

USER'S GUIDE**SynPaQ/E RS-232 and USB Version****Receivers Suitable for selection:**

Synergy SSR-6Tf 16 channel GPS precision timing receiver
Synergy SSR-M8T 72 channel Multi-GNSS precision timing receiver
Synergy SSR-M8U 72 channel Multi-GNSS navigation receiver with Dead-Reckoning
Synergy SSR-M8P 72 channel Multi-GNSS receiver with RTK Precise Point Positioning
iLotus M12M 12 channel GPS timing receiver

Note: Contact Synergy for backward compatibility with Motorola's Legacy 6 and 8 channel VP and 8 channel GT+, UT+ Oncore receivers (Synergy SSR-VP, SSR-GT+, SSR-UT+ and SSR-M12+ receivers (on Adaptor Boards). This choice is for upgrading the receiver board only in older SynPaQ/E products.

Other manufacturers quoted on request (minimum order and other conditions may apply).

The above listed GPS and Multi-GNSS receivers that are optimized for fixed timing applications, also offer excellent performance in mobile timing, positioning and navigation applications.

This document outlines attributes of the SynPaQ/E hosting platform; not the individual GPS or Multi-GNSS receivers that are customer selected from the above list. For receiver specification and performance details, please refer to the manufacturer's receiver documentation.

RECEIVER PERFORMANCE

GPS and Global Navigation Satellite Systems (GNSS) receivers embedded in the SynPaQ/E rely on signals made available and controlled by different countries. The U.S. Department of Defense makes the NavStar Global Positioning System (GPS) available for civilian use solely at its discretion and the GPS is subject to degradation of position and velocity accuracies by the Department of Defense. Similar cautions apply for GNSS systems that are controlled by other countries: GLONASS by Russia; Galileo by the EU; BeiDou by China and QZSS by Japan. Neither Synergy Systems, LLC nor the various suppliers of the GNSS modules used in SynPaQ/E products warrant or control GNSS availability or performance.

PRODUCT DESCRIPTION

The SynPaQ/E is a self-contained OEM GPS Sensor comprising an embedded, user specified GPS or Multi-GNSS receiver. Support electronics are enclosed in a robust, IP68 rated extruded Aluminum housing. The support electronics include ESD tolerant RS-232 or USB compatible communications links, input power regulation, filtering and front panel mounted Power and Data display LED indicators.

The GPS or Multi-GNSS receiver can be selected from several types depending on the user's requirements. This document does not discuss the differences in the available receivers; it is only intended as a User Guide for the SynPaQ/E host product regardless of receiver installed.

The standard SynPaQ/E includes a water resistant, circular connector for power and all I/O functions. The circular connector is an IP68 rated SwitchCraft EN3. A DB-9 connector is optional (replacing the EN3) and meets IP65 when the connector is mated. An optional USB connector is IP60 rated when mated.

An RS-232 version of the SynPaQ/E incorporates the non-standard DB-9 electrical interface design of the original Motorola "XT" Oncore™ and Synergy's "XTS/II" OEM GPS Sensors. The special DB-9 I/O wiring has been retained for backward compatibility for Motorola Land Mobile Products Sector (LMPS) and many other customers who have required the convenience of a single connector for data I/O and power (standard Serial Port version quoted on request). The term "XTS" will be used in this document as a reference to the non-standard DB-9 wiring.

The SynPaQ/E uses a standard bayonet style BNC connector for the GPS antenna connection (TNC optional). With the increased convenience of using a DB-9 connector, there is a resultant drop in water resistance to IP65. Care should be taken when deciding where to mount the unit.

The "USB" version provides for a connection to external devices where a DB-9 RS-232 UART does not exist. In this version, the 1PPS output is provided by a front panel mounted SMA connector. This IP60 version is also NOT as water resistant as the standard version so care should be taken when deciding where to mount the unit.

PHYSICAL CHARACTERISTICS

Size: Less connectors and mounting plate

3.22" W x 5.21" L x 1.26"H - 82mm x 132mm x 32mm

Weight: 12 oz. (0.28 kg) with Mounting Plate

Housing: Black Powder-Coated Aluminum

ELECTRICAL INTERFACE (Standard)

Power/Data: SwitchCraft EN3P8M - 8 Pin

Mating Conn: SwitchCraft EN3C8F - 8 Pin

GPS Antenna: BNC Jack (TNC optional)

ELECTRICAL INTERFACE (XTS)

Power/Data: DB-9M

Mating Conn: DB-9F

GPS Antenna: BNC Jack (TNC optional)

ELECTRICAL INTERFACE (USB)

Power/Data: USB

Mating Conn: USB

1PPS SMA

GPS Antenna: BNC Jack (TNC optional)

ENVIRONMENTAL CONDITIONS

Operating Temp: w/o Batt -40°C to +85°C

Storage Temp: w/o Batt -40°C to +85°C

Operating Temp: w/Batt -20°C to +60°C

Storage Temp: w/Batt -20°C to +60°C

Relative Humidity: 10% to 90%, non-condensing

POWER REQUIREMENTS

+9 to +32 VDC (200 mA max)

Constant 1.6W max

POWER

Standard EN3 Version: Power is supplied through Pins 8 (+) and 6 (-) of the SwitchCraft EN3 Data/Power connector. Allowable input voltage range is 9-32VDC. Regulation of the input DC power is not required as voltage regulation, reverse voltage, over-current and over-voltage protection circuitry is provided by the SynPaQ/E internal electronics. Optionally, a regulated +5V may be supplied to pin 7.

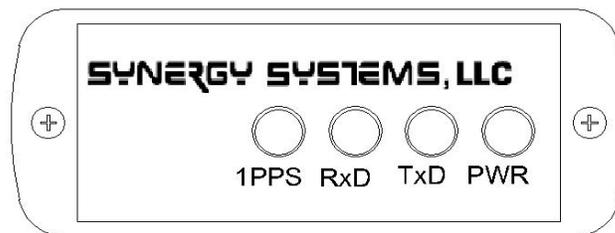
Maximum power consumption of the SynPaQ/E is approximately 1.6W (0.7W with M12M receiver). **Note: Only one power source may be connected at a time - Don't use port isolators).**

XTS Version: This product accepts an unregulated 9-32 Vdc through pin 8 or a regulated 5 VDC through pin 6 of the DB-9. Power/Data common is on pin 7. All other characteristics are identical to those of the standard EN3 version.

USB Version: This product is powered by the USB-VCC. All other characteristics are identical to those of the standard EN3 version.

Resettable fuses are incorporated in all SynPaQ/E assemblies. Since a resettable fuse is a thermally activated device, if it opens due to application of excessive input voltage, the unit should be allowed to cool for several minutes before power wiring is checked and re-applied. Repeated opening of this device under conditions of proper input power indicate a probable internal problem, and the SynPaQ/E should be returned to Synergy Systems for analysis.

FRONT PANEL INDICATORS



The front panel of the SynPaQ/E contains four LEDs for status display. Details are:

PWR—This LED should always be GREEN when power is applied to the SynPaQ/E.

TxD—The **TxD** indicator provides the user with visual feedback concerning data output from the receiver. The **TxD** LED will momentarily flash RED whenever the SynPaQ/E is sending GPS data to the host.

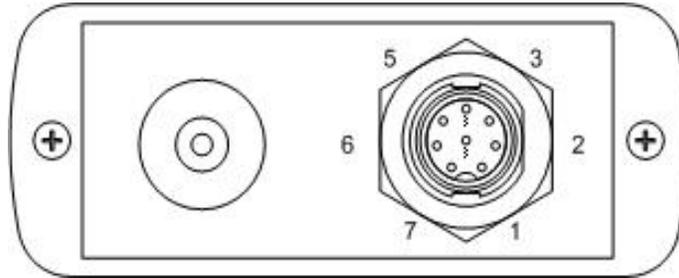
RxD—The **RxD** indicator will flash RED whenever commands are received from the host computer or control device.

1PPS—The **1PPS** indicator will flash RED whenever a **1PPS** pulse is output from the GPS or Multi-GNSS receiver. There are 2 Modes of operation for the **1PPS** LED indicator. In Mode-1, the default mode, the **1PPS** indicator will start to flash whether satellites are being actively tracked and the receiver has developed a position fix or not.

In Mode-2 the **1PPS** will only flash if satellites are being actively tracked and the receiver has developed a position fix. See Timing Pulse control in Motorola M12+ and iLotus M12M User's Guides available here: <http://www.synergy-gps.com/> or LEA-6 and LEA-M8 Protocol Specifications here: <https://www.u-blox.com/en>.

The 1PPS Mode is determined by the type of Receiver selected at time of purchase. This LED indicator also serves as a “heart-beat” giving the user visual feedback that the receiver’s processor is powered up and accomplishing normal housekeeping routines, unless the user has previously disabled the **1PPS** output through software control of the receiver.

REAR PANEL CONNECTORS



Standard Interface

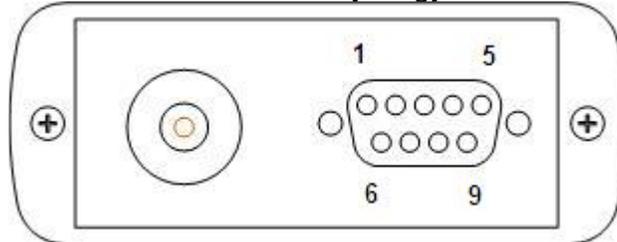
The rear panel of the Standard SynPaQ/E contains both a BNC connector (TNC optional) for antenna connection and an 8 pin combination Power/Data connector. Pin functions are as follows:

<u>PIN</u>	<u>FUNCTION</u>
1	1PPS Out, TTL levels
2	Data Out - RS-232 levels →
3	Commands In - RS-232 levels ←
4	RTCM Corrections In - RS-232 levels (Option)
5	Common (Data)
6	Common (Power)
7	Power In (+5V regulated)
8	Power In (9-30 VDC)

Note: Only one power source may be connected at a time

“XTS” Interface

the original Motorola XT Oncore™ and Synergy XTS/II Pin-Out configuration



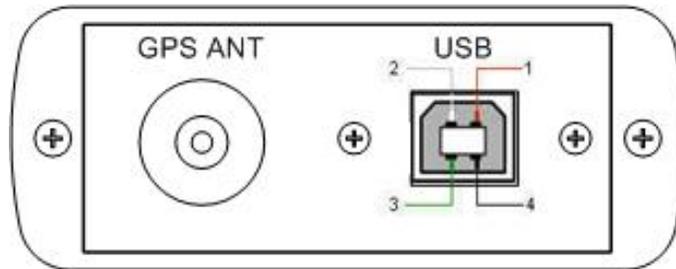
The “XTS” version of the SynPaQ/E uses a standard DB-9M Male connector that includes conductors for data and power. **This is NOT a standard DB-9 serial interface.**

XTS DB-9 Pin functions are as follows:

<u>PIN</u>	<u>FUNCTION</u>
1	RTCM In - RS-232 levels
2	Commands In - RS-232 levels ←
3	Data Out - RS-232 levels →
4	N/C
5	Common (1PPS)
6	Power In (+5V regulated)
7	Common (power and data)
8	Power In (9-30 VDC)
9	1PPS Out (TTL levels)

Note: Only one power source may be connected at a time

USB Interface



The “USB” version of the SynPaQ/E uses a standard USB Type B connector for data and power. Pin functions are as follows:

<u>PIN</u>	<u>FUNCTION</u>
1	Red: +5V / Voltage + / VCC
2	White: D - / Data - / USB -
3	Green: D + / Data + / USB +
4	Black: GND / Voltage - / Ground

ANTENNA INSTALLATION

Standard SynPaQ/E RS-232, USB and Optional SynPaQ/E RS-422 products connect to a GPS or Multi-GNSS antenna through the panel mounted BNC jack (TNC optional).

Synergy provides several types of GPS and GNSS antennas optimized for fixed position timing and position and navigation applications. Synergy also provides various cable types with different lengths and connectors also based on application requirements. See:

http://www.synergy-gps.com/index.php?option=com_content&task=section&id=10&Itemid=114

SYNPAQ/E OPERATION

With power applied, the SynPaQ/E is ready for immediate operation. Communications with receivers is generally accomplished with Windows based GPS or Multi-GNSS software applications, although Unix, Linux and custom user applications may also be used.

To control and observe fundamental receiver performance for Motorola and iLotus navigation and precision timing receivers, use WinOncore or SiRF Oncore software. These are free and available at Synergy's web site: <http://www.synergy-gps.com> (Click on Support > Software and scroll down to those applications).

As an alternate, download Synergy's SynTAC test and diagnostic software from the same location or use Tac32 from <http://www.cnssys.com>. These test and diagnostic applications are not free, but they automatically initialize and configure M12+, M12M many SSR Series OEM GPS receivers and are fully functional during a 30 day evaluation period.

Setup parameters for Motorola M12+ and iLotus M12M receivers, such as message output rate, antenna mask angle, etc. are saved in battery backed RAM. The motherboard needs to be powered on for 24 hours to charge the on-board backup battery. A full charge will keep the internal Real-Time Clock (RTC) running and receiver setup data saved in RAM for 60+ days depending on battery condition, temperature, number of charge cycles, etc.

For u-Blox based SSR-6 Series GPS and SSR-M8 Series Multi-GNSS receivers, setup data is stored in Flash Memory and the on-board battery runs the RTC when main power is removed.

For controlling Synergy's line of SSR Series of OEM navigation and precision timing receivers in u-Blox mode, download u-Center from <http://www.u-Blox.com>. Use SynTAC or Tac32 to switch back and forth between Motorola mode and u-Blox mode and to make simple message selections. Use u-Center to fully configure and control all available functions. See Synergy's Pass-Through App-Note or SSR Integration Guide for additional details.

The actual performance parameters and supported commands for each OEM receiver board embedded in the SynPaQ/E are totally dependent upon the GPS or Multi-GNSS receiver installed. Please refer to the Manufacturer's GPS or Multi-GNSS Receiver User's Guide to determine which commands and functions are supported by each receiver.

RECEIVER OPTIONS

The SynPaQ/E is designed to incorporate a variety of GPS and Multi-GNSS receiver boards to optimize evaluation and testing for various user applications. User selectable GPS and GNSS receivers are as follows:

RECEIVER BOARD OPTIONS – GPS ONLY

- iLotus M12M OEM Precision Timing Receiver – Outputs high accuracy 1PPS, Motorola 12 channel binary and NMEA messages and is form-fit-function compatible with the legacy Motorola M12+ Oncore precision timing receiver.
- iLotus M12M OEM Navigation Receiver - Outputs Motorola 12 channel binary and NMEA messages and is form-fit-function compatible with the legacy Motorola M12+ navigation receivers.
- Synergy SSR-6Tf OEM 16 Channel Precision Timing Receiver – Embeds the SBAS Enabled u-Blox LEA-6T module. Outputs u-Blox binary and NMEA and emulated 12 channel Motorola binary messages.

Note: 1. All Legacy Motorola M12+ and VP, GT+, UT+ Oncore receivers in existing SynPaQ/E products may be replaced with Synergy's SSR Series clone receivers (shipped on Synergy's Adaptor Boards).

2. For command details, refer to the LEA-6 Series "Receiver Description and Protocol Specification" located at: <http://www.u-Blox.com>.
3. When the above receivers include popular timing messages in Motorola 6, 8 and 12 channel binary emulation protocol, use SynTAC, SiRF Oncore, or WinOncore12 software applications located at <http://www.synergy-gps.com> or TAC32 at <http://www.cnssys.com>.

MULTI-GNSS RECEIVER OPTIONS

The Multi-GNSS receivers listed below use SynTAC, Tac/32 and u-Blox u-Center software. Refer to LEA-8 Series "Receiver Description and Protocol Specification" for commands which are located at: <http://www.u-Blox.com>.

Synergy's SSR Series Multi-GNSS models that include Motorola binary messages require the use of SynTAC, TAC32, WinOncore12, SiRF Oncore software or user supplied custom software. u-Center is required for full operation in u-Blox mode.

- Synergy SSR-6N Navigation Receiver - Embeds the SBAS enabled u-Blox LEA-6N GPS/GLONASS module. Outputs u-Blox binary and NMEA and emulated Motorola binary messages. (Note: End of Life (EOL) due to introduction of SSR-8 Series Multi-GNSS OEM boards).
- Synergy SSR-M8T Multi-GNSS Receiver – Embeds the u-Blox SBAS enabled LEA-M8T precision timing Module with UBX binary and NMEA messages plus Motorola Binary emulation messages. Includes GPS, GLONASS, BeiDou, QZSS and Galileo. Operates simultaneously in GPS/GLONASS, GPS/BeiDou and other combination GNSS modes.

- Synergy SSR-M8F Multi-GNSS Receiver – Embeds the u-Blox LEA-M8F Timing and Frequency Module with u-Blox binary and NMEA and emulated Motorola binary messages. Includes GPS, GLONASS, BeiDou, QZSS and Galileo. Operates simultaneously in GPS/GLONASS, GPS/BeiDou and other combination of GNSS modes.

Note: The u-Blox GPS and Multi-GNSS based products listed above are optimized for fixed position Precision timing applications but, with proper setting of “Dynamic Mode,” they also provide superb performance in both high and low speed mobile timing and navigation applications.

- Synergy SSR-M8U Multi-GNSS Tetherless Dead-Reckoning Receiver - Embeds the u-Blox LEA-M8U Module with u-Blox binary and NMEA messages. Includes GPS, GLONASS, BeiDou, QZSS and Galileo. u-Blox binary and NMEA messages only.
- Synergy SSR-M8P Multi-GNSS Precise Point Positioning Receiver – Embeds the u-Blox LEA-M8P RTK Module with u-Blox binary and NMEA messages. Includes GPS, GLONASS, BeiDou and QZSS. u-Blox binary and NMEA messages only.

Note: Synergy’s SSR Series GPS and Multi-GNSS OEM receivers are also available with backward compatible 6, 8 and 12 channel Motorola binary emulation messages. Email legacy requirements to OEMtech@synergy-gps.com.

SUPPORT

For installation suggestions and product support, contact Synergy's technical support team at the e-mail address or phone/fax numbers below.

LIMITED WARRANTY

Synergy Systems, LLC offers a limited warranty for SynPaQ/E products, and associated Antenna and Interconnecting Cables, if any, against defects in material and workmanship, under normal use and service, for a period of one year from the product's original ship date. For full Synergy Systems Terms and Conditions statement, visit: <http://www.synergy-gps.com>

Contact Synergy first for Tech-Support as required to aid in operation, or trouble shooting problems prior to returning products.

After confirmation from Synergy that a return is needed, a Material Return Authorization (MRA) number is assigned based on the customer's completed MRA form available at Synergy's web site "Customer Support" section at: <http://www.synergy-gps.com>.

Products should be shipped to Synergy via prepaid freight. On receipt at Synergy, the unit is diagnosed, refurbished or replaced and shipped back at no charge via pre-paid freight. Ship to:

Attn: MRA number _____
Synergy Systems, LLC
9950 Scripps Lake Drive, Suite 106
San Diego, CA 92131 USA
TEL: (858) 566-0666
FAX: (858) 566-0768

Non-Warranty repairs are quoted on request