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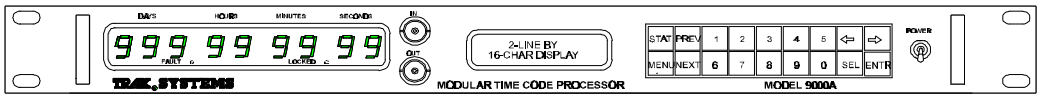
MODEL 9000

MODULAR

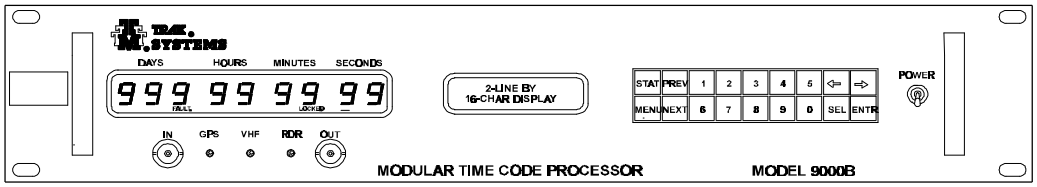
TIME CODE PROCESSOR

March, 1998

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Model 9000A Modular Time Code Processor



Model 9000B Modular Time Code Processor

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MODEL 9000 OVERVIEW

TRAK Systems Model 9000 Modular Time Code Processor is a single unit that can be customized to fit a multitude of different precise timing applications using available rear-panel plug-in modules. This versatile instrument can be configured as a standalone time code generator or can be synchronized to an external source. Modules are available for synchronizing to GPS (Global Positioning System), precise serial time codes (landline or VHF receiver module), tape reproducer time code outputs, and computer outputs. Available output modules include time code generators; TTL and sinewave rate generators; telecommunications signal generators; computer interfaces; and multiple-output line drivers.

With a synchronization module installed, the Model 9000 has four basic operating modes:

- **STANDALONE**: Unit is manually or externally preset and started. Time accumulates using either the internal oscillator or an external frequency input.
- **SYNCHRONIZED GENERATOR: Unit is precisely synchronized to the GPS satellite system or a serial time code from a master station with a cesium (or better) standard. Internal oscillator is disciplined by the synchronizing signal and freewheels at last-disciplined frequency during sync dropouts. Two synchronizers (Primary & Backup) with auto-switching may be used.**
- **READER/GENERATOR**: Unit reads a non-precise serial time code such as a 1:1 playback from a tape reproducer. A phase locked loop (PLL) is locked to the input code frequency while a code is present, and freewheels during time code dropouts. Error-bypass selection is provided.
- **TIME CODE READER**: Unit reads and displays high speed forward and reverse time codes from tape reproducers. Code carrier provides internal clocking. No usable signal outputs are generated.

The Instrument is available as the Model 9000A with six module locations in a 1-3/4 high (1U) chassis and the Model 9000B with 12 module locations in a 3-1/2-inch high (2U) chassis. The instrument mounts in a standard 19-inch rack and is available with or without slides. The two versions are identical with the exception of their size and option capacity.

Each of the available input and output modules can be inserted in any module location. Modules may be installed or removed with power applied (“hot swapping”). The instrument automatically senses module types and locations and reports this information to the front panel display. This report, along with fault reports, additional status data, and unit serial number (available via remote interface) is also available to remote computers via rear panel ports. Also included is a fault sensing system encompassing the main unit and all its installed modules. Any fault is isolated to the module level.

Current time being processed is shown on a nine-digit LED display and vital status data are indicated on individual small LED's at the bottom of this display. Setup data are entered on a 18-key keypad. Setup, status, and housekeeping data are displayed on a two-line by 16 character alphanumeric LCD.

A menu system directs the operator to all available system setup and status-request modes, eliminating the need for constant reference to this instruction manual. Nonvolatile memory stores all operating mode parameters when power is off.

The keypad, with the aid of the display, is also used for operational control (Preset, Slew, etc.) of the instrument.

Each Model 9000 includes an RS-232 I/O port for command and status. An RS-232 printer port is standard on the Model 9000B and optional on the 9000A. Also available as an option is an IEEE-488 port that duplicates the functions of the RS-232 I/O port. The included I/O features are:

- Duplication of front-panel setup commands
- Duplication of front-panel status and fault reports
- Time output

CHAPTER 1

INTRODUCTION

1-1 GENERAL

This manual contains the description, operating instructions, and maintenance instructions for the Model 9000 Modular Time Code Processor. It is intended to provide electronics personnel with the information necessary to operate the instrument and to maintain it to the lowest replaceable unit (LRU) level. The body of this manual covers the basic Model 9000 and discusses operation with its available synchronization options. Detailed descriptions of synchronization, computer interface, signal generator, and driver modules are given in the appendices.

1-2 LEVEL OF COVERAGE

This manual provides coverage to the lowest replaceable-assembly (LRU) only. No schematic or logic diagrams of replaceable assemblies are provided. Unlike instruments in use a few decades ago, where it was possible to troubleshoot to the logic gate level, the Model 9000 uses modern technology consisting of CPU's, gate arrays, and imbedded software. Packaging is largely with surface-mount technology. Only factory-trained technicians with a high level of training can perform maintenance below the LRU level. Most of the LRU's have an MTBF in excess of ten years, so frequent replacements are not required.

1-3 ORGANIZATION OF THIS MANUAL

The body of this manual describes operation of the basic Model 9000 and its most common synchronization options (plug-in modules). All other plug-in option modules (code generators, signal generators, drivers, I/O, special oscillators, and special power inputs) are described in appendices. The appendix arrangement is as follows:

Appendix A	Model 9000 Data Sheet
Appendix B	Standard RS-232 & IEEE-488 Interface Commands
Appendix C	Commonly Used Time Code Formats
Appendix D	Special Power Input Configurations
Appendix E	GPS Antenna Installation and Options
Appendix F & up	Module Descriptions

1-4 AVAILABLE MODULES

The following types of modules are available for the Model 9000:

* Synchronizers (time code, VHF link, & GPS)
* Computer I/O
* Time code and signal generators
* Signal drivers
* Special function (e.g., Time Tag & Event Trigger)
* Rubidium oscillator

1-5 FUNCTIONAL DESCRIPTION

Figure 1-1 is a functional block diagram of the Model 9000. The items shown below the Backplane are replaceable assemblies within the instrument. All items shown above the Backplane are plug-in modules accessible from the rear of the unit. One module, AUX I/O, with the RS-232 interface, external standard input, and 1 PPS output is a standard feature of the Model 9000. It plugs into location A2. All other modules are optional and any module can be placed in any location. The instrument senses which modules are installed and handles both setup and failure reporting through the front panel keypad and displays.

The Main Logic Board (MLB) contains the internal oscillator, timekeeping circuits, control/indicator housekeeping, module management, and failure management hardware/software. All housekeeping signals and power buses are routed through the MLB.

Refer to the OVERVIEW at the front of this manual for a brief discussion of the keypad and displays.

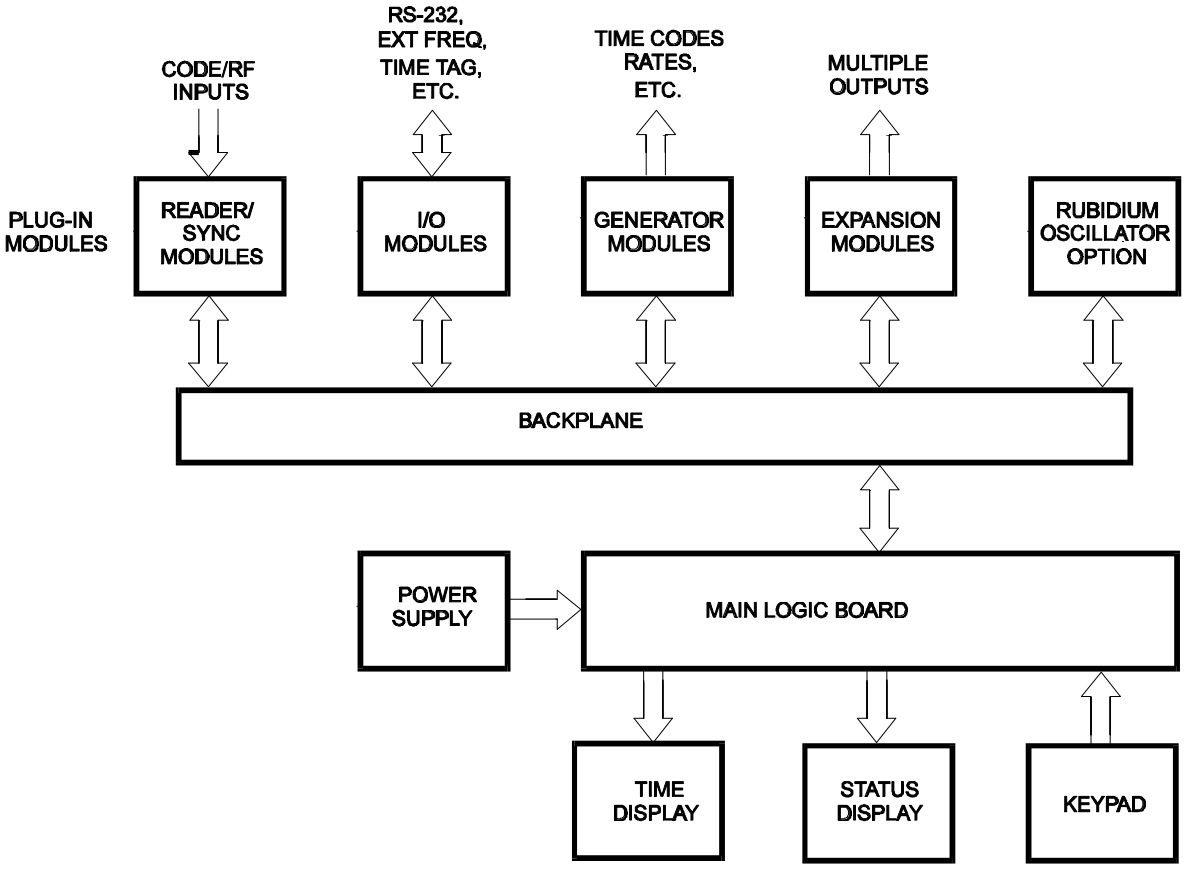


Figure 1-1. Model 9000 Functional Block Diagram

1-6 PHYSICAL DESCRIPTION

This manual covers the Model 9000A with six module locations in a 1-3/4-inch high (1U) rack-mount chassis and the Model 9000B with 12 module locations in a 3-1/2-inch high (2U) chassis. Both are standard 19-inch rack-mount units and are available with or without slides. The two versions are identical with the exception of their size and option capacity. Chassis depth is 18 inches exclusive of front panel handles and rear panel connectors. The MLB, power supply, keypad, and displays are replaceable using ordinary hand tools. All of the other modules plug in from the rear of the unit.

1-7 ENVIRONMENTAL CHARACTERISTICS

The instrument meets all specifications when operated over a temperature range of -10°C to +60°C. It can be stored over a temperature range of -20°C to +70°C. Maximum operating humidity is 95%. The unit withstands normal shock and vibration found in all forms of common-carrier shipment.

1-8 POWER REQUIREMENTS

The unit operates from 85 to 265 Vac, 48 to 440 Hz (100 to 370 VDC may also be used on this port). As an option, the Model 9000B (but not the 9000A) can have a DC backup power input 24 or 48 VDC (nominal). Power consumption is 25 watts nominal. When both AC and DC power inputs are present, the AC input has priority and the unit smoothly switches to the DC backup when AC is removed.

As an option, both the Model 9000A and Model 9000B can be ordered with only a single 24 VDC or 48 VDC (nominal) power input.

1-9 INTERNAL OSCILLATOR CHARACTERISTICS

The Model 9000 has a disciplined oscillator with nonvolatile digital storage of its center frequency. When the instrument is used as a standalone generator, the oscillator is calibrated at the factory and may be recalibrated in the field if a Model 9002 Reader/Synchronizer is installed. A precise 1 PPS is applied at the Model 9002 to calibrate the oscillator (see Chapter 4). When the unit is synchronized by a precise time code or GPS input, the oscillator is automatically disciplined by the input and the last-stored center frequency value is retained whenever synchronization or power is removed. The oscillator options available on the Model 9000 are described in Table 1-1. The model 9000B uses an option B12 oscillator (standard feature), while the Model 9000A may be ordered with either an Option B4 (standard) or B12 (upgrade) oscillator.

1-9.1 Rubidium Oscillator Module

The Model 9018 rubidium module is available for plug-and-play factory or field upgrading. When a Model 9018 is installed, the internal crystal oscillator becomes a hot standby. This option normally has application where GPS or precise time code synchronization is being used and it is desired to provide a highly-stable backup frequency source when synch is lost. Frequency accuracy while synchronized is better than $1X10^{-12}$ referenced to the input for an averaging period of one hour or greater. Drift while coasting (i.e., without a synchronizing input) is less than one microsecond in 20 hours. The Model 9018 is described in Table 1-1 and in the Appendix section of this manual.

Table 1-1 Model 9000 Available Oscillators

OPTION NO	TYPE	APPLICATION	COASTING PHASE & FREQUENCY DRIFTS *	ACCURACY REF TO UTC (GPS SYNC)	MODEL AVAILABILITY
B4	AT CUT OCXO	-140 dBc noise floor, good holdover	1-3 μs/hr $1X10^{-9}$/day	100 - 200 ns	9000A Standard
B12	SC CUT OCXO	Better stability, -150 dBc noise floor, better holdover	8-15 μs/day $2X10^{-10}$/day	80 - 100 ns	9000B Standard 9000A Option
Model 9018 module	Rubidium	Long Holdover periods. $1X10^{-11}$ freq. stability	5-10 μs/wk $5\ X10^{-11}$/day	50 - 100 ns	Available for 9000B only

* Phase and frequency drifts apply when the internal oscillator is not being disciplined by an external signal such as GPS, a serial time code, or an external 1 PPS.

1-9.2 Finding Your Oscillator Type

Refer to Maintenance Screen discussions in Chapter 4 to display the oscillator type installed in your instrument.

1-10 EXTERNAL STANDARD INPUT

In the standalone generate mode, an external 1, 5, or 10 MHz input may be used in place of the internal oscillator. This EXT STD input may also be used in conjunction with an external time code sync input if the two signals are derived from the same source; i.e., the time code and external standard must be phase locked to each other. The EXT STD input is located on Module A2 rear panel its use is further discussed in the following paragraphs. Signal characteristics are given in Table 1-2A, and the Model 9003 AUX I/O module is described in Appendix G.

1-11 RS-232 I/O AND STATUS PORTS

Two versions of the Model 9003 AUX I/O module are available. The Model 9003-1 has an RS-232 I/O port, the External Standard input, and the 1 PPS system reference output. It is standard on the Model 9000A. The Model 9003-2 AUX I/O module has all of the above signals plus an RS-232 printer port and a summary Status output. It is standard on the Model 9000B and is an option for the Model 9000A. These ports are described in Table 1-2 and command formatting is described in Appendix B.

Table 1-2A AUX I/O Signals On All A2 Modules (Types 9003-1 &-2)

SIGNAL	CHARACTERISTICS	
EXT STD in	Frequency:	1, 5, or 10 MHz (or OFF*)
	Freq. Selection:	Front panel keypad
	Signal Selection:	Applying an external input automatically overrides internal oscillator
	Input Level:	1 to 5 Vpp
	Input impedance:	50 ohms
	Waveform:	Sinewave or squarewave
	Connection:	Grounded BNC connector
1 PPS OUT	Usage:	Primary system reference output for minor rates
	Reference edge:	Positive- or negative-going via front panel selection
	Pulsewidth:	100 μseconds after positive-going edge (positive-going mode)* 100 μseconds before negative-going edge (negative-going mode)
	Levels:	TTL logic levels
	Impedance:	Will drive 50 ohms
	Rise & fall times	<10 nanoseconds
RS-232A I/O	Function:	Remote setup and monitoring including time output
	Description:	For connection to remote computer or terminal. Provides command echoing and responds to asynchronous ASCII command data.
	Transfer time:	Less than 100 milliseconds at 2400 baud
	Baud rates:	300, 600, 1200 2400, 4800, 9600* & 19.2K by front panel selection.
	Parity:	Odd, Even or None* by front panel selection.
	Data bits:	7 or 8* by front panel selection.
	Stop bits:	One
	DSR:	Enabled or Disabled* by front panel selection.
	Time msg rate:	Once per second or on request* by front panel selection.
	Connection:	DE-9 connector

* Denotes factory default setting

Table 1-2B Additional AUX I/O Signals On Type 9003-2 Modules

SIGNAL	CHARACTERISTICS	
RS-232B (PRINTER PORT)	Function:	Output status data to printer or terminal
	Baud rates:	300, 600, 1200 2400, 4800, 9600* & 19.2K by front panel selection.
	Parity:	Odd, Even or None* by front panel selection.
	Data bits:	7 or 8* by front panel selection.
	Stop bits:	One
	DSR:	Enabled or Disabled* by front panel selection.
	Time msg rate:	Once per minute or on request* by front panel selection.
	Connection:	DE-9 connector
STATUS	Function	Provides signal if any fault is detected
	Normal level	TTL ONE (4.5 ± 0.5 VDC)
	Fault level	TTL ZERO (zero volts)
	Drive	Will drive 50 ohms
	Connection	BNC Connector

* Denotes factory default setting

1-12 MODEL 9000 OPERATING MODE DESCRIPTIONS

The Model 9000 has four different operating modes: one Standalone and three for external synchronizing inputs with different levels of accuracy. The paragraphs below describe these modes with a focus on clocking sources and qualitative accuracy differences. See the Model 9000 data sheet in Appendix A and the individual module descriptions in Appendices F and up for further details.

The Model 9002 Time Code Reader module has three modes of synchronization that are selected from the front panel of the Model 9000. It is important that the operator selects the proper mode for his application; e.g., if the Precise Translate mode is selected and a non-precise tape reproducer output is fed to the unit, synchronization will be erratic. The three modes are described in paragraphs 1-14 through 1-16 below. For a discussion of the DC code sync and 1 PPS sync features, see the Model 9002 specifications in Appendix F of this manual.

1-13 STANDALONE MODE

In this mode, the unit is preset manually and is started either manually using the front panel keypad or automatically on receipt of an external Start Pulse input at the front panel IN connector. Once started, time accumulates using either the internal oscillator or an external frequency input.

1-13.1 External Start Pulse Characteristics (Standalone mode)

The External Start pulse is applied to the front panel IN connector. This connector is automatically set to accept an external start when in the Standalone mode. The unit starts on the positive-going edge of a +3 to +10 volt pulse of any duration. Input impedance is 50 ohms.

NOTE: When arming the unit to receive an external start pulse at year-end transition, you must allow a minimum of two seconds (or earlier).
(i.e., use 365 (366):23:59:58 not 365 (366):23:59:59)

1-13.2 Clocking Source (Standalone mode)

The default clocking source for the Model 9000 is the internal oscillator. If you change the factory default setting for External Standard from OFF to one of the three available frequency selections (1, 5 or 10 MHz), and you connect an input to the unit, operation will be from the external input. When the input is not present, operation reverts to the internal oscillator.

This automatic switchover feature is provided to eliminate the need for an extra switch for the occasional situations where it is desired to change between internal and external clocking. It is not designed to provide fast switchover between sources. Switchover time is approximately 50 ms. Following are some samples of the use of this clocking source selection feature when setting up Module A2:

1 - Select external standard OFF to assure operation from the internal oscillator only. The Model 9000 will ignore any external standard inputs.

2 - Select the appropriate external frequency value and connect the external input when it is desired to operate from an external source. The unit will operate from the external input as long as it is present. It will revert to the internal oscillator when the external signal is not present.

The front panel CLOCKING SOURCE status screen always shows the source currently being used.

1-13.3 Propagation Delay Compensation and Slewing (Standalone mode)

In the Standalone mode, front panel controls are provided to enter a propagation delay compensation during initial start. Once counting has started, controls are provided to manually slew all outputs with a resolution of 100 ns. These features provide for precise synchronization to an external 1 PPS signal when using the Model 9000 with a cesium (or better) external standard.

1-13.4 Output Signal Generation (Standalone mode)

Signal outputs are generated from all installed generator modules. All signals are derived from the selected internal or external frequency source.

1-14 SYNCHRONIZED GENERATOR MODE

This mode is used to precisely synchronize the Model 9000 to an external source. The two primary types of synchronizing signal are: (1) the GPS satellite system; and (2) Serial time code from a master timing station with a cesium (or better) standard, either hard-wired or via VHF link. Three synchronizer modules are available for the Model 9000:

- Model 9001 GPS Synchronizer
- Model 9002 Time Code Reader/Synchronizer
- Model 9017 VHF Receiver/Synchronizer (includes demodulator IRIG B time code reader)

In the Synchronized Generator mode, the internal oscillator is disciplined to the long-term averaged frequency of the source. If the synchronizing signal becomes unreliable or drops out, or the synchronizer module is removed, time accumulation continues using the internal oscillator at its last-disciplined center frequency. Then, if the synchronizing signal comes back (or module replaced) before the Model 9000 minor time has drifted more than 10 μseconds, the oscillator is smoothly corrected with no loss of long term accuracy. If the drift has exceeded 10 μseconds when the signal is re-applied, the unit immediately resets its phase to the input signal and restarts the disciplining process. Also see paragraph 1-14.7 below for operation with a backup synchronizer.

1-14.1 Signal Input Accuracy (Sync Gen mode)

The Synchronized Generator mode is intended for use with precise synchronization signals that have calibration traceability to universal or secondary standards. Do not attempt to use this mode with less-precise signals such as tape reproducers or inexpensive standalone generators. The Reader/Generator mode (para. 1-15) has been provided for those applications. To assure proper oscillator disciplining, accuracy of the input signal must be better than 1×10^{-10} when using the standard internal OCXO or when a 9018 rubidium module is installed. Use the Reader/Generator mode if you don't have accurate signals.

1-14.2 Resynchronization Parameters (Sync Gen mode)

Initial synchronization in the Synchronized Generator mode is automated. No manual input of frame error bypass is needed or provided. The synchronizing module (Time Code Reader/Synchronizer, VHF Receiver/Synchronizer, or GPS Synchronizer) and its associated software automatically determine when a signal is acceptable to perform initial synchronization. Once synchronized (referred to as "Tracking"), the unit disciplines its internal oscillator and countdown circuits to be in exact frequency and phase synchronism ("locked") with the input.

The Model 9000 can tolerate long periods of synchronization dropout or sync module removal without affecting long term accuracy. If output signal phase has drifted less than 10 μseconds (an arbitrary set point incorporated in the Model 9000 design) while coasting, re-application of the signal (or reinstallation of the synchronizing module) causes the phase to smoothly correct without affecting long term frequency or timing accuracy. Coasting time before reaching 10 μseconds ranges from 6-10 hours for the least expensive OCXO to 6-14 days for the best rubidium oscillator option. See Table 1-1 for details.

1-14.3 External 1 PPS Sync With Time Code Input (Sync Gen mode)

When a Reader/Sync (time code input) module is being used, phase synchronization precision can be improved by adding a 1 PPS input at the Reader/Sync module. With the 1 PPS present, the more precise 1 PPS input automatically overrides 1 PPS sync from the time code. The phase of the 1 PPS input signal must be exactly coherent to the time code input. Removing the 1 PPS signal causes 1 PPS sync to revert to the time code.

1-14.4 External Standard With Time Code Input (Sync Gen mode)

When a Reader/Sync (time code input) module is being used for synchronization, an external standard may be used in place of the internal oscillator. The external standard phase must be exactly coherent to the time code input. The external standard automatically overrides the internal disciplined oscillator and does not provide oscillator disciplining. An external standard should be used in conjunction with a time code input only in situations where the code may drop out and a precise external frequency is desired in place of the internal disciplined oscillator during coasting periods.

1-14.5 VHF Receiver Synchronization (Sync Gen mode)

The Model 9017 VHF Receiver/Synchronizer allows synchronization of the Model 9000 using a time code transmitted via RF link. Coding is normally IRIG B, and Precise Translation as described above should normally be used. If a less-precise time code has been transmitted, it may be necessary to use the Reader/Generator mode described below.

1-14.6 GPS Synchronization (Sync Gen mode)

The Model 9001 GPS module synchronizes the Model 9000 to the GPS satellite system. An antenna and 50 feet of lead-in cable are included when this module is ordered. Available antenna lead-in length options to 2500 feet are discussed in Appendix E. Synchronization accuracy referenced to Universal Time (UTC) depends on the installed oscillator type and is listed in Table 1-1 above. When the GPS module is operating, front panel and remote status reports include satellite tracking and navigation data.

1-14.7 Operating With A Backup Synchronizer (Sync Gen mode)

In the Synchronized Generator mode, the Model 9000 can be operated with primary and backup synchronizers. Any number of synchronizers may be installed, and any two of the installed synchronizers may be selected from the front panel during setup. Different types of synchronizers must be used for primary and backup. The status monitoring system does not accommodate using the same type.

When using the Model 9000 with primary and backup synchronizers, a choice must be made on how long to wait after the primary stops producing usable outputs before switching to the backup. For example: Assume that a GPS Primary module, a Reader/Sync backup module, and an OCXO internal oscillator are installed. Further assume a situation where the GPS antenna can “see” only part of the sky and has several hour periods without satellites. Since the OCXO easily bridges these gaps in reception, a holdover period of several hours would be acceptable before automatically switching to the backup Reader/ Synchronizer module. The acceptable time-out period is longer with more stable oscillators. A timeout setting of 00:00 through 99:59 hours and minutes is provided during setup of each synchronizer module.

Once a switchover to the backup synchronizer has been made, operator intervention is required to revert to the primary.

1-14.8 Propagation Delay Compensation (Sync Gen mode)

Each type of synchronizer module has its own setting for propagation delay. This allows the operator to enter different values, as required, for signals coming from different locations. For instance, a GPS Synchronizer would normally have a small antenna cable delay compensation, while a range time IRIG code input could have many milliseconds of delay to compensate for.

1-14.9 Output Signal Generation (Sync Gen mode)

Signal outputs are generated from all installed generator modules. All signals are clocked by the selected internal or external frequency source.

1-14.10 External 1 PPS Measurement (Sync Gen mode)

When an external 1 PPS signal is applied to the front panel IN connector, the unit measures the difference between this signal and internal (UTC) 1 PPS with a resolution of 10 ns. This connector is automatically set to accept external 1 PPS when in the Sync Gen mode. The unit measures the positive-going edge of a +3 to +10 volt signal of any duration. Input impedance is 50 ohms. Range is 10 ns to 8 ms.

1-15 READER/GENERATOR MODE

This mode is used to read and synchronize the Model 9000 to a non-precise serial time code such as a 1:1 playback from a tape reproducer. In this mode, a phase locked loop (PLL) is used as the time base. The PLL is locked to the input code frequency while a code is present, and freewheels during time code dropouts. Input frequency variations of up to ± 5% are followed.

The Model 9002 Reader/Synchronizer module is the only type of reader that may be used in this mode. More than one Model 9002 module may be installed in the Model 9000, but only one may be selected at a time. Default is the module in the lowest slot number. Others may be selected using the front panel controls.

1-15.1 Frame Error Checking and Bypass (Reader/Gen mode)

The Model 9000 incorporates an error checking and bypass system that includes two major functions: (1) Requires a selected number of sequential frames of input code with time correctly incrementing before allowing the unit to synchronize to the input code; and (2) Once synchronized, allows a selected number of sequential frames of input data to disagree with the internal time before reverting to Resynchronization.

1-15.2 Propagation Delay Compensation (Reader/Gen mode)

The Reader/Generator mode is intended for use with imprecise time codes, normally eliminating the need for propagation delay compensation; however, each Time Code Reader/Synchronizer module can have a delay compensation factor entered during module setup.

1-15.3 Output Signal Generation (Reader/Gen mode)

Signal outputs are generated from all generator modules installed. Output frequencies are derived from the PLL and follow the time code input frequency.

1-16 TIME CODE READER MODE

This mode is used to read and display high speed forward and reverse **modulated** time codes from tape reproducers. In this mode, the code carrier provides internal clocking. Neither the PLL nor the internal oscillator are used. Codes can be read both forward and reverse using automatic direction detectors. No usable signal outputs are generated in this mode.

1-17 OUTPUT DRIVERS

Output driver modules are available for producing multiple outputs of any installed serial code or rate generator. Each module provides four additional serial outputs. For instance, when a module with an IRIG B time code output is installed, the IRIG B signal (or any other output of that module) may be patched to one of four available backplane busses provided for this purpose. A Four-Channel Linear Driver module with an input patch from the same bus may then be installed to produce four additional IRIG B outputs.

CHAPTER 2
INSTALLATION

2-1 UNPACKING PROCEDURE

The Model 9000, when not installed in a special carrying case or in a system rack, is packed for shipment in an antistatic bag nestled in a molded Styrofoam cushion located in the bottom of the shipping carton. Accessories, such as antenna, antenna cable, chassis slides and power cord are also nestled in the bottom cushion. A separate molded Styrofoam top cushion is placed between the Model 9000 and the carton top. Unpack the Model 9000 as follows:

a. Examine shipping container for any signs of damage and rough handling. Record any damage observed.

b. Remove and retain shipping list from outside of the carton.

c. Open shipping carton top and lift out molded Styrofoam top cushion.

d. Examine contents for any sign of damage. Record any damage found.

e. Remove Model 9000 and its accessories from the carton.

f. Unpack the Model 9000 from its antistatic bag and unpack the accessories from their shipping bags.

g. Ensure that all items listed on the packing list have been removed from the shipping carton.

h. Remove and retain antistatic covers from the Model 9000's connectors.

I. Retain shipping carton and all packing material for future use.

2-2 MODULE INSTALLATION

When the Model 9000 has been ordered with a specific set of modules it is shipped with the modules factory-installed. All units have an AUX I/O card installed in rear panel location A2. Most other modules can be installed in any available location. Of course, double-height modules cannot be installed in the top row.

If one or more of your modules are, for any reason, separated from the Model 9000 chassis, install them in any convenient location. The unit senses all installed modules and automatically directs the operator for proper setup.

The Model 9000 operating system will handle two synchronization modules (primary and backup) in the Synchronized Generator mode and one in the Reader/Generator and Time Code Reader modes. Additional modules may be installed; but no more than the supported number may be used for any given mission. The operator may choose different modules for different missions.

2-3 NORMAL MOUNTING PROCEDURE

The Model 9000 is designed for mounting in a standard 19-inch rack. Chassis slides are optional. The Model 9000A is 1-3/4 inches high (1U) and the Model 9000B is 3-1/2 inches high (2U). Chassis depth is 18 inches exclusive of front and rear panel projections. Allow at least four inches behind the rear panel for cable clearance. Free flow of circulating air should be allowed to assure an ambient operating temperature not exceeding 60° C.

2-4 REAR PANEL MODULE I/O CONNECTIONS

All module input and output connections and signal characteristics are given in the separate module appendices (Appendix F and up). When using a Model 9001 GPS Receiver/ Synchronizer, also refer to Appendix E for Antenna installation instructions.

2-5 MODULE INTERNAL ADJUSTMENTS AND SELECTIONS

Many of the module adjustments, such as time code output levels, are made using the front panel keypad and alphanumeric display. Others are made on the modules themselves. For instance, time code modulation levels are adjusted on the modules, while code output levels are adjusted from the front panel. Consult the individual module appendices for the locations of these adjustments and selections. The Model 9000 brochure in Appendix A contains an overview of available modules. Paragraph 2-6 below covers the special situation of bussing for multiple outputs of individual signals.

CAUTION

Although there are very few restrictions on which location any module may be inserted, some special setups performed for modules, whether by front panel or remotely, are unique to a module location. If a module is moved to a new slot, any setups will have to be redone for that slot. For instance, if a Reader/Synchronizer is set to read modulated IRIG B in slot location A3, and the module is moved to A4, slot A4 will now have to be set for reading modulated IRIG B.

2-6 BUSSING FOR MULTIPLE OUTPUTS

The Model 9000 module backplane has four busses available for connecting selected codes and rates from generator modules to distribution modules. For example, four additional IRIG B modulated (or DC) outputs can be obtained from the Model 9000 by strapping an IRIG B output from a code generator module (Model 9005) to one of the four busses, then strapping a 4-Channel Linear Driver (Model 9008) input to this same bus. The Model 9008 then has IRIG B available on each of its four separately buffered outputs. For more than four added IRIG B outputs, additional Model 9008's can be installed and strapped to this same buss. Likewise, Four additional outputs of four different types of signals can be obtained by using all four busses and installing four Driver modules. Jumper installation for each module type is discussed in the module appendices.

2-7 INPUT POWER CONNECTION

The standard Model 9000 operates on power from 85 to 265 Vac or 100 to 370 VDC. No voltage range switchover is required. The 3 ampere fuse supplied with the unit is correct for any voltage within these ranges. For any special input power connections for your unit, refer to Appendix D.

CHAPTER 3

OPERATION

3-1 OPERATING CONTROLS AND INDICATORS

The front panel of the TRAK Systems Model 9000 Time Code Processor (Figure 3-1) contains an LCD display for viewing instrument status and setup data and an 18-key alphanumeric keypad for entering setup data and for operational control. The instrument also contains an LED display for viewing Time-of-Year (TOY) in days, hours, minutes and seconds. Individual LED critical status indicators are provided within the Time-of Year (TOY) display. In addition, the Model 9000B has three multi-colored LED indicators that give status on up to three installed synchronizer modules.

All setup data entered from the front panel are stored in non-volatile memory and remain there until changed. These data are immediately available after a power-down and power-up.

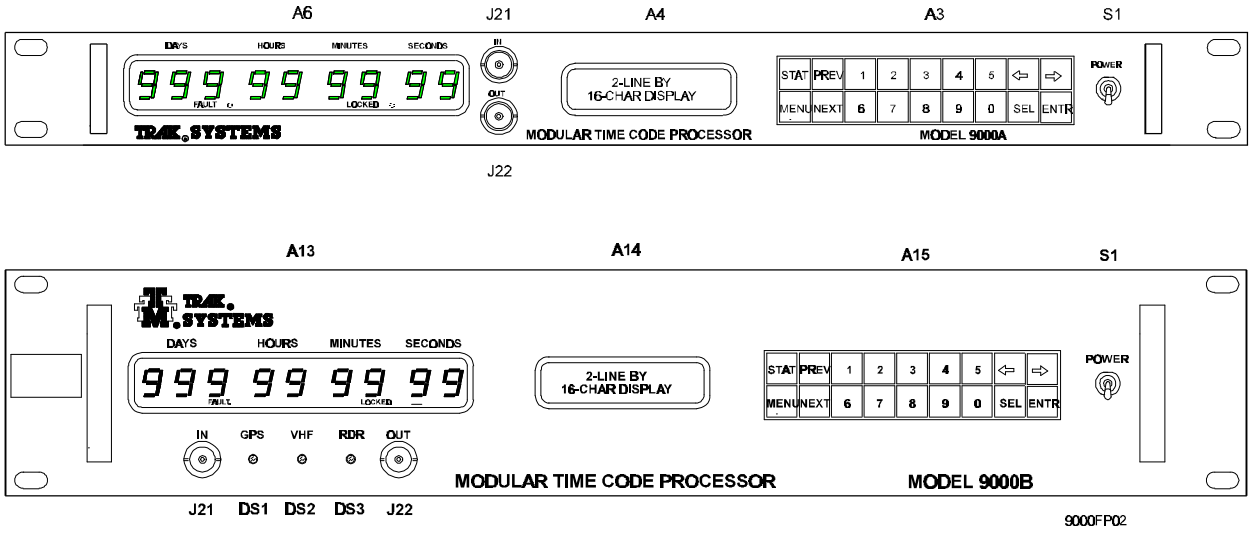


Figure 3-1. Model 9000A & B Front Panels

3-1.1a Alphanumeric Display (LCD)

The alphanumeric LCD display has two lines of 16 characters. This display is backlighted for increased viewability in low ambient-light environments. If required, the contrast of the display may be adjusted using the keypad. This display features a set of Status screens for monitoring instrument operation and a set of Setup Screens to enter or change instrument operating parameters. After a brief initialization period, when the instrument verifies its operation, the Model 9000 powers up with the Mode Setup Screen displayed. This screen can also be displayed at any time during operation by pressing the MENU key. Main Setup screens may then be displayed using the NEXT and PREV keys on the keypad. Display of instrument status and operating parameters is initiated by pressing the STAT key followed by the PREV and NEXT keys.

3-1.1b Numeric Display (LED)

The numeric display contains nine, high-intensity LED indicators for viewing UTC or LOCAL time in days, hours, minutes and seconds and individual LED status indicators. When there is a reportable failure in the unit, the LED's flashes **FAIL**, and the fault description is given on the LCD display.

3-1.1c Multi-colored LED's

The Model 9000B has three separate multi-colored LED's that give the status of any installed and selected synchronizers. One of these three indicators (GPS, VHF, and RDR) is active if the Model 9000B is operating with one synchronizer and no backup selected. Two are active if primary and backup synchronizers are selected (the backup synchronizer cannot be the same type as the selected primary). The colors have the following meanings:

- GREEN Module is selected, on line, working, and tracking an input.
- YELLOW Module is the selected backup and is working.
- RED Module (selected Primary or Backup) is not tracking.
- OFF Module is not present or is present but not selected.

3-1.2 Keypad

NOTE: For a quick operational overview, see Paragraph 3-3 USING THE KEYPAD.

The front-panel 18-key keypad is shown in Figure 3-2. A description of the operation of the individual keys is given below.

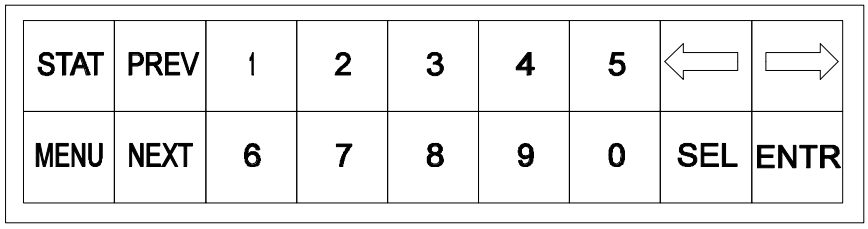


Figure 3-2. Model 9000 Front-Panel Keypad

3-1.2 Keypad (cont'd)

STAT Places the display in the Status mode and displays one of the status screens. Other status screens may be viewed using the NEXT and PREV keys.

MENU Places the Mode Setup screen on the LCD, allowing SELection and ENTRy of the desired operating mode. The NEXT and PREV keys are then used to reach operating Setup screens. Screens for setup of individual installed modules are reached by pressing MENU followed by the one or two digit module number or, if the module number is not known, by pressing MENU/PREV/ENTR. This second method gives a list of installed modules.

NEXT Scrolls to the next screen when viewing one of the Status, Setup, or module list screens. When in the Setup Mode, repeatedly pressing the NEXT key (without pressing ENTR) allows the operator to view all setup screens for the selected mode without modifying setup. Wraparound is provided. All Status screens can also be viewed using the NEXT key.

PREV Scrolls to the previous screen when viewing one of the Status, Setup or module list Screens. Wraparound is provided.

0 - 9 When entered after pressing **MENU**, the first one or two digits select a module for setup. Once in a selected Setup screen, the number keys are used to enter data.

ENTR Enters selected data. Also used to enter subroutines.

SEL Scrolls data through available choices on some Setup Screens. For example, on the "SELECT MODE AND & ENTER" screen, the selection scrolls between the four Operating Modes. Where required, the **SEL** key also allows the user to change sign on selected data to be either + or -.

←→ When in a Setup Screen, left and right arrows move cursor for data entry or corrections. The right arrow moves the cursor to the next field and the left arrow moves the cursor to the previous field. The arrows are also used in slewing the outputs of the unit during manual synchronization.

3-2 OPERATING MODES

The four basic Model 9000 operating modes are fully described in Chapter 1. The overview of these modes is repeated below:

3-2.1 Standalone Mode

Unit is manually or externally preset and started. Time accumulates using either the internal oscillator or an external frequency input. The AUX I/O module (A2) supplied with every Model 9000 is the only module required for operation in this mode. This module provides for inputting an external standard and has an RS-232 port for outputting time and status. The type 9003-2 AUX I/O module used on the Model 9000B and optional for the Model 9000A also has printer (RS-232B) and STATUS outputs.

Any of the signal generator and I/O modules listed in the Model 9000 brochure in Appendix A may also be installed in any available slots. For multiple outputs of up to four of the generated serial signals, use one or more of the available driver modules.

3-2.2 Synchronized Generator Mode

Unit is precisely synchronized to the GPS satellite system or a serial time code from a master station with a cesium (or better) standard. Internal oscillator is disciplined by the synchronizing signal and freewheels at last-disciplined frequency during sync dropouts. To operate in this mode, at least one synchronization module (GPS, time code, or VHF) must be installed. If backup synchronization is desired, install two synchronization modules. For details on operating with a backup, see paragraph 1-14.7 above. Time processed is UTC. An external 1 PPS measurement feature (vs UTC) is included.

Any of the signal generator and I/O modules listed in the Model 9000 brochure in Appendix A may also be installed in any available slot. For multiple outputs of up to four of the generated serial signals, use one or more of the available driver modules.

3-2.3 Reader/Generator Mode

Unit reads a non-precise serial time code such as a 1:1 playback from a tape reproducer. A phase locked loop (PLL) is locked to the input code frequency while a code is present, and freewheels during input signal dropouts. Error-bypass selection is provided. To operate in this mode a Time Code Reader/Synchronizer module must be installed.

Any of the signal generator and I/O modules listed in the Model 9000 brochure in Appendix A may also be installed in any available slots. For multiple outputs of up to four of the generated serial signals, use one or more of the available driver modules.

3-2.4 Time Code Reader Mode

Unit reads and displays high speed forward and reverse time codes from tape reproducers. Code carrier provides internal clocking. No usable signal outputs are generated in this mode. A Time Code Reader/Synchronizer module must be installed to use this mode.

The diagrams for screens for setting up individual modules are self-explanatory. Module numbers shown are examples only (except A2, the only fixed location). Where there are multiple screens for a module, escape to MENU or main STAT is allowed only after the last screen for that module.

3-3 USING THE KEYPAD

Following are a set of general rules for using the keypad to operate the Model 9000.

- Pressing the STAT key at any time displays the first status screen for the current mode. Use the NEXT and PREV keys to scroll through all available status screens for the current mode. The last screen wraps around to the first.

- Pressing MENU key at any time displays the Mode Setup screen. Use the NEXT and PREV keys to scroll through all available operating setup screens for the current mode. The last screen wraps around to the first. If scrolling in search of a particular Setup screen, do not press SEL or ENTR until you have reached the desired Setup Screen.

- After pressing MENU to reach the Mode Setup screen (also displayed at power-up), a different mode can be selected using the SEL key. When the desired mode is reached, press ENTR to enter that mode. The mode flashes during selection and stops flashing after a new mode is entered.

- Once in the desired mode and scrolling through the operating Setup screens, follow the instructions on the screens to change setups. The terms used are as follows:

  SEL or SELECT: Use SEL key to scroll to choice.

  ENTR or ENTER: Use ENTR key to reach a setup or to enter a choice.

  SET: Use number and arrows keys to set the desired parameters. Once in this routine, use the SEL key to change signs.

3-4 Module Setup

Many of the installed modules have parameters that must be set from the front panel. Use one of the following ways to reach a module:

1. If you know the module number, press MENU followed by the one- or two-digit number.

2. The last screen in each setup mode prompts for module setup. This screen can be reached during setup or can be called up at any time by sequentially pressing MENU and PREV. From this screen, press ENTR to see a list of installed modules. Once the module number is known, use Step 1 above.

3. Once in the module setup sequence, you may use NEXT and PREV to walk through all module setup screens. Instructions for module setup are given in Appendix F and up.

3-5 MODEL 9000 STARTUP

Apply power to the instrument and place the front panel POWER switch in the up position. Initially, the backlight of the LCD lights to indicate power on. Next, the LED time display lights and the following screen appears.



In a few seconds, the Mode Setup screen appears:



The unit comes up in the mode being used before its last power down. Pressing MENU also enters this screen. At this point, a new mode can be selected by using SEL to scroll through choices. All except the default choice flash. Modes not supported by installed modules are not listed. Press ENTR when the desired mode is displayed. The next screen to appear is mode dependent and is covered by the individual "mode" paragraphs below.

At initial power-up, required warmup time is very short for most applications, and the unit is ready to operate as soon as setup has been completed.

NOTES

Before proceeding with setup and operation in any of the modes below, the operator should read the descriptions contained in Chapter 1 and Appendix A of this manual. Also note the following guidelines:

- Use the Standalone mode with the internal oscillator in general purpose applications not requiring accuracy beyond the range of 1 to 100 ms/day.
- Use the Standalone mode with an external cesium beam oscillator when a high-stability time/frequency standard is required. The Slew controls can be used to align the Model 9000 to within 100 ns of an external precise 1 PPS.
- Use the Synchronized Generator mode to make the Model 9000 a secondary standard precisely and automatically synchronized to UTC.
- Use the Reader/Generator mode to synchronize to less-accurate time codes such as tape recorder of general purpose time code generator outputs.

Use the Reader mode to observe time codes in the high speed forward and reverse modes.

3.5.1 Viewing Installed Modules and Respective Locations

Pressing "NEXT" will bring up the following screen.

```
FOR MODULE & S/U
MENUS PRESS ENTR
```

Press "ENTR" to view module types and their location as illustrated in the screen sample below.

```
A2 AUX I/O
A4 CODE READER
```

Additional "ENTR" selection will scroll through all installed modules.

To directly jump to a specific module, enter the module location (in the screen example above "A2", "2" is the location for the AUX I/O module) number in any screen being viewed. Refer to the appropriate module in its respective appendix for setup or viewing.

3-5.2 Current Executing Flash Software Version

To read this screen, press “MENU” than “9”, “7”. This screen presents two rows of information:

The top row gives the flash device number (DEVn) that is currently active, the flash software version; followed by a CRC validation. The bottom row presents the date and time for this release.

```
DEVn XXXXX XXXX
11/05/97  13:25
```

3-6 STANDALONE MODE SETUP

The following paragraphs describe setup in the Standalone mode once startup has been completed or when changing to this mode. If not already in the Mode Setup screen, press MENU to bring this screen up.

CAUTION

If you plan to use an external standard, set the desired frequency on module A2 before setting up for Standalone operation. No setup of A2 is required to use the internal oscillator. See Appendix G for instructions on how to select external frequency.

3-6.1 Preset & Start - Manual Mode

Use this mode to preset to within ±0.5 seconds of readily available time sources such as commercial broadcast time tones, telephone service time tones, and local clocks. On the Mode Setup screen, press SEL to locate STANDALONE GEN and press ENTR. The following screen appears:

```
PRESS ENTR TO
PRESET & START
```

Press ENTR to bring up the following screen:

```
DATESET 01/01/96
TIMESET 00:00:00
```

Use the numbers and arrows to select the desired preset time. In selecting a time, allow several seconds for this presetting process. Press ENTR to enter the time. If an invalid time such as 31 hours is entered, a screen saying “INVALID FIELD VALUE” appears for 2 or 3 seconds. Set and enter a valid date and time. When a valid date and time is entered, time accumulation stops and the following screen appears : If the Model 9000 was last used in the Remote start mode “ARM” will appear instead of “MANUAL”. Press SEL key to change to “MANUAL”.

```
SEL START MODE
& ENTR   MANUAL
```

To start time accumulation, press ENTR. Time accumulation starts and can be observed on the LED display. At this time, the screen gives the option to use the slew controls. Use of this feature is covered under “Time Adjustments” below.

3-6.2 Preset & Start - Remote Start Mode

Use this mode to precisely preset the Model 9000 to an external start pulse. After arming the unit, as described below, apply a positive-going pulse (+3 to +10 VDC into 50 ohms) to the front panel IN connector to precisely start time accumulation.

On the Mode Setup screen, press SEL to locate STANDALONE GEN and press ENTR. The following screen appears:

```
PRESS ENTR TO
PRESET & START
```

Press ENTR to bring up the following screen:

```
DATESET 01/01/96
TIMESET 00:00:00
```

Use the numbers and arrows to select the desired preset time. In selecting a time, preset the exact time that the external start pulse will occur. Press ENTR to enter the time. If an invalid time such as 31 hours is entered, a screen saying “INVALID FIELD VALUE” appears for 2 or 3 seconds. Set and enter a valid date and time. When a valid date and time is entered, time accumulation stops and the following screen appears. If the Model 9000 was last used in the manual start mode, “MANUAL” will appear instead of “ARM”. Press SEL key to change to “ARM”

```
SEL START MODE
& ENTR   ARM
```

Press ENTR. Time remains static and the following screen appears:

```
ENTR PROP DELAY
 123,456.7 μSEC
```

3-6.2 Preset & Start - Remote Start Mode (continued)

If the external start pulse is from an adjacent piece of equipment, you will probably set all zeros, using the number keys. If, however, you are using an external start pulse from a remote station, and the amount of delay from that station is known, enter that number. This will start the Model 9000 advanced from the start pulse, thereby compensating for the delay.

Once the required Minor Offset value is set, just prior to inputting of the expected external start pulse, press ENTR. The screen shown below appears.

```
ARMED FOR EXT IN
OR ENTR TO START
```

When the external start pulse arrives, the Model 9000 starts counting and the slew control command screen (see below) appears. To provide an escape in the event that no start pulse arrives or the screen was entered in error, pressing ENTR manually starts the unit with no precise timing.

3-6.3 Time Slewing

Slew controls are provided to permit a precise phase alignment to an external 1 PPS reference signal in applications using a high-quality oscillator. Alignment is performed periodically to compensate for accumulated time drifts resulting from oscillator frequency offsets and drifts. Resolution to 100 ns is provided; however, when the unit is operating with an internal crystal oscillator (Standalone mode with no oscillator disciplining), it is not practical to align the phase to better than about 10 microseconds. Accumulated phase error after alignment exceeds ten microseconds in as little as two hours, depending on temperature and the oscillator option installed. Traditionally, manual time slewing has had use when operating with a rubidium, cesium, or very high stability external crystal oscillators.

When initially presetting, the Slew control entry screen shown below appears after presetting has been completed. To reach this screen at any other time while in the Standalone mode, press MENU then press NEXT two times.

```
 PRESS ENTER TO
USE SLEW CONTRLS
```

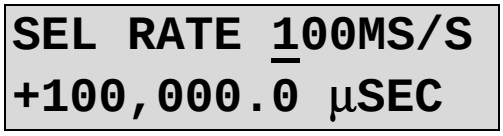
To access the Slew controls, press ENTR. The following screen appears, indicating that the slew rate is selected using the SEL key, and that time is slewed using the two arrow keys:

```
SEL RATE 100MS/S
 -> ADV  <- RET
```

3-6.3 Time Slewing (continued)

To use the slew feature, synchronize an oscilloscope to the 1 PPS output from the Model 9000 front panel (OUT connector) and apply the external reference 1 PPS reference signal to an oscilloscope vertical input. Select the desired slew rate, and use the arrows to align the pulse to the beginning of the trace. The available slew rates are 100MS/S, 10MS/S, 1MS/S, 100µS/S, 10µS/S, 1µS/S and 100nS/S. A blank appears on the screen for the selection after 100nS/S before repeating the sequence.

The first time that an arrow is pressed to begin slewing, the screen changes to show total accumulated offset applied during the current session, as shown below. The first number to appear depends on the rate selected and the arrow direction.



For initial course synchronization if the phase is off by several hundred milliseconds, use a slew rate of 100MS/S and an oscilloscope sweep speed of 100 ms/cm. For finer adjustments, progressively move to slower rates and corresponding faster sweep speeds. When your session is complete, exit by pressing STAT, MENU, PREV or NEXT.

HINT

To forward-compensate for expected drift before the next calibration, apply a total offset *twice* the amount required to bring the Model 9000 into alignment during the current session. In other words, if 15.4 µsec was added to bring the Model 9000 into alignment with the reference 1 PPS after one day, increase the offset to 30.8 µsec to increase the required calibration period to two days.

3-6.4 Leap Second Programming (Standalone)

The next screen in the Standalone mode allows programming for a leap second insertion at midnight June 30 or Dec 31. Default is NONE. The Leap Second screen is the NEXT screen after the Slew control screens. To reach this screen at any other time while in the Standalone mode, press MENU then press NEXT until this screen appears. When a leap second correction has been announced by USNO, use the SEL key to program for automatic correction. Traditionally, only Jun 30 and Dec 31 have been the selected dates. The Model 9000 allows programming up to six months in advance. The programming defaults to NONE when the rollover occurs. It also defaults to NONE if a new date later than programmed is entered from the preset screen.



3-6.5 Summer Time (Daylight Savings) Programming (Standalone)

This is the prompt screen for programming for automatic DST rollovers when the Model 9000 is being used to accumulate local time. It is the NEXT screen after Leap Second. To reach this screen at any other time while in the Standalone mode, press MENU then press PREV (or NEXT) until this screen appears.

```
PUSH ENTR TO SET
SUMMER TIME(DST)
```

This screen is a prompt to allow selection or canceling of Spring and Fall dates. If no changes to the current selection are required, escape this screen by pressing NEXT, PREV, and STAT OR MENU. To select new dates, see current setup, or cancel DST correction, press ENTR. The screen shown below appears.

```
DST CORRECTION?
SEL & ENTR YES
```

To cancel DST correction, SELect “NO” and ENTR. To observe or change current programming, SELect “YES” and ENTR. If “YES” has been selected, ENTR brings up the following screen (With the last programmed dates shown).

```
SPRNG DATE MM/DD
FALL DATE  MM/DD
```

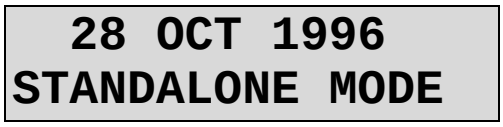
If you are just observing the dates, press ENTR to escape. To change the dates, use the numbers and arrows keys. Press ENTR to enter the selection.

3-7 STANDALONE MODE STATUS SCREENS

The following paragraphs describe the Standalone mode normal operating Status screens. To reach the first Status screen, press STAT. To view other Status screens, use NEXT and PREV.

3-7.1 Main Status Screen (Standalone)

This screen shows the current date and current operating mode.



3-7.2 Time Mode (Standalone)

This screen appears only if Summer Time (DST) has been selected. During summertime, the display is as follows:



Before and after the DST dates, the screen is as follows:



3-7.3 Leap Second Status (Standalone)

One of the following appear:

```
NO LEAP SECOND
  SCHEDULED
```

```
  LEAP SECOND
SCHEDULED 30 JUN
```

```
  LEAP SECOND
SCHEDULED 31 DEC
```

3-7.4 Clocking Source (Standalone)

Table 3-1 lists the Clocking Source Status screens for all Model 9000 operating Modes and conditions. The screens found in the Standalone mode are shown here. The three available external frequencies (XX) are 1 MHz, 5 MHz and 10 MHz.

```
CLOCKING SOURCE
  INTERNAL OSC
```

```
CLOCKING SOURCE
EXTERNAL XX MHZ
```

Table 3-1. Clocking Source Status Screens

MODE	CONDITION	MESSAGE
Standalone	EXT STD OFF selected	INTERNAL OSC
	EXT STD XX selected but missing	INTERNAL OSC
	EXT STD XX selected and present	EXTERNAL XX MHZ
Synchronized Gen using TCR & EXT STD XX selected	Ext std and sync present (normal condition)	EXTERNAL XX MHZ
	Ext std present; sync missing	EXT XX MHZ
	Ext std missing; sync present; osc not yet locked	OSC DISCIPLINING
	Ext std missing; sync present; osc locked	DISCIPLINED OSC
	Ext std missing; sync missing	FREE-RUNNING OSC
Synchronized Gen using TCR & no ext std (EXT STD OFF)	Unit tracking and locked (normal condition)	DISCIPLINED OSC
	Tracking input signal but osc not yet locked (temporary condition)	OSC DISCIPLINING
	Input signal dropped out or not properly reading code	FREE-RUNNING OSC
Synchronized Gen using VHF	Has same screens as TCR with no external std selected (as described above)	
Synchronized Gen using GPS	Unit tracking and locked (normal condition)	DISCIPLINED OSC
	Tracking input signal but osc not yet locked (temporary condition)	OSC DISCIPLINING
	Input GPS dropped out or unit not properly reading GPS signal	FREE-RUNNING OSC
Reader/Generator	Code present and PLL locked (normal condition)	LOCKED PLL
	Code dropped out	FREE-RUNNING PLL
Reader	Code present	CODE CARRIER
	Code not present	NONE

3-8 SYNCHRONIZED GENERATOR MODE SETUP

The following paragraphs describe setup in the Synchronized Generator mode once startup has been completed or when changing to this mode. If not already in the Mode Setup screen, press MENU to bring this screen up. *At least one synchronizer must be installed for this screen to appear.*

CAUTION

If you want to use an external standard, set the desired frequency on module A2 before setting up for Synchronized Generator operation. No setup of A2 is required to use the internal oscillator. See Appendix G for instructions on how to select external frequency.

Assure that all installed synchronizer modules have been set up as desired; e.g., selection of time code format and type. Paragraph 3-4 above gives instructions for locating module setup screens.

3-8.1 Setting Year (Sync Gen)

Pressing ENTR or NEXT from the Mode Setup screen brings up the Set Year screen. Set the year using the numbers and arrows keys, and ENTR. When using a synchronizing source that contains YEAR data (GPS & some time codes), it is not necessary to set the year. Update is automatic when the unit synchronizes. It is also not mandatory to set the year unless modules having outputs with YEAR encoded are installed in your unit. This screen is provided for convenience in timekeeping when synchronizing to codes with no YEAR data encoded. Once set, the year remains unchanged during power interruptions. If a year rollover has occurred during power-off, the year must be reset. Use the numbers keys to set year and press ENTR.



3-8.2 Leap Second (LS) Programming (Sync Gen)

The next screen in the Synchronized Generator mode allows programming for a leap second insertion at midnight June 30 or Dec 31. Default is NONE. However, if the unit finds a GPS Synchronizer installed or a Time Code Reader/Synchronizer programmed to get the leap second programming bit from the code, programming for insertion at the proper date is automatic when the LS bit is received and this screen shows “AUTO”.

To reach this screen at any time while in the Synchronized Generator mode, press MENU then press NEXT twice. When a leap second correction has been announced by USNO, use the SEL key to program for automatic leap second insertion. Traditionally, only Jun 30 and Dec 31 have been the selected dates. The Model 9000 allows programming up to six months in advance. The programming defaults to NONE when the rollover occurs. It also defaults to NONE if a new date later than programmed is entered from the preset screen. When AUTO shows on the screen, the Model 9000 looks for the LS bit in the input synchronizing data and provides LS insertion at the programmed date.



3-8.3 Setting Offset From UTC (Time Zones)

Use of the Synchronized Generator mode assumes the processing of real time UTC data; i.e., it is assumed that the input synchronizing signal such as GPS or a range time code is coded for UTC. The Model 9000 allows offsetting this time to local time for display and output. The offset from UTC set on this screen is a time zone offset to local standard time. For an additional offset for Summer Time (DST) see the next paragraph.

To reach this screen at any time while in the Synchronized Generator mode, press MENU then press NEXT or PREV until it appears. At most locations in the world, time zone offsets are to the nearest hour. A few are resolved to the quarter hour. To cover eventualities, the Model 9000 provides a resolution of one minute. Use the SEL key to change sign, the numbers to enter the offset, and the arrows to move around the screen. When the desired setting is complete, press ENTR to enter the data.



3-8.4 Summer Time (Daylight Savings) Programming (Sync Gen)

This is the prompt screen for programming for automatic DST corrections when the Model 9000 is being used to output local time. It is the NEXT screen after Leap Second. To reach this screen at any other time while in the Standalone mode, press MENU then press PREV (or NEXT) until this screen appears.



This screen is a prompt to allow selection or canceling of Spring and Fall dates. If no changes to the current selection are required, escape this screen by pressing NEXT, PREV, and STAT OR MENU. To select new dates, see current setup, or cancel DST correction, press ENTR. The screen shown below appears.



To cancel DST correction, SELect “NO” and ENTR. To observe or change current programming, SELect “YES” and ENTR. If “YES” has been selected, ENTR brings up the following screen (With the last programmed dates shown).

```
SPRNG DATE MM/DD
```

If you are just using this screen to observe the dates, press ENTR to escape. To change the dates, use the numbers and arrows keys. Press ENTR to enter the selection.

3-8.5 Synchronizer Selection

If more than one Synchronizer module is installed, the operator is given the choice to select which one to use exclusively or to chose both primary and backup synchronizers. To bypass this selection, press NEXT. To make the selection, press ENTR.

```
PUSH ENTR TO SEL
PRIME & B/U SYNC
```

After pressing ENTR, the primary selection screen appears, giving the current selection and a choice to SELect a different synchronizer. Use the SEL key to view installed synchronizer modules and ENTR to choose the current selection.

```
SEL/ENTR PRIMARY
SYNC MDL A4 GPS
```

After making your primary selection, press NEXT to reach the backup selection screen. Selections are available for all remaining installed synchronizer modules or NONE. Make a SELection and press ENTR. When the selection is made, press NEXT to proceed to the next screen.

```
SEL/ENTR BACKUP
SYNC MDL A1 TCR
```

3-8.6 Minor Time Offset

The outputs from the Model 9000 can be offset from the internal synchronized Minor Scalar time. This offset is *after* any propagation delay or antenna lead-in compensation has been introduced at the synchronizing module level. In other words, this is an offset from internal UTC time and is completely separate from compensation delays used in the input synchronizing process. This offset is applied to all generated outputs.

The entry screen is shown below. Use the SEL key to change the sign.

```
ENT MINOR OFFSET
+123,456.7 μSEC
```

3-9 SYNCHRONIZED GENERATOR MODE STATUS SCREENS

The following paragraphs describe the Synchronized Generator mode normal operating Status screens. To reach the first Status screen, press STAT. To view other Status screens, use NEXT and PREV.

3-9.1 Main Status Screen (Sync Gen)

This screen shows the current date and current operating mode.



3-9.2 Time Mode (Sync Gen)

This screen describes LCL (Local Time) time appearing on the LED display. The differences from UTC take into account the entered Time Zone and Summer Time (DST) corrections. Examples shown are as it would be for Eastern Standard Time.







3-9.3 Leap Second Status (Sync Gen)

The Leap Second Status screens are as shown in paragraph 3-7.3 above in the Standalone mode descriptions.

3-9.4 Synchronizer Data (Sync Gen)

This screen identifies the Synchronizer in use and data about its setup. An example of a Time Code Reader/Synchronizer installed in slot A3 is shown here.

```
READER/SYNC: A03
IRIG B  NORM MOD
```

3-9.5 GPS Data (Sync Gen)

When a GPS Synchronizer is in use, one of the screens below appears. “Tracking” refers to the GPS engine tracking satellites, and “Locked” indicates that the internal oscillator is locked.

```
GPS MODULE: A04
  NOT TRACKING
```

```
GPS MODULE: A04
TRACKING 8 SVs
```

```
GPS MODULE: A04
TRKING & LOCKED
```

The NEXT screen shows the PRN’s of the satellites being tracked:

```
NOT TRACKING SVs
 NO INFORMATION
```

```
TRACKNG 01 02 03
 04 05 06 07 08
```

The NEXT screen covers position mode and averaging to obtain position. The mode is chosen during setup and is described in Appendix F. “FIXED” position indicates that the Model 9000 is using either an averaged position performed by the unit or a user-entered position obtained by survey or other outside means. When the screen indicates that the unit is averaging, the Model 9000 is operational and producing outputs, but the coherence to UTC is degraded to about ± 1 μsec, and holdover drift will exceed specified limits. At the end of the 24-hour averaging period, the unit averages that position data and sets it as a fixed value to be used by the Model 9000.

```
AVRGING POSITION
23 HR 59 MN LEFT
```

```
 FIXED POSITION
    AVERAGED
```

```
 FIXED POSITION
  USER ENTERED
```

```
NAVIGATING POSN
   LAND MODE
```

```
NAVIGATING POSN
  MARINE MODE
```

```
NAVIGATING POSN
   AIR MODE
```

The NEXT screen gives current fixed position or navigation solution.

```
 LAT  27 09.320N
LONG 082 33.010W
```

The last screen included in the GPS status set is height.

```
    HEIGHT
+00058.1 METERS
```

3-9.6 Clocking Source (Sync Gen)

Table 3-1 above lists the Clocking Source Status screens for all Model 9000 operating Modes and conditions.

3-9.7 External 1 PPS Measure (Sync Gen)

The front-panel 1 PPS **IN**put jack (J21) has two functions:

> In Standalone Generator Mode, front-panel **IN** jack J21 is used as an External Start input.
>
> In Synchronized Generator Mode, the front panel **IN** signal input at J21 is automatically configured as a measurement input. This input is compared with the Model 9000 1 PPS output at front panel **OUT** jack J22.

The front panel OUTput jack (J22) can provide either on-time SYSTEM 1 PPS or DELTA 1 PPS. SYSTEM 1 PPS is derived directly from the minor scaler logic. DELTA 1 PPS includes all propagation delay adjustments specific to the installed application.

The selection can be made via the front panel keypad. Select “MENU” then “PREV” or “NEXT” until the screen shown below is displayed.

```
SEL FRONT PANEL
OUT DELTA 1 PPS
```

Pressing “SEL” followed by ENTR will allow the user to use or monitor either signal at BNC OUTput jack J22.

When a 1 PPS is connected to front-panel **IN** jack J21, a measurement is executed 4-times per minute (top of the minute, 15 sec, 30 sec and 45 sec after the minute). To make a measurement, the unit compares the front-panel INput and OUTput 1 PPS signals. The first measurement is discarded and the second is displayed.

By pressing **STA**T and **PREV**, and **PREV** again the following screen is displayed:

```
1PPS MEASURE
    NO INPUT
```

If the 1 PPS is not connected to front panel IN BNC connector (J21) NO INPUT is displayed.

```
1 PPS MEASURE
+7,999.99 µSEC
```

When a 1 PPS signal is present at IN BNC connector J21, the measurement is displayed and updated 4 times per minute. Phase difference is displayed in microsecond with 10 nanosecond resolution. Maximum phase difference is +/- 7,999.99 microseconds. If the 1 PPS input is leading the unit 1 PPS (SYS 1PPS), the measurement is a positive number. If the 1 PPS input is lagging the measurement is a negative number.



If the 1 PPS input phase is greater than +/- 7,999.99 microseconds second line displays “OUT OF RANGE”.

3-10 READER/GENERATOR MODE SETUP

The following paragraphs describe setup in the Reader/Generator mode once startup has been completed or when changing to this mode. If not already in the Mode Setup screen, press MENU to bring this screen up. *At least one synchronizer must be installed for this screen to appear.*

CAUTION

Assure that any installed synchronizer modules have been set up as desired; e.g., selection of time code format and type. Paragraph 3-4 above gives instructions for locating module setup screens.

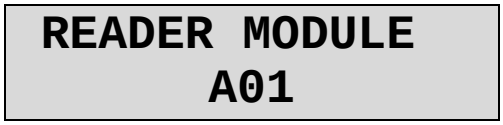
3-10.1 Setting Year (Reader/Gen)

Pressing ENTR or NEXT from the Mode Setup screen brings up the Set Year screen. When using a synchronizing source that does not contain YEAR data (most time codes), this feature allows you to set a year into the Model 9000 internal scalers and, therefore, to encode year data, as required, in its outputs. It is not mandatory to set the year unless modules having outputs with YEAR encoded are installed in your unit. Once set, the year remains unchanged during power interruptions. If a year rollover has occurred during power-off, the year must be reset. Use the numbers keys to set year and press ENTR.



3-10.2 Reader Module (Reader/Gen)

The next screen in the Reader/Generator mode identifies the reader module in use and allows selection of any other installed Reader/Synchronizer. If more than one is installed, use the SEL key to select the desired one and press ENTR.



3-10.3 Frames Required to Sync

To reach this screen at any time while in the Reader/Generator mode, press MENU then press NEXT or PREV until it appears. The time code reader in this mode is designed to read noisy codes. Part of this design includes provision for requiring several consecutive frames with properly-implementing time to be processed before allowing synchronization. The number of consecutive frames required can be set to 0, 2, 4, or 8. Use the SEL key to select the desired number (higher number for noisy codes) and press ENTR.



3-10.4 Frame Error Bypass

To reach this screen at any time while in the Reader/Generator mode, press MENU then press NEXT or PREV until it appears. Another feature of the design to read noisy codes includes allowing several consecutive input time frames to disagree with the output time being generated before attempting to resynchronize. The number of consecutive frames required can be set to 0, 2, 4, 8, 16 or ∞. Use the SEL key to select the desired number and press ENTR.



3-10.5 Setting Time Offset (Reader/Gen)

To reach this screen at any time while in the Reader/Generator mode, press MENU then press NEXT or PREV until it appears. This setup allows the operator to offset the outputs from the Model 9000 by plus or minus 12 hours from input code time. A resolution of one minute is provided. Use the SEL key to change sign, the numbers keys to enter the offset, and the arrows to move around the screen. When the desired setting is complete, press ENTR to enter the data.

```
SET TIME OFFSET
& ENTR +12HR 00M
```

3-11 READER/GENERATOR MODE STATUS SCREENS

The following paragraphs describe the Reader/Generator mode normal operating Status screens. To reach the first Status screen, press STAT. To view other Status screens, use NEXT and PREV.

3-11.1 Main Status Screen (Reader/Gen)

This screen shows the current date and current operating mode.

```
  28 OCT 1996
READER/GEN MODE
```

3-11.2 Output Time Offset (Reader/Gen)

This screen shows the amount of time offset that has been applied to the input code to get the time shown on the LED Display and on any output codes.

```
  OUTPUT TIME
OFFSET +12HR 00M
```

3-11.3 Synchronizer Data (Reader/Gen)

This screen identifies the Synchronizer in use and data about its setup. An example of a Time Code Reader/Synchronizer installed in slot A3 is shown here.

```
READER/SYNC: A03
IRIG B  NORM MOD
```

3-11.4 Clocking Source

Table 3-1 above lists the Clocking Source Status screens for all Model 9000 operating Modes and conditions.

3-12 READER MODE SETUP

Unit reads high speed forward and reverse time codes from tape reproducers. Time codes supported are IRIG A, B, G and NASA-36. The performance in the READER mode requires the signal input levels be approximately 3 volt peak-to-peak. Lower input levels result in slower read speeds. Maximum read speed for IRIG B and NASA-26 is 100, IRIG A is 8 and IRIG G is 1:1. Higher speeds are possible with higher peak-to-peak input voltage levels. IRIG G is limited to 1:1 read speeds.

Refer to the Model 9002 appendix for module set-up options. *READER mode only allows 600 ohm isolated impedance selection.* All other settings for READER mode are discussed in READER/GENERATOR and READER/SYNCHRONIZER operation and setup.

CHAPTER 4
MAINTENANCE

4-1 GENERAL

The Model 9000 Time Code Processor's high reliability circuits minimize required maintenance. Built-In Test (BIT) circuits and front-panel fault status reporting minimize required maintenance time. The information contained in this section describes the fault status system and the displayed fault status messages. When applicable, adjustment procedures are provided in the respective module descriptions located in Appendices F and up of this manual.

4-2 MAINTENANCE PHILOSOPHY

The Model 9000's BIT capability detects, localizes, and reports anomalies that occur in the basic unit and in each replaceable module. Errors are appended to the top of an "Error List" stored in system RAM. This list is accessible to the operator on the front-panel LCD display as a scrollable Status Screen.

When an anomaly occurs in the unit, the following occurs:

1. An entry is appended to the stored "ERROR LIST" identifying the failure.
2. The front-panel LED TOY display alternately flashes between and TOY and "FAIL".
3. The "FAULT" LED decimal point in the LED TOY display is illuminated.

The anomalies stored in the "ERROR LIST" are:

1. Module Failure
2. Module not communicating
3. DAC out of range
4. System Errors
    a. SRAM failure
    b. Flash memory checksum failure
    c. NVRAM failure
    d. NVROM checksum failure
    e. COP failure

4-2 MAINTENANCE PHILOSOPHY (cont'd)

When an error is displayed, the operator may:

1. Disable the flashing "FAIL" LED display
2 Maintain the stored "ERROR LIST"
3. Maintain the illuminated "FAULT" LED decimal point indicator
4. Raise the "STATUS" output at the rear panel of the A2 Auxiliary I/O Module (Model 9003-2 only) whenever the front-panel TOY LED display flashes "FAIL".

4-3 MODULE FAILURES

The fault conditions detected for each module are listed in Table 4-1.

Table 4-1. Module Failures

Module No.	Module Name	Faults Detected
9001	GPS	GPS Receiver stopped tracking and the user-set delay was exceeded GPS antenna failure and the user-set delay was exceeded. Module not communicating with Main Logic Board (MLB.). This could be a module failure or that the module has been removed from the unit.

Table 4-1 Module Failures (cont'd)

Module No.	Module Name	Faults Detected
9002	RDR	Reader code input is low/dropped-out. Phase locked loop (PLL) is unlocked or the time information is wrong (code error) and the user-set delay was exceeded. Module not communicating with Main Logic Board (MLB). This can be a module failure or that the module has been removed from unit.
9003	AUX	External standard frequency is selected but not present. 1 PPS output has failed. Module not communicating with MLB. This can be a module failure or that the module has been removed from the unit.
9004	IEEE-488	Module not communicating with MLB. This can be a module failure or that the module has been removed from the unit. .
9005	TCG	Time code output failure. Module not communicating with MLB. This can be a module failure or that the module has been removed from the unit.
9006	4-Channel Digital Driver	Output signal failure. Module not communicating with MLB. This can be a module failure or that the module has been removed from the unit. .
9007	4-Channel Differential Driver	Output signal failure. Module not communicating with MLB. This can be a module failure or that the module has been removed from the unit.
9008	4-Channel Linear Driver	Output signal failure. Module not communicating with MLB. This can be a module failure or that the module has been removed from the unit.
9009	Sinewave Rate Generator	Output signal failure. Module not communicating with MLB. This can be a module failure or that the module has been removed from the unit.
9010	RS-232 Time Output	Output signal failure. Module not communicating with MLB. This can be a module failure or that the module has been removed from the unit.

Table 4-1 Module Failures (cont'd)

Module No.	Module Name	Faults Detected
9011	Telecommunication Signal Generator	Output signal failure Module not communicating with MLB. This can be a module failure or that the module has been removed from the unit.
9012	Parallel Code Generator	Output signal failure Module not communicating with MLB. This can be a module failure or that the module has been removed from the unit.
9013	Slow Code Generator	Output signal failure Module not communicating with MLB. This can be a module failure or that the module has been removed from the unit.
9014	Digital Rate Generator	Output signal failure Module not communicating with MLB. This can be a module failure or that the module has been removed from the unit.
9016	Time Tag And Event	PPS input failure MLP will show FAIL conditions due to input pulses being greater than 100 per second. The time Tag module will subsequently be disabled. Input conditions must be corrected before being successfully re-enabled.
9017	VHF	Code input is low/dropped-out. Phase locked loop (PLL) is unlocked (code error), and the user-set delay was exceeded. Module not communicating with MLB. This can be a module failure or that the module has been removed from the unit.
9018	Rubidium Oscillator	10 MHz failure. RUB not locked. DAC value is near upper or lower limit. Module not communicating with MLB. This can be a module failure or that the module has been removed from the unit.
MLB	Main Logic Board	NV(Non Volatile) RAM failure NVROM failure CRC Failure Oscillator failure DAC value is near lower or upper limit.

.

4-4 FAULT STATUS SCREENS

The fault status screens may be viewed at any time by pressing the **STAT** and **PREV** keys. and then the **ENTR key.** Use the **NEXT** and **PREV** keys to scroll through the fault status list.

When there are no failures, the "FAULT" decimal point LED in the front-panel TOY display will be extinguished and the following fault status screen is displayed.

```
FAULT STATUS
NO FAILURES
```

If the "FAULT" LED is on, the following status is displayed when the **STAT** and **PREV** key are pressed.

```
FAULT STATUS
PUSH ENT TO VIEW
```

Pressing **ENTR** key displays the following screen.

```
AXX YYYYYYY FAIL
ENTR TO CLEAR
```

The "AXX" is the module's location in the Model 9000 and the "YYYYYYY" is the module type. Table 4-2 lists the Model 9000 module model number and its associated module type.

Table 4-2. Model 9000 Module Type Message

Model No.	Module Type Message
9001	GPS
9001	GPS ANT
9002	RDR/SYN
9005	TCG
9006, 9007, 9008	DRIVER
9009	SINEGEN
9010	232TIME
9011	TELEGEN
9012	PARALLEL
9013	SLOCODE
9014	RATEGEN
9017	VHF
9018	RUBLOCK
9018	RUBIDIUM

4-4 FAULT STATUS SCREENS (cont'd)

Table 4-3 lists the Module/Main Logic Board assembly (MLB) specific error messages as they appear on the fault status screen.

Table 4-3. Module/MLB Specific Error Messages

Model No.	Module/ASSY Specific Message
9018	AXX DAC WARNING
9003	A2 EXT STD DROP
9003	A2 1PPS DROPOUT
MLB	NVRAM FAIL
MLB	NVROM FAIL
MLB	CRC FAILURE
MLB	COP FAILURE
MLB	OSC FAILURE
MLB	DAC WARNING

4-5 CLEARING FAULT CONDITIONS

When the Model 9000 is operating correctly and there are no failures reported from the modules or the MLB, the “FAULT” decimal point LED in the front-panel TOY display is off. When a failure occurs, the front-panel TOY display alternately flashes between “FAIL” and the TOY and the “FAULT” decimal point LED in the TOY display comes on. To clear the failure, proceed as follows:

NOTE

The Model 9000 has many different applications depending on the modules installed. If an installed module fails that is not used in your application, the following procedure stops the TOY display from flashing, leaves the stored error message, and leave the “FAULT” indicator on. The failed module can be replaced when convenient without interrupting your application.

If the failed module is part of your application, it must be replaced before proceeding. This can be accomplished with the power on.

1. Press **STAT** and **PREV** keys and then press **ENTR** to display the fault status message(s).

2. Press **ENTR** key to clear failure. If failure is cleared and there are no other fault status messages, the fault status screen displays “NO FAILURES”, the TOY display stops flashing and the “FAULT” LED goes off. If there are additional fault status messages scroll to the next message using the **NEXT** key, and press the **ENTR** key.

3. If pressing ENTR key does not clear failure, the TOY display stops flashing but the “FAULT” LED remains on.

The failed module may be replaced with the power on. Repeat step 2 above to clear stored error message.

4.5.1 EXTERNAL STANDARD RESET

When the Model 9000 is operating from an External 1, 5 or 10MHz and this external standard is good, the Model 9000 will display the following when selecting the applicable STAT screen:

```
CLOCKING SOURCE
EXTERNAL XX MHZ
```

If the external standard is lost for any reason, the Model 9000 will generate an interrupt and the External Standard will immediately be disconnected. The Model 9000 will revert to the internal oscillator. At this point, the Time Code Reader 9002 will use the coherent synchronizing signal to begin the disciplining process of the internal oscillator. The STAT will now display:

```
CLOCKING SOURCE
OSC DISCIPLINING
```

Once the discipline process is complete, the STAT display will now show:

```
CLOCKING SOURCE
DISCIPLINED OSC
```

Should the synchronization signal be faulty or absent, the Time Code Reader 9002 card will report the fault and the STAT display will now show:

```
CLOCKING SOURCE
FREE-RUNNING OSC
```

Whenever the External Standard is lost, the fault can only be reset by addressing the AUX I/O slot (MENU, 0, 2) and setting the External Standard to OFF, and then pressing STAT, PREV and ENTR to clear the External Standard fault message. When the External Standard is returned to normal, the set up procedure must be repeated.

4-6 CLEARING COMMUNICATION FAULTS

When an installed module fails to communicate with the MLB or when a module has been pulled, the TOY display alternately flashes “FAIL” and TOY, the “FAULT” decimal point LED comes on, and the following screen is displayed when **STAT, PREV,** and **ENTR** keys are pressed.

```
AXX NO RESPONSE
ENTR TO CLEAR
```

When pressing **ENTR** key LCD fault status screen flashes until fault has been cleared. If communications fault is not cleared, the above error message remains, the TOY display stops flashing “FAIL”, and the “FAULT” decimal point LED remains on.

NOTE

Failed modules may be replaced with the power on. When a failed module is part of your application, the failed module must be replaced and the error message cleared before proceeding.

Pressing the **ENTR** key will stop the TOY display from flashing and will extinguish the “FAULT” LED if the condition causing the initial fault has been cleared.

4-7 Factory Defaults

The Model 9000 will have the following settings when shipped from the factory. All settings are held on nonvolatile RAM on the main logic board. These settings also apply in the event that a factory default reset is initiated by the user. If the instrument's application differs, manual intervention will be required to reconfigure the operational settings required for the specific application.

Model Type and Serial #:	Not Cleared
ARM Setting:	MANUAL
1PPS Out (Front Panel):	DELTA 1PPS
LCD Contrast:	0x42
Operation Mode:	STANDALONE
Current Year:	1998
Leap Second Date:	NONE
DST - Spring Month/Day:	04/01
DST - Fall Month/Day:	10/15
Frame Error Bypass:	2
UTC Hour/Minute Offset:	00:00
STANDALONE mode Pd:	000,000.0 microseconds
Minor Scaler Offset:	000,000.0 microseconds
LCL Hour/Minute Offset:	00:00
Frames to Synchronize:	2
Scaler Mode:	1
DAC:	32,768
User Pin#:	9999
TRAK ID Signature	TRAK
Time Tag binary second of year table:	0xFFFFFFFF = -1
Time Tag millisec table:	0xFFFF = -1

CHAPTER 5

REPLACEABLE PARTS LIST

5-1 GENERAL

The replaceable modules for the Model 9000A and 9000B Modular Time Code Processors are listed in Table 5-1.

Table 5-1. Model 9000 Replaceable Module List

Model Number	Name	Description
9001-1	GPS Synchronizer	GPS Receiver/Synchronizer
9002-1	Time Code Reader/Synchronizer	IRIG A, B, G,& NASA 36, mod DC
9003-1	AUX I/O	AUX I/O
9003-2	AUX I/O	AUX I/O
9004-1	IEEE-488 I/O	Standard IEEE-488 I/O
9005-1	Dual Time Code Generator	IRIG A & B modulated and DC
9005-2	Dual Time Code Generator	IRIG E & G modulated and DC
9005-3	Dual Time Code Generator	IRIG D & H mod (1 KHz) and DC
9005-4	Dual Time Code Generator	IRIG B & NASA 36 mod and DC
9005-5	Dual Time Code Generator	XR3 & 2137 modulated and DC
9005-6	Dual Time Code Generator	HAVEQUICK, 800 KPPS, & 800 KHz
9005-7	Dual Time Code Generator	IRIG B & G modulated and DC
9005-8	Dual Time Code Generator	IRIG E & H modulated and DC
9006-1	4-Channel Digital Driver	Digital driver
9007-1	4-Channel Differential Driver	Standard RS-422 driver

Table 5-1. Model 9000 Replaceable Module List (con't)

Model Number	Name	Description
9008-1	4-Channel Linear Driver	Direct Coupled
9008-2	4-Channel Linear Driver	Transformer Coupled (100 Hz - 10 kHz)
9009-1	Sinewave Generator	1 kHz, 10 kHz, 100 kHz, 1 MHz
9009-2	Sinewave Generator	3.125 kHz, 6.25 kHz, 12.5 kHz, 25 kHz
9009-3	Sinewave Generator	(4) 5 MHz
9009-4	Sinewave Generator	1 MHz, 5 MHz, (2) 10 MHz
9010-1	2-Channel RS-232 Time	
9011-1	Telecom Generator (T-1)	1.544 MB
9011-2	Telecom Generator (E-1)	2.048 MB
9012-1	Parallel Code Generator	PBCB1-A IRIG (205-87)
9012-2	Parallel Code Generator	Grouped Binary (Special)
9012-3	Parallel Code Generator	PBCD1-B (No Parity, No ID)
9013-1	Slow Code Generator	
9014-1	Digital Rate Generator	Software SEL (15) Rates
9014-2	Digital Rate Generator	2400, 4800, 9600, 19200
9014-3	Digital Rate Generator	10 PPS, 20 PPS, 1 KPPS, 1 MPPS
9014-4	Digital Rate Generator	0.5 PPS, 1 PPS
9014-5	Digital Rate Generator	10 KPPS & 3.456 MPPS
9016-1	Time Tag & Event Trigger	
9017-1	VHF Receiver/Synchronizer	Synchronize to IRIG B via RF Link
9018-1	Rubidium Oscillator	

The replaceable assembly views of the Model 9000A and 9000B Modular Time Code Processors are shown in Figure 5-1 and 5-2. Replaceable parts for the 9000A and 9000B units are listed in Tables 5-2 and 5-3, respectively.

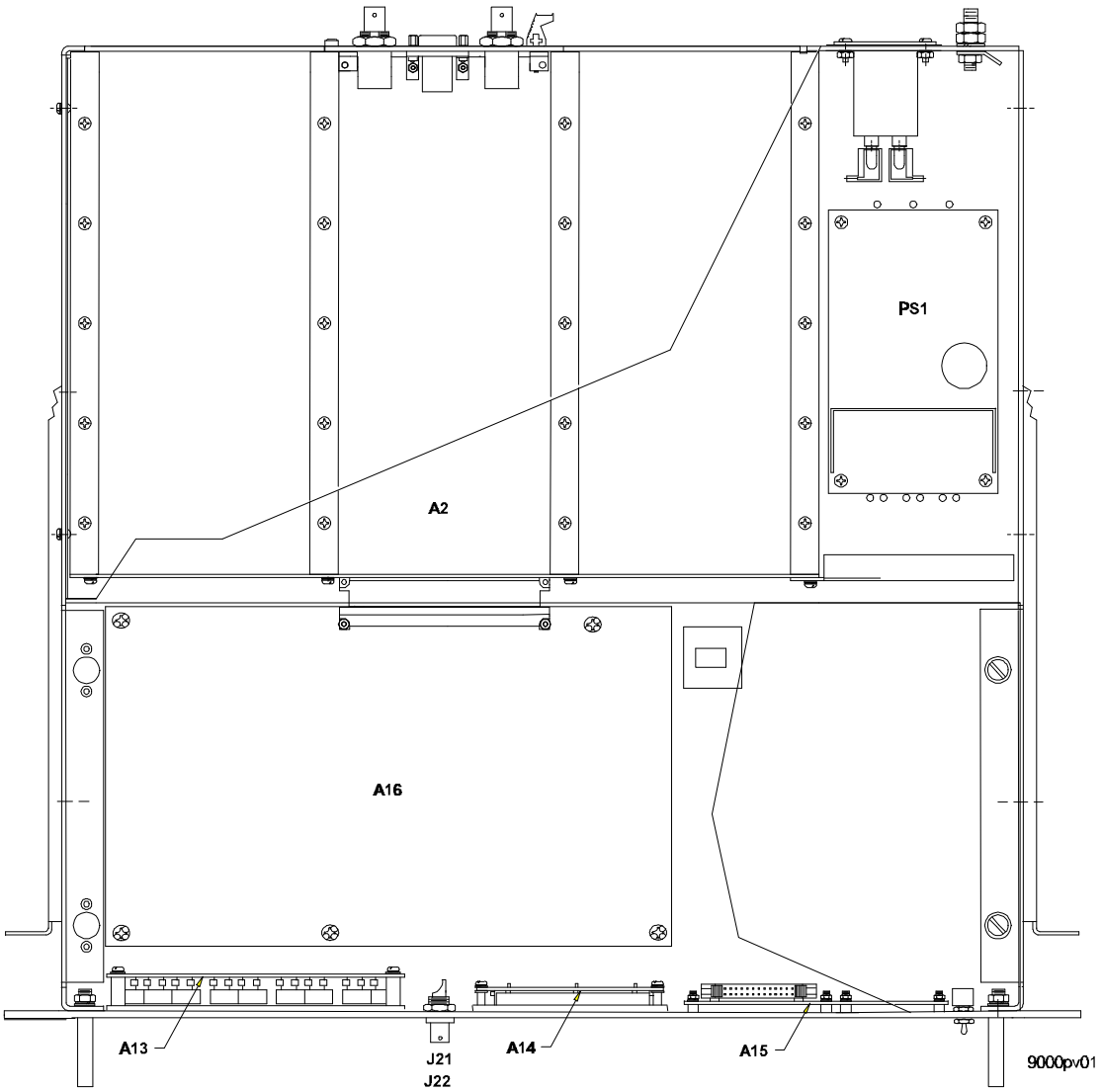


Figure 5-1. Model 9000A Replaceable Assemblies

Table 5-2. Model 9000A Replaceable Assemblies

REF DES	DESCRIPTION	MFG CODE	PART NO	QTY
A13	NINE DIGIT DECIMAL DISPLAY	11165	4003811-101	1
A14	16 CHARACTER LCD DISPLAY	11165	3004971-101	1
A15	KEYBOARD ASSEMBLY	11165	3004642-102	1
A16	MAIN LOGIC PC BD ASSEMBY (MLB)	11165	4005740-102	1
PS1	SWITCHING POWER SUPPLY	11165	4701412	1

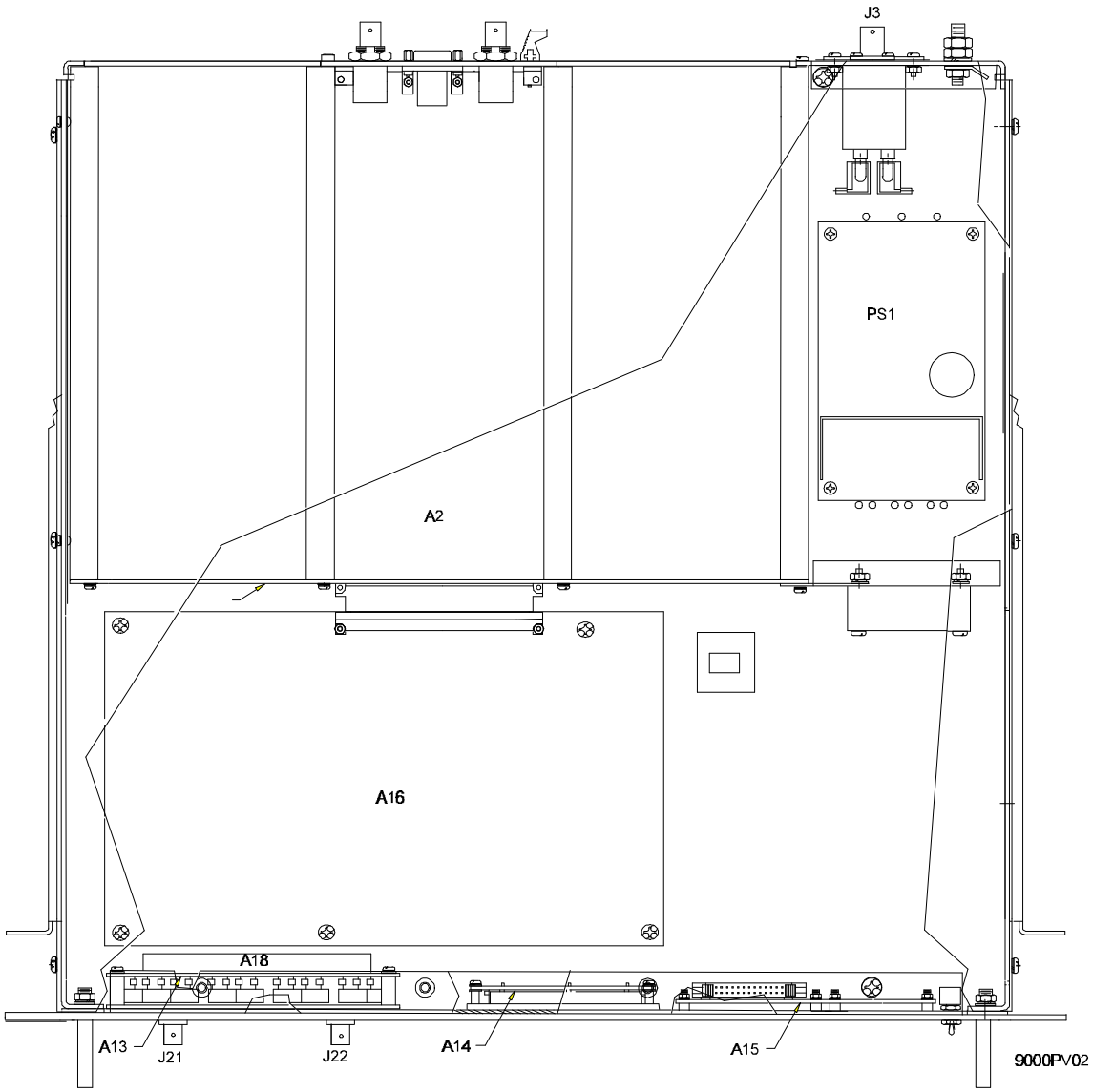


Figure 5-2. Model 9000B Replaceable Assemblies

Table 5-3 Model 9000B Replaceable Assemblies

REF DES	DESCRIPTION	MFG CODE	PART NO	QTY
A13	NINE DIGIT DECIMAL LED DISPLAY	11165	4003811-101	1
A14	16 CHARACTER LCD DISPLAY	11165	3004971-101	1
A15	KEYBOARD ASSEMBLY	11165	3004642-102	1
A16	MAIN LOGIC PC BD ASSEMBY (MLB)	11165	4005740-105	1
A18	FRONT PANEL I/O ASSEMBLY	11165	4006369-101	1
PS1	SWITCHING POWER SUPPLY	11165	4701880	1

APPENDIX A

MODEL 9000 DATA SHEET

APPENDIX B

STANDARD RS-232 COMMANDS

A. GENERAL

When a computer or dumb terminal is connected to the RS-232 serial port on the rear of AUXiliary Module A2, the remote computer or terminal may request status from and transmit setup commands to the Model 9000. The communication parameters and serial message format for the RS-232 port are set to correspond with the remote computer or terminal's parameters and serial data format using the instructions contained in Appendix G.

B. REMOTE OPERATION

RS-232 Operation

The Model 9000 can be operated from a remote computer or terminal using RS-232 port on Module A2. The two remote operating modes provided for this port are:

Computer Mode

The Computer Mode is the default mode of RS-232 communications port and is used when controlling the Model 9000 from a remote computer. No echoing of input commands is given, and the once-per-second time output, if commanded, is active. When writing interface programs, do not issue three or more successive carriage return <CR> commands. This will switch the port communications mode to Local Echo. To reenter the Computer Mode after using the Local Echo mode, issue a control E <^E>.

Local Echo Mode

Use this mode when controlling the Model 9000 from a terminal keyboard. Enter the Local Echo Mode by typing three successive carriage returns <CR>. A '9000>' prompt is displayed when in this mode, and all input keystrokes are echoed to the screen. While in the Local Echo mode, once-per-second time outputs from this port are suspended. To exit this mode, type a control E <^E>.

NOTE

> Before attempting to use either RS-232 port, assure that the remote computer or terminal and the Model 9000 are set to the same baud rate and serial-data format. Configure Model 9000's RS-232 port, as described in Appendix G.

All requests and commands are initiated from the host computer or terminal. All entries must be terminated with a carriage return <CR>. The Model 9000's response ends with a carriage return <CR> and line feed <LF>. The Model 9000 Remote Time Request, Status Request, and Setup Command-data formats are described in the following paragraphs

C. REMOTE COMMANDS

The Model 9000 remote status request commands, descriptions, and factory default parameters are listed in Table B-1.

Table B-1. Summary Of Request Commands

COMMAND	PAGE	DESCRIPTION	DEFAULT
RQUT	B1-4	UTC time	N/A
RQLT	B1-4	Local time	N/A
RQCS	B1-4	Request Clocking Source	N/A
RQSS	B1-5	Request Synchronization Source	N/A
RQOM	B1-5	Request Operating Mode	N/A
RQLK	B1-5	Request Lock Status	N/A
RQLP	B1-5	Request Position Data	N/A
RQTP	B1-6	Request Time Of Position	N/A
RQST	B1-6	Request Satellites Being Tracked	N/A
RQIR	B1-6	Request Time Difference	N/A
RQML	B1-6	Request Modules installed in unit	N/A
RQUN	B1-6	Request Chassis Model Number and Serial No, of unit	N/A
RQCD	B1-7	Request Antenna Delay	65 ns
RQVR	B1-7	Request Flash Software Version Information	N/A
RFM	B1-7	Request Fault Messages	N/A

C. REMOTE COMMANDS (cont'd)

The Model 9000 remote SETup/REQUEST commands, descriptions, and factory default parameters are listed in Table B-2.

Table B-2. Summary Of Setup Commands

COMMAND	PAGE	DESCRIPTION	DEFAULT
RQTS	B1-8	Request Time Once-per-Second	N/A
RQTX	B1-8	Terminate RQTS	N/A
SUT	B1-9	Set/Request UTC Time	N/A
SLS	B1-10	Set Leap Second Date	N/A
SRS	B1-11	Select Primary and Backup Synchronizers	N/A
STM	B1-12	Set/Request Time Mode (UTC or Local)	UTC
SDD	B1-13	Set/Request DST dates	4/1, 11/15
SMT	B1-14	Set Minor Time Offset	0
SDC	B1-15	Set/Request User Offset and Antenna Delay	65 ns
SPS	B1-16	Set/Request Position Source	24 Hour AVG
SLP	B1-17	Set/Request Local Position	N/A
SROM	B1-18	Set/Request Operating Mode	N/A
SST	B1-18	Set Start Time	N/A
SGFD	B1-19	Set Failure Report delay for GPS	60 minutes
SRC	B1-20	Set/Request Code and Mode for TCR Synchronizer	Model Dependent
SRI	B1-21	Set/Request Isolation for TCR Synchronizer	50 ohm
SRPD	B1-22	Set/Request Propagation Delay for TCR Synchronizer	0
SRLY	B1-23	Set/Request Leap Sec/Leap Year from TCR Sync Code	Disable
SRFD	B1-23	Set/Request failure Report for TCR Synchronizer	1 minute
SXS	B1-24	Set/Request External setting for AUX/IO module	OFF
SPPS	B1-25	1 PPS Output On-Time Edge for AUX/I/O	Positive
SVPD	B1-26	Set/Request Propagation Delay for VHF Synchronizer	0
SVFD	B1-27	Set Failure Report for VHF	1 minute
SRAP	B1-28	Set/Request TCG Amplitude	3V pk-pk
CRFM	B1-29	Clear/Request Fault Messages	N/A
FLCL	B1-29	Clears all non-active faults in System.	N/A
MODL	B1-29	Enters Model Parameters	

Remote Requests

Time outputs are resolved to 10 milliseconds. To obtain more accurate time output at RS-232 port on Module A2, select the Once-Per-Second auto-timed output using the “RQTS” command. The time mode is specified using the STM command.

9000 Remote Status Commands

Request UTC Time

Host sends: RQUT <CR>

9000 replies: RQUT ddd:hh:mm:ss.ff0,Q<CR><LF>

where:
ddd = day of year
hh = hours
mm = minutes
ss = seconds
ff0 = milliseconds with 10 ms resolution.
Q = Quality byte: = 0
0 = zero

Request LOCAL Time

Host sends: RQLT <CR>

9000 replies: RQLT yyyy,MM,dd,hh:mm:ss.000,Q<CR><LF>

where:
yyyy = year; e.g. 1991
MM = month
dd = day of month
others: as previously described in RQUT

Request Clocking Source

Host sends: RQCS <CR>

9000 replies: RQCS NNNNN<CR><LF>

where:
NNNNN = INT10 if clocking source is internal oscillator
= EXT10 if clocking source is external 10 MHz
= EXT05 if clocking source is external 5 MHz
= EXT01 if clocking source is external 1 Mhz
= PLL if clocking source is TCR PLL

Remote Requests (cont'd)

Request Synchronization Source

Host sends: RQSS <CR>

9000 replies: RQSS NNN<CR><LF>

where: NNN = GPS if synchronization source is GPS
= TCR if synchronization source is Reader (RDR/SYNC)
= VHF if synchronization source is VHF
= STN if in Standalone Generate

Request Operating Mode

Host sends: RQOM <CR>

9000 replies: RQOM NNN<CR><LF>

where: NNN = SGN if operating mode is Synchronized Generator
= RGN if operating mode is Reader Generator
= RDR if operating mode is Reader
= STN if operating mode is Standalone Generator

Request Discipline Oscillator Lock Status

This command provides the time that the unit locked or unlocked to the synchronized generator

Host sends: RQLK <CR>

9000 replies RQLK NO LOCK SINCE POWERUP <CR><LF>
If the unit has not been synchronized since powerup

RQLK LOCKED SINCE ddd:hh:mm:ss <CR><LF>
If the unit is disciplined to a synchronized generator and the time disciplining started.

RQLK FREE RUN SINCE ddd:hh:mm:ss <CR><LF>
If the unit loss lock (free-running) and the time lock was lost.

Request Position Data

Host sends: RQLP <CR>

9000 replies: RQLP dd:mm.fffN,ddd:mm.fffW,Shhhhh.f<CR><LF>

Where: dd:mm.fff is the latitude N is North or S is South
ddd:mm.fff is the longitude W is West or E is East
S is a + if the height is positive or a "-" if the height is negative, hhhhh.f is the height.

If no position information is available latitude, longitude and height are all zeros

Remote Requests (cont'd)

Request Time of Position

Host sends: RQTP <CR>

9000 replies: RQTP NOT YET IMPLEMENTED

Request Satellites being tracked

Host sends: RQST <CR><LF>

9000 replies: RQST sv,sv,sv,sv,sv,sv,sv,sv <CR><LF>,
or: RQST NONE<CR><LF>
or: RQST ERROR (NO GPS SYNCHRONIZER) <CR><LF>
or: RQST ERROR (GPS SYNCHRONIZER NOT ACTIVE) <CR><LF>

Where: sv is the satellite number.

Request Time Difference

Host Sends: RQIR CR>

9000 replies: RQIR ttt,REF-UTC,Sn,nnn.nn
RQIR ERROR (FP MEAS NOT ACTIVE) <CR><LF>

Where: ttt is "EXT" if the reference is from the front panel 1 PPS input.

S is a "+" if 1 PPS is leading or a "-" if lagging.

n,nnn.nn is the difference in microseconds

Request Modules Installed In the Unit

Host sends RQML<CR>

9000 replies: A1=XXX,A02=XXX,A03=XXX,A04=XXX,A05=XXX,A06=XXX,A07=XXX,
A8=XXX,A9=XXX,A10=XXX,A11=XXX,A12=XXX<CR><LF>

Where: XXX is a three letter acronym of the module RDR,GPS,VHF,TCG,ect...,
or NON if no module in slot.

Request Chassis Model Number and Serial Number of Unit

Host sends: RQUN<CR>

9000 replies: RQUN MODEL 9000X-XX SN nnnn<CR><LF>

Where: X-XX is an "A" or "B" followed by a two-digit dash number.
nnnn is a four-digit serial number.

Remote Requests (cont'd)

Request Antenna Cable Delay

Host sends: RQCD<CR><LF>

9000 replies: RQCD XXXXXXX<CR><LF>
RQCD NO GPS SYNCHRONIZER<CR><LF>

Where: XXXXXX is the antenna cable delay in nanoseconds.

Request Flash Software Version Information

Host Sends: RQVR <CR>

9000 replies: RQVR MODEL 9000 VER XXXXX DEV n CRC=cccc mm/dd/yy hh:mm<CR><LF>

Where:

XXXXX	is Display ID
Dev n	Indicates which flash devise is active
mm/dd/yy hh:mm	Date and time of version release

Request Fault Messages (Note: All first-time faults are acknowledged, i.e, "FAIL" flashing display goes away.)

Host sends: RFM<CR>

9000 replies: RFM cccc,xxx MMMMMMMMMMMM<CR><LF><EOI>
displays continue until all faults are displayed
RFM DONE<CR><LF><EOI>
RFM NO FAULTS<CR><LF><EOI>

where: cccc = card model number currently in the Axx slot
xxx = Axx the assembly number(slot number or MLB) that is the source of the error. What ever card is in the slot is causing the fault.
MMMMMMMMMMM = The message dialog

TYPE	MODEL	(12)Ms STRING	TYPE	MODEL	(12)Ms STRING
GPS SYNC	9001	"GPS^^FAIL^^^"	DUAL RS232	9010	"232TIME^FAIL"
GPS SYNC	9001	"GPS^ANT^FAIL"	TELECOM GEN	9011	"TELEGEN^FAIL"
TCR SYNC	9002	"RDR/SYN^FAIL"	PARA BCD	9012	"PARALEL^FAIL"
AUX I/O	9003	"EXT^STD^DROP"	SLOW CODE	9013	"SLOCODE^FAIL"
AUX I/O	9003	"1PPS^DROPOUT"	DIGRATGEN	9014	"RATEGEN^FAIL"
IEEE-	9004	NONE	TIME TAG	9016	"TT^OVRN^FAIL"
TCG GEN	9005	"TCG^^^^FAIL^"	TIME TAG	9016	"TT^PPS^FAIL^"
DIG DSTR	9006	"DRIVER^FAIL^"	VHF	9017	"VHF^^^^FAIL^"
DIFF DSTR	9007	"DRIVER^FAIL^"	RUBIDIUM	9018	"RUBIDUM^FAIL"
LIN DRVR	9008	"DRIVER^FAIL^"	ALL CARDS	MODULE	"NO^RESPONSE^"
SINE GEN	9009	"SINEGEN^FAIL"	MLB	9000	"NVRAM^FAIL^^"
			MLB	9000	"RAM^FAILURE^"

Remote Setup Commands

The RQTS command sets up the Model 9000 to output time once per second. It is only available through the RS-232A port. The command is accepted in either the Local Echo Mode or the Computer Mode; however, outputs are suspended as long as the unit is in the Local Echo Mode. The time mode is specified using the STM command. The "*" is no greater then approximately 500 μs after on-time, time output follows within 300 **ms** later.

Request Time Once-Per-Second -

Host sends:	RQTS<CR> to select Format A RQTS Y<CR> to select Format B RQTS P<CR> to select Format C RQTS Y,P<CR> to select Format D
9000 replies:	RQTS DONE<CR> RQTS ERROR<CR><LF> Invalid input parameter

If this command is issued via the IEEE-488 module then:

9000 replies: RQTS ERROR (Command not supported for IEEE-488)

Once-Per-Second Formats:

A: *RQTS t,ddd,MM:hh:mm:ss.0,Q <CR><LF>

B: *RQTS t,yyyy:MM;dd,hh:mm:ss.0,Q <CR><LF>

C: *RQTS t,ddd,hh:mm:ss.0,Q,dd:mm.fffN,ddd:mm.fffW,Shhhhh.f <CR><LF>

D: *RQTS t,yyyy:MM:dd,hh:mm:ss.0,Q,dd:mm.fffN,ddd:mm.fffW,Shhhhh.f <CR><LF>

Where:		
	t=	U for UTC and L for local
	ddd =	day of year
	yyyy =	year
	MM =	month
	hh =	hours
	mm =	minutes
	ss =	seconds
	Q =	Quality byte :
		0 = Unknown
		4 = Phase < 1 us
	dd:mm.fffN	is Latitude, where N is North or S is South.
	ddd:mm.fffW	is Longitude, where W is West or E is East.
	Shhhhh.f	is Height in meters.
	S =	+ (positive) or - (negative) elevation

To terminate requests:

Host sends: RQTX <CR>

9000 replies: RQTX DONE<CR><LF>

Remote Setup Commands (cont'd)

SYNC/GEN Remote Commands

SET/REQUEST UTC time - (Optional). This command is never required but is provided to allow the unit to be used as a time code generator, without the need of a satellite. Returns time on front panel LED display (Local or UTC).

Request mode:

Host sends: SUT <CR>

9000 replies: SUT ddd:hh:mm:ss.ff0,Q<CR><LF>

where:
ddd = day of year
hh = hours
mm = minutes
ss = seconds
ff0 = milliseconds with 10 ms resolution. (Third character is always a zero)

Q = Quality byte is blank (white space)
0 = Unknown
4 = Phase < 1us

Set mode:

Host sends: SUT yyyy,MM,dd,hh,mm,ss <CR>

where:
yyyy = year; e.g. 1991
MM = month
dd = day of month
others: as previously described

9000 replies:
SUT DONE <CR><LF>
SUT ERROR<CR><LF> Invalid input parameter

Remote Setup Commands (cont'd)

Set Leap Second Date

This command sets the date for a leap second correction. The unit must be in SYNCH Gen or STANDALONE mode to enter a Leap Second correction date.

Request mode

Host sends: SLS<CR>

9000 replies: SLS yy,mm,dd<CR><LF>
SLS 00,00,00<CR><LF>

where: yy = two digit year
mm = month
dd = day

Note: If no leap second, date is set yy,mm,dd are zeros

Set mode

Host sends: SLS yy, mm, dd<CR><LF>

where: format is described above.

9000 replies: SLS DONE<CR><LF>
SRS ERROR<CR><LF> Invalid input parameter
SLS ERROR (INVALID MODE)<CR><LF> Unit not in correct mode
SLS ERROR (CURRENT DATE PAST 06, 30 USE 12, 31)<CR><LF>
SLS ERROR (CURRENT DATE PAST 12, 31 USE 06, 30)<CR><LF>

Remote Setup Commands (cont'd)

Select Primary and backup Synchronizer

This command selects the primary synchronizer and backup synchronizer. The unit must be in SYNCH GEN mode to update the primary and secondary synchronizers.

Request Mode

Host sends: SRS <CR>

9000 replies: SRS ppp,bbb<CR><LF>

where: ppp = GPS if primary synchronizer is GPS
TCR if primary synchronizer is Reader (RDR/SYNC)
VHF if primary synchronizer is VHF

bbb = GPS if backup synchronizer is GPS
TCR if backup synchronizer is Reader (RDR/SYNC)
VHF if backup synchronizer is VHF
NON if no backup synchronizer is selected

SRS DONE<CR><LF>

Set mode

Host sends: SRS ppp,bbb<CR><LF>

where: format is described above.

9000 replies: SLS DONE<CR><LF>
SRS ERROR<CR><LF> Invalid input parameter
SLS ERROR (INVALID MODE)<CR><LF> Unit not in correct mode

Remote Setup Commands (cont'd)

SET/REQUEST time mode

This command selects UTC or Local for all time outputs in the unit. Hours and minutes offset between time zones can be entered. The unit must be in SYNCH GEN or READER GEN mode.

GPS is not normally used.

Request mode:	
Host sends:	STM <CR>
9000 replies:	STM t,ooo, mm<CR><LF>
where:	t is a "U" if UTC t is a "L" if LOCAL ooo is the signed offset value in hours (±HH) for Local mm is the offset in minutes (00-59) for Local
Set mode:	
Host sends:	STM t,ooo,mm <CR>
where:	Same as for STM Request mode
9000 replies:	STM DONE<CR><LF> STM ERROR<CR><LF> Invalid input parameter STM ERROR (INVALID MODE)<CR><LF> Incorrect mode

Remote Setup Commands (cont'd)

SET/REQUEST DST DATES -

This command enters the day light savings time (DST) Spring and Fall change dates. Refer to Table 3-3 for factory default dates. Local standard time may be selected when DST is not used. The unit must be in STANDALONE or SYNCH GEN mode.

Request mode:

Host sends: SDD <CR>

9000 replies: SDD M,mm,dd,mm,dd<CR><LF>

where: 1st mm,dd - is Spring's date and
2nd mm,dd - is Fall's date
M is a "Y" if enabled or an "N" if Daylight Savings disabled

Set mode:

Host sends: SDD Mmm,dd,mm,dd<CR>

where: 1st mm,dd - is Spring's date and
2nd mm,dd - is Fall's date
M is a "Y" if enable or an "N" if disable Daylight Savings

9000 replies: SDD DONE<CR><LF>
SDD ERROR<CR><LF> Invalid input parameter
SDD ERROR (INVALID MODE)<CR><LF> Incorrect mode

Remote Setup Commands (cont'd)

SET MINOR TIME OFFSET

The unit must be in SYNCH GEN mode.

Request mode:

Host sends: SMT <CR>

9000 replies: SMT suuu,uuu.u<CR><LF>

Where: s is a + or a - sign
uuu,uuu.u is the offset in micro-seconds (+- 499,999.9)

Set mode:

Host sends: SMT suuu,uuu.uM<CR>

where: same as for Request Mode.

9000 replies: SMT DONE<CR><LF>
SMT ERROR<CR><LF> Invalid input parameter
SMT ERROR (INVALID MODE)<CR><LF> Incorrect mode

GPS Sync Setup

SET/REQUEST user offset and antenna delay compensation -

Request mode:

Host sends:	SDC <CR>
9000 replies:	SDC aaa.aaa<CR><LF>
where:	aaa.aaa is the antenna delay compensation in nanoseconds up to 999.999 micro-seconds.

Set mode:

Host sends:	SDC aaa.aaa<CR>
where:	format is as described above.
9000 replies:	SDC DONE<CR><LF> SDC ERROR<CR><LF> Invalid input parameter SDC ERROR (NO GPS MODULE)<CR><LF>

Remote Setup Commands (cont'd)

SET/REQUEST Position Source -

NOTE: Normal user will accept 24 hour antenna position averaging provided. If a surveyed antenna position is available, this position can be entered in SLP (previous) command and "U" selected here. Doing so bypasses the factory default 24 hour averaging period and provides a very small improvement in time accuracy. The "A", "L", or "M" mode bypasses all averaging and uses the current position from the GPS receiver.

If the application type setting is set to select the static mode of operation at power-up, the unit will automatically select the "SPS AV" option and begin a 24 hour average of the once-per-second navigation solutions from the GPS receiver. At the completion of the averaging period, the GPS receiver will use the computed average and no more navigation solutions will be performed. Should the user change the position source to "A", "L", "M", "AV" or "U" during an average, the averaging operation will be halted and reset. All averaging data will be erased. If the user changes the position source to "U", the unit will enter this mode on the next power-up and will not perform an average position operation.

Request mode:

Host sends:	SPS <CR>
9000 replies:	SPS m<CR><LF>
where:	m - is an "A" if the Air navigation solution is selected m - is an "L" if the Land navigation solution is selected m - is an "M" if the Marine navigation solution is selected m - is a "AV'ING" if the computed average position is selected and the average position computation has not completed yet. m - is a "AV'ED" if the computed average position is selected and the average position computation has completed. m - is an "U" if the user entered position is selected

Set mode:

Host sends:	SPS m <CR>
where:	m - is an "A" if the Air navigation solution is selected m - is an "L" if the Land navigation solution is selected m - is an "M" if the Marine navigation solution is selected m - is a "AV" if the computed average position is selected m - is an "U" if the user entered position is selected
9000 replies:	SPS DONE<CR><LF> SPS ERROR<CR><LF> Invalid input parameter SPS ERROR (NO GPS MODULE)<CR><LF>

Remote Setup Commands (cont'd)

SET/REQUEST Local Position -

NOTE: Most users will accept the default 24 hour averaging mode and will not need this command

The position entered using this command may be used in two ways: if the position source is "AV" the GPS receiver will accept and use the entered position, but will update it and the GPS will begin a new 24 hour average solution. If the position source is "U", the entered position will be used and saved and no position solutions will be performed. This command will be rejected if a position is entered and the GPS setting is "A", "L", or "M" (see SPS command above).

Request mode:

Host sends:	SLP <CR>
9000 replies:	SLP dd:mm.fffN,ddd:mm.fffW,Shhhhh.f<CR><LF>
where:	dd:mm.fff is Latitude (N is North or S is South) ddd:mm.fff is Longitude (W is West or E is East) Shhhhh.f is Height in meters where S = + (positive) or - (negative) elevation

Set mode:

Host sends:	SLP dd:mm.fffN,ddd:mm.fffW,Shhhhh.f<CR>
where:	dd:mm.fff is Latitude (N is North or S is South) ddd:mm.fff is Longitude (W is West or E is East) Shhhhh.f is Height in meters where S = + (positive) or - (negative) elevation
9000 replies:	SLP DONE<CR><LF> SLP ERROR<CR><LF> Invalid input parameter SLP ERROR (DYNAMIC MODE)<CR><LF> Wrong GPS mode SLP ERROR (NO GPS MODULE)<CR><LF>

Remote Setup Commands (cont'd)

Request Operating Mode

Host sends: SROM<CR>

9000 replies: SROM NNN<CR><LF>
SROM ERROR<CR><LF><EOI>
SROM ERROR (CURRENT SYNCHRONIZERS DO NOT SUPPORT REQUEST)<CR><LF><EOI>

where: NNN = SGN - Set to Synchronized Generator mode
NNN = RGN = Set to Reader Generator mode
NNN = RDR = Set to Reader mode
NNN = STN = Set to Standalone mode

Set Operating Mode

Host sends: SROM NNN<CR> NNN = same as above

9000 replies: SROM DONE<CR><LF>

where: NNN = same as above

Set Start Time

Host sends: SST mm,dd,yy,hh:mm:ss,MANUAL<CR>
Or
SST mm,dd,yy,hh:mm:ss,ARM,+ppp,ppp.p,sss<CR>

9000 replies: SROM DONE<CR><LF>

where: mm,dd,yy = month,day,year
hh:mm:ss = hour:minute:second
MANUAL = manual start mode
ARM = arm for external edge or manual start mode
+ppp,ppp.p = propagation delay of 0 thru +499,999.9
sss = EXT – start mode is external edge
MAN- start mode is manual

Remote Setup Commands (cont'd)

Set Failure Report Delay for GPS

Request mode:

Host sends:	SGFD<CR>
9000 replies:	SGFD hh:mm<CR><LF>
where:	hh:mm is hours and minutes fail-over delay from primary to backup synchronizer when in SYNCH GEN mode.

Set mode:

Host sends:	SGFD hh:mm<CR>
where:	format is as described above.
9000 replies:	SGFD DONE<CR><LF> SGFD ERROR<CR><LF> Invalid input parameter SGFD ERROR (NO GPS MODULE)<CR><LF>

Remote Setup Commands (cont'd)

Reader/Sync Setup

SET/REQUEST Code and Mode for TCR Synchronizer -

Request mode:

Host sends:	SRC<CR>
9000 replies:	SRC c,m<CR><LF>
where:	c is A - IRIG-A c is B - IRIG-B c is E - IRIG-E c is G - IRIG-G c is 2 - 2137 c is 3 - NASA-36 m is N - NORM m is I - INV m is D - DC m is A - AUTO MODE

Set mode:

Host sends:	SRC c,m<CR>
where:	format is as described above.
9000 replies:	SRC DONE<CR><LF> SRC ERROR<CR><LF> Invalid input parameter SRC ERROR (NO TCR MODULE)<CR><LF> SRC ERROR (INVALID TCR MODULE VERSION)<CR><LF>

Remote Setup Commands (cont'd)

SET/REQUEST Isolation for TCR Synchronizer -

Request mode:

Host sends: SRI<CR>

9000 replies: SRI c<CR><LF>

where: c is 5 - 50 ohm single ended
c is 6 - 600 ohm isolated
c is 7 – 75 ohm single ended

Set mode:

Host sends: SRI c<CR>

where: format is as described above.

9000 replies: SRI DONE<CR><LF>
SRI ERROR<CR><LF> Invalid input parameter
SRI ERROR (NO TCR MODULE)<CR><LF>

Remote Setup Commands (cont'd)

SET/REQUEST Propagation Delay for TCR Synchronizer -

Request mode:

Host sends: SRPD<CR>

9000 replies: SRPD nnn,nnn.n<CR><LF>

where: nnn,nnn.n is the propagation delay in micro-seconds (499,999.9 μsecs maximum)

NOTE: You must include the decimal followed by a zero or a number.

Set mode:

Host sends: SRPD c<CR>

where: c = format is as described above.

9000 replies: SRPD DONE<CR><LF>
SRPD ERROR<CR><LF> Invalid input parameter
SRPD ERROR (NO TCR MODULE)<CR><LF>

Remote Setup Commands (cont'd)

SET/REQUEST Leap Sec/Leap Year from TCR Synchronizer Output Code

Request mode:

Host sends: SRLY<CR>

9000 replies: SRLY r<CR><LF>

where: r is Y - Get Leap Sec/Leap Year from code
r is N - Disable Leap Sec/Leap Year from code

Set mode:

Host sends: SRLYc<CR>

where: format is as described above.

9000 replies: SRLY DONE<CR><LF>
SRLY ERROR<CR><LF> Invalid input parameter
SRLY ERROR (NO TCR MODULE)<CR><LF>

Set Failure Report Delay for TCR Synchronizer

Request mode:

Host sends: SRFD<CR>

9000 replies: SRFD hh:mm<CR><LF>

where: hh:mm is hours and minutes fail-over delay from primary to backup synchronizer when in SYNCH GEN mode.

Set mode:

Host sends: SRFD hh:mm<CR>

where: format is as described above.

9000 replies: SRFD DONE<CR><LF>
SRFD ERROR<CR><LF> Invalid input parameter
SRFD ERROR (NO TCR MODULE)<CR><LF>

Remote Setup Commands (cont'd)

AUX I/O Setup

SET/REQUEST External Setting for AUX IO Module -

Request mode:

Host sends:	SXS<CR>
9000 replies:	SXS r<CR><LF>
where:	r is 0 - Set External Standard "OFF" r is 1 - Set External Standard "1 MHZ" r is 5 - Set External Standard "5 MHZ" r is 10 - Set External Standard "10 MHZ"

Set mode:

Host sends:	SXSc<CR>
where:	format is as described above.
9000 replies:	SXS DONE<CR><LF> SXS ERROR<CR><LF> Invalid input parameter SXS ERROR (NO AUXIO MODULE)<CR><LF>

Remote Setup Commands (cont'd)

SET/REQUEST 1 PPS Output On-Time Edge for AUX IO Module -

Request mode:

Host sends: SPPS<CR>

9000 replies: SPPS r<CR><LF>

where: r is + Edge is set for positive
r is - Edge is set for negative

Set mode:

Host sends: SPPS c<CR>

where: format is as described above.

9000 replies: SPPS DONE<CR><LF>
SPPS ERROR<CR><LF> Invalid input parameter
SPPS ERROR (NO AUXIO MODULE)<CR><LF>

Remote Setup Commands (cont'd)

VHF Setup

SET/REQUEST Propagation Delay VHF Synchronizer -

Request mode:

Host sends: SVPD<CR>

9000 replies: SVPD nnn,nnn.n<CR><LF>

where: nnn,nnn.n is the propagation delay in micro-seconds (499,999.9 μsecs maximum)

Set mode:

Host sends: SVPD c<CR>

where: c = format is as described above.

9000 replies: SVPD DONE<CR><LF>
SVPD ERROR<CR><LF> Invalid input parameter
SVPD ERROR (NO VHF MODULE)<CR><LF>

Remote Setup Commands (cont'd)

SET FAILURE REPORT DELAY for VHF

Request mode:

Host sends: SVFD<CR>

9000 replies: SVFD hh:mm<CR><LF>

where: hh:mm is hours and minutes fail-over delay from primary to backup synchronizer when in SYNCH GEN mode.

Set mode:

Host sends: SVFD hh:mm<CR>

where: format is as described above.

9000 replies: SVFD DONE<CR><LF>
SVFD ERROR<CR><LF> Invalid input parameter
SVFD ERROR (NO VHF MODULE)<CR><LF>

Remote Setup Commands (cont'd)

Request TCG amplitude

Host sends: SRAP ss,a<CR>
or
SRAP ss,s,n.n<CR>

9000 replies: SRAP ss,a,n.n<CR><LF><EOI>
SRAP PROCESSING<CR><LF><EOI>
SRAP ERROR<CR><LF><EOI>
SRAP ERROR (SLOT DOES NOT CONTAIN TCG MOD)
<CR><LF><EOI>

where: ss = slot number (01-12) containing the TCG module
a = channel 1 or channel 2
n.n = amplitude in volts (1.0 - 5.0) for "a"

NOTE: When any valid SRAP setup command is received, there will be a *5 second delay* before any new SRAP command will be accepted for the *same* slot and channel. The "SRAP PROCESSING" response will be sent when starting the setup and in response to any subsequent command before the 5 second delay has expired.

Set TCG Amplitude

Host sends: SRAP ss,a,n.n<CR>

9000 replies same as above

NOTE: Channel 1 and channel 2 correspond to existing TCG modules as follows:

Model	**Channel 1**	**Channel 2**
9005-1	IRIG-A	IRIG-B
9005-2	IRIG-G	IRIG-E
9005-3	IRIG-D	IRIG-H
9005-4	IRIG-B	NASA-36
9005-5	XR3	2137
9005-6	HAVEQUICK	800 KHz
9005-7	IRIG-G	IRIG-B
9005-8	IRIG-E	IRIG-H

Remote Setup Commands (cont'd)

Clear Fault Messages

Host sends: CRFM xxx<CR>

9000 replies: CRFM DONE<CR><LF>
CRFM UNABLED TO CLEAR FAULT<CR><LF>
CRFM NO FAULTS<CR><LF><EOI>
no faults anywhere in system
CRFM ERROR<CR><LF><EOI>
CRFM ERROR (NO MODULE FOUND IN
SLOT<CR><LF><EOI>

where: xxx = assembly number (A01 through A12 or MLB) to clear

FAULT CLEAR

Host sends: FLCL<CR>

9000 replies: Display should clear fault message.
Clears all non-active faults in system

MODEL NUMBER PARAMETERS

Enter the model number, dash number and serial number into nvRAM.

Host sends: MODL X-XX, nnnn<CR>

9000 replies: RQUN MODEL 9000 X-XX SN nnnn <CR><LF>
MODL DONE <CR><LF>

Where: X-XX is an "A" or "B" followed by a two-digit dash number
nnnn is a four-digit serial number

APPENDIX B2

IEE-488 I/O COMMANDS

A. GENERAL

When a Model 9004-1 IEEE-488 I/O Module is installed in the Model 9000 Time Code Processor and a remote computer or dumb terminal is connected to the module's rear-panel connector, the Model 9000 may be set up and status monitored using remote commands.

The Model 9004-1 IEEE-488 I/O Module is described in Appendix G of this manual. When connected to a remote computer or dumb terminal Model 9000 status may be requested and setup parameters changed using the remote status and setup commands provided in Appendix B1 (RS-232) I/O commands) except for the following two commands that are not supported by the IEEE-488 interface:

RQTS - Request Time Once-per-Second
RQTX - Terminate RQTS

NOTE: THE RS-232 AND IEEE-488 INTERFACES CANNOT BE USED SIMULTANEOUSLY.

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