

MANUAL OR OPTION SECTION

NAME: 700 MODEL – MINIATURE TIME CODE GENERATOR - MASTER

APPROVALS

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SECTION ONE

GENERAL INFORMATION

1.1 SCOPE OF MANUAL

This manual contains the information necessary to operate and maintain a TrueTime Inc.¹ Model 700 Miniature Time Code Generator (MTCG).

Note: This unit may contain Custom Options. If Custom Options are supplied descriptions of these options will be found on sheet ii in the index of this manual. Specifications and operating instructions found in the Custom Options section will supersede those found in Sections One and Two.

1.2 PURPOSE OF EQUIPMENT

The MTCG is a portable unit primarily used in mobile and airborne applications. The unit is microprocessor based and operates in two basic modes:

- A. As a stand alone time code generator that accumulates time based on an internal oscillator from some operator entered start point. The user may program the time and start and stop the unit.
- B. As a synchronized time code generator. In this mode the MTCG derives its time from an IRIG B time code input and phase locks its time base to the code. Error Bypass is provided in this mode. If the input code should fail the MTCG will continue to update its time using its internal oscillator. If a source of IRIG B is connected to the code input connector the MTCG automatically selects the synchronized generator mode.

The various options listed in the Table of Contents are supplied only if their descriptions are (X)'ed.

1.3 PHYSICAL DESCRIPTION

The MTCG is self contained in one chassis. The chassis dimensions are:

Height	-	2.65" (6.73cm)
Width	-	3.00" (7.72cm)
Depth	-	6.62" (16.81cm)
Weight	-	1.65 lb (.75Kg)

1.4 MOUNTING

Mounting Holes	-	0.196 dia.
Hole Pattern	-	Four Holes in a 6.12" X 2.50" pattern

1.5 ENVIRONMENTAL SPECIFICATIONS

Operating Temperature	-	0C to + 50C
Storage Temperature	-	-60C to + 70C
Humidity	-	To 95% relative without condensation

¹ TrueTime is now Symmetricom

1.6 POWER REQUIREMENTS

DC Input	-	+10.5 VDC to +32 VDC
Current	-	Approximately 500 mA with display and Video option
AC (using adapter)	-	95 to 260 VAC, 50-440 Hz
Power	-	Approximately 6 W

Connector Pins:

<i>Pin</i>	<i>Function</i>
B	DC Input
A	DC Input Return
F	Chassis Ground

1.7 INTERNAL BATTERY

An internal battery is provided. The battery will power the timekeeping circuits plus the IRIG B time code output for four to eight hours (with the time display de-activated).

1.8 OPTION IDENTIFICATION

Each of the options supplied with this unit is indicated in the Table of Contents by an (X) next to the respective option listing. If the Custom Options is (X)'ed pages may be appended to Sections One and Two further describing the custom options and their use.

1.9 SIGNAL SPECIFICATIONS

1.9.1 Generator Specifications

A. Basic Functions:

- Days Reset - to day one after 365 days
- Leap Year - reset to day one after 366 days
- Advance/Retard
- Front Panel Controls - Right/Left Arrows

B. Internal Oscillator (STD)

Frequency	-	10 MHz
Stability	-	50 PPM, 0 to +50 C
Aging	-	1 PPM/year

C. Internal Oscillator (TCXO Option)

Frequency	-	10 MHz
Stability	-	0.5 PPM, 0 to +50 C
Aging	-	1 PPM/year

D. IRIG B Time Code Output

Amplitude	-	Adjustable (R16) from 0 to 6 Vp-p into 600 Ω
Ratio	-	Adjustable (R15) from 2:1 to 5:1 Factory set to 3:1
Connector	-	SMA

E. 1 PPS Pulse Rate

Duty Cycle	-	50%
Timing	-	Positive going on time
Amplitude	-	0 V, +5 V through 2.2 k Ω
Connector	-	Tip Jack

1.9.2 Synchronized Generator Specifications

A. Basic Functions:

1. Days Reset - Reset to day one after 365
2. Leap Year - Reset to day one after 366
3. Phase Lock Resolution - 10 microseconds
4. Front Panel Controls - Right/Left Arrows, Enter

B. Internal Oscillator (STD)

Frequency	-	10 MHz
Stability	-	50 PPM, 0 to +50° C
Aging	-	1 PPM/year

C. Internal Oscillator (TCXO Option)

Frequency	-	10 MHz
Stability	-	0.5 PPM, 0 to +50° C
Aging	-	1 PPM/year

D. IRIG B Time Code Input

Amplitude	-	0.5 Vp-p to 10 Vp-p
Impedance	-	10 k Ω to ground
Ratio	-	2:1 to 5:1
Connector	-	SMA

E. Error Bypass - Selectable from zero to nine frames plus infinite bypass

F. 1 PPS Pulse Rate

Duty Cycle	-	50%
Timing	-	Positive going on time
Amplitude	-	0 V, +5 V through 2.2 k Ω
Connector	-	Tip Jack

1.9.3 Standard Option Specifications

A. LED Display

Ten character, 0.145" red alpha-numeric
Used to display time and set-up parameters

B. Video Time Inserter

This option superimposes time information on a user supplied video signal. The following parameters may be modified using on-screen commands:

- Start/Stop
- Time Insertion on-off
- Background on-off
- Background color white-black
- Character intensity
- Days display on-off
- Milliseconds display on-off
- Horizontal position
- Vertical position
- Character size, vertical
- Character size, horizontal
- Interlace on-off
- Interlace even-odd field

Input Impedance: A 75 Ω terminator may be switched on or off using a front panel mounted switch.

Resolution: The data display contains Seconds, Minutes and Hours information. The user may also add days, tenths of seconds, hundredths of seconds and milliseconds.

C. Extended Life Battery

When using this option the battery discharge life is extended to approximately 24 hours. The time required to completely charge the battery is approximately eight hours.

D. Large Volume Chassis Option

The chassis height is increased to 3.75" (9.52 cm)
This chassis is used when the Extended Life battery option is supplied or when various combinations of multiple outputs are ordered.

E. Extended Temperature Range

This option requires the TCXO option to be installed.

When the Extended Temperature option is supplied, the operating range is increased to -40° to +70° C, and the standard oscillator specification is superseded from +0.5 PPM to ± 2 PPM. The VTI option is slightly degraded at -40° C.

F. Parallel BCD Outputs

This option provides parallel BCD information from milliseconds through days plus a 1 kPPS data ready strobe signal.

Logic Levels	-	0 V, +5 V at +/-6 mA
Logic Sense	-	Each output is positive true
Data Ready	-	Data is available on the positive edge of the strobe
Connector	-	44 pin "D" type connector (mating connector is supplied)
Pinouts	-	See Table 1-1 for pinouts

1.10 Custom Options/Configurations

A. IRIG G Code

Modulated Carrier:	100 kHz
Amplitude:	0 V to 5 VP-P into 600 Ω
Ratio:	Adjust from 2:1 to 5:1
Connector:	SMA

TABLE 1-1

PARALLEL BCD PIN ASSIGNMENTS

PIN	SIGNAL	PIN	SIGNAL
1	MILLISECONDS ONE	23	UNITS MINUTES EIGHT
2	MILLISECONDS TWO	24	TENS MINUTES ONE
3	MILLISECONDS FOUR	25	TENS MINUTES TWO
4	MILLISECONDS EIGHT	26	TENS MINUTES FOUR
5	HUNDRETHS SECONDS ONE	27	UNITS HOURS ONE
6	HUNDRETHS SECONDS TWO	28	UNITS HOURS TWO
7	HUNDRETHS SECONDS FOUR	29	UNITS HOURS FOUR
8	HUNDRETHS SECONDS EIGHT	30	UNITS HOURS EIGHT
9	TENTHS SECONDS ONE	31	TENS HOURS ONE
10	TENTHS SECONDS TWO	32	TENS HOURS TWO
11	TENTHS SECONDS FOUR	33	UNITS DAYS ONE
12	TENTHS SECONDS EIGHT	34	UNITS DAYS TWO
13	UNITS SECONDS ONE	35	UNITS DAYS FOUR
14	UNITS SECONDS TWO	36	UNITS DAYS EIGHT
15	UNITS SECONDS FOUR	37	TENS DAYS ONE
16	UNITS SECONDS EIGHT	38	TENS DAYS TWO
17	TENS SECONDS ONE	39	TENS DAYS FOUR
18	TENS SECONDS TWO	40	TENS DAYS EIGHT
19	TENS SECONDS FOUR	41	HUNDREDS DAYS ONE
20	UNITS MINUTES ONE	42	HUNDREDS DAYS TWO
21	UNITS MINUTES TWO	43	DATA READY STROBE
22	UNITS MINUTES FOUR	44	GROUND

SECTION TWO

INSTALLATION AND OPERATION

2.1 INTRODUCTION

This section contains installation instructions and detailed operating procedures for the Model 700.

Note: This unit may contain Custom Options/Configurations. If they are supplied a description will be found on page ii of the Table of Contents. Any specification or operating procedure noted supersedes those found in Sections One/Two.

2.2 INSTALLATION

Unpack the unit and carefully inspect it for shipping damage. Any damage must be reported to the carrier immediately.

Mount the unit in the desired location. Four mounting holes are located on the base plate.

Fabricate the appropriate input/output connectors. The input/output connectors are SMA types. Four SMA to BNC adapter cables are supplied for your convenience.

Connect the AC adapter or the DC input power cable.

The Model 700 is now ready for operation.

2.3 OPERATION, GENERAL INFORMATION

This section describes operating procedures for the standard unit and certain options. The options supplied are noted by (X)'s in the Table of Contents. If your unit does not contain certain options disregard references to the options in the following paragraphs.

In general the controls consist of the Enter and Right and Left Arrow keys. The unit may be setup using either the optional LED display or by using the on-screen functions when an optional Video Time Inserter is supplied.

If neither the LED nor Video Time Inserter option is supplied the unit will operate as follows:

1. At turn-on the MTCG is reset and begins accumulating time from zero. If no input code is present the unit will continue to accumulate time indefinitely, i.e. operate in the generator mode.
2. If an IRIG B source is connected to the code input connector the MTCG will automatically be put into the Synchronized Generator mode.

2.4 OPERATION, DETAILED INFORMATION

The following text applies to a unit with both the LED and the Video Time Inserter options.

LED Display: When the unit is turned on, the MTCG initializes and the LED display control functions become available. Pressing either Arrow key illuminates the LED and displays the current time. After approximately ten seconds the display turns off. If no IRIG B input code is present, pressing the Enter key shows START or STOP on the LED display. Pressing either Arrow key toggles between START and STOP. After ten seconds the display turns off. Pressing the Enter key displays START/STOP. Pressing ENTER again displays "T", followed by the current time with the first digit flashing.

The flashing digit is used like a cursor. It indicates that a value or mode can be changed. Pressing the Left Arrow key increments the value of the flashing digit. Pressing the Right Arrow key moves the "cursor" one digit to the right. After approximately ten seconds the display turns off. Pressing Enter again re-activates the time display. Pressing Enter again scrolls the display to the next function, in this case, Leap Year select. Pressing either Arrow key toggles between LEAP YR ON and LEAP YR OFF.

Use the Enter key to scroll through the remaining choices:

- BRIGHTNESS: Left Arrow increases and the Right Arrow decreases.
- BYPASS: Left Arrow decreases the number of frames from zero through nine then infinite, and the Right Arrow increases the numbers.
- DISPLAY: Left and Right Arrows toggle between DISPLY ON and DISPLY OFF. DISPLY OFF means that it is timed, that is, it will automatically be extinguished after pressing a key. Note that when the display is ON it turns off when the unit is operating on batteries. To view the display during battery operation press either Arrow key and the display will illuminate for approximately ten seconds.

Pressing ENTER again will cause the display to blank. Pressing either Arrow key will call the time display. If the display is programmed to be ON, see "D" above, it is the preferred mode for permanent time display, as the time cannot be programmed from this display.

On-Screen Programming: The on-screen mode is available only when the Video Time Inserter option is supplied.

If no IRIG B input code is connected, the current time will be displayed followed by a flashing asterisk. The asterisk indicates that either the input code is invalid or, in this case, that no input code is present. The following descriptions assume no input code. If code is present, the time set and start/stop functions are not available.

To invoke the on-screen mode simultaneously press and hold both Arrow keys for approximately three seconds, then press ENTER. The first menu, GENERATOR START/STOP PRESS CURSOR TO ALTER will appear on the screen. If the IRIG B input code is present, that is the MTCG is in the Synchronized Generator mode, the first display will be LEAP ON/OFF PRESS CURSOR TO ALTER.

To leave the on-screen programming mode, simultaneously press and hold the Right and Left Arrow keys for approximately three seconds.

In the following discussions "PRESS CURSOR TO ALTER" means press either Arrow key.

Press ENTER until the PRESET TIME menu is displayed. Pressing either Arrow key will cause the on-screen display to display the current time with the first digit flashing. Pressing the Left Arrow key will increment the flashing digit and pressing the Right Arrow will move the flashing digit to the right one place. When the desired time is displayed wait approximately ten seconds and the display will revert to normal operation, or press Enter and the PRESET TIME menu will be recalled. Press ENTER again and the next menu will appear. Use the Enter key to scroll through the following choices:

GENERATOR START/STOP
PRESET TIME
ERROR BYPASS
LEAP YEAR ENABLED/DISABLED
VIDEO OUTPUT ENABLED/DISABLED
INTERLACED/NON-INTERLACED
VIDEO BACKGROUND ON/OFF
CHARACTER INTENSITY
DAYS DIGITS CONTROL

FRAC(TIONAL) SECONDS DISPLAY
HORIZ CHAR SIZE
VERTICAL CHAR SIZE
HORIZONTAL POSITION
VERTICAL POSITION

ERROR BYPASS PUSH CURSOR TO ALTER: Pressing the Left Arrow will cause the frame number to decrease and pressing the Right Arrow will cause the frame number to increase. When the desired number is selected, press Enter to move to the next menu or, after ten seconds, the time display will be called automatically.

LEAP YEAR ENABLED/DISABLED PRESS CURSOR TO ALTER: Pressing either Arrow key will cause the display to toggle between ENABLED AND DISABLED. Enabled means that the MTCG will reset to day one after 366 days, disabled means that the MTCG will reset to day one after 365 days.

VIDEO OUTPUT PUSH CURSOR TO ALTER: Pressing either Arrow key will cause a toggle between DISABLED and ENABLED. DISABLED turns off the time insertion feature.

INTERLACED PUSH CURSOR TO ALTER: Pressing either Arrow key will cause the display to toggle between ODD and EVEN. Odd and Even selects the fields where the time is to be inserted.

VIDEO BACKGROUND PUSH CURSOR TO ALTER: Pressing either Arrow Key will cause the mask around the time display to toggle between white and black masks. Note that white characters on a white background or black characters on a black background may cause the characters to disappear. If required use the following function to restore the characters.

CHARACTER INTENSITY PUSH CURSOR TO ALTER: The Left Arrow will move the character "color" towards black and the Right Arrow will move the "color" towards white.

DAYS DIGIT CONTROL PUSH CURSOR TO ALTER: The Right and Left Arrow keys will toggle the display between DAYS ON and DAYS OFF. DAYS OFF means that the three 'days' digits are not included in the time insertion.

FRAC SECONDS DISPLAY PUSH CURSOR TO ALTER: Pressing the Right and Left Arrow keys will change the digits to the right of the seconds digits as follows:

365:14:22:34
365:14:22:34.7
365:14:22:34.76
365:14:22:34.765
356:14:22:34

Note: the direction of resolution increase or decrease is a function of whether the Right or Left Arrow key is pressed.

HORIZ CHAR SIZE PUSH CURSOR TO ALTER: Pressing the Right Arrow key will increase the horizontal size while pressing the Left Arrow key will decrease the character size.

VERT CHAR SIZE PUSH CURSOR TO ALTER: Pressing the Right Arrow key will increase the vertical character size while pressing the Left Arrow key will decrease the character size.

HORIZONTAL POSITION PUSH CURSOR TO ALTER: Pressing the Left Arrow key will move the inserted time to the left on the screen. Pressing the Right Arrow key will move the time to the right.

VERTICAL POSITION PUSH CURSOR TO ALTER: Pressing the Left Arrow key will move the inserted time up on the screen. Pressing the Right Arrow key will move the inserted time down on the screen.

SECTION THREE
THEORY OF OPERATION

3.1 INTRODUCTION

This section contains detailed descriptions of the circuits used on each of the circuit cards supplied in this unit. These descriptions should be used in conjunction with the schematic drawings that are located in Section Five.

3.2 INDIVIDUAL CIRCUIT BOARD DESCRIPTIONS

The following pages contain the individual circuit board descriptions and are inserted in numerical order.

SECTION FOUR

MAINTENANCE AND TROUBLESHOOTING

4.1 INTRODUCTION

Effective maintenance of this equipment requires a thorough understanding of the equipment specifications, operating instructions, theory of operation and a thorough understanding of both analog and digital circuitry. Specifications, operating instructions and theory of operation are contained in Section One through Section Three of this manual.

All work done on this unit will be either preventative or corrective maintenance. Preventative being defined as that which is required to maintain peak operating efficiency and to reduce the likelihood of failure. Corrective maintenance is defined as that which is performed to troubleshoot and repair equipment malfunctions. Both types of maintenance procedures are described in the following paragraphs.

4.2 GENERAL INFORMATION

A. WARNINGS AND CAUTIONS

The following is a list of warnings and cautions that are to be observed while performing maintenance on this equipment. Failure to observe these warnings and cautions can result in loss of life, injury or equipment damage.

WARNINGS

1. Exercise extreme care when working in or around energized electrical equipment. Dangerous voltages may be present that can cause serious injury or loss of life. The power supply in particular has high voltages associated with it.
2. Disconnect equipment from the primary power prior to disassembly, cleaning or inspection.

CAUTIONS

1. Exercise extreme care when handling this equipment. It contains precision parts that can be damaged by improper handling.
2. **DO NOT TOUCH** exposed connector pin surfaces. Foreign material deposited on contact surfaces can cause corrosion resulting in equipment damage and failure.
3. Remove the power connector and turn the POWER switch to the OFF position prior to disassembly or service of this equipment.

B. LOCATING DRAWINGS

Reduced drawings of all necessary mechanical assemblies and circuit board schematics are located in Section Five of this manual. The List of Drawings contained in the Index section list the drawings that are furnished.

C. LOCATING CIRCUITS

Section Three provides a written description of each of the circuit boards that are used in this unit. These descriptions, used in conjunction with the schematic diagrams, help in locating individual components.

D. CIRCUIT BOARD REMOVAL

To remove the circuit boards use the following procedure:

1. Remove the top cover
2. Remove the side covers
3. Remove switch caps and retaining nuts
4. Remove the rear cover (eight screws)
5. Remove the two screws at the bottom of the tow rear corner posts.
6. Carefully slide the processor and any option board free of the slots in the front corner posts. Note that the processor and option boards are cabled to the power supply board.
7. To service the boards fold them back to expose the option board(s) and the power supply.
8. To remove the power supply, first remove the two connectors at the front of the board, remove the connector at the voltage regulator on the battery bracket, and remove the four screws securing the power supply to the battery bracket and the bottom cover.

To reassemble the unit, reverse the above process.

During the re-assembly process make sure that all locking hardware is installed and each threaded surface has a commercial retention agent such as Locktite applied to it.

4.3 PREVENTATIVE MAINTENANCE

A. INSPECTION

Routinely inspect the MTCG for loose connectors or mechanical damage. Perform operational tests that verify each of the specifications at regular intervals. Broken or damaged parts or frayed connections must be repaired immediately.

B. CLEANING

Use a soft rag and mild commercial cleaner such as Windex to clean the lens and painted surfaces. The internals may be cleaned with compressed air.

4.4 CORRECTIVE MAINTENANCE

The following procedures propose troubleshooting techniques that require the drawings and aids supplied in this manual, along with a thorough knowledge of troubleshooting sophisticated electronic equipment.

A. BASIC TROUBLESHOOTING PROCEDURES

The following suggestions are general in nature and are based upon established techniques. When followed they aid in minimizing down time. Any procedure is a guide and may be deviated from whenever it is expedient to do so.

B. OPERATING PROCEDURES

Often what appears to be a malfunction is in reality the result of improper operation or application of the equipment. Thoroughly evaluate the procedures that were in use when the malfunction occurred. Check external loads and connections to make sure that they are within the limit of the specifications of the MTCG.

C. VISUAL INDICATIONS

Use the visual indicators such as Lock and, in particular, the alpha-numeric display as troubleshooting aids. Note any variations of nominal indications during suspected malfunctions.

D. POWER CIRCUITS

Verify that the power supplies are operating to their specifications and that the input power is within its specifications. Note that the fuses used in this unit are of the self-healing type and will return to proper operation when the fault is corrected.

E. REPLACING COMPONENTS

It is imperative that integrated circuits and other components are replaced with exactly the same type of component as specified on the bill of materials for the assembly that is being repaired. Be sure not to bend the integrated circuit legs when replacing them.

When replacing soldered-in components, use a low temperature soldering iron and be careful not to damage the copper foil (etch). Use of acid-core solder will void the warranty. Use resin-core solder, and carefully clean the repaired area with alcohol. Do not allow the cleaning fluid to penetrate switches or potentiometers, or to contact the viewing surfaces of the LED's.