

# BesTime Sync Module

## Synchronization Modules for Wireless Base Stations

### KEY FEATURES

- BesTime Technology
- Multiple Input Sources – GPS, T1, E1, Plus On-board Crystal or Rubidium Oscillator Inputs
- High Resolution Time Stamping for LMUs (using EOTD & OTDOA)
- Customizable in both Operation Performance and Mechanical Size
- Optimized for 3G Technologies (CDMA2000, W-CDMA)
- Takes GPS L1 or GPS Timing Antenna Input
- C/A Code, L1 Carrier for GPS
- 8 Channel, Parallel Tracking GPS Engine
- Hitless Switchover or Dual Active Redundancy Formats
- Built-in Self Test

### MAJOR APPLICATIONS

- cdma2000
- cdma2000 1xEV
- CDMA IS-95
- W-CDMA (UMTS)
- GSM
- EDGE
- GPRS
- Location Services (LMU)

### INTRODUCTION

The new BesTime™ Sync Module from Symmetricom is focused to meet the needs of Network Equipment Manufacturers of CDMA 2000, W-CDMA (UMTS), GSM, EDGE, GPRS, WLL, Location Measurement Units (LMU) and other wireless base station technologies. This new OEM product is based upon Symmetricom's BesTime technology allowing Network Manufacturers of base stations the capability of utilizing multiple sources of time and frequency for synchronization. BesTime technology also provides these OEM products with the ability to produce extended holdover when using span lines in the holdover mode of operation.

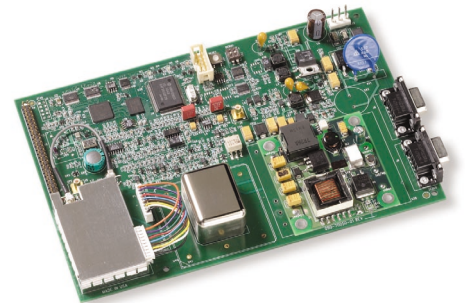
### BESTIME TECHNOLOGY

BesTime technology developed by Symmetricom has the capability to use multiple input sources from time and frequency references to adaptively generate and output timescale frequency that operates with a stability that is better than any of the individual sources used. These multiple input sources may be a cesium standard, the GPS Satellite System, a local oscillator, or T1/E1 lines. In doing this, Symmetricom's new OEM products are able to improve the locked performance of these frequency and time products while extending their holdover performance.

Extended holdover greater than 48 hours with accuracies of less than 4 micro seconds is also possible when a E1/T1 line is used as the primary holdover reference for GPS based receivers.

### BESTIME FEATURES

- Algorithms for Measurement and Control
- Thermal Compensation of the Oscillator
- Ensembling Capability – Multiple Sources for Sync & Timing Can be Utilized
- Input Monitoring, Evaluation and Reporting
- Provides MTIE and TDEV Measurements on Reference Inputs
- Proprietary Multi-level Digital Filtering
- Enhanced Holdover via qualified T1/E1 Lines



**FIG.1** BesTime Sync Module for Wireless Base Stations (70000 series)

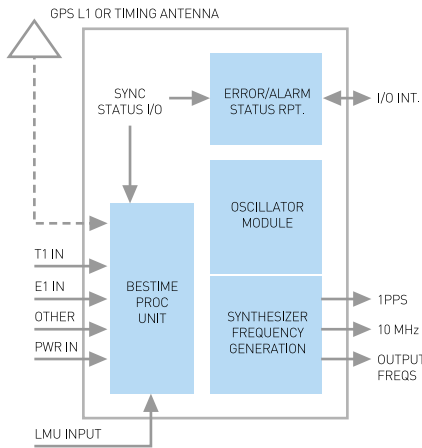


FIG.2 BesTime™ Sync Module Block Diagram

## Product Specifications

### LOCATION MEASUREMENT TIMING (LMU)

- OUTPUTS TIME STAMP DATA NECESSARY FOR ACCURATE E-911 LOCATION DETERMINATION
- TIME STAMP RESOLUTION; 7ns
- ACCURACY:  $\pm 7$ ns TO LOCAL 1PPS

### REFERENCE SOURCE INPUT OPTIONS

- GPS L1 ANT. INPUT: 1575.42 MHz
- GPS TIMING ANT. INPUT: 1 PPS
- QUARTZ OSCILLATOR: 5 MHz
- RUBIDIUM OSCILLATOR: 10 MHz
- T1 LINE: 1.544 MHz
- E1 LINE: 2.048 MHz
- FRAME PULSE: 8.0 kHz

### OUTPUTS AVAILABLE

#### • 1PPS

FREQUENCY: 1 Hz  
 SIGNAL TYPE: LVTTL  
 ACCURACY:  
 ON-TIME EDGE WHEN LOCKED TO GPS:  
 PHASE DIFFERENCE <50 nsec (95%) RELATIVE TO UTC  
 JITTER: MAXIMUM 100 nsec BETWEEN ADJACENT PULSES WHEN RECOVERING FROM HOLDOVER  
 POSITIVE PULSE WIDTH: >10  $\mu$ s (ON-TIME RISING EDGE)  
 STANDARD HOLDOVER:  
 LEARN TIME BEFORE HOLDOVER: 2 DAYS  
 ACCURACY:  
 $\pm 8 \mu$ s AFTER 0.5 HRS OF HOLDOVER, 10° C/HR  
 $\pm 8 \mu$ s AFTER 8.0 HRS OF HOLDOVER, 8° C/HR  
 $\pm 8 \mu$ s AFTER 24 HRS OF HOLDOVER, 10° C/HR,  
 MAX TEMP CHANGE OF 50°C  
 EXTENDED HOLDOVER: (SPAN LINE ASSIST)  
 LEARN TIME BEFORE HOLDOVER: 1 DAY  
 ACCURACY:  $\pm 8 \mu$ s FOR OVER 48 HOURS OF HOLDOVER (WITH QUALIFIED SPAN LINE)

#### • PP2S (EVEN SECONDS)

FREQUENCY: 0.5Hz  
 SIGNAL TYPE: DIFFERENTIAL LVTTL, PECL  
 ACCURACY: SAME AS 1PPS

#### • 10 MHz ANALOG

ACCURACY:  
 $1 \times 10^{-12}$  [1 DAY AVERAGE] LOCKED TO GPS  
 $1 \times 10^{-11}$  [1 DAY AVERAGE] WITH QUALIFIED E1/T1  
 SHORT TERM STABILITY:  $1 \times 10^{-11}$  [ROOT ALLEN VARIANCE, 100 SECOND AVERAGE]  
 SIGNAL TYPE: ANALOG SINUSOID  
 AMPLITUDE: 12  $\pm 3$  dBm  
 HARMONICS: < -30 dBc

SPURIOUS LEVEL:  
 @ 1 kHz = -135 dBc  
 @ 10 kHz = -115 dBc  
 @ 100 kHz = -95 dBc  
 @ 1 MHz = -95 dBc

Phase Noise:  
 @ 100 Hz = -120 dBc  
 @ 1 kHz = -125 dBc  
 @ 10 kHz = -135 dBc  
 @ 100 kHz = -140 dBc  
 @ 1 MHz = -145 dBc

#### • 10 MHz DIGITAL

ACCURACY: SAME AS 10 MHz ANALOG  
 SIGNAL TYPE: LVTTL, PECL, LVDS, etc.

#### • OUTPUT FREQUENCIES (LOCKED TO 10 MHz)

19.6608 MHz  
 29.4912 MHz  
 30.72 MHz  
 39.3216 MHz  
 61.44 MHz  
 9.8304 MHz  
 2.048 MHz  
 1.544 MHz  
 8 kHz

#### OTHER FREQUENCIES AVAILABLE

ACCURACY: SAME AS 10 MHz ANALOG  
 $1 \times 10^{-12}$  [1 DAY AVERAGE] LOCKED TO GPS  
 $1 \times 10^{-11}$  [1 DAY AVERAGE] WITH QUALIFIED E1/T1  
 SIGNAL TYPE: LVTTL, PECL, LVDS, etc.  
 DUTY CYCLE: 50%  $\pm 10\%$

#### • TIME-OF-DAY

MESSAGE TIMING  
 TOD START: > 40 msec AFTER EVEN SECOND  
 TOD STOP: < 200 msec EVEN SECOND  
 COMMAND RESPONSE START: >200 ms AFTER EVEN SECOND  
 SIGNAL LEVEL: RS-422  
 SIGNAL PINS: Tx, Rx, SIGNAL GROUND  
 DATA RATE: 9600 bps  
 DATA FORMAT: 8 DATA BITS, 1 STOP BIT, NO PARITY BIT  
 TOD OUTPUT FORMAT:  
 HEADER: 2 Bytes  
 SECOND (SEC): 11 BYTES - BINARY  
 LEAP SECOND: 2 BYTES - BINARY  
 STATUS: 1 BYTE  
 ERROR: 1 BYTE  
 END: 1 BYTE  
 CHECK SUM: 2 BYTES

#### ENVIRONMENTAL SPECIFICATIONS

OPERATING TEMPERATURE: 0°C to + 70°C  
 STORAGE TEMPERATURE: -40°C to +85°C  
 HUMIDITY: 95% NON-CONDENSING

#### INTERFACE SPECIFICATIONS

SERIAL INTERFACE: RS-232  
 CONNECTOR: 9-PIN D-SUB  
 BAUD RATE: 9600 bps & 19,200 bps  
 SERIAL PROTOCOL: 1 START BIT, 8 DATA BITS, 1 STOP BIT, NO PARITY BIT

#### COMMANDS

- ACTIVE/STANDBY SWITCHING
- BLOCK SWITCHING
- STATUS INFORMATION
- ERROR INFORMATION
- DIAGNOSTIC LOG DATA
- POSITION
- TIMING ERROR
- TRACKING INFORMATION
- ANTENNA FEED LINE-DELAY COMPENSATION SUPPORTED

#### INPUT POWER

VOLTAGE: +24V AND -48 Vdc (OTHERS AVAILABLE, +20 Vdc, +60 Vdc)  
 POWER: WARM UP: 30 WATTS  
 STEADY STATE: 20 WATTS



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