GPS Time and Frequency Systems

TRAK Microwave Corporation

4726 Eisenhower Boulevard
Tampa, Florida 33634 USA
T: (813) 901-7200 F: (813) 901-7490
www.trak.com

Introduction

For years, precise time and frequency has played many important roles in commercial, military, and aerospace applications. Most of us are more familiar with the commercial applications. A few of these include high quality television pictures, excellent voice and data quality over telecommunications networks, and very good long-term frequency stability from power companies.

As the world becomes more "digital," demand for higher performance time and frequency systems have increased, along with the usual requirement for reduction in size and cost. Coupled to this, is the need for highly accurate synchronization of multiple systems. These demands have been answered with the availability of lower cost and smaller size crystal and rubidium oscillators, multi-function microprocessors and programmable logic, and perhaps most importantly, the constellation of satellites in the Global Positioning System (GPS). GPS offers "high stability time and frequency sources in the sky" that we can use to control and synchronize multiple time and frequency systems.

Time and frequency systems are basically available in two mechanical configurations, traditional chassis type for general purpose use, and board level types for integration into specific high volume systems, such as telecommunications. Both types incorporate a crystal or rubidium oscillator as the time and frequency reference, circuitry for producing frequency(s), pulse rates (such as 1 pulse per second), and time. A GPS timing receiver is included for setting and synchronizing time and for steering or disciplining the reference oscillator. In very critical applications, two or three systems may be combined, through fault sensing and switching logic, to produce a dual or triple redundant system.

Three TRAK Time and Frequency Systems model types are outlined below as representative examples of products described in the introduction.

Model 8821

This versatile and cost-effective chassis type unit satisfies needs for a broad range of applications. The standard oscillator is a single oven crystal, disciplined to the GPS timing receiver's 1 pulse per second (PPS) through microprocessor circuitry. Double oven crystal or rubidium oscillators are available as options, for the more stringent requirements of operation over a broad range of temperatures or very long periods of "holdover" (periods without GPS).

Standard outputs typically include a 5 or 10 MHz reference frequency, a variety of selectable pulse rates, and time through an IRIG-B amplitude modulated serial time code or the RS-232 I/O port. Expansion modules are available providing such options as Network Time Server (NTS) running Network Time Protocol (NTP), providing network time, T1 and/or E1 framed and/or unframed telecommunications references, and additional sine wave/rate outputs.

Model 9100

The Model 9100 is a modular, dual redundant, GPS time and frequency system. Its typical application is supplying telecommunications frequencies and references, especially in critical applications such as those related to public safety.

Since this system is modular, it may be configured for a wide variety of applications, with a large selection of functional modules to choose from. A typical application might specify a GPS Synchronizer disciplining a rubidium oscillator as the primary reference and a crystal oscillator as the secondary, back up reference. Very critical applications may specify dual GPS Synchronizers and dual rubidium oscillators. A Fault Sense module monitors system

faults and performance and switches to the backup channel in the event of a primary failure. Redundant power supply modules are available with wide range AC or DC power inputs. External communications is through an RS-232 I/O port. Other functional modules include digital and frequency distribution, telecom reference, NTP/NTS, and sine wave, rate, and time code generators. Single and double oven crystal and rubidium oscillators are available, with the single oven crystal oscillator providing the shortest holdover time and the rubidium oscillator the longest.

Model 8833

This model represents a broad line of GPS board level products and is designed for application specific OEM uses. These products are always integrated into higher level systems and provide time and frequency references to these systems. Time Division Multiple Access (TDMA) and/or Code Division Multiple Access (CDMA) telecommunications systems are typical users.

As in the chassis level units previously mentioned, the units include a GPS timing engine and typically a double oven crystal oscillator, with output references tailored to a customer's specific requirements. The double oven crystal oscillator provides a holdover in the order of ± 7 microseconds in a 24-hour period and a frequency stability of± 3 X 10-10 over a temperature range of —20^{o} C to +70^{o} C.

For test data and further information about TRAK Time and Frequency Systems or other TRAK products, please contact Dick Gast, Staff Engineer, 813-901-7254.