Model 5601MSC
Master SPG/Master Clock System
Instruction Manual

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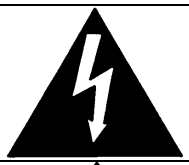
IMPORTANT SAFETY INSTRUCTIONS

	The lightning flash with arrowhead symbol within an equilateral triangle is intended to alert the user to the presence of uninsulated “Dangerous voltage” within the product’s enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons.
	The exclamation point within an equilateral triangle is intended to alert the user to the presence of important operating and maintenance (Servicing) instructions in the literature accompanying the product.

- Read this information
- Keep these instructions.
- Heed all warnings.
- Follow all instructions.
- Do not use this apparatus near water
- Clean only with dry cloth.
- Do not block any ventilation openings. Install in accordance with the manufacturer’s instructions.
- Do not install near any heat sources such as radiators, heat registers, or other apparatus (including amplifiers) that produce heat.
- Do not defeat the safety purpose of the polarized or grounding type plug. A polarized plug has two blades, one blade being wider than the other. A grounding type plug has two blades and a third grounding prong. The wide blade or the third prong is provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.
- Protect the power cord from being walked on or pinched particularly at plugs, convenience receptacles and the point where they exit from the apparatus.
- Only use attachments/accessories specified by the manufacturer
- Unplug this apparatus during lightning storms or when unused for long periods of time.
- Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way (i.e. liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped).

WARNING
TO REDUCE THE RISK OF FIRE OR ELECTRIC SHOCK, DO NOT EXPOSE THIS APPARATUS TO RAIN OR MOISTURE.

WARNING
DO NOT EXPOSE THIS EQUIPMENT TO DRIPPING OR SPLASHING AND ENSURE THAT NO OBJECTS FILLED WITH LIQUIDS ARE PLACED ON THE EQUIPMENT.

WARNING
TO COMPLETELY DISCONNECT THIS EQUIPMENT FROM THE AC MAINS, DISCONNECT THE PLUG FROM THE DUAL POWER SUPPLIES AC RECEPTACLE.

WARNING
THE MAINS PLUG OF THE POWER SUPPLY CORD SHALL REMAIN READILY OPERABLE.

INFORMATION TO USERS IN EUROPE

NOTE

This equipment with the CE marking complies with both the EMC Directive (89/336/EEC) and the Low Voltage Directive (73/23/EEC) issued by the Commission of the European Community.

Compliance with these directives implies conformity to the following European standards:

- EN60065 Product Safety
- EN55103-1 Electromagnetic Interference Class A (Emission)
- EN55103-2 Electromagnetic Susceptibility (Immunity)

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to the European Union EMC directive. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

INFORMATION TO USERS IN THE U.S.A.

NOTE

FCC CLASS A DIGITAL DEVICE OR PERIPHERAL

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

WARNING

Changes or Modifications not expressly approved by Evertz Microsystems Ltd. could void the user's authority to operate the equipment.

Use of unshielded plugs or cables may cause radiation interference. Properly shielded interface cables with the shield connected to the chassis ground of the device must be used

NOTICE TO MODEM USERS IN THE USA

The 5601MSC Master Clock/Sync Generator complies with the FCC Rules Part 68. The 5601MSC is designed to be used on standard device telephone lines. It connects to the telephone line by means of a standard jack called the USOC RJ11C and should be connected to the telephone network with a FCC compliant telephone cord and modular plug.

It is not necessary to notify the telephone company before connecting the modem in the 5601MSC. However, the telephone company may request the telephone number to which the 5601MSC modem is connected and the FCC registration number and ringer equivalence number (REN), both of which are on the label on the rear panel.

The REN is used to determine the number of devices you may legally connect to your telephone line. In most areas, the sum of the REN of all devices connected to one line must not exceed five (5.0). You should contact your telephone company to determine the maximum REN for your calling area.

The 5601MSC may not be used on coin service provided by the telephone company. Connection to party lines is subject to state tariffs.

If the modem in the 5601MSC is malfunctioning, it may affect the telephone lines. In this case, disconnect the modem until the source of the difficulty is traced.

IMPORTANT INSTALLATION NOTICE

FOR A RELIABLE TELEPHONE CONNECTION TO THE MODEM IN THIS 5601MSC A DIRECT TELEPHONE LINE MUST BE USED. THIS LINE MUST NOT PASS THROUGH A PBX OR SIMILAR KEY DEVICE.

REVISION HISTORY

REVISION	DESCRIPTION	DATE
0.1	Preliminary	Feb 2010
0.2	Mass updates	Jun 2010
0.2.1	Updated Features and Technical Specifications	Jul 2010
0.3	Updated Overview, Features, Technical Specifications, & System Status Messages. Added information on Configuring the Outputs (Global Phasing) and General Configuration (Power Supplies & Saving and Recalling Presets)	Aug 2010
0.4	Added Global Phase Offset and Phase of Sync Outputs info	Dec 2010

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CHAPTER 1: OVERVIEW

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1. OVERVIEW

Figure 1-1: Front View of the 5601MSC

The 5601MSC Master Sync and Clock Generator is both a broadcast quality master sync pulse generator (SPG) and a master clock. It provides all of the synchronizing signals needed in a 21st century TV station or post production facility at the same time as solving the problem of locking the in-house master clock system to the master video sync pulse generator.

A high stability, temperature controlled oscillator provides the 5601MSC with better than $5.0x10^{-9}$ (or 0.005ppm) frequency reference. The free-running drift of this 10MHz reference will be less than 0.1Hz (which amounts to less than 1 millisecond time drift per day). This guarantees that any frequency drift, with time and temperature, will be within the tolerances expected from the best SPGs or master clocks available in the industry. The 5601MSC may also be referenced to an external 5MHz or 10MHz master oscillator if higher stability is required. Both the SPG and the Master Clock sections may be referenced to high stability time and frequency standards present in the Global Position System (GPS) by adding the **GP** option.

The SPG section provides six programmable sync outputs. These six BNC outputs may be configured to provide 6 independently timed color black (black burst) outputs or 6 independently timed HDTV tri-level sync outputs. Each color black output can optionally carry vertical interval time code (VITC) on a user specified set of lines. Additionally, there are many more sync modes available for each output. The wordclock output provides a 48kHz wordclock or may be configured as an additional sync output. The 10MHz output provides 10MHz or 5MHz, or may be configured as an additional sync output.

When referenced to the optional GPS receiver, the start of the NTSC four field sequence, or the PAL eight field sequence, will coincide with a specific point in the GPS code. In this way, by referencing multiple 5601MSCs in a system to GPS, they will all be automatically locked to each other. This is ideal for applications requiring a remote facility frequency to be phase and time locked. The GPS head may be remotely located from the unit with the standard weatherproof 50 ft. cable included or optional 100 ft. and 400 ft. cables. For remote GPS head requirements of greater than 400 ft. or for fiber optic isolation, GPS Data Fiber Transmitters & Receivers are also available (7707GPS-DT, 7707GPS-DR).

The master clock section provides two longitudinal time code (LTC) outputs on XLR connectors and a 15-pin D connector. Having two LTC outputs provides the ability to drive 24 and 30 Fps, or drop-frame and non drop-frame timecode simultaneously. System time may also be inserted as VITC onto the sync outputs. The system clock may be synchronized to GPS time, to a high-level time source via modem, to the LTC input, to extracted VITC from the reference input, or to another 5601MSC through a syncro link. Each of the LTC and VITC outputs can be offset from system time to a specific time zone as required. The 5601MSC can also provide RFC-1305 compliant NTP via Ethernet, and operates in both broadcast and server mode. GPS, NTP and modem access are all options for the 5601MSC. A battery backed-up real time clock maintains time while power is not applied to the unit.

There are three test signal generator options available. The **SDTG** option provides two composite analog video test signal outputs, two AES and one DARS output in both balanced and unbalanced formats, and balanced analog audio tone generators. The **SDTG** option also provides four standard definition SDI test signal generators, each with two outputs. The **HDTG** option adds high definition support. The **3GTG** option adds Dual Link, 3G Level A and Level B support along with 3D test signals.

All versions of the 5601MSC offer a COM port for software upgrades. An optional redundant power supply is also available.

Features:

- Six programmable and independently timeable sync outputs
- Each sync output can be configured for many different signal types including NTSC-M/PAL-B black burst, HD tri-level, 5MHz, 10MHz, 48kHz wordclock, NTSC/PAL-B Subcarrier, and more
- VITC can be inserted on black burst outputs. Ten Field Pulse is available for NTSC-M outputs
- One 10MHz output that can also be configured as an additional sync output
- One 48kHz wordclock output that can also be configured as an additional sync output
- Two independent LTC outputs on XLR connectors (primary) with copies on a DB15 (secondary)
- One balanced LTC input
- Reference loop input for Black Burst, Tri-level sync, or 5MHz/10MHz references
- Ability to read and synchronize to VITC and Ten field pulse present on references
- GPS antenna for frequency/phase and time reference (**GP** option)
- Two GPS-locked units will be in time and phase even when remotely separated by miles
- Compatible with Evertz Dual GPS Data Fiber Receivers & Transmitters (7707GPS series)
- Output frequency stability guaranteed better than 5.0×10^{-9} (or 0.005ppm)
- Special “Slow” lock mode prevents sudden changes in system frequency/phase when a reference is lost and regained by slowly retiming the outputs until lock is established
- Special “Wide” lock mode allows rapid locking to video or 10MHz references over a ±15ppm range
- Automatic fallback to backup oscillator if main oscillator circuit fails
- Optional Modem for NRC and NIST time reference dial up or NRC hosting with the **M** option
- Four independent standard definition SDI test generators with the **SDTG** option
- Optional HD format support for all four TGs with the **HDTG** option (includes **SDTG** support)
- Optional 3G/Dual Link format support with the **3GTG** option (includes **HDTG** and **SDTG** support)
- The **SDTG, HDTG**, and **3GTG** options include two analog video test generators, two AES and one DARS output in both balanced and unbalanced formats, and two balanced analog audio channels
- Supports 2k D-Cinema output standards (SMPTE428) with **HDTG** and **3GTG** options
- On-screen 1 or 2 line text message can be inserted on SDI TGs 1 and 3 and Analog TG 1
- Hot-swappable front panel with dual 6 line x 16 character alpha-numeric LCD displays, 10 pushbuttons, and a control knob. Online HELP for describing menu functions
- Rack mountable with available rear support kit
- Programmable general purpose outputs and inputs. Two GPOs and two GPIs
- Hot-swappable power supply and fan module with optional redundant power supply (**2PS** option)
- Automatic changeover units available for dual redundant system applications (5601ACO2)
- Front panel menus can be disabled through a password-protected engineering menu
- CONTROL 10/100Mbit Ethernet port for NTP and SNMP control/monitoring with VistaLINK® Pro
- TIME 10/100Mbit Ethernet port for future functionality
- Optional Network Time Protocol (NTP) support (**T** option)
- 2 factory presets and 3 user-presets available
- Hardware monitoring of power supplies, fans, and temperature

Two 5601MSC units in combination with an Automatic Change Over (model 5601ACO2) provide an extra degree of reliability where dual redundant installations are required. The ACO provides relay changeover for all outputs from both 5601MSC units with the exception of the LTC XLR outputs. A syncro link through the 5601ACO2 guarantees that the configuration and timing of the units are identical so that changeovers are done with minimal disruption of the plant timing reference. The 5601ACO2 automatically splits an LTC input, and two GPIs to both 5601MSC units.

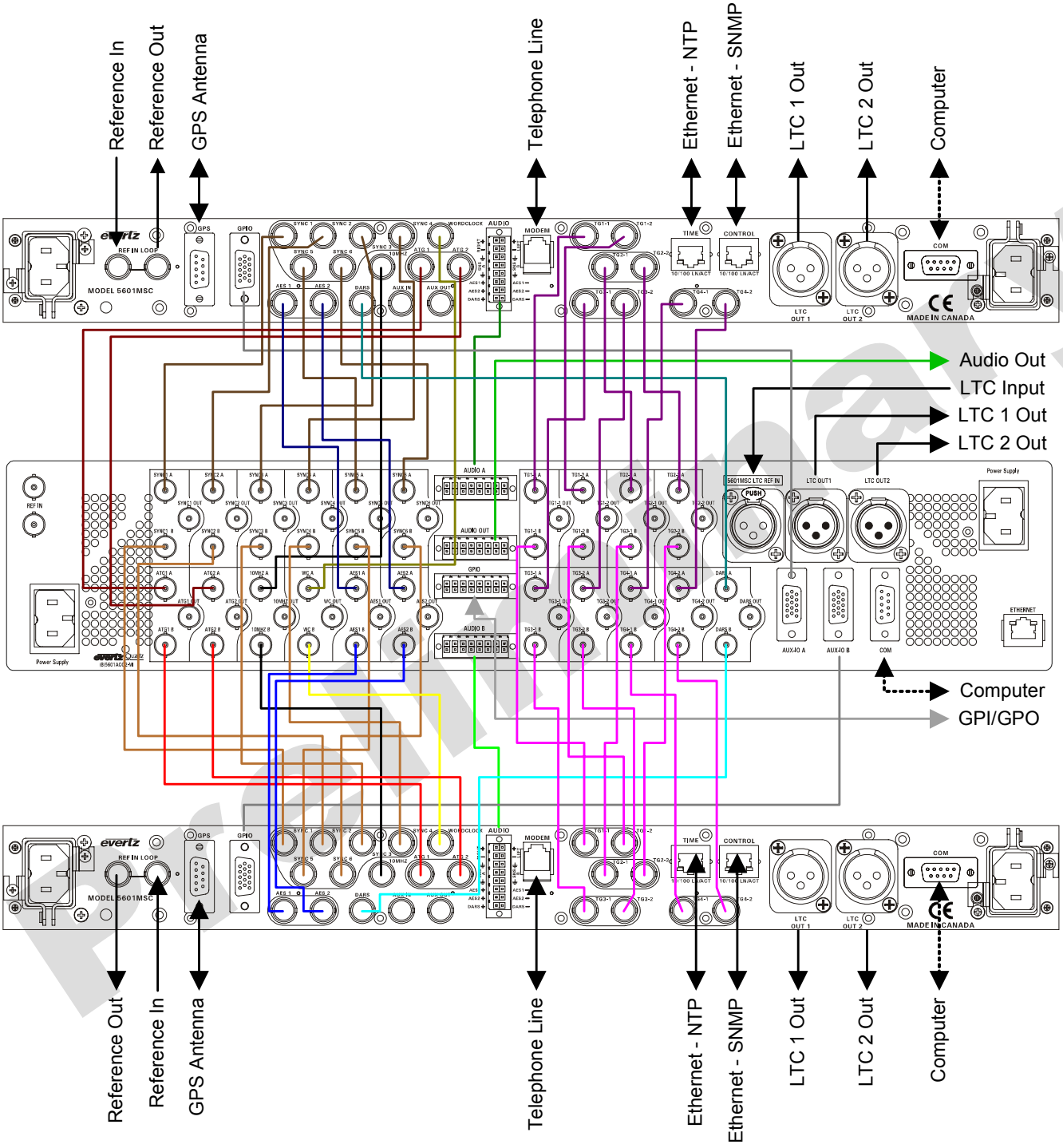

Figure 1-2: Redundant Master Clock/SPG with Auto Changeover System Diagram

1.1. QUICK START GUIDE

This quick start guide discusses the major steps in getting a new installation of a 5601MSC up and running.

Figure 1-3: 5601MSC with Front Panel Removed and Other Components Partially Extracted

1.1.1. Mounting and Power Connections

The 5601MSC chassis holds the main board, one power supply, and one fan module. Dual power supplies are an available option in which case a second power supply replaces the fan module. The chassis has built in rack mounting ears and fits in a standard 19" rack. Two fans on each side cool the unit. Clearance of 2" (5cm) must be maintained around the fan exhausts on either side of the chassis. The power supply operates from an AC line frequency of 50Hz to 60Hz, at 95V-125V or 185V-260V (auto-sensing). The fan module does not require AC power to function. The peak power consumption of a 5601MSC during warm-up is 75 Watts. The maximum steady state power draw is 65 Watts.

If dual power supplies are fitted, they must both be supplied with AC power. Each power supply has its own IEC C14 AC power inlet. The inlets are isolated from each other and can be powered by the same AC power source but ideally should be powered from different AC sources for true redundancy. Both supplies must be powered at all times otherwise the unpowered supply will trigger a system fault. A redundant power supply may be added at any time to a unit by removing the fan module and installing the second power supply. The *Number PS* menu item must be changed to the correct setting in order for the power supply fault detection to work properly (see section 3.5.9.5).

The power supplies do not have an on/off power switch. They will start up automatically once plugged in. The power supplies and fan module are hot swappable and accessed from the front of the unit by removing the front panel. Each power supply and fan module has a Phillips mounting screw at the front that can be used to secure the module in order to prevent accidental removal.

1.1.2. Front Panel Installation

The 5601MSC comes with a removable front panel that is equipped with two color LCD screens, 10 pushbuttons, and a control knob for navigating the menu system and configuring the unit. The front panel is secured to the chassis by the two thumbscrews on either end. The front panel can be removed and re-installed while the unit is running to provide access to the main board and power supplies for troubleshooting purposes. When installing the front panel make sure to tighten the two thumb screws.

When AC power is applied to the 5601MSC, the unit will start up automatically. The front panel should become operative within approximately 30 seconds.

1.1.3. Configuring the Ethernet Ports

Press the **GENERAL** button on the front panel to access the general setup menu. This menu can be used to configure the CONTROL Ethernet port on the 5601MSC. The CONTROL port is used for SNMP monitoring and control of the unit and also to host the NTP server and to send NTP broadcasts (if the **T** option is installed). The *TIME* Ethernet port is reserved for future functionality.

The current menu selection will be indicated by the **>** character. Rotate the control knob or press the ↑ and ↓ buttons to select the *IP Control* menu item and press the **SELECT** button or depress the knob. The *IP address mode* should be selected first. Choosing *Dynamic (bootp)* mode causes the 5601MSC to look for a BOOTP server in order to configure the IP network settings for this Ethernet port. The *Static IP* mode requires the user to specify the IP address, netmask and gateway settings manually.

If *Static IP* mode is selected, assign an unused IP address to the unit and an IP netmask, according to your network addressing scheme. When entering an IP address, the control knob can be used to set each value. Depress the control knob while turning to adjust in larger steps. If *Dynamic (bootp)* mode is selected, the acquisition of IP settings will be automatic and can be checked by pressing the **STATUS** button and scrolling down to select the *Control Ethernet* status screen.

If SNMP monitoring or control of the unit is desired, the SNMP feature must first be enabled (it is disabled by default). Select the **GENERAL** menu and press **ESC** to return to the root menu. Scroll down to *EngineeringMenu* and press **SELECT**. A password is required to enable the engineering menu items. Press **SELECT** on *Password* and use the ↑ and ↓ buttons or control knob to enter each digit of the numeric password and then press **SELECT**. The default password is 5601. The SNMP menu should now be accessible and SNMP can be enabled through *SNMP Ctl*. The trap addresses must be assigned if SNMP traps are required to be sent to remote logging software such as Vista*LINK*® Pro. Contact Evertz customer service if a MIB to the 5601MSC is required.

1.1.4. Selecting and Connecting Frequency References

Pressing the **INPUT** button on the front panel will select the input menu. The user can set the frequency and time references of the unit using this menu. Use the knob to select the *Frequency Ref* menu item and press **SELECT** or depress the knob. Here the *Reference Src* menu item selects four different ways the 5601MSC can lock its master oscillator.

- ***GPS*** – The 5601MSC will look for a GPS antenna attached to the GPS port on the back of the unit. The ovenized oscillator inside the unit will lock to the 1PPS pulse from the GPS antenna. This provides a very accurate frequency reference to the unit. The high precision time and date provided by the GPS antenna is used to phase the outputs of the 5601MSC by referencing them to a specific point in GPS time. Multiple 5601MSC units locked to GPS will all have the same phase on their outputs. This also means the time reference will be forced to GPS.

- ***10 MHz*** – The 5601MSC will look for a 5MHz or 10MHz reference on its reference loop input. The 5MHz/10MHz reference should come from a source that has higher stability than the internal oscillator of the 5601MSC such as a Rubidium or Cesium frequency standard. A 5MHz or 10MHz reference does not provide any phase information and the phase of the outputs will not be the same between different 5601MSC units.

- ***Video*** – The 5601MSC will genlock to a black burst or HD tri-level reference applied to its reference loop input. The frequency stability of the 5601MSC will be only as good as that of the reference input. The phase of the outputs will be aligned to that of the reference input, including color frame alignment and AES phase alignment if a 10-field pulse is detected.

- ***Internal*** – The 5601MSC will free run on its internal high stability ovenized oscillator. Select this option if no external reference is available to the unit.

There are two other menu items that control how the 5601MSC locks to its reference. These are *Genlock Range* and *Lock type*. Press the **HELP** button for a short description on what each menu item does. For a detailed description see section 3.3.

1.1.5. Selecting and Connecting Time References

Once the desired frequency reference has been selected and the antenna/reference connections have been made, the Time reference should be selected. The time reference is where the 5601MSC obtains time and date for the system clock. Press the **INPUT** button to access the input menu. Return to the root level by pressing **ESC** a couple times. Select the *Time* menu using the control knob and press **SELECT**. Use the *Reference Src* menu item to choose a time reference for the unit. There are other menu items that control how the 5601MSC handles the time reference. Press the HELP button to identify the function of each item or see section 3.3.5 for more detail.

- ***GPS*** – If the frequency reference has been set to GPS, the time reference will also be forced to GPS. However it is also possible to use a frequency reference other than GPS (such as video) but still obtain very accurate continuous time and date updates from a GPS antenna.

- ***Modem*** – If the unit is equipped with a modem, the 5601MSC can synchronize its system time and date by dialling out to a high-level time reference provider such as the NRC or NIST ACTS. The high frequency stability of the 5601MSC will ensure that the acquired time is accurate for a maximum period of 10 days, however the unit can be configured to dial out every day, or once per week if desired. See section 3.5.6.

- ***Syncro*** – If the 5601MSC is paired with another unit and connected through a 5601ACO2 automatic changeover it can acquire time and date updates from the master unit. Therefore in dual redundant installations only one GPS antenna (or other high-level time source) is required for both units. Syncro slave time mode must be selected in the GENERAL menu before this selection will work. See section 2.4 for more information on Syncro.

- ***LTC*** – Selecting this option will cause the 5601MSC to obtain its system time from the LTC input on the GPIO connector on the back of the unit. It can also decode date information from the user bits in several different formats.

- ***VITC*** – The 5601MSC will look for Vertical Interval Time Code on the selected line of a black burst signal that is applied to the reference loop input. It can also decode date information from the user bits in several different formats. In order to use VITC as a time reference, the frequency reference must first be set to *Video*.

- ***None*** – The 5601MSC will not acquire time from any outside source and the time and date must be manually entered using the front panel in the GENERAL menu. The high frequency stability of the unit and battery backup will ensure the 5601MSC keeps fairly accurate time.

1.1.6. Checking the Status of the Unit

After the input references are connected and set up, the status of the unit can be checked by pressing the **STATUS** button on the front panel. There are several different status screens which can be selected by using the control knob or the ↑ and ↓ buttons. The status of the frequency and time references can be viewed by choosing the *Lock status* screen and pressing **SELECT**. Press **ESC** to return to the status menu to select another screen for viewing. Any screen name that is highlighted with a red or yellow background indicates that one of the statuses in that screen is in a fault or warning condition.

Figure 1-4: Rear View of 5601MSC

1.1.7. Wiring the Outputs

Most outputs are provided as BNC connectors and wiring is straightforward. There are also two male XLR connectors for the primary LTC1 and LTC2 outputs. The LTC input and secondary copies of LTC1 and LTC2 are available on the 15-pin D-sub **GPIO** connector. This connector also has two GPIs (general purpose inputs) and two GPOs (general purpose outputs). The cable for this connector is not supplied and must be built by the end user.

If a test generator option is installed, such as the **SDTG**, **HDTG**, or **3GTG** options, there will be two channels of balanced analog audio and balanced versions of the AES1, AES2, and DARS outputs available on a 16-pin removable terminal block connector. The removable terminal block can be unscrewed from the 5601MSC to be wired up, then inserted and secured with the two slotted flange screws. The terminal block can accept wires in the range of 28-18 AWG. Stranded wires should be tinned first or crimped to wire pin terminals. The tension clamp can be released by pushing a small slotted screwdriver into the middle square hole. The wire can then be inserted into the outside round hole and then clamped by removing the screwdriver.

If the 5601MSC is to be used as part of a dual redundant system involving a 5601ACO2 automatic changeover, the wiring diagram in section 1 should be observed. Use the included 15-pin male-male cables to connect the GPIO ports of the 5601MSCs to the 5601ACO2. The SNSA and SNSB pins are used by the 5601MSC to detect the 5601ACO2 and automatically enable highdrive on the SDI TG outputs. If automatic highdrive support is not required, these pins can be left unconnected but highdrive will have to be enabled manually for the SDI TGs. The GPI and LTC input connections on the 5601ACO2 are internally split and sent to both 5601MSC units.

1.1.8. Configuring the Sync Outputs

The sync outputs of the 5601MSC are configured in the OUTPUT menu, accessed by pressing the **OUTPUT** button. All sync outputs are derived from the master oscillator and will be locked in frequency and phase. The sync outputs are all programmable to output several different sync types and can be phased independently from each other.

The 10MHz and Wordclock outputs are additional sync outputs that can be programmed to output any standard including black burst or HD tri-level. Likewise, Sync outputs 1 to 6 can be configured to output 10MHz or Wordclock. The BNC labels and matching default mode assignments for the 10MHz and Wordclock outputs were chosen to ease migration from the older model 5600MSC.

In the OUTPUT menu, the sync outputs are configured using the *SYNC 1* to *SYNC 6* sub-menus as well as the *10MHz* and *Wordclock* sub-menus. Each sync output can set to output any number of black burst or HD tri-level standards. They are all phased independently. When configuring a sync output the *Mode* must be selected first. By default, the mode of all sync outputs are set to NTSC-M black burst for North American units, and PAL-B black burst for European units. Configure the *Mode* of each sync output to the format desired for the installation.

There are numerous other configuration settings for each sync output, some may be disabled (dark text) or enabled (white text) depending on the output mode selected. Scroll over each of the available menu items and press the **HELP** button for more information on the function of each menu item. See section 3.4.2 for more information on configuring the sync outputs.

1.1.9. Configuring the Test Generator Outputs

If the unit has been equipped with a test generator option, such as the **SDTG**, **HDTG**, or **3GTG** options, then there will be several test generator outputs available. The video test generator outputs include two composite analog video test generators that are configured in menus *ATG 1* and *ATG 2*. There are four serial digital video test generators, each with two BNC outputs. These are configured in the *SDI TG 1*, *SDI TG 2*, *SDI TG 3*, and *SDI TG4* menus. All test generators are derived from the master oscillator and will be automatically locked in frequency and phase. The test generators are independent from one another and can be configured to different formats and different phase offsets. By default, all phases will be aligned to the selected frequency reference.

There are also three AES outputs configured in the *AES Audio* sub-menu. AES 1 and AES 2 can contain audio tones while the DARS output is muted. There are unbalanced (75Ω) versions of these outputs available as BNC connectors as well as balanced (110Ω) copies available on the AUDIO terminal block.

Two channels of balanced analog audio (left and right) are configured in the *Analog Audio* sub-menu. These outputs are on the AUDIO removable terminal block connector.

The quickest and easiest way to discover how to configure the outputs is to scroll through the available menu items and press the **HELP** button for a description of each menu item function.

1.1.10. Configuring the Time Outputs

All time outputs from the unit come from the System Time clock. This clock can be viewed by pressing the **STATUS** button and selecting the "*System/LTC* time" screen. When the time reference is obtained from GPS or modem sources, the system time will be Coordinated Universal Time (UTC). UTC time is the same at all locations around the world.

In order to output local time, the Time Zone must be selected to match the time zone offset of your location. For example, in North America, Eastern Standard Time (EST) is UTC –5:00 hours. Central Standard Time (CST) is UTC –6:00 hours. Mountain Standard Time (MST) is UTC –7:00 hours. Pacific Standard Time is UTC –8:00 hours. The 5601MSC also supports Daylight Saving Time, which must be enabled separately for each time output. Below are descriptions of the time outputs available from the 5601MSC:

Sync Outputs: When a Sync output mode is set to NTSC-M or PAL-B black burst, VITC time can be inserted onto two lines in the vertical blanking interval. The VITC is controlled by the *Vitc Enable*, *Vitc Line 1*, *Vitc Line 2*, *Time Zone*, and *DST enable* menu items.

LTC Outputs: There are two Linear Time Code outputs from the 5601MSC. The primary outputs are provided as XLR connectors on the back of the unit. Secondary copies are provided on the 15-pin GPIO D-sub connector. The LTC outputs are configured in the *LTC 1* and *LTC 2* sub-menus located off the OUTPUT root menu.

NTP Server: If the 5601MSC has the **T** option installed, it will support the Network Time Protocol on the CONTROL Ethernet port. This is configured by pressing the **GENERAL** button and entering the *NTP rules* sub-menu. The 5601MSC hosts an NTP server and also sends out periodic NTP broadcasts. NTP time should always be UTC.

1.1.11. Final Steps of Set Up and Securing all Connections

Once the 5601MSC has been configured, the various *STATUS* screens should be checked to ensure there are no items displayed with a red or yellow background. The left LCD screen should show "Sys OK" and "Ref OK" with a green background in the bottom corners.

The power supply and fan modules (accessed by removing the front panel) should be secured to the chassis by fastening the Phillips mounting screw. All D-Sub connectors on the back of the unit should be secured to the 5601MSC using their mounting screws. The removable terminal block should also be secured using the flange screws. The AC power cords can be fixed to the unit using the retaining clips provided (see section 2.1.9).

1.1.12. Access Control

The engineering menu password can be changed from the default to prevent unauthorized tampering of SNMP and menu access control settings. In the *Menu Visibility* sub-menu, each of the front panel menus can be disabled to prevent local changes. The SNMP Ctl menu item can be changed to *SNMP off* or *SNMP status* to prevent remote SNMP control of the unit. Furthermore, pressing the **PANEL LOCK** button can lock the front panel. This prevents accidental changes by someone bumping or leaning into the front panel. The front panel can be unlocked by pressing the **SELECT** and **PANEL LOCK** buttons simultaneously.

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CHAPTER 2: INSTALLATION

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2. INSTALLATION

2.1. REAR PANEL

Figure 2-1 provides an illustration of the 5601MSC rear panel. The following sections describe the purpose of the rear panel connectors of the 5601MSC. The following sections 2.1.1 to 2.1.9 describe the specific signals that should be connected to the 5601MSC.

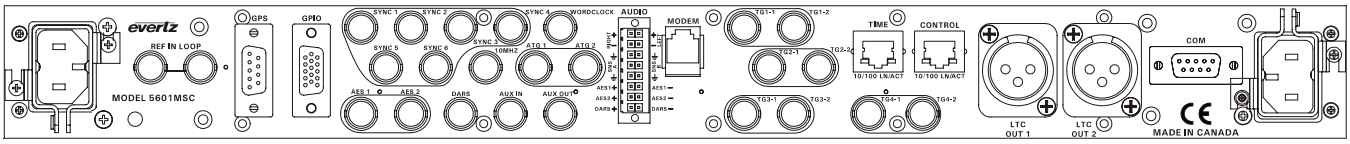


Figure 2-1: 5601MSC Rear Panel

2.1.1. Reference Loop Connections

REF IN LOOP: These BNC connectors provide a reference loop input for NTSC/PAL black burst, HD tri-level, or 5MHz/10MHz signals. The frequency reference source must be set to *Video* in order to genlock to black burst or tri-level video signals. It must be set to *10MHz* in order to lock to 5MHz or 10MHz reference signals. See section 3.3 for more information. The loop is high impedance and will need to be properly terminated with 75 ohms using an external termination.

2.1.2. Sync Outputs

SYNC 1 to 6: These BNC connectors provide six independent programmable sync outputs that are configured by the *SYNC 1* to *SYNC 6* group of sub-menus in the *OUTPUT* setup menu. Each output can be configured for any format of sync output from black burst, to tri-level, to 5MHz/10MHz, to wordclock, and more. See section 3.4.2.

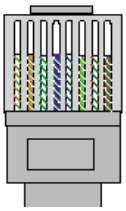
10 MHz OUT: This BNC connector provides a 10MHz frequency reference but can also be programmed as another sync output. It is recommended that this output be configured as a 10MHz output when used in conjunction with a 5601ACO2 to simplify wiring. It is configured using the *10 MHz* sub-menu in the *OUTPUT* setup menu.

WORDCLOCK: This BNC connector provides a 48kHz wordclock signal but can also be programmed as another sync output. It is recommended that this output be configured as a wordclock output when used in conjunction with a 5601ACO2 to simplify wiring. It is configured using the *Wordclock* sub-menu in the *OUTPUT* setup menu.

2.1.3. Ethernet Connections

The 5601MSC is equipped with two fast Ethernet ports. They can be used with either 10Base-T (10 Mbps) or 100Base-TX (100 Mbps) twisted pair Ethernet cabling systems. When connecting for 10Base-T systems, category 3, 4, or 5 UTP cable as well as EIA/TIA – 568 100Ω STP cable may be used. When connecting for 100Base-TX systems, category 5 or better UTP cable is required. The cable must be "straight through" with an 8-pin modular connector at each end. Make the network connection by plugging one end of the cable into the CONTROL receptacle of the 5601MSC and the other end into a port of the supporting hub or switch. The TIME port is reserved for future use.

The straight-through Ethernet cable can be purchased or can be constructed using the pinout information in Table 2-1. A color code wiring chart is provided in Table 2-1 for the current Ethernet standards (AT&T 258A or EIA/TIA 258B color coding shown). Also refer to the notes following the table for additional wiring guide information.



Pin #	Signal	EIA/TIA 568A	AT&T 258A or EIA/TIA 568B	10BaseT or 100BaseTX
1	Transmit +	White/Green	White/Orange	X
2	Transmit –	Green	Orange	X
3	Receive +	White/Orange	White/Green	X
4	N/A	Blue	Blue	Not used (required)
5	N/A	White/Blue	White/Blue	Not used (required)
6	Receive –	Orange	Green	X
7	N/A	White/Brown	White/Brown	Not used (required)
8	N/A	Brown	Brown	Not used (required)

Table 2-1: Standard 8-pin Modular Connector Wiring Color Codes

Note the following cabling information for this wiring guide:

- Only two pairs of wires are used in the 8-pin modular connector to carry Ethernet signals.
- Even though pins 4, 5, 7 and 8 are not used, it is mandatory that they be present in the cable.
- 10BaseT and 100BaseTX use the same pins; a crossover cable made for one will work with both.
- Pairs may be solid colors and may not have a stripe.
- Category 5 cable must use Category 5 rated connectors.

The maximum cable run between the 5601MSC and the supporting hub or switch is 300 ft (90 m). The maximum combined cable run between any two end points (i.e. 5601MSC and PC/laptop via network hub) is 675 feet (205 m).

Devices on the Ethernet network continually monitor the receive data path for activity as a means of checking that the link is working correctly. When the network is idle, the devices also send a link test signal to one another to verify link integrity. The 5601MSC rear panel is fitted with two LEDs to monitor the Ethernet connection.

10/100: This Amber LED is ON when a 100Base-TX link is detected. The LED is OFF when a 10Base-T link is detected.

LN/ACT: This dual purpose Green LED will turn on to indicate that the 5601MSC has established a valid link. This gives a good indication that the segment is wired correctly. The LED will BLINK when the 5601MSC is sending or receiving data. The LED will be OFF if there is no valid connection.

2.1.4. Linear Time Code Connections

The *LTC 1* and *LTC 2* groups of sub-menus in the *OUTPUT* root menu are used to configure the LTC outputs. See section 3.4.1. The output level is adjustable from approximately 0.8V to 9.0V using the *Output Level* item on the *LTC* output menus. This assumes a load impedance of greater than 1kΩ.

LTC OUT 1 & 2: There are two 3-pin male XLR connectors for SMPTE/EBU linear time code outputs 1 and 2. These are the primary copies for each LTC output. The LTC OUT 1 connector can also drive +12 V_{DC} power for downstream Evertz clocks (see section 3.4.1.1).

Pin #	Name	Description
1	GND	Signal Ground
2	LTC+	Primary LTC + output
3	LTC-	Primary LTC – output

Table 2-2: LTC OUT 1 and LTC OUT 2 XLR Pin Definitions

Secondary copies of the two LTC outputs are available on the GPIO 15-pin female 'D' connector. The pinout of this connector is shown in Table 2-5. When LTC power is turned on for LTC1, this secondary output of LTC1 will not have +12V_{DC} power but will provide an isolated copy of LTC1.

The primary LTC outputs on the XLR connectors are not fully isolated from the secondary copies on the GPIO DB15 connector. This means a wiring fault (such as a short) affecting an XLR output will also affect its copy on the GPIO connector (the exception being for LTC1 when power is turned on).

2.1.5. Serial Port and Modem Connections

COM: The COM connector is a 9-pin female 'D' connector for RS-232 serial communications. This port is configured for a 'straight through' RS-232 connection to a PC COM port and can be used for uploading firmware to the unit. Table 2-3 shows the pinout of the serial port in its default RS-232 DCE configuration. See section 4.2 for information on upgrading the firmware in the unit.

Pin #	Name	Description
1		
2	TxD	RS-232 Transmit Output
3	RxD	RS-232 Receive Input
4		
5	Signal Gnd	RS-232 Signal Ground
6		
7	RTS	RS-232 RTS Input
8	CTS	RS-232 CTS Output
9		

Table 2-3: COM Port Pin Definitions

GPS: A 9-pin female 'D' connector for connecting the optional GPS receiver (**GP** option). Table 2-4 shows the pinout of the port. See section 2.5 for information about mounting and connecting the GPS receiver.

Pin #	Name	Description
1	GND	Chassis ground
2	Tx-	Transmit A (Tx-) Output
3	Rx+	Receive B (Rx+) Input
4	PPS+	1 PPS + Input
5	+VDC	+ 12 Volts DC out to supply GPS receiver
6	PPS-	1 PPS - Input
7	Tx+	Transmit B (Tx+) Output
8	Rx-	Receive A (Rx-) Input
9	GND	Chassis ground

Table 2-4: GPS Serial Port Pin Definitions

2.1.6. LTC Input, Secondary LTC Outputs, and Syncro Connections

GPIO: A 15-pin female 'D' connector provides two general purpose inputs, two general purpose outputs, secondary LTC1 and LTC2 outputs, and an LTC input. This connector is also used to connect the 5601MSC to a 5601ACO2 auto-changeover unit to establish synchronization of settings and time between the two units (syncro). A 15-pin male-male cable is used for this purpose. The pinout of the **GPIO** connector is shown in Table 2-5.

Pin #	Name	Description
1	LTC Input +	Linear Time Code Input +
2	LTC1 Out +	Secondary Linear Time Code Output 1 +
3	LTC2 Out +	Secondary Linear Time Code Output 2 +
4	GPO 1	General Purpose Output 1
5	GPO 2	General Purpose Output 2
6	GND	Signal Ground
7	GND	Signal Ground
8	Syncro Tx	Syncro Transmit
9	Syncro Rx	Syncro Receive
10	GND	Signal Ground
11	LTC Input -	Linear Time Code Input -
12	LTC1 Out -	Secondary Linear Time Code Output 1 -
13	LTC2 Out -	Secondary Linear Time Code Output 2 -
14	GPI 1	General Purpose Input 1
15	GPI 2	General Purpose Input 2

Table 2-5: GPIO Pin Definitions

2.1.7. Analog Audio and Modem Connections

ATG 1 & 2: These two BNC connectors provide independent analog composite video test generator outputs compatible with the SMPTE 170M or ITU-R BT.1700-1 standards. The *ATG1 and ATG2* group of sub-menus on the *OUTPUT* root menu are used to configure the analog test generator outputs.

AES 1&2: These two BNC connectors provide unbalanced 48kHz AES audio compatible with the AES3-1992 and SMPTE 276M standards. Balanced versions of these signals are available on the **AUDIO** 16-pin terminal strip. The *AES Audio* sub-menu in the *OUTPUT* root menu is used to configure the AES audio outputs.

DARS OUT: This BNC connector has an unbalanced 48kHz Digital Audio Reference signal (DARS) output compatible with the AES3-1992 and SMPTE 276M standards. A balanced version of this signal is available on the **AUDIO** 16-pin terminal strip. The *AES Audio* sub-menu in the *OUTPUT* root menu is used to configure the phase of the AES and DARS outputs.

AUDIO: This 16-pin terminal strip provides balanced versions of the AES1/AES2 and DARS signals as well as two balanced analog audio signals. The output audio cables can be secured into the removable portion of the terminal strips using a small screwdriver. The removable part of the terminal strip (Weidmuller part #174822) is then inserted into the rear panel and secured using the hold down screws. The pinout of this connector is shown in Table 2-6.

Right +	Left +
Right -	Left -
GND	GND
SNSA	SNSB
GND	GND
AES 1 +	AES 1 -
AES 2 +	AES 2 -
DARS +	DARS -

Table 2-6: AUDIO Terminal Strip Pin Definitions

The *ANALOG AUDIO* sub-menu in the *OUTPUT* root menu is used to configure the analog audio outputs. The SNSA and SNSB pins are used by the 5601MSC to detect connection to a 5601ACO2 and automatically enable highdrive. They may be left unconnected if this functionality is not desired.

MODEM: This RJ11 jack is used to connect the optional internal modem (**M** option) to the telephone line. The Modem sub-menu off the *GENERAL* root menu is used to configure the modem. See section 3.5.5 for more information.

IMPORTANT INSTALLATION NOTICE: For a reliable telephone connection to the modem in the 5601MSC, a direct telephone line must be used. This line must not pass through a PBX or similar key device.

2.1.8. Test Generator Connections (SDTG, HDTG, 3GTG options)

There are four test generators each with two output BNCs. These are enabled with the **SDTG** option and produce SMPTE259M serial digital video. The **HDTG** option adds support for HD video (SMPTE 292M) HD video (SMPTE 372M) to all four test generators. The **3GTG** option adds support for 3G Level-A and Level-B (SMPTE 424M) and dual-link video to all four test generators.

Each test generator has two output BNCs. They are labelled (A) and (B) for when dual-link mode is in use but otherwise contain the same copy of the test generator output.

BNCs: SDI Test Generator 1 BNCs are labeled TG1-1 (A) and TG1-2 (B)
SDI Test Generator 2 BNCs are labeled TG2-1 (A) and TG2-2 (B)
SDI Test Generator 3 BNCs are labeled TG3-1 (A) and TG3-2 (B)
SDI Test Generator 4 BNCs are labeled TG4-1 (A) and TG4-2 (B)

2.1.9. Power Connections

The 5601MSC has one or two (redundant supply is optional) auto-ranging power supplies that operate on either 95-125 or 185-260 volts AC at 50Hz or 60Hz. Power should be applied by connecting a 3-wire grounding type power supply cord to the power entry modules on the rear panel. The power cord should be minimum 18 AWG wire size; type SVT marked VW-1, maximum 2.5 m in length.

The IEC 320 power entry modules combine a standard power inlet connector and an EMI line filter.

CAUTION - TO REDUCE THE RISK OF ELECTRIC SHOCK, GROUNDING OF THE GROUND PIN OF THE MAINS PLUG MUST BE MAINTAINED

The EMI line filters in the 5601MSC use the chassis ground as part of the circuit. This generates a small amount of AC leakage current to ground. In order to reduce risk of electric shock, the unit MUST be grounded properly through the ground connections on the AC power supply inlets.

2.1.10. M4 Grounding Stud

The M4 grounding stud is used to provide a ground point to the 5601MSC chassis. It is located under the **REF IN LOOP** connectors. It can be used for protective earthing in installations that require it. An M4 or #8 ring terminal can be used with the provided M4 nut and lock washer.

2.2. MOUNTING AND COOLING

The 5601MSC is equipped with rack mounting ears and fits into a standard 19 inch by 1 ¾ inch (483 mm x 45 mm) rack space. An optional rear support kit is available for rear mounting in a rack. The main board and power supplies are forced-air cooled by two fans in each power supply (or fan module). Both power supply slots must be occupied by a power supply or fan module at all times to ensure proper operating temperatures inside the unit. The air is drawn in through slits along the edges of the front panel and exhausted out the sides of the unit. Ensure that the exhaust holes along the side of the unit are not blocked by rack supports or cabling otherwise the unit may overheat. A system fault is activated when the temperature inside the unit exceeds operating limits.

2.3. CONNECTING THE GENERAL PURPOSE INPUTS AND OUTPUTS

The 15-pin female **GPIO** connector has 2 general purpose inputs and 2 general purpose outputs. The GPI inputs are active low. This means that if an input is floating (not connected) then it will not be activated. The GPIs can be activated by connecting the GPI input pin to Ground using a button, switch, relay or an open collector transistor. The GPIs can be configured to send out SNMP traps on activation.

The GPO outputs are internally pulled up to +5 volts DC. When a GPO activates, the GPO pin is pulled to ground. Care must be taken to limit the sink current to less than 50mA or damage to the GPO will result. The functions of the general purpose outputs are set using the *GPO 1 Mode* and *GPO 2 Mode* menu items on the *GENERAL* Setup menu.

Figure 2-2 and Figure 2-3 shows the circuitry for each of the I/O pins.

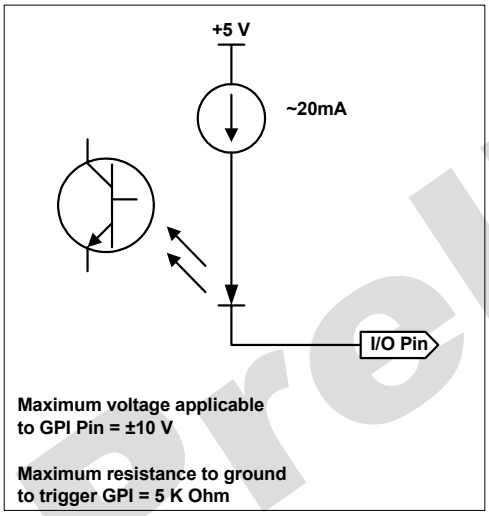


Figure 2-2: Typical GPI Circuitry

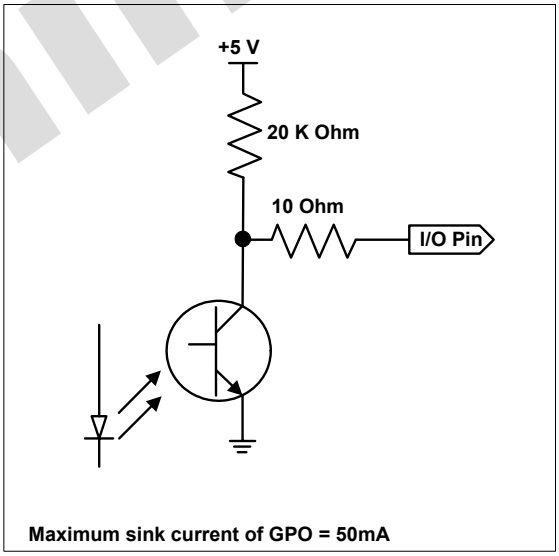


Figure 2-3: Typical GPO Circuitry

2.4. CONNECTING TWO 5601MSC UNITS IN SYNCRO MODE

When two 5601MSCs are connected in a redundant configuration with a 5601ACO2 automatic changeover, it is necessary that both 5601MSC units have the same timing and output settings. Identical timing for the 5601MSCs is assured by locking both to the same frequency and phase source (e.g. GPS or by genlocking one unit to the other). Ensuring that both 5601MSCs have the same output configuration and time can be accomplished by implementing *syncro* between the two units.

The syncro link is automatically made when the GPIO connector of both 5601MSC units is connected to the 5601ACO2 using male-to-male DB15 cables. Once the two units are connected, one must be designated the master unit and the other the slave. The slave unit will copy all the output menu settings from the master unit so that any change done on the master (such as changing a test pattern or phase offset) will also be applied to the slave. Additionally, the master 5601MSC can be used as a time reference by the slave unit, with the time and date being transmitted through the syncro link.

To use syncro, the master 5601MSC must be set to one of the master syncro modes. Likewise, the slave 5601MSC must be set to a slave mode. See section 3.5.5 for information on these settings. When the master 5601MSC has been configured to send syncro information and the slave 5601MSC has been configured to receive it, the state of the link can be viewed on the slave unit by pressing the STATUS button and selecting the *Inputs* status screen. The slave unit will indicate *Syncro link ok*. When the link has been established, the slave unit can also set its time reference source to Syncro and will obtain time through the link as well as menu settings. See section 3.3.5 for details.

When syncro menu mode is active, all of the menu settings in the OUTPUT root menu are copied from the master 5601MSC to the slave unit. The menu settings in the INPUT and GENERAL menus are not affected by syncro. In the OUTPUT menu the SDI TGs and ATGs can be excluded from syncro. This can be done individually for each test generator (see sections 3.4.3.8 and 3.4.4.5).

2.5. GPS RECEIVER INSTALLATION (GP OPTION)

The 5601MSC unit (with the **GP** option fitted) is designed to work with the Trimble Accutime Gold antenna. The Smart Antenna houses the GPS receiver, antenna, power supply and other support circuitry in a sealed, shielded, self-contained unit with a digital interface to the main unit. The GPS Smart Antenna also receives power from the main unit through the connection cable.

2.5.1. Mounting the GPS Smart Antenna

The smart antenna's enclosure is completely waterproof and is designed for outdoor installation. It is protected against interfering signals and thus is suitable for reliable operation in most environments. Select an outdoor location for the antenna, like the roof of your building that has a relatively unobstructed view of the sky. Dense wood and concrete or metal structures will shield the antenna from satellite signals. The antenna can receive satellite signals through glass, canvas and thin fibreglass; thus it may be mounted inside a skylight, if an outdoor location is not possible.

The smart antenna is an active-head antenna. For optimal performance, locate the smart antenna as far as possible from transmitting antennas, including radar, satellite communication equipment and cellular transmitters. When locating the antenna near a radar installation, ensure that the antenna is positioned outside of the radar's cone of transmission. Follow the same guidelines when installing the antenna near satellite communication equipment. For best results, mount the antenna at least ten feet away from satellite communication equipment. Do not mount the antenna near high vibration areas such as fan or motor housings, or near sources of heat such as exhaust stacks.

When mounting two or more smart antennas they must be spaced at least 3 feet (1 meter) apart to prevent interference.

Consider the length of the cable run when selecting the location. A 50 foot cable is supplied; however, longer cables are available on special order from the factory. You may also wire a straight-through extender cable to extend the able distance up to 200 feet. The smart antenna is designed for a pole mount with a 1" - 14 straight thread, which is a common marine antenna mount. For stationary installations a 3/4" pipe thread can be used, but a 1"-14 straight thread is recommended. Pole mounting is illustrated in Figure 2-4. Secure the mounting pole to a solid structure so that it is oriented vertically. Thread the smart antenna onto the pole or pile and hand tighten until snug.

CAUTION: Over-tightening the smart antenna on the pole or using a tool could damage the threaded socket in the base of the antenna. In addition, do not use thread-locking compounds, since they can corrode plastic

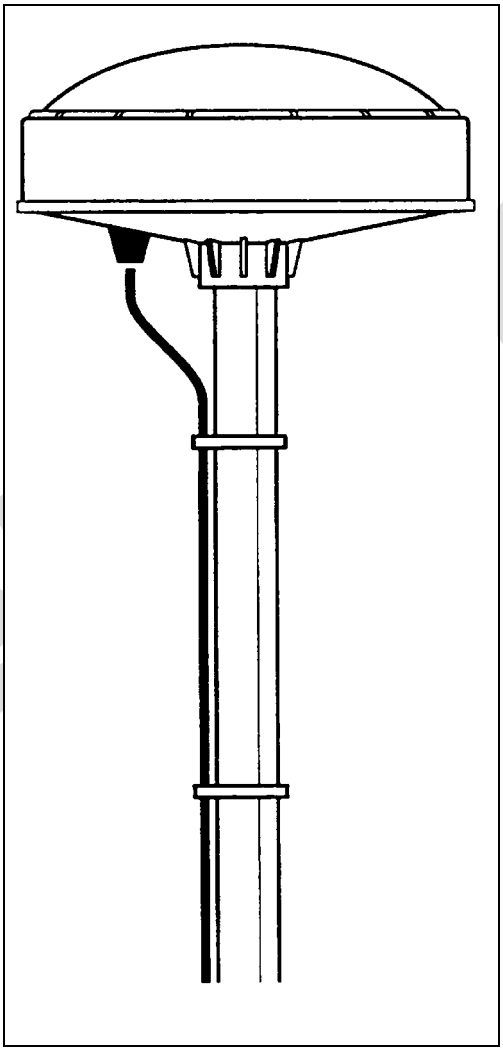


Figure 2-4: Pole Mounting the Smart Antenna

2.5.2. Connecting the GPS Smart Antenna to the 5601MSC

A standard 50 foot long interface cable (Evertz part WA-T09) is provided with the 5601MSC and the smart antenna. One end of this cable is fitted with a weather-tight 12-pin Molex connector. The other end is fitted with a 9-pin male sub-miniature D connector and should be connected to the GPS connector on the rear panel of the 5601MSC. The pinout of the cable is shown in Figure 2-5. If you require a longer cable, a 100 foot (Evertz part WA-T76), 200 foot cable (Evertz part WA-T10), 400 foot cable (Evertz part WA-T11), 800 foot cable (Evertz part WA-08) or 1200 foot cable (Evertz part WA-T12) may be ordered from the factory. Custom length weatherproof cables can also be special ordered. Alternately, you can wire a 9-pin Extender cable as shown in Figure 2-6.

Connect the 12-pin connector on the interface cable to the smart antenna. The connector on the interface connector has a locking ring for securing the connection.

CAUTION: Over tightening the locking ring can damage the connector on the smart antenna

Route the interface cable to the location of the 5601MSC unit using the most direct path. Avoid routing the cable near hot surfaces, sharp or abrasive surfaces, or corrosive fluids or gases. Avoid sharp kinks or bends in the cable. Additional protection such as heat shrink tubing may be required to protect the cable jacket at points where the cable enters the building, especially if the opening is rough or sharp. Once the cable is run, use cable-ties to secure the cable to the pole and to provide strain relief for the connections. When securing the cable, start at the antenna and work towards the 5601MSC unit. Connect the 9-pin male D connector to the GPS connector on the rear panel of the 5601MSC. Power is provided from the 5601MSC along the interface cable to the smart antenna.

It is best to keep the antenna cable run as short as possible. If two 5601MSC units are being used, each with their own GPS antenna, the antenna cable lengths should be matched as closely as possible.

Trimble antenna Mini-Con 12-pin (female)		Evertz 5601MSC 9-pin "D" style (male)
DC Ground	9 ---------- 1	Frame Ground
Receive Port (R-)	2 ---------- 2	TX A -
Transmit Port (T+)	5 ---------- 3	RX B +
Timing pulse 1pps	11 ---------- 4	1 PPS + in
DC Power IN	1 ---------- 5	+12 V DC Unreg.
Timing pulse 1pps	12 ---------- 6	1 PPS - in
Receive Port (R+)	3 ---------- 7	TX B +
Transmit Port (T-)	4 ---------- 8	RX A -
	---------- Drain Wire	Shield

Figure 2-5: Accutime Gold Smart Antenna to 5601MSC Interface Cable (Evertz part WA-T09)

9-pin "D" style (female) Pin	Pair #	9-pin "D" style (male) Pin	Description
7	1	7	TX B +
2	1	2	TX A -
8	2	8	RX A -
3	2	3	RX B +
4	3	4	1 PPS +
6	3	6	1 PPS -
5	4	5	+12 V DC Unreg.
1	4	1	Ground.
	Drain Wire		Shield

Figure 2-6: Accutime Gold Extender Cable

When making your own extender cable be sure to use low capacitance twisted pair cable and adhere to the pairing shown in Figure 2-6.

2.5.3. System Start-up

At power up, the smart antenna will automatically begin to acquire and track the GPS satellite signals. From a cold start, the smart antenna will normally take from 2 to 5 minutes to lock on to sufficient satellites to accurately determine the time. During this time the *Inputs* status screen on the front panel will show the various stages of initialization. For complete information on configuring the 5601MSC to operate with the GPS Smart antenna see section 3.3.1 of this manual

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CHAPTER 3: OPERATION

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Table 3-5: Top Level of the General Setup Menu 3-52

3. HOW TO OPERATE THE MASTER CLOCK/SPG

The model 5601MSC Master Clock/SPG combines the latest LSI technology with sophisticated embedded microcontroller firmware to provide a powerful, flexible, and upgradeable Master Clock and Sync Pulse Generator system. The 5601MSC Master Sync and Clock Generator, is both a broadcast quality Master SPG and a Master Clock. It provides all of the synchronizing signals needed in a 21st century TV station at the same time as solving the problem of locking the in-house master clock system to the master video sync pulse generator.

3.1. FRONT PANEL CONTROLS

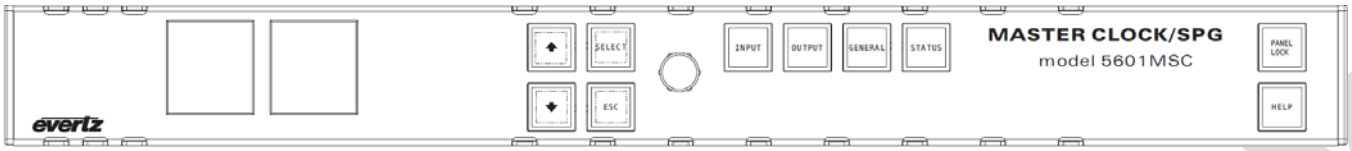


Figure 3-1: Model 5601MSC Front Panel Layout

The front panel controls consist of two color LCD displays, 10 pushbuttons and a control knob.

The buttons are used to navigate the front panel menu system, view status information, and to change various settings on the unit. The control knob can also be used to navigate the menu system and make changes to settings. Pressing in the control knob is equivalent to pressing the **SELECT** button in most cases. Press the **HELP** button at any time to view information on any currently selected menu item.

The two color LCD displays are used to display the menu system and the current position within the menu tree. There are also messages on the left LCD that indicate system status. Sections 3.3 to 3.5 give detailed information on the specific operations required to control the 5601MSC.

3.1.1. Front Panel Buttons

There are four buttons to the right of the control knob that are used to select the four main root menus. These buttons are labelled **INPUT, OUTPUT, GENERAL,** and **STATUS**. These buttons will illuminate to show which menu is currently active. The control knob and the four buttons to the left**,** ↑, ↓, **SELECT**, and **ESC**, are used to navigate the menu system and change settings. The **PANEL LOCK** button can be used to lock the front panel to prevent accidental button presses after the unit has been configured (see section 3.1.3). The **HELP** button can be pressed at any time to display online help about the currently selected menu or menu item.

INPUT: Enters the *INPUT* menu that contains various menus for configuring the frequency and time references of the 5601MSC and how to lock to them. See section 3.3.

OUTPUT: Enters the *OUTPUT* menu that is used to configure the Sync and test generator outputs of the 5601MSC. See section 3.4.

GENERAL: Enters the *GENERAL* menu that contains controls for configuring the Syncro, GPOs, Modem, DST, SNMP, and NTP features of the 5601MSC. See section 3.5.

SELECT: In the menu system the **SELECT** button is used to enter a sub-menu or to select a menu parameter that is to be changed.

ESC: When in a sub-menu the **ESC** button is used to exit the next higher menu level. It is also used to abort changing the setting of a menu item.

↑, ↓: The arrow buttons are used to navigate through the menu system. The currently selected menu item is indicated by the **>** character. The arrow buttons are used to select the next or previous menu item. When changing a menu item's value, the arrow buttons are used to select the next or previous items in a list, or for a numerical value are used to increment or decrement the current value.

Control Knob: The control knob can be used as an alternative to the ↑ and ↓ buttons and allows quicker navigation and setting of menu items. Turning the control knob clockwise (to the right) has the same effect as pressing the ↑ button. Turning the control knob counter-clockwise (to the left) has the same effect as pressing the ↓ button. Depressing the control knob inwards has the same effect as pressing the **SELECT** button. When changing a numerical value (such as when phasing an output) depressing the knob while turning allows changing the numerical value in steps of 16. This makes it easier to change large numerical values.

When in the menu or a selection list, pressing the control knob has the same effect as pressing the SELECT button. When adjusting a numerical value, depressing the control knob while turning it will increment or decrement in larger steps of 16.

3.1.2. The Status Button

The **STATUS** button enters the *STATUS* menu which contains a list of status screens that show information about the current state of the 5601MSC. The ↑ and ↓ buttons are used to select a status screen and the **SELECT** buttons display the screen. Press the **ESC** button to return to the status screen list. If an item in a status screen is in a faulted condition (e.g. over temperature), the status screen name will be highlighted in Red. If one of the items in the status screen is in a warning condition (e.g. time reference missing), the status screen name will be highlighted in Yellow. Below is a list of the status screens and the information they contain.

***System/LTC time*:** Displays the current system time and date. Also displays the time read from the LTC Input (*L i*), the VITC time read from the reference input (*V i*), and the current time being output on the LTC1 and LTC2 outputs (*L1* and *L2*).

***Sync 1-6*:** This status screen shows the VITC time being inserted onto the sync outputs. If the time is greyed out, this indicates that VITC is disabled for the sync output or the sync output mode is set to a signal type where VITC cannot be inserted (e.g. HD tri-level sync or PAL-B subcarrier).

***Atg/Wc/Ten MHz*:** This screen shows the VITC time being inserted onto the analog video test generator outputs (currently not supported), and onto the Wordclock and 10MHz sync outputs. These time displays will be greyed out unless the Wordclock or 10MHz outputs have been changed to output black burst and VITC enabled.

***Lock Status*:** This is a very important status screen that shows the current status of the frequency and time references of the 5601MSC. This screen should be checked to see if the 5601MSC has locked successfully to the chosen references. The tuning range of the oscillator and lock progress are shown here.

***Fan/PS Status*:** This screen is used to monitor the physical state of the unit. It shows the status of the power supplies (*PSL* = Left Supply, *PSR* = Right Supply), and fans. Each power supply slot will either contain a power supply module or a fan module with two fans. The fan status is indicated as *Left Front*, *Left Rear* and *Right Front* and *Right Rear*. If a fan has stopped or has slowed to below 500 RPM it will be considered in a failed state. The bottom line indicates whether the temperature of the unit is within normal operating limits. If a fan has failed but the temperature inside the unit remains normal, urgent intervention may not be required. However if multiple fans fail, or if the fan exhausts on the sides of the unit are blocked the unit will report temperature too high and this requires immediate attention.

***Inputs*:** This status screen shows information on the various inputs to the 5601MSC. It will show the detected reference that is applied to the REF IN LOOP and whether 5MHz or 10MHz is detected. It shows the status of the GPS antenna, if installed. It also displays the current status of the Syncro receiver and both General Purpose Inputs (GPIs). When the GPI is *high*, it has not been activated.

***Modem/ACO2/Hw*:** This screen shows the current status of the modem, if installed. It also shows the current operational mode of SNMP, and whether connection to a 5601ACO2 has been detected on the SNSA and SNSB pins of the AUDIO connector (see section 2.1.7). If an internal hardware fault is detected in the oscillator circuit the fault message will be displayed in this screen.

***Control Ethernet*:** This screen shows the current settings for the CONTROL Ethernet port. If the port is in *Dynamic* mode, this screen will show the acquired settings from the BOOTP server. The IP Address (A), Subnet Mask (M), and Gateway (G) addresses are displayed. The MAC address of the port and current Ethernet link status are also shown.

***Options Firmware*:** This status screen shows which options have been installed on the 5601MSC and the current version of firmware it is running.

Pressing the STATUS button and scrolling through the status screen names is a quick way to see if there are any problems with the 5601MSC. Screens that are in fault or warning conditions will be highlighted RED or YELLOW.

3.1.3. Panel Lock Function

PANEL LOCK: Pressing this button will lock the front panel. The **PANEL LOCK** button will illuminate indicating that the front panel keys are disabled. This is used to prevent accidental changes to the unit once it has been configured. While the front panel is locked, the **STATUS** screens will still be accessible. It will still be possible to press the **STATUS** button and view the various status screens but it will not be possible to enter any other menu or change menu items. To unlock the panel, press the **PANEL LOCK** button while holding the **SELECT** button. The front panel will return to normal operation and the **PANEL LOCK** button LED will turn off.

3.1.4. Front Panel LCD Displays

There are two full color LCD displays on the front panel. The left LCD displays the current position in the menu structure as well as system health status. The right LCD is used to display the menu system and status screens. Below is a basic diagram of the layout of the LCD screens.

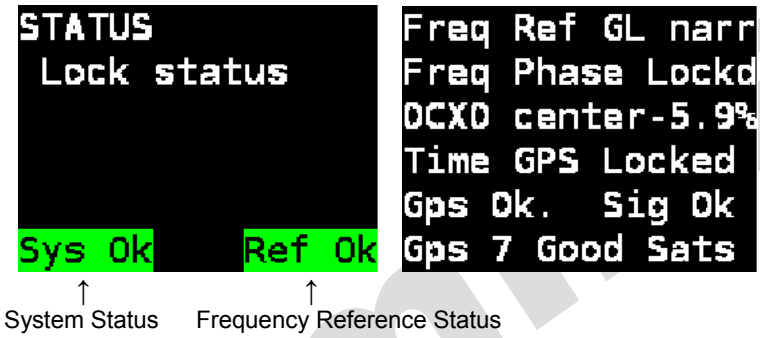


Figure 3-2: LCD Displays in Status Screen

The left LCD displays the current position in the menu tree. In the bottom-left corner the system status is shown. A critical fault will appear in red blinking text. The possible system status messages are summarized in Table 3-1 in order of severity:

System Status Messages	
Message	**Description**
Hw fail	Appears blinking red in the bottom-left corner. Indicates an internal hardware problem has been detected. It is advisable not to power off the unit and to contact the factory immediately (see section 3.3.4).
Temp Hi	Appears blinking red in the bottom-left corner. Indicates the internal temperature of the unit has exceeded operating limits. Requires immediate attention. May be due to excessive ambient temperature, fan failures, missing power supply or fan module, or blocked exhaust vents on the side of the unit.
Ps fail	Appears blinking red in the bottom-left corner. Indicates that one of the power supplies is not producing the correct voltage. Only applicable for dual power supply installations. If only a single power supply is in use, make sure the Number PS menu item is set correctly (see section 3.5.9.5).
Warning	Appears in yellow text in the bottom-left corner. Indicates a non-critical fault in the unit such as frequency or time reference missing, or fan failure.
Sys Ok	Appears in green text in the bottom-left corner. Indicates no system fault.

Table 3-1: System Status Messages

In the bottom-right corner of the left LCD the frequency reference status is shown. When ***Ref Ok*** is displayed this means the currently selected frequency reference is present and the 5601MSC has locked to it properly. This will be ***Ref unlk*** with a yellow background if the frequency reference is missing or the 5601MSC is unable to lock to the supplied reference.

Other messages are possible on the left LCD. These messages require a manual user jam, or mode change to clear. See section 3.3.9 for more information. Such messages include ***REF JAM NEEDED***, which will be displayed if the 5601MSC is in *Slow* mode and is in the process of gradually relocking to a change in the frequency reference. If the time reference lock type has been set to *USER*, then ***TIME JAM NEEDED*** will be displayed when the system time and reference time mismatch.

3.2. FRONT PANEL MENU SYSTEM

The 5601MSC menu system consists of three main menus with several choices for each menu item. The **INPUT, OUTPUT**, and **GENERAL** buttons allow you to quickly go to each of the three main menus, while the **SELECT, ESC,** ↑ and ↓ buttons and control knob are used to navigate the menu.

To enter the *INPUT* menu, press the **INPUT** button, which will then illuminate to show that it is now the active menu. Similarly you can enter the *OUTPUT or GENERAL* menus by pressing the **OUTPUT** or **GENERAL** buttons respectively. The menu selections will be displayed on the right LCD. The > character is used as a selection cursor to show which menu item is currently selected. Use the ↑ and ↓ buttons or turn the control knob to move the > character beside the desired sub-menu and press the **SELECT** button to enter it. The menu tree is shown on the left LCD and identifies which menus have been entered. Press the **ESC** button to return to the previous level in the menu structure. Refer to Figure 3-3:

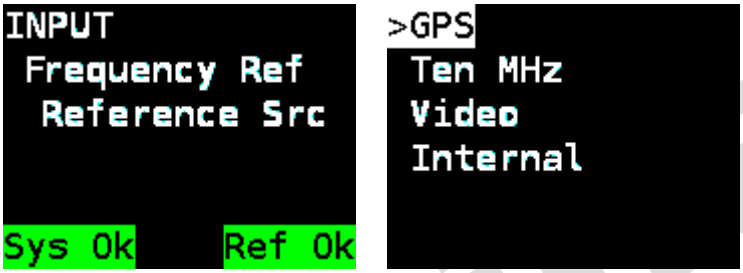


Figure 3-3: Menu System and Selection List

When a menu item is selected, there will be several different formats to changing the value of the configuration of the selected setting. The most common is the selection list (see Figure 3-3). In a selection list, the currently active value is highlighted in white. The > character can be moved to select a new value, but the change won't take effect until the **SELECT** button is pressed, after which the new value will become highlighted to show it is now active. Press the **ESC** button at any time to exit from the selection list. Other formats are used for changing numeric items.

When accessing some menu items, the message ***LIVE CONTROL*** will be displayed on the left LCD with a red background. This message is a warning that pressing SELECT on the menu item will perform an immediate task such as jamming a reference (see section 3.3.9) or saving a preset (see section 3.5.11). Use caution with such menu items. Refer to Figure 3-4 below for an example.

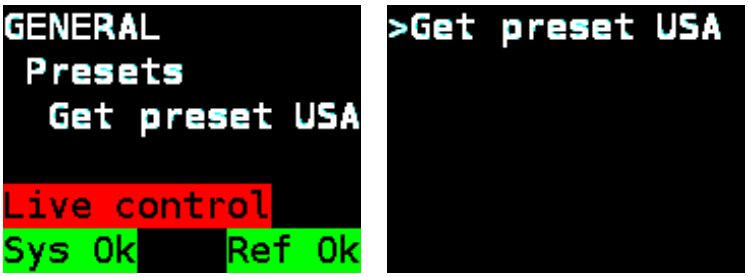


Figure 3-4: Menu Item Live Control

When adjusting the value of some settings, the message LIVE CONTROL will be displayed on the left LCD with a yellow background. This message is a warning that any change made with the ↑ and ↓ buttons or control knob will immediately be applied to the output without requiring the **SELECT** button to be pressed. An example is when adjusting phase of the sync outputs or when adjusting the analog audio levels. Proceed with caution and press the **ESC** button to return to the previous menu without making a change. See Figure 3-5 below as an example.

Figure 3-5: Adjustment Live Control

Sections 3.3 to 3.5 provide detailed descriptions of the *INPUT, OUTPUT* and *GENERAL* menus. The tables in these sections are arranged in an indented structure to display the path to reach each control.

3.2.1. Menu Reference Guide

The following table provides a quick reference of the front panel menu system.

Level 1	Level 2	Level 3	Level 4	Level 5
INPUT	**Frequency Ref**	Reference Src	GPS Ten MHz Video Internal	
		Genlock Range	Narrow Wide	
		Lock type	Slow Abrupt	
	Time	Reference Src	GPS Modem Syncro LTC VITC None	
		Vitc Line	line xx	
		VitcLtc Date	Auto Mode No date Legacy Production SMPTE 309 BCD SMPTE 309 MJD	
		Lock Type	User Never Always	
	Jam Input	Jam Reference [LIVE]		
		Jam Time [LIVE]		
OUTPUT	**LTC 1** & **LTC 2**	Power Applied (LTC 1 Only)	Power Off Power On	
		Frame Rate	23.98 FPS 24 FPS 25 FPS 29.97 FPS 29.97DF FPS 30 FPS	
		Set Jam Time	0:00	
		Jam Output	Jam Output [LIVE]	TIME JAMMED
		Jam all VITC/LTC	Jam all VITC/LTC [LIVE]	ALL TIMES JAMMED
		Time offset	0 frames	
		Time zone	0:00 hours	
		DST Ctl	Off On	
		Output Level	level = 7	
		Parity	Parity Off Parity On	
		Color Frame	Color Frame Off Color Frame On	

OUTPUT (continued)	**SYNC 1 (1, 2, 3, 4, 5, 6)** Or **10 MHz** Or **Wordclock**	Mode	PAL-B NTSC-M 1080p/23.98 1080p/24 1080i/50 1080i/59.94 1080i/60 720p/59.94 720p/60 1080p/23.98sF 1080p/24sF 1080p/25 1080p/29.97 1080p/30 720p/50 720p/24 625i/48 625i/47.95 PAL color frame 1 Hz 1/1.001 Hz 6/1.001 Hz 5 MHz 10 MHz NTSC-M subcarr. PAL-B subcarr. Wordclock	
		Vitc Ctl	Off On	
		Vitc Line 1	line 1 = 14	
		Vitc Line 2	line 2 = 16	
		Dropframe Ctl	Off On	
		Set Jam Time	0:00	
		Jam Output	Jam Output [LIVE]	TIME JAMMED
		Jam all VITC/LTC	Jam all VITC/LTC [LIVE]	ALL TIMES JAMMED
		Time offset	0 frames	
		Time zone	0:00 hours	
		DST Ctl	Off On	
		Ten field Ctl	Off On	
		Fine phase [LIVE]	Phase value Cf v h fine% 0 0 0 0.0	
		Hor phase [LIVE]		
		Vert phase [LIVE]		
		Color phase [LIVE]		
		Pulse type	5V CMOS +/-1V bi-level +/-1V tri-level	
		Sine wave level	+/-1 Volts +/-2 Volts	
		Wordclock levl	5V CMOS +/-1 Volts	

OUTPUT (continued)	**SDI TG 1 (1, 2, 3, 4)**	Signal	BLACK WHITE FIELD IDENT. FRAME IDENT. 75% COLORBARS 100% COLORBARS RP219 COLORBARS LAB BARS, MOVING BOX VALID RAMP FULL FIELD PLUGE SDI CHECKFIELD SDI EQ STRESS SDI PLL STRESS BOUNCING BOX 10 FRAME SEQUENCE RANDOM SEQUENCE W. AUDIO VISUAL LIP SYNC W. AUDIO MULTIPULSE Y MULTIPULSE CIRCLE WITH CENTER CROSS CLEAN APERTURE WITH	
		Format	Link Format	Single Link HD 3G Level A 3G Level B Dual Link HD Standard Def
			Image Format	525i 625i 1920x1080i/59 1920x1080p/23 1920x1080p/29 1920x1080p/23sF 1920x1080p/29sF 2048x1080p/23 2048x1080p/23sF 1920x1080i/50 1920x1080p/25sF 1280x720p/50 1920x1080i/60 1920x1080p/24 1920x1080p/30 1920x1080p/24sF 1920x1080p/30sF 2048x1080p/24 2048x1080p/24sF
		Hor Phase [LIVE]	Phase value Vert hor 0 0	
		Vert Phase [LIVE]		
		Audio Group 1, 2, 3, 4	Group Ctl	Off On
			Ch 1 frequency	1.0 kHz
			Ch 1 level	-10 dBFS
			Ch 2 frequency	1.0 kHz
			Ch 2 level	-10 dBFS
			Ch 3 frequency	1.0 kHz
			Ch 3 level	-10 dBFS
			Ch 4 frequency	1.0 kHz
			Ch 4 level	-10 dBFS
		Message Ctl (SDI TG 1, 3 Only)	Message Off Message 1 line Message 2 lines	
OUTPUT (continued)	**SDI TG 1 (1, 2, 3, 4)** (continued)	H Position [LIVE]	Message Position vert. hor.	

		V Position [LIVE]	
		Message 1	EVERTZ 5601MSC
		Message 2	Master Sync
		Message font	Normal size Large size
		Output Drive	Auto detect ACO No 5601ACO2 5601ACO2 in use
		Syncro	Include syncro Exclude syncro
	ATG 1 (1, 2)	Signal	Black Grey White Field ID (B=1, W=2) 10 Y Step Y Ramp Shallow Y Ramp Modulated Ramp 75% Color Bars 100% Color Bars NTC7 Composite NTC7 combination FCC Composite FCC Multiburst 60% Ext MB Y Multipulse 2T Pulse & Bar SinX/X BOWTIE SDI CHECKFIELD COMPOSITE SIGNAL
		Image Format	525 NTSC M 625 PAL B
		Fine phase [LIVE]	Phase value cf v h fine% 1 1 1 0.0
		Hor phase [LIVE]	
		Vert phase [LIVE]	
		Color phase [LIVE]	
		Message Ctl (ATG 1 Only)	Message Off Message 1 line Message 2 lines
		H position [LIVE]	Message Position vert. hor. 2 1
		V position [LIVE]	
		Message 1	EVERTZ 5601MSC
		Message 2	Master Sync
		Message font	Normal size Large size
		Syncro	Include syncro Exclude syncro
	Analog Audio	Left frequency	1.0 kHz
		Right frequency	1.0 kHz
		Left level [LIVE]	Audio Level Left 10.0 dBu Right 10.0 dBu
		Right level [LIVE]	
OUTPUT (continued)	**AES Audio**	AES/DARS/WC lck	PAL/integer NTSC/fractional

		AES coarse [LIVE]	AES/DARS/WC Phasing coarse fine 0 0
		AES fine [LIVE]	
		WC phase [LIVE]	Wordclock Phasing 0
		AES1 Left Freq	1.0 kHz
		AES1 Left level	-10 dBFS
		AES1 Right Freq	1.0 kHz
		AES1 Right levl	-10 dBFS
		AES2 Left Freq	1.0 kHz
		AES2 Left level	-10 dBFS
		AES2 Right Freq	1.0 kHz
		AES2 Right levl	-10 dBFS
	Global Pedestal	Pedestal Off Pedestal On	
	Global Phasing	Global ph En	Global ph Off Global ph On
		Milli Seconds [LIVE]	Global phasing MS. US. NS. 0 0 0
		Micro Seconds [LIVE]	
		Nano Seconds [LIVE]	
GENERAL	**Set System Time**	0:00:00	
	Set System Date	2010 Jun. 22	
	VitcLtc Userbit	00000000	
	VitcLtc dte fmt	Legacy Production SMPTE - 309 MJD SMPTE - 309 BCD User set bits Lat/Long	
	Syncro	Slave menu Slave time Slave menu/time Master menu Master time Master menu/time	
	Modem	Modem Mode	No auto dialAns Auto answer Auto dial Auto dialAnswer
		Modem standard	NRC format NIST format
		Modem volume	Speaker off Speaker on
		Modem number	16137453900
		Auto dial time	0:00:00

GENERAL (continued)	**MODEM** (continued)	Auto dial day	Sunday Monday Tuesday Wednesday Thursday Friday Saturday Every day	
		Dial Now	Dial Now [LIVE]	DIALING MODEM
		Cancel Call	Cancel Call [LIVE]	CANCELING CALL
		Modem Retries	0 retries	
	GPO 1 mode (1, 2)	GPO off GPO no referene GPO fan failure GPO PS failure GPO any fault GPO no time GPO gps fault GPO audio on GPO HW fault GPO no ref slow		
	Firmware	Upgrade	ARE YOU SURE?	
	EngineeringMenu	Password	5601	
		Set Password	5601	
		SNMP	SNMP Ctl	SNMP off SNMP status SNMP on
			Com string Rd	public
			Com string Wr	private
			Trap 1 Ctl	Trap IP disabld Trap IP enabled
			Trap1 IP Add	0.0.0.0
			Trap 2 Ctl	Trap IP disabld Trap IP enabled
			Trap2 IP Add	0.0.0.0
			Trap 3 Ctl	Trap IP disabld Trap IP enabled
			Trap3 IP Add	0.0.0.0
			Trap 4 Ctl	Trap IP disabld Trap IP enabled
			Trap4 IP Add	0.0.0.0
			Freq Ref Trap	Trap disabled Trap enabled
			Time Ref Trap	
			Freq Ref JamTrp	
			Time Ref JamTrp	
			LF Fan Fail Trp	
			LR Fan Fail Trp	
			RF Fan Fail Trp	
			RR Fan Fail Trp	
			PSL Fail Trap	
			PSR Fail Trap	
			Hw Fail Trap	
			Overtemp Trap	
			GPI 1 Trap	
			GPI 2 Trap	

GENERAL (continued)	**ENGINEERING MENU** (continued)	Menu Access Ctl	MASTER Access	All Menus Norma Menu Locks On
			Set Time	Menu Accessible Menu Locked
			Set Date	
			VITC/LTC Userbi	
			VitcLTC dateFmt	
			Serial Port	
			Syncro Enable	
			Modem	
			GPO 1 mode	
			GPO 2 mode	
			GPI 1 mode	
			GPI 2 mode	
			Firmware	
			DST rules	
			Presets	
			IP Control Ctl	
			IP Time Ctl	
			NTP rules	
			Freq Ref Source	
			Genlock Range	
			Freq Lock Type	
			Time Ref Source	
			Vitc Read Line	
			VITC/LTC Date	
			Time Lock Type	
			Jam Freq Ref	
			Jam Time Ref	
			LTC 1	
			LTC 2	
			Sync 1	All items On Menu Locked Phasing only
			Sync 2	
			Sync 3	
			Sync 4	
			Sync 5	
			Sync 6	
			10 MHz	
			Wordclock	
			SDI TG 1	All items On Menu Locked Phasing only Test Sigs only PhasingTestSig
			SDI TG 2	
			SDI TG 3	
			SDI TG 4	
			ATG 1	
			ATG 2	
			Analog Audio	Menu Accessible Menu Locked
			AES Audio	
			Global Pedestal	
			Global Phasing	
		Number PS	One Power Suppl Dual Pwr Supply	

GENERAL (continued)	**DST rules**	DST mode	day/week/month day of month	
		Start Hour	DST starts 0000	
		DST start day	Sunday – Saturday	
		DST start week	First week Second week Third week Fourth week Last week	
		DST start month	January to December	
		End Hour	DST ends 0000	
		DST end day	Sunday - Saturday	
		DST end week	First week Second week Third week Fourth week Last week	
		DST end month	January to December	
		DST hrs offset	0 hours 1 hour 2 hours	
	Presets	Get preset 1	Get Preset 1 [Live]	
		Get preset 2	Get Preset 2 [Live]	
		Get preset 3	Get Preset 3 [Live]	
		Get preset USA	Get preset USA [Live]	
		Get pre EUROPE	Get Pre EUROPE [Live]	
		Save preset 1 [Live]	SAVED PRESET 1	
		Save preset 2 [Live]	SAVED PRESET 2	
		Save preset 3 [Live]	SAVED PRESET 3	
	IP Control	IP address mode	Dynamic (bootp) Static IP	
		IP address	172.21.1.56	
		IP netmask	255.255.255.0	
		IP gateway	0.0.0.0	
		IP gateway en	gateway off gateway on	
	NTP rules	NTP spoofing	NTP normal NTP spoofed	
		NTP restricts1 (1,2,3,4,5,6,7,8)	Restrict mode	Restrict permit Restrict deny
			Restrict IpAdd	0.0.0.0
			Restrict IpMsk	255.255.255.255

Table 3-2: Menu System

3.3. CONFIGURING THE INPUT REFERENCES

The *INPUT* menu is used to set up various items related to the input references of the 5601MSC. The chart below shows the items available in the *INPUT SETUP* menu. Sections 3.3.1 to 3.3.9 give detailed information about each of the sub-menus.

Frequency Ref	Contains items controlling the frequency reference and how to lock to it
Time	Contains items related to the time reference and how to lock to it
Jam Input	Contains live controls that can force the 5601MSC to lock immediately to the frequency or time reference

Table 3-3: Root Level of the *INPUT* Menu

3.3.1. Selecting the Frequency Reference

INPUT
- *Frequency Ref*
  - *Reference Src*
    - *GPS*
    - *Ten MHz*
    - *Video*
    - *Internal*

The *Reference Src* menu item in the *Frequency Ref* menu is used to select the frequency reference that the 5601MSC will use to lock its internal oscillator. All outputs are driven from a common oscillator and therefore are clock locked to each other (i.e. they do not drift with respect to each other). When set to the different possible reference sources and the appropriate reference is supplied, the phasing of the video and DARS outputs is affected as shown in Figure 3-6 to Figure 3-12.

When set to *GPS* the 5601MSC will lock its ovenized oscillator to the 1pps pulse from the GPS smart antenna. Selecting this option forces the *Genlock Range* to Narrow. All outputs are phased with respect to a specific date in GPS time. This forces the time reference to GPS time. The GPS-disciplined internal oscillator will maintain superb long-term accuracy (see section 3.6).

When set to *10 MHz* the 5601MSC will look for a 10MHz or 5MHz frequency reference on the reference loop input. It will lock in either Narrow or Wide mode, depending on the *Genlock Range* setting. The 10MHz or 5MHz reference supplies no phase information and the phase of the outputs will change if the unit is powered down and rebooted. The phase between different 5601MSC units locked to 5MHz or 10MHz will not be the same.

When set to *Video* the 5601MSC will lock to a valid black burst or tri-level video signal applied to the reference loop inputs. The *Genlock Range* menu item is used to select the tolerance of the master oscillator lock range. Note that the 5601MSC requires a colorburst on NTSC and PAL references, with a SCH error of less than 35º. Burst is not required for Slo-PAL bi-level references.

When set to *Internal* the 5601MSC will free-run on its internal ovenized oscillator. This forces the *Genlock Range* to Narrow. The stability of this ovenized oscillator is 0.01ppm, which corresponds to a time drift of about 0.31 seconds per year.

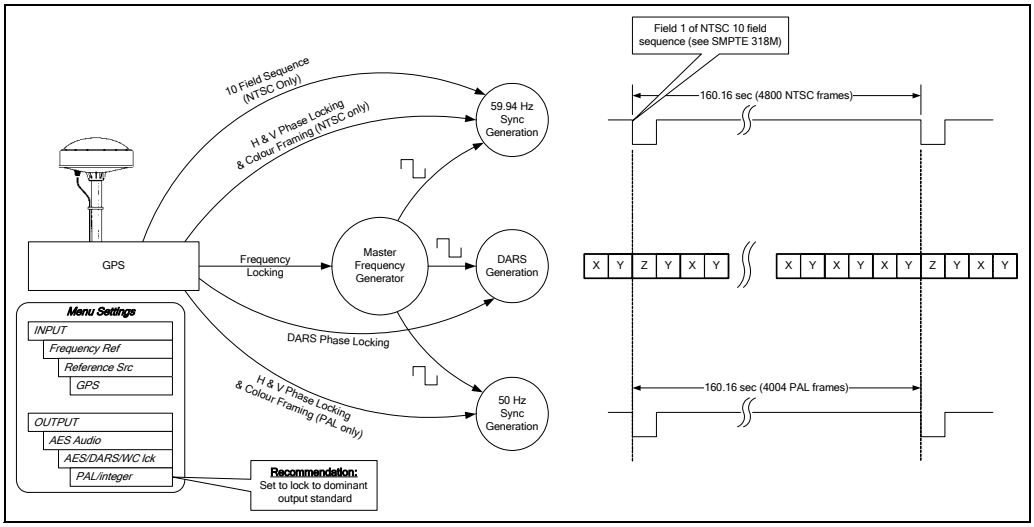


Figure 3-6: Sync Generation - GPS Frequency Reference

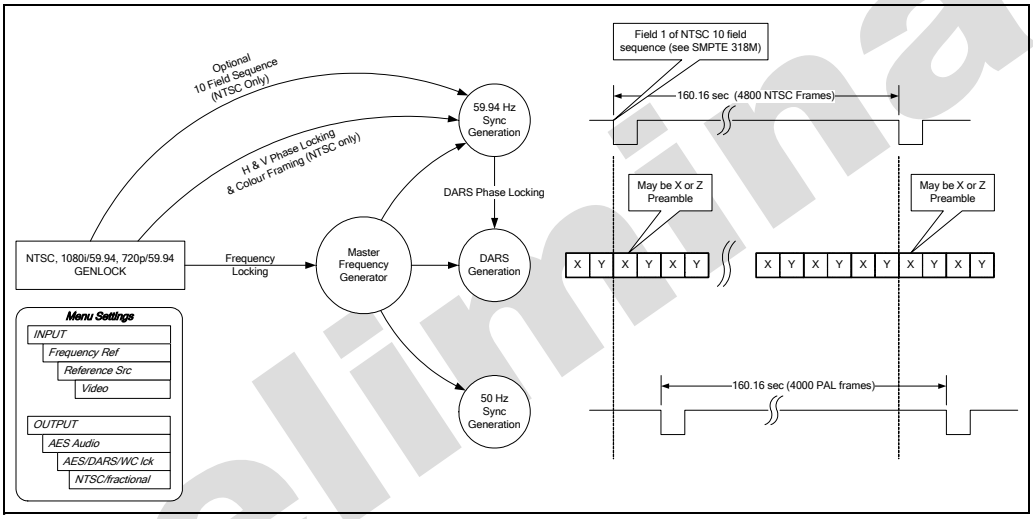


Figure 3-7: Sync Generation – NTSC or 59.94Hz Video Reference

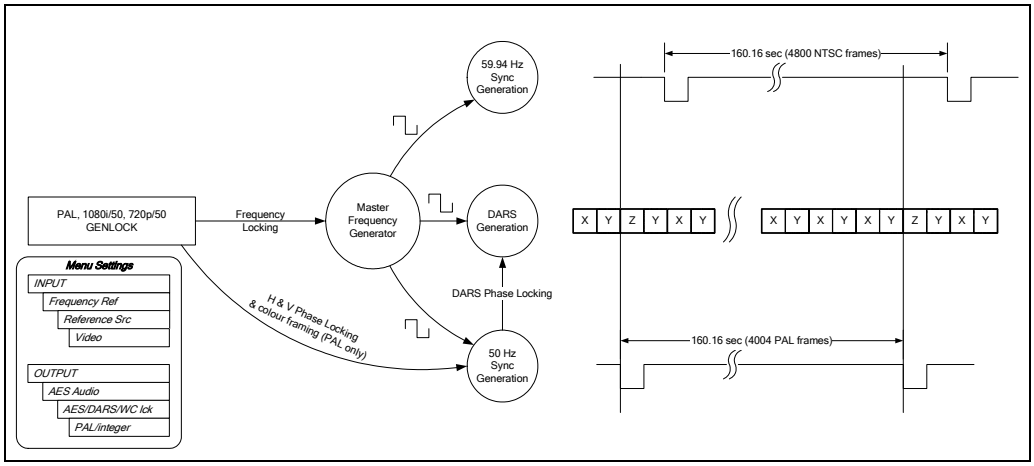


Figure 3-8: Sync Generation – PAL or 50Hz Video Reference

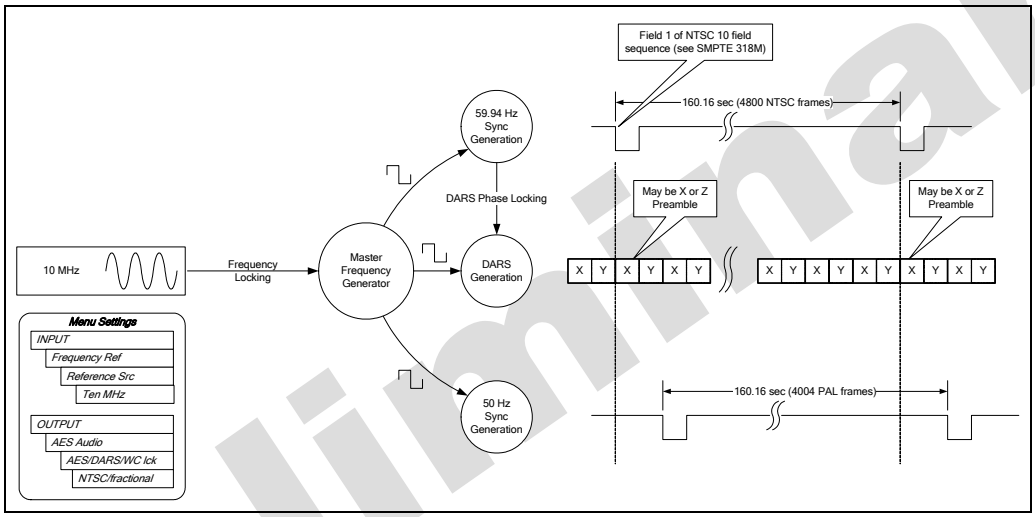


Figure 3-9: Sync Generation – 10 MHz Reference – NTSC outputs

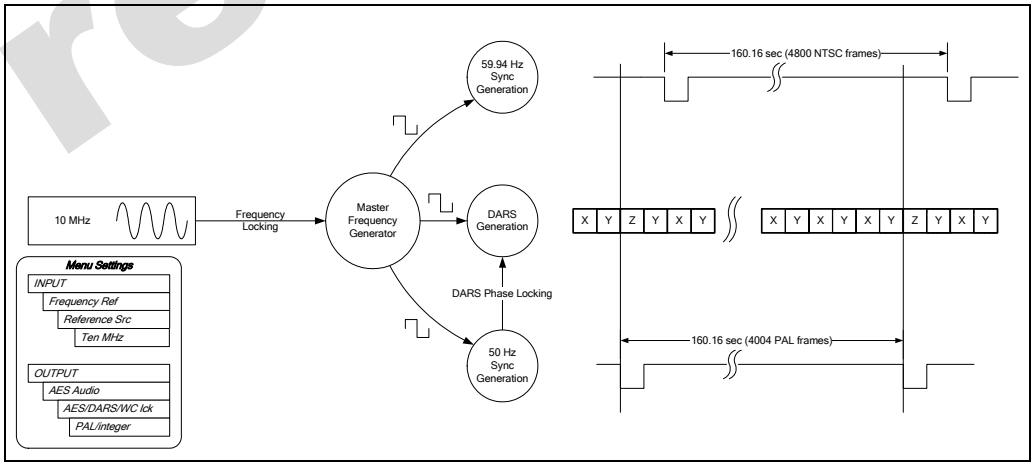


Figure 3-10: Sync Generation – 10 MHz Reference – PAL outputs

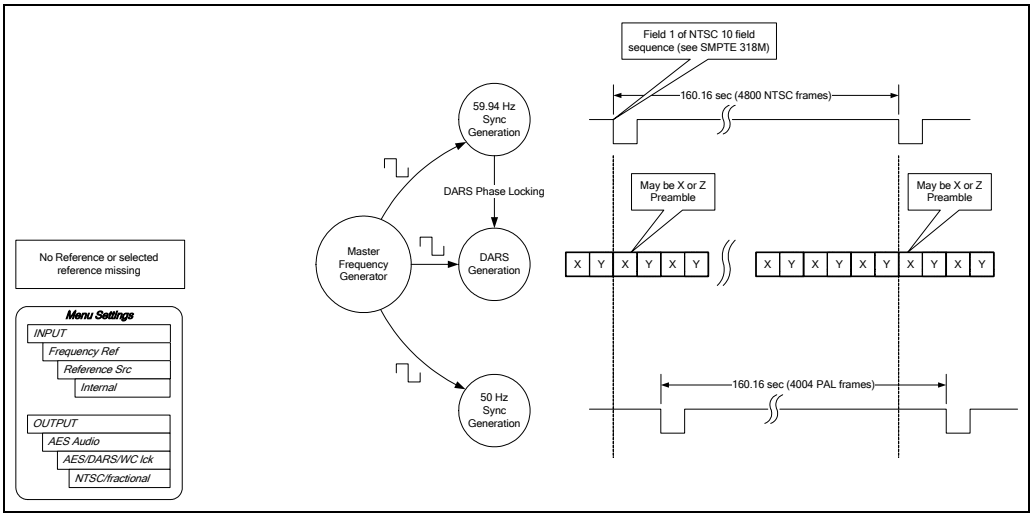


Figure 3-11: Sync Generation – No Reference – NTSC outputs

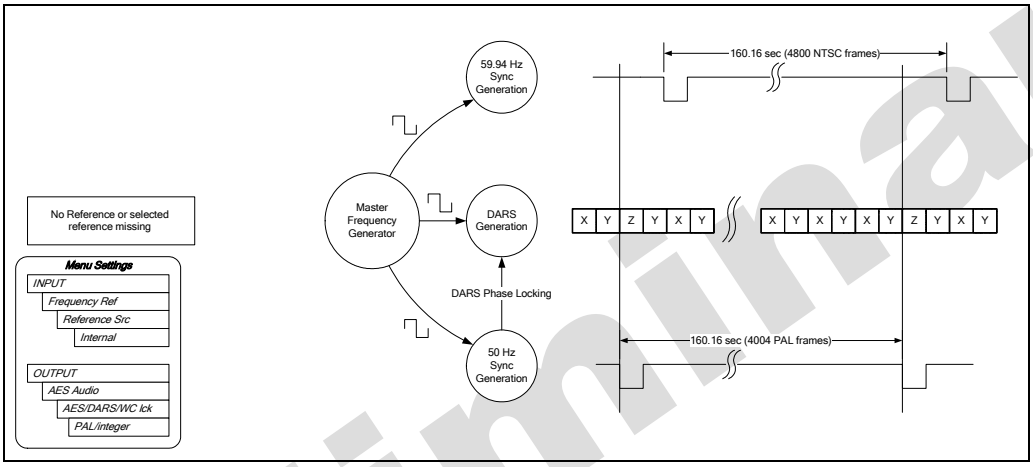


Figure 3-12: Sync Generation – No Reference – PAL outputs

3.3.2. Configuring the Genlock Capture Range

```
INPUT
  Frequency Ref
    Genlock Range
      Narrow
      Wide
```

The *Genlock Range* menu item is used to select the type of oscillator to use when locking to video or 5/10MHz references. See section 3.3.4.

Set this to *Narrow* to use the ovenized oscillator when the frequency stability of the reference is tightly controlled and within ±0.1 ppm. The ovenized oscillator provides excellent stability and enables use of the *Slow* lock mode. The *Slow* lock mode allows the 5601MSC to recover smoothly from a loss of reference or reference shift condition. The Narrow range is superior to the Wide range in every way except in lock time and lock range. It is the default setting and does not normally need to be changed.

Select the *Wide* range only when a wide locking range of ±15ppm is required and when very fast lock times are needed. This may be required in some post-production facilities where the input reference is changing occasionally and a fast relock time is desired. Low freerun stability and slightly higher jitter are the drawbacks of the wide range.

3.3.3. Selecting the Frequency Reference Lock Type

```
INPUT
  Frequency Ref
    Lock Type
      Slow
      Abrupt
```

The *Lock Type* menu item is used to select how the 5601MSC will relock to its frequency reference when the reference is lost and then regained, or experiences a change.

In *Abrupt* mode, whenever the 5601MSC detects that its internal oscillator is no longer synchronized to the reference it will make a sudden change to bring it back into lock. This may cause disturbances to the outputs as the unit shifts its frequency and phase.

In *Slow* mode, when the 5601MSC detects that its internal oscillator is not synchronized to the reference it will report *REF JAM NEEDED* on the LCD display and optionally send an SNMP trap. The unit will then slowly adjust its internal oscillator to bring it back into lock with the reference. This gradual correction will not cause any disturbances to the outputs as they re-phase. This adjustment may take a long time, depending on the size of the discrepancy between the internal oscillator and reference. If the unit is required to lock to its reference without delay the user can perform a manual jam by selecting the *Jam Input* menu item. The *Slow* lock type is only available if the *Genlock Range* is set to *Narrow*.

If a large shift in the reference occurs while Slow lock mode is enabled, the outputs of the 5601MSC may be out of phase for a long time while relocking. The 5601MSC will gradually slew its oscillator to bring it back into phase with the reference. This slewing action combined with the phase shift may seem to indicate that the unit is completely unlocked to the reference. This is not a fault and a manual jam can be performed to force the 5601MSC to lock immediately.

3.3.4. Wide and Narrow Genlock Ranges

The *Wide* and *Narrow* genlock ranges select between two oscillators in the 5601MSC. In almost all cases, the *Narrow* range is superior and should be the default selection. The *Narrow* range has very good freerun stability so if reference is lost the drift will be very low. The *Narrow* range also has lower jitter, and allows use of the *Slow* lock mode to prevent glitches when relocking to a lost reference. The disadvantages of the *Narrow* range is that it requires a very good reference source within ±0.1ppm and that it can take a long time, from 30 seconds to 2 minutes, to fully lock to the reference. The *Wide* range has a ±15ppm lock range which means it can lock to just about any video reference source and locks very quickly, normally in 1 second or less. The disadvantages of the Wide range are high freerun drift when the reference is lost, and slightly higher jitter.

The status of the reference and lock progress can be monitored on the *Lock Status* screen, accessed by pressing the **STATUS** button and selecting *Lock Status*. The tuning range position of the selected oscillator is shown as *OCXO center* or *WIDE center*. It is displayed as a percentage (+100% to –100%) of the total tuning range.

The *Narrow* range OCXO oscillator ages over time and the center frequency may drift. It is important that despite any drift it retains the ability to lock to a precision frequency source such as GPS or a rubidium/cesium frequency standard. Such frequency sources are constant and extremely accurate. The oscillator is guaranteed from the factory to lock to such a reference within ±10% of the center of its tuning range. The aging of the oscillator is 10% maximum for the first year, and 5% for every year thereafter. This assures a minimum lifetime of 15 years. If the oscillator locks at over ±90% of its tuning range this indicates a warning condition and the status line will be shown in Red. Keep in mind that the *OCXO center* value is only meaningful when locked to a very accurate frequency reference.

The 5601MSC monitors the condition of both oscillators at all times. If an oscillator problem is detected, the unit will seamlessly switch to the other oscillator and report an internal hardware fault. This will activate the *Hw Fail* message on the front panel and can also send out an SNMP trap. If such a fault occurs, it is not advisable to power down the unit. Contact Evertz customer service for further assistance at +1 905-335-7570 or see www.evertz.com/support.

3.3.5. Selecting the Time Reference

```
INPUT
  Time
    Reference Src
      GPS
      Modem
      Syncro
      LTC
      VITC
      None
```

The *Reference Src* menu item in the *Time* menu is used to select the type of time reference to be used by the 5601MSC.

When *GPS* is selected, the 5601MSC system time clock is referenced to time information that is acquired from the GPS receiver. (**GP** option required) When the frequency reference is set to *GPS* the time reference is forced to GPS. See section 3.6 for more information.

When set to *Modem* the 5601MSC system time is obtained by dialling into a high-level time service such as the NRC or NIST ACTS (**M** option required). After a successful modem call, the 5601MSC time locked status will be valid for a period of ten days. If ten days elapse before another successful dial-up time acquisition the 5601MSC will report that its time is unlocked, as the system time accuracy can no longer be guaranteed. See section 3.5.6 for information on configuring the modem.

When *Syncro* is selected, the 5601MSC will obtain time from another 5601MSC unit that is connected through a 5601ACO2 automatic changeover. In the *GENERAL* menu, the *Syncro* menu item must be set to *Slave time* or *Slave menu/time* for this time reference to work. See section 3.5.5 for more information.

When set to *LTC*, the 5601MSC system time will be referenced to time information being read from the LTC input. The frame rate of the incoming LTC is auto-detected and must be either 29.97fps drop-frame, or 25fps.

When set to *VITC* the 5601MSC system time will be referenced to time information being read from Vertical Interval Time Code on a black burst reference applied to the REF IN LOOP BNCs. The incoming VITC frame rate can be either 29.97fps drop-frame on NTSC-M, or 25fps on PAL-B. The line to read VITC from is selected by the *Vitc Line* menu item (see section 3.3.6). Note that the frequency reference must be set to *Video* in order for the time reference to be set to *VITC*.

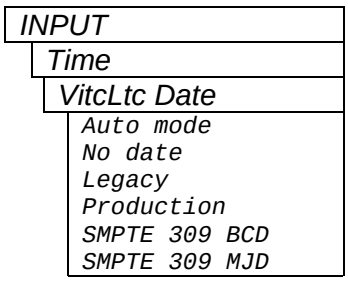
When the time reference source is set to *None*, the 5601MSC system time will freerun. The user must set the system date and time from the *GENERAL* menu using the eyeball and wristwatch method. The time cannot be guaranteed with any sort of accuracy and the NTP server will report an unlocked condition, unless spoofed (see section 3.5.13.1).

3.3.6. Setting the VITC Reader Line

```
INPUT
  Time
    Vitc Line
      line 14
```

This menu item is used to specify which line on the black burst reference input the VITC will be read from. The VITC that is read from the reference input can be viewed in the STATUS menu on the *System/LTC time* status screen.

3.3.7. Configuring the VITC and LTC Time Reference Date Format



The *Date Mode* menu item is used to select how the 5601MSC will decode date information from the user bits of the VITC and LTC inputs. It is only valid when the time reference source is set to VITC or LTC.

When set to *Auto mode*, the 5601MSC will analyze the incoming user bits to try to find the best date format. Use caution with this as some random data, including all 0s will look like a valid Legacy date format.

Select *No date* to ignore the user bits of the incoming VITC and LTC. This means that if the time reference is set to VITC or LTC the date must be set manually in the GENERAL menu.

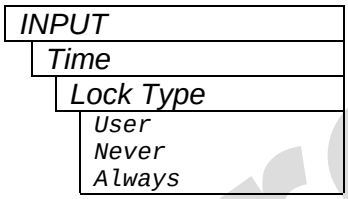
Select *Legacy* to decode the date in a format compatible with Leitch master clock systems.

Select *Production* to decode the date in a format compatible with time code smart slates used in film and television production. In this mode the date is encoded as yymmddrr, where rr is the nominal frame rate of the respective output (30 for 29.97Hz outputs).

Select *SMPTE 309 BCD date* to decode the date in the SMPTE 309M standard Binary Coded Decimal mode. In this mode the date is encoded as zzyymmdd, where zz is the time zone of the respective output.

Select *SMPTE 309 MJD date* to decode the date in the SMPTE 309M standard Modified Julian Date mode. In this mode the date is encoded as zzdddddd, where zz is the time zone of the respective output and dddddd is the date expressed in its Modified Julian Date representation.

3.3.8. Selecting the Time Reference Lock Type



The *Lock Type* menu item is used to control how and when the 5601MSC updates its system time to match the time reference. This decision is made whenever the system time is in disagreement with the time reference.

Select *User* when user intervention is required before updating system time. When the 5601MSC system time does not match the time reference a warning will be displayed on the front panel (TIME JAM NEEDED), which can optionally trigger an SNMP trap. The user must initiate a manual jam of reference time into system time using the *Jam Time* menu item in order to get system time to match the time reference.

Select *Never* to ignore the time reference completely unless the user performs a manual jam. No warnings are generated in this mode.

When set to *Always* the system time of the 5601MSC will constantly track the time reference. Any change in the time reference will be immediately applied to the system time of the 5601MSC.

3.3.9. Synchronizing the System Oscillator or System Time to the Reference Immediately

```
INPUT
  Jam Input
    Jam Reference
    Jam Time
```

This menu item allows the user to initiate an immediate forced synchronization of the master system oscillator to its frequency reference, or the system time to its time reference.

CAUTION: These controls perform an immediate action once the **SELECT** button is pressed. The text “Live control” will be shown on the left LCD with a red background as a warning.

Jamming the Frequency Reference:

This action will only be required when the frequency lock type has been set to *Slow*. In *Slow* mode, the 5601MSC can only gradually adjust its internal oscillator if it becomes unsynchronized to the frequency reference (see section 3.3.3 for more information on *Slow* mode). This can occur if the frequency reference is disconnected for a period of time. The internal oscillator will drift slightly and upon reconnection a slight difference will exist between the two.

The slow lock process can take a long time. To resolve this discrepancy immediately, the user can initiate a manual jam of the frequency reference. The word *Jam* here is used in the context that the timing and phase measured on the reference will be jammed into the system oscillator forcing it into synchronization. This can cause glitches on all outputs of the 5601MSC and should be used with caution.

To perform a jam of the frequency reference, select the *Jam Reference* menu item and press the **SELECT** button.

Jamming the Time Reference:

Performing a manual jam of the time reference will only be required when the time lock type is set to *User* or *Never*. In User mode the 5601MSC will warn whenever system time does not agree with the time reference (see section 3.3.9). When the lock type is *Never*, the 5601MSC will ignore the time reference completely and not generate any warnings. Performing a manual jam with this menu item is the only way to synchronize the system clock to the time reference. The word *Jam* is used in the context that the time and date provided by the time reference will be jammed into the system time clock to synchronize them.

To perform a jam of reference time/date into system time, select the *Jam Time* menu item and press the **SELECT** button.

When performing a frequency or time reference jam, allow 10 seconds for the jam warning messages to clear.

3.4. CONFIGURING THE OUTPUTS

The *OUTPUT* menu is used to configure the various outputs of the 5601MSC. The chart below shows the items available in the *OUTPUT* menu. Sections 3.4.1 and 3.4.2 give detailed information about each of the sub-menus.

LTC 1	Configures LTC output 1
LTC 2	Configures LTC output 2
SYNC 1	Configures the Sync 1 output
SYNC 2	Configures the Sync 2 output
SYNC 3	Configures the Sync 3 output
SYNC 4	Configures the Sync 4 output
SYNC 5	Configures the Sync 5 output
SYNC 6	Configures the Sync 6 output
10 MHz	Configures the 10MHz output
Wordclock	Configures the Wordclock output
SDI TG 1	Configures the SDI Test Generator 1 output
SDI TG 2	Configures the SDI Test Generator 2 output
SDI TG 3	Configures the SDI Test Generator 3 output
SDI TG 4	Configures the SDI Test Generator 4 output
ATG 1	Configures the Analog Video Test Generator 1 output
ATG 2	Configures the Analog Video Test Generator 2 output
Analog Audio	Configures the Analog Audio outputs
AES Audio	Configures the AES1, AES2, and DARS outputs
Global pedestal	Global control of NTSC setup pedestal on Sync and ATG outputs
Global Phasing	Global phase control for the Sync, LTC, AES/DARS, and test generators

Table 3-4: Top Level of the Output Setup Menu

3.4.1. Configuring the LTC Outputs

There are two LTC outputs available on the 5601MSC. Each LTC output has primary outputs on XLR connectors, and secondary outputs on the GPIO DB15 connector. Each of the outputs can be individually configured using a similar set of menus. The +12V LTC power is only available on the LTC1 primary output (XLR). This is controlled by the *Power Applied* menu item described in section 3.4.1.1. For the sake of simplicity only the menus for LTC output 1 will be described in the manual.

3.4.1.1. Selecting Normal or Powered LTC 1 Output (LTC1 XLR output only)

```
OUTPUT
  LTC 1
    Power Applied
      Power Off
      Power On
```

This menu item controls whether the primary LTC 1 output available on the 3-pin XLR connector will be a standard SMPTE 12M signal or whether it will be modulated to drive Evertz 1200 series clocks operating in slave mode. The secondary LTC 1 output on the 15-pin GPIO connector does not have the capability of powering the 1200 series clocks.

Select *Power Off* for all applications except driving Evertz 1200 series clocks. The LTC output level is set using the *Output Level* menu item.

Select *Power On* for applications where you want to transmit power through the LTC 1 XLR output to Evertz 1200 series clocks.

3.4.1.2. Setting the LTC Output Frame Rate

```
OUTPUT
  LTC 1
    Frame Rate
      23.98 FPS
      24    FPS
      25    FPS
      29.97 FPS
      29.97DF FPS
      30    FPS
```

This menu item sets the frame rate and counting mode of the LTC output. In order to maintain a correlation to real time when using time code rates that do not run at real time, they must be resynchronized to the system time once per day. The *Set Jam Time* menu item is used to set the time when the re-synchronization will occur. This time should be chosen so that time code disruptions will have the least effect in the television plant. (See section 3.4.1.3)

Select *30 FPS* to generate time code that counts at 30 frames per second and has a bit rate of 2400 bits per second. This LTC will run at exactly real time and is often used for driving master clock systems. This time code will be asynchronous to video sync pulse outputs in the NTSC-M, 1080i/59.94, and 720p/59.94 video standards.

Select *29.97 FPS* to generate time code that counts at nominal 30 frames per second and has a bit rate of approximately 2397 bits per second. This LTC will run approximately 86.3 seconds per day slower than real time. This time code will be synchronous to video sync pulse outputs in the NTSC-M, 1080i/59.94, and 720p/59.94 video standards.

Select *29.97DF FPS* to generate time code that counts at a nominal 30 frames per second using the SMPTE Drop Frame counting sequence and has a bit rate of approximately 2397 bits per second. This LTC will run approximately 2.6 frames per day faster than real time. This time code will be synchronous to video sync pulse outputs in the NTSC-M, 1080i/59.94, and 720p/59.94 video standards.

Select *25 FPS* to generate time code that counts at 25 frames per second and has a bit rate of 2000 bits per second. This LTC will run at exactly real time and is often used for driving master clock systems. This time code will be synchronous to video sync pulse outputs in the PAL-B, 1080i/50, and 720p/50 video standards.

Select *24 FPS* to generate time code that counts at 24 frames per second and has a bit rate of 1920 bits per second. This LTC will run at exactly real time and will be synchronous to video sync pulse outputs in the 1080p/24sF and 1080p/24 video standards.

Select *23.98 FPS* to generate time code that counts at a nominal 24 frames per second and has a bit rate of approximately 1918 bits per second. This LTC will run approximately 86.3 seconds per day slower than real time. This time code will be synchronous to video sync pulse outputs in the 1080p/23.98, and 1080p/23.98sF video standards.

3.4.1.3. Selecting when the LTC Time is Synchronized to the System Time

OUTPUT
LTC 1
Set Jam Time
0:00

This menu item allows the user to set the time of day when the LTC output time will be synchronized to the system time. This synchronization is necessary once per day to maintain a long-term correlation between the LTC time and system time when using time code rates that do not run at real time. When the time reference is set to *GPS* the LTC output time will have to be synchronized to the system time to correct for leap seconds.

Enter the hour and minute value for the jam time.

The LTC output can also be synchronized to system time immediately using the *Jam Output* menu item (see section 3.4.1.4). All LTC and VITC time code outputs can be synchronized to system time in one shot using the *Jam all VitcLtc* menu item (see section 3.4.1.5).

3.4.1.4. Synchronizing the LTC Output Time to System Time Immediately

OUTPUT
LTC 1
Jam Output
Jam Output [LIVE]

This menu item allows the user to synchronize the LTC output time to the system time immediately. This synchronization will also happen once per day at the time specified using the *Set Jam Time* menu item (see section 3.4.1.3). **Caution: This menu item is a live control**.

To synchronize the LTC time immediately, enter the Jam Output menu item and then press the **SELECT** button. The left LCD screen will display *TIME JAMMED* in yellow for 2 seconds to show the time has been synchronized.

When the time reference is set to *VITC* or *LTC* and the frame rate of the output is the same as the reference, the time will be jammed directly from the time reference source rather than from the system time.

3.4.1.5. Synchronizing All the LTC and VITC Outputs to System Time Immediately

OUTPUT
LTC 1
Jam all VitcLtc
Jam all VitcLtc [LIVE]

This menu item allows the user to synchronize both LTC outputs and all the VITC output times to system time immediately.
Caution: This menu item is a live control.

To synchronize all the LTC and VITC times immediately, enter the *Jam all VitcLtc* menu item and then press the **SELECT** button. The left LCD panel will display *ALL TIMES JAMMED* for 2 seconds to indicate that the time has been synchronized.

3.4.1.6. Setting the LTC Frame Offset

```
OUTPUT
  LTC 1
    Time offset
      -125 frames
      to
       125 frames
```

This menu item allows the user to set an offset between the system time and the LTC output time. This feature is commonly used to compensate for video path delays common within a television facility. The offset value will be added along with the time zone offset (see section 3.4.1.7) and the Daylight Saving Time correction (see section 3.4.1.8) to obtain the final LTC output time. To advance the LTC earlier than the system time set the offset to a negative (-) value.

3.4.1.7. Selecting the LTC Time Zone Offset

```
OUTPUT
  LTC 1
    Time zone
      -12:00 hours
      to
      +12:00 hours
```

This menu item allows the user to set a time zone offset between the system time and the LTC output time. The time zone offset value is set in 30-minute increments. The system time should be running at UTC. This time zone offset will be added to the system time along with the Daylight Saving time correction (see section 3.4.1.8) and the LTC frame offset (see section 3.4.1.6) to obtain the final LTC output time.

Use the ↑ and ↓ buttons or turn the control knob to move the cursor to select the desired time zone offset. Press the **SELECT** button to choose the indicated value. It will then become highlighted to show it is the active value.

3.4.1.8. Enabling Daylight Saving Time for the LTC Output

```
OUTPUT
  LTC 1
    DST Ctl
      Off
      On
```

This menu item allows the user to control whether Daylight Saving Time (DST) compensation will be applied to the LTC output.

When set to *Off*, Daylight Saving Time compensation will not be applied to the LTC time.

When set to *On* the rules set by the *DST rules* menu in the *GENERAL root* menu will be used to adjust the LTC time (see section 3.5.9.5).

3.4.1.9. Setting the LTC Output Level

```
OUTPUT
  LTC 1
    Output Level
      Level = 1 to 15
```

This menu item allows the user to adjust the LTC output amplitude. The range is from 1 to 15, with a level of 1 corresponding to approximately 800mV and a value of 15 corresponding to approximately 9.0V (with a 1kΩ or greater termination). See section 2.1.4 for more information.

3.4.1.10. Enabling LTC Polarity Correction

```
OUTPUT
  LTC 1
    Parity
      Parity Off
      Parity On
```

This menu item selects whether the LTC polarity correction flag will be set on the LTC output so that there is an even number of 0's in each 80-bit word. This prevents the polarity of the LTC waveform from flipping making observation easier on a waveform monitor.

Set to *Parity Off* to leave the polarity correction bit as 0.

Set to *Parity On* to drive the polarity correction bit to maintain parity in the LTC waveform.

3.4.1.11. Enabling the LTC Output Color Frame Bit

```
OUTPUT
  LTC 1
    Color Frame
      Color Frame Off
      Color Frame On
```

This menu item allows the user to control whether the color frame flag is set on the LTC output.

When set to *Color Frame Off*, the color frame bit will always be set to 0.

When set to *Color Frame On*, the color frame bit will be set to 1 to indicate color frame synchronization.

3.4.2. Configuring the Sync, 10MHZ and Wordclock Outputs

The menu items for the Sync outputs and 10MHz and Wordclock outputs are all the same. For the sake of simplicity, only the Sync 1 menu will be described in the manual.

3.4.2.1. Selecting the Standard of the Sync Outputs

- *OUTPUT*
  - *Sync 1*
    - *Mode*
      - *PAL-B*
      - *NTSC-M*
      - *1080p/23.98*
      - *1080p/24*
      - *1080i/50*
      - *1080i/59.94*
      - *1080i/60*
      - *720p/59.94*
      - *720p/60*
      - *1080p/23.98sF*
      - *1080p/24sF*
      - *1080p/25*
      - *1080p/29.97*
      - *1080p/30*
      - *720p/50*
      - *720p/24*
      - *625i/48*
      - *625i/47.95*
      - *PAL color frame*
      - *1 Hz*
      - *1/1.001 Hz*
      - *6/1.001 Hz*
      - *5 MHz*
      - *10 MHz*
      - *NTSC-M subcarr.*
      - *PAL-B subcarr.*
      - *Wordclock*

This menu item sets the format of the sync output. All sync outputs including the 10MHz and Wordclock outputs are fully configurable to output numerous sync formats.

The PAL-B and NTSC-M selections are black burst outputs compliant with SMPTE 318M. When either of these standards is selected, vertical interval time code can be inserted onto two lines of the VBI. A ten-field reference can also be inserted onto line 15 of the NTSC-M color black output. See section 3.4.2.2 for more information.

There are numerous HD tri-level standards that can be output compliant with SMPTE 274M, SMPTE 296M, and SMPTE 292M.
For 1080p/30sF use the 1080i/60 format
For 1080p/25sF use the 1080i/50 format
For 1080p/29.97sF use the 1080i/59.94 format
For 1035i/59.94 use the 1080i/59.94 format
For 1035i/60 use the 1080i/60 format

The 625i/48 and 625i/47.95 selections are “slow PAL” signals, which are sync only bi-level formats synchronous to 24Hz and 23.98Hz rates.

The pulse formats consist of various timing signals that can be used to line up signals with different timing. The *PAL color frame* pulse occurs during field 1 of the PAL-B 8-field color sequence. The *1Hz* pulse occurs once per second at the beginning of the second and indicates the point where the vertical syncs of 60Hz and 50Hz HD sync formats are coincident. The *1/1.001 Hz* pulse occurs nominally once per second at the beginning of the second and indicates the point where the vertical syncs of 59.94Hz and 23.98Hz HD sync formats are coincident. The 6*/1.001 Hz* pulse occurs nominally six times per second and indicates the point where the vertical syncs of 59.94Hz and 23.98Hz HD sync formats are coincident. The pulse type is controlled by the *Pulse type* menu item (see section 3.4.2.2.11).

Wordclock is a 48kHz sampling rate clock synchronized to the AES/DARS outputs. The amplitude is controlled by the *Wordclock levl* menu item (see section 3.4.2.2.13).

The continuous wave formats output a sine wave at different frequencies. The amplitude of these outputs is controlled by the *Sine wave level* menu item (see section 3.4.2.2.12). If the unit is locked to a black burst frequency reference the subcarrier outputs will be lined up with the reference.
NTSC-M subcarr. = NTSC CW subcarrier frequency at 3.58MHz nominal.
PAL-B Subcarr. = PAL-B CW subcarrier frequency at 4.43MHz nominal.
5 MHz = Continuous sine wave at 5MHz.
10 MHz = Continuous sine wave at 10MHz.

3.4.2.2. Configuring the VITC Generator for the Color Black Outputs

3.4.2.2.1. Enabling VITC on the Video Output

```
OUTPUT
  Sync 1
    Vitc Ctl
      Off
      On
```

This menu item controls whether Vertical Interval Time Code will be inserted into the vertical blanking interval of the sync output.

This menu item is only applicable when the Sync *Mode* is set to the *PAL-B* or *NTSC-M* formats and will disabled for other formats (shown in dark text).

3.4.2.2.2. Selecting the VITC Insertion Lines

```
OUTPUT
  Sync 1
    Vitc Line 1
      line 1 = 14
```

These menu items select the lines onto which the VITC will be inserted when the *Vitc Ctl* menu item is set to *On*. If only one line of VITC is desired, set both menu items to the same line.

```
OUTPUT
  Sync 1
    Vitc Line 2
      line 2 = 16
```

The default line values for NTSC-M are lines 14 and 16.
The default line values for PAL-B are lines 17 and 17 (same line).

This menu item is only applicable when the Sync *Mode* is set to the *PAL-B* or *NTSC-M* formats and will be disabled for other formats (shown in dark text).

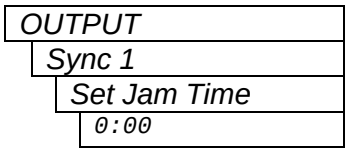
3.4.2.2.3. Enabling Drop Frame Counting for NTSC VITC

```
OUTPUT
  Sync 1
    Dropframe Ctl
      Off
      On
```

This menu item allows the user to control whether the drop frame counting mode will be used for the VITC inserted onto the sync output.

This menu item is only applicable to the NTSC-M format and will be disabled for all other formats (shown in dark text).

3.4.2.2.4. Selecting when the VITC Time is Synchronized to the System Time



This menu item allows the user to set the time of day when the VITC on the sync output will be synchronized to the system time. This synchronization is necessary once per day to maintain a long-term correlation between the VITC time and system time for the NTSC-M sync format.

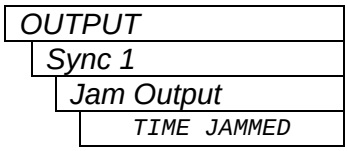
When the time reference is set to *GPS*, the VITC output time will have to be synchronized to the system time to correct for leap seconds. This affects both NTSC-M and PAL-B formats.

Enter the hour and minute with the ↑ and ↓ buttons or by turning the control knob.

The VITC can also be synchronized to system time immediately using the *Jam Output* menu item (see section 3.4.2.2.5). All LTC and VITC time code outputs can be synchronized to system time in one shot using the *Jam all VitcLtc* menu item (see section 3.4.2.2.6).

This menu item is only applicable when the Sync *Mode* is set to the *PAL-B* or *NTSC-M* formats and will disabled for other formats (shown in dark text).

3.4.2.2.5. Synchronizing the VITC to System Time Immediately



This menu item allows the user to synchronize the VITC on the sync output to system time immediately. This synchronization will also happen once per day at the time specified using the *Set Jam Time* menu item (see section 3.4.2.2.4). **Caution: This menu item is a live control**.

To synchronize the VITC on the sync output to system time immediately, select the *Jam Output* menu item and press the **SELECT** button. The left LCD screen will display *TIME JAMMED* in yellow for 2 seconds.

This menu item is only applicable when the Sync *Mode* is set to the *PAL-B* or *NTSC-M* formats and will disabled for other formats (shown in dark text).

When the time reference is set to VITC or LTC and the frame rate of the time reference is the same as the sync output, the time will be jammed directly from the time reference rather than from system time.

3.4.2.2.6. Synchronizing all the VITC and LTC Outputs to System Time Immediately

```
OUTPUT
  SYNC 1
    Jam all VitcLtc
      ALL TIMES JAMMED
```

This menu item allows the user to synchronize both LTC outputs and all the VITC output times to system time immediately.
Caution: This menu item is a live control.

To synchronize all the LTC and VITC times immediately, select the Jam all VitcLtc menu item and press the **SELECT** button. The left LCD panel will display *ALL TIMES JAMMED* in yellow for 2 seconds.

This menu item is only applicable when the Sync *Mode* is set to the *PAL-B* or *NTSC-M* formats and will be disabled for other formats (shown in dark text).

3.4.2.2.7. Setting the VITC Frame Offset

```
OUTPUT
  Sync 1
    Time offset
      0 frames
```

This menu item allows the user to set an offset between the system time and the VITC time. This feature is commonly used to compensate for video path delays common within a television facility. The offset value will be added along with the time zone offset (see section 3.4.2.2.8) and Daylight Saving Time correction (see section 3.4.2.2.9) to obtain the final VITC time. To advance the VITC earlier than the system time, set the offset to a negative (-) value.

This menu item is only applicable when the Sync *Mode* is set to the *PAL-B* or *NTSC-M* formats and will be disabled for other formats (shown in dark text).

3.4.2.2.8. Selecting the VITC Time Zone Offset

```
OUTPUT
  Sync 1
    Time zone
      -12:00 hours
      to
      +12:00 hours
```

This menu item allows the user to set a time zone offset between the system time and the VITC time on the sync output. The time zone offset value is set in 30-minute increments. The system time should be running at UTC. This time zone offset will be added to the system time along with the Daylight Saving Time correction (see section 3.4.2.2.9) and the VITC frame offset (see section 3.4.2.2.7) to obtain the final VITC time.

Use the ↑ and ↓ buttons or turn the control knob to move the cursor to select the desired time zone offset. Press the **SELECT** button to choose the indicated value. It will then become highlighted to show it is the active value.

This menu item is only applicable when the Sync *Mode* is set to the *PAL-B* or *NTSC-M* formats and will be disabled for other formats (shown in dark text).

3.4.2.2.9. Enabling Daylight Saving Time for the VITC on the Sync Output

```
OUTPUT
  Sync 1
    DST Ctl
      Off
      On
```

This menu item allows the user to control whether Daylight Saving Time (DST) compensation will be applied to the VITC time on the sync output.

When set to *Off*, Daylight Saving Time compensation will not be applied to the VITC time on the sync output.

When set to *On* the rules set by the *DST rules* menu in the *GENERAL root* menu will be used to adjust the VITC time (see section 3.5.9.5).

This menu item is only applicable when the Sync *Mode* is set to the *PAL-B* or *NTSC-M* formats and will be disabled for other formats (shown in dark text).

3.4.2.2.10. Enabling Insertion of the Ten Field Reference

```
OUTPUT
  Sync 1
    Ten field Ctl
      Off
      On
```

This menu item controls insertion of a SMPTE 318M compatible ten field pulse sequence on line 15 of NTSC-M black burst formats. This pulse sequence is commonly used to synchronize the AES audio sample distribution over ten fields of NTSC video.

When set to *Off*, the ten field pulse sequence is not inserted.

When set to *On,* a ten field pulse sequence will be inserted onto line 15 of the NTSC-M black burst format.

This menu item is only applicable to the NTSC-M format and will be disabled for all other formats (shown in dark text).

3.4.2.2.11. Selecting the Pulse Type

```
OUTPUT
  Sync 1
    Pulse type
      5V CMOS
      +/-1V bi-level
      +/-1V tri-level
```

This menu item allows the user to set the pulse type for the pulse formats (see section 3.4.2.1). This affects the PAL color frame, 1Hz, 1/1.001Hz, and 6/1.001Hz sync modes.

When set to *5V CMOS*, the pulse will be from 0V to 5V (unterminated) and will be approximately 16ms/20ms in duration.

When set to *+/-1V bi-level*, the pulse will be from –1V to +1V (unterminated) and will be approximately 16ms/20ms in duration.

When set to *+/-1V tri-level*, the output will be 0V nominal with a short pulse to -1V followed by a short pulse to +1V then back to 0V (unterminated). Both pulses will be approximately 64µs in duration.

3.4.2.2.12. Selecting the Sine Wave Level

```
OUTPUT
  Sync 1
    Sine wave level
      +/-1 Volts
      +/-2 Volts
```

This menu item is used to select the output amplitude of the sine wave sync formats. This affects the subcarrier modes and the 5MHz/10MHz modes.

When the *Sine wave level* is set to +/-1 volts, then the output will be 2 volts peak-to-peak in amplitude (unterminated).

When the *Sine wave level* is set to +/-2 volts, then the output will be 4 volts peak-to-peak in amplitude (unterminated).

3.4.2.2.13. Selecting the Wordclock Level

```
OUTPUT
  Sync 1
    Wordclock levl
      5V CMOS
      +/-1 Volts
```

This menu item allows the user to select the wordclock output level for the wordclock sync output mode. This affects only the wordclock output mode.

When *5V CMOS* is selected, the wordclock output amplitude will be 0V during channel 2 (right channel) and will be 5V during channel 1 (left channel). This assumes an unterminated output.

When *+/-1 Volts* is selected, the wordclock output will be -1V during channel 2 (right) and +1V during channel 1 (left). This assumes at 75Ω terminated output.

The output impedance of the sync outputs is 75Ω. The output amplitudes will drop by half when loaded with a 75Ω termination.

3.4.2.3. Setting the Phase of the Sync Outputs

The phase of the sync outputs are set independently of each other. There are four menu items that are used to set the phase. Figure 3-13 and Figure 3-14 show the default video sync alignment (V phase = 1, H phase = 1, fine phase = 0.0%) for 59.94Hz and 50Hz systems respectively.

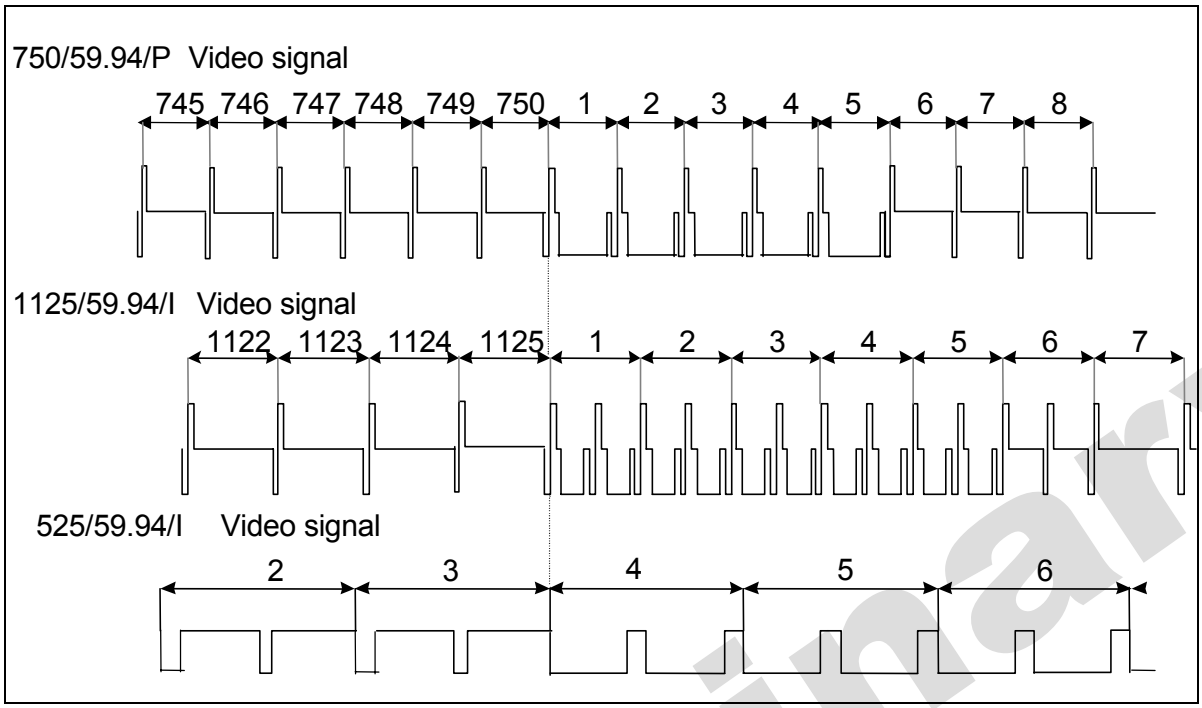


Figure 3-13: Video Sync Phase Alignment in 59.94Hz Field Rate Systems

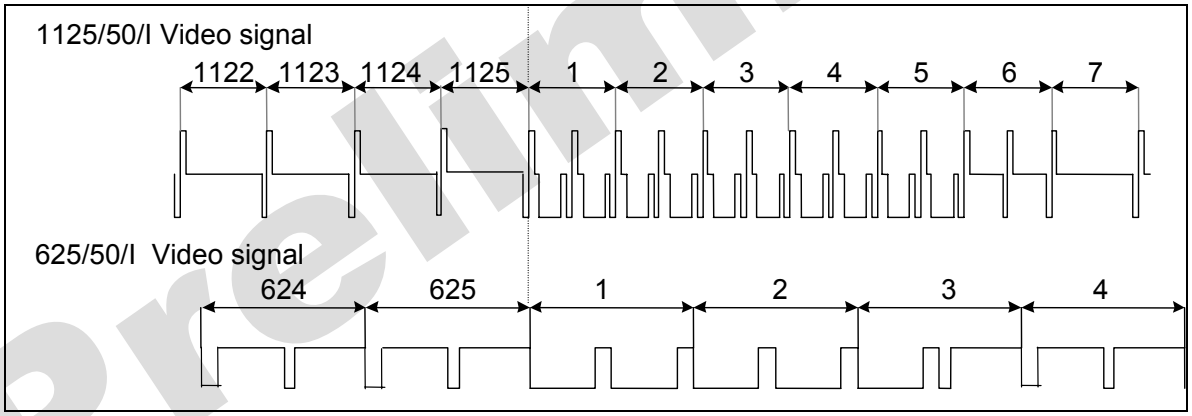


Figure 3-14: Video Sync Phase Alignment in 50Hz Field Rate Systems

The front panel display will show `LIVE CONTROL` on the left LCD screen in green to indicate that adjusting the sync output phase menu items will affect the phasing of the respective sync output immediately. You do not have to press the SELECT button to accept the new values. Use these controls with caution, as they will affect the overall timing of devices connected to the sync outputs.

OUTPUT
Sync 1
Fine phase
Hor phase
Vert phase
Color phase

```
Phase value


Cf   v   h fine%
1    1   1   0.0
```

BLACK BURST PHASE SCREEN

```
Phase value


     v   h fine%
     1   1   0.0
```

HD TRILEVEL PHASE SCREEN

There are four menu items that are used to adjust the phase of the sync output. Only the black burst (NTSC-M and PAL-B) and HD tri-level output modes can be phased. The pulse and subcarrier sync formats will always remain in phase with the frequency reference, plus any global phase adjustments. The wordclock phase is controlled in the AES Audio menu (see section 3.4.6).

When any of the four phase adjustments is selected, the right LCD panel will display a phase control screen that can be used to view all four adjustments simultaneously. The active adjustment will be highlighted and the other adjustments will be shown in dark text. For HD tri-level and Slo-PAL bi-level sync modes the color frame adjustment will not be shown. Turn the control knob or press the ↑ and ↓ buttons to adjust the phase value.

Tip: Pressing in the control knob while turning will make adjustments in steps of 16 allowing large adjustments to be done quickly.

The phase adjustments are wrapping. This means that when the smaller phase control is adjusted beyond its maximum, it will wrap back to 0 and the next larger phase control will automatically be incremented by one. Similarly, when the smaller phase control is adjusted below 0, it will wrap to its maximum value and the next larger phase control will be decremented by one. For example, when the fine phase is adjusted past 99.6%, it will wrap to 0.0% and the horizontal phase will automatically be incremented by one. This can be used to make very gradual phase adjustments by continually adjusting the fine phase control until the horizontal and vertical phases reach their desired values (may take a long time).

Caution: These menu items are live controls. Changing their values will immediately affect the sync output and all downstream devices.

The *Color phase* menu item is the largest phase control that is used to adjust the sync output in steps of whole frames. It is normally used to align the color frame sequence for the black burst outputs. It is only available for the NTSC-M and PAL-B sync modes and will be disabled (shown in dark text) for HD tri-level and Slo-PAL bi-level modes.

The *Vert phase* menu item is used to adjust the phase of the sync output in steps of lines.

The *Hor phase* menu item is used to adjust the phase of the sync output in steps of samples.

The *Fine phase* menu item is used to adjust the phase of the sync output in fractions of a sample. 100.0% is equivalent to one sample period.

IMPORTANT NOTICE: When the phase of a blackburst sync output has been changed, a JAM of the VITC must be performed in order to ensure proper video to timecode alignment.

3.4.3. Configuring the SDI Video Test Generator Outputs (SDTG, HDTG, 3GTG options)

There are four menus to control each of the SDI video test generators. These menus are all identical to each other and for the sake of simplicity, only the SDI TG 1 menu will be described in the manual.

3.4.3.1. Selecting the SDI Test Generator Test Pattern

```
OUTPUT
  SDI TG 1
    Signal
      BLACK
      GREY
      WHITE
      FIELD ID (B=1,W
      VALID RAMP
      100% COLOR BARS
      more…
```

The *Signal* menu item is used to select the test pattern for the SDI test generator output. The test patterns available will depend on the link format selected and also on the current image format.

Caution: This menu item is a live control. Changes made by pressing the ↑ and ↓ buttons or rotating the control knob will immediately affect the picture output of the SDI test generator.

3.4.3.2. Selecting the Standard of the SDI Video Test Generator Link Format

```
OUTPUT
  SDI TG 1
    Format
      Link Format
        Single Link HD
        3G Level A
        3G Level B
        Dual Link HD
        Standard Def
```

The *Link Format* menu item is located in the *Format* sub-menu and is used to select the physical SDI interface type for the SDI test generator. Each SDI test generator has two BNC outputs and this menu item controls what will be present on the BNCs. Depending on the options that are installed on the 5601MSC some of the menu items may not be available.

Select *Single Link HD* for a 1.48Gb/s (SMPTE 292) interface speed for 1080i & 1080p (SMPTE 274M), 720p (SMPTE 296M), and 2k DCDM (SMPTE 428) image formats. Both BNCs will contain the same video.

Select *3G Level A* for a 2.97Gb/s (SMPTE 424M) interface speed for direct image format mapping (SMPTE 425 Level A).

Select *3G Level B* for a 2.97Gb/s (SMPTE 424M) interface speed for Dual Link format mapping (SMPTE 372M).

Select *Dual Link HD* for a 1.48Gb/s (SMPTE 292) interface speed for dual-link image formats (SMPTE 372M). In this format one BNC will be Link A and the other BNC will be Link B. The BNCs are labelled (A) and (B).

Select *Standard Def* for a 270Mb/s (SMPTE 259M) interface speed for 525i/59.94 (SMPTE 125M) and 625i/50 (ITU-R BT.601) image formats.

3.4.3.3. Selecting the Standard of the SDI Video Test Generator Image Format

```
OUTPUT
  SDI TG 1
    Format
      Image Format
        525i
        625i
        1920x1080i/59
        1920x1080p/23
        1920x1080p/29
        1920x1080p/29sF
        2048x1080p/23
        2048x1080p/23sF
        1920x1080i/50
        1920x1080p/25sF
        1280x720p/50
        1920x1080i/60
        1920x1080p/24
        1920x1080p/30
        more…
```

The *Image Format* menu item is located within the *Format* sub-menu and controls the video standard that is output from the SDI test generator. The image format selections will depend on what the current link format is. Move the selection cursor to a format and press the **HELP** button to obtain more information.

3.4.3.4. Setting the Phase of the SDI Video Test Generator

The four SDI test signal outputs are all phased independently from each other and can be adjusted independent of the sync and analog video test generator outputs. Refer to Figure 3-13 and Figure 3-14 for the default video sync alignment for 59.94Hz and 50Hz systems respectively.

The left LCD display will show `Live control` in green to indicate that adjusting the SDI Test Generator output phase menu items will affect the phasing of the SDI Test Generator output immediately. You do not have to press the SELECT button to accept the new values. Use these controls with caution, as they will affect the overall timing of devices connected to the SDI Test Generator output.

```
OUTPUT
  SDI TEST GEN
    Hor Phase
    Vert Phase
      Phase value


      Vert   hor
        1      1
```

There are two menu items that are used to set the vertical and horizontal phase of the SDI test generator output. When either of the phase adjustments is selected, the right LCD panel will display a phase control screen that can be used to view both vertical and horizontal settings simultaneously. The active adjustment will be highlighted while the other value will be shown in dark text. Turn the control knob to adjust the phase. Turning the knob while pressing it in will make adjustments in steps of 16.

The phase adjustments are wrapping. This means that when the horizontal phase control is adjusted beyond its maximum, it will wrap back to 0 and the vertical phase control will automatically be incremented by one. Similarly, when the horizontal phase control is adjusted below 0, it will wrap to its maximum value and the vertical phase control will be decremented by one.

Select Hor Phase to adjust the phase of the output in steps of samples.

Select Vert Phase to adjust the phase of the output in steps of lines.

3.4.3.5. Configuring the SDI Test Generator Embedded Audio

Each SDI test generator is capable of inserting up to four groups of audio onto all supported link formats and video standards. The audio is embedded according to SMPTE 272M (SD) and SMPTE 299M (HD/3G). Each audio group contains four channels of audio all of which can be configured to various test tones at selectable levels. There are four menu items that control each group of audio for the SDI test generators. For the sake of simplicity, only the controls for Audio Group 1 are described in the manual.

3.4.3.5.1. Controlling Embedding of Audio Groups onto the SDI Test Generator

- *OUTPUT*
  - *SDI TG 1*
    - *Audio Group 1*
      - *Group Ctl*
        - *Off*
        - *On*

The *Group Enable* menu item is used to enable or disable embedding of audio group 1.

Selecting *on* will embed group 1 with all four channels of audio. Selecting off will not embed this group.

3.4.3.5.2. Selecting the Audio Tone for an SDI Embedded Audio Channel

There are 4 identical menu items to select the tone frequency for each of the audio channels in the group. For the sake of simplicity only the menu item for channel 1 is described in the manual.

- *OUTPUT*
  - *SDI TG 1*
    - *Audio Group 1*
      - *Ch 1 frequency*
      - *Ch 2 frequency*
      - *Ch 3 frequency*
      - *Ch 4 frequency*
        - *20 Hz*
        - *60 Hz*
        - *100 Hz*
        - *200 Hz*
        - *400 Hz*
        - *800 Hz*
        - *1.0 kHz*
        - *1.6 kHz*
        - *2.0 kHz*
        - *3.2 kHz*
        - *4.0 kHz*
        - *5.0 kHz*
        - *6.4 kHz*
        - *8.0 kHz*
        - *10 kHz*
        - *12 kHz*

The *Ch1 Frequency* menu item is used to select the frequency of the tone that will be embedded into audio channel 1.

Selecting one of these signals will set the frequency of the tone that is embedded into this channel.

3.4.3.5.3. Setting the Audio Level for an SDI Embedded Audio Channel

There are 4 identical menu items to set the audio level for each of the audio channels in the group. For the sake of simplicity only the menu item for channel 1 is described in the manual.

```
OUTPUT
  SDI TG 1
    Audio Group 1
      Ch 1 level
        mute
        0 dBFS to –60dBFS
```

The *Ch 1 level* menu item is used to set the audio level of the tone that was selected for channel 1 of the audio group.

The audio level is set in units of dBFS (dB Full-Scale) and is adjustable in increments of 1 from 0 dBFS to –60 dBFS.

Select *mute* to completely mute the audio channel.

3.4.3.6. Configuring the On-Screen Message for the SDI Test Generator Outputs

It is possible to overlay a user-defined text message onto the outputs of SDI TG 1 and SDI TG 3. This capability is not available for SDI TG 2 and SDI TG 4. There are six menu items used to control the message displayed and are described below.

3.4.3.6.1. Enabling the On-Screen Message for the SDI Test Generator

```
OUTPUT
  SDI TG 1
    Message Ctl
      Message off
      Message 1 line
      Message 2 lines
```

This menu item is used to enable the on-screen message and to select how many lines will be overlayed onto the SDI test generator output. This menu item will only be available for SDI TG 1 and SDI TG 3.

When set to *Message off*, the text message will not be visible.

When set to *Message 1 line*, the first line of text will be overlayed onto the SDI test generator video output.

When set to *Message 2 lines*, there will be two lines of text overlayed onto the SDI test generator video output.

3.4.3.6.2. Setting the On-Screen Message Position for the SDI Test Generator

```
OUTPUT
  SDI TG 1
    H Position
    V Position
      Message position

       Vert.  hor.
         2     1
```

There are two menu items used to control the position of the test message on the SDI test generator video output. When either menu item is selected, the right LCD display will show a message position screen where the active adjustment will be highlighted and the other adjustment will be in dark text. These menu items are only available for SDI TG 1 and SDI TG 3.

The *H position* menu item is used to control the horizontal position of the text message.

The *V position* menu item is used to control the vertical position of the text message.

3.4.3.6.3. Entering User-Defined Text for the On-Screen Message

```
OUTPUT
  SDI TG 1
    Message 1
    Message 2
      Message 1

        EVERTZ 5601MSC

      Message 2

        Master Sync
```

There are two lines of user-defined text that can be entered using the *Message 1* and *Message 2* menu items. When entering text, use the ↑ and ↓ buttons or turn the control knob to set each character. Press the **SELECT** button to advance to the next character. Turn the control knob all the way counter-clock wise to get to the space character. There is a maximum of 15 characters. When finished press the **SELECT** button. These menu items are only available for SDI TG 1 and SDI TG 3.

The *Message 1* menu item allows entry of text for the first message line.

The *Message 2* menu item allows entry of text for the second line.

3.4.3.6.4. Selecting the Font Size of the On-Screen Message for the SDI TG

```
OUTPUT
  SDI TG 1
    Message font
      Normal size
      Large size
```

This menu item controls the size of the font that is used for the on-screen message text. This menu item is only available for SDI TG 1 and SDI TG 3.

Select *Normal size* for normal sized letters.

Select *Large size* for large text that is easier to view on small monitors.

3.4.3.7. Configuring the SDI Test Generator Output Drive

```
OUTPUT
  SDI TG 1
    Output Drive
      Auto detect ACO
      No 5601ACO2
      5601ACO2 in use
```

This menu item is used to control how highdrive on the SDI test generator outputs is enabled. Highdrive is a feature that doubles the usual SDI output amplitude from the normal 800mV to 1600mV. Most equipment cannot accept a highdrive signal properly. Highdrive mode should only be used if the output is going to a 5601ACO2 or similar resistive attenuator.

Select *Auto detect ACO* to have the 5601MSC automatically turn highdrive on when the SNSA and SNSB pins of the AUDIO connector are pulled low through connection to a 5601ACO2 (see section 2.1.7).

Select *No 5601ACO2* to disable highdrive for the SDI test generator. This is the recommended setting for installations not using a 5601ACO2.

Select *5601ACO2 in use* to turn highdrive on for the SDI test generator. The SDI outputs for this test generator will be double amplitude.

When the SDI test generator is in highdrive mode, most equipment will not be able to receive the SDI signal properly. Leave highdrive disabled unless the SDI test generator outputs are connected to a 5601ACO2 automatic changeover.

3.4.3.8. Setting the SDI Test Generator Syncro Mode

```
OUTPUT
  SDI TG 1
    Syncro
      Include syncro
      Exclude syncro
```

This menu item controls the behaviour of the SDI TG when the unit is in syncro mode. If syncro is not enabled this menu item is ignored.

Select *Include syncro* to include the SDI TG in the synchronization of menu items between the master and slave units.

Select *Exclude syncro* to exclude the SDI TG from synchronizing its settings with the master or slave unit. This allows the TG to be modified freely on the slave unit to different settings than the master.

3.4.4. Configuring the Analog Video Test Generator Outputs (SDTG, HDTG, 3GTG options)

There are two individual Analog Test Generators (ATG 1 and ATG 2). For the sake of simplicity, only the menu for ATG 1 will be described in this manual.

3.4.4.1. Selecting the Test Pattern for the Analog Video Test Generator Output

```
OUTPUT
  ATG 1
    Signal
      BLACK
      GREY
      WHITE
      FIELD ID (B=1,W=2)
      10 Y Step
      Y Ramp
      Shallow Y Ramp
      Modulated Ramp
      75% Color Bars
      100% Color Bars
      NTC7 Composite
      NTC7 Combination
      FCC Composite
      FCC Multiburst
      60% Ext MB
      Y Multipulse
      2T Pulse & Bar
      SinX/X
      BOWTIE
      SDI CHECKFIELD
      COMPOSITE SIGNAL
```

This menu item selects the picture content for the analog video test generator output. There are different test patterns available for the PAL-B and NTSC-M image formats.

Caution: This menu item is a live control. Changes made by pressing the ↑ and ↓ buttons or rotating the control knob will immediately affect the picture output of the analog test generator.

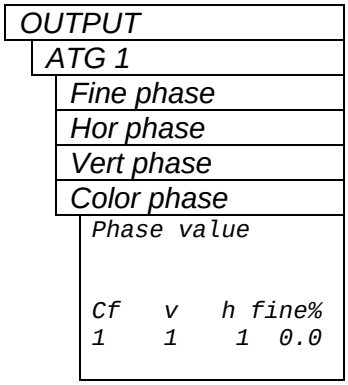
3.4.4.2. Selecting the Standard of the Analog Video Test Generator

```
OUTPUT
  ATG 1
    Image Format
      525 NTSC M
      625 PAL B
```

This menu item sets the output format of the analog video test generator.

3.4.4.3. Setting the Phase of the Analog Video Test Generator

The Analog test signal output can be adjusted independent of the Sync and SDI test generator outputs. There are four menu items that are used to set the phase of the Analog Test Generator output. Refer to Figure 3-13 and Figure 3-14 to see the default alignment for 59.94Hz and 50Hz systems respectively.



There are four menu items that are used to adjust the phase of the analog test generator output. When any of the four phase adjustments is selected, the right LCD panel will display a phase control screen that can be used to view all four adjustments simultaneously. The active adjustment will be highlighted and the other adjustments will be shown in dark text. Rotate the control knob or press the ↑ and ↓ buttons to change the phase value.

Note: Pressing in the control knob while turning will make adjustments in steps of 16 allowing large adjustments to be done quickly.

The phase adjustments are wrapping. This means that when the smaller phase control is adjusted beyond its maximum, it will wrap back to 0 and the next larger phase control will automatically be incremented by one. Similarly, when the smaller phase control is adjusted below 0, it will wrap to its maximum value and the next larger phase control will be decremented by one. For example, when the fine phase is adjusted past 99.6%, it will wrap to 0.0% and the horizontal phase will automatically be incremented by one.

Caution: These menu items are live controls. Changing their values will immediately affect the analog video test generator output.

The *Color phase* menu item is the largest phase control that is used to adjust the output in steps of whole frames. It is normally used to align the color frame sequence.

Select *Vert phase* to adjust the phase of the output in steps of lines.

Select *Hor phase* to adjust the phase of the output in steps of samples.

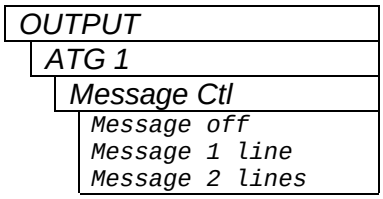
Select *Fine phase* to adjust the phase of the sync output in fractions of a sample. 100.0% is equivalent to one sample period.

The left LCD display will show `Live control` in green to indicate that adjusting the Analog Video Test Generator output phase menu items will affect the phasing of the Analog Video Test Generator output immediately. You do not have to press the SELECT button to accept the new values. Use these controls with caution.

3.4.4.4. Configuring the On-Screen Message for Analog Video Test Generator 1

It is possible to overlay a user-defined text message onto the output of analog video test generator 1. This will affect the ATG 1 output. This capability is not available for the ATG 2 output. There are six menu items used to control the message displayed and are described below.

3.4.4.4.1. Enabling the On-Screen Message for Analog Video Test Generator 1



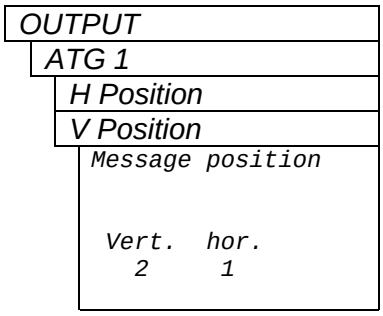
This menu item is used to enable the on-screen message for ATG 1 and to select how many lines will be overlayed onto the output video.

When set to *Message off*, the text message will not be visible.

When set to *Message 1 line*, the first line of text will be overlayed onto the picture of the ATG 1 output.

When set to *Message 2 lines*, there will be two lines of text overlayed onto the picture of the ATG 1 output.

3.4.4.4.2. Setting the On-Screen Message Position for ATG 1

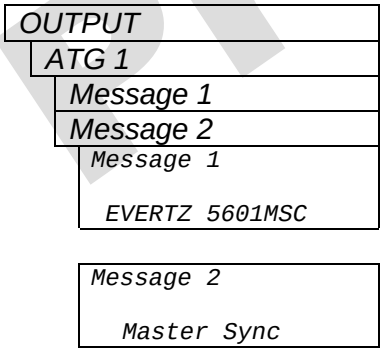


There are two menu items used to control the position of the test message on the ATG 1 video output. When either menu item is selected, the right LCD display will show a message position screen where the active adjustment will be highlighted and the other adjustment will be in dark text.

The *H position* menu item is used to control the horizontal position of the text message.

The *V position* menu item is used to control the vertical position of the text message.

3.4.4.4.3. Entering User-Defined Text for the On-Screen Message of ATG 1



There are two lines of user-defined text that can be entered using the *Message 1* and *Message 2* menu items. When entering text, use the ↑ and ↓ buttons or turn the control knob to set each character. Press the **SELECT** button to advance to the next character. Turn the control knob all the way counter-clock wise to get to the space character. There is a maximum of 15 characters. When finished press the **SELECT** button.

The *Message 1* menu item allows entry of text for the first message line.

The *Message 2* menu item allows entry of text for the second line.

3.4.4.4.4. Setting the Font Size for the On-Screen Message of ATG 1

- *OUTPUT*
  - *ATG 1*
    - *Message font*
      - `Normal size`
      - `Large size`

This menu item controls the size of the font that is used for the on-screen message text.

Select *Normal size* for normal sized letters.

Select *Large size* for large text that is easier to view on small monitors.

3.4.4.5. Setting the Analog Test Generator Syncro Mode

- *OUTPUT*
  - *ATG 1*
    - *Syncro*
      - `Include syncro`
      - `Exclude syncro`

This menu item controls the behaviour of the analog TG when the unit is in syncro mode. If syncro is not enabled this menu item is ignored.

Select *Include syncro* to include the analog TG in the synchronization of menu items between the master and slave units.

Select *Exclude syncro* to exclude the analog TG from synchronizing its settings with the master or slave unit. This allows the TG to be modified freely on the slave unit to different settings than the master.

3.4.5. Configuring the Analog Audio Outputs

The two channels of balanced analog audio are configured in the *Analog Audio* menu located in the *OUTPUT* root menu. There are two identical menu items that control each of the left and right analog audio channels on the AUDIO connector. For the sake of simplicity, only the controls for the left channel will be described in the manual.

3.4.5.1. Setting the Analog Audio Tone Frequency

OUTPUT
- *Analog Audio*
  - *Left frequency*
  - *Right frequency*
    - 20 Hz
    - 60 Hz
    - 100 Hz
    - 200 Hz
    - 400 Hz
    - 800 kHz
    - 1.0 kHz
    - 1.6 kHz
    - 2.0 kHz
    - 3.2 kHz
    - 4.0 kHz
    - 5.0 kHz
    - 6.4 kHz
    - 8.0 kHz
    - 10 kHz
    - 12 kHz

The *Left frequency* and *Right frequency* menu items are used to select the frequency of the tone that will be output onto the analog audio channels.

Move the selection cursor (**>**) to the desired frequency and press the **SELECT** button to apply it to the output.

3.4.5.2. Configuring the Analog Audio Tone Level

OUTPUT
- *Analog Audio*
  - *Left level*
  - *Right level*
    - *Audio Level*
    - *Left 10.0 dBu*
    - *Right 0.0 dBu*

There are two menu items used to set the volume of the analog audio outputs. When either the *Left level* or *Right level* menu items are selected, the right LCD panel will display an audio level adjustment screen. The active adjustment will be highlighted while the other adjustment will be shown in dark text. Rotate the control knob or press the ↑ and ↓ buttons to change the current audio level. Turning the control knob while pressing it in allows making quicker adjustments in larger steps.

The audio level range is from +10.0 dBu down to –30.0 dBu. The lowest setting is *Mute*, which effectively disables the analog audio channel. The adjustments are done in steps of 0.1 dBu (decibels unloaded).

Caution: These menu items are live controls. Any changes to the audio levels will immediately affect the analog audio outputs.

3.4.6. Configuring the AES and DARS Digital Audio Outputs

The AES Audio menu located in the OUTPUT root menu configures the AES and DARS digital audio outputs. The phase of all wordclock outputs is also controlled in this menu.

3.4.6.1. Setting the AES, DARS, and Wordclock Locking Mode

OUTPUT
AES Audio
AES/DARS/WC lck
PAL/integer
NTSC/fractional

The AES/DARS/WC lck menu item is used to control how the AES, DARS, and Wordclock outputs will be aligned with respect to the sync and video outputs. See Figure 3-6 to Figure 3-12 for timing diagrams.

Select *PAL/integer* to align these outputs to PAL sync and video.

Select *NTSC/fractional* to align these outputs to NTSC sync and video. If the input reference is NTSC video that contains a SMPTE 318M ten-field reference, this mode will make use of it to align the digital audio.

3.4.6.2. Setting the Phase of the AES and DARS Outputs

OUTPUT
AES Audio
AES coarse
AES fine
AES/DARS/WC
Phasing

Coarse fine
0 0

There are two menu items used for setting the phase of the AES and DARS outputs. When either of the *AES coarse* or *AES fine* menu items are selected the right LCD panel will show a phasing screen. The active phase control will be highlighted while the other control will be shown in dark text. Rotate the control knob or press the ↑ and ↓ buttons to change the phase. Depress the knob while turning to make adjustments in larger steps.

Caution: These menu items are live controls. Any adjustments made will immediately affect the AES and DARS outputs.

The *AES coarse* menu item adjusts the phase of the outputs in steps of entire subframes. This control is not applicable when in the *NTSC/fractional* lock mode.

The *AES fine* menu item adjusts the phase of the outputs in steps of half of a bit period (about 163ns).

3.4.6.3. Setting the Phase of the Wordclock Outputs

OUTPUT
AES Audio
WC phase
Wordclock
Phasing

0

The WC phase menu item is used to set the phase of the wordclock signal that is output by the 5601MSC. This is a global phase control that affects any output which is configured to wordclock mode. Rotate the control knob or press the ↑ and ↓ buttons to change the phase. Depress the knob while turning to make adjustments in larger steps.

Caution: The wordclock phase adjustment is a live control. Any changes made will immediately affect the wordclock output(s).

The *WC phase* menu item adjusts the phase of the wordclock output in steps of half of a bit period (about 163ns).

3.4.6.4. Selecting the Tones to Generate on the AES Digital Audio Outputs

- *OUTPUT*
  - *AES Audio*
    - *AES1 Left Freq*
    - *AES1 Right Freq*
    - *AES2 Left Freq*
    - *AES2 Right Freq*
      - 20 Hz
      - 60 Hz
      - 100 Hz
      - 200 Hz
      - 400 Hz
      - 800 kHz
      - 1.0 kHz
      - 1.6 kHz
      - 2.0 kHz
      - 3.2 kHz
      - 4.0 kHz
      - 5.0 kHz
      - 6.4 kHz
      - 8.0 kHz
      - 10 kHz
      - 12 kHz

There are four menu items that are used to select the frequencies of the tones that are generated on the AES outputs. Each AES output is controlled separately and has two controls, one for the left channel (channel 1) and another for the right channel (channel 2).

Press the ↑ and ↓ buttons or rotate the control knob to move the selection cursor (**>**) to the desired frequency. Press the **SELECT** button to make the selection active on the output.

3.4.6.5. Setting the Audio Levels for the AES Digital Audio Outputs

- *OUTPUT*
  - *AES Audio*
    - *AES1 Left level*
    - *AES1 Right Levl*
    - *AES2 Left level*
    - *AES2 Right Levl*
      - 0 dBFS
      - to
      - -28 dBFS
      - mute

There are four menu items used for setting the volume of the audio that is generated on the AES outputs. Each AES output is controlled separately and has two menu items, one for the left channel (channel 1) and another for the right channel (channel 2).

The audio level can be set from 0 dBFS to –28 dBFS with the lowest setting being *mute* which is a digital mute (all zeros). The volume is controlled in steps of 2 dBFS (decibels Full Scale).

3.4.7. Enabling the Setup Pedestal for all Sync and Analog Test Generator Outputs

- *OUTPUT*
  - *Global pedestal*
    - *Pedestal Off*
    - *Pedestal On*

The *Global pedestal* menu item in the *OUTPUT* root menu is used to control whether a 7.5 IRE setup pedestal is added to the active video lines of all NTSC-M outputs. This control has no effect on PAL-B outputs. It affects the sync and analog test generator outputs.

3.4.8. Configuring Global Phase

The *Global Phasing* menu allows setting a phase offset that will affect all outputs of the 5601MSC simultaneously. The phase offset can be applied in increments of nanoseconds (ns), microseconds (us), and milliseconds (ms). The total global phase range is 160 milliseconds. The global phase control can be used to correct for differences in reference phase between a 5601MSC and another device (such as that caused by mismatched cable length). The global phase offset affects the LTC, sync, AES, DARS, wordclock, SDI TGs, and analog TG outputs. Global phase does NOT affect the pulse or continuous wave outputs (such as the 1Hz, 6Hz, and subcarrier outputs).

3.4.8.1. Enabling or Disabling the Global Phase Offset

```
OUTPUT
  Global Phasing
    Global ph En
      Global Ph Off
      Global Ph On
```

The *Global ph En* menu item is used to enable or disable applying of the global phase offset to all outputs of the 5601MSC.

Select *Global Ph Off* to turn off global phasing. This disables the global phase offset and all outputs will be locked to the reference phase.

Select *Global Ph On* to enable the global phase offset. Any offset entered will immediately affect all outputs of the 5601MSC. An offset of 0ms, 0us, and 0ns is reference phase.

3.4.8.2. Entering a Global Phase Offset

```
OUTPUT
  Global Phasing
    Milli Seconds
    Micro Seconds
    Nano Seconds
      Global Phasing

       MS.  US.  NS.
         0    0    0
```

There are three menu items that are used to set the global phase offset. When any of these controls are selected, the right LCD panel will show a global phasing screen. The active phase control will be highlighted while the other controls will be shown in dark text. Rotate the control knob or press the ↑ and ↓ buttons to change the phase. Depress the knob while turning to make adjustments in larger steps.

Caution: These menu items are live controls. Any adjustments made will immediately affect phasing of all outputs of the 5601MSC.

The *Milli Seconds* menu item adjusts the global phase offset in steps of 1 millisecond (thousandth of a second).

The *Micro Seconds* menu item adjusts the global phase offset in steps of 1 microsecond (millionth of a second).

The *Nano Seconds* menu item adjusts the global phase offset in steps of 1 nanosecond (billionth of a second).

IMPORTANT NOTICE: When the global phase is changed, a JAM must be performed on all LTC/VITC outputs to ensure proper alignment to video.

3.5. GENERAL CONFIGURATION ITEMS

The *GENERAL* setup menu is used to set up various items related to the overall operation of the 5601MSC. Table 3-5 shows the items available in the *GENERAL* setup menu. Sections 3.5.1 to 3.5.12.5 give detailed information about each of the sub-menus.

Set System Time	Used to set the system time when there is no time reference.
Set System Date	Used to set the system date when there is no time/date reference.
VitcLtc Userbit	Sets userbits for the VITC/LTC outputs when *VitcLtc Dte fmt* is User set bits.
VitcLtc Dte fmt	Selects what to output on the userbits for the VITC and LTC outputs.
Syncro	Used to enable synchronization of settings between two 5601MSC units.
Modem	Configures the modem parameters (**M** option only).
GPO 1 mode	Sets the function of General Purpose Output 1.
GPO 2 mode	Sets the function of General Purpose Output 2.
Firmware	Used to initiate a firmware upgrade of the unit.
EngineeringMenu	Controls for configuring SNMP and disabling front panel menus.
DST rules	Configures Daylight Saving Time settings.
Presets	Controls for saving and recalling presets
IP Control	Used to configure the IP settings for the CONTROL Ethernet port.
NTP rules	Configures the Network Time Protocol settings on the unit.

Table 3-5: Top Level of the General Setup Menu

3.5.1. Setting the System Time

GENERAL
Set System Time
`Set System time`
`00:00:00`

This menu item sets the system time of the unit. Only valid when no time reference is selected. Each digit is changed using the ↑ and ↓ buttons or by turning the control knob. Press the *SELECT* button to accept each digit.

3.5.2. Setting the System Date

GENERAL
Set System Date
`Set System Date`
`2010 Jun. 22`

This menu item sets the system date of the unit. Only valid when no time reference is selected, or LTC or VITC is being used as a time reference and no date decoding from the userbits is selected. Change the year, month, and day by using the ↑ and ↓ buttons or by turning the control knob. Press the SELECT button to accept the new values.

3.5.3. Setting the VITC/LTC Userbits

GENERAL
VitcLtc Userbit
VitcLtc Userbit

00000000

This menu item is used to manually enter the userbits for the VITC/LTC outputs. Only valid when *VitcLtc dte fmt* is set to User set bits.

3.5.4. Setting the VITC/LTC Date Format

GENERAL
VitcLtc dte fmt
Legacy
Production
SMPTE-309 MJD
SMPTE-309 BCD
User set bits
Lat/Long

This menu item is used to set the contents of the user bits for the LTC and VITC generators. All the LTC and VITC generators will operate in the same user bit mode, although the actual user bits may vary from generator to generator depending on the mode chosen and the respective time zone being applied to the generator. Four of the user bit modes encode date information into the user bits in various formats. This date information will be the system date compensated for any time zone or daylight saving time adjustments being applied to a particular output.

Select *Legacy* date to output the date in a format compatible with Leitch master clock systems.

Select *Production* date to output the date in a format compatible with Time code smart slates used in film and television production. In this mode the date is encoded as yymmddrr, where rr is the nominal frame rate of the respective output (30 for 29.97Hz outputs).

Select *SMPTE BCD* date to output the date in the SMPTE 309M standard BCD mode. In this mode the date is encoded as zzyymmdd, where zz is the time zone of the respective output.

Select *SMPTE MJD* date to output the date in the SMPTE 309M standard Modified Julian Date mode. In this mode the date is encoded as zzdddddd, where zz is the time zone of the respective output and dddddd is the date expressed in its Modified Julian Date representation.

Select *Manual entry t*o output the user bits that are entered using the *VITC/LTC Userbit* menu item.

Select *Lat/Long* to embed location information in the user bits. This is only valid when the frequency reference is GPS. Note that this embeds the location of the antenna, and not the 5601MSC. See section 3.6.3 for more information. This is useful for mobile applications and remote site filming.

3.5.5. Enabling Syncro Mode

- *GENERAL*
  - *Syncro*
    - `Slave menu`
    - `Slave time`
    - `Slave menu/time`
    - `Master menu`
    - `Master time`
    - `Master menu/tim`

This menu item is used to turn on the syncro feature that allows two 5601MSC units to synchronize their settings and/or time with each other. When the GPIO ports of two 5601MSC units are connected to a 5601ACO2, the syncro link is established. One unit must be designated master, and the other unit slave. The Slave unit pulls settings and time from the master unit.

Select *Slave menu* to put the unit into slave mode and tell it to pull menu settings from the master unit.

Select *Slave time* to put the unit into slave mode and to tell it to pull time from the master unit. The time reference on the slave unit can then be set to syncro and the slave unit will use the master unit as its time reference.

Select *Slave menu/time* to put the unit into slave mode and tell it to pull both menu settings and time from the master unit. The time reference on the slave unit can then be set to syncro and the slave unit will use the master unit as its time reference.

Select *Master menu* to put the unit into master mode and tell it to send its menu settings over the syncro link.

Select *Master time* to put the unit into master mode and tell it to send time through the syncro link.

Select *Master menu/tim* to put the unit into master mode and tell it to send both menu settings and time through the syncro link

3.5.6. Configuring the Modem (Units fitted with the M option)

The *Modem* sub-menu of the *GENERAL* root menu is used to configure the operation of the internal modem in the 5601MSC. This modem is typically used to dial once per day to a standard time service or to another 5601MSC or 5600MSC fitted with the modem option in order to obtain its time reference. Alternately, if the 5601MSC is fitted with the GPS option, it can be set up to answer calls and act as a master time source for other units to call into (NRC mode only).

3.5.6.1. Setting the Modem Operating Mode

- *GENERAL*
  - *Modem*
    - *Modem Mode*
      - `No auto dialAns`
      - `Auto answer`
      - `Auto dial`
      - `Auto dialAnswer`

This menu item sets the operational mode of the modem.

When set to *No auto dialAns* the modem will not automatically dial out or answer calls. It must be dialled manually using the *Dial Now* menu item.

When set to *Auto Answer* the modem will answer incoming calls to provide a time reference (NRC mode only).

When set to *Auto dial* the modem will dial out at the time set by the *Auto dial time* menu item on the day(s) set by the *Auto dial day* menu item.

When set to *Auto dialAnswer* the modem will answer any incoming calls and dial out each day at the time set by the *Auto dial Time* menu item (NRC mode only).

Note that the modem will only dial out if the time reference source of the unit has been set to *Modem*.

3.5.6.2. Setting the Modem Standard

- *GENERAL*
  - *Modem*
    - *Modem standard*
      - `NRC format`
      - `NIST format`

This menu item sets the standard of the modem communications.

When the *Modem Standard* is set to *NRC* (National Research Council), it communicates using NRC standards. In this mode, the 5601MSC may be set to answer calls and act as an NRC time source for other equipment. See http://www.nrc-cnrc.gc.ca/eng/index.html for more information.

When the *Modem Standard* is set to *NIST* (National Institute of Standards and Technology), it communicates using NIST standards. In this mode the modem can get time from other equipment, but cannot be used as a NIST time reference. See www.boulder.nist.gov/timefreq for more information.

3.5.6.3. Setting the Modem Speaker Volume

```
GENERAL
  Modem
    Modem volume
      Speaker off
      Speaker on
```

This menu item is used to enable or disable the modem speaker.

When *Modem volume* is set to *Speaker off* the modem speaker will be silent.

When *Modem volume* is set to *Speaker on* the modem speaker will be audible during dialup and connection.

3.5.6.4. Setting the Modem Phone Number to Dial

```
GENERAL
  Modem
    Modem number
      Modem number

      16137453900
```

This menu item sets the phone number of the time information provider to call. This number may be the number of a high-level time standards service such as the Canadian National Research Council (NRC) or National Institute of Standards and Technology (NIST). This may also be the number of another 5601MSC unit that is referenced to GPS time and configured to answer calls in NRC mode.

When you press the **SELECT** button the current phone number will be displayed. If you want to exit the phone number entry mode press the **ESC** key at any time.

Enter the phone number by setting each digit using the ↑ and ↓ buttons or by turning the control knob. Remember to enter all the digits required to get an outside line. You can insert a 1 second pause (indicated by a "P") into the dialling string by pressing the ↑ button past the number 9. Press the **SELECT** button to accept the digit and move onto the next. Press the **SELECT** button on an empty character to finish entry.

At the time of printing, the following phone numbers are valid for these time standard services:

Canadian National Research Council (NRC):
http://www.nrc-cnrc.gc.ca/eng/services/inms/time-services/time-date.html

Ottawa, ON	+1 (613) 745-3900

Automated Computer Time Service (NIST)
http://www.nist.gov/physlab/div847/grp40/acts.cfm

Boulder, CO	+1 (303) 494-4774
Kauai, Hawaii	+1 (808) 335-4721

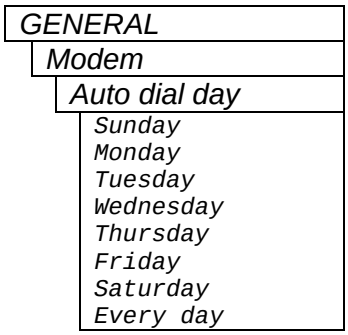
3.5.6.5. Setting the Auto Dial Time

```
GENERAL
  Modem
    Auto dial time
      Auto dial time

      0:00:00
```

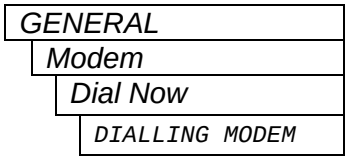
This menu item sets the time at which the modem should dial out to a remote system given in system time, which is normally UTC. The *Auto dial day* menu item sets the day of the week that the modem dials out. Note that the modem will only dial out if the time reference has been set to *Modem*.

3.5.6.6. Setting the Auto Dial Day



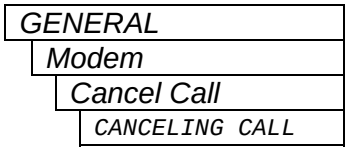
This menu item sets the day on which the modem should auto dial out to a remote system. Select the day of week to call out once a week, or select ***Every day*** to dial out once per day. The modem will only dial out if it has been set as the time reference source of the unit.

3.5.6.7. Dialling the Modem Immediately



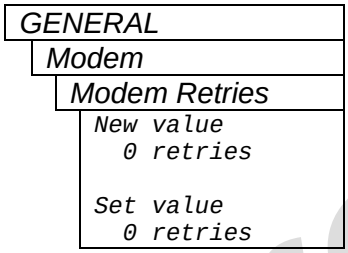
This menu item forces the modem to dial out to a remote system to get the time immediately regardless of the setting of the *Modem* Mode menu item. It will not retry, regardless of the settings of Modem retries.

3.5.6.8. Cancelling the Current Call



This menu item forces the modem to hang up and abort its current call attempt. This also cancels any pending retries that modem may have been set up for.

3.5.6.9. Setting the Number of Times the Modem will Retry a Failed Call



After a failed attempt to dial a remote system, the modem will attempt to reconnect once per minute. This menu item sets the number of retries before a calling sequence is cancelled. It only retries if the call has been initiated by auto dial.

The time until the next retry is shown in the *Modem/ACO2/Hw* status screen.

3.5.7. Setting the GPO 1 and 2 Mode

There are two General Purpose Outputs (GPO 1 and GPO 2) with identical menu items. A GPO in its normal inactive state is OPEN (5V pull-up). When a GPO is activated, it is pulled LOW to ground. See section 2.3 for more details. For the sake of simplicity, only GPO 1 will be described in this manual.

```
GENERAL
  GPO 1 mode
  GPO 2 mode
    GPO off
    GPO no referene
    GPO fan failure
    GPO PS failure
    GPO any fault
    GPO no time
    GPO gps fault
    GPO audio on
    GPO HW fault
    GPO no ref slow
```

This menu item selects the behaviour of general purpose output 1 or 2.

Selecting *GPO off* puts the GPO into its inactive state (OPEN).

Selecting *GPO no referene* will activate the GPO when the frequency reference is lost, or has a problem (e.g. GPS lost contact with satellites).

Selecting *GPO fan failure* will activate the GPO if any of the fans has stopped spinning.

Selecting *GPO PS failure* will activate the GPO when one of the power supplies are missing, has failed, or are not producing the correct voltage (only applicable for the dual power supply option).

Selecting *GPO any fault* will activate the GPO on any system fault which includes: fan failure, power supply failure, hardware failure, frequency reference fault, and GPS fault.

Selecting *GPO no time* will activate the GPO when the selected time reference is missing or invalid.

Selecting *GPO gps fault* will activate the GPO when the GPS antenna is missing or satellite reception is below required levels.

Selecting *GPO audio on* will activate the GPO when the analog audio test generator is producing a tone. This can be used to activate an amplifier or a speaker.

Selecting *GPO HW fault* will activate the GPO when an internal hardware fault is detected, and the unit is running on its backup oscillator.

Selecting *GPO no ref slow* will activate the GPO when the frequency reference is lost for a period longer than 40 seconds. It will deactivate once reference has been regained and valid for 40 seconds.

3.5.8. Initiating a Firmware Upgrade

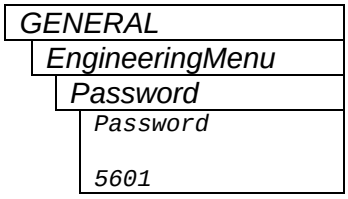
```
GENERAL
  Firmware
    Upgrade
```

This menu item is used to put the 5601MSC into a firmware upgrade mode. The new firmware is then uploaded to the unit using the COM port on the back of the 5601MSC. See section 4.2 for more information. You will be required to press the **SELECT** button three times to enter upgrade mode. Note that when in upgrade mode the front panel, Ethernet, and LTC and VITC outputs cease to function. Be very careful when using this menu item. To abort, press **ESC** several times until you return to the root menu.

3.5.9. Engineering Menu – Configuring SNMP and Front Panel Menu Access

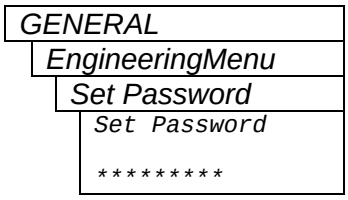
The Engineering Menu is used to configure the Simple Network Management Protocol feature of the 5601MSC, as well as access to menus through the front panel. This menu is password protected to prevent unauthorized tampering of the unit. From this menu remote SNMP access can be disabled, set to read-only, or set to full control. The SNMP community strings can be set, and SNMP traps configured. The engineering menu also allows individual control of each item in the front panel menu system. Menus can be disabled to prevent access and changing of settings from the front panel.

3.5.9.1. Entering the Engineering Menu Password



The engineering menu is disabled unless the correct numeric password is entered using this menu item. Use the ↑ and ↓ buttons or the control knob to set each digit and the **SELECT** button to move onto the next. Press the **SELECT** button when finished. The password can be up to 9 digits in length. The default password for new units is 5601. If the current password has been forgotten, contact Evertz customer service for instructions on recovering the password. The engineering menu will remain active for a period of 5 minutes before returning to its disabled state. The password must then be entered again to re-enable the menu.

3.5.9.2. Changing the Engineering Menu Password

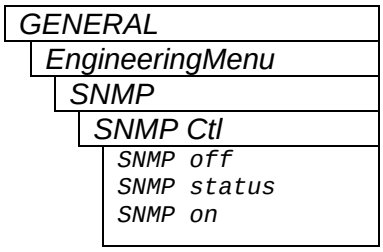


This menu item is used to change the engineering menu password. It must first be enabled by entering the correct engineering menu password using the *Password* menu item. Use the ↑ and ↓ buttons or the control knob to set each digit and the **SELECT** button to move to the next. Be sure to record the new password in a safe place.

3.5.9.3. Configuring the Simple Network Management Protocol (SNMP)

The *SNMP* sub-menu of the *EngineeringMenu* setup menu is used to configure SNMP operation of the 5601MSC. The SNMP protocol runs on the CONTROL Ethernet port and is used for remote monitoring and control of the unit. The 5601MSC can also send SNMP traps to as many as four remote IP addresses so they can be logged and monitored by software such as Vista*LINK*® Pro. There are a variety of traps conditions that can each be enabled or disabled. The SNMP read & write community strings are also set in this menu and can be used as a plain-text password to prevent possible changes from extraneous SNMP systems.

3.5.9.3.1. Enabling and Disabling SNMP



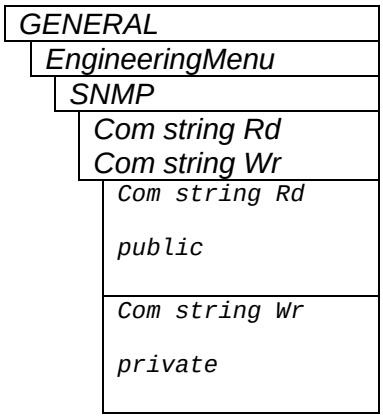
This menu item sets the operational mode of SNMP for the 5601MSC.

Setting this to *SNMP off* completely disables SNMP in the unit. The 5601MSC will ignore all SNMP traffic and no traps will be sent out. This is the default setting.

When set to *SNMP status*, the 5601MSC will respond to SNMP read requests but ignore all write requests. This allows remote monitoring of the unit but not remote control. Effectively it is a read-only mode. The unit will continue to send out any configured SNMP traps in this mode.

When set to *SNMP on*, all read and write SNMP requests are honoured and configured SNMP traps are sent out. This is a full-access mode allowing remote SNMP monitoring and configuration.

3.5.9.3.2. Changing the SNMP Read and Write Community Strings

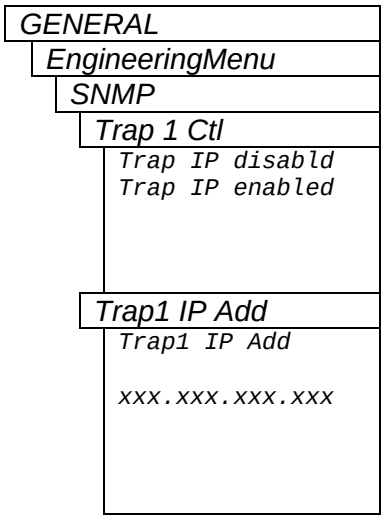


There are two menu items in the SNMP menu that allow changing of the SNMP read and SNMP write community strings. Note that these strings are case-sensitive. The default strings are “public” for *Com string Rd* and “private” for *Com string Wr*. By default, this is what Vista*LINK*® Pro is configured for. Contact Evertz customer service for information on configuring Vista*LINK*® Pro to use different strings.

These strings are used as a password for SNMP read and write requests. When the 5601MSC receives an SNMP read request, the community string in the request must match the string set by the *Com string Rd* menu item. Likewise a write request must contain a community string that matches the string set by the *Com string Wr* menu item.

Use the ↑ and ↓ buttons or the control knob to select each character. These strings are case-sensitive. Press select to accept each character. Enter a space by pressing ↓ button or turning the knob counter-clockwise to get to the blank character. End the string with all spaces. Trailing spaces will be ignored. Each string can be a maximum of 16 characters.

3.5.9.3.3. Configuring the SNMP Trap Destinations



There are four trap destinations that the 5601MSC can send SNMP traps to. Each trap destination has a control menu item, and an IP address menu item. For sake of simplicity only the menu items for Trap Destination 1 are shown in the manual.

The *Trap 1 Ctl* menu item is used to disable or enable sending traps to the IP address entered for the *Trap1 IP Add* menu item. When set to *Trap IP disabld*, the unit will not send traps to the Trap 1 IP address. When set to *Trap IP enabled*, an SNMP trap packet will be sent to the Trap 1 IP address for each SNMP trap event that has been enabled.

The *Trap1 IP Add* menu item is used to specify the IP address that the SNMP traps will be directed to. To log trap events, set this to the IP address of the computer that is running Vista*LINK*® Pro Server, or another 3rd party SNMP trap logging software.

3.5.9.3.4. Enabling and Disabling SNMP Traps

- *GENERAL*
  - *EngineeringMenu*
    - *SNMP*
      - *Freq Ref Trap*
      - *Time Ref Trap*
      - *Freq Ref JamTrp*
      - *Time Ref JamTrp*
      - *LF Fan Fail Trp*
      - *LR Fan Fail Trp*
      - *RR Fan Fail Trp*
      - *PSL Fail Trap*
      - *PSR Fail Trap*
      - *Hw Fail Trap*
      - *Overtemp Trap*
      - *GPI 1 Trap*
      - *GPI 2 Trap*
        - `Trap disabled`
        - `Trap enabled`

There are a total of 13 events that the 5601MSC can be configured to send out SNMP traps for. All traps except for the Frequency Reference failure are disabled by default. The various traps are described below:

The *Freq Ref Trap* will send out a trap when the frequency reference is missing or has a problem.

The *Time Ref Trap* will send out a trap when the selected time reference is missing or has a problem.

The *Freq Ref JamTrp* will send out a trap when the system oscillator is not synchronized to the frequency reference and is attempting to gradually adjusting its frequency until locked. This may take a long time and requires user intervention if an immediate lock is desired. Will only occur when the frequency Lock type is set to Slow.

The *Time Ref JamTrp* will send out a trap when the system time does not match the time reference and requires a user jam to synchronize. Will only occur when the time Lock type is set to User.

The *LF Fan Fail Trp* will send out a trap when the front fan on the left power supply or fan module has failed or is spinning too slowly.

The *LR Fan Fail Trp* will send out a trap when the rear fan on the left power supply or fan module has failed or is spinning too slowly.

The *RF Fan Fail Trp* will send out a trap when the front fan on the right power supply or fan module has failed or is spinning too slowly.

The *RR Fan Fail Trp* will send out a trap when the rear fan on the right power supply or fan module has failed or is spinning too slowly.

The *PSL Fail Trap* will send out a trap when the power supply in the left slot is missing or has failed. Only valid for units with dual power supplies.

The *PSR Fail Trap* will send out a trap when the power supply in the right slot is missing or has failed. Only valid for units with dual power supplies.

The *Hw Fail Trap* will send out a trap when an internal hardware problem has been detected and the unit is running on its backup oscillator. See section 3.3.4 for more information).

The *Overtemp Trap* will send out a trap when the internal temperature of the unit has exceeded the safe operating limits.

The *GPI 1 Trap* will send out a trap when GPI1 is pulled low to ground.

The *GPI 2 Trap* will send out a trap when GPI2 is pulled low to ground.

3.5.9.4. Configuring Access to Front Panel Menus

The *Menu Access Ctl* sub-menu of the *EngineeringMenu* setup menu is used to control access to menus in the front panel menu system. It has no effect on SNMP control (if enabled) of these menus. This can be used to prevent unauthorized changes from the front panel. There is a master control to turn on or off menu restrictions. If some menus need to be disabled this master control must first be turned on, only then can individual menus be disabled.

3.5.9.4.1. Enabling and Disabling Front Panel Menu Access Control

GENERAL
EngineeringMenu
Menu Access Ctl
MASTER Access
`All Menus Normal`
`Menu Locks On`

This menu item enables or disables menu access control for the front panel menu system.

Setting this to *All Menus Normal* disables menu restrictions and all menus will be fully accessible in the front panel menu system.

Setting this to *Menu Locks On* enables menu restrictions and individual menus access can be controlled using the sub-menus in section 3.5.9.4.2.

3.5.9.4.2. Setting the Front Panel Menu Restrictions

- *GENERAL*
  - *EngineeringMenu*
    - *Menu Access Ctl*
      - *Set Time*
      - *Set Date*
      - *VITC/LTC Userbi*
      - *VitcLTC dateFmt*
      - *Serial Port*
      - *Syncro Enable*
      - *Modem*
      - *GPO 1 mode*
      - *GPO 2 mode*
      - *GPI 1 mode*
      - *GPI 2 mode*
      - *Firmware*
      - *DST rules*
      - *Presets*
      - *IP Control Ctl*
      - *IP Time Ctl*
      - *NTP rules*
      - *Freq Ref Source*
      - *Genlock Range*
      - *Freq Lock Type*
      - *Time Ref Source*
      - *Vitc Read Line*
      - *VITC/LTC Date*
      - *Time Lock Type*
      - *Jam Frq Ref*
      - *Jam Time Ref*
      - *LTC 1*
      - *LTC 2*
      - *Sync 1*
      - *Sync 2*
      - *Sync 3*
      - *Sync 4*
      - *Sync 5*
      - *Sync 6*
      - *10 MHz*
      - *Wordclock*
      - *SDI TG 1*
      - *SDI TG 2*
      - *SDI TG 3*
      - *SDI TG 4*
      - *ATG 1*
      - *ATG 2*
      - *Analog Audio*
      - *AES Audio*
      - *Global Pedestal*
      - *Global Phasing*
        - `All items On`
        - `Menu Accessible`
        - `Menu Locked`
        - `Phasing only`
        - `Test Sigs only`
        - `PhasingTestSig`

There are 46 separate controls for enabling or disabling menu access for the front panel menu system. Entire menus can be disabled or just certain menu items within. Below are the various settings for each menu, or menu item:

Selecting *Menu Accessible* maintains this menu items accessibility.

Selecting *All items On* makes all items in the menu accessible.

Selecting *Menu Locked* disables the menu or menu item completely.

Selecting *Phasing only* restricts access to all menu items except those required for phasing.

Selecting *Test Sigs only* restricts access to all items in the menu except the menu item for changing test signals.

Selecting *PhasingTestSig* restricts access to all menu items except those for changing test signals and phasing.

3.5.9.5. Setting the Number of Power Supplies Installed

```
GENERAL
  EngineeringMenu
    Number PS
      One Power Suppl
      Dual Pwr Supply
```

This menu item is used to tell the 5601MSC how many power supplies are installed in the chassis. This menu item must be set correctly when first installing the 5601MSC and when adding or removing a power supply from the chassis, otherwise power supply monitoring will not work properly.

Select *One Power Suppl* to tell the 5601MSC to expect just one 5601PS power supply with the other module being a 5601FM fan module.

Select *Dual Pwr Supply* to tell the 5601MSC that there are two 5601PS power supply modules installed in the chassis. The system will generate a fault if it doesn't detect voltage from either module.

3.5.10. Setting the Daylight Saving Time Rules

Daylight Saving Time (DST) or Summer Time, as it is called in many countries, is a way of getting more daylight out of the summer days by advancing the clocks by one hour during the summer. Then, the sun will appear to rise one hour later in the morning when people are usually asleep anyway, at the benefit of one hour longer evenings when awake. The sunset and sunrise are one hour later than during normal time.

To make DST work, the clocks have to be adjusted one hour ahead when DST begins, and adjusted back one hour to standard time when DST ends. There are many countries that observe DST, and many who do not.

During the months of March/April to September/October, the countries in the Northern Hemisphere are having their summer and may observe DST, while the countries in the Southern Hemisphere are having winter. During the rest of the year (September/October to March/April) the countries in the Southern Hemisphere are having their summer and may observe DST, while the countries in the Northern Hemisphere are having winter.

Daylight Saving Time is difficult to predict, as many countries change the transition days/principles every year because of special happenings or conditions that have happened or will happen.

How does the transition to DST start?
Let's say that DST starts at 2:00 am local time and DST is one hour ahead of standard time:

DST Start Transition		
Local time HH:MM:SS	**DST or normal?**	**Comments**
01:59:58	normal	
01:59:59	normal	
03:00:00	DST	DST started, time advanced by one hour
03:00:01	DST	
03:00:02	DST	

Note that local time is never between 2:00:00 - 2:59:59. At the transition from standard time to DST, this hour is skipped and therefore this day has only 23 hours (instead of 24 hours).

How does the transition from DST end?
Let's say that DST ends at 2:00 am local time and DST is one hour ahead of standard time:

DST End Transition		
Local time HH:MM:SS	**DST or normal?**	**Comments**
00:59:59	DST	
01:00:00	DST	
01:00:01	DST	
...3556 seconds from 01:00:02 to 01:59:57 daylight saving time not shown...		
01:59.58	DST	
01:59.59	DST	
01:00:00	Normal	Time is turned back to normal
01:00:01	Normal	
...3556 seconds from 01:00:02 to 01:59:57 standard time not shown...		
01:59.58	Normal	
01:59:59	Normal	
02:00:00	Normal	
02:00:01	Normal	

Note that local time between 1:00:00 and 1:59:59 actually is repeated twice this day, first during DST time, then clocks are turned back one hour to normal time, and the hour is repeated during standard time and therefore this day has 25 hours (instead of 24 hours). To avoid confusion when referring to time within this hour, it is important to tell whether it happened before or after the change back to normal time. For further information about daylight saving time in your area consult the web page http://www.timeanddate.com/time/aboutdst.html.

Because of the variation of daylight saving time rules throughout the world, the 5601MSC has several menu items to allow the user to set the DST rules for their region. These rules affect all outputs for which DST is enabled.

3.5.10.1. Setting the DST Date Entry Mode

GENERAL
DST rules
DST mode
`day/week/month`
`day of month`

This menu item allows the user to set the method of entering the DST information in the DST registers.

Select *day/week/month* to enter the DST information in the following format:

Day 1 of week 1 of month 4 (e.g. Sunday of first week of April)

Select *day of month* to enter the DST information in the following format:

Day 1 of month 4 (e.g. First day of April)

3.5.10.2. Setting the DST Start Hour

```
GENERAL
  DST rules
    Start Hour
      New value
      DST starts 0200

      Set value
      DST starts 0200
```

This menu item allows the user to set the hour of the day when DST begins. Use the control knob to change the start hour for DST in 24 hour time.

3.5.10.3. Setting the DST Start Day

```
GENERAL
  DST rules
    DST start day
      Sunday
      Monday
      Tuesday
      Wednesday
      Thursday
      Friday
      Saturday
```

When the *DST date mode* menu is set to *day/week/month* this menu item allows the user to set the day of the week when DST begins. Use the control knob to change the start day for DST.

When the *DST date mode* menu is set to *DST Start Day* this menu item allows the user to set day of the week when DST begins.

3.5.10.4. Setting the DST Start Week

```
GENERAL
  DST rules
    DST start week
      First week
      Second week
      Third week
      Fourth week
      Last week
```

When the *DST date mode* menu is set to *day/week/month* this menu item allows the user to set the week of the month when DST begins. Set the value to *last wk* when DST starts on the fourth or fifth week of the month depending on the year.

When the *DST date mode* menu is set to *day of month* this menu item is not used, and will display “Not in Week Mode”.

3.5.10.5. Setting the DST Start Month

```
GENERAL
  DST rules
    DST start month
      January to December
```

This menu item allows the user to set the month when DST begins. Use the control knob to change the start month for DST.

3.5.10.6. Setting the End Hour

```
GENERAL
  DST rules
    End Hour
      New value
      DST ends 0200

      Set value
      DST ends 0200
```

This menu item allows the user to set the hour of the day when DST begins. Use the control knob to change the end hour for DST in 24-hour time.

3.5.10.7. Setting the DST End Day

GENERAL
- DST rules
  - DST end day
    - Sunday
    - Monday
    - Tuesday
    - Wednesday
    - Thursday
    - Friday
    - Saturday

This menu item allows the user to set day of the week when DST ends.

3.5.10.8. Setting the DST End Week

GENERAL
- DST rules
  - DST end week
    - First Week
    - Second Week
    - Third Week
    - Fourth Week
    - Last Week

When the *DST date mode* menu is set to *day/week/month* this menu item allows the user to set the week of the month when DST ends. Set the value to *last wk* when DST starts on the fourth or fifth week of the month depending on the year.

When the *DST date mode* menu is set to *day of month* this menu item is not used, and will display “Not in Week Mode”.

3.5.10.9. Setting the DST End Month

GENERAL
- DST rules
  - DST end month
    - January to December

This menu item allows the user to set the month when DST end. Use the control knob to change the end month for DST.

3.5.10.10. Setting the DST Offset

GENERAL
- DST rules
  - DST hrs offset
    - 0 hours
    - 1 hour
    - 2 hours

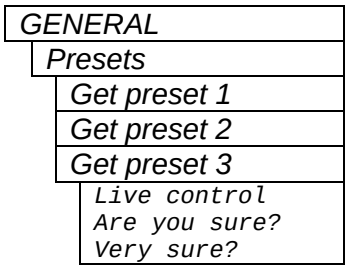
This menu item allows the user to set the amount of adjustment to be made when DST is active.

Setting the DST offset to 0hrs effectively disables daylight saving time.

3.5.11. Saving and Recalling Presets

The 5601MSC allows saving the entire system setup, including all menu settings to a preset. There are three user presets available, and two factory presets. The Presets menu in the GENERAL root menu contains controls for saving and recalling user presets, and recalling factory presets.

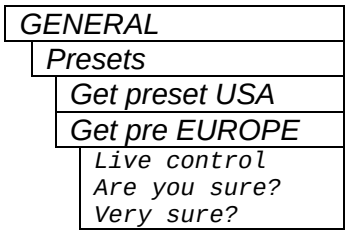
3.5.11.1. Recalling a User Defined Preset



There are three user-defined presets that can be saved in the 5601MSC. These are recalled using the *Get preset 1*, *Get preset 2*, and *Get preset 3* menu items. To recall a user preset, press **SELECT** on the desired menu item. The Left LCD screen will briefly display “Are you sure?”. Press the **SELECT** button again and the left LCD screen will display “Very sure?”. Press **SELECT** a third time to load the preset.

Caution: Loading a preset will immediately apply the user preset configuration to the 5601MSC. This can cause a large disruption to all outputs. Perform a user preset recall only when it is safe to do so.

3.5.11.2. Recalling a Factory Preset



There are two factory-defined presets that cannot be changed by the user. These are recalled using the *Get preset USA*, and *Get pre EUROPE* menu items. The *USA* preset sets all output standards to NTSC, 525i/59.94, or 1080i/59.94, enables global pedestal, and sets the AES lock mode to NTSC. The *EUROPE* preset sets all output standards to PAL-B, 625i/50, or 1080i/50 and sets the AES lock mode to PAL.

Recalling a factory preset will reset all settings in the unit to their defaults with the exception of the CONTROL ethernet port IP settings, Engineering menu password, SNMP settings, and the NumberPS menu item.

To recall a factory preset, press **SELECT** on the desired menu item. The Left LCD screen will briefly display “Are you sure?”. Press the **SELECT** button again and the left LCD screen will display “Very sure?”. Press **SELECT** a third time to load the preset. Press **ESC** at any time to abort.

Caution: Loading a preset will immediately apply the factory settings to the 5601MSC. This can cause a large disruption to all outputs. Perform a factory preset recall only when it is safe to do so.

3.5.11.3. Saving a User Defined Preset

```
GENERAL
  Presets
    Save preset 1
    Save preset 2
    Save preset 3
      Live control
      SAVED PRESET
```

There are three user-defined presets that can be saved in the 5601MSC. To save the current configuration of the 5601MSC to a preset, use the *Save preset 1*, *Save preset 2*, *Save preset 3* menu items. Once a preset is saved, it will be stored in flash even when the power is removed from the unit. To save a preset, press **SELECT** on the desired preset menu item.

Caution: The current configuration of the unit will be saved to the selected preset number, overwriting the settings of any preset that was saved previously. The preset will be saved immediately when the SELECT button is pressed.

3.5.12. Configuring the IP Settings for the CONTROL Ethernet Port

The following sections will provide the user with instructions on how to set the IP Control Setup menu items. The TIME ethernet port is currently reserved for future use.

3.5.12.1. Setting Up the Internet Protocol Address Mode

```
GENERAL
  IP Control
    IP address mode
      Dynamic (bootp)
      Static IP
```

This item is used to determine if the IP address of the port will be determined from another server or will be set locally.

When *Dynamic (bootp)* is selected, the IP address is retrieved from the server using BOOTP services. To check if the 5601MSC has obtained an IP address, view the *ControlEthernet* screen in the STATUS menu.

When *Static IP* is selected, a static IP address is used. This is set by the *IP address* menu item, and subnet mask set by the *IP net mask* menu item.

3.5.12.2. Setting up the Internet Protocol Address

```
GENERAL
  IP Control
    IP address
      IP address

      172.21.1.56
```

This menu item sets the unique Internet Protocol (IP) address of the port when the *IP address mode* is set to *Static IP*. An example of a private (internal) reserved IP address is 172.21.1.XXX. This IP address is ignored when the IP address mode is set to *Dynamic (bootp).*

3.5.12.3. Setting up the Internet Protocol Subnet Mask

```
GENERAL
  IP Control
    IP netmask
      IP netmask

      255.255.255.0
```

This menu item sets the subnet mask of the network. Specifically, this parameter defines all the IP addresses that can directly communicate with the 5601MSC without having to go through a gateway or router. This parameter is usually set to 255.255.255.0 for a private network. Normally you will not have to adjust this parameter from its default value. This parameter is obtained automatically from a bootp server in dynamic mode.

3.5.12.4. Setting Up the Internet Protocol Gateway Address

```
GENERAL
  IP Control
    IP gateway
      IP gateway
      0.0.0.0
```

This menu item identifies the IP address of the gateway or router. In a private network, this gateway could be identified as 172.21.1.YYY. This tells the 5601MSC where to forward packets that are destined for an IP address outside the IP address range defined by the subnet mask. This parameter is ignored in dynamic mode and the gateway address is obtained from a bootp server instead.

3.5.12.5. Enabling or Disabling usage of the Internet Protocol Gateway

```
GENERAL
  IP Control
    IP gateway en
      gateway off
      gateway on
```

This item is used to enable or disable the 5601MSC from responding to packets coming from outside the local subnet.

When set to *gateway on* the 5601MSC will respond to SNMP and NTP requests that come from outside the local subnet by sending the response packets to the gateway for delivery.

When set to *gateway off* the 5601MSC will not attempt to respond to SNMP or NTP requests that come from outside the defined subnet.

3.5.13. Configuring the Network Time Protocol Functions (Units fitted with the T option)

The *NTP rules* sub-menu of the *GENERAL* root menu is used to configure the NTP server on the 5601MSC. The NTP server runs on the CONTROL ethernet port. The TIME ethernet port is currently reserved for future use. The NTP server responds to NTP requests and also sends out periodic NTP broadcasts. See section 3.5.12 for information on configuring the CONTROL ethernet port.

It is possible to perform a quick validation that NTP is working properly using a Windows XP or Windows 2000 PC that is connected to the same network as the 5601MSC. For Windows XP Home edition, right-click on the time display of the taskbar and select *Adjust Date/Time*. This will open up the Date and Time control panel. There should be three tabs at the top: “Date & Time”, “Time Zone” and “Internet Time”. If the “Internet Time” tab does not exist, use the command-line method below. Enter the IP address of the 5601MSC into the Server text box and click on the “Update Now” button. If the PC communicates with the 5601MSC NTP server, the time should update successfully.

Another method is the use the “w32tm” command from the command prompt. It may be necessary to install the Windows Time Service before this command will be available. Open a command prompt window by going to START->Programs->Accessories or by going to START->Run and typing in “cmd”. Type in the command “w32tm /monitor /computers:172.21.1.56”. In this case 172.21.1.56 is the IP address of the 5601MSC. Additionally, the command “w32tm /stripchart /computer:172.21.1.56 /dataonly” will display the offset between computer time and the 5601MSC NTP server time.

3.5.13.1. Enabling NTP Spoofing

When the unit is not configured for a time reference, or the current time reference is missing the NTP packets will be flagged with an alarm condition in the Leap Indicator bits (LI_ALARM). This may cause NTP clients to reject the time provided by the 5601MSC. The NTP Spoofing prevents this alarm condition from being set so that NTP packets sent out by the 5601MSC will indicate that the time is from a valid reference, even when no reference is present. This should only be used for testing purposes as it technically breaks compliance to the NTP standard.

GENERAL
- *NTP rules*
  - `NTP normal`
  - `NTP spoofed`

This menu item is used to enable NTP spoofing to indicate a time reference lock condition when the time reference is missing.

Set to *NTP normal* for normal NTP operation.

Set to *NTP spoofed* to force NTP packets to always indicate that the time provided comes from a valid time reference.

3.5.13.2. Configuring the NTP Restrictions

Restrictions are a list of IP addresses that will be ignored by the NTP server. There are 8 restrictions allowed, and they are additive. By default, all IP addresses are permitted to query the NTP server. Each restriction can block an IP address or range of IP addresses.

Each restriction is specified by an IP address, and a mask. The mask is compared to the IP address in binary format. Every bit that is set to a 1 in the mask acts as a “don’t care”. Note that 255 is equivalent to 11111111 in binary. Some examples are given below:

To restrict a single IP address (e.g. 172.21.1.70), set the mask to all 0’s
Restrict IpAdd = 172.21.1.70 Restrict IpMsk=0.0.0.0

To restrict all IP addresses beginning with a certain prefix (e.g. 172.21.1.XXX):
Restrict IpAdd = 172.21.1.0 Restrict IpMsk=0.0.0.255

For the sake of simplicity in the manual, only the menu items for restriction 1 will be shown.

3.5.13.2.1. Setting the NTP Restriction Mode

GENERAL
NTP rules
NTP restricts1
Restrict mode
Restrict permit
Restrict deny

This item is used to enable or disable the current restriction rule. Set it to *permit* to effectively disable the rule, or set it to *deny* to apply the rule to incoming NTP traffic.

3.5.13.2.2. Setting the NTP Restriction IP Address

GENERAL
NTP rules
NTP restricts1
Restrict IpAdd
Restrict IpAdd
172.21.1.70

This menu item is used to enter the IP Address portion of the restriction rule. It is used with the IP Mask to determine the range of IP addresses that will be ignored by the NTP server. Only effective when the Restrict mode is set to *deny*.

3.5.13.2.3. Setting the NTP Restriction Mask

GENERAL
NTP rules
NTP restricts1
Restrict IpMsk
Restrict IpMsk
0.0.0.0

This item is used to enter the IP mask portion of the restriction rule. This mask identifies which parts of IP address must match exactly, and which parts don't matter. A mask of 0.0.0.0 means that the entire IP address of the incoming request must match exactly with the restriction IP address in order for this rule to apply. A mask of 0.0.0.255 means only the first three octets of the IP addresses must match, and the last octet is not compared.

Example: Restrict IpAdd = 172.21.1.0 and Restrict IpMsk = 0.0.0.255
This means all IP addresses in the range of 172.21.1.0 to 172.21.1.255 will match this rule and will be ignored by the NTP server, if the Restrict mode is set to *deny*.

3.6. OPERATING WITH GLOBAL POSITIONING SYSTEM LOCK (GP option)

When the GPS option is installed, the 5601MSC can be both frequency and time locked to the Global Positioning System (GPS). The following section describes an overview of the GPS system and the operation of the 5601MSC when it is locking to the GPS satellites. See section 2.5 for information about installing the GPS antenna and connecting it to the 5601MSC.

3.6.1. The Global Positioning System Overview

The Global Positioning System (GPS) is a satellite based navigation system operated and maintained by the U.S. Department of Defence. There are currently 29 satellites in orbit providing worldwide 24 hour coverage. Currently GPS is the most accurate technology available for marine and land navigation and it is the technology of choice in timing applications including site and network synchronization.

As a satellite system, the GPS is immune from the limitations of land based systems previously available. By computing the distance to GPS satellites orbiting the earth, a GPS receiver can calculate an accurate position. This process is called satellite ranging. A two-dimensional position calculation requires three satellite ranges. A three-dimensional position calculation, including altitude requires four satellite ranges. GPS receivers can also provide precise time, speed, and course measurements.

3.6.2. GPS Lock Operation

Once the GPS has been locked and is in steady state condition for longer then 20 minutes the 5601MSC's frequency reference is locked to within 100ns of the GPS system time reference.

If the GPS head is disconnected, the frequency reference within the 5601MSC may drift very slowly over time. The maximum frequency drift of the 5601MSC's frequency reference is less than 0.04Hz of subcarrier frequency after a day of the GPS receiver being disconnected. The drift will be less than 0.3Hz if the GPS receiver was disconnected or obscured from the sky for 1 year.

Upon reconnecting the GPS antenna there will be a very smooth transition of the 5601MSC’s frequency reference back to the GPS frequency (Lock mode=SLOW). This transition is very smooth and gradual with no non-linear jumps. The re-lock will take less then 40 minutes after an unspecified period of time (i.e. 1 year or more) of the GPS receiver being disconnected or obscured from the sky. If the GPS head is removed for 5 minutes and then returned, the unit will take nominally less then 5 minutes to fully lock to GPS receiver. If the GPS receiver is removed for 15 minutes and then returned, the unit will take nominally less than 20 minutes to return fully locked to the GPS receiver.

3.6.3. GPS Position Insertion

The 5601MSC can insert the current position of the GPS antenna into the user bits of the LTC and VITC time outputs. This is controlled by the *VitcLtc dte fmt* menu item in the *GENERAL* root menu (see section 3.5.4). Fields with even numbered frames contain longitude in the user bits, and fields with odd numbered frames contain latitude. The format for latitude is wxxyyzz where w is 1 for south (-), and 2 for north (+), xxx is degrees, yy is minutes, and zz is seconds. The format for longitude is wxxxyyzz where w is 3 for west (-), and 4 for east (+), xxx is degrees, yy is minutes, and zz is seconds.

For example, at the Evertz Microsystems factory, the data is lat: *20432348 and long: 30794623*
This corresponds to North +43 degrees, 23.48 minutes and West -79 degrees, 46.23 minutes.
It can be entered into Google maps using the format +43 23.48 -79 46.23.

CHAPTER 4: TECHNICAL DESCRIPTION

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4. TECHNICAL DESCRIPTION

4.1. SPECIFICATIONS

4.1.1. Analog Sync Outputs

Output Standards:

Black Burst:	SMPTE 170M (NTSC-M), ITU-R BT.1700-1 (PAL-B)
Bi-Level:	Slo-Pal 625i/48, 625i/47.95
HD Tri-Level:	SMPTE 274M (1080p/23.98, 1080p/24, 1080i/50, 1080i/59.94, 1080i/60, 1080p/23.98sF, 1080p/24sF, 1080p/25, 1080p/29.97, 1080p/30) SMPTE 296M (720p/59.94, 720p/60, 720p/50, 720p/24)
Pulse Signals:	PAL color frame, 1Hz pulse, 1/1.001Hz pulse, 6/1.001Hz pulse
CW Signals:	5MHz, 10MHz, NTSC-M Subcarrier, PAL-B Subcarrier
Wordclock:	48kHz Wordclock
Connectors:	8 BNC per IEC 61169-8 Annex A
Number of Outputs:	8
Output Impedance:	75Ω
Signal Level:	
Black Burst:	Sync level –300mV ± 5mV (PAL-B, 75Ω terminated)
HD Tri-Level:	-300mV to +300mV ± 5mV (75Ω terminated)
CW Signals:	$2V_{p-p}$ or $4V_{p-p}$ selectable (unterminated)
Pulse Signals:	5V CMOS (±5%) or $2V_{p-p}$ bi-level/tri-level selectable (unterminated)
Wordclock:	5V CMOS (±5%) or $2V_{p-p}$ selectable (unterminated)
Wordclock Rise Time:	< 35ns
10MHz SFDR:	> 50dBc
DC Offset:	0V ± 0.05V
Return Loss:	>40dB to 10MHz
SNR:	>75dBrms
Freerun Stability:	Narrow ±10ppb, Wide ±25ppm

4.1.2. LTC Outputs

Standard:	SMPTE 12M-1 or IRIG-B
Frame Rate:	24, 25, and 30 (drop frame and non drop frame)
Number of outputs:	2
Connectors:	3-pin male XLR type, Female DB9
Level:	
Unpowered:	Adjustable, $0.8V_{(p-p)}$ to $9.0V_{(p-p)}$ into 1kΩ termination
Powered:	$2V_{(p-p)}$ with 11VDC offset to drive downstream 1200 series slave clocks
Signal Level – LTC1 XLR Power On:	
Output Level:	$2V_{(p-p)}$ with $11.5V_{DC}$ offset to drive downstream 1200 series slave clocks
Current Limit:	0.8A max (8 Watts)
Output Impedance:	66 ohm balanced (un-powered)
Rise Time:	40µs ± 10µs
Jitter:	< 2 µsec

4.1.3. Communications and Control

Serial Port:

Connector:	Female DB-9
Level:	RS232
Baud Rate:	115200 baud
Format:	8 data bits, no parity, 2 stop bits

Modem: (M option installed)

Connector:	RJ-11 telephone jack
Baud Rate (NRC):	300 baud (Bell 103 compatible)
Baud Rate (NIST):	1200 baud (V.22) or 4800-14400 baud (V.32bis)

Ethernet:

Network Type:	Fast Ethernet 100 Base-TX IEEE 802.3u standard for 100 Mbps baseband CSMA/CD local area network Ethernet 10 Base-T IEEE 802.3 standard for 10 Mbps baseband CSMA/CD local area network
Connector:	RJ-45
Function:	
CONTROL Port:	NTP server and SNMP Vista*LINK*® Control
TIME Port:	Reserved for future use
NTP Standard:	RFC-1305 compliant, broadcast and server mode support
SNMP Standard:	SNMP v1 compliant (RFC-1157, RFC-1213)

4.1.4. GPS Receiver (GP option installed)

Receiver:	Trimble Accutime Gold
Operating Temperature:	-40°C to +70°C
Humidity:	95% Relative Humidity, non-condensing at 60°C
Dimensions:	3.74” (100mm) Diameter, 2.85” (72mm) Height

4.1.5. DARS & AES Test Generator Outputs (SDTG, HDTG, or 3GTG options)

Standard:
- **Unbalanced:** SMPTE 276M Single ended AES (24 bits)
- **Balanced:** AES3-1992 (24 bits)

Number of Outputs:
- **DARS:** 1 unbalanced, 1 balanced
- **AES Test Gen**: 2 unbalanced, 2 balanced

Connector:
- **Unbalanced:** BNC per IEC 61169-8 Annex A
- **Balanced:** Removable Terminal Strip

Sampling Rate: 48kHz

Impedance:
- **Unbalanced:** 75 Ω unbalanced
- **Balanced:** 110 Ω balanced

Signalling:
- **Unbalanced Amplitude:** $1V_{p-p}$ ± 10% (into 75Ω)
- **Unbalanced Rise/Fall:** 30ns to 44ns (10% to 90%)
- **Unbalanced DC Offset:** 0V ± 50mV
- **Balanced Amplitude:** $4V_{p-p}$ ± 10% (into 110Ω)
- **Balanced Rise/Fall:** 5ns to 30ns

Unbalanced Return Loss: > 25dB 100kHz to 6MHz

AES Tones: Menu selectable

4.1.6. Reference Loop and Genlock

Absolute Maximum Rating: -5V to +5V

Supported References: (auto-detected)
- Black Burst (NTSC-M or PAL-B)
- Bi-Level sync (Slo-PAL 625i/48 or 625i/47.95)
- HD Tri-Level sync (1080i/60/50/59.94)
- HD Tri-Level sync (1080p/24sF/23.98sF/30/29.97/25/24/23.98)
- HD Tri-Level sync (720p/24/50/60/59.94)
- 5MHz or 10MHz Continuous Wave (frequency auto-detected)

Number of Inputs: 2 Loop thru

Connector: BNC per IEC 61169-8 Annex A

Black Burst References:
- **Input Level Range:** from –3.5dB (double terminated) to +6dB (unterminated)
- **Input SCH Range:** ± 35º
- **Lock Type:** Sync edge lock / subcarrier lock with NTSC-M and PAL-B

5MHz/10MHz
- **Input Level:** $300mV_{(p-p)}$ to $4.0V_{(p-p)}$

Locking Range: Narrow ±0.1ppm, Wide ±15ppm

Operating Common-Mode Hum Level: $3V_{(p-p)}$

Operating In-Signal Hum Level: $0.5V_{(p-p)}$

Input Impedance: 4.4kΩ, isolated, differential (external termination required)

Return Loss: > 40dB to 10MHz (with external 75Ω termination)

4.1.7. Analog Composite Video Test Signal Generators (SDTG, HDTG, or 3GTG options)

Standard:	SMPTE 170M (NTSC-M), ITU-R BT.470-6 (PAL-B)
Number of Outputs:	2 individual test generators with 1 output each
Connector:	BNC per IEC 61169-8 Annex A
White Level (PAL-B):	700mV ± 5mV
Sync Level (PAL-B):	-300mV ± 5mV
DC Offset:	0V ± 0.05V
Chroma to Luma Delay:	< ± 3ns
Chroma to Luma Gain:	100.0% ± 0.5%
Differential Gain:	< 0.50%
Differential Phase:	< 0.50º
Frequency Response:	ripple < 0.30dB to 5.8MHz
SCH Phase:	0º ± 1.0º
Output Impedance:	75 Ω
Return Loss:	> 30dB to 10MHz
SNR:	> $75dB_{(RMS)}$

4.1.8. Analog Audio Tones Generator (SDTG, HDTG, or 3GTG options)

Number of Outputs:	2
Type:	Balanced analog audio
Connector:	6 pins on 16-pin removable terminal strip
Output Impedance:	66Ω balanced
Signal Level:	-30dBu to +10dBu
DC Offset:	< 10mV
THD+N Ratio:	< -100dB (1kHz tone at +10.0dBu)

4.1.9. SDI Test Generator Outputs (SDTG, HDTG, or 3GTG options)

Supported Standard:	SMPTE 259M-C (270 Mb/s)
Number of Outputs:	4 individual test generators with 2 outputs each (8 total)
Embedded Audio:	Up to 4 groups as specified in SMPTE 259M Selectable tone frequencies (from 20Hz to 20kHz) and audio level control
Connectors:	BNC per IEC 61169-8 Annex A
Signal Level:	800mV ± 10% nominal, 1600mV high drive enabled
Rise and Fall Time:	400ps to 800ps (20% to 80%)
Rise and Fall Overshoot:	< 10% of amplitude
Return Loss:	> 20 dB 100kHz to 270MHz
Wide Band Jitter:	< 0.2 UI (10Hz high-pass filter)

4.1.10. HDTV Test Generator Outputs (HDTG option installed)

Supported Standards:	SMPTE 259M-C (270Mb/s) SMPTE 292M 4:2:2, YCbCr SMPTE 428M 2k DCDM
Number of Outputs:	4 individual test generators with 2 outputs each (8 total)
Embedded Audio:	Up to 4 audio groups as specified in SMPTE 299M Selectable tone frequencies (from 20Hz to 20kHz) and audio level control
Connectors:	BNC per IEC 61169-8 Annex A
Signal Level:	800mV ± 10% nominal, 1600mV high drive
Rise and Fall Time:	400ps to 800ps (SMPTE 259M), < 270ps (SMPTE 292M/372M/428M)
Rise and Fall Overshoot:	< 10% of amplitude
Return Loss:	> 15 dB to 1.5GHz
Wide Band Jitter:	< 0.20 UI (10Hz high-pass filter)

4.1.11. 3GTV Test Generator Outputs (3GTG option installed)

Standards:	SMPTE 259M-C (270Mb/s) SMPTE 292M 4:2:2, YCbCr SMPTE 428M 2k DCDM SMPTE 372M Dual Link 4:4:4 GBRA or YCbCr SMPTE 424M Level A and Level B
Number of Outputs:	
4:2:2	4 individual test generators with 2 outputs each
4:4:4	In dual-link mode each TG has one output Link A, other output Link B
Embedded Audio:	Up to 4 groups of audio as specified in SMPTE 299M. Selectable tone frequencies (from 20Hz to 20kHz) and audio level control
Connector:	BNC per IEC 61169-8 Annex A
Signal Level:	800mV ± 10% nominal, 1600mV high drive
Rise and Fall Time:	< 135ps
Rise and Fall Overshoot:	< 10% of amplitude
Return Loss:	> 15dB to 1.5GHz > 10dB to 3.0GHz
Alignment Jitter:	< 0.3 UI (100kHz high-pass filter)
Timing Jitter:	< 2.0 UI (10Hz high-pass filter)

4.1.12. General Purpose Inputs and Outputs

Number of Inputs:	2 (can send SNMP trap on activation)
Number of Outputs:	2 (function menu selectable)
Type:	Opto-isolated, active low with internal pull-ups to +5V
Connector:	4 pins plus 2 ground pins on GPIO connector (female DB15)
Signal Level:	+5V maximum

4.1.13. Power Supplies

Voltage:	Auto-ranging 100 - 240 Volts AC, 50/60Hz
Power Factor:	> 0.7
Configuration:	Optional redundant supply available with **PS** option
Power (Warm-Up):	75 watts max (with all options installed and max LTC1 power draw)
Power (LTC1 power on):	65 watts typical (warmed up and operating with all options installed)
Power (LTC1 power off):	57 watts typical (warmed up and operating with all options installed)
Safety:	ETL Listed, complies with EU safety directives
EMI/RFI:	Complies with FCC Part 15 Class A regulations Complies with EU EMC directive

4.1.14. Mechanical and Environmental

Dimensions:	19“ Width x 1.75” Height x 11.5” Depth (without front panel installed) (483mm Width x 45mm Height x 292mm Depth)
Weight:	8 lbs (3.5kg)
Mounting Clearance:	Requires 2” (5cm) clearance around fan exhaust on both sides
Operating Temperature:	0ºC to +40ºC (32ºF to 104ºF) ambient

4.1.15. Ordering Options

+2PS	Redundant power supply
+M	Modem Option
+GP	GPS Option (includes GPS receiver and 50’ weatherproof cable)
+T	Network Time Protocol (Must be ordered with +GP or +M option)
+SDTG	4 Dual output SD SDI Test/Black generators 2 NTSC/PAL test signal generator outputs 2 Analog Audio tone generators 1 DARS generator (balanced & unbalanced) 2 AES generators (balanced & unbalanced)
+HDTG	4 Dual output configurable SD/HD SDI Test/Black generators 2 NTSC/PAL test signal generator outputs 2 Analog Audio tone generators 1 DARS generator (balanced & unbalanced) 2 AES generators (balanced & unbalanced)
+3GTG	4 Dual output configurable SD/HD/Dual Link/3G SDI Test/Black generators 3D Test Patterns 2 NTSC/PAL test signal generator outputs 2 Analog Audio tone generators 1 DARS generator (balanced & unbalanced) 2 AES generators (balanced & unbalanced)

4.2. UPGRADING THE FIRMWARE

4.2.1. Overview and Setup

The firmware in the 5601MSC is contained on a FLASH EPROM. From time to time firmware updates will be provided to add additional features to the unit. Check the Evertz web site for information on firmware releases (www.evertz.com).

The following equipment is required in order to update the firmware:

- PC with available communications port. The communication speed is 115200 baud, therefore a 486 PC or better with a 16550 UART based communications port is recommended.
- "Straight-thru" serial extension cable (DB9 female to DB9 male) or (DB25 female to DB9 male).
- Terminal program that is capable of XModem file transfer protocol such as HyperTerminal.
- New firmware supplied by Evertz.

Perform the following steps to establish communications with the 5601MSC:

1. Connect the serial cable to the COM DB9 connector on the rear of the 5601MSC.
2. Connect the other end of the serial cable to the RS-232 COM port on the PC.
3. Start the terminal program.
4. Configure the port settings of the terminal program as follows:

Baud	**115200**
Parity	**no**
Data bits	**8**
Stop bits	**2**
Flow Control	**None**

5. In the terminal program window, press the **ENTER** key several times and you should see a ">" prompt appear with each key press. This verifies that the PC is communicating properly with the 5601MSC.

4.2.2. Putting the 5601MSC into Upgrade Mode

1. Press the **GENERAL** button on the front panel to access the GENERAL menu. Press the **ESC** button until the root menu level is reached.
2. Scroll down to the *Firmware* menu item.
3. Press the **SELECT** button to enter the menu. Press **SELECT** again on *Upgrade*. You will have to press the **SELECT** button twice more to put the unit into upgrade mode.
4. Alternatively, at the ">" prompt, type "UPGRADE" and press enter.

CAUTION: While the 5601MSC is in upgrade mode, all time outputs will stop running (VITC, LTC) and the Ethernet ports will not function (SNMP, NTP). When the unit reboots after new firmware has been sent, all outputs will experience a shutdown for about 10 seconds. Be very sure that this will have no effect on your system before continuing with the upgrade procedure.

4.2.3. Uploading the Firmware

1. Once the unit has been placed into upgrade mode, the 5601MSC will print out an initialization message and ask for the firmware file to be uploaded. Below is an example:

```
EVERTZ MCF5474 MONITOR 1.0 BUILD 25 (266 MHZ)
COPYRIGHT 1997 - 2009 EVERTZ MICROSYSTEMS LTD.
28F256P30B FLASH DETECTED
BRD=5601MSC
MODEL=BA5601MSC-REVB
PROD=5601MSC
FRAME=5601FR

UPLOAD FILE NOW, CONTROL-X TO CANCEL
```

2. Send the new firmware .bin file using the XModem protocol (checksum mode). The file transfer will take about 10-15 minutes depending on the speed of the PC.
3. When the transfer has completed, you should see a message stating “UPLOAD OK”. If for some reason the transfer aborted or was cancelled accidentally you may see messages stating “UPLOAD FAILED” or “NO PROGRAM”. In this case, enter the command “upgrade” and press enter. Press “Y” to upload flash and resend the firmware .bin file using XModem.
4. On a successful upload, the unit should reboot automatically. If it does not, either power-cycle the unit or enter the “boot” command. The unit will become operational after about 30 seconds and the front panel becomes active again.

Contact Evertz customer service at +1 905-335-7570 or service@evertz.com for more information

4.3. SERVICING INSTRUCTIONS

CAUTION: These servicing instructions are for use by qualified service personnel only. To reduce risk of electric shock, do not perform any servicing instructions in this section of the manual unless you are qualified to do so.

CAUTION: If the unit is fitted with dual power supplies, make sure that power is removed from both supplies before performing any work on the unit. There is no power switch so the power cords must be unplugged.

4.3.1. Changing the Fuses

CAUTION: For continued protection against the risk of fire, replace only with the same type and rating of fuse.

ATTENTION: Pour éviter les risques d'incendie, remplacer le fusible avec un fusible de même calibre.

Each power supply module contains a fuse. The fan module does not have a fuse. Remove the front panel to gain access to the mounting screw on the front of the power supply module. Unscrew the Phillips screw and remove the module by pulling on the handle. The fuse is located at the rear of the supply behind the rear connector and fan. Pull out the blown fuse being careful not to bend or damage the diode and place a fuse of the correct value in its place. Use a slow-blow (time delay) 5x20mm fuse rated for 250 Volts with a current rating of 1 Amp. Carefully reinsert the module, checking to make sure the diode doesn't impact the chassis. Secure the power supply module using the Philips mounting screw and replace the front panel.

4.3.2. Replacing the Battery

The 5601MSC is fitted with a 3V 20mm diameter Lithium battery type CR2032. This battery is used to power the clock while power is removed from the unit. If the unit is not keeping time properly when it is powered down, the battery should be replaced according to the procedure outlined in section 4.3.2.1.

Before attempting to change the battery remove power from the 5601MSC.

CAUTION
Danger of explosion if battery is incorrectly replaced.
Replace only with the same or equivalent type.

4.3.2.1. Safety Guidelines and Precautions Concerning the Use of 3V Lithium Batteries

Please observe the following warnings strictly. If misused, the batteries may explode or leak, causing injury or damage to the equipment.

- The batteries must be inserted into the equipment with the correct polarity (+ and -).
- Do not attempt to revive used batteries by heating, charging or other means.
- Do not dispose of batteries in fire. Do not dismantle batteries.
- Do not short circuit batteries.
- Do not expose batteries to high temperatures, moisture or direct sunlight.
- Do not place batteries on a conductive surface (anti-static work mat, packaging bag or form trays) as it can cause the battery to short.

4.3.2.2. Procedure for Replacing the Battery

- Remove the front panel
- Eject the main board by unlatching the ejectors on each side and pulling outwards
- The battery is located on the left side of the main board behind the metal shield
- Carefully lift out the old battery
- Insert the new battery with the + side facing up. Make sure it is firmly inserted into the socket
- Reinsert the board by carefully lining it up on the card guides and push until both ejectors latch
- Reinstall the front panel back onto the unit