NEW SSR "GPS Forever Board" ©

1024 Week Roll-Over Free When Used in Legacy Timing Instrumentation

Single Board, Drop-In* Replacements for Motorola VP, UT+ and GT+ Oncore GPS Receivers and Synergy's Legacy 12 Channel M12+ and M12M GPS Receiver Adaptor Boards

Introduction – Now upgraded to Synergy's single-board, u-Blox based, SSR-M8T, these replacement receivers are plug-compatible with the original, larger format Motorola VP, GT+ and UT+ GPS receivers - **No Adaptors Needed!**

SSR-M8T Single Board Replacement

Background - Synergy started the firmware design process in 2010 to emulate the most popular Motorola binary messages used in timing applications. This resulted in the SSR Series of drop-in replacements for receivers suffering from GPS week roll-over events. Emulated versions of Motorola's 6 and 8 channel binary messages were first made available in Synergy's SSR-6Tf GPS receivers delivered on Adaptor Boards - No motherboard changes were needed to replace Motorola's VP, GT+ and UT+ receivers.

Summary - SSR Series Single-Board replacement receivers offer enhanced performance over the original 6 and 8 channel Motorola VP Oncore OEM GPS receiver boards introduced in 1994, and the 8 channel GT+ and UT+ Oncore introduced in 1998. Like their predecessor Synergy Adaptor Board products, The new SSR-VP/UT+ replacement receivers operate in an emulated Motorola binary mode that produces popular 6, 8 or 12 channel messages, factory programmed for the receiver models being replaced.

Applications – One of the main applications taking advantage of these SSR Series "Drop-In" replacement receivers is in upgrading legacy 6 and 8 channel precision timing and telecom products manufactured by many companies. These include HP, Datum, FEI, Zypher, Austron, Spectracom, CNS Systems, Motorola, Odetics, Lucent Technologies, Symmetricom, Microsemi, Microchip and others. Another is for scientific research projects for replacing Legacy VP and UT+ Oncore receivers in long-term, multi-location data acquisition field studies.

All of those legacy products can take advantage of the performance boost SSR-M8T boards provide by plugging 72 channel technology directly into their 6 and 8 channel products, with no hardware changes required. The SSR-M8T receivers also provide 12 channel binary messages to legacy Motorola and, and other 6 and 8 channel products, that have been updated to recognize 12 channel messages.

Electrical Characteristics - SSR Clone receivers appear to the external electronics as a legacy, 5 Volt Motorola receiver. Power. PPS and signal pinouts are the same as Motorola's VP, GT+ and UT+ Oncore receivers.

The SSR-M8T receivers function properly from a regulated +5 VDC power applied to the board from various manufacturer's timing instrumentation products, Campus Area Synchronization products and legacy Evaluation Kits supplied by Motorola and Synergy since 1994.

Message Formats – A list of emulated Motorola binary messages is shown in Synergy Tech-Note 498 "Motorola Binary Emulation." SSR Command\Reply Messages are being expanded as requested by users (NRE may apply).

Performance –The SSR-VP/UT+ replacements offer much faster TTFF, higher sensitivity and accuracy and much better jamming immunity than the receivers they replace. This is accomplished by using modern GPS module technology and a propriety conversion method for reducing the 72 available channels to the required 6, 8 or 12 channels needed by the products being updated. See pages 5 and 6 for a list of the timing instrumentation products already being updated.

*Drop-In compatibility in most legacy applications

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VP, UT+ and GT+ Board Configuration Details

Motorola VP, UT+ and GT+ Oncore OEM GPS precision timing boards were supplied with either a Right Angle or Straight MCX RF connector. Components were populated on both the top and the bottom sides of these boards. Synergy supplies SSR Series receivers with both antenna connector options and duplicates Motorola's VP, UT+ and GT+ receiver's larger board dimensions of 52.80 mm x 82.60 mm (2.00 in x 3.25).

Motorola VP Oncore board with a right angle MCX (UT+ and GT+ are the same)

Motorola VP Oncore board with a straight (STR) MCX (UT+ is the same)

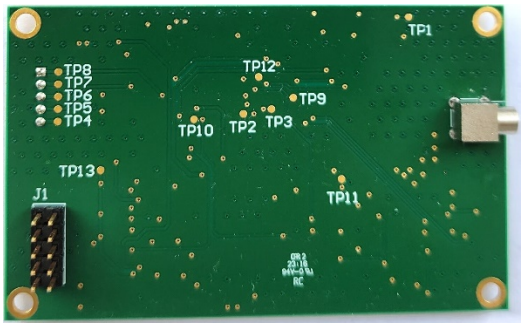
The Straight MCX version allowed both 10 Pin I/O and the RF connector to be simultaneously plugged directly into a motherboard. The UT+ and GT+ RF Connector positions are identical.

The Straight MCX connector on VP and UT+ Oncore receivers allowed designers to include additional antenna protection components on the motherboard. It also eliminated the cost of an RF coax cable. (GT+ Oncore used Right angle MCX only).

GT+ Oncore receivers were used in some lower cost Motorola timing products with ~500 ns timing accuracy and no precision timing features like T-RAIM.

SSR Board Connector Locations

(all components mounted on the top side)

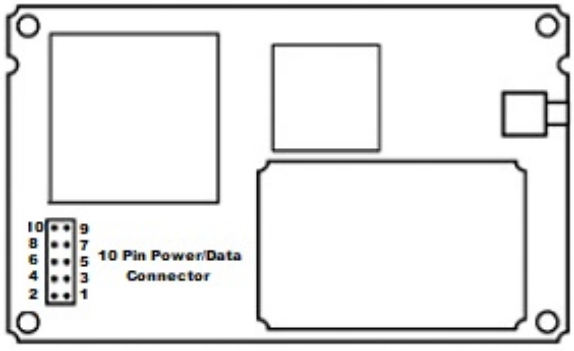


To comply with Motorola VP, UT+ and GT+ standard, SSR Series Drop-In replacement GPS receiver boards are populated with the 10 pin I/O and MCX RF connectors mounted on the bottom side of the board (top mount MCX part numbers quoted on request).

6 & 8 Channel VP, GT+, UT+ and SSR Pinouts

PIN	FUNCTION	DESCRIPTION
1	Battery	External Back-Up
2	Power	5 VDC Main Power
3	GND	Ground
4	VPP	Reprogramming Voltage
5	N/A	Not Used (Do Not Connect)
6	1PPS	Timing Pulse
7	1PPS RTN	Timing Pulse Return (GND)
8	TTL TxD	Receiver Command Input
9	TTL RxD	Receiver output Messages
10	TTL RTN	TTL I/O Return (Ground)

I/O Pinout Locations on VP, UT+ and GT+ Boards



Connector side of the board.

Optional "full enclosure" EMI Shield part number and price are quoted on request.

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Features and Specification Comparison
Legacy Motorola VP and UT+ vs. SSR-VP/UT+ Clone Receivers using SSR-M8T

Feature	Motorola 6 and 8 channel VP Oncore	Motorola 8 channel UT+ Oncore	Synergy SSR-M8T
Susceptibility to 1024 Week Roll-Over	Yes, all models already rolled over	Yes, all models already rolled over	**NO 1024 Week Roll-Overs** **GPS Forever Board©**
Tracking Capability	• 6 or 8 parallel channels • L1 1575.42 MHz • C/A code (1.023 MHz chip rate)	• 6 or 8 parallel channels • L1 1575.42 MHz • C/A code (1.023 MHz chip rate)	• 72 channels, reduced to 6, 8 and 12 channel "Best in View" to match legacy Motorola channel number requirements • L1 1575.42 MHz • C/A code (1.023 MHz chip rate)
SBAS	No	No	• WAAS, EGNOS, MSAS
Acquisition Time (Time To First Fix)	• cold - 180 s • Warm - 45 s typical • Hot - 20 s typical • Reacquisition - 2.5s	• cold - 300 s typical • Warm - 50 s typical • Hot - 20 s typical • Reacquisition - < 1 s	• cold - 26 s • Warm - < 2 s typical • Hot - 1 s • Reacquisition – < 1 s
Precision Timing	• 1 PPS timing output with Time RAIM	Same	Same
Timing Accuracy	• < 50 ns observed - position hold	• < 50 ns observed - position hold	• < 25 ns - position hold
Output Messages	• Latitude, longitude, height, velocity, heading, time, satellite tracking status (Motorola binary protocol) • Software selectable output rate (Continuous or poll) • Broad list of commands/messages • TTL interface	• Latitude, longitude, height, velocity, heading, time, satellite tracking status (Motorola binary protocol) • Software selectable output rate (Continuous or poll) • Broad list of commands/messages • TTL interface	• Latitude, longitude, height, velocity, heading, time, satellite tracking status (Emulated Motorola binary protocol) • Software selectable output rate (Continuous or poll) • Popular timing commands/messages • Broad list of timing commands/messages • TTL interface
Programmable Processor	No	No	Yes (To add features and/or future commands)
Power Requirements	• 5 ± 0.25 Vdc; 50 mV p-p ripple (max)	• Same	•Same
Power Consumption	• 5 VDC, 1.1 W	• 5 VDC, 0.9 W	• 5 VDC, 0.5W
Antenna Drive	• 5 VDC Powered through receiver module	• Same	•More robust Antenna 3V-5V Power Management System
Dimensions	• 2.00 x 3.25 x 0.64 in. [50.8 x 82.6 x 16.3 mm]	• Same	• Same
Weight	• 1.8 oz. (51 g)	• same	• Same
Connectors	• Data/power: 10 pin (2x5) header, 0.10" centers • RF: right angle OSX (subminiature Snap-On)	•Same • Same	• Same • MCX Backward Compatible with OSX
Operating Temperature	• -30ºC to +85ºC	• -40ºC to +85ºC	• -40ºC to +85ºC
Operating Period	• 1024 Weeks	• 1024 Weeks	• Un-Lmited
Humidity	• 95% noncondensing +30ºC to +60ºC	• Same	• Same
Certifications	• FCC	• Same	• FCC, Industry Canada, CE (tested in SynPaQ/E)

Note: GT+ Oncore navigation receiver the same as the UT+ but with 500 ns PPS and without timing features like T-RAIM and Position Hold

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Corrected Part Numbers: January 6, 2025

SSR SERIES DROP-IN REPLACEMENTS FOR SYNERGY'S ORIGINAL 1000xxx Series M12+ And M12M, 12 CHANNEL ADAPTOR BOARDS

Legacy SSR-6Tf part numbers in gray - New SSR-M8T part numbers in blue

OLD SYNERGY ADAPTOR BOARD to be REPLACED		SYNERGY'S NEW SINGLE-BOARD REPLACEMENT ORDERING INFORMATION		
OLD SYNERGY P/N	**OLD MODEL/DESCRIPTION**	**SYNERGY MODEL**	**NEW DESCRIPTION**	**SYNERGY P/N**
10001872 w/ M12M	M12M-T 12 channel receiver on Adaptor Board, no bat, Straight 10 pin I/O header, R/A MCX Jack	SSR-M12M-T	SSR-M8T+, 12 channel, Single Board receiver, no bat, Straight 10 pin I/O header, R/A MCX Jack	16U54525G-P3 **16UT4525G-P3**
10001472 w/ M12+	M12+/ T 12 channel receiver on Adaptor Board, no bat, Straight 10 pin I/O header, R/A MCX Jack	SSR-M12+	SSR-M8T+, 12 channel, Single Board receiver, no bat, Straight 10 pin I/O header, R/A MCX Jack	16U54525G-P2 **16UT4525G-P2**
10001874 w/ M12M	M12M-T 12 channel receiver on Adaptor Board, no bat, Straight 10 pin I/O header, Str MCX Jack	SSR-M12M-T/S	SSR-M8T, 12 channel, Single Board receiver, no bat, Straight 10 pin I/O header, straight MCX Jack	16U54524G-P3 **16UT4524G-P3**
10001474 w/ M12+	M12+/T 12 channel receiver on Adaptor Board, no bat, Straight 10 pin I/O header, Str MCX Jack	SSR-M12+/S	SSR-M8T, 12 channel, Single Board receiver, no bat, Straight 10 pin I/O header, straight MCX Jack	16U54524G-P2 **16UT4524G-P2**
10001827	M12M-T 12 channel Shielded receiver on Adaptor Board, no bat, Straight 10 pin I/O header, R/A MCX Jack	SSR-M12M-T	SSR-M8T, 12 channel, Single Board receiver, no bat, Straight 10 pin I/O header, R/A MCX Jack, No extra shield required	16U54525G-P3 **16UT4525G-P3**
10001860G	M12M-N 12 channel Navigation receiver on Adaptor Board, W/Bat, Straight 10 pin I/O header, R/A MCX Jack	SSR-M12M-N	SSR-M8T, 12 channel, Single Board receiver, No Bat, Straight 10 pin I/O header, R/A MCX Jack (needs user supplied battery B/U on pin 1 of header)	16U54525G-P3 **16UT4525G-P3**
10001729 Motorola P/N MOTO187995D01	M12M-T 12 channel Shielded receiver on Adaptor Board, no bat, Straight 10 pin I/O header, R/A MCX Jack	SSR-M12M-T	SSR-M8T, 12 channel, Single Board receiver, no bat, Straight 10 pin I/O header, R/A MCX Jack, No extra shield required	16U54525G-P3 **16UT4525G-P3**

Notes:

1. The Synergy Model Numbers shown in this table are designed to work in Motorola, and other manufacturer's products where the product's internal software has been updated from the original 6 or 8 channel Motorola binary code to recognize 12 channel binary command\reply messages produced by Motorola's original M12+ and follow-on iLotus M12M GPS receivers.
2. The original Synergy Adaptor Board product P/N 10001729 and P/N 10001827 with an overall EMI Shield can now be replaced with the P/N 16UT4525G-P3 since the entire GPS module on the SSR-M12M-T is shielded - an additional overall shield is not required.
3. SSR Series timing receivers offer excellent tracking, positioning and navigation results. For navigation applications, please send the "platform maximum expected acceleration and velocity" to Synergy so the SSR receiver dynamics can be set prior to shipment.
4. Adaptor Board P/N 10001860G included an on-board keep-alive battery to hold Almanac, position and time (including an RTC) in RAM to aid in a faster Time to First Fix (TTFF). The replacement SSR-M12T features much faster TTFF so a backup battery is no longer necessary. Non-battery SSR boards also eliminate the need to replace the battery in the field at the end of their service life (8 – 12 years depending on environmental factors).
5. For timing products using non-Synergy Adaptor Boards, please contact Synergy at oemtech@synergy-gps.com.

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Revised: January 6, 2025

SSR Replacement Receiver Selection chart for updating Lucent Technologies Legacy Products Designed for Motorola VP and UT+ Oncore OEM boards

Gray part numbers document SSR-6Tf boards that went EOL. Blue part numbers are for the follow-on SSR-M8T Multi-GNSS replacement boards configured for GPS only mode

Lucent Technologies Product	Original GPS Receiver Type	Channels	Synergy Replacement Model	Synergy P/N
SII - RFTG L104B/C, L106A/B	Motorola - VP Oncore B1	6	SSR-VP1/R	16U54525G-B1 **16UT4525G-B1**
SII - RFTG L106C, L109	Motorola - VP Oncore B3	8	SSR-VP3/R	16U54525G-B3 **16UT4525G-B3** *
SII - RFTG L106C, L109	Motorola - VP Oncore B4	8	SSR-VP4/R	16U54525G-B4 **16UT4525G-B4** *
SII - RFTG L106C, L109	Motorola - VP Oncore B4	8	SSR-VP4/S	16U54524G-B4 **16UT4524G-B4** *
SII - RFTG L106C, L109	Motorola - VP Oncore B8	8	SSR-VP8/R	16U54525G-B8 **16UT4525G-B8** *
SII - RFTGu	Motorola - UT + Oncore R5	8	SSR-UT+/R	16U54525G-R5 **16UT4525G-R5**
RFTGM-II XO	Motorola UT+ Oncore R5	8	SSR-UT+/R	16U54525G-R5** **16UT4525G-R5**
RFTGM-II XO	Motorola UT+ Oncore R5	8	SSR-UT+/S	16U54524G-R5** **16UT4524G-R5**

* Some SII - RFTG L106C, L109 units may have embedded the VP-B3 or VP-B4 receiver versions prior to migrating to the VP-B8.

** Some of the RFTGM-II XO products were manufactured with UT+ receivers with a straight MCX RF connector (/S) and others were shipped with right angle MCX RF connectors (/R).

To ensure compatibility, please confirm the manufacturer of the product being updated and send a photo of the top and bottom of the Motorola GPS board to Synergy showing the RF Connector. Synergy will return confirmation of the replacement SSR receiver part number and quote a price for the number of receivers desired.

Note: As a result of a contract agreement with another customer, Synergy does not offer replacement GPS boards for the following Lucent Technologies legacy products: TFU - 44ww7, TFU - 44ww8, TFU - 44ww7B, TFU - 44ww8B, CTU - 1:1, 1:2, CTU - 1:3 and later

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Manufacturers will be added to this page as their products are tested Added New Part Numbers: March 6, 2025

SSR VP/UT+ Series - Receiver Selection chart and Ordering Instructions

Drop-In Replacements for Legacy Motorola 6 and 8 Channel VP and 8 Channel UT+ and GT+ Oncore GPS Receivers

10 Pin Header and MCX RF Connector are both bottom mounted for backward compatibility with Motorola boards

Legacy timing products were designed for GPS only operation. Multi-GNSS operation is incompatible and not offered or supported

MOTOROLA PRODUCT to be REPLACED			SYNERGY REPLACEMENT		MANUFACTURER'S TIMING PRODUCT
Motorola Model	**Motorola P/N**	**Receiver Description**	**Synergy Model**	**Synergy P/N**	**Black part numbers document SSR-6Tf boards that went EOL. Blue part numbers are for the follow-on SSR-M8T Multi-GNSS replacement boards. All configured for GPS only mode**
VP-B1 6 Channel	B1xxxXxxxX	6 channel VP Oncore – R/A OSX	SSR-VP1/R	16U54525G-B1 **16UT4525G-B1**	Austron\Datum System2000***; HP Z3801A and Z3805A ; HP 59551A
VP-B3 8 Channel	B3xxxXxxxX	8 channel VP Oncore – R/A OSX	SSR-VP3/R	16U54525G-B3 **16UT4525G-B3**	
VP-B4 8 Channel	B4xxxXxxxX	8 channel VP Oncore – R/A OSX	SSR-VP4/R	16U54525G-B4 **16UT4525G-B4**	
VP-B4 8 Channel	B4xxxXxx5X	8 channel VP Oncore – STR OSX	SSR-VP4/S	16U54524G-B4 **16UT4524G-B4**	HP Z3816A; Lucent KS-24361 REF-1****
VP-B8 8 Channel	B8xxxXxx1X	8 channel VP Oncore – R/A OSX	SSR-VP8/R	16U54525G-B8 **16UT4525G-B8**	HP 58503A; HP 58503B*; Symmetricom SSU-2000 ***
VP-B8 8 Channel	B8xxxXxx5X	8 channel VP Oncore – STR OSX	SSR-VP8/S	16U54524G-B8 **16UT4524G-B8**	
UT+ 8 Channel	R5xxxUxxx1X	8 channel UT+ Oncore – R/A OSX	SSR-UT+/R	16U54525G-R5 **16UT4525G-R5**	Symmetricom SSU 2000 ; HP 58503B* Datum/Symmetricom ET6000; Zypher GPStarPlus** HP Z3811; Lucent KS-24361****
UT+ 8 Channel	R5xxxUxxx5X	8 channel UT+ Oncore – STR OSX UT+ size 12 Channel M12+ Clone	SSR-UT+/S	16U54524G-R5 **16UT4524G-R5**	Zypher CommSync II; HP 58503B*; TRAK Micro 9001-1 GPS cards. Efratom Model 137, 16 Motorola Simulcast
GT+ 8 Channel	R3xxxUxxx5X	8 channel GT+ Oncore – R/A OSX	SSR-GT+/R	16U54525G-R3 **16UT4525G-R3**	General Navigation and for +/- 500 ns Timing Instruments

* Original HP 58503B units were delivered with 8 channel Motorola VP Oncore receivers. Later units used an 8 channel UT+ Oncore with either a right angle MCX or a straight MCX RF connector. Some were delivered with 12 channel iLotus M12M receivers on non-Synergy Adaptor Boards that output 8 channel messages. See Note B below.

** Early GPStar products were produced with Motorola 8 channel UT+ Oncore receivers. Later products were shipped with a smaller formfactor 12 channel Motorola M12+ mounted on a Synergy Adaptor Board P/N 10001874 that would plug into the larger formfactor UT+ slot. See Tech-Note 500 for 12 channel M12+ receiver replacement.

*** Early SSU-2000 products were produced with Motorola 6 channel VP Oncore receivers. Next, products were shipped with 8 channel VP Oncore receivers and finally 12 channel Motorola M12+ receivers mounted on a Synergy Adaptor Board that would plug into the larger formfactor VP/UT+ slot. iLotus 12 channel M12M receivers were the last of the Motorola designed receivers to be used. See Tech-Note 500 for option to specify 12 channel M12+ receiver replacement (requires disassembly and reassembly on Adaptor Board).

**** Early Lucent KS-24361 Ref-1 products were produced with Motorola 8 channel VP receivers. Later products were shipped Motorola 8 channel UT+ receivers.

To Order: A. Determine a part number from pages 4 and 5 or a manufacturers name and product model number from this page (for example HP Model Z3801A). If a Manufacturer's name and product model is not included on this page, please e-mail a front panel photo of the manufacturer's product and the top and bottom of the existing GPS board.

B. E-mail a photo of the top and bottom of the Motorola board (and, if used, the bottom of an Adaptor Board's RF connector). Some timing products manufacturers switched from right angle to straight MCX RF connectors during their production phase and the proper SSR part number needs to be specified.

C. Synergy will return confirmation of the replacement SSR receiver part number from page 4, 5 or 6 and quote a price for the number of receivers desired.

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