



# Mark V

## GPS P(Y) Code Time and Frequency Receiver with SAASM

### KEY FEATURES

- 10 Nanoseconds rms Accuracy to UTC
- Uses the Precise Positioning Service (PPS)
- Dual Frequency
- Receiver Autonomous Integrity Monitoring (RAIM)
- Versatile and Modular Architecture
- SAASM Capable Receiver

Symmetricom's Mark V™ offers ultra-precise timing performance by using the GPS Precise Positioning Service (PPS) that takes full advantage of the accuracy and anti-spoofing capabilities of the P(Y) code. The Mark V corrects for Selective Availability and uses Y-code augmented with Receiver Autonomous Integrity Monitoring (RAIM) to protect against satellite/system anomalies and spoofing. In addition, it incorporates the latest Selective Availability Anti-Spoofing (SAASM) technology. U.S. Department of Defense and Government customers obtain the most reliable GPS-based timing possible with accuracy better than 10 nanoseconds to UTC.

The superior performance levels achieved by the Mark V are the result of a complete strategy based on accurate position determination, dual frequency GPS tracking, system integrity monitoring, multi-satellite ensembling techniques, and a high-stability ovenized oscillator.

Standard timing outputs from the Mark V include a 1 PPS accurate to less than 10 nanoseconds rms to GPS/UTC, analog IRIG-B

time code, and serial I/O time strings. Using the keypad or RS-232 port, users have control over a variety of time formats, configurations, and output options, including GPS and oscillator status and controls.

The very modular backplane architecture of the Mark V supports multiple time and frequency output options to address specific needs. These plug-in output modules can be incorporated at any time and significantly increase the clock adaptability to changing mission requirements. See the Options section for a list of the currently supported options. The base models support up to four single-height plug-in modules. Using the optional 3.5" high chassis, up to ten single-height modules can be accommodated.

The features of the Mark V make it the instrument of choice for critical mission applications such as

- C<sup>4</sup>
- Range Timing
- Satellite Communication Stations
- T1/E1 Primary Reference Sources
- Network Synchronization



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## Mark V Specifications

### RECEIVER/GENERAL

- Receiver input: L1/L2, P(Y) code (PPS), SAASM capable
- Tracking: Twelve parallel, dual-frequency channels
- Crypto key input: Compatible with KYK-13 and Kol-18  
Front panel mounted
- Security: Approved PPS-SM and AOC chip set  
Unclassified when keyed
- Position update rate: Once per second
- Time to first fix: 1.5 minutes nominally
- Antenna/preamplifier: L1 1575 MHz and L2 1227 MHz microstrip with 40 dB gain, all-weather, outdoor mounting.
- Lead-in cable: 50' (15 m) of RG-59/U supplied with the system  
Longer cable runs can be accommodated optionally by:  
Lower-loss cable  
Fiber optic cable  
In-line amplifier

### TIMING OUTPUTS

- 1 PPS output: TTL into 50 $\Omega$ , rising edge on time  
20-microsecond pulse width  
Rear panel BNC
- IRIG B output: 1 kHz amplitude modulated carrier  
3 Vpp high, into 600 $\Omega$   
Rear panel BNC
- Serial I/O: Bidirectional port at RS-232 levels  
Full user-selectable protocol  
DB9 connector

### ADDITIONAL STANDARD FEATURES

- External frequency measurement
  - Frequencies: 1, 5, or 10 MHz
  - Resolution: 6 x 10<sup>-11</sup> at 1 second intervals
  - Accuracy: 1 x 10<sup>-12</sup>
- Time interval/event timing
  - Resolution: 30 ns, single shot
  - Accuracy: 100 ns  $\pm$  30 ns
- Loss of lock alarm: Open collector type alarm output

### PERFORMANCE (AUTHORIZED USERS)

- Dynamics
  - Velocity: 0-400 m/sec (800 knots)
  - Acceleration: 4 g
- PPS position accuracy (WGS84)
  - 3-D, 10 meters SEP in dynamic model 3-D
  - 3 meters 2d rms in static mode after completing 24-hour initialization position averaging
- Altitude
  - PPS: -400 to 21,500 meters (70,000')
  - SPS: -400 to 18,200 meters (60,000')
- Timing accuracy, 1 PPS
  - To GPS: <10 ns rms (<100 ns peak)
  - To UTC: <10 ns rms (<100 ns peak)

- Internal oscillator: 10Mhz high-stability OCXO
- Accuracy: <2x10<sup>-13</sup> when tracking satellites
- Stability:
  - 1x10<sup>-11</sup> at 1 second
  - 1x10<sup>-11</sup> at 100 seconds
  - <2x10<sup>-3</sup> at one day
- Stability when not tracking satellites: 3.5x10<sup>-11</sup>/° C

### FRONT PANEL CONTROLS

- Alphanumeric front panel display
  - Initialization parameters, time of year, as well as alarms/status messages can be viewed on the 2-line, 32 character LCD
- Keypad: 0-9; up, down, left and right arrows; CLR, FUNC/ENTR, TIME, STATUS, POSITION
- Front-panel time display: LCD type, 10 characters, 1 line; default is time-of-year

### MECHANICAL/ENVIRONMENTAL

- Receiver
  - Size: 1.75" x 17.0" x 17.0" (4.4 cm x 43.2 cm x 43.2 cm)
  - Power: 95-260 Vac, <40 watts, 47-440 Hz
  - Operating temperature: 0° C to +50° C
  - Storage temperature: -40° C to +85° C
  - Humidity: To 95% noncondensing
- Antenna
  - Operating temperature: -55° C to +85° C
  - Storage temperature: -55° C to +85° C

### OPTIONS

- Telecommunication interface: Primary Reference Source 1.544 Mbps (T1) or 2.048 Mbps (E1), Status/Alarm
- 1, 5, or 10 MHz frequency outputs
- Multiple time code outputs
- Selectable output pulse rates
- N.8 data rate outputs
- Low phase noise frequency outputs
- Oscillator upgrades: Rubidium and cesium standard disciplining
- External oscillator control
- Network time server
- Network interface card for telnet remote control
- Precision time and time interval interface (PTTI)
- Have Quick II
- Video time inserter
- Parallel BCD
- 3.5" height, 10-option bay chassis
- AC/DC power input
  - 95-260 Vac/18-36 Vdc
  - 95-260 Vac/36-72 Vdc
  - 110 or 220 Vac/10.5-32 Vdc
- IEEE-488 interface
- Fiber optic antenna link (up to 2 km)

Note: U.S. Government policy restricts the sale of Precise Positioning Service (PPS) equipment to those authorized by the U.S. Department of Defense. Non-U.S. authorized users must purchase PPS equipment through the Foreign Military Sales (FMS) process. Made in the U.S.A.



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