

# Tycho GPS Frequency Reference

*Model 3021-5 for Broadcast, DAB/DVB and Other Communications*

**The Model 3021-5 Tycho GPS Frequency Reference is a high-performance, cost-effective unit, that is ideally suited as a site master clock for communication systems.** The Model 3021-5 includes a 1 PPS output, an alarm output, and four low-phase-noise, spectrally-pure 10 MHz outputs. The highly-integrated solid state design yields a conservative MTBF of 225,000 hours, giving many years of troublefree service. The unit can be remotely managed via a network port or locally managed via an RS-232 serial port.

## FEATURES

- Timing Accuracy: < 20 Nanoseconds RMS to GPS Time
- Frequency Accuracy: <  $1 \times 10^{-13}$
- Four 10 MHz LPN Frequency Outputs
- 1 PPS Output
- Advanced Design Maintains Spectral Purity of the Oscillator
- High Channel-to-Channel Signal Isolation
- Network Port with Telnet, FTP, SNMP, SSH and more



## GPS Timing and Frequency Control

Utilizing a Global Positioning System (GPS) receiver with advanced algorithms, the Tycho GPS Frequency Reference is accurate to within 20 nanoseconds. The frequency of the internal oscillator is disciplined to match the frequency of the UTC timescale to parts in  $10^{14}$  level-of-accuracy over 24-hour observation intervals. The time and frequency outputs are coherent after initial GPS synchronization, and synchronization is maintained via 20-bit DAC frequency control, rather than phase stepping, to provide the ultimate in short-term stability.

## Low-Phase-Noise Outputs

The 10 MHz low-phase-noise outputs work with a Medium-Stability OCXO to provide four individually buffered, spectrally pure, sinewaves. The levels of the contributors to spectral impurity have been carefully controlled by the selection of the oscillator, and by the design of the circuit and its integration

into the rackmount chassis. Very good channel-to-channel isolation has also been achieved.

## Other Features

In addition to sourcing the low-phase-noise outputs, this unit provides for a precision 1 PPS timing reference, an alarm output, and a user-selectable timecode output. The Tycho can be managed via the network port or an RS-232 port.

## Secure Network Interface

An ethernet port is provided as a standard feature of the Tycho Frequency Reference with a wide variety of network protocols including TELNET, FTP, DHCP, SSH and SNMP with Enterprise MIB. The incorporation of SNMP v3 and SSH provides the ultimate in network security and allows the safe performance of monitoring and maintenance activities. Security-conscious users can also disable any of the risky protocols such as Telnet. In addition, access via SSH, SNMP and Telnet can be restricted to specific hosts.

## Two-Year Warranty

The Tycho is backed by a full two-year warranty against defects in material and workmanship. Free technical support and software upgrades are available for life.

## Money-Back Guarantee

If your standard Tycho does not meet your time and frequency needs for any reason, simply return it within 60 days for a full refund. See [www.endruntechnologies.com/guarantee.htm](http://www.endruntechnologies.com/guarantee.htm) for more information.



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## Model 3021-5 Specifications



### GPS RECEIVER:

- L1 Band - 1575.42 MHz.
- 8 Channels, C/A Code.

### ANTENNA:

- TNC jack on rear panel,  $Z_{in} = 50\Omega$ .
- Integral +35 dB gain LNA and filter for out-of-band interference rejection.
- Operation over -40° to +85°C temperature extremes.
- Mounting via 18" long, 3/4" PVC pipe with clamps.
- 50' low-loss RG-59 downlead cable is standard. Other lengths are optional.

### LOCAL OSCILLATOR:

- Medium-Stability OCXO:  $4 \times 10^{-9}$  over 0° to 70° C,  
< 100 us holdover at 24 hours, 5° C max delta.

### TIME TO LOCK:

- < 10 minutes, typical.

### 1 PPS CHARACTERISTICS:

- 1 PPS: Positive TTL pulse into 50Ω.
- User-Selectable Width: 20 us, 1 ms, 100 ms, 500 ms.
- User Calibration: +/- 500 us, 1 ns resolution.
- Stability: TDEV < 10 ns @  $\tau < 10^5$  secs,  $\sigma_y(\tau) < 1 \times 10^{-13}$  @  $\tau = 10^5$  secs.
- Accuracy: < 20 nanoseconds RMS to GPS Time when locked. < 100\* ns to UTC when locked.  
\*Constraints in the official GPS spec prohibit claiming an accuracy to UTC better than 100 ns.

### LOW PHASE NOISE CHARACTERISTICS:

- Quantity: 4 outputs on rear-panel BNC connectors (up to 8 possible).
- Frequency: 5 or 10 MHz.
- Output Level @ 50Ω: +13 dBm, +/- 2 dBm.
- Harmonics @ 50Ω: < -45 dBc.
- Channel-Channel Isolation: > +75 dB.
- Frequency Accuracy:  $1 \times 10^{-13}$  @ one day.
- Phase Noise dBc/Hz (with MS-OCXO) @ 10 / 5 MHz:

1 Hz	-95 dBc / -100 dBc
10 Hz	-120 dBc / -130 dBc
100 Hz	-135 dBc / -140 dBc
1 kHz	-145 dBc / -150 dBc
10 kHz	-145 dBc / -150 dBc
100 kHz	-145 dBc / -150 dBc

### ALARM CHARACTERISTICS:

- Open Collector, 40V Max, 100 mA Max Saturation Current.
- High impedance after signal loss or at major hardware fault.

### TIMECODE CHARACTERISTICS:

- Signal: Amplitude-modulated (AM), 3:1 ratio, 1 kHz carrier.
- Drive: 1 Vrms into 50Ω.
- User-Selectable Formats: IRIG-B (122, 123, IEEE-1344), NASA-36, or 2137.

### NETWORK I/O:

- Rear-panel RJ-45 jack.
- AMD PC-Net Fast III 10/100Base-T Ethernet.

### SUPPORTED NETWORK PROTOCOLS:

- SSH server with "secure copy" utility, SCP.
- SNMP v1, v2c, v3 with Enterprise MIB.
- TELNET client/server.
- FTP client.
- DHCP client.
- TIME and DAYTIME server.
- SYSLOG.
- IPv4, IPv6 and IPv4/IPv6 Hybrid.

### SERIAL PORT I/O:

- RS-232 serial I/O on rear-panel DB9M jack for secure, local terminal access.
- Parameters fixed at 19200 baud, 8 data bits, no parity, 1 stop bit.

### SYSTEM STATUS INDICATORS:

- Sync LED: Green LED pulses to indicate lock status.
- Network LED: Amber LED indicates network activity.
- Alarm LED: Red LED indicates a serious fault condition.

### FIRMWARE UPGRADES:

- Software is field-upgradeable and provided free-of-charge.

### POWER:

- 90-264 VAC, 47-63 Hz, 0.5A Max. @ 120 VAC.
- 110-370 VDC, 0.5A Max. @ 120 VDC.
- 3-Pin IEC 320 on rear panel, 2-meter cord included.

### SIZE:

- Chassis: 1.75"H x 17"W x 10.75"D.
- Weight: < 5 pounds.
- Antenna: 2.5" high x 3.5" diameter.

### ENVIRONMENTAL:

- Temperature: 0° to +50° C.
- Humidity: 0 to 95%, non-condensing.

### COMPLIANCE:

- CE, FCC.

### OTHER OPTIONS:

- High-Stability OCXO, Ultra-Stable OCXO, 10 MPPS, User-Selectable Pulse Rate Outputs, Additional Low-Phase-Noise Outputs, -48 Vdc Input, DC-Shift Timecode, 10 MPPS, 1 MHz, Additional RS-232 Serial Port, Telecom Outputs, 10-Nanosecond Calibration.  
More options available - see [Tycho Options](#) datasheet for more information.

**This datasheet describes Model 3021-5. Other configurations and options exist. For more information please contact EndRun Technologies.**

