95% non-condensing

Maximum altitude 18,000 m

INTERFACE SPECIFICATIONS

Prime power +24V and return using DC to DC power supply (19V–34V). Mechanical connection uses a three pin locking connector.
Board alone uses +12V, –12V, +5V and ground.

1 PPS BNC Connector TTL levels into 50 Ω
10 microseconds-wide pulse with the leading edge synchronized to UTC within 20 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 +12.5 dBm ± 2.5 dB into 50 Ω

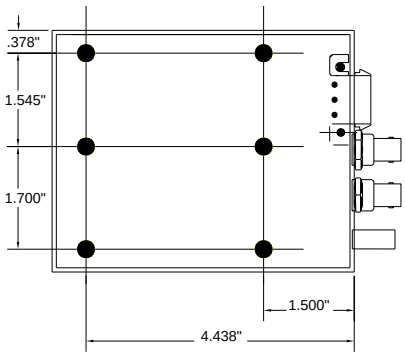
Serial interface RS-232 through a DB-9 connector

Serial protocol Trimble Standard Interface Protocol (TSIP) binary protocol @ 9600, 8-None-1

PHYSICAL CHARACTERISTICS

Power consumption 15 watts cold; 10 watts steady state

Power consumption (board only)
+5 VDC @ 300 mA
+12 VDC @ 25 mA
–12 VDC @ 25 mA



Dimensions 5"L x 4"W x 2"H (127mm x 102mm x 51mm)

Mounting Six mounting holes for #6-32 screws.
Max. depth 3/8"

Weight Under 20 oz. (567g)

ORDERING INFORMATION

You may visit our website for current information, part numbers and ordering information at:
http://www.trimble.com/products/thunderbolt

Specifications subject to change without notice.

Trimble

Trimble Navigation Limited
Corporate Headquarters
645 North Mary Avenue
Sunnyvale, CA 94086
+1-408-481-8000
+1-408-481-7744 Fax
www.trimble.com

Trimble Navigation Europe Limited
Trimble House,
Meridian Office Park
Osborne Way
Hook, Hampshire RG27 9HX U.K.
+44 1256-760-150
+44 1256-760-148 Fax

Trimble Japan K.K.
Torigoe F-Building, 7F
111-0054
1-8-2, Torigoe, Taitoku, Tokyo,
JAPAN
Phone: +81-3-3865-8070
Fax: +881-3-3865-8091

Trimble Navigation
Austrailia Pty Limited
Level 1/123 Gotha Street
Fortitude Valley QLD 4006
Australia
Phone: +61-7-3216-0044
Fax: +61-7-3216-0088