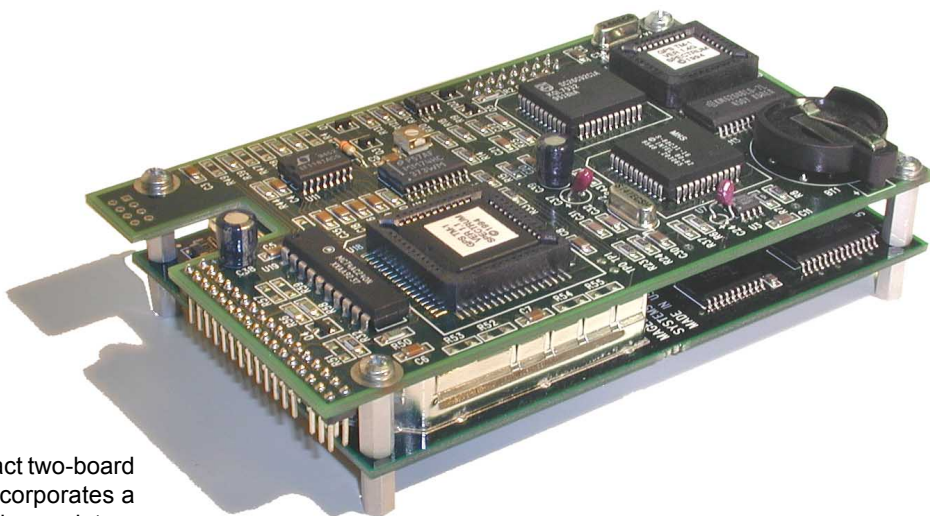


The GPS TIME-MACHINE/OEM™ Time & Frequency System

Spectrum Instruments, Inc., the leader in high-performance, low-cost timing and frequency technology, offers the GPS Time-Machine/OEM™, a highly versatile, low-cost solution for applications where an OEM product is appropriate. The GPS Time-Machine/OEM™ is a complete GPS-based time and frequency system, and combines the following features and performance in a compact module:

- One pulse-per-second (PPS) with separate ASCII serial time message.
- State-of-the-art GPS technology.
- Timing information requires only one satellite in static mode.
- Frequency accuracy of 4×10^{-10} RMS.
- Timing accuracy of ± 50 ns.
- Optional programmed output pulse (POP) with 100 ns resolution.
- Optional external event time-tag (ETT) with 100 ns resolution.
- Optional IRIG-B serial time code output.
- Optional GPS-corrected frequency synthesizer with six selectable outputs: 1, 10, 100 kHz and 1, 5, 10 MHz.
- Customized configurations and features available.



The GPS Time-Machine/OEM™ consists of a compact two-board set that measures 4.8" x 2.9" x 1.0" (LWH), and incorporates a state-of-the-art GPS timing receiver, integrated with proprietary microprocessor controlled timing and interface logic.

The GPS receiver simultaneously tracks every available satellite. The timing and interface logic derives precise timing information from these satellites and provides additional features, including a 1 PPS output with associated ASCII serial time message. Other optional features include external event time-tag, programmed output pulse, GPS-corrected frequency synthesizer, and IRIG B time code output.

Control and operation of the GPS Time-Machine/OEM™ is achieved via the control interface, which consists of a standard RS-232 serial data channel. All communication to and from the unit utilize a series of compact ASCII messages which allow the host to make changes to the operating parameters and to read GPS tracking, status and timing information.

The GPS Time-Machine/OEM™ is capable of autonomous operation without connection to a host computer. Once power is supplied, the unit requires no intervention to acquire satellites and provide the basic time and frequency functions based on factory default settings. A host computer may be connected for initialization purposes and left connected to monitor the system operation. The host may be disconnected at any time, and the unit will continue to operate normally with the selected configuration. Once configured by the user, the unit adopts this configuration in place of the factory settings for subsequent power-on starts.

The unit features two timing modes: static and dynamic. Static timing mode may be used when the user is stationary and position is known. In static mode, only one satellite needs to be tracked in order to generate precise time. Dynamic timing mode is used when the user is moving or position is not known. In

this mode, the unit continuously computes position and derives timing information from as many satellites as it can track.

An optional frequency synthesizer is available in the GPS Time-Machine/OEM™ to generate precise frequency sources controlled by the time-corrected signal from the GPS receiver. When tracking at least one satellite and valid time is being derived, the accuracy and stability of the synthesizer output is constantly corrected by GPS. If GPS signals are lost, the receiver enters a coast mode and the accuracy of the time-corrected signal degrades very slowly, since the receiver continues to correct the timing signal at the rate in effect at the time GPS signals were lost.

The optional programmed output pulse feature allows the user to specify a date, time, polarity and repetition rate for generating an output pulse with exceptional 100 ns resolution.

The optional event time-tag function marks the date and time of occurrence of an external event with the very same 100 ns resolution. Multiple events are buffered and supplied to the host computer via the control interface.

An optional IRIG B serial time code generator can provide two outputs: IRIG B002, a PWM logic signal, and IRIG B122, a 1 kHz amplitude modulated carrier.

The unique design of the GPS Time-Machine/OEM™ allows for custom configurations with reasonable one-time engineering costs. All connections are made via a 34-pin IDC-compatible header and an SMB antenna connector.

Control software, antenna kits and documentation are all available separately.

GPS TIME-MACHINE/OEM™: Technical Specifications

PHYSICAL (OEM)

LENGTH: 4.8 in. (121.9 mm)
WIDTH: 2.9 in. (73.7 mm)
HEIGHT: 1.0 in. (25.4 mm)
WEIGHT: 5.5 oz. (155.9 g)

PHYSICAL (OPTIONAL ANTENNA)

HEIGHT: 5.0 in. (126.6 mm)
DIAMETER: 3.54 in (90.0 mm)
WEIGHT: 0.66 lbs (0.30 kg)

MOUNTING: Flush mount. Optional 1.25" mast mount.

CABLE: RG-58 (50 ft.) with TNC connectors standard. Longer cables optional.

ENVIRONMENTAL (OEM)

OPERATING TEMPERATURE: -20 to +70°C
HUMIDITY: Up to 95% R.H., non-condensing.

ENVIRONMENTAL (Antenna)

OPERATING TEMPERATURE: -45 to +85°C
HUMIDITY: Waterproof/All-Weather

POWER

USER SUPPLIED POWER REQUIREMENTS:

Input Supply: Regulated, 5.0 VDC \pm 0.25 VDC @ 300 mA nominal

Maximum Ripple: 100mV_{ptp}

Antenna: 5.0 VDC, 20 mA

Antenna power is supplied via the coaxial cable from the unit.

PERFORMANCE (GPS)

RECEIVER TYPE: Eight-channel, parallel tracking, CA code, L1 carrier

TIME TO FIRST FIX (typical):

Hot Start: <15 seconds (valid almanac, time, date position & ephemeris)

Warm Start: <45 seconds (valid almanac, time, date & position)

Cold Start: <10 minutes (no information)

ALTITUDE: -1,000 to +40,000 ft.

POSITION UPDATE RATE: Once per second, nominal.

MAXIMUM VELOCITY: 1,000 knots (515 m/s)

POSITION ACCURACY: Less than 15 m SEP

PERFORMANCE (TIME)

1 PPS OUTPUT: (Referenced to UTC)

Conditions:

Static Mode, position known
2D Dynamic Mode - HDOP <2
3D Dynamic Mode - PDOP <2

Accuracy: \pm 50ns

1 PPS Message: Serial, ASCII date and time of next 1PPS epoch.

Drift Rate: (coasting): 4×10^{-9} typical

PERFORMANCE (FREQUENCY)

GPS-CORRECTED FREQUENCY OUTPUT:

Condition: Time Valid

Accuracy (long-term): Approaches accuracy of GPS Cesium clocks.

Accuracy (short-term):

2.5×10^{-9} ($\Delta t=1$ second)

4×10^{-10} ($\Delta t=10$ seconds)

INPUTS & OUTPUTS

1 PPS OUTPUT:

Drive: TTL levels into 50 Ω

Rise Time: 10 ns, maximum

Pulse Width: Positive pulse, 20 μ sec nominal. Rising edge on-time.

CONTROL PORT:

Signal Levels: RS-232C

Baud Rate: 9600

Signals: Serial in, serial out, ground

OPTIONAL MULTIPLEXER OUTPUT:

Drive: TTL levels into 50 Ω

Rise/Fall Time: 10 ns, maximum

Selectable Output: 1 kHz, 10 kHz, 100 kHz, 1 MHz, 5 MHz, 10 MHz at 50% duty cycle, programmed output pulse, IRIG B serial time code

TIME MESSAGE OUTPUT:

RS-232C, 1200/2400/4800/9600 baud, software selectable

OPTIONAL EXTERNAL EVENT INPUT:

TTL/CMOS level, edge-triggered, edge software selectable

OPTIONAL IRIG B MODULATED OUTPUT:

Output Level: 2.7 V_{ptp} into 600 Ω

Modulation Level: 3.3:1

OPTIONAL PROGRAMMED OUTPUT PULSE:

Drive: TTL levels into 50 Ω

Rise/Fall Time: 10 ns, maximum

Pulse Width: 20 μ sec nominal.

Polarity: selectable

SERIAL TIME CODE OUTPUT: TTL levels into 50 Ω

ALARM OUTPUT: Open collector

POWER CONTROL INPUT: TTL level

ANTENNA INPUT: SMB connector

USER I/O INTERFACE: 34 pin (2 x 17) header, 0.1 in. spacing

Spectrum

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