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Symmetricom

9700/9700AT 9710 Programmable Time System

Revision F

User's Guide

8500-0057

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9700AT/9710AT
PROGRAMMABLE TIME SYSTEM

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CHAPTER ONE
GENERAL DESCRIPTION

1.0 INTRODUCTION

This User's Guide contains procedures and descriptive information for proper installation and operation of the 9700AT/9710 Programmable Time System (PTS).

1.1 DOCUMENTATION

Since the 9700AT/9710AT Programmable Time System has many options designed to meet individual instrumentation requirements, this User's Guide is divided into two parts. The first part describes all configurations of the 9700AT/9710AT basic instrument and comes with complete specifications. The second part provides information about the PLUG-IN options, and modifications to the basic unit. Descriptions of each PLUG-IN option may be found in the envelope inside the rear cover of this User's Guide.

1.2 PURPOSE OF EQUIPMENT

The 9700AT/9710AT Programmable Time System performs two basic functions. First, it operates as a Time Code Generator using an internal 1 or 5 MHz oscillator, or optionally an external frequency input, as a time base. Secondly, it operates as a Translator using a Serial Time Code as a time base. With the addition of a double-wide option assembly, the PTS is also usable as a Tape Search System.

When used as a Generator, the 1MHz oscillator is divided down to 1PPS. This divider is called the minor time counter. The 1PPS is further divided and the count permuted so as to generate BCD Time-of-Year in seconds, minutes, hours, and days. This divider is called the major time counter. The terms from the major time counter are decoded into decimal form and used to drive a LED Display. The initial time count must be manually preset into the instrument. The Generator operation is continuous even during operation of the Translator. See Chapter Four, Theory of Operation, in this User's Guide for a more detailed description of the Generator.

The 9700AT/9710AT Translator relies upon an input Serial Time Code for its time base. This code is typically a member of the IRIG family. The carrier frequency of the time code is used for the clock and the time information is automatically set into the major time counter of the Translator. Chapter Four, Theory of Operation, in this User's Guide gives a more detailed description of the Translator.

The terms derived from both the major and minor time counters of the Generator and Translator are also used to drive option circuits which develop Serial Time Codes, Parallel Outputs, and Pulse Trains, etc.

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1.3 PHYSICAL DESCRIPTION

The 9700AT, Figure 1.3.1 and the 9710AT, Figure 1.3.2, are identical as far as operation. The only difference is the physical size, which allows more option assemblies to be installed in the 9710AT.

The 9700AT is constructed in a 1¾ inch package requiring a minimum 19 inch rack mounting space. The 9710AT is constructed in a 3½ inch package requiring a minimum 19 inch rack mounting space. A decimal (LED) display, located on the front panel, shows either generated time or translated time, depending on the mode of operation. The LCD Display along with the switches are used to set-up and control the PTS. All operating controls, with the exception of the POWER switch, are located on the front panel. Option assemblies may have switches or jumpers to set them up in specified configurations.

9700AT Front View

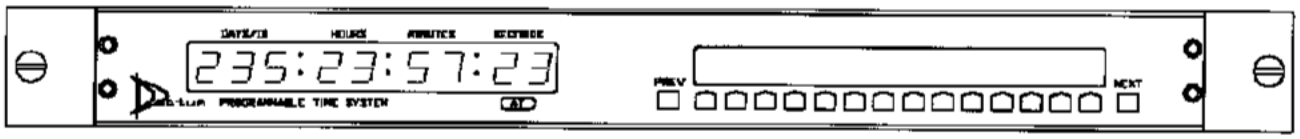


Figure 1.3.1

9710AT Front View

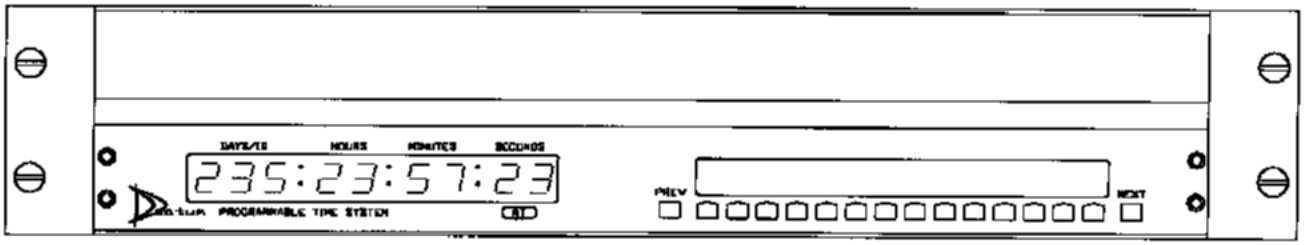


Figure 1.3.2

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1.4 SPECIFICATIONS

Refer to the following paragraphs and tables for the specifications applicable to the 9700AT/9710AT PTS. Changes or additions to these specifications, if any, are listed in Appendix A.

1.4.1 INPUTS

1.4.1.1 AC POWER (J1)

90 VAC to 264 VAC ±10%
47 - 440 Hz
Less than 40 VA

The power supply used in this unit has an input range of 90 to 264 Volts. No Jumpering required.

1.4.1.2 CARRIER CODE INPUTS (J2)

Connector J2, Carrier Code Inputs, is a BNC male type connector.

Table 1-1 lists the Code Input formats and Specifications for each, which are accepted by this unit.

Table 1-1
Carrier Code Inputs (J2)

Formats	IRIG A, B, E, G, H. NASA 28, 36. XR3, 2137, 1892, AN/GSQ-53.
Carrier Frequencies	IRIG A - 10kHz. IRIG B - 1kHz. IRIG E - 1kHz or 100Hz. IRIG G – 100kHz. IRIG H - 1kHz or 100Hz. NASA 28 100Hz. NASA 36 1Khz. XR3 250Hz. 2137 1kHz. 1892 1kHz. AN/GSQ-53 250Hz (Use XR3). AN/GSQ-53 1kHz (Use 2137).
Modulation Ratio	2:1 to 6:1.
Input Signal Level	0.1 volts to 10.0 volts peak-to-peak.
Input Impedance	Greater than 50kΩ, single-ended.
Frequency Range	30Hz to 2MHz.

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1.4.1.3 TIME BASE INPUTS

Tables 1-2 lists the specifications for the normally supplied Time Base. Tables 1-3 and 1-4 list the specifications of the optional Internal Oscillators. Table 1-5 shows the requirements of the External Frequency input to the unit at J8 if used.

Table 1-2
Low Stability Internal Oscillator (Normally Supplied)

Frequency	1MHz.
Frequency Stability	±5 parts in 10^6 over specified temperature range.
Temperature Range	0°C to 50°C.
Aging Rate	1 x 10^{-7} parts per day. 1 x 10^{-6} parts per month.
Frequency Adjustment Range	Greater than 5 parts in 10^5.

Table 1-3
Mid Stability Oscillator (TCXO Optional)

Frequency	1MHz.
Frequency Stability	Greater than 5 parts in 10^7 over specified temperature range.
Temperature Range	0°C to 50°C.
Aging Rate	Less than 1 part in 10^8 per day.
Frequency Adjustment Range	Greater than 1 part in 10^5.

Table 1-4
High Stability Oscillator (OCXO Optional)

Frequency	5MHz.
Frequency Stability	Greater than 5 parts in 10^8 over specified temperature range.
Temperature Range	0°C to 50°C.
Aging Rate	Less than 5 parts in 10^9 per day.
Frequency Adjustment Range	Greater than 5 parts in 10^6.

The High Stability External Sine Wave Input connector, J8, is a BNC male type connector.

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Table 1-5
High Stability External Sine Wave Input (J8)

Frequency	1MHz/5MHz/10MHz.
Amplitude	1 volt peak-to-peak to 5 volts peak-to-peak.
Input Impedance	50Ω, nominal.

1.4.1.4 PULSE INPUT (J7)

The Pulse Input connector, J7, is a BNC type male connector.

Table 1-6 shows the specifications for the Pulse Input at J7 of this unit if used.

Table 1-6
J7 Pulse Input (May be used for Ext Start or Tracking.)

Format	1PPS TTL Pulse.
Pulse Width	1-999,999 microseconds.
Rise & Fall Times	Less than 1 microsecond.

1.4.2 OUTPUTS

The following paragraphs and tables list the outputs and specifications of each.

1.4.2.1 IRIG B BCD TIME-OF-YEAR (J6)

Connector J6, the IRIG B BCD Time-of-Year, Serial Time Code output connector is a BNC male type connector.

Table 1-7 shows the specifications of the IRIG B Serial Time Code output at J6.

Table 1-7
J6 IRIG B: BCD Time-of-Year (B122)

Carrier Frequency	1kHz sine wave.
Amplitude	Adjustable from 0 to 5V Peak to Peak on the Mark Pulse.
Modulation Ratio	Adjustable, 3:1 nominal.
External Load	50Ω minimum.

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1.4.2.2 IRIG B DC CODE (J4, PIN 10)

The IRIG B DC Code output at J4, Pin 10, is CMOS compatible. Connector J4 is a 15 pin "D", DA-15P, Cannon or equivalent type connector.

1.4.2.3 STANDARD PULSE RATES (J4)

The connector type used for J4, is a 15 pin "D", DA-15P, Cannon or equivalent type connector.

Table 1-8 lists the specifications of the standard pulse rate outputs. Table 1-9 shows the Pulse Rates and the output pins of J4 which are from the Generator while Table 1-10 shows the Standard Pulse Rates and the output pins of J4 which are from the Translator.

Table 1-8
Pulse Rate Output Specifications

Duty Cycle	50/50%
On-Time Edge	Positive
Output Levels	Logic "0" +0.5 ±0.5 VDC Logic "1" +4.25 ±0.75 VDC
Source Impedance	HCMOS Compatible

Table 1-9
J4 Standard Pulse Rates From Generator

1K PPS	Pin 1
100 PPS	Pin 2
10 PPS	Pin 3
1 PPS	Pin 4
GND	Pin 9

Table 1-10
J4 Standard Pulse Rates From Translator

Carrier	Pin 5
Carrier/10	Pin 6
Carrier/100	Pin 7
Carrier/1K	Pin 8

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1.4.2.4 AGC'D CODE OUTPUT (J3 OPTIONAL)

This optional output if installed has an output amplitude of approximately 2 Volts Peak-to-Peak with a 50Ω source. This is a buffered output of the AGC signal. This signal is routed from J109 of the Translator Assembly to the optional J3 connector via a coaxial cable. When this output is used a BNC type male connector is required.

1.4.2.5 LOS OUTPUT (J4, PIN 11)(FROM TRANSLATOR)

The connector type used for J4, is a 15 pin "D", DA-15P, Cannon or equivalent type connector.

Table 1-11 shows the specifications of the LOS Output of the Translator.

With an input to the Translator, at J2, this output will be low if the input signal is above the adjusted threshold level. It will go high if the signal is lost or drops below the adjusted threshold level.

Table 1-11
Loss Output (J4, Pin 11) From Translator

Threshold	Adjustable 1-10 V P-P
Carrier Frequency	100Hz – 100KHz
Source Impedance	HCMOS Compatible

1.4.2.6 ERR OUTPUT (J4, PIN 12)(FROM TRANSLATOR)

Connector J4 is a 15 pin "D", DA-15P, Cannon or equivalent type connector.

This CMOS Compatible output will go high, indicating an error, if there is no input to the Translator at J2, or if when in the Translator mode of operation two or more consecutive frames do not agree.

1.4.3 ENVIRONMENT

Table 1-12 shows the Environmental specifications of this unit.

Table 1-12
Environmental Specifications

Temperature	0°C to +40°C Operating. -20°C to +55°C Storage.
Humidity:	Up to 95% Relative.

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1.4.4 SIZE AND CONFIGURATION

Table 1-13 shows the physical size and configuration of the 9700AT and 9710AT PTS units.

Table 1-13
Size and Configuration

Chassis, 9700AT	Height 1 ¾" Width 19" Depth 18"
Chassis, 9710AT	Height 3 ½" Width 19" Depth 18"
Mounting	Standard 19" equipment cabinet

1.5 SAFETY PRECAUTIONS AND HEALTH HAZARDS

This product contains no materials, which could cause any health hazards.

This product utilizes low voltages which in themselves cause no personal safety problems with the exception of the AC Power input voltage,

The following "CAUTION" label will appear in this manual where precautionary measures should be taken.

***** CAUTION *****

The AC Power input module utilizes a power supply which has an input range of 90 to 264 volts. This voltage is only exposed to personnel when the Top and/or Bottom Cover of the unit are removed. This High Voltage exists in the right rear corner of the unit as viewed from the front.

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CHAPTER TWO
INSTALLATION

2.0 INTRODUCTION

This section provides an installation procedure for the 9700AT/9710AT Programmable Time System.

2.1 INSTALLATION PROCEDURE

Upon receiving the 9700AT/9710AT, make a thorough inspection of the instrument and all its accessories. Any damage or loss of equipment should be reported immediately to the responsible carrier. If no damage is found, install the 9700AT/9710AT as outlined in the following steps:

2.1.1 PRE-INSTALLATION CHANGES (IF DESIRED)

Before shipping, the PTS was configured for the anticipated use. If the user wishes to make any changes this can most conveniently be done before installation. See the Top Assembly Drawing.

2.1.1.1 POWER SUPPLY

The Power Supply in this unit has an input operation range of 90 to 264 Volts AC 47 to 440 Hz therefore no jumpers are required.

2.1.1.2 GENERATOR ASSEMBLY

If it is desired to ground one side of the external reference frequency input transformer T1 on the Generator Assembly, install a jumper from E1 to E8.

If it is desired to silence "Beeper", which sounds at power-up and each time a select switch is pressed, cut etch at R35 between the eyelets for the resistor.

2.1.1.3 TRANSLATOR ASSEMBLY

If the unit has the T1 option, jumpering E39 to E40 provides a 600Ω termination of the input.

2.1.1.4 OTHER OPTIONS

Jumpers, if provided and required, are described in the Option Descriptions.

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2.1.2 RACK MOUNTING PROCEDURE

The 9700AT and the 9710At are designed for standard nineteen inch rack mounting.

Optional chassis slides are recommended if the unit is to be installed in an equipment rack. If slides are not used, a supporting bar or tray should be provided for the rear of the instrument. The chassis slides attach to the sides of the 9700AT and 9710AT Programmable Time Systems. To mount it using the optional slide mounting kit, use the #6 self tapping screws provided with the kit.

General Cautions/hazards to be considered when installing the Programmable Timing System into an equipment rack:

- **Tmra** - The maximum recommended ambient temperature (Tmra) that this equipment is specified to operate at is +40°C.

- **Elevated Operating Ambient Temperature** - If installed in a closed or multi-unit rack assembly, the operating ambient temperature of the rack environment may be greater than room ambient. Therefor, consideration should be given to installing the equipment in an environment compatible with the maximum rated ambient temperature (Tmra).

- **Reduced Air Flow** - The equipment has no cooling fans and depends on convection for cooling. Installation in a rack may cause an excessive heat rise if sufficient air flow is not available. Installation should be such that the amount of air flow required for safe operation of the equipment is not compromised.

- **Mechanical Loading** - Mounting of the equipment in the rack should be such that a hazardous condition is not achieved due to an uneven mechanical loading.

- **Circuit Overloading** – Consideration should be given to the connection of the equipment to the supply circuit and the effect that overloading of circuits may have on over current protection and supply wiring. Appropriate consideration of equipment nameplate ratings should be used when addressing this concern.

- **Reliable Earthing** – Reliable earthing of rack-mounted equipment should be maintained. Particular attention should be given to supply connections other than direct connections to the branch circuit (e.g., use power strips).

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2.1.3 CONNECTIONS

Rear panel connectors J2, J3, J5, J6, J7, and J8 are BNC type connectors. Mating connectors are not provided with the PTS as the type used depends upon the type of coaxial cable used.

Connector J4 is a 15 pin "D" type connector, DA-15P Cannon or equivalent. The mating connector is provided with the PTS.

Make all connections to the PTS rear panel and Option assemblies as follows:

- Ensure that the POWER switch is in the OFF position. Connect a primary power source to power input connector on rear panel of the 9700AT/9710AT power entry module, using the Power Cord provided.

- Make appropriate connections to 9700AT/9710AT Input/Output connectors to the rear panel of the PTS as well as any Option Assemblies.

Note: Input /Output cable assemblies are not supplied, and must be fabricated, using the connector plugs supplied with the 9700AT/9710AT. Refer to Chapter One and the Option Description(s) for connector type, J-numbers and pin assignments.

- Connect a Carrier Modulated Code to the input connector (J2) if desired.

- An External Frequency, any integer of 1 through 10 MHz (1, 2, 3 MNz, etc.) input to the PTS, at rear panel BNC connector J8, may be used to operate the PTS in lieu of the internal oscillator. This input must be TTL Square Wave or Sine Wave with a minimum amplitude of 1 volt Peak-to-Peak and a maximum of 5 volts Peak-to-Peak into a 50 Ohm load.

Note: When an External Frequency is input to the PTS via J8, the External Frequency input is automatically used. When it is removed, the Internal Oscillator is automatically selected for use.

- If the 9700AT/9710AT is to be used as a Tape Search Control Unit, connect the Tape Search output connector to the reproducer.

- The unit is now ready for operation

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2.2 OPTION CARD INSTALLATION PROCEDURE

The following procedure should be adhered to when installing any option card assembly:

- Disconnect power from the 9700AT/9710AT.
- Select an open option slot and remove the two assembly securing clips from the slot rails. See Option Installation, Figure 2.2.1 and rear panel views Figure 2.2.2 and 2.2.3.
- Configure and verify the settings of the option card. Refer to the Option Description supplied with the card or furnished in the back of this User's Guide.
- Insert the module into the selected option slot, being careful that the components are on the upper side of the module.
- Reattach the securing clips to the slot rails.
- Attach any applicable I/O cables, and apply power to the unit.

Option Installation

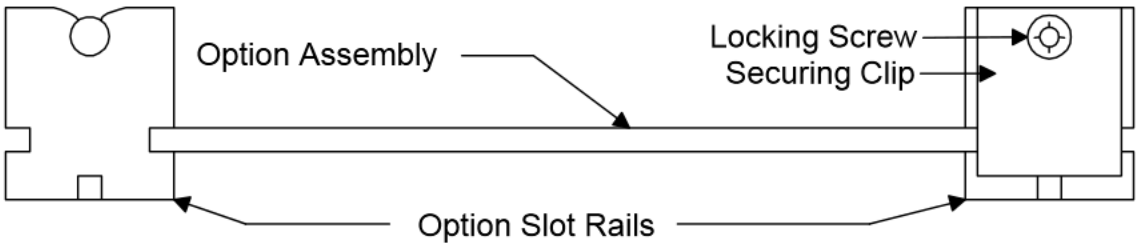


Figure 2.2.1

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Rear View 9700AT



Figure 2.2.2

Rear View 9710AT

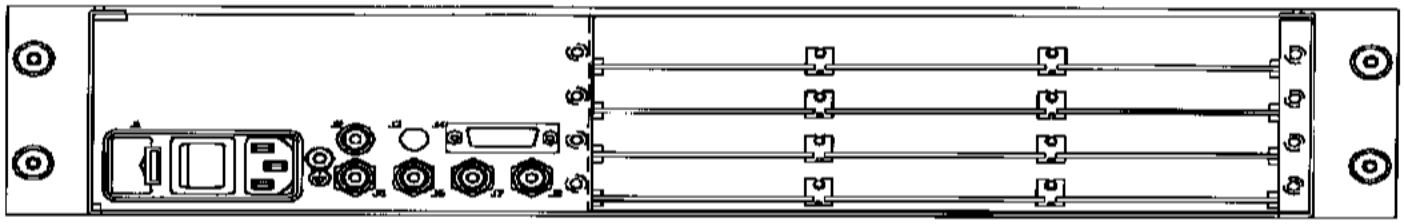


Figure 2.2.3

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CHAPTER THREE
OPERATION

3.0 INTRODUCTION

The PTS features two independent displays, an LED Time display and a LCD Display (MENU) of instrument function and user selections. Immediately below the LCD Display are sixteen push-button switches. The switches at either end are used to select the next or previous menu. The remaining fourteen switches are used to make selections from the menu.

In many cases when a selection is made, the menu is automatically changed to the next menu. If the operator wishes to retain the previously made selection, he may simply press the NEXT switch. Once made, a selection remains in memory indefinitely until changed by the operator.

3.1 CONTROLS AND INDICATORS

With the exception of the POWER switch, all of the normal operating controls of the PTS are located on the front panel. Their purposes and functions are described in the following paragraphs.

9700AT Front Panel

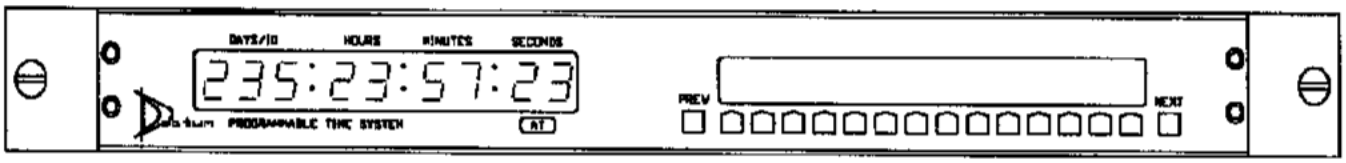


Figure 3.1

Note: The only difference between the 9700AT and the 9710AT is the height. The location of the displays and controls are the same.

3.2 CONTROLS

The following is an explanation of the controls used in this unit:

3.2.1 POWER SWITCH

The POWER Switch is rocker type switch, located on the rear panel Power Entry Module of the unit. It controls application of AC power to the unit. The internal battery for backup time keeping is not controlled with this switch.

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3.2.2 NEXT SWITCH

The NEXT switch is used to change the LCD Display to the next menu. When the end of a series of menus is reached, this switch selects the menu most likely to be used next. This switch is located in the lower right hand corner of the front panel. See Figure 3.1.

3.2.3 PREV SWITCH

The PREV switch is used to change the LCD Display to the previous menu. The PREV is located near the bottom center of the unit. See Figure 3.1.

3.2.4 SELECT SWITCHES

The remaining switches, located between the NEXT and PREV switches (See Figure 3.1), are used to make the selections within a menu. Most menus have a function on the top line, and selections on the bottom line. The bottom line thereby identifies the purpose of the SELECT switches. The purpose of these switches changes when the menu changes. When two or more switches are below a legend, any of them may be used for that selection.

3.3 INDICATORS

The following paragraphs give an explanation of the indicators used in this unit:

3.3.1 LCD DISPLAY

The LCD Display is used to display menus for operator prompting, instrument status, and the function of the select switches. The LCD Display is located on the right half of the front panel just above the SELECT switches. See Figure 3.1.

3.3.2 LED DISPLAY

The LED Display is normally used to display Time-of-Year. The time displayed is automatically selected from the Generator or the Translator according to the menu chosen. The LED Display is located on the left half of the PTS front panel. See Figure 3.1.

3.3.3 BEEPER

The BEEPER provides audible confirmation whenever an operating control is activated. The BEEPER is located on the Generator PC board just behind the LED Display.

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3.4 OPERATING PROCEDURES

This section contains operating procedures for the PTS. All units are capable of operation in the GENERATOR or TRANSLATOR mode. Those supplied with the Tape Search Option can also operate in the TAPE SEARCH mode. Selection of any optional mode not supplied results in the LCD Display changing to that shown in Figure 3.4.1. Pressing any switch will exit this menu.

Selection Not Installed Display

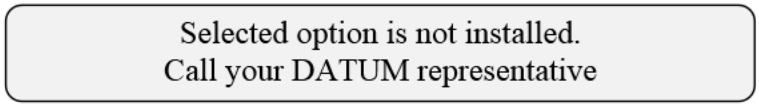


Figure 3.4.1

3.5 POWER ON/OFF

Push the POWER switch to the ON position to activate the unit.

To remove power from the unit, push the POWER switch to the OFF position.

Note that the POWER switch has no effect on the internal backup time keeping circuitry, although POWER must be ON to charge the backup battery.

When power is first applied to the unit, a self-test and diagnostic procedure is performed. During the several seconds this takes, the condition of the displays are indeterminate. Following self test the "HELLO" Message, as shown in Figure 3.5.1, will be displayed on the LCD Display. In units equipped with the Power On Translate option, the LCD Display will display the menu as shown in Figure 3.5.2, and Translator time will appear on the LED Display. The LED Display will indicate Time-of-Year if the Generator is running. If stopped, a LED test will be performed, and then day one will be displayed. Any other display indicates a failure.

HELLO Message Display

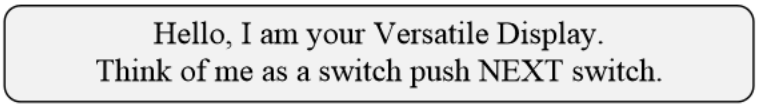


Figure 3.5.1

Power On Translate Option Display

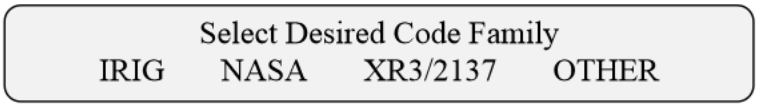


Figure 3.5.2

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3.6 MENU SELECTIONS

The SELECT switches provide manual control of the PTS. The function of these switches changes when the menu is changed. The menu may be changed by pressing the NEXT switch, the PREV switch, or one of the select switches.

The progression of menus is broken into logical sequences for the three distinct functions of the PTS: Generator, Translator, and Tape Search (Optional). In order to avoid operator confusion, the menus corresponding to options, which are not included in a specific unit configuration, are not accessible to the user. If selected, the message shown in Figure 3.4.1 will appear on the LCD Display. Menus for the Computer I/O's are accessed from the Generator Menu, as the Generator is present in all unit configurations. The menus relating to the hardware options are presented with the Option Description.

In some instances, a menu selection requires a mode change in the unit. The following Warning Message shown in Figure 3.6.1 will appear to remind the user of a mode change:

Warning Message

```
WARNING! This selection will change time
Output and LED display. PROCEED? YES  NO
```

Figure 3.6.1

The unit will only proceed to a different mode if YES is selected from this menu. If NO is selected, the unit will revert to the previous menu and the mode remains intact.

In this chapter each menu will be depicted. The menus, which may be accessed from this initial menu, are shown below it, along with explanatory text, when additional clarity is needed.

Once a set-up parameter has been input, i.e. Translate IRIG B, that menu may be subsequently skipped over by continuously pressing the NEXT switch. Observe that when a Generator Menu is displayed, the Translator ceases to function even though the Generator is continuous when the Translator or Tape Search is being used. Tape searching is stopped when the AUTO-S or MAN-S menus are exited. The new user is encouraged to experiment with the selection of the different menus and operating modes.

3.6.1 CHANGE DISPLAY FORWARD OR BACKWARD DISPLAY

The following is an introduction to the NEXT and PREV switches. Pressing the NEXT switch while the "HELLO Message Display" as shown in Figure 3.5.1 is displayed, will access the NEXT/PREV Switch Explanation Display.

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NEXT/PREV Switch Explanation Display

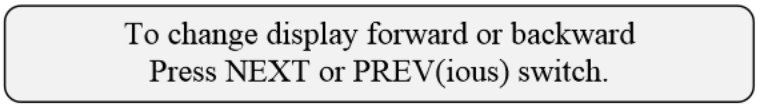


Figure 3.6.1.1

This display merely explains the use of the NEXT and PREV switches located on the front panel of the PTS.

Pressing the NEXT switch again will result in changing to the Explanation of Switch Display as shown in Figure 3.6.2.1

Pressing the PREV switch results in the Hello Message Display as shown in Figure 3.5.1

3.6.2 EXPLANATION OF SWITCH DISPLAY

The Explanation of Switch Display, Figure 3.6.2.1, explains that the top line of the display will show the switch function such as Select Generator Mode. The bottom line is the selection to be made such as SET-UP or OPERATE. See Example Figure 3.6.2.2.

Explanation of Switch Display

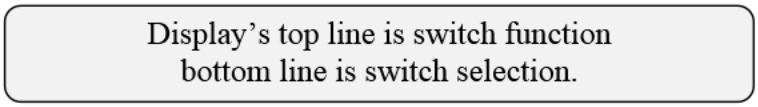


Figure 3.6.2.1

Example



Figure 3.6.2.2

Pressing the NEXT switch will cause the display to change to that of the Introduction to Select Switches display shown in Figure 3.6.3.1

Pressing the PREV switch will return the LCD Display the NEXT/PREV Switch Explanation Display, Figure 3.6.1.1.

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3.6.3 INTRODUCTION TO SELECT SWITCHES DISPLAY

The Introduction to Select Switches Display shown in Figure 3.6.3.1 explains the use of the switches to make the selection desired from a menu screen. See Figure 3.6.3.2 for an example of using the switches.

Introduction to Select Switches Display

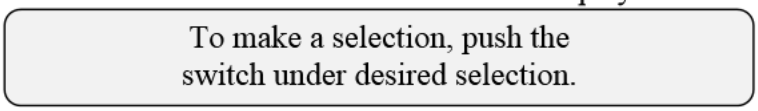


Figure 3.6.3.1

Example



Figure 3.6.3.2

The example shows the Generator Select Mode select Screen. If either of the switches directly below SET-UP is pressed, access to the SET-UP Generator menu screen would appear on the LCD Display. Pressing either of the switches directly below OPERATE would select the OPERATE Generator menu screen to appear on the LCD Display.

Pressing the NEXT switch will advance the LCD display to the Select Versatile Display Function Menu screen shown in Figure 3.6.4.1.

When the PREV switch is pressed while the Introduction to Select Switches Display is shown the LCD Display will revert to the Explanation of Switch Display, Figure 3.6.2.1

3.6.4 VERSATILE DISPLAY FUNCTION MENU

This display, the Versatile Display Function Menu, allows the user to select the mode of operation in which the PTS is to operate.

Versatile Display Function Menu



Figure 3.6.4.1

Selecting GENERATOR from the menu by pressing any key beneath GENERATOR will result in the Select Generator Mode display, Figure 3.7.1 in Paragraph 3.7 being displayed.

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Depressing any of the switches under TRANSLATOR causes the LCD Display to changing to the Warning Message, Figure 3.8.2, prior to entering the Set-up Translator Menu, Figure 3.8.1 in Paragraph 3.8 Translator Operation.

Selection of the TAPE SEARCH mode of operation is accomplished by pressing any of the switches under TAPE SEARCH. Selecting TAPE SEARCH will change the LCD Display to the Warning Message, Figure 3.8.2, prior to entering the Select Tape Search Mode Menu screen if the Tape Search option assembly, PTS Option 02/02A is installed. If this option in installed see PTS 02/02A Option Description, located in the envelope on the inside of the rear cover of this User's Guide for menus and operation.

3.7 GENERATOR OPERATION

The initial menu, as shown in Figure 3.7.1, for the Generator Function requires the user to choose between SET-UP and OPERATE modes. The Generator Time is displayed on the LED Display whenever a Generator function is displayed on the menu. When powered down with the Generator stopped it, will power up stopped and time set to day one, so you can go directly to the SETUP menu and preset the time. Conversely if the Generator is running, it may be desirable to go to the OPERATE menu and stop the Generator before presetting time. It is not necessary to stop the Generator to preset time, so a shift to daylight savings time (for example) can be easily accomplished.

Select Generator Mode Menu



Figure 3.7.1

Using either of the switches below SET-UP will change the LCD Display to that shown in Figure 3.7.7.1 for user use in controlling the Generator.

Pressing the PREV switch will return the LCD Display to the Versatile Display Function Menu, Figure 3.6.4.1.

3.7.1 GENERATOR OPERATE MENU

Using either of the switches below OPERATE will change the LCD Display to that shown in Figure 3.7.1.1.

This menu provides controls for starting and stopping the Generator, and access to menus for manual or automatic synchronization. To start the generator press the START switch, located beneath START. To stop the Generator the two stop switches must be activated in sequence, STOP (1) then STOP (2). When stopped, the sub-seconds time is set to zero or to the amount of propagation delay.

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Generator Operate Menu

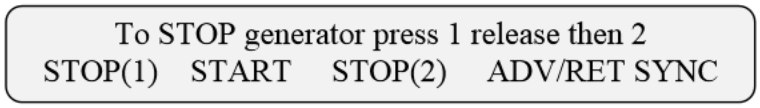


Figure 3.7.1.1

Pressing the NEXT or PREV switch while this menu is displayed will return the LCD Display to the Select Generator Mode Menu shown in Figure 3.7.1.

Access to the Advance/Retard Menu can be obtained by pressing the appropriate switches below the desired function. See Paragraph 3.7.2.

Access to the SYNC Select Menu is accomplished by pressing the switch beneath "SYNC". This leads to the SYNC Select Menu being displayed on the LCD display as shown in Figure 3.7.1.2.

SYNC Select Menu

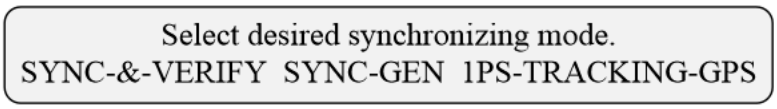


Figure 3.7.1.2

The SYNC-&-Verify selection is made by pressing any switch under SYNC-&-VERIFY. See Paragraph 3.7.4, Sync & Verify Operation, for an explanation of the Sync-&-Verify selection.

Selecting 1PS-TRACKING will change the LCD Display to the 1PPS Tracking Control Menu. See Paragraph 3.7.5 and Figures 3.7.5.1 or 3.7.5.2 depending on whether or not the PTS Option 21, 100nS Propagation Delay Assembly, is installed.

GPS SYNC is an Option. See Paragraph 3.7.6 for GPS SYNC Operation.

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3.7.2 ADVANCE/RETARD OPERATION

Selecting ADV/RET from the menu screen shown in Figure 3.7.1.1 changes the LCD to the ADV/RET Menu Screen shown in Figure 3.7.2.1.

This menu provides the controls for manually advancing or retarding the time generated by the PTS. First select the desired rate, which will be indicated by a blinking digit, then press a switch under ADV or RET until the desired positioning has been achieved. If necessary, the rate can be changed and the procedure repeated.

ADV/RET Menu Screen

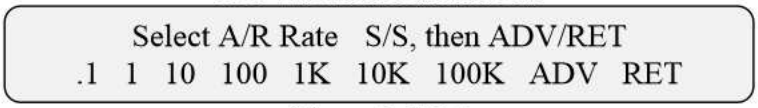


Figure 3.7.2.1

The Advance/Retard Rate is changed by depressing the switch under the desired rate .1, 1, 10, 100 etc. This will cause the selected rate to blink.

Pressing the NEXT or PREV switch changes the LCD Display to the Generator Operate Menu, Figure 3.7.1.1.

3.7.3 SYNC GEN OPERATION (OPTIONAL)

If PTS Option 21 is installed, selecting SYNC GEN from the Sync Select Menu, Figure 3.7.1.2 results in the Sync-Gen Menu screen; Figure 3.7.3.1 being displayed on the LCD Display.

Sync-Gen Menu Screen



Figure 3.7.3.1

This menu is used to control the synchronized generator and to indicate a LOSS or NORM(al) level of code into the Translator. Input for the Sync Gen operation may come from the optional GPS module or the code input to the Translator. The Sync Gen function may be enabled or disabled using the appropriate switch. Tracking continues at the rate stored when a loss of input occurs if enabled. The stored rate may be reset, by depressing the switch below RESET.

In units equipped with the Disciplined Oscillator, PTS Option 22, the DISC - ON - OFF switches control the function. The SYNC GEN must be enabled for disciplining to operate in the SYNC GEN mode. Disciplining provides an analog voltage for control of the internal oscillator. It will not work with the external oscillator. DISC - ON - OFF also functions with 1PPS Tracking if installed.
The internal oscillator may be adjusted while tracking to minimize the tracking rate. See Chapter Five.

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Several seconds (or minutes, if disciplined) are required for the oscillator to settle.

The menu displayed in Figure 3.7.3.1 shows input code to be normal, SYNC GEN to be disabled, and disciplining to be OFF. If the proper code input level was not present, Loss would be shown after Code.

Enabling or Disabling the SYNC-Gen mode is accomplished by pressing a switch under the desired mode. The selected mode will appear in upper case letters.

To set optional Disciplining ON or OFF press the switch directly below the desired function and the display will change the selected mode to upper case letters.

3.7.4 SYNC & VERIFY OPERATION

See SYNC Select Menu, 3.7.1.2.

This selection initiates a synchronizing sequence. The PTS can synchronize to IRIG A, IRIG B, or any 1KHz carrier, one frame per second code which the unit translates. The code is applied to the Translator input (J2) and must be selected on the Translator Code Select Menu. Attempting to Sync and Verify to a code not selected can cause the Generator to lock-up. If this happens perform a Manual System Reset, See Chapter Five, Paragraph 5.3.5.

A message showing "synchronizing" will be displayed on the LCD Display while the unit is synchronizing to the input code and "synchronized" will appear momentarily when synchronization is complete then return to the LCD Display to the SYNC Select Menu, Figure 3.7.1.2.

If the input is bad or has not been properly selected a fault message will appear.

Pressing the NEXT or PREV switch changes the LCD Display to the Generator Operate Menu, Figure 3.7.1.1.

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3.7.5 1PPS TRACKING OPERATION

See SYNC Select Menu, Figure 3.7.1.2.

The following menus are used for control of 1PPS Tracking with and without Prop Delay, respectively. When the optional Prop Delay plug-in module is installed, selection of the Tracking Edge is under menu control and Prop Delay may be used to offset the Generator. Tracking is enabled or disabled by use of the appropriate switch. If the PROP Delay plug-in module is not installed, the alternate edge of 1PPS can be tracked by switching jumper, located on the Generator Assembly of the unit, E9 to E10 or E10 to E11.

1PPS Tracking with the PROP Delay Assembly installed requires that a 1PPS, TTL level, signal be connected to BNC connector J1 of the PROP Delay Assembly.

Selection of 1PS-Tracking from the SYNC Select Menu, Figure 3.7.1.2, will cause the LCD Display menu to be as shown in Figure 3.7.5.1.

1PPS Tracking Control Menu (Optional Prop Delay Assy. Installed.)

SELECT ON-TIME EDGE	1PPS TRACKING
POSITIVE negative	ON off

Figure 3.7.5.1

Selecting the ON-TIME Edge is accomplished by pressing any switch below the desired edge, either Positive (rising) or Negative (falling). The ON-TIME Edge selected will be shown in upper case letters on the LCD Display.

1PPS TRACKING may be turned either ON or OFF by depressing the switch below either ON or OFF. The selected 1PPS TRACKING mode ON or OFF will be displayed in upper case letters.

Figure 3.7.5.2 illustrates the display shown on the LCD Display when 1PS-TRACKING is selected from the SYNC Select Menu with the Optional PROP Delay Assembly not installed.

1PPS Tracking Control Menu (Option Assy. Not Installed.)

This option disables	1PPS TRACKING
propagation delay	on OFF

Figure 3.7.5.2

The 1PPS Tracking mode can be either set to ON or OFF by pressing the switch directly under the desired mode. The mode selected will be displayed in upper case letters.

A 1PPS, TTL level, signal must be connected to rear panel BNC connector J7, for 1PPS Tracking to operate if the PROP Delay Assembly is not installed.

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Pressing the NEXT or PREV switch changes the LCD Display to the SYNC Select Menu, Figure 3.7.1.2.

3.7.6 GPS SYNC OPERATION (OPTIONAL)

See SYNC Select Menu, Figure 3.7.1.2.

If the GPS SYNC option is installed, see Option Description, PTS Option 35 for menus and operation. This Option Description can be found in the envelope attached to the inside rear cover of this User's Guide.

3.7.7 GENERATOR SET-UP

Selecting SET-UP from the Select Generator Mode Menu, Figure 3.7.1, leads to the Generator Set-Up Menu screen shown in Figure 3.7.7.1.

This menu provides a selection of other menus to set-up the Generator and the Computer I/Os.

Generator Setup Menu

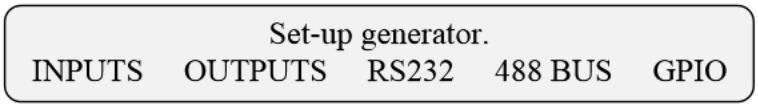


Figure 3.7.7.1

Selecting NEXT will revert the LCD Display to that shown in Versatile Display Function Menu, Figure 3.7.7.2.

Versatile Display Function Menu



Figure 3.7.7.2

Selecting PREV will revert the LCD Display to that shown in Figure 3.7.7.3, the Select Generator Mode Menu.

Select Generator Mode Menu



Figure 3.7.7.3

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3.7.8 GENERATOR SET-UP INPUTS

From the Generator Set-Up Menu, Figure 3.7.7.1, the Select Generator Inputs Menu will appear on the LCD Display when "INPUTS" is selected as shown in Figure 3.7.8.1.

Set-Up Generator Inputs Menu

```
Set-Up Generator Inputs.
TIME  PROP DELAY  CNTRL FUNC  EXT START
```

Figure 3.7.8.1

This menu is used to select a menu to input data to the Generator. The four choices permit presetting Time-of-Year (TIME), presetting Propagation Delay (PROP DELAY), inputting Control Functions (CNTRL FUNC), or preparing the PTS for an External Start Input (EXT START).

3.7.9 INPUTTING TIME

Selecting "TIME" from the Set-Up Generator Inputs Menu, Figure 3.7.8.1, by pressing a switch below TIME will generate the Preset Time Display Menu shown in Figure 3.7.9.1 on the LCD Display.

Preset Time Display Menu

```
PRESET GENERATOR    (0=LY) X:XXX:XX:XX:XX
   0  1  2  3  4  5  6  7  8  9 CURSOR < >
```

Figure 3.7.9.1

This menu is used for setting Time-of-Year into the Generator.

Presetting is accomplished by using the switches, located under the numbers, for numbers zero through nine, and the cursor left "<" and cursor right ">" switches.

When this menu is selected, the cursor will be positioned at the far left (Leap Year) position. When a digit is entered, the cursor automatically moves right to the next digit. If desired, the cursor may be moved without changing a digit by use of the cursor right or left switches. The cursor wraps around at either end.

It is the operator's responsibility to ensure that only legal times are entered. Leap Year days radix is provided for by the LY digit left of days. This digit should be 0-3, 0 during Leap Year, 1 the next year, etc. This digit is automatically incremented each year.

Pushing NEXT from this menu will advance to the Generator Operate Menu, Figure 3.7.9.2 allowing the user to start the Generator immediately.

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Generator Operate Menu



Figure 3.7.9.2

Pushing the PREV while the Preset Time Menu is displayed will return the LCD Display to the Set-Up Generator Inputs screen, Figure 3.7.8.1.

3.7.10 INPUTTING PROPAGATION DELAY

The Set Propagation Delay screen as shown in Figure 3.7.10.1 is displayed on the LCD Display when it is selected from the Select Generator Inputs Menu.

Set Propagation Delay Screen



Figure 3.7.10.1

Any propagation delay between 0 and 997.0000 mS (milliseconds) may be selected. The Generator must be stopped to enter a Propagation Delay.

When this menu is selected, the cursor will be on the far left digit next to the (+) sign. Digits for the desired PROP DELAY are entered using the switches located under the numbers 0 through 9. When a digit is entered, the cursor automatically moves right to the next digit. If desired, the cursor may be moved without changing a digit by use of the cursor right ">" or cursor left "<" switches. The cursor wraps around at either end.

3.7.11 SETTING CONTROL FUNCTIONS

When Control Functions (CNTL FUNC) is selected from the Select Generator Inputs Menu, shown in Figure 3.7.8.1, the LCD Display will change to show the Control Function Bit Display (1) as shown in Figure 3.7.11.1.

Control Functions entered from these screens are inserted into the Serial Time Code Output of the basic PTS. They are also output via the Control Function Outputs option if installed.

A "0" represents the OFF condition of the Control Function Bit and a "1" represents the ON condition.

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Pressing the switch below a Control Function Bit number will change it to a "1" if it is a "0" or to a "0" if is a "1".

Up to five groups of nine bits of Control Functions may be accessed. Control Function Bit Display (1) is the first.

Control Function Bit Display (1)

TOGGLE CF BIT	0	1	2	3	4	5	6	7	8
	0	1	0	1	0	0	1	1	0

Figure 3.7.11.1

Pressing the PREV switch while this display is shown will return the LCD Display to the Set-Up Generator Inputs Menu screen.

Pressing the Next switch will change the LCD Display to show Control Function Bits 9 through 17, which allows for setting Control Function Bits 9 through 17.

Pressing the NEXT switch while Control Function Bits 9 through 17 are shown will change the Control Function Bits to 18 through 26 allowing them to be changed.

When Control Function Bits 18 through 26 are shown on the LCD Display, pressing NEXT will change the Control Function Bits to 27 through 35 allowing them to be changed.

While Control Function Bits 27 through 35 are displayed, pressing NEXT will change the LCD Display to show Control Function Bits 36 through 44, which may be changed.

Pressing the PREV switch while any of the above screens are shown will change the LCD Display to the last (previous) screen shown.

Pressing NEXT while Control Function Bits 36 through 44 are shown will cause the LCD Display to return to the Set-Up Generator Inputs Menu screen, Figure 3.7.8.1.

3.7.12 EXTERNAL START PROCEDURE AND SET-UP

The purpose of this menu screen is to set-up the Generator to start at a preset time on the second.

For External Start operation, the jumper between E10 and E11 should be moved to between E9 and E10 on the Generator board.

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To use the External Start feature of this unit one must use the following procedure.

- Connect a 1PPS, TTL level, signal to rear panel BNC connector J7 if the PROP Delay Assembly is not installed. If the PROP Delay Assembly is installed, connect a 1PPS, TTL level, signal input to J1 of the PROP Delay Assembly.
- Stop the Generator as described in Paragraph 3.7.1 of this Users Guide.
- Preset the Generator to the desired start time as described in Paragraph 3.7.9 of this User's Guide.
- Using the External Start Setup Menu, Figure 3.7.12.1; select the Starting Edge desired.
- ARM the External Start one (1) Second prior to the entered start time.
- On the next selected edge of the External Start input signal the Generator will start.

The LCD Display screen shown when EXT START is selected depends upon whether the PROP DELAY Assembly is or is not installed.

The LCD Display will be as shown in Figure 3.7.12.1 if the PROP Delay Assembly is not installed and as in Figure 3.7.12.2 if the 100nsPROP Delay Assembly, PTS Option 21, is installed.

External Start Setup (PROP Delay Option not installed.)

```
SELECT STARTING EDGE   ARM 1 SECOND EARLY
   POSITIVE  negative          ARM
```

Figure 3.7.12.1

This menu is used to select the active edge of start pulse applied to rear panel BNC connector J7 and to "ARM" the PTS to start on the next second.

Selection of the Starting Edge is accomplished by using a switch located below the desired edge to be used, either Positive or Negative. The selected edge will displayed on the LCD Display in uppercase letters.

Pressing the switch under ARM will cause a decimal point on the TENS of HOURS LED, on the LED Time-of-Year Display, to illuminate indicating the unit is "Armed". It will then start the Generator on the selected edge of the next 1PPS input pulse.

External Start Setup (PROP Delay Option installed.)

```
Select desired start source, then arm.
tick- -PULSE    EDGE- -POS- - -neg    ARM
```

Figure 3.7.12.2

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This menu is used when the external start input is either be a "TICK", if option with Tick Shaper is installed, or a pulse. The start source should be connected to J1 of the Option Assembly. If using a pulse, select PULSE and the desired edge. Selecting TICK, if this option is installed, forces the edge to be correct.

Selection of the Edge of the start pulse to be used to start the PTS is accomplished by using a switch located below the desired edge to be used, either Pos or Neg. The selected edge will be displayed on the LCD Display in uppercase letters.

Pressing the switch under ARM will cause a decimal point on the TENS of HOURS LED on the LED Time-of-Year Display to illuminate indicating the unit is armed. It will then start the Generator on the selected edge of the next 1PPS input pulse.

3.7.13 SETTING GENERATOR OUTPUTS

Selecting "OUTPUTS" from the Generator Setup Menu, Figure 3.7.13.1 changes the LCD Display to the Select Generator Output Menu, Figure 3.7.13.2

Generator Setup Menu

Set-up generator.				
INPUTS	OUTPUTS	RS232	488 BUS	GPIO

Figure 3.7.13.1

Select Generator Outputs Menu

Select Generator Outputs.			
ID on-OFF	LS on-OFF	SPEEDUP	RE/GEN

Figure 3.7.13.2

3.7.14 SELECTING ID (OR DAYS)

The Generator Outputs Menu, Figure 3.7.13.2, permits selection of the ID mode for the Generator. This selection allows the user to utilize the Days portion of the display, and in the Code Output, as a three digit ID (Identification Number). When ID has been set to ON, on will be in upper case letters and off will be in lower case letters. With ID "ON", days are not updated at midnight rollover. Normally ID is OFF.

To enter an ID Number, use Inputting Time as described in paragraph 3.7.9 to enter the desired ID Number in the Days portion.

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3.7.15 SELECTING LS (LEAP SECONDS)

The Select Generator Outputs Menu provides a method of setting Leap Seconds as either ON or OFF. Setting Leap Second (LS) "ON" any time within 24 hours prior to midnight will automatically add 1 Second to the Day, at midnight, and will then set itself to "OFF"

"ON" or "OFF" being in upper case letters designates the current mode selection of the function.

3.7.16 SELECTING GENERATOR SPEED-UP OR RE/GEN

A multiplier for the optional SPEED-UP Generator and re-generate (RE/GEN) code may be selected here provided the Multi-Code Serial Encoder option is installed. For SPEED-UP and RE/GEN menus and operation, see PTS Option 15 Multi-Code Serial Encoder Option Description, located in an envelope attached to the inside rear cover of this User's Guide.

3.7.17 RS-232 INTERFACE OPERATION (OPTIONAL)

Back on the Generator Set-Up Menu, Figure 3.7.13.1, selecting the RS-232 mode of operation will lead to the LCD Display showing the Selection Not Installed Display, Figure 3.7.14, if the RS-232 I/O Option, PTS Option 06, has not been installed.

If PTS Option 06 has been installed, a menu screen will appear. See PTS Option 06A/B RS-232/RS422 Interface Assembly Option Description, located in an envelope attached to the inside rear cover of this User's Guide, for menu use and operation.

PTS Option 07 does not use the LCD Display setup menus. For its use and operation, see PTS Option Description 07A/07B, RS-232/RS-422 Interface Assembly, located in the envelope attached to the inside rear cover of this User's Guide.

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Selection Not Installed Display

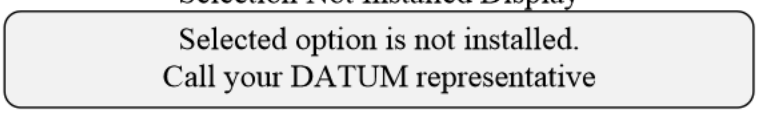


Figure 3.7.14

3.8 TRANSLATOR OPERATION

The following paragraphs provide information on the Set-up and operation of the PTS in the Translator mode.

The Translate functions, Code, Filters, Direction and Polarity are stored and Memory and will remain there until changed or upon initiating a PTS Reset.

Translator operation and set-up is selected from the Select Versatile Display Function Menu screen shown in Figure 3.8.1

When Translator is selected from the Versatile Display Function Menu the Warning Message as shown in Figure 3.8.2 will appear on the LCD Display.

Versatile Display Function Menu



Figure 3.8.1

Warning Message

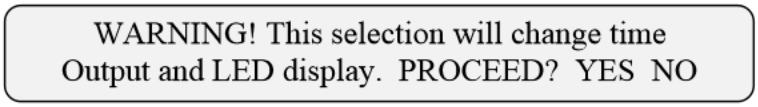


Figure 3.8.2

The unit will only proceed to a different mode if YES is selected from this menu. If NO is selected, the unit will revert to the previous menu and the mode remains intact.

Selecting YES from the Warning Message screen will change the LCD Display to the Set-Up Translator Menu shown in Figure 3.8.3

Set-up Translator Menu



Figure 3.8.3

Frequently there will be no reason to proceed beyond this menu as the LED Display shows translated time, and all outputs are available as previously set-up.

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When the Translator is initially powered up, it may be necessary to select the Serial Time Code being input to the Translator at BNC connector J2 on the rear panel of the unit. To select the desired input code press the NEXT switch which will change the LCD Display to the Select Desired Code Family Menu screen as shown in Figure 3.8.1.1.

The functions after CODE, AC-dc, select whether the input code is Amplitude Modulated (AC) or DC Level Shift (DC). If the Failsafe (Narrow and Wide) and DC Code option, PTS Option 17, is not installed, selecting DC will not change the function, and AC will remain in upper case letters as it will be the selected type of input. If PTS Option 17 is installed see PTS Option 17, Failsafe (Narrow and Wide) and DC Code Option Description, located in the envelope inside the rear cover of this User's Guide, for use of menus and use of the option.

The FAILSAFE function OFF will be in upper case letters if the DC Code Option, PTS Option 17, is not installed. It can only be changed if the DC Code option is installed and selected.

The FAILSAFE selections ON/OFF – w – n are only functional when PTS Option 17 is installed. See PTS Option 17 Option Description, located in the envelope inside the rear cover of this User's Guide, if this option is installed, for menu and use and operation.

The SLOW CODE selection requires that the Slow Code Assembly, PTS Option 18, be installed. If the option is installed see PTS Option 18 Option Description, located in an envelope on the inside of the rear cover of this User's Guide, for menu use and operation.

3.8.1 TRANSLATOR CODE INPUT SELECTION

The following menus and descriptions are used to allow the user to select type of Serial Time Code being input to the Translator.

Select Desired Code Family Menu

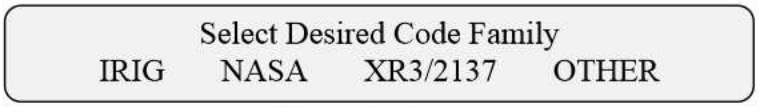


Figure 3.8.1.1

Selecting IRIG, by pressing the switch below IRIG, leads to the Select Desired IRIG Code Menu as shown in Figure 3.8.2.1, on the LCD Display, allowing the user to select any of the IRIG Serial Time Codes shown to be translated. Selecting NASA changes the LCD Display to the Select Desired NASA Code Menu, Figure 3.8.3.1 and selecting XR3/2137 causes the Select Desired Code Menu, Figure 3.8.4.1 to be displayed on the LCD Display screen.

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3.8.2 TRANSLATOR IRIG CODE INPUT SELECTION

The Select Desired IRIG Code Menu allows the user to select the Desired IRIG Serial Time Code to be translated by the Translator.

Pressing the PREV switch while this menu is shown on the LCD Display will return it to the Set-Up Translator Menu, Figure 3.8.3.

Select Desired IRIG Code Menu

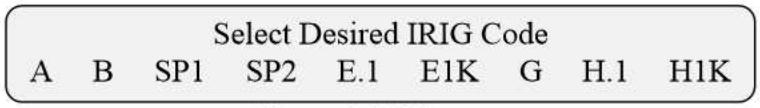


Figure 3.8.2.1

A blinking cursor appears at the presently selected IRIG code to be translated. If the desired code has been selected, pressing the NEXT switch will cause the Translating Menu, Figure 3.8.5.1 to be displayed on the LCD Display.

If there is not a blinking cursor on this menu no IRIG code has been selected. If it is desired to see what input code has been selected press the NEXT switch and the Translating Menu, Figure 3.8.5.1, will appear on the LCD Display showing the selected Translator code selected in the upper right hand corner after "Translating".

If the input code is different than that shown on the display, it is necessary to select the correct code. Changing the code selection is accomplished by pressing the switch beneath the desired code. When the new desired code is selected the LCD Display will change to that shown in Figure 3.8.5.1 with the selected code being translated shown in the upper right hand corner of the display.

The selection of SP1 or SP2 are reserved for translation of special codes, and the message "Selected option is not installed…(See Figure 3.4.1) will appear. If either one of these special codes are provided, its option description will be in the Option Envelope.

3.8.3 TRANSLATOR NASA CODE INPUT SELECTION

The Select Desired NASA Code Menu, Figure 3.8.2.1, is used to select the NASA code to be translated. If the code has previously been selected, skip to the Translating Menu, Figure 3.8.5.1 by pressing NEXT. To select a code, push the corresponding switch.
Pressing the PREV switch while the Translating Menu is shown on the LCD Display will return it to the Set-Up Translator Menu, Figure 3.8.3.

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Select Desired NASA Code Menu



Figure 3.8.3.1

A blinking cursor will appear on the selected code to be translated. If the desired code has been selected, pressing the NEXT switch will cause the Translating Menu, Figure 3.8.5.1 to be displayed on the LCD Display.

If no blinking cursor appears on this menu, none of the NASA codes have been selected. Pressing the NEXT switch causes the Translating Menu Figure 3.8.5.1 to appear on the LCD Display showing the selected Translator Code in the upper right hand corner after "Translating".

Should the input code be different than that previously selected, it is necessary to select the correct code. Selecting the correct code is accomplished by pressing the switch beneath the desired code. When the new code selection is made, the LCD Display will change to that shown in Figure 3.8.5.1 with the selected code being translated shown in the upper right hand corner of the display.

Selection of 28.1 corresponds to NASA 28 with a carrier frequency of 100 Hz. Selection of NASA 28 with a carrier frequency of 1KHz. (Optional)

3.8.4 TRANSLATOR XR3/2137 CODE INPUT SELECTION

The Select Desired XR3/2137 Code Menu, Figure 3.8.4.1, is used to select a code which is a member of the XR3 family to be translated. If the desired code has previously been selected, skip to the Translating Menu, Figure 3.8.5.1 by pressing NEXT.

Select Desired XR3/2137 Code Menu

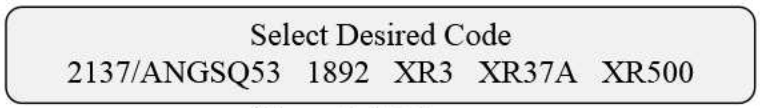


Figure 3.8.4.1

To select a code from this group, push the corresponding switch below the displayed code. Upon selection of a new code, the LCD Display will change to that shown in Figure 3.8.5.1 with the selected code being translated shown in the upper right hand corner of the display.

Pressing the PREV switch while the Translating Menu is shown on the LCD Display will return it to the Set-Up Translator Menu, Figure 3.8.3.

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3.8.5 TRANSLATING MENU

This menu is normally displayed while translating. It shows the code being translated and the Filter, Direction, and Polarity selected.

Translating Menu

FILTER	DIRECTION Translating (SEL CODE)	
IN- - - OUT	rev-auto-FWD	Pol-NORM-inv

Figure 3.8.5.1

When any switch under FILTER "IN --- OUT" is selected from the Translating Menu, the LCD Display changes to the Select Filters Menu screen Figure 3.8.6.1.

When a switch is pressed below rev, auto or fwd under "DIRECTION" the direction is selected. The selected DIRECTION will be displayed in upper case letters. When REV is selected the Translator is forced into Reverse. When AUTO is selected, Auto Forward/Reverse detection is enabled. When FWD is selected, the Translator is forced into Forward.

Pressing the switch below norm or inv after Pol selects the Polarity of the incoming code. The selected Polarity will be displayed in upper case letters. NORM selects Normal Polarity and INV selects Inverted Polarity.

If the code into the PTS has normal Polarity, "NORM" should be selected. If the input code is inverted, "INV" should be selected. When the direction of the input code is reversed, a Polarity inversion takes place automatically to provide optimal translating capability.

The update rate of translated time on the LED Display is changed according to the code being translated, and the rate (real time versus speed-up). This can cause a peculiar appearance of the time display. If, for example, the seconds update ten times as fast as the display, they would not appear to change. Changing the code speed slightly could cause the seconds display to increment (or even decrement) at a slow rate. This phenomenon only occurs at rates much faster than real time.

Pressing NEXT or PREV will change the LCD Display to the Warning Message screen, Figure 3.8.2, which forces the user to make a decision on whether to proceed or not to proceed. Making the decision to Proceed "YES" returns the LCD Display to the Select Versatile Display Function Menu, Figure 3.8.1 allowing the user to select the PTS operating mode in which to operate.

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3.8.6 FILTERS

The Select Filters LCD Display as shown in Figure 3.8.6.1, provides for the enabling and disabling of independent filters for the Envelope and Carrier of the input code.

When the "IN" below CARRIER FILTER is selected "IN" will be displayed in upper case letters and "out " will be displayed lower case letters.

The Carrier Filter is a band pass filter, implemented with a Phase Lock Tracking filter, designed to remove extra, and/or supply missing carrier cycles.

The "COAST" switch enables/disables freewheeling during dropouts or loss (below the threshold set by R46) of input code. If the carrier frequency is not precise (within 1%) or if the fail-safe option is enabled, disable the carrier filter.

The Carrier Filter must be IN (enabled) for the "COAST" function to operate.

When "COAST" is displayed in upper case letters it is enabled. If "coast" is in lower case letters it is disabled.

Note: When reading codes with more than one second between elements, adjust the threshold for "space" cycles or enable "COAST" to prevent discontinuous translation.

Select Filters Display



Figure 3.8.6.1

The Envelope Filter is a two pole low pass filter designed to improve performance by removing higher frequencies from the input code.

When "IN" under ENVELOPE FILTER is selected, it will be in upper case letters and "out" will be in lower case letters. When IN, Filters appropriate to the real-time rate of the code are enabled. The appropriate filter for the code selected is preset when the input code was selected. For sped-up rated the Filter should be selected OUT.

When NEXT is pressed while the Select Filters Display is shown on the LCD Display it will change to the Play/Search Speed Menu as shown in Figure 3.8.6.2. Note that either (or both) the Envelope Filter or the Carrier Filter have to be selected IN.

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Play/Search Speed Menu

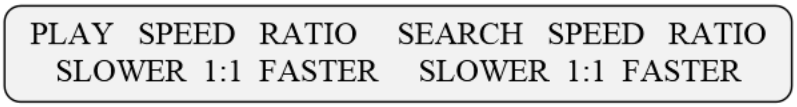


Figure 3.8.6.2

This menu provides for selecting the frequency of the filters during Playback operation and (optionally) Search operation. Filters are selected as a multiple of the real-time rate, in accordance with the previously selected code. If only the Envelope Filter is enabled, the filter frequency may be set higher than the input rate, but this must never be done when the Carrier Filter is enabled. To accommodate uncontrolled Tape Search speeds, the Search Filters may be selected OFF by going "faster" than the maximum rate.
The filters are selectable from nominal rates of 31.25Hz to 400KHz depending on the selected code. The actual corner frequency of the Envelope Filters is approximately one and a half times nominal, i.e. 1.5KHz for IRIG B at 1:1.

The PLAY SPEED RATIO and the SEARCH SPEED RATIO may be set slower by pressing any switch under SLOWER, or set faster by pressing any switch below FASTER.

The PLAY SPEED RATIO and the SEARCH SPEED RATIO selected is displayed on the LCD Display between SLOWER and FASTER for each.

For Tape Search operation see PTS Option Description, PTS 02/02A, which is located in the envelope on the inside of the rear cover of this User's Guide if the option is installed.

3.9 EXTERNAL FREQUENCY INPUT OPERATION

An External Frequency, any integer of 1 through 10 MHz (1, 2, 3 MHz, etc.) input to the PTS at rear panel BNC connector J8, and may be used to operate the PTS in lieu of the internal oscillator. This input must be TTL Square Wave or Sine Wave with a minimum amplitude of 1 volt Peak-to-Peak and a maximum of 5 volts Peak-to-Peak into a 50 Ohm load.

When an External Frequency is input to the PTS via J8, the External Frequency input is automatically used. When it is removed, the Internal Oscillator is automatically selected for use.

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CHAPTER FOUR
THEORY OF OPERATION

4.0 LOGIC DESCRIPTION AND USE

The 9700AT and the 9710AT are depicted by several drawings. These units are identical electrically. One of these drawings is the Top Assembly drawing which shows the physical location of the assemblies, which are contained in the instrument. This print should be used to locate connectors on the rear panel and for quick reference to the physical location of any of the assemblies and controls.

Note: Drawings and schematics are not furnished in this manual but can be obtained from Symmetricom upon request.

In the Title Block of each logic print is a circled number. For instance, the GENERATOR print (Analog) has been circled number (2) in the Title Block. The GENERATOR print (Microprocessor) has circled number (3). Except for terms originating within the drawing being studied, this reference number will precede each term, showing the sheet of logic on which it originated. To use these numbers, simply observe the term, look at the term reference number in front of the term, then select the print that has this reference number in the Title Block. This print will show the point of origin of the term you are trying to find. This provides a convenient means of getting back and forth from various pages of the logics.

Each time a term reference number appears, it will refer you back to the source of that signal. In each of the logics there will be a number such as U4, U8, U11 etc. These numbers refer to the physical location on this assembly for that particular integrated-circuit element. In order to determine a physical location of an integrated circuit, one would merely refer to the Top Assembly drawing. On this drawing, each assembly contained within the Basic instrument is identified by referencing the mechanical view of the top of the instrument. Look for the PC Board of interest. Examine the board until the desired integrated circuit is located.

All references in this discussion will be based on the circled term reference numbers located in the Title Blocks of all logic prints. The reader should be familiar with the above before proceeding.

4.1 GENERAL

The Model 9700AT and the 9710AT is both a Time Generator and a Time Translator. A Time Generator is a device which takes a reference frequency and divides it so as to accumulate or "count" time intervals. A Time Translator is a device which requires a Serial Coded input and "decodes" or "translates" this input to some other form, usually parallel time data.

In order to better understand the logic organization of the 9700AT and 9710AT, lets first review the basic configuration of typical timing units.

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Figure 4.1.1 shows a simplified diagram of a typical Time Code Generator. The significant sections of a Time Code Generator are:

- Frequency Source – Usually a crystal controlled oscillator.
- Minor Time Counters – The purpose of these counters is to develop scan terms and rates required to develop the Serial Code format or to be used for parallel outputs. They also supply a 1PPS signal that is used to update the Major Time Accumulator.
- Major Time Accumulator – This section is a counter whose function is to store the Time-of-Year data. It is incremented by the 1PPS clock output of the Minor Time. Its outputs are buffered and used for parallel outputs or are scanned by the Encoder and output in a serial format.
- Counter Control – This section synchronizes the time accumulators (Minor Time) and includes switches to select and enter the Time-of-Day into the Major Time Accumulator.
- Parallel-to-Serial Converter – This section consists of scan gates that serialize the contents of the accumulator into a continuous pulse train.
- Formatter – This section uses pulse rates from the Minor Time Counter to obtain the pulse widths and index pulses required to provide the format defined by the type of time code being generated. This format is then usually combined with a sine wave to provide an amplitude-modulated signal.
- Output Amplifier – This section provides the required output drive and signal levels of the formatter output.
- Display – This section provides a visual interface between the Generator and the operator.

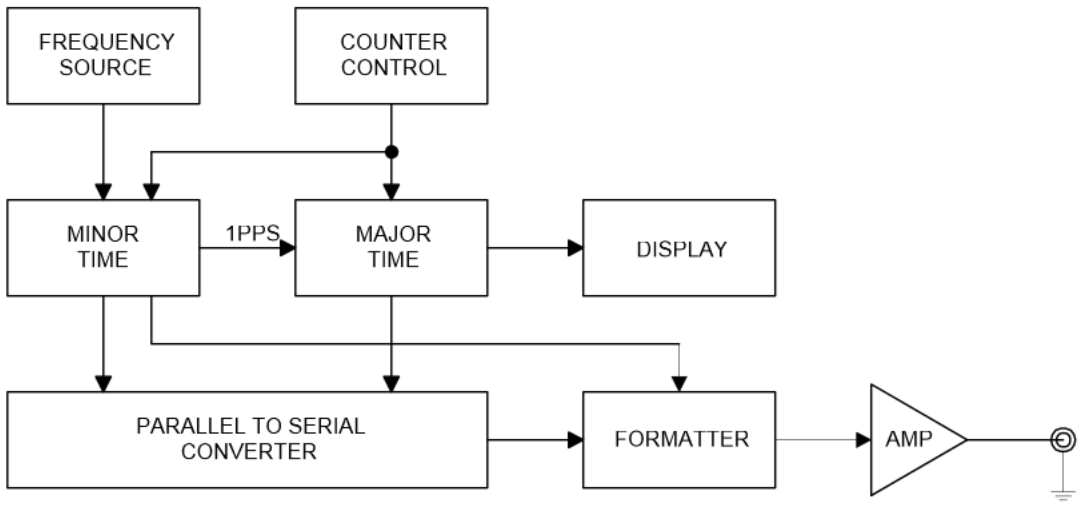


Figure 4.1.1
Typical Time Code Generator

Figure 4.1.2 shows a simplified diagram of a typical Time Code Translator. The significant points of a Time Code Translator are:

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- Input Amplifier – Usually this is an AGC (Automatic Gain Control) type amplifier. Its function is to provide a constant amplitude signal to the decode and detection circuitry.
- Serial-to-Parallel Converter – This is the heart of the unit. Its function is to detect digital data in the input format and assign it to storage in the Time Accumulator. This portion contains the necessary circuits to synchronize the frequency dividers.
- Frequency Dividers – These counters divide the carrier frequency. Once synchronized by decoding circuitry in the Serial-to-Parallel section, this counter provides the terms necessary to index the digital data contained in the input code. This allows the locating of each code bit and the proper assignment to accumulator storage. They also provide a 1PPS signal to update the Time Accumulator.
- Time Accumulator – This counter stores the value being read from the input code. It is updated with the 1PPS signal from the Frequency Dividers and is permuted to count in the format of the input Time Code (usually Seconds, Minutes and Hours). Day-of-Year is provided if it is contained in the input Time Code. The Time Accumulator is the basis for most outputs provided by the unit.
- Display – This section takes the Time Accumulator data and displays it to the user.

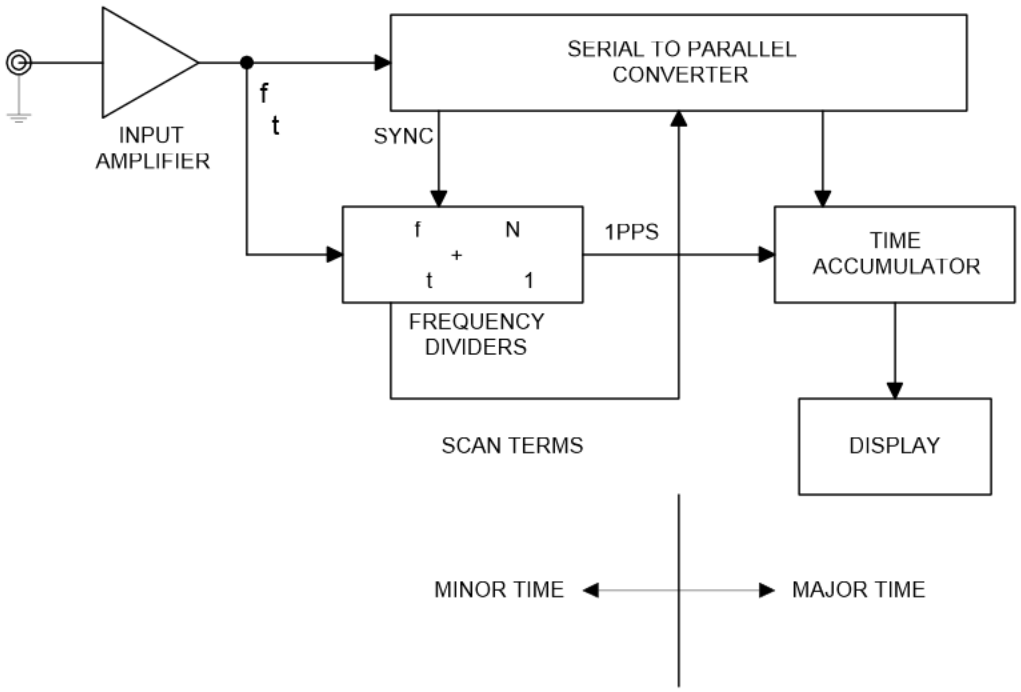


Figure 4.1.2
Typical Time Code Translator

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Now if we combine the two functions, taking advantage of circuitry found common to both, we obtain a Time Code Generator/Translator (Figure 4.1.3). Logic functions, which are common, i.e., those which need not be duplicated are:

- Operator controls
- Display

The Power Supply and Chassis are shared.

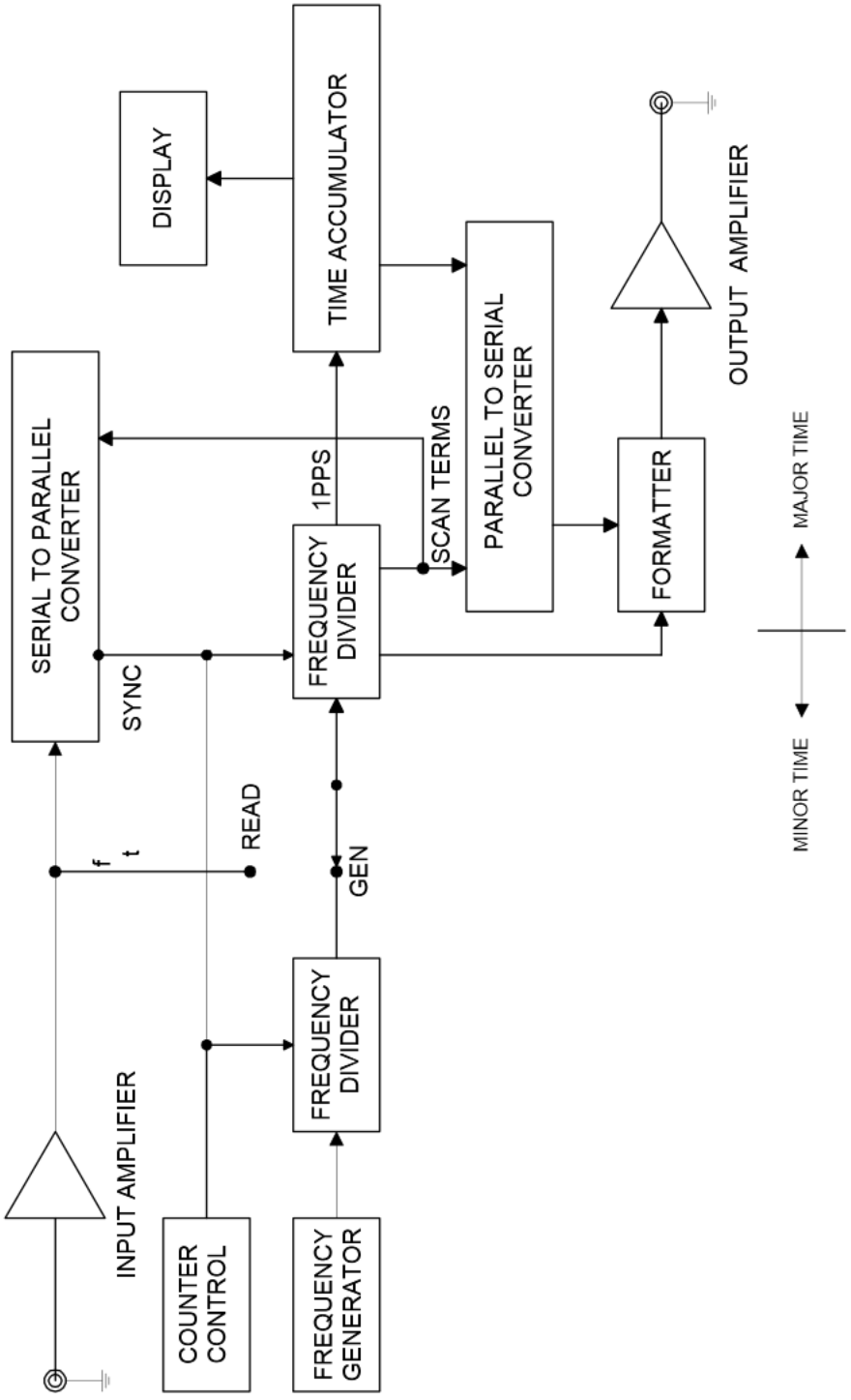


Figure 4.1.3
Typical Time Code Generator/Translator

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4.2 DETAILED LOGIC DESCRIPTION

This description will be referenced only to the term reference numbers that are contained within the Title Block of each individual logic print. Before proceeding, the reader should be familiar with paragraph 4.0, LOGIC DESCRIPTION AND USE.

It is also important to keep in mind that while the simplified block diagrams presented are conceptually accurate, the functions performed by a mixture of hardware and firmware. A functional block diagram of the PTS may be found in Figure 4.2.1.

The PTS is a Microprocessor based system. The Microprocessor used, a 65C02, has an eight bit data bus and a non-multiplexed 16 bit address bus. The processor in the GENERATOR assembly is used as a system controller for handling external (Optional) I/O as well as the user interfaces: Time Display, LCD Display and Keyboard.

4.3 (1) GENERATOR (CONNS)

The primary function of this logic is to show the interconnections between the GENERATOR and other assemblies. Interconnect to the Keyboard is shown on (4). Logic terms originating on this assembly have their origins indicated using the term referencing system. Terms for which no reference is shown originate elsewhere (if at all) in the instrument. Many of the signals, which appear here, are bi-directional.

This logic also shows the Standby Battery and the Charging circuitry. The adjustment circuit for the LCD Display contrast (R32) is also shown here.

The 74HC374 (U32) is used to output 1PPS-G/, 1KHz, 10KHz, and 100KHz to the Distribution Assembly via connector J105. Ø2 is used as a clock for this IC.

U28 and U29 are optional DC to DC Converters used with the Disciplined Oscillator Option. The DC to DC Converter used depends on the Oscillator used. These DC to DC Converters provide the +15 Volt power for the Oscillator as well as U31, the Digital-to-Analog Converter (DAC) .

U31, the Analog-to-Digital Converter is used to steer the Oscillator on frequency. U30 and U33 are used for address decoding used by the DAC.

4.4 (2) GENERATOR (ANALOG)

This logic includes derivation of the Microprocessor Clock, which is also used for timekeeping, IRIG B output circuits, and circuits for Power-Up and Power-Down control of the Microprocessor.

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When an External Reference Frequency is input, it is stepped up by transformer T1, terminated (at about 50 Ohms) by R1, and converted to a logic level by Schmidt trigger U22. The SELECT one-shot, U18, is an activity sensor, which controls whether the External Reference or the output of Oscillator Y1 is input to U19. U19 divides the selected reference frequency by 16 which is then used to trigger the SELREF one-shot (U18). The SELREF one-shot is used as a divider to provide one output pulse every 16 microseconds over a wide range of input trigger rates. The SELREF one-shot is connected in a non-retriggerable configuration.

If the External Reference Frequency is 1 MHz, the input to SELREF will occur every 16 microseconds, and SELREF will trigger every input. If the input to SELREF is every 8 microseconds (2MHz External Reverence) it will trigger on every other one. Similarly for 5 or 10 MHz External References, SELREF will be triggered by every fifth or tenth input, maintaining a
constant output frequency of 1/16MHz for any External Reverence of N MHz where N is an integer between 1 and 10.

SELREF is one input to a Phase Detector and VCO (U23). The other Phase Detector input is VCO divided by 32. Action of the Phase Locked Loop forces the VCO to operate at 2MHz (nominal) with the stability of the selected reference oscillator. The VCO output ∅2-IN is used as a clock for the Microprocessor and as the reference frequency for timekeeping.

Division of the VCO by 32 is accomplished by U24 and U19. U19 provides a fixed division of 8. The division of U24 can be modified to be 2 or 6 (instead of 4) by the action of the ADV and A/R (Advance/Retard) flip-flops U25. Modifying the count of U24 (to 2 or 6) for one cycle of 500KHz effectively adds or subtracts 2 cycles of 2MHz from ∅2-IN. Thus ∅2-IN is retarded or advanced by 1 microsecond.

When A/R has been set by SAR/, U24 divides by 6 once, providing 1 microsecond of retard. When A/R and ADV have both been set, the division is 2, providing an advance of 1 microsecond. This Advance/Retard circuitry provides the slower rates (i.e. 1 microsecond/S) of Advance/Retard. The fastest rate (i.e. 100mS/S) is accomplished by changing the 2MHz-100KHz divisor (see paragraph 4.7) to eighteen or twenty-two.

The IRIG B output circuits bandpass filter a 1KHz square wave to provide a 1KHz sine wave at the output of U26 pin 7. The part of U26, whose output is pin 1, is operated as a follower with gain. With FET switch Q2 ON, the gain determined by R24 and R26 is approximately 15. When Q2 is OFF, the gain determined by R24, R27 (ratio) and R26 is approximately 4 (depending upon adjustment of R27). Switching Q2 ON and OFF with the DC Shift form of IRIG B causes the output at U26 pin 1 to be a 3:1 Amplitude-Modulated signal.

The output of U26 pin 1 is attenuated by R23 (LEVEL) and buffered by U27 to provide a low impedance CODE OUTPUT.

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Power status is provided by Q1, which monitors the +8V. Power status is important during both the Power-UP and Power-Down transitions. During Power-Up U22 pin 2 holds PON (Power ON) low until +8V is high enough to provide a regulated +5V for the logic. PON holds C8 discharged. C8 forces RES and RES/ to remain active for about .5 seconds after PON is true. RES/ is used throughout the PTS to initialize hardware to a known status. Following RES, a Firmware startup procedure is performed. Then the main program executes. When power is lost for any reason, PON goes false forcing NMI/ false. PF is ored into U16 at pin 3 to prevent NMI/ during critical parts of the program. NMI/ generates a non-maskable interrupt to the Processor, which causes an orderly shutdown before power is lost. Following shutdown, the status of PON is monitored to provide program recovery without a Reset if the power failure was momentary. R13 prevents RES during shutdown.

4.5 (3) GENERATOR (MICROPROCESSOR)

This logic contains the heart of the Microprocessor: the Microprocessor-controller, the ROM-program storage, and the RAM-variable storage. Also on this logic is the decoding and encoding logic for I/O service.

The Microprocessor (U2) is an 8 bit CMOS device. It accepts as an input clock ∅2-IN and outputs ∅2 and ∅1 clocks.

Other inputs are the non-maskable interrupt (NMI/), the maskable interrupt (IRQ/), and Reset (RES/). The data lines (D0-D7) are bi-directional. The address lines (A0-A15) are outputs. The ROM (U3) contains the program, which the Microprocessor executes. When an address of 8000 Hex or more is on the address bus, the ROM outputs to the data bus while ∅2 is high. The RAM (U4) is used for temporary storage of data and variables.

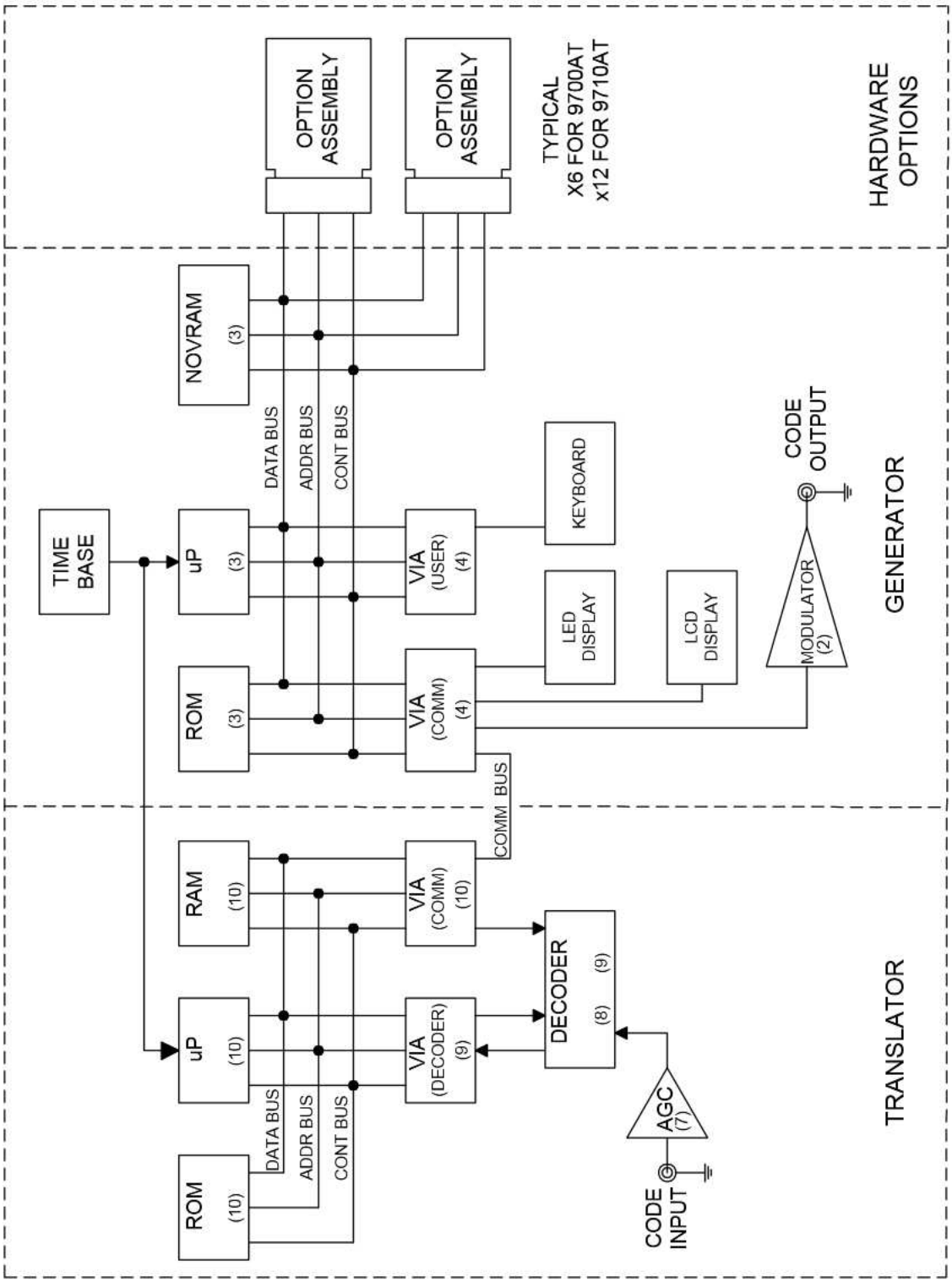
The RAM used in the PTS is a combination of static RAM (SRAM) and electrically erasable PROM (E^2PROM). The internal configuration provides a byte of E^2PROM for every byte of RAM. In normal system operation, all reads and writes are to the RAM, but when power fails, every byte of RAM is written to E^2PROM. When power returns, each byte of E^2PROM is written to RAM. This feature enables the PTS to remember user entered configuration information during any power outage.

The RAM is disabled for all addresses above X3FF Hex and 7FFF Hex by U16, as the addresses are used by options and ROM. The RAM is also disabled for addresses in the range XXE0-XXFF by U17, permitting the VIA's (see (4) to use that range. Combining the outputs of U16 and U17 in U20 gives 0XX/, the VIA enable.

U14 is used to decode I/O1 through I/O7 which are used to enable option assemblies, and I/O0. I/O0/ through I/O7/ correspond to addresses N400 Hex-NFFF Hex when N is the I/O number 0-7.

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U12 is an 8:3 line priority encoder. Interrupt requests from the options are connected to IR1/-IR6/. When any of these lines is asserted (low), pin 14 of U12 goes low asserting IRQ/. When interrupt request is processed, reading I/O0 puts the address of the interrupt source with highest priority on to the data bus by enabling U13 at pin 1. I/O0 is never written to.



BLOCK DIAGRAM 9700AT AND 9710AT
PROGRAMABLE TIME SYSTEMS (PTS)
Figure 4.2.1

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U15 also uses I/O0. This part is a quad two way multiplexer. It is used here as a Quad Three Input NAND gate with enable. Any of the four outputs can be activated (low) by performing a read of address 04XX Hex, where the true bits of the LSN of X determine the output. For example, reading address 0402 Hex would cause SAD/ to be pulsed to ground. The Seconds digit of the LED Display is written, using LDUS/, by reading 0404 Hex after storing the correct data to VCOM PB0-PB3. Whenever a keyboard input is processed, a read of 0408 Hex is used to trigger the LEN one-shot which sounds the Beeper.

4.6 (4) GENERATOR (I/O)

This logic provides most of the I/O between the Microprocessor Bus and the other parts of the Basic PTS. Also included are dividers and buffers which provide the Pulse Rate Outputs. U5, VUSR, and U6, VCOM, are Versatile Interface Adapters (VIA). Each of them contains 2-8 bit I/O ports with handshaking, 2-16 bit counters, an 8 bit shift IN-or-OUT register, and extensive interrupt capabilities.

All of the functions of the VIAs are under program control, and many of them are changed dynamically. As a convenience, the VIAs have been named according to their primary function. VUSR provide user interface via the Keyboard. VCOM provides communication with the Translator Assembly. One of the counters of VUSR counts ∅2 to generate 100KHz. This 100KHz becomes the reference frequency for the Generator. It is further divided by U21 to provide 10KHz, which interrupts VUSR (at CA1) to "clock" the Firmware Minor Time. 10KHz is further divided by hardware (U21) to 1KHz which becomes the IRIG B carrier after filtering. VUSR, CB2, provides the signal GEN 1PPS, which is used to Start/Stop the counter chain, and also to synchronize it to the Firmware Minor Time. This synchronizing signal does not appear once per second and may occur only rarely. It is only useful when the firmware part of the Generator is synchronized. VUSR PA0-PA7 are used to service the Keyboard. The Keyboard is a 4X4 matrix. It is periodically scanned for a connection. If a connection (closure) exists, it is debounced in firmware, then acted upon. Due to the scanning technique, simultaneous closures are not permitted. VCOM, CA2, is used as an inhibit to prevent I/O interrupts during time sensitive parts of the program.

The second counter in VUSR generates periodic interrupts which are used to debounce the Keyboard. VUSR PB0 outputs W/, which is used to write to the LED Display. VUSR, PB1, outputs ENL, which enables the LCD Display.

VUSR, CA2, is used as a Power Fail (FP) output during the Power-Down sequences to prevent multiple sequencing. VUSR, PB4, is used as a Clock Inhibit (C1H) for the Backup Clock. VUSR, PB5, is used as an input to sample the Power-On (PON) status during Power-Down and Power-Up sequence. This permits optional circuitry to store the Generator Time for subsequent Serial or Parallel output. VUSR, CB1, is an optional input with interrupt capability. Depending on the configuration, it may be used to either Start or Synchronize the Generator.

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VCOM, PA0-PA7, and CA1 and CA2 are used for the GEN COMM half of the I/O with the Translator assembly. All lines tie to the corresponding lines of the TRANS COMM except that CA1 and CA2 are crossed. This is a bi-directional data path over which time and other information pass between the Generator and Translator. Data transfer is asynchronous. Data on the PA0-PA7 bus is latched into the receiving bus by a transition on the sending bus CA2 (receiver's CA1). This transition also sets a flag in the receiver's status register. When the flag is discovered, it is acknowledged by a transition on the receiver's CA2 (sender's CA1). Generally transfer to the Translator causes an interrupt (in the Translator) while that to the Generator merely sets a flag which must be polled to be recognized. In some cases however, the Generator is enabled to be interrupted.

VCOM, PB0-PB3, are used as data outputs to the Backup Clock, the LCD Display, and the LED Displays. VCOM, PB4-PB6, are used, in conjunction with C1H, to write an address, write data, or read data, respectively to the Backup Clock. When writing to the LED Display, W/ is used to store data into the display driver with the digit address provided by VCOM PB4-PB6. PB7 provides decimal point information. The Seconds digit is written by LDUS/. VCOM, PB4, is a register select to the LCD Display. VCOM, PB5, functions as a read/write control for the LCD Display. As previously mentioned, ENL is used to clock transfers to the LCD Display.

CAUTION

The PTS will not operate without a functioning LCD Display connected. The LCD Display is a Microprocessor based subsystem, which must interact with the Generator Microprocessor for correct operation. Also note that the pin numbers shown at J103 on (1) do not correspond to the LCD Display manufacturer's data. This is because different numbering systems are used.

Finally VCOM, CB1 and CB2 are used to shift out the DC envelope (DCC/) of the IRIG B Serial Time Code. CB1 is the clock input and CB2 is the shift register output.

The remaining circuits on this logic (U8 and half of U7) are used to count and buffer the Translator Pulse Rates. ZAD/, is counted by a counter, which is synchronized by the frame rate (FRP) from the Translator.

4.7 PTS LED DISPLAY (ASSEMBLY 19381)

The display uses an 8 digit driver (U1) to drive displays DS1-DS7. Data is input over line VCOM, PB0-PB3, with address input on VCOM, PB4-PB6. Line PB7 has decimal point information. W/ is used to store the information. The output of this driver is multiplexed constant current segment, decimal point, and digit drive for 8 LED digits. The ninth digit of the display (US) is driven by a constant current decoder/driver with storage. The data presented on VCOM, PB0-PB3, is stored by LDUS/. Resistor R1 is selected to match the intensity of DS9 to the rest of the display.

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4.8 POWER SUPPLY (ASSEMBLY 21053 AND 21055)

The Power Supply consists of an AC to DC Converter which receives its input power from the Power Input Module. The Power Input Module contains the AC power input connector and Fuses.

The AC to DC Converter receives its power from the Power Input Module at connector CN1. CN1 pin 1 is the AC Line and pin 3 is AC Neutral. This unit will operate on an input voltage of either 115 Volts AC or 220 Volts AC as the Power Supply in this unit has an input operation range of 90 to 264 Volts AC 47 to 440 Hz. Therefore, no jumpers are required.

The AC to DC Converter outputs +5, +12, and –12 Volts. The +5 volt output is not used by the PTS.

The +5 Volts required by the PTS is derived from the +12 Volts which is input to the +5 Volt regulator at location A1 of the 21053 PC Board Assembly.

Power is routed to the Translator Assembly through a cable from J106 of the 21053 PC Board. The Power pins of J106 are as shown in Table 4-1.

Table 4-1
Connector J106 Power Pins

Pin 9	+12 Volts
Pin 11	-12 Volts
Pin 17	+5 Volts
Pin 19	+5 Volts
Pins 13, 15, & 22	Ground

Signals to the rear panel are also routed through the 21053 PC Board Assembly. These signals are as shown in Table 4-2 and 4-3.

Table 4-2
Rear Panel BNC Connections

BNC Connector	Signal
J5	Not Used
J6	Code Output
J7	1PPS Input
J8	External Oscillator Input

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Table 4-3
Rear Panel Connector J4 Signals

Connector J4 Pin	Signal
1	Pulse Rate 1KPPS
2	Pulse Rate 100PPS
3	Pulse Rate 10PPS
4	Pulse Rate 1PPS
5	Carrier
6	Carrier /10
7	Carrier /100
8	Carrier 1K
9	Ground
10	IRIG DC Level Shift Output
11	LOSS
12	ERR

4.9 (6) TRANSLATOR (CONNECTORS)

The primary function of this logic is to show the interconnections between the Translator and other assemblies. The Translator provides interconnection between the Power Supply and the Generator for the power and signals shown here. This logic shows the source of Translator power. Signal connections between the Translator, Generator and Power Supply are shown at their respective origins.

The regulator shown at A1 is used to generate the – 5 Volt power for the Translator Assembly.

4.10 (7) TRANSLATOR (AGC/STRIPPER)

This logic contains the input amplifier AGC and the code strippers required to normalize the input and to derive the necessary clock signals for the decoder.

The AGC amplifier is wide band so as to make the unit operational where variations of input signal frequency as well as amplitude are experienced such as in Tape Search applications.

Generally if a Translator is used as a single purpose unit such as to only translate code at a single rate and display it, the AGC circuits can be narrow band. To make the unit more adaptable to different types of applications, we have provided a 100 mV to 10 Volt dynamic range and a frequency response of 30Hz to 2MHz. The circuit does not require adjustment over this range.

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The input signal is AC coupled by C32 (or optionally T1) through R14 to attenuator FET Q1. Q1 is employed as a voltage controlled resistor to maintain a constant level at the input of U34 of approximately 13 mV Peak-to-Peak. It is not recommended to observe this signal. U34 provides a gain of 14 yielding about 180 mV Peak-to-Peak at U26-13 and the FILT INPUT (11). U26 is an Analog Switch. U26, pins 1, 2, 10 and 15, are used to provide signal inversion by controlling whether the Plus or Minus input at U25 is driven. The input of U26 at pin 15 comes from the output of U23 pin 6 (11). U25 provides a gain of about 12 so that the AGC signal is a constant 2 Volts Peak-to-peak at TP1.

Analog Switch, U26 pins 3, 4, and 5 are used to route the code (C) to the input of amplifier U23 (11) when the Envelope Filter is not used (OFF).

Completing the AGC loop, U16, pins 13, 14, and 15 are controlled by comparing AGC with –1V. When the negative peak of AGC exceeds –1V, Q3 supplies current to C13, which raises the voltage at the gate of FET Q1, lowering its resistance and decreasing the input to U34. When Q3 is not conducting R39 pulls C13 minus increasing the resistance of Q1. R40 provides fast recovery when loss of activity is detected at AS1 (Activity Sensor 1). The AGC signal is applied to the optional output buffer U17 and to the ∅B and ∅C detectors U16 pin 6, and U16 pin 9. ∅B detector, U16 pins 5, 6, and 7, is a zero crossing detector with hysteresis on the negative edge. The positive (on-time) edge coincides with the positive zero crossing of the input code. ∅C detector U16, pins 9, 10, and 11, detects the Mark Amplitude cycles of the input code. ∅B and ∅C are used by the decoders (8). ∅C is also used by the activity sensing circuitry described above. A secondary function of the activity sensor is to increase the threshold of the ∅C detector at pin 10 slightly to provide hysteresis for AS1.

Shown in the lower left of this logic is the LOS (Loss of Signal) circuitry U16 pin 3. This circuit senses peak amplitudes of the input signal versus an adjustable threshold established by potentiometer R46 (THOLD).

4.11 (8) TRANSLATOR (DECODER 1)(REFER TO FIGURE 4.2.4 AND SCHEMATIC)

Analog Switch U32 is used to control the source of ZAD/ at U32, pin 15. When the Carrier Filter is set to OFF, the Translator uses the ∅B/ input as ZAD/. When the Carrier Filter is ON the Translator uses CAR0/ (11) as the ZAD/ input. This Analog Switch is controlled by SR7 (9).

The DC envelope of the input code is recovered by DF1 (U7-5), DF2 (U21-16), and DF3 (U21-5). Each ∅C pulse sets DF1 true. ZAD (derived from ∅B) clocks DF1 false and DF2 true. The following ZAD will clock DF3 true if, DF1 has been set by ∅C. This provides immunity against a spurious ∅C. (A form of error bypass)

Once true, DF3 will only clock false when both DF1 and DF2 are false. This provides immunity against a missing ∅C. The output of DF3 is a DC envelope of the input code, delayed by 2 ZAD periods. Each time DF3 goes true, Mark Sync (MS) (U22-9) is clocked true for 1 ZAD period. MS synchronizes counters U10, U19, and U39 to the input code.

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Frame Sync (FS) (U22-5) is detected by PI (Position Identifier) counter U8. U8 is preset to appropriate values to accommodate different codes by the terms SR10-SR13. If DF3 is false when the PICLK, U39 pin 11 occurs, U8 is preset. U39 generates the PICLK by counting an appropriate number of ZAD clocks. At MS time U39 is preset to the value contained by SAVE1, SAVE2, and SR9. U39 is enabled to count by EN, a pre-scaled derivative of ZAD.

The ratio of carrier cycles to code elements is 10 for many popular codes such as IRIG A, B, and G. For other codes such as IRIG H or 2137 the carrier must be pre-scaled (divided) to enable decoding. U19 and U10 divide ZAD by 1-160 to generate EN, the enable for U39 and the ROM address counters U11, U14, and U12. U19 has a fixed division of 10. U10 is programmed by SR14-SR17. Both dividers, U19 and U10, are synchronized to the input code by MS.

The heart of the decoder is a look-up table, U6, a ROM (9). U6 is addressed by the ROM address counters and the output of the forward (FWD) flip-flop (U7-9). The ROM address counters (U11, U14, and U12) are synchronized by FS. The least significant bit of the counter, U11 pin 14, GCLK is not used as an address bit. It is used in the gated (by EN) clock.

Code direction is determined by the FWD (U7-9) flip-flop. It may be directly set or reset under program control using SFWD or RFWD, or toggled by U27 (11) pin 17 (CFWD) at U7-11. U27, pin 18 ((11) TRANSLATOR (PLL and LPF)), is enabled to increment by direction enable (DIREN) one output from the look-up table, U6. At DIREN time, if DF3 is true U27 will be incremented by GCLK. If U27 (DIV 2) is incremented a set number of times, under program control, CFWD will clock the FWD flip-flop.

4.12 (9) TRANSLATOR (DECODER 2)

Left/Right shift register U13 is used to convert the DC envelope of the code (DF3) to binary data. ZAD clocks U13. The shift direction is determined by inputs at S0 and S1. These inputs are controlled by FXR3, ENG, and SREN (Shift Register Enable). SREN occurs at the correct time to discern whether the code bit is a zero or a one. FXR3 determines whether to shift right or left. ENG permits only one ZAD to be recognized, as S0 and S1 both low is a do nothing condition. SREN is so spaced (in time) that the data shifted into U13 produces a group BCD (in the case of most codes) at SR outputs DB0-DB7. When a group has been assembled, U6 outputs Byte Ready Enable (BREN). BREN is synchronized by U21, pins 1, 11, 12, and 13, then input to U5, a Versatile Interface Adapter (VIA). BRDY latches the time data into the VIA. It also latches U6 outputs BA0-BA3 into the VIA. BA0-BA3 are validating bits. When these bits are latched, the VIA issues an interrupt to the Microprocessor which then performs the firmware part of the decoding process.

Once per frame, U6 outputs Frame Ready Enable (FREN). This signal is used to generate FRP (U21-15), which is on-time with the input code (in the forward direction). FRP is used by the Microprocessor and is also output to the Generator where it synchronizes the Translator Pulse Rates and, in Synchronized Generator modes, the Generator.

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U18, U9, and U15 are used to store the set-up data peculiar to each code such as presets for the counters and RA11-RA14 which select the correct table in U6. This data is serially entered from the VIA at U1 (10).

VIA U5 serves various additional functions not previously discussed. ZAD is an input to both CA2 and PB6. At carrier rates of lKHz and lower CA2 causes an increment of Minor Time. For faster rates, PB6 counts ZAD down, as appropriate, then increments Minor Time. FWD is sensed at PB4 to inform the Microprocessor of the code direction. SHIFT/ is a test output, which initializes many binary devices.

4.13 (10) TRANSLATOR (BASIC & COMM)

This logic contains the heart of the Translator: The Microprocessor-Controller (U2), the ROM (U3) - program storage, and the RAM (U4) - variable storage.

The Microprocessor is an 8 bit CMOS device. It accepts as an input clock ∅2-IN and outputs ∅2.

Other inputs are the non-maskable interrupt (NMI/), the maskable interrupt (IRQ), and RESET (RES/). The data lines (D0-D7) are bi-directional. The address lines (A0-A15) are outputs. The ROM contains the program, which the Microprocessor executes. When an address of 8000 Hex or more is on the address bus, the ROM outputs to the data bus while ∅2 is high.

The RAM is used for temporary storage of data and variables. The RAM is disabled for all addresses above XXFX Hex and 7FFF Hex by U30D as the addresses are used by VIA U5 and ROM.

RES/ and ∅2-IN come from the Generator, otherwise, the Translator Microprocessor is a totally independent system. It cannot operate independently however, because all user I/O i.e. Keyboard and Display, is provided by the Generator, via the GEN/TRANS COMM port. This port is part of VIA U1. For a description of the operation of the COMM port see (4) GENERATOR (I/O). In addition U1 provides the data (SRD) and clock (SRC) to set-up shift register U18, U9, and U15 on (9).

U28, pins 4, 5, and 6, inverts the LOS/ signal from the AGC and provides LOS (Loss of Signal to U1 where it is monitored.

U21, labeled ERR, is used as a buffer for the ERR output at rear panel connector J4 Pin 12.

4.14 (11) TRANSLATOR (PLL AND LPF)

U24, U33 and U23 make up the Low Pass (Envelope) Filter. The input, FILT IN source is from (7). The Output at pin 6 of U23 is routed through C55 to input, F, of U26 at pin 15 (7).

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When the Envelope Filter is turned OFF the code C from (7) is routed through amplifier U34. Filter selection is accomplished using RSELA and RSELB of U24 and CSELA and CSELB of U33. These filters are enabled with SR23. Filter selection is preprogrammed in ROM for the selected input code.

A2 is a +5 Volt regulator, which provides the +5 (+5F) volts for Analog Switches U24, U26, U32, and U33.

U32, U35, U36, U38 and part of U27 make up the Phase Lock Loop.

∅B is input to U36, a Phase Locked-Loop with VCO, at pin 3. U35 is setup as an integrator whose output is inserted into the PLL IC, U36 at pin 9. The VCO output at pin 4 of U36 is routed to the DIV 0 portion of U27. Division of DIV 0, DIV 1, and DIV 2, are under program control by the Control portion of U27. The output of DIV 0, 4CAR, is used to clock U35.

The Analog Switches, U32 are used to select the frequency and range of the Phase Locked Loop.

See Chapter Five, Maintenance, in this manual, for testing of the LPF (Envelope Filter) and the Carrier Filter (PLL). Adjustments to the PLL are also found in Chapter Five.

4.15 DISTRIBUTION BOARD ASSEMBLY (19385)

The 9700AT contains only one 19385 Distribution Board Assembly. Option Plug-in Assemblies are installed into the Distribution Board Assembly. This assembly has provisions for installing up to six single wide Option Plug-in modules.
The 9710AT contains two 19385 Distribution Board Assemblies which are interfaced with the Generator via the 20144 I/O Buffer Assembly. These two assemblies allows up to 12 single wide Option Plug-in modules to be installed

4.16 I/O BUFFER (ASSEMBLY 20114)

The I/O Buffer Assembly is used only in the 9710AT. It interfaces the two 19385 Distribution Board Assemblies in the Option Assembly area of the 9710AT with the Generator assembly via connector J105 of the Generator PC Board. The 9700AT contains only one 19385 Distribution Board Assembly.

The I/O Buffer contains buffers for the ∅2 clock and Data Bit 7.

Integrated circuit, U2, is used to buffer the ∅2 clock from the Generator, preventing overloading of the ∅2 source.

Programmable Logic IC, U1, Controls the direction of D7. D7A and D7B are effectively ored in U1.

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CHAPTER FIVE
OPERATION MAINTENANCE AND ADJUSTMENTS

5.0 INTRODUCTION

***** CAUTION *****

Care should be used in handling CMOS integrated circuits. Users must remember that CMOS devices can be seriously damaged if subjected to high electrical fields in the gate oxide regions. Such stress voltages can sometimes be caused by improper testing methods. However , very likely sources are random electrical charges. Possible damage from such static charges can be avoided by implementing the following handling procedures:

- ***All package leads should be shorted together whenever the device is handled or stored. The devices are shipped this way.***

- ***Personnel handling CMOS devices should wear anti-static clothing and be electrically grounded when handling packaged items. This is a standard procedure on most CMOS assembly lines.***

- ***Your equipment, which comes in contact with finished units, should be properly grounded to prevent random voltage spikes.***

This section describes the general techniques for maintenance of timing equipment. Special maintenance information, if required, is included with the option descriptions.

5.1 TOOLS AND TEST EQUIPMENT REQUIRED

No tools or equipment are supplied with this unit. The following is a list of equipment needed for maintenance and adjustment of the Programmable Timing System (PTS).

- Dual Trace Oscilloscope, Tektronix 2247A or equivalent. This Oscilloscope is a 100MHz bandwidth Oscilloscope with a Frequency Counter and Timer.
- Digital Multimeter, Fluke 8010A or equivalent. This instrument should measure AC voltages up to 750 Volts, DC Volts up to 1000 Volts and Ohms up to 20 Megohms.
- Insulated Tuning Tool for use in adjusting potentiometers and oscillators.
- Screw Drivers, Flat Blade an Philips used to remove/reinstall top covers and bolt-in assemblies.

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5.2 PREVENTATIVE MAINTENANCE

This instrument consists of solid-state electronic circuits, which require very little attention. In general, the equipment will meet its performance requirements without periodic adjustments.

The equipment should be cleaned periodically to prevent accumulations of dust for proper cooling of the equipment.

- Wipe the external surfaces of the instrument with a soft damp cloth to remove dirt, fingerprints, and any other foreign material.

***** CAUTION *****

The polarization plate attached to the surface of the LCD Display panel is easily scratched, and must be handled with care.

To clean the display surface, dampen a soft cloth slightly with clean water and wipe gently. Do not use organic solvents such as alcohol.

To check the inside of the unit for excessive dust or foreign matter, first remove the AC Power and then remove the top cover.

If the internal component surfaces and/or components have and excessive amount of dust deposited on them, use a soft brush or low pressure stream of air to remove any foreign material.

***** CAUTION *****

Do not clean PC boards or small internal components with a stiff brush or solvents since damage to the circuits may result. A high powered vacuum device cleaner should not be used on small components.

When cleaning is completed replace the cover and reconnect the power. Check the operation of the unit.

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5.3 TROUBLESHOOTING

If at any time the unit fails to operate or operates intermittently, it is a good idea to remove the top cover and look for any visible problems or damage. Make sure all cables are securely connected. Insure all integrated circuits are mounted into their sockets where applicable. Look for damaged components.

***** CAUTION *****

Before removing the top and/or bottom covers, remove the AC Power input. If trouble shooting is necessary with power applied, take precautions near the right rear of the unit, as viewed from the front, as the primary AC power is exposed.

Because the design of the unit utilizes LSI (Large Scale Integrated) circuits, and is Microprocessor based, much of the operation is controlled by firmware/software. There are few user serviceable components.

The PTS executes a self-test program when the unit is powered-up. Following are possible symptoms of operational problems and possible causes.

When the user attempts to access an optional assembly and gets the "Selection Not Installed Display", as shown in Figure 5.3.1, the option is either not properly installed, or has failed and should be replaced.

Selection Not Installed Display

Selected option is not installed.
Call your DATUM representative

Figure 5.3.1

In the event this message is displayed the user should check to see if the Option is installed. If the option is installed check to be sure the option is plugged into the option assembly connector and is oriented with the component side up.

5.3.1 POWER-UP SELF TEST

At power on, a self-test is performed on many circuits within the Generator, Translator and other optional assemblies. If the unit passes self-test (at power on) but doesn't seem to be working properly, manually resetting the microprocessor is probably all that is necessary. Paragraph 5.3.5 explains the Manual Reset procedure.

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5.3.2 GENERATOR

When the Generator assembly fails self test, the "HELLO" menu, shown in Figure 5.3.1.1, will not be displayed (assuming power has been off for several seconds). While this test is primarily intended to alert the user to a failed condition which might otherwise go undetected, diagnostics are indicated which may pinpoint the source of the trouble. The BEEPER and units seconds (far right LED) display are used for diagnostics as follows in Table 5-1: (last indication points to the failure).

Hello Message

Hello, I am your Versatile Display.
Think of me as a switch push NEXT switch.

Figure 5.3.2.1

Table 5-1
Self-Test Fault/Pass Table

Indication	Test Passed
One Beep	RAM (U4)
Two Beeps	VUSR ORB (U5)
"- -"	VCOM ORB (U6)
"E"	VUSR ORA (U5)
"H"	VCOM ORA (U6)
"L"	U12, U13, I/O'S
"P"	LCD DISPLAY

"P" will be displayed momentarily at the end of a successful test.

For example, if the Self-Test failed, and an "L" was displayed, it would indicate that the LCD test failed.

5.3.3 TRANSLATOR

Each time a command is sent to the Translator, it must respond or a special "HELP" "TRANSLATOR FAILED" message will be displayed. This does not interfere with the Generator time keeping, so it may be desirable to keep the unit operating until the Translator can be replaced.

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5.3.4 SYSTEM TROUBLES

Table 5-2 lists some system troubles and possible solutions. This, along with the Theory of Operation in Chapter Four of this User's Guide, can be very helpful.

Table 5-2
Trouble Symptoms/Solutions

Symptom	Possible Problem and Solution
LED and LCD Displays do not illuminate at Power-up.	Check internal cabling using 97ATCE-01-5 Drawing Sheet 2. Check AC Power fuses in Input Power Module. If bad replace with 1 Amp 250V 3AG Slow Blow Fuses. Check AC fuse on 8010-UPS4-0 Power Supply. If bad replace with 2 Amp 250V 1AG Slow Blow Fuse.
AC Input Fuses OK but LED and LCD Displays do not illuminate.	Check output voltages at CN2 of 8010-UPS4-0 Power Supply. Pin 1 is +12 Volts and Pin 6 is –12 Volts referenced to Pin 4 (Ground). Disconnect the power supply connector and measure the voltages at the power supply. This will determine if the power supply is defective, or if the unit is loading down the power supply. If bad replace Power Supply. Check for a +5 Volt output at pin 3 of A1, a 7805 Three Pole Regulator.
LCD Display Back Light illuminates and all Power Supply Voltages present on Translator and Generator Assemblies.	Check for presence of a TTL level, signal at Pin 6 of IC U17 on the Generator Assembly. This signal depends upon the frequency of the Oscillator at Y1. If no TTL signal is observed at Pin 6 Oscillator Y1 need to be replaced. As a check to see if the Internal Oscillator at Y1 is bad, an External Frequency may be input to rear panel connector J8.
Unit powers up and passes self-test but LCD Display Characters not easily readable.	Try adjusting the LCD Display Intensity control R32 on the Generator Assembly.
LCD Display characters illegible.	Perform a Manual Reset. If characters are still bad replace LCD Display.
Unit Powers-Up but does not operate.	Microprocessor may need to be reset. Perform a Manual Reset.

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Table 5-2
Trouble Symptoms/Solutions (Continued)

Symptom	Possible Problem and Solution
Unit fails to operate at power up and after Manual Reset performed.	Possible failure or improper installation of an Option Assembly. Remove Option Assembly(s) and perform Manual Reset. Possible bad LCD Display. LCD Display must respond to Microprocessor to allow unit to operate. Replace LCD Display.
Some SELECT switches do nothing when depressed.	Defective Switch Overlay. Replace.
Unit will not Translate or Sync to the Code input at J2.	Possibly wrong input code selected. Check Input Code selected. Possible AGC/Code Stripper problem. Check TP3, on the Translator, for CMOS level square wave at the rate of the selected Code Input. Check TP2, on the Translator, for a ∅C signal. Check AGC/Stripper circuitry if no signals at TP2 and TP3.

5.3.5 MANUAL SYSTEM RESET

If the unit passes self-test (at power on) but doesn't seem to be working properly, manually resetting the microprocessor is probably all that is necessary.

***** CAUTION *****

A Manual Reset will stop the Generator and set all user selected parameters to default values, necessitating re-entry of all set-up information.

To perform a Manual System Reset proceed as follows:

- Set the units POWER Switch to OFF.
- Depress and hold the SELECT switch adjacent to the PREV switch.
- Apply power to the unit and release the select switch after the first "BEEP."

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5.4 REPLACING A MODULE

***** CAUTION *****

CMOS circuitry is used exclusively in this unit. Exercise appropriate precautions.

Plug-in options can be readily replaced by removing the power source, removing the option, and replacing it if a spare is available. If an option has failed and cannot be replaced, it should nonetheless be removed (with power turned OFF) to prevent possible effects on the rest of the unit. When a unit is equipped with FAILSAFE, the Translator will not function with FAILSAFE removed.

The following procedure should be adhered to when removing and reinstalling any option card assembly:

- Disconnect power from the 9700AT/9710AT.
- Remove the two assembly securing clips from the slot rails, which secure the module to be removed. See Option Removal/Reinstallation, Figure 5.4.1.
- Remove the defective option assembly. Repair the assembly and replace it or install a new/spare option card after having first verified all the settings and correct configuration. Refer to the Option Description supplied with the card or furnished in the back of this User's Guide.
- Insert the option assembly into the selected option slot, being careful that the components are on the upper side of the assembly.
- Reattach the securing clips to the slot rails.
- Attach any applicable I/O cables, and apply power to the unit.

Replacement of bolt-in modules (Generator, Translator, LCD Display) can be easily accomplished using the following procedure:

- Removing power.
- Remove the top and bottom covers.
- Remove cables attached to the module
- Removing the screws or nuts, which secure the module. The Translator and Generator assemblies are removed by lifting the edge toward the center of the unit then sliding out. The LED Time-of-Year display is an integral part of the Generator Assembly.

Modules are replaced by reversing the above procedure. Take special care that all cables are correctly connected, lest the unit be damaged.

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Option Removal/Reinstallation

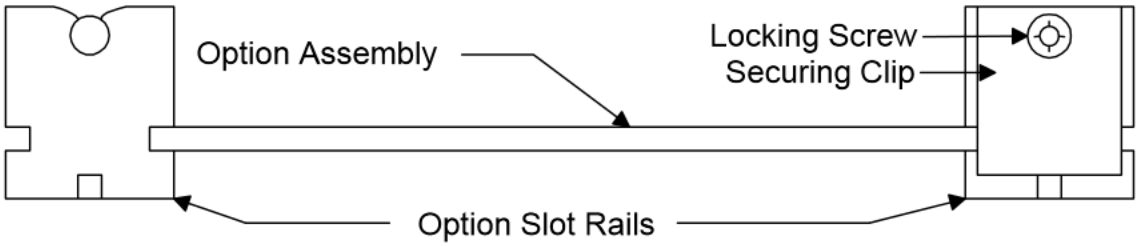


Figure 5.4.1

5.5 ADJUSTMENTS AND TEST

The following are adjustment and tests used to check adjustments if applicable.

***** CAUTION *****

The Top Cover of the PTS must be removed to make the following adjustments and tests. This exposes a potential safety hazard in the Power Supply area which is located in the right rear corner of the unit as viewed from the front.

5.5.1 OSCILLATOR ADJUSTMENTS

The following paragraphs are to be used in the adjustment of the various oscillators, which may be used in the PTS:

5.5.2 STANDARD OSCILLATOR ADJUSTMENT

There is one control for adjusting the PTS Internal Oscillator. The COARSE adjustment is located on the oscillator and is accessible after removing the dust cover screw.

To Adjust the Internal Oscillator proceed as follows:

- Sync one channel of an oscilloscope with a pulse rate output from the unit (preferably 1KPPS) found in rear panel connector J4 pin 1.
- Connect a stable oscillator of known frequency to the other input channel of the oscilloscope. Note that the stability of the External Oscillator must be better that that of the Internal Oscillator.

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- Adjust the COARSE oscillator adjustment (with an insulated tuning tool) for the most stable display possible.
- Return the instrument to its original configuration.

5.5.3 MID AND HIGH-STABILITY OSCILLATOR ADJUSTMENT

There are two controls for adjusting this PTS optional Internal Oscillator. The FINE adjustment (R9) is located adjacent to the oscillator. The COARSE adjustment is located on the oscillator. To accomplish this adjustment proceed as follows:

- Remove dust cap screw from side of oscillator (if necessary).
- Center the FINE tuning oscillator control R9.
- Sync one channel of an oscilloscope with a pulse rate output from the unit (preferably 1KPPS). The 1KPPS rate may be found at pin 1 of rear panel connector J4.
- Connect a stable oscillator of known frequency to the other input of the oscilloscope. Note that the stability of the external oscillator must be better than that of the internal oscillator.
- Adjust the COARSE oscillator adjustment (with an insulated screwdriver) for the most stable display possible. It should not drift either left or right.
- If the display continues to drift slowly in either direction, adjust the FINE oscillator control to stop the drift. This completes the oscillator adjustment.
- Return the instrument to its original configuration.

5.6 CODE OUTPUT ADJUSTMENTS

Following are the adjustments for the Modulated Serial Time Code output of the Generator. The adjustments are on the Generator Assembly.

- **Phase Adjustment:** While observing the code output on an oscilloscope, adjust R20 for minimum discontinuity at the modulation points of the code. This is the point where the sine wave goes from a “Mark” amplitude to a “Space” near the zero crossing point.

- **Amplitude Adjustment:** While observing the code output on an oscilloscope, adjust R23 for the desired peak-to-peak amplitude.

- **Modulation Ratio Adjustment:** While observing the code output, adjust R27 for the desired ratio of the “Mark” amplitude to the “Space” amplitude (typically 3:1).

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5.7 SEL REF (SELECT EXTERNAL REFERENCE) ADJUSTMENT

***** CAUTION *****

This adjustment is performed in the factory and should only be required following replacement of parts in the immediate circuit. Incorrect adjustment will render the PTS unreliable or inoperable.

To adjust the SEL REF proceed as follows:

- Apply an External Oscillator input of 1MHz to J8 on the rear panel of the unit.
- While monitoring the signal at test point TP2 (near U18) of the Generator PCB with an oscilloscope, adjust R5 to produce a pulse width of 15.2 0.1 microseconds. This pulse repeats at 16 microseconds, so the best accuracy can be achieved by setting the period between pulses for 800 nanoseconds.

5.8 LCD CONTRAST ADJUSTMENT

If the LCD will be consistently viewed from a higher or lower angle than normal, R32 (Near connector J102) on the Generator PCB, may be adjusted to improve contrast. Keep in mind that improving the contrast from one angle may make it worse from another. Seek an optimum compromise.

5.9 LOS THRESHOLD ADJUSTMENT

The loss of signal (LOS) threshold is adjustable with a potentiometer (R46), located near the right front corner of the Translator Assembly. Monitor the LOS signal using whatever output option is employed. Apply a code of the desired threshold amplitude to the Translator input. Wait until translation is normal (the output cannot change unless the unit is translating). Starting with R46 fully CCW, slowly adjust CW until LOS goes true, then turn CCW until LOS goes false.

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5.10 PLL (CARRIER FILTER) ADJUSTMENT AND TEST

The PLL circuitry is located on the Translator PC Board assembly. To adjust the PLL (Carrier Filter) proceed as follows:

***** CAUTION *****

This adjustment is performed in the factory and should only be required following replacement of parts in the immediate circuit. Incorrect adjustment will render the PTS unreliable or inoperable.

- Ground the + end of capacitor C5 (4.7uf). This point is easier to ground at the end of R89 nearest J106.
- Select "Translate IRIG B". See Paragraphs 3.8 and 3.8.1 in Chapter Three of this manual for IRIB B selection.
- Adjust the frequency at pin 9 of IC U27 to be 2.95MHz using potentiometer R26.
- Remove the Ground from the + end of C5 and connect this point to +5 volts.
- Adjust the frequency at pin 9 of IC U27, to be 3.32MHz using potentiometer R90.
- Select "Translate IRIG A". See Paragraphs 3.8 and 3.8.1 in Chapter Three of this manual for IRIB B selection.
- Ground the + end of capacitor C5 (4.7uf). This point is easier to ground at the end of R89 nearest J106.
- Adjust potentiometer R41 to produce an output frequency of 2.25MHz at pin 9 of IC U27.
- Disconnect the Ground connection from the + end of C5.

To test the PLL (Carrier Filter) adjustments made above proceed as follows:

- Connect a 1:1 IRIG B source to rear panel connector J2 of the PTS.
- Set up the PTS to translate IRIG B.
- Set both the Envelope and Carrier Filters to ON. (See Section 3.8.6 of this User's Manual)
- Set "COAST" to OFF
- Momentarily (less than 1 second) remove and reconnect the IRIB B input from J2 and observe the unit continues to update.
- Note that if removing the input for more than 2 seconds, the PTS update will stop.
- Set "COAST" to ON.
- Remove the IRIG B input from J2 and observe that the PTS continues to update. It should continue to update indefinitely.

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5.11 FIRMWARE/SOFTWARE UPGRADING

This section provides installation instructions for upgrading the software of the PTS. Upgrading is accomplished by replacing EPROMs in the PTS with those provided. Upgrade kits may consist of one, two, or three EPROMs. Replace the original EPROM's with those provided as follows:

- Switch the PTS off and remove the power cable.
- Remove eight screws in the top cover, and then remove the top cover.
- The EPROMs provided are marked with a four digit number, followed by a revision letter. The first number (2, 3, or 4) identifies the location to install the EPROM (for example; 2XXXP).
- Examine the EPROMs provided to determine their first number, and then carefully replace the existing EPROMs bearing the same first number.
- Replace all EPROMs for which upgrades are provided.
- Replace the top cover and replace the eight screws.
- Re-connect the power cable.
- Perform a manual reset by depressing and holding the SELECT switch adjacent to the PREV switch while switching the power on.
- Turn power on, and release the select switch after the first "beep."

The unit may now be returned to service, or if new features have been incorporated, the unit may be used or tested as described in the PTS User's Guide.

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6.0 DRAWINGS LIST

The drawings listed below can be found following page 6-2.

Title	Number	Revision
Programmable Time System (9700AT)	97ATCE-01-5	N/C
Programmable Time System (9710AT)	97ATCE-02-5	N/C
PTS Display (Schematic Drawing)	19381	B
PTS Display (Assembly Drawing)	A-19381	B
Distribution Board Assembly (Assembly Drawing)	A-19385	A
I/O Buffer (Schematic Drawing)	20114	C
I/O Buffer (Assembly Drawing)	A-20114	C
Translator (Schematic Drawing)	20127	D
Translator (Assembly Drawing)	A-20127	D
Generator (Schematic Drawing)	20128	H
Generator (Assembly Drawing	A-20128	H
Power Supply (Schematic Drawing)	21053	B
Power Supply (Assembly Drawing)	A-21053	B
Power Supply (Assembly Drawing)	A-21055	A

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7.0 PARTS LISTS

The parts lists below can be found following page 7-2.

Title	Number	Revision
Programmable Time System (9700AT)	KT97ATCE-01-5	B
Shipping Kit	SK9700-1	N/C
Translator	20127	D
Basic Chassis Assembly	KT9700-06	B
Distribution Board Assembly	19385	A
Gen/LED Assembly	21025	C
Power Supply	21053-1	B
LED Display Assembly	19381	B
Generator	20128	H
Programmable Time System (9710AT)	97ATCE-02-5	C
I/O Buffer	20114	C
Power Supply	21055-1	A

Note: The "KT" prefix in front of a parts list number only signifies that it is a kit for an outside process, and the parts listed are identical to the number without the prefix.

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