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 (2004/108/EC) and the Low Voltage Directive (2006/95/EC) 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.

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.

| CE | EN60065   Safety
EN55103-1: 1996   Emission
EN55103-2: 1996   Immunity | | EN504192 2005
Waste electrical products should not be
disposed of with household waste.
Contact your Local Authority for
recycling advice |

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
0.2.2	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
1.0	IRIG features and VistaLINK screens	Jan 2011
1.1	Updates throughout. (Firmware 1v2 b69)	Oct 2011
1.2	Corrections made to "Front Panel LCD Displays" section	Feb 2012
1.2.1	Updated system diagram in "Automatic Changeover Operation" section	Feb 2012
1.2.2	Updates throughout manual	Jun 2012
1.2.3	Update made to "Connecting the GPS Smart Antenna to the 5601MSC" section	Nov 2012
2.0	Updates throughout manual. (Firmware 2v0 b30)	Jun 2013
2.1	Updates made to section 1.1.9	Jun 2014
2.2	PTP option added	Jul 2016

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1. OVERVIEW

Figure 1-1: Front View of the 5601MSC

The 5601MSC Master Sync and Clock 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 5.0×10^{-9} (or 0.005ppm) frequency reference. The free-running drift of this oscillator 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 independently programmable sync outputs. These six BNC outputs may be configured to provide independently timed color black (black burst) outputs or independently timed HDTV tri-level sync outputs, or pulses or subcarriers. 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 and the PAL eight field sequence will coincide with a specific point in GPS time. In this way, by referencing multiple 5601MSCs in a system to GPS, they will all be locked to each other in all standards. This is ideal for applications requiring a remote facility 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 system clock may be synchronized to GPS time (**GP** option), to the LTC input, to extracted VITC from the reference input, or to another 5601MSC through a syncro link. With the **T** option it can also synchronize once daily to a remote SNTP server. With the **IRIG** option the system clock may also be synchronized to incoming IRIG-B timecode. When a modem module is installed (**M** option), the system clock is able to synchronize to a dial-up high-accuracy time source via modem. A battery backed-up real time clock maintains time while the unit is without power.

The master clock provides two independently programmable timecode outputs (LTC standard, IRIG optional) on XLR connectors and a 15-pin D connector. System time may also be inserted as VITC onto any black burst sync output. Additionally, time can be "burned-in" to any of the SDI or analog test generator outputs. All of these time outputs can be individually offset from system time to a specific time zone as required. The 5601MSC can also provide RFC-1305 compliant NTP via Ethernet.

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.

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/IRIG outputs on XLR connectors (primary), copies on DB15 (secondary)
- One balanced LTC/IRIG 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 a black burst reference
- GPS antenna for frequency/phase and time reference (**GP** option)
- 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 lock 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
- The **HDTG** option adds HD format support for all four TGs (includes **SDTG** support)
- The **3GTG** option adds 3G/Dual Link format support (includes **HDTG** and **SDTG** support)
- The **SDTG, HDTG**, and **3GTG** options include two analog video test generators, two AES and one DARS output both balanced and unbalanced, and two balanced analog audio generators.
- Supports 2k D-Cinema output standards (SMPTE ST 2048-2) with **HDTG** and **3GTG** options
- Additional test patterns can be loaded with insertion of a CompactFlash card.
- On-screen text message and time burn-in windows available on all SDI and Analog TG outputs.
- 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
- Programmable general purpose outputs and inputs. Two GPOs and two GPIs
- Hot-swappable power supply and fan module with dual redundant power supply option (**2PS**)
- 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 NTP, SNMP and future PTP support.
- Optional Network Time Protocol (NTP) support (**T** option)
- 2 factory presets and 3 user-presets available
- Hardware monitoring of power supplies, fans, and temperature

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 1-2: 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 should 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. If both supplies are not powered, 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 4.5.9.5).

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, along with 10 pushbuttons, and a control knob for navigating the menu system and configuring the unit. The front panel is secured 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 power supplies, CompactFlash slot, and for troubleshooting purposes. When re-installing the front panel be sure to fully tighten the 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 two Ethernet ports on the 5601MSC. Both the CONTROL port and the TIME port are used for SNMP monitoring and control of the unit. If the **T** option is installed, both ports will host an NTP server, while regular NTP broadcasts will be sent out on the CONTROL port only. The network that the TIME port is connected to should contain very little traffic in order to obtain the lowest latencies.

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. Assign an unused IP address and subnet mask to the CONTROL and TIME ports. The two ports must be on separate subnets in order to function properly. When entering an IP address, the control knob can be used to set each octet. Depress the control knob while turning to adjust in larger steps. The Ethernet link status and current IP settings can be viewed by pressing the **STATUS** button and selecting the *ControlEthernet* status screen or the *TimeEthernet* 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. From here the frequency and time references of the unit can be configured. Use the control knob to select the *Frequency Ref* menu item and press **SELECT** or depress the knob. 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 (see section 4.3.3).

- *Video* – The 5601MSC will genlock to an analog 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 ten-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 4.3.

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 how 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 4.3.4 for more detail.

- *GPS* – When a GPS receiver (**GP** option) is connected to the unit, it can obtain continuous time and date updates from 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) and still use GPS as a very accurate time reference.

- *Modem* – If the unit is equipped with a modem (**M** option), 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 4.5.6.

- *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 3.4 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.

- *IRIG* – If the **IRIG** option is installed, the 5601MSC can acquire time and date from an IRIG-B signal applied to the LTC/IRIG input on the GPIO connector. Refer to section 2.3.3.6.

- *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*.

- *SNTP* – If the NTP (**T**) option is installed, the 5601MSC can synchronize once daily to time and date from an NTP server. See section 2.3.3.7 for more information.

- *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 1-3: 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 two primary LTC/IRIG outputs. The LTC/IRIG 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 15-pin male-male cables included with the 5601ACO2 to connect the GPIO ports of the 5601MSCs to the 5601ACO2. The SNSA and SNSB pins can be 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 may 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 4.4.2 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 contains muted audio. There are unbalanced (75Ω) versions of these outputs available on 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. They can be configured to output steady tones, or beeps scheduled to occur at specific times during the day. The analog audio outputs are available 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.

Many test patterns are built into the 5601MSC firmware, but additional test signals can be loaded from the CompactFlash. The CompactFlash slot is located behind the front panel as shown below. To access the CompactFlash card, the front panel must first be removed by loosening the two thumb screws and pulling it off the front of the unit. This can all be done while the unit is powered on.

The CompactFlash card can be removed by pressing the black eject button at the left side and pulling the card out. New test pattern files can be written onto the CompactFlash by installing it into the CompactFlash reader attached to any laptop or computer. The files can be copied into the CompactFlash from the Evertz website. These test signal files are a custom Evertz .evt format. When the CompactFlash is re-installed in the 5601MSC, it will automatically reload the test signals set. It is not necessary to reboot or power off 5601MSC. Alternativly, test signal files can be upgraded using FTP.

Figure 1-4: Front Panel Removed, CompactFlash Location

1.1.9.1. FTP Feature

To use this feature from a DOS command or Unix, enter *ftp IP*; where IP is the IP address of the 5601MSC, for example "ftp 192.168.192.175". When promted to enter the user and password take the following steps: for *User* press enter, and for *Password* use the password of the 5601MSC (Note: the default is 5601). Either of the Ethernet ports may be used for FTP.

The following are commands to work with the FTP feature: *dir, send, get, delete*.

To send a test signal, enter *send filename filename*, for example *send ts1920smscHDq1.evt ts1920smscHDq1.evt*.

FTP can also be used to upgrade the application.

To send the application, the ftp must be enabled. To do this enter *GENERAL*, then enter *Firmware*, then enter *Enable FTP.* This will enable sending files to the 5601MSC for 15 minutes.

To send the application, enter *send filename a:\5601MSC.bin*. Where filename is the name of the file in the computer, for example *send 5601MSC_2v5b4.bin A:\5601MSC.bin*. It is recommended to use the hash command if in DOS command, to show activity. It will take about 6 seconds to send the application. After it has been sent, enter *bye* to exit ftp.

At this time, the 5601MSC will store the downloaded file into its flash memory, and reboot. It will take about 3 minutes to store the application. During this time, **DO NOT TURN OFF THE POWER TO THE 5601MSC**. If power is interrupted, the code will have to be reloaded via the com port. Progress can be seen on the front panel.

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*, Dropframe Ctl, Color Frame, Set Jam Time, Jam Output, Jam all VitcLtc, Time Offset, *Time Zone*, and *DST enable* menu items.

LTC/IRIG 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. If the **IRIG** option is installed, they can be configured to one of several IRIG-B output modes.

NTP Server - If the 5601MSC has the **T** option installed, it will support the Network Time Protocol. 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.

Test Generator Outputs - If the 5601MSC has any of the test generator options installed, timecode can be "burned-in" at the bottom of the test signal output. The time is controlled by the TC Burn In, Dropframe Ctl, Set Jam Time, Jam Output, Jam all VitcLtc, Time Offset, *Time Zone*, and *DST enable* menu items.

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 3.1.11).

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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2. THEORY OF OPERATION

The 5601MSC is equipped with six programmable sync outputs along with a 10MHz and a Wordclock output. Two LTC/IRIG outputs are provided with primary copies on XLR connectors and secondary copies on a DB15 connector (GPIO). When equipped with a test generator option, analog/digital audio and analog/digital video outputs will be available. Refer to the block diagram of Figure 2-1.
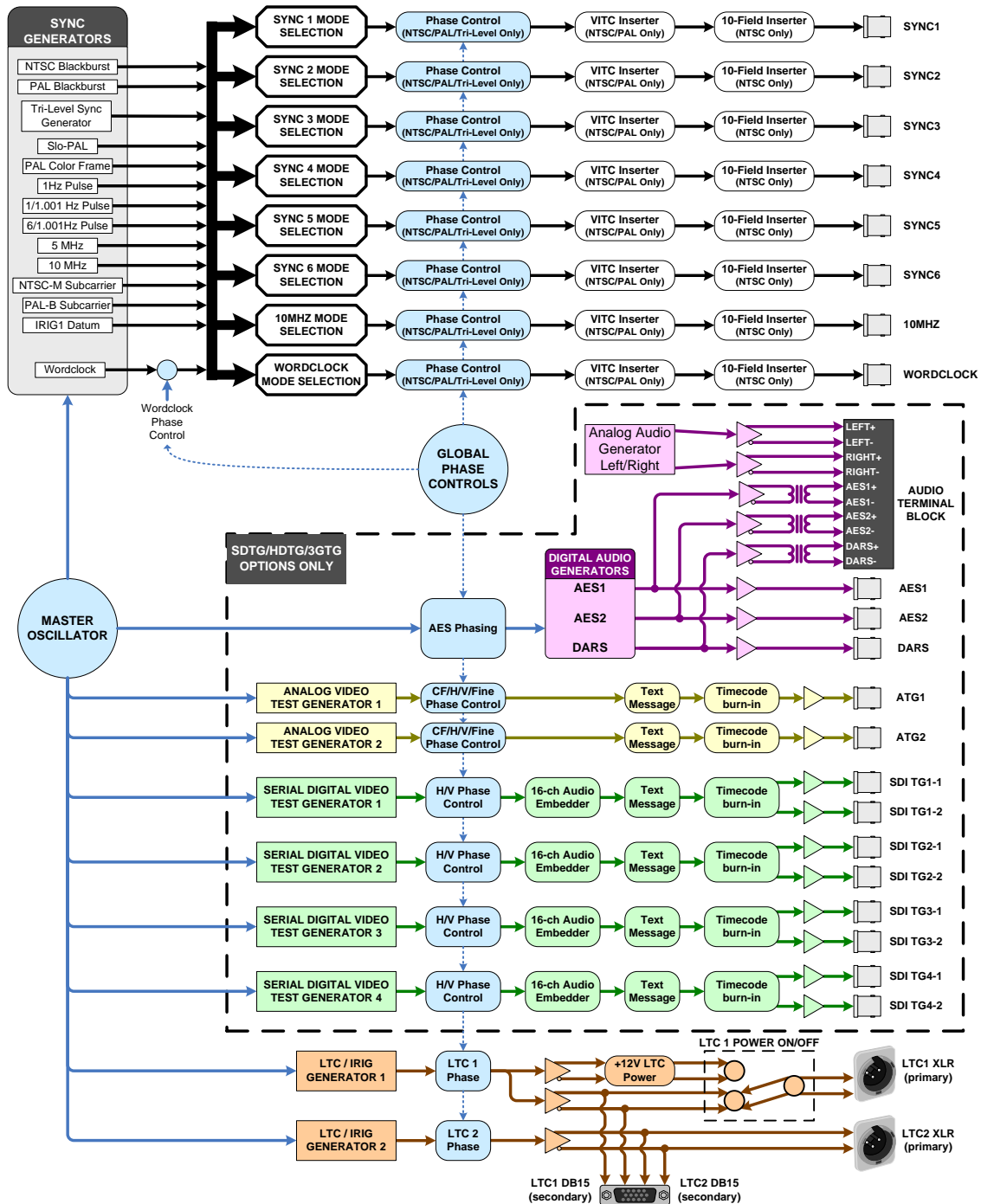
Figure 2-1: 5601MSC Outputs Block Diagram

2.1.   OUTPUTS

2.1.1. Sync Outputs
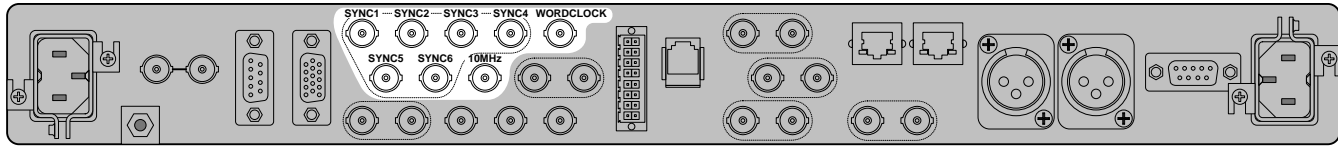
The sync output section provides six sync outputs along with a 10MHz and a Wordclock output. The 10MHz and Wordclock outputs can be configured as additional sync outputs, if required. All sync outputs are generated from the master oscillator and will be locked in frequency to the selected reference. Most sync output types will be phase locked to the reference, depending on the reference type and the phase information supplied (see section 2.2.1). When a video sync mode is selected, an independent phase offset can be applied to the output. The sync outputs are configured from the OUTPUT root menu. See section 4.4.2 for more information.

All sync outputs are fully programmable to output several different sync formats by changing the sync mode. The different output modes are described below:

Black Burst Signals	
NTSC-M PAL-B	There are two color black output modes, one in NTSC-M format and the other in PAL-B format. These modes are referred to as "black burst" or "color black" because they contain black video and have a colorburst to provide a colorframe reference. Vertical Interval Time Code (VITC) can be inserted on up to two lines in these modes. Additionally, a SMPTE ST 318 ten-field reference can be inserted onto line 15 for the NTSC-M output mode. Both these outputs modes can be phased independently over the entire color frame sequence.

Progressive SD Signals (Video)	
480p/59.94 576p/50	These sync modes are progressive versions of the 525 line (480p, SMPTE 293M) and 625 line (576p, ITU-R BT.1358-1) standards. They contain only sync and do not have a colorburst. They are useful for synchronizing equipment that deals with progressive SD formats.
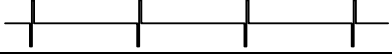
Slo-PAL Signals (Video)	
625i/47.95 625i/48	The "Slo-PAL" sync output modes use the PAL video format but run at a slower frame rate to be synchronous with 24Hz and 23.98Hz film standards. These output modes consist of sync pulses only and do not have a colorburst. These outputs can be phased independently. Note that VITC cannot be inserted onto slo-PAL outputs.
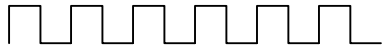
HD Tri-Level Signals	
<u>North American</u> 1080i/60 1080i/59.94 1080p/60 1080p/59.94 1080p/30 1080p/29.97 720p/60 720p/59.94 720p/30 <u>European</u> 1080i/50 1080p/50 1080p/25 720p/50 <u>Film Standards</u> 1080p/24 1080p/24sF 1080p/23.98 1080p/23.98sF 720p/24	Analog tri-level sync output modes are available for a variety of HD formats. These outputs are generated according to SMPTE ST 274 and SMPTE ST 296. All tri-level sync formats can be phased independently. If the 1035i/59.94 format is required, select 1080i/59.94. These sync formats are identical to each other. Similarly, if 1035i/60 is required, select 1080i/60. The 1080p/30sF, 1080p/29.97sF, and 1080p/25sF sync formats are identical to the 1080i/60, 1080i/59.94, and 1080i/50 output modes available here. The 1080p/60, 1080p/59.94, and 1080p/50 sync formats can be used for 3G 1080p synchronization, but contain no field information. The 1080i/60, 1080i/59.94, and 1080i/50 formats should be used instead, whenever possible.

Continuous Wave (CW) Signals	
  10MHz 5MHz NTSC Subcarrier PAL Subcarrier	The continuous wave (CW) output modes produce a sine wave at a specific frequency. The 10MHz and 5MHz outputs are locked in frequency to the reference but are not phased with respect to the reference. The NTSC Subcarrier (3.579MHz) is phase locked only when using either GPS or NTSC black burst as a reference. It will be inverted (180º out of phase) with respect to a proper NTSC subcarrier and is better described as a "burst-locked sinewave". The PAL Subcarrier (4.434MHz) is phase locked only when using GPS or PAL black burst as a reference. It is generated at sine (U) phase.

Wordclock	
Wordclock	The wordclock output mode produces a square wave at 48kHz. It is high during subframe1 (left channel) and low during subframe2 (right channel). Sync outputs that are set to wordclock cannot be independently phased. There is a single global wordclock phase control in the *AES Audio* menu. The wordclock output amplitude is set with the *Wordclock level* menu item (see section 4.4.2.2.14).
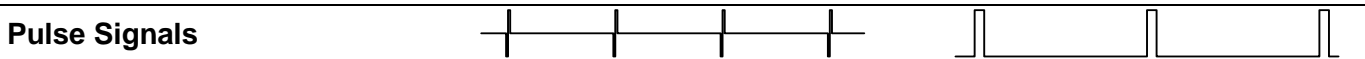
Pulse Signals	
1Hz 1/1.001Hz 6/1.001Hz PAL Colorframe IRIG1 Datum	The pulse output modes provide timing pulses that can be used to lock downstream equipment or can be helpful for troubleshooting purposes. These outputs cannot be phased and always remain phase-locked to the frequency reference. These signals may not be affected by any global phase offset (refer to Table 2-1). The pulse type is set with the *Pulse type* menu item (see section 4.4.2.2.12). Refer to the pulse diagrams in Figure 2-2 and Figure 2-3 for timing relationships. The 1Hz pulse goes high at the beginning of each second (see Figure 2-4). The 1/1.001Hz pulse indicates the start of the second for 29.97Hz LTC/VITC rates and is also synchronized to NTSC color field 1 (see Figure 2-5). Will be high for the duration of NTSC color field 1. The 6/1.001Hz pulse indicates where 59.94Hz video coincides with the 23.98Hz standards. This pulse is only phase locked when using a GPS reference or NTSC with a ten-field pulse (see Figure 2-5). The PAL Colorframe pulse will be high during PAL color field 1. It will only be phase locked when referenced to GPS or a PAL-B reference (see Figure 2-4). The IRIG1 Datum pulse will go high at the start of the IRIG second for 100ms. This pulse will be aligned within 20 microseconds of the GPS 1PPS pulse when locked to a GPS reference.

2.1.2. Timecode Outputs (LTC & IRIG)
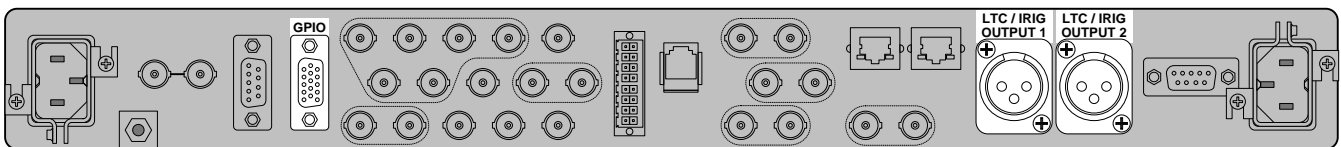
There are two LTC/IRIG outputs, each with primary outputs on XLR connectors and secondary copies available on the GPIO DB15 connector. The LTC outputs are driven by the master oscillator and will be locked in frequency and phase to the selected reference. The LTC1 and LTC2 outputs are generated independently from one another and can be configured to run at different rates. Refer to section 2.1.2, which describes the operation of the 5601MSC with regards to LTC and IRIG timecode.

The LTC1 primary output on the XLR connector has an LTC power driver which can be enabled through the menu system or remotely through SNMP. Once enabled, it supplies +12V power on pin 3 of the XLR for powering downstream Evertz clocks. See section 3.1.4 for wiring information.

If the IRIG option is installed, either of the LTC outputs can be switched to IRIG mode to supply IRIG-B timecode. There are several different IRIG-B formats available (see section 2.3.5).

2.1.3. Test Generator Options (SDTG, HDTG, 3GTG)
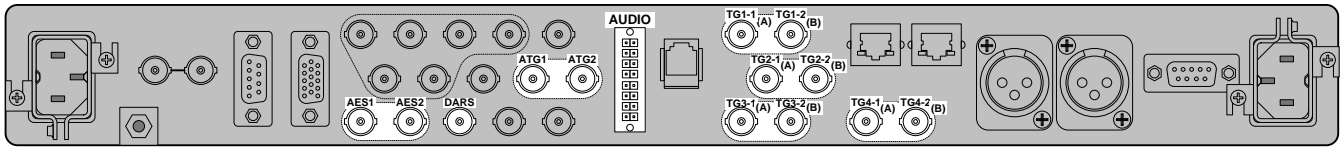
If a test generator option is installed (**SDTG**, **HDTG**, or **3GTG**), then a variety of audio and video test generators will be available.

- Analog Audio test generators. Two channels, Left & Right. Supplied as balanced outputs on the AUDIO terminal block. Can be configured to output continuous, or timed audio tones.
- Digital Audio test generators. Two AES outputs with configurable audio tones and a silent DARS output. Provided as unbalanced outputs on BNC connectors and also as balanced, isolated outputs on the AUDIO terminal block
- Analog Video Test Generators (ATGs). Two independent test generators on BNC connectors capable of producing NTSC-M and PAL-B composite video. Both feature a 2-line configurable on-screen message display with two font sizes and a timecode burn-in window at the bottom of the image. Each output is independently phaseable.
- Serial Digital Interface Test Generators (SDI TGs). There are four independent test generators, each with two outputs on BNC connectors. The SDTG option provides the capability to generate Standard Definition formats. The HDTG option adds the ability to generate High Definition formats. The 3GTG option adds the ability to generate 3G formats as well as dual-link formats. The 3GTG option also includes 3D test patterns in various formats. All test generators have an audio embedder and can generate audio tones in up to four groups of audio. They also feature a 2-line configurable on-screen message display and timecode burn-in window at the bottom of the image.

2.1.4. Global Pedestal Control

There is a single control to enable or disable applying 7.5IRE setup to all sync outputs and analog video test generator outputs (ATGs). This control only affects the NTSC-M output format. This control is located in the **OUTPUT** root menu (see section 0).

2.1.5. Global Phase Controls

The Global Phase feature of the 5601MSC provides a single point of control from which all video outputs can be phased simultaneously. There are separate controls for each of the frequency lock modes (GPS, Video, 10MHz, and Internal) to allow different phase offsets to be applied depending on the lock source. This global phase allows for phase correction to be applied when locking to a 10MHz reference. See section 4.4.9 for information on how to enable and specify a global phase offset.

> **The "10MHz" and "Internal" global phase settings are reset to zero at startup. This is done because no phasing information is supplied in these reference modes and the phase of the outputs will be random when the unit is restarted.**

Once enabled, the global phase offset can be specified in milliseconds, microseconds, and nanoseconds. The global phase offset is applied before the individual phase controls for each output. Refer to Table 2-1 for a list of all the outputs affected and the minimum phasing resolution for each. The outputs unaffected by global phase will remain locked to the reference. The Global Phasing menu in the OUTPUT root menu is used to configure global phase.

Output	Affected by Global Phase	Minimum Phasing Resolution
Sync – NTSC & PAL modes	Yes	1 ns
Sync – Tri-level modes	Yes	1 ns
Sync – Slo-PAL modes	Yes	1 ns
Sync – 5MHZ/10MHZ CW modes	No	-
Sync – NTSC/PAL subcarrier modes	No	-
Sync – PAL Color Frame Pulse	No	-
Sync – 1Hz and 1/1.001Hz Pulses	No	-
Sync – 6/1.001Hz pulse	No	-
Sync – Wordclock	Yes	59 ns
AES/DARS outputs	Yes	163 ns
LTC outputs	Yes	1 us
IRIG outputs and IRIG Datum Pulse	Yes	1 ms
Analog video TG (ATG) outputs	Yes	1 ns
SDI TG outputs	Yes	37 ns SD 13.5 ns HD & 3G

Table 2-1: Global Phasing Characteristics
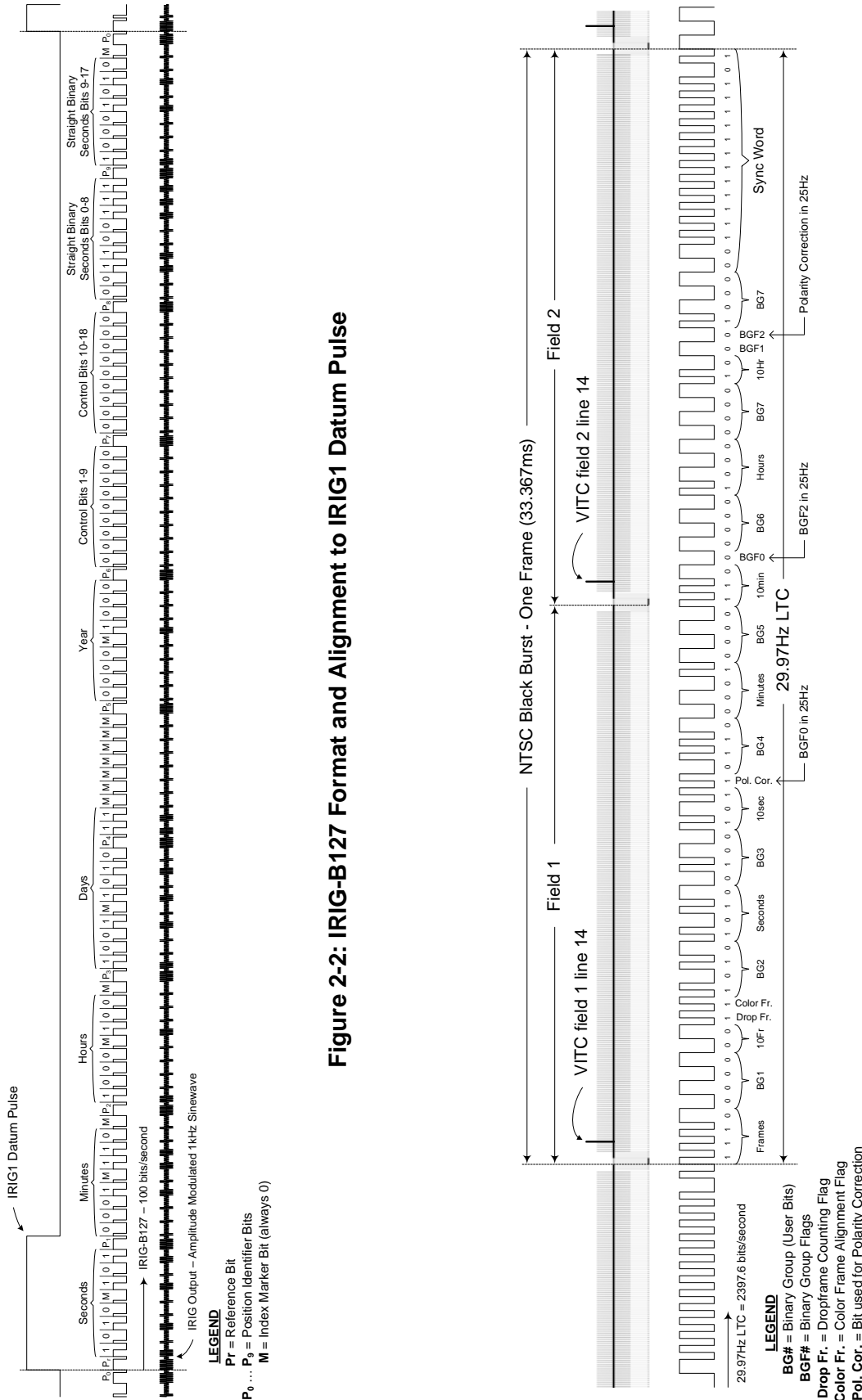
Figure 2-2: IRIG-B127 Format and Alignment to IRIG1 Datum Pulse
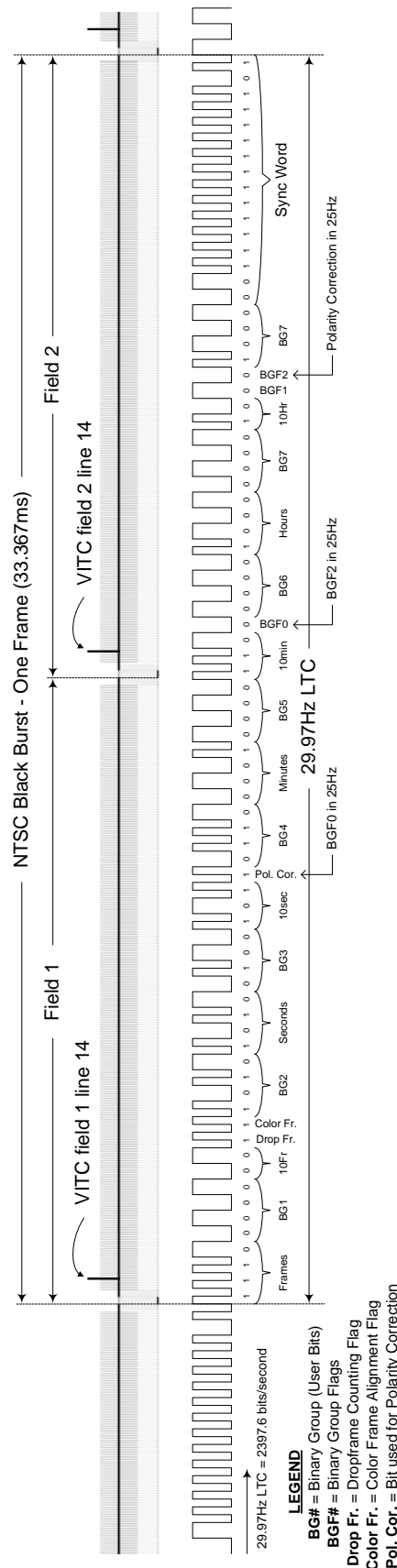
Figure 2-3: 29.97Hz LTC Format and Alignment to NTSC Video

Figure 2-4: PAL Alignment to 1Hz Pulse and PAL Color Frame Pulse
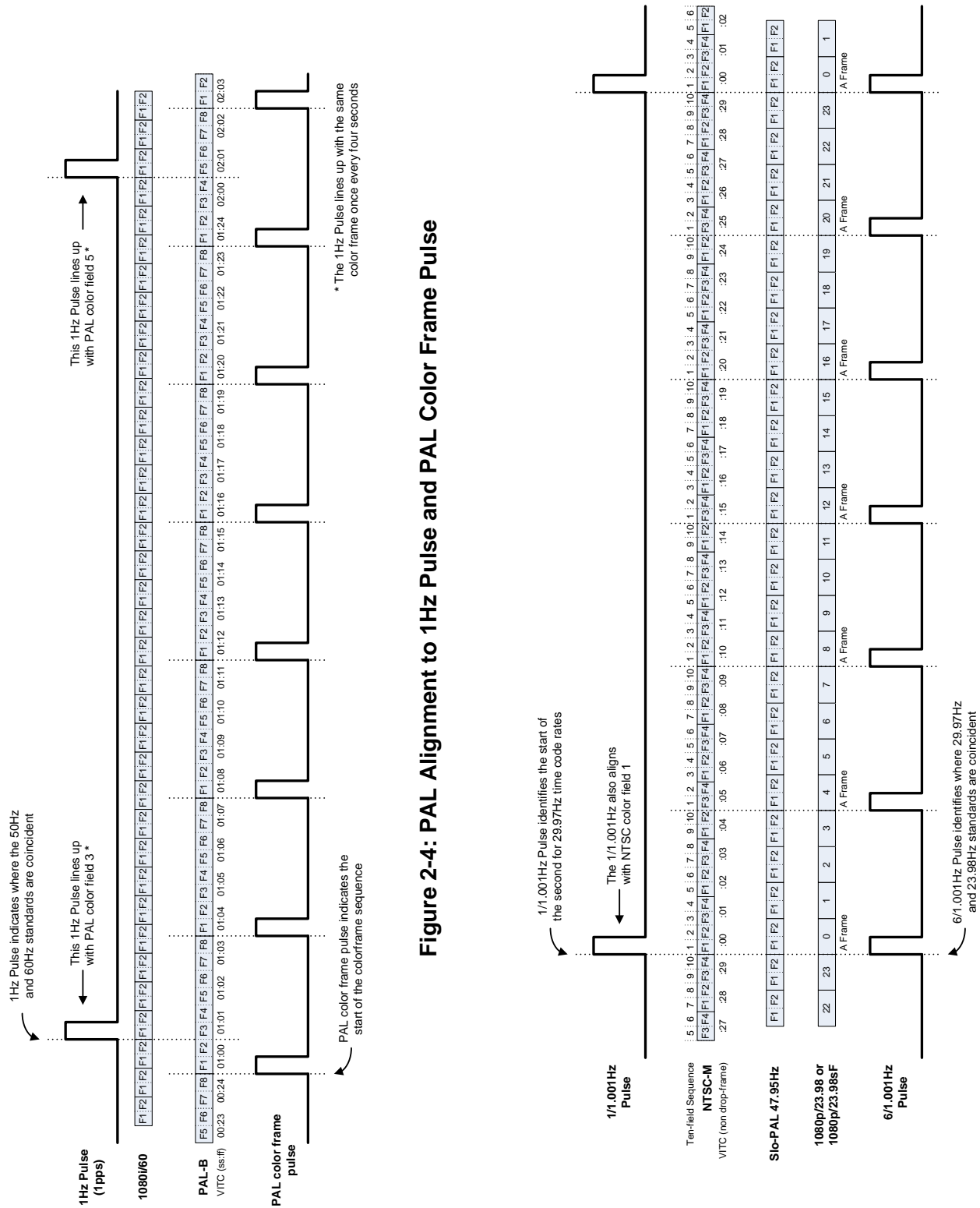
Figure 2-5: NTSC Alignment to 1/1.001Hz Pulse and 6/1.001Hz Pulse with VITC Color Framing

2.2.   GENLOCK

2.2.1. Frequency Locking

At the heart of the 5601MSC is the master oscillator circuit. Refer to the block diagram in Figure 2-6 below. For maximum versatility and reliability, two separate oscillators are employed. In *narrow* mode, an ovenized quartz oscillator (OCXO) is used for maximum stability. In *wide* mode, a voltage controlled oscillator (VCXO) provides a wide lock range and fast lock times. For added reliability this dual configuration allows the unused oscillator to act as a backup to the active oscillator. In the case of a hardware fault the backup oscillator will take over. See section 2.2.3 for more information.
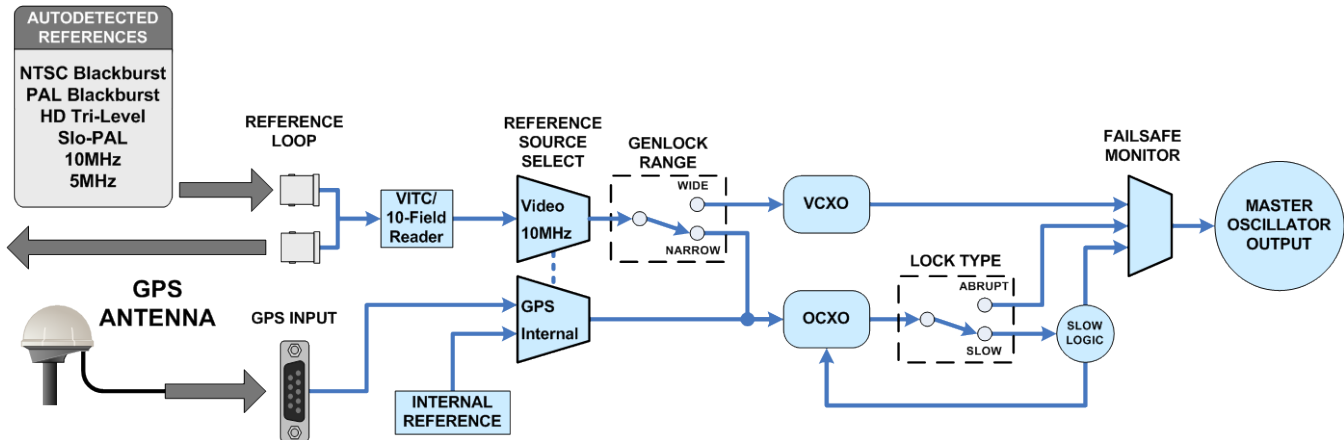
Figure 2-6: Main Oscillator Circuit Block Diagram

The 5601MSC can be configured to free-run on its internal reference, or it can lock its oscillator to an available frequency reference. This locking operation uses a Phase Lock Loop (PLL) to continuously adjust the oscillator to track the frequency and phase of the reference signal. In *narrow* mode an additional feature is available whereby the adjustment rate of the oscillator is limited to prevent sudden changes during a re-locking operation (see *Slow* mode in section 2.2.4).

The 5601MSC can lock to several different frequency reference types. The supported signal types are shown in Table 2-2. Video and Continuous Wave (CW) signals are applied to the reference loop BNCs and are auto-detected. A GPS receiver can also be connected to the unit and used as a frequency reference (see section 2.5). Each reference type is explained in detail in the following sections.

Reference	Lock Type	Phase Lock Period	Lock Diagram	Lock Range
NTSC	Sync edge/burst	2 Color Frames	Figure 2-7	Wide/Narrow
NTSC+10field	Sync edge/burst	5 Frames	Figure 2-8	Wide/Narrow
PAL	Sync edge/burst	4 Color Frames	Figure 2-10	Wide/Narrow
HD Tri-Level	Sync edge	1 Frame	Figure 2-11	Wide/Narrow
Slo-PAL	Sync edge	1 Frame	-	Wide/Narrow
10MHz CW	Edge	None	Figure 2-12	Wide/Narrow
5MHz CW	Edge	None	Figure 2-12	Wide/Narrow
GPS	1pps edge	4004 PAL frames/ 4800 NTSC frames	Figure 2-13	Narrow only
Internal Ref	Free-run	None	Figure 2-12	Narrow only

Table 2-2: Frequency Reference Types for the 5601MSC

2.2.2. Selecting the Frequency Reference Type

The frequency reference for the 5601MSC is selected with the *Reference Src* menu item in the *Frequency Ref* menu off the **INPUT** root menu. When *GPS* is selected, the 5601MSC will use the GPS receiver attached to the GPS port on the rear of the unit (see section 2.2.13). When set to *Ten MHz*, the 5601MSC will look for a 5MHz or 10MHz continuous wave (CW) signal on the reference loop input BNCs (see section 2.2.12). When set to *Video*, the 5601MSC will lock to an analog video sync signal (auto-detected) that is applied to the reference loop BNCs (see section 2.2.5). When set to *Internal*, the 5601MSC will free-run off its internal reference (see section 2.2.12.1).

```
INPUT                >GPS
 Frequency Ref        Ten MHz
  Reference Src       Video
                      Internal


Sys Ok      Ref Ok
```
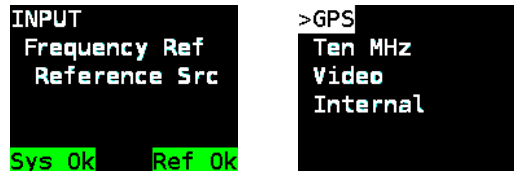
The *Inputs* status screen in the **STATUS** root menu can be used to view which frequency references have been detected by the 5601MSC. The first three lines indicate status of video sync, 5MHz or 10MHz detection, and GPS status. See section 4.1.2 for more information.

2.2.3. Selecting the Genlock Range

The *Genlock Range* menu item in the *Frequency Ref* menu selects which oscillator is used when locking to a video sync or CW reference. When *Narrow* is selected, the high-stability oven controlled quartz oscillator (OCXO) is used and the VCXO runs as backup. When *Wide* is selected, the voltage controlled quartz oscillator (VCXO) is used and the OCXO runs as backup. It should be noted that when the frequency reference source is set to *GPS* or *Internal Ref*, the genlock range is forced to *Narrow* mode (OCXO) regardless of this menu setting.

```
INPUT                >Narrow
 Frequency Ref        Wide
  Genlock Range


Sys Ok      Ref Ok
```

In the event that the frequency reference is lost, the 5601MSC will free-run using the selected oscillator. The *Narrow* range OCXO has extremely high stability which will translate to very low drift. This also translates into lower jitter on the outputs. Another advantage of the *Narrow* range is that it allows use of the *Slow* re-lock mode that prevents glitches when re-locking to a reference (see section 2.2.4). The disadvantages of the Narrow range are that it requires a very tight reference source (±0.1 PPM) and requires a longer time to fully lock. The OCXO also requires five minutes of warm-up time before reaching full stability once the unit has been powered on.

The Wide range VCXO provides very fast lock times with a wide lock range (±15 PPM) which means it can lock to just about any reference signal. It can be useful if the 5601MSC reference source changes frequently such as in a post-production facility. The *Wide* range cannot be used when locking to GPS or when free-running on the internal reference. In almost all cases, the *Narrow* range is superior and should be left as the default selection. See Table 2-3 for a summary of the characteristics of each range.

> ✍ In the event that the frequency reference is lost when locked in *Wide* mode, the 5601MSC will freerun on its VCXO. Note that this oscillator can freerun at a frequency outside the *Narrow* mode lock range which may cause problems for downstream 5601MSC units. The Wide oscillator is also capable of going beyond the frequency tolerance specifications stated in ITU-R BT.601 and SMPTE ST 292-1. Operating outside the range of ±10ppm may cause locking issues for downstream equipment.

Genlock Range	Oscillator	Lock Range	Time to Lock	Jitter	Free-run Drift
Narrow	OCXO	± 0.1 PPM	>20 seconds	very low	very low
Wide	VCXO	± 15 PPM	<1 second	Low	moderate

Table 2-3: Genlock Range Characteristics

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* (see section 4.1.2). The current position within the tuning range 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. This reading gives an idea of how close to the edges of the tuning range the oscillator is when locked to a reference.

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 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 translates to an expected lifetime of 15 years. If the oscillator locks at over ±90% of its tuning range, a warning condition will be indicated 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 unused 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 or attempt to restart the unit. Contact Evertz customer service for further assistance at +1 905-335-7570 or see www.evertz.com/support.

2.2.4. Lock Type Selection

When the *Genlock Range* is set to *Narrow*, the *Lock Type* controls how the 5601MSC will respond when its oscillator becomes out of sync to the frequency reference. This situation can occur if the incoming frequency reference changes or is reconnected after a period of absence long enough that the 5601MSC oscillator has drifted and is no longer synchronized. There are two lock types available: *Slow* and *Abrupt*.

```
INPUT              >Slow
 Frequency Ref      Abrupt
 Lock type



Sys Ok     Ref Ok
```
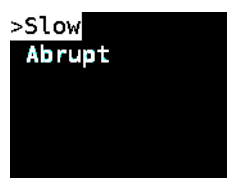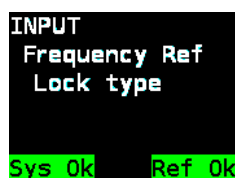
In the *Abrupt* mode, the 5601MSC will respond to any change in the incoming frequency reference with an immediate re-lock, shifting the timing of the unit to match the reference. This effect will ripple to the outputs and may cause undesired effects in downstream equipment, depending on the amount of correction performed. This is the default mode of operation. When the *Genlock Range* menu item is set to *Wide*, the relocking mode is always *Abrupt*, regardless of the *Lock Type* menu setting.

When the *Slow* lock mode is selected, the 5601MSC will detect when its oscillator is not synchronized to the reference and issue a frequency reference unlocked warning. It will display REF JAM NEEDED on the left LCD display and can also be configured to send out an SNMP trap (see section 4.5.9.3.4). It will then gradually adjust the frequency of the OCXO, limiting the rate of change, until the oscillator is brought back into sync with the incoming reference. Once this "slow" re-lock process is complete, the "REF JAM NEEDED" warning will be cleared. The Lock progress display will return to 100% and the unit will continue normal operation.

```
STATUS              Freq      GL narr
 Lock status        Lock progrs    4%
                    OCXO center+4.4%
                    Time No Ref

REF JAM NEEDED
```
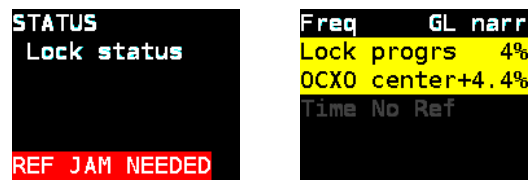
The *Slow* lock type can take a long time to relock to the reference signal, especially when correcting for a large discrepancy in phase. It takes about a minute to correct for a phase difference of one line of video. At any time during this Slow relock process, the operator can force the 5601MSC to immediately lock to the reference by performing a frequency *jam*. This can be performed by selecting *Jam Reference* in the *Jam Input* menu off the **INPUT** root menu. It can also be performed remotely through SNMP. Once the *Jam Reference* has been initiated, the frequency and phase from the reference is jammed into the main oscillator, forcing it to lock immediately. Performing a *Jam* may cause disturbances on all sync and test generator outputs as the phase of the unit is reset.

Careful consideration and testing of Slow lock mode effects should be made, especially when using multiple 5601MSC units locked to each other. Portable truck systems that may require a cold start of all equipment should allow for some time for oscillator warm-up and GPS lock but could require a manual frequency *jam* to be performed in order to get units locked up quickly.

> ✍ **When the unit is first started up, or if the frequency reference source is changed by the user, a frequency *jam* is always performed. This *jam* occurs even if the *Lock Type* has been set to *Slow* mode. When locked to GPS, this initial frequency *jam* could occur 5 to 30 minutes after the unit has been restarted, once GPS lock is fully established.**

> ✍ **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 re-locking. The 5601MSC will gradually slew its oscillator to bring it back into phase with the reference. This slewing action combined with the apparent phase shift may seem to indicate that the unit is completely unlocked to the reference and freerunning. This should not be considered a fault. A manual jam can be performed at any time to force the 5601MSC to lock immediately.**

2.2.5. Video Genlock Operation

The 5601MSC can lock to various analog video sync references including NTSC, PAL, Slo-Pal signals, and HD tri-level signals. The applied video reference type is auto detected. The full list of supported standards is shown in Table 2-4. The lock behavior is described for each of the main video sync types.

Video Signal	Frequency Lock	Phase Lock
NTSC-M	Sync edge/Burst	2 Color Frames
NTSC-M + 10field	Sync edge/Burst	5 Frames
PAL-B	Sync edge/Burst	4 Color Frames
625i/48	Sync edge	1 Frame
625i/47.95	Sync edge	1 Frame
1080i/60	Sync edge	1 Frame
1080i/59.94	Sync edge	1 Frame
1080i/50	Sync edge	1 Frame
1080p/60	Sync edge	1 Frame
1080p/59.94	Sync edge	1 Frame
1080p/50	Sync edge	1 Frame
720p/60	Sync edge	1 Frame
720p/59.94	Sync edge	1 Frame
720p/50	Sync edge	1 Frame
720p/24	Sync edge	1 Frame
720p/30	Sync edge	1 Frame
1080p/23.98	Sync edge	1 Frame
1080p/23.98sF	Sync edge	1 Frame
1080p/24	Sync edge	1 Frame
1080p/24sF	Sync edge	1 Frame
1080p/25	Sync edge	1 Frame
480p/59.94	Sync edge	1 Frame
576p/59.94	Sync edge	1 Frame

Table 2-4: Supported Analog Video Sync References

2.2.6. Serial Digital Video Timing

The 5601MSC has four separate serial digital video test generators that can be phased independently, and are also phased by the Global Phase controls. In all the supported standards, SD, HD, and 3G, the video outputs are aligned to the supplied reference. The alignment to analog sync has been calibrated using SMPTE compliant timing and is guaranteed to be accurate to within one sample.

It should be noted that certain Tektronix equipment such as the WFM700 and WFM7120 will not show correct alignment of a serial digital video source to a supplied external analog reference. These devices appear to have been calibrated to the output of an unknown video DAC. This means they will not display correct SMPTE timing due to the delay introduced in the measurements by the DAC process. Since the outputs of the 5601MSC are aligned using SMPTE timing, their phase must be advanced significantly in order to appear correct with Tektronix timing.

> **With no phase offset applied, the SDI outputs of the 5601MSC will be measured by Tektronix gear as approximately 4.7us delayed (SD) or 1.3us delayed (HD) when the Tektronix device is externally referenced to the respective analog sync**

Examples of equipment that perform SMPTE compliant timing measurements are the Phabrix SX/DX and OmniTek OTM-1000.

2.2.7. NTSC Genlock Operation
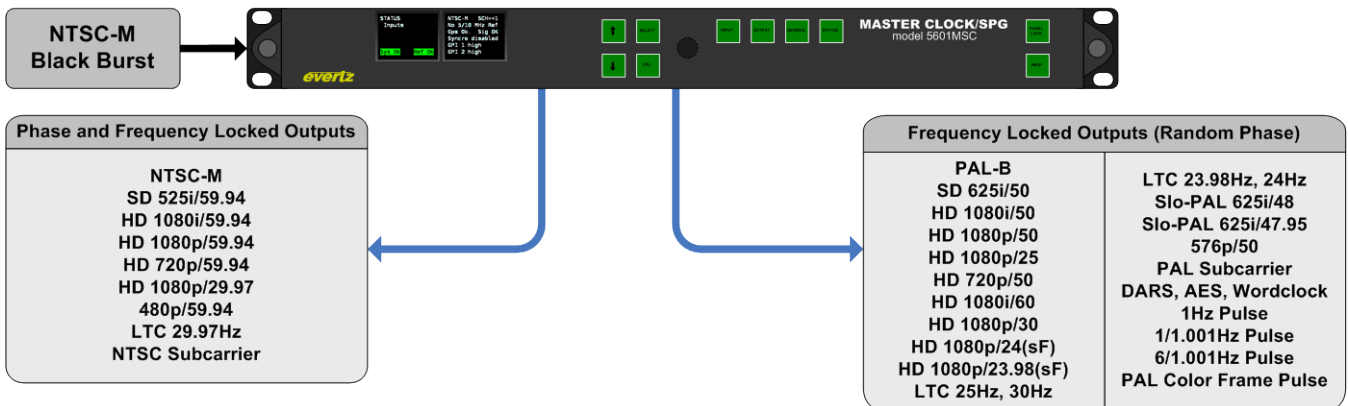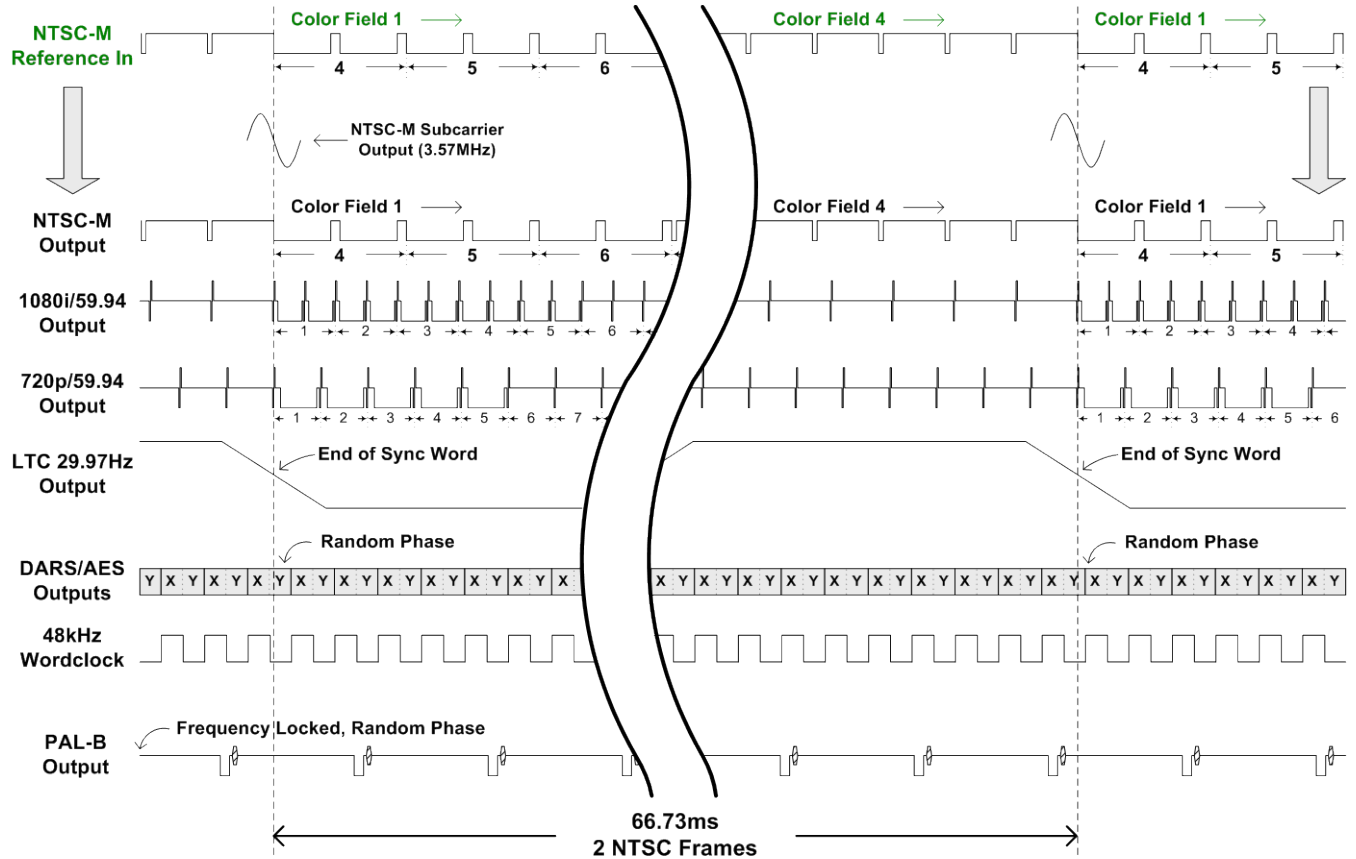
Figure 2-7: Lock Diagram #1 - NTSC Reference without 10field Reference

Figure 2-7 shows the timing relationship between the outputs of the 5601MSC and the applied NTSC video reference. The master oscillator will lock its frequency to the NTSC video reference, and all outputs will become frequency locked. This frequency locking process uses both the horizontal sync and the colorburst to obtain an accurate lock. The applied NTSC reference should have no video content and a low Subcarrier to Horizontal (SCH) offset to assure proper lock. The approximate SCH value is shown in the *Inputs* status screen (see section 4.1.2). If the SCH error is higher than 30°, the 5601MSC will fall back to locking to the horizontal edge of the video only. If the SCH error is in excess of 50°, or the colorburst cannot be accurately measured, the 5601MSC will report that the applied reference is unlockable.

It is important to ensure that the incoming black burst reference is of good quality. The reference loop BNCs are isolated from chassis ground and the signal is received differentially. This provides good immunity to DC offsets and provides common-mode hum rejection. There should be no video content on the reference otherwise reference lock could be lost, or higher jitter may be produced on the outputs.

The color frame sequence of the NTSC reference is decoded and used to phase the outputs. Because the NTSC color frame sequence is only 2 frames long, this is not enough phase information to *deterministically* lock signals which align to NTSC on longer periods. This includes 23.98Hz standards, DARS/AES signals, and the 6/1.001Hz pulse. These signals align with NTSC once every 5 frames. This is illustrated in Figure 2-5. The phase of these signals will be set arbitrarily and cannot be guaranteed to be the same between different units that are locked to the same reference. The phase may also change if the unit is restarted.

The phase locking ability of the 5601MSC when supplied with an NTSC reference is summarized at the bottom of the lock diagram (Figure 2-7). The HD standards listed apply to both the HD test generators and the tri-level sync outputs. The serial digital video test generator outputs are phased according to SMPTE compliant timing, which may differ from the timing shown on Tektronix equipment. See the note in section 2.2.6.

If the NTSC reference is lost, the unit will freerun on the selected oscillator as described in section 2.2.3. Note than when the *Genlock Range* is set to *Wide*, the freerun drift upon loss of reference will be much higher. When the NTSC reference is re-applied the *Lock Type* menu selection controls how the 5601MSC will respond to re-align its internal oscillator with the reference (see section 2.2.4).

When locked to NTSC **without** a ten-field reference, the AES/DARS outputs cannot be deterministically phased. The *AES/DARS/WC lck* menu item located in the *AES Audio* menu off the **OUTPUT** root menu should be set to *NTSC/fractional*, however the phase relationship will be chosen arbitrarily and may change if the reference is lost or the unit is restarted.

2.2.8. NTSC Genlock with Ten-field Reference
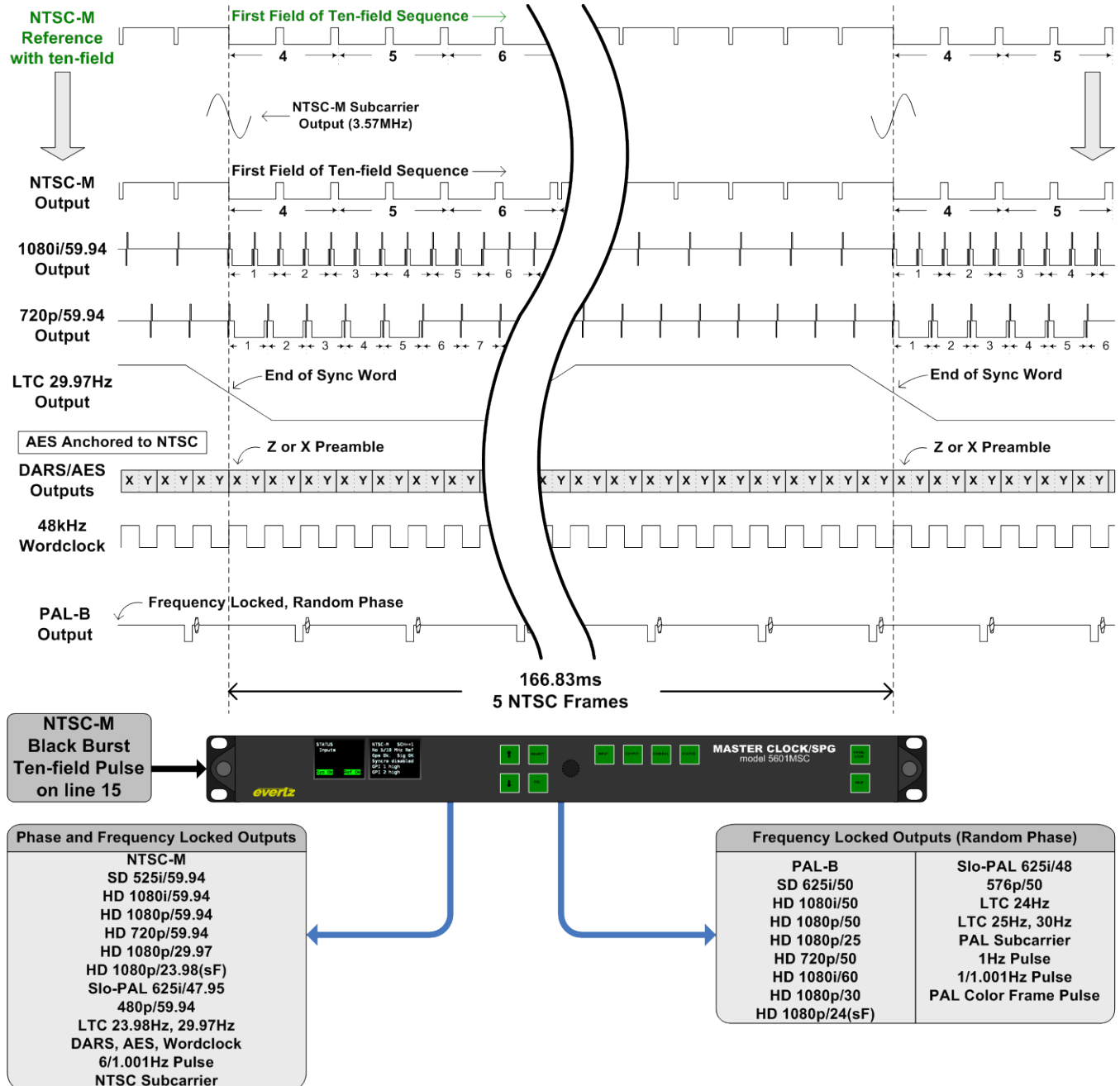
Figure 2-8: Lock Diagram #2 - NTSC Reference with Ten-field Reference

When an NTSC reference is applied that carries a ten-field reference pulse in the vertical blanking interval (VBI) as specified in SMPTE ST 318, the phase locking ability of the 5601MSC is enhanced. The ten-field reference provides 5 frames worth of phasing information that allows deterministic locking of 23.98Hz standards, the 6/1.001Hz pulse, and DARS/AES signals. These outputs can be guaranteed to be the same phase between multiple units. The color frame sequence of the NTSC reference is also decoded and used for phasing NTSC sync outputs. Note that the lock diagram above (Figure 2-8) now shows a span of 5 frames instead of 2 frames for regular NTSC lock (Figure 2-7).

The SMPTE ST 318 ten-field reference can be generated by the 5601MSC and its predecessor the 5600MSC on any NTSC sync output. It is turned on and off using the Ten Field Ctl menu item (see section 4.4.2.2.11). The 10field waveform is illustrated below in Figure 2-9. The number of pulses indicates where in the sequence the frame belongs. It is inserted on lines 15 (field 1) and 278 (field 2).
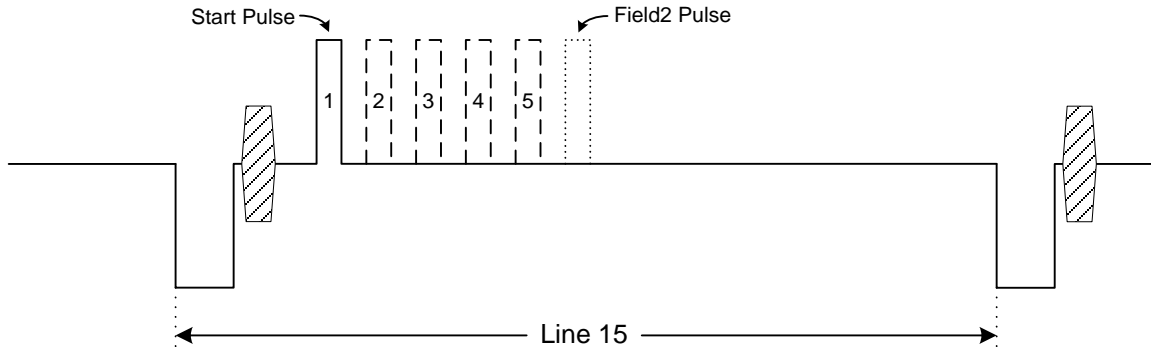
Figure 2-9: SMPTE ST 318 Ten-field Reference on NTSC line 15

When the 5601MSC is locked to an NTSC reference with a ten-field pulse, the AES, DARS, and Wordclock outputs can be phase locked properly. The *AES/DARS/WC lck* menu item located in the *AES Audio* menu off the **OUTPUT** root menu should be set to *NTSC/fractional*.

In the NTSC ten-field lock diagram above (Figure 2-8), the AES/DARS outputs are displayed as frames. Each frame is divided into two subframes, labeled X and Y. The X subframe identifies channel 1 (left channel). The Y subframe identifies channel 2 (right channel). The wordclock output is high during channel 1 and low during channel 2. Note that the AES/DARS and wordclock outputs can be phased independently. If the phase of the AES/DARS outputs is changed for any reason, the phase of the wordclock output should be changed as well to match.

The AES/DARS outputs provide a fixed sample rate of 48kHz (48,000 samples per second). This means that during a single NTSC frame, 1601.6 AES frames will have been generated. It takes five NTSC frames to fit a whole number of AES frames (8008 frames). This means that 48kHz AES/DARS will line up evenly with NTSC sync once out of every five frames, and during the other four frames the AES/DARS waveforms will appear to be partially shifted. The 10field sequence identifies frame #1 (a single pulse) as the frame where the AES/DARS waveforms line up perfectly to horizontal sync of line 4 of the NTSC waveform. This is illustrated in lock diagram #2 (Figure 2-8).

Note that the Z preamble (which identifies the start of a 192-frame AES block) will only line up with NTSC sync once every 120 frames (4.004 seconds). This is in contrast to PAL sync where it will line up every frame. This essentially renders the *AES Coarse* phase adjustment meaningless when locked to an NTSC reference. The alignment of an AES block to analog video sync is not important for proper reception of an AES signal.

If the NTSC reference is lost, the unit will freerun on the selected oscillator as described in section 2.2.3. Note than when the *Genlock Range* is set to *Wide*, the freerun drift upon loss of reference will be much higher. When the NTSC reference is re-applied the *Lock Type* menu selection controls how the 5601MSC will respond to re-align its internal oscillator with the reference (see section 2.2.4).

2.2.9. PAL Video Genlock Operation
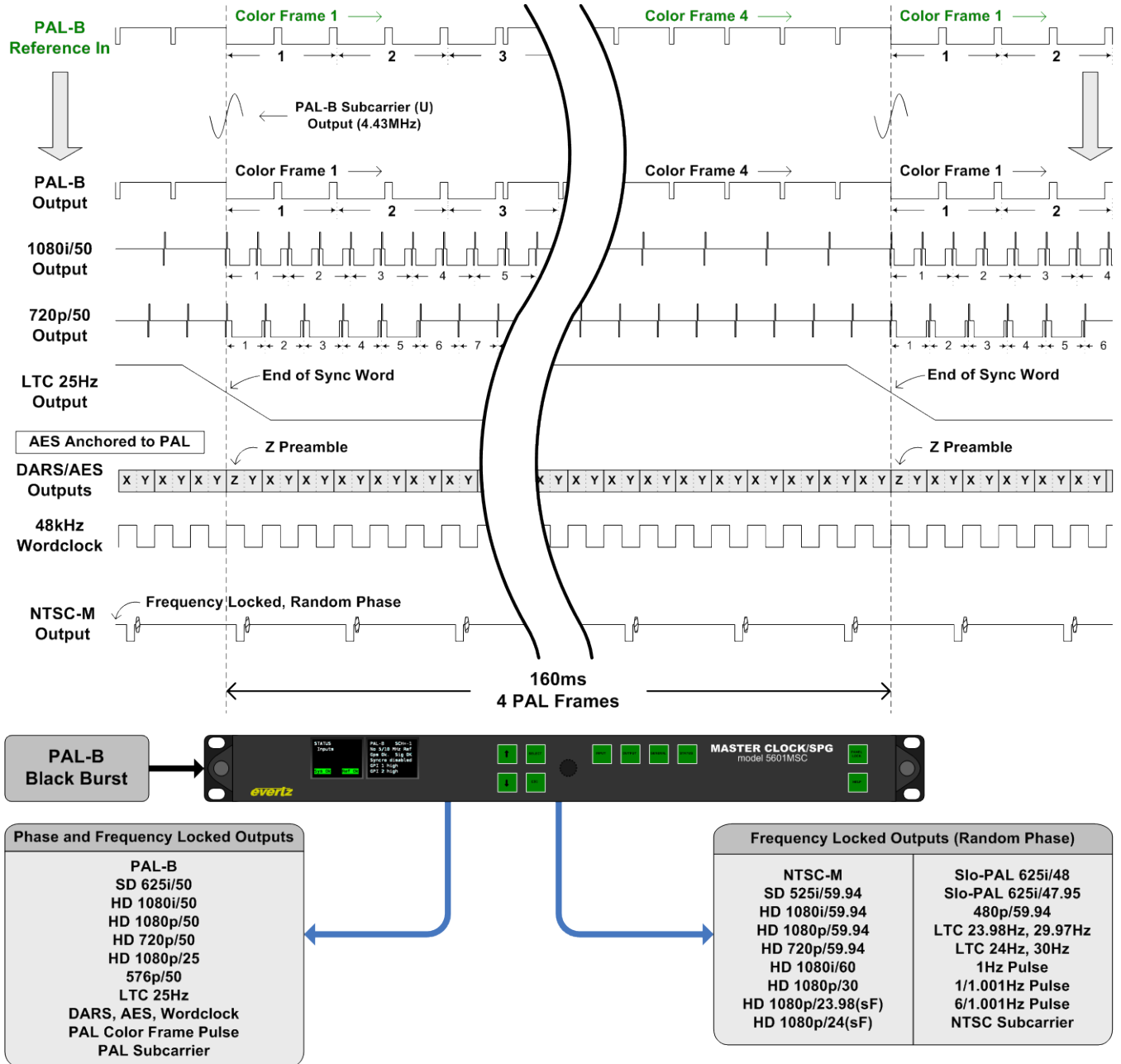
Figure 2-10: Lock Diagram #3 - PAL Genlock

Refer to Figure 2-10 for the timing relationship of signals when the 5601MSC is locked to a PAL black burst reference. The color frame sequence is decoded from the PAL reference and provides a 4 frame phase reference. As with NTSC references, the 5601MSC locks to both the horizontal sync edges and colorbursts of the PAL reference. If the Subcarrier to Horizontal sync error is higher than 30º the 5601MSC will fall back to horizontal sync edge locking only. If the SCH error is higher than 50º, or the colorburst cannot be measured, the unit will report that the reference is unlockable. See section 4.1.2 for details on the *Inputs* status screen.

When the 5601MSC is provided with a PAL reference, the AES/DARS outputs can be deterministically phase aligned. This is because an even number of AES samples are generated during each frame of the PAL reference. Exactly 1920 AES frames fit into a single PAL frame. The *AES/DARS/WC lck* menu item should be set to *PAL/integer* to assure that the AES/DARS outputs are anchored to the PAL reference. Because the AES signal coincides with the PAL signal on every frame, the phase of the AES/DARS outputs will be the same between multiple 5601MSC units that are locked to PAL. In addition, the AES block length of 192 frames is evenly divisible into a single PAL frame so the start of an AES block (identified by the Z preamble) will correctly align to line 1 of the PAL reference (as illustrated in lock diagram #3 of Figure 2-10).

A PAL reference provides enough information for phasing of 50Hz and 25Hz standards, but does not provide a long enough phase period to deterministically phase 60Hz or 24Hz standards. The standards that can be phased properly are listed at the bottom of lock diagram #3 (Figure 2-10). The HD standards listed apply to both the HD test generators and the tri-level sync outputs. The serial digital video test generator outputs are phased according to SMPTE compliant timing, which may differ from the timing shown on Tektronix equipment. See the note in section 2.2.6.

If the PAL reference is lost, the unit will freerun on the selected oscillator as described in section 2.2.3. Note that if the Genlock Range is set to Wide, the freerun drift upon loss of reference will be much higher. When the PAL reference is regained, the *Lock Type* menu selection controls how the 5601MSC will respond to re-align its internal oscillator with the reference (see section 2.2.4).

2.2.10. HD Tri-Level Genlock
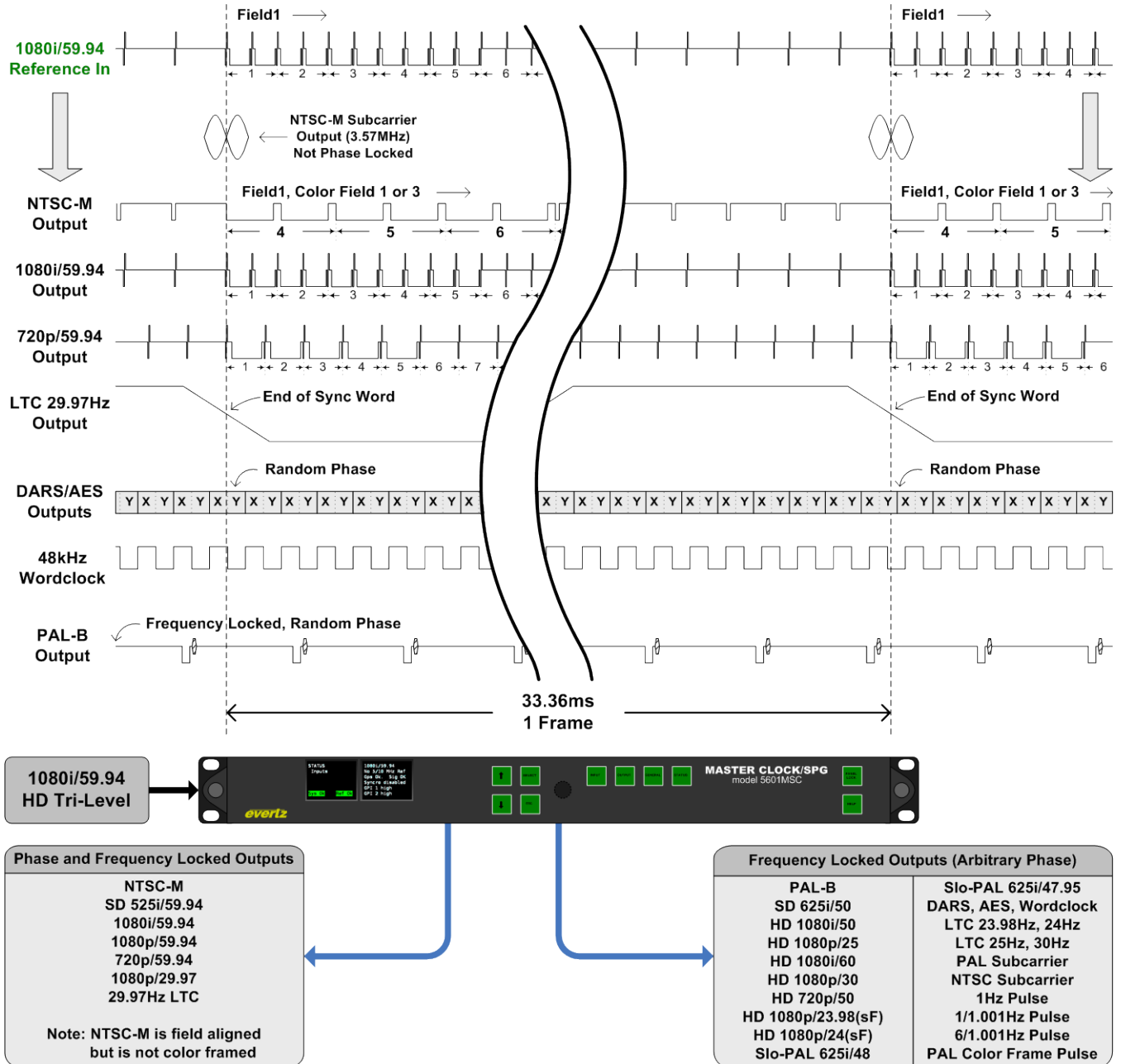
Figure 2-11: Lock Diagram #4 - HD Tri-Level Genlock Operation

The 5601MSC can lock to several different HD analog tri-level signals. The main oscillator frequency is locked to the rising edge of the tri-level waveform. The phase information provided by tri-level reference signals is limited and each signal standard can only be used to deterministically phase lock standards of a similar frame rate. Lock diagram #4 above gives an example for 1080i/59.94 tri-level sync. Refer to Table 2-5 for a summary on the phase locking capability with other tri-level references.

It should be noted that tri-level references do not supply enough phase information to color frame NTSC-M or PAL-B sync outputs. When multiple 5601MSC units are locked to a tri-level source, the black burst outputs from either unit cannot be guaranteed to have the same color frame phase. As such, the subcarrier outputs of the two units may also not be in phase with each other.

For tri-level sync standards that run at a fractional rate (i.e. 1080i/59.94, 720p/59.94) the AES, DARS, and Wordclock outputs cannot be deterministically phase locked. This is because only one frame of phase information is provided by the tri-level reference. For these standards, the AES/DARS, and Wordclock outputs cannot be guaranteed to be the same phase between different units, or that the phase will remain the same if the 5601MSC is restarted.

Reference	Phase Locked Outputs
1080i/60	1080i/60, 1080p/60, 720p/60, AES/DARS, 30Hz LTC
1080i/59.94	NTSC, 525i/59.94, 1080i/59.94, 1080p/59.94, 720p/59.94, 480p/59.94, 29.97Hz LTC
1080i/50	PAL, 625i/50, 1080i/50, 1080p/50, 720p/50, 1080p/25, 576p/50, AES/DARS, 25Hz LTC
720p/60	720p/60, 1080p/60, AES/DARS
720p/59.94	720p/59.94, 1080p/59.94, 480p/59.94
720p/50	720p/50, 1080p/50, 576p/50, AES/DARS
720p/24	625i/48, 720p/24, 1080p/24, 1080p/24sF, AES/DARS, 24Hz LTC
1080p/23.98	625i/47.95, 1080p/23.98, 1080p/23.98sF, AES/DARS, 23.98Hz LTC
1080p/23.98sF	625i/47.95, 1080p/23.98, 1080p/23.98sF, AES/DARS, 23.98Hz LTC
1080p/24	625i/48, 720p/24, 1080p/24, 1080p/24sF, AES/DARS, 24Hz LTC
1080p/24sF	625i/48, 720p/24, 1080p/24, 1080p/24sF, AES/DARS, 24Hz LTC
1080p/25	PAL, 625i/50, 1080i/50, 720p/50, 1080p/25, 576p/50, AES/DARS, 25Hz LTC

Table 2-5: Phase Locking to HD Tri-Level Standards

2.2.11. Slo-PAL Genlock

The 5601MSC supports two Slo-PAL references to provide an ability to lock film-rate standards while using a common analog sync format (PAL). The two standards supported are 625i/48 for use with 24Hz film standards and 625i/47.95 for use with 23.98Hz film standards. With Slo-PAL references, the 5601MSC locks its frequency to the horizontal sync edges and uses the vertical sync for phasing. See Table 2-6 for phasing ability of each reference type.

With a Slo-PAL reference, the AES/DARS outputs can be properly phase aligned since the number of AES samples (48,000 per second) is evenly divisible by Slo-PAL frame rates. There are exactly 2,000 AES samples generated for each frame of 48Hz Slo-PAL. Exactly 2,002 AES samples are generated for each frame of 47.95Hz Slo-PAL.

Note that a 47.95Hz Slo-PAL reference does not provide enough phasing information to deterministically lock the 6/1.001Hz pulse output. When multiple 5601MSC units are referenced to a 47.95Hz Slo-PAL signal, the 6/1.001Hz pulse outputs are not guaranteed to be lined up.

Reference	Outputs Phased Deterministically
625i/48	625i/48, 720p/24, 1080p/24, 1080p/24sF, AES/DARS, 24Hz LTC
625i/47.95	625i/47.95, 1080p/23.98, 1080p/23.98sF, AES/DARS, 23.98Hz LTC

Table 2-6: Slo-PAL Phase Locking

2.2.12. Continuous Wave and Internal References
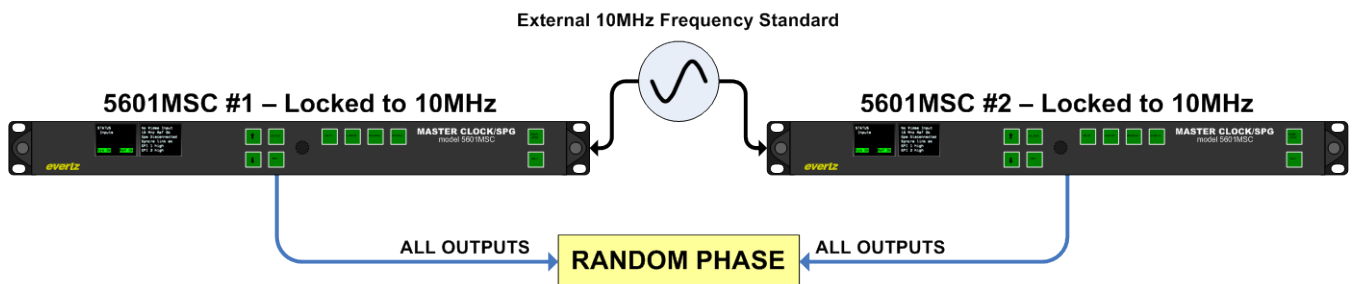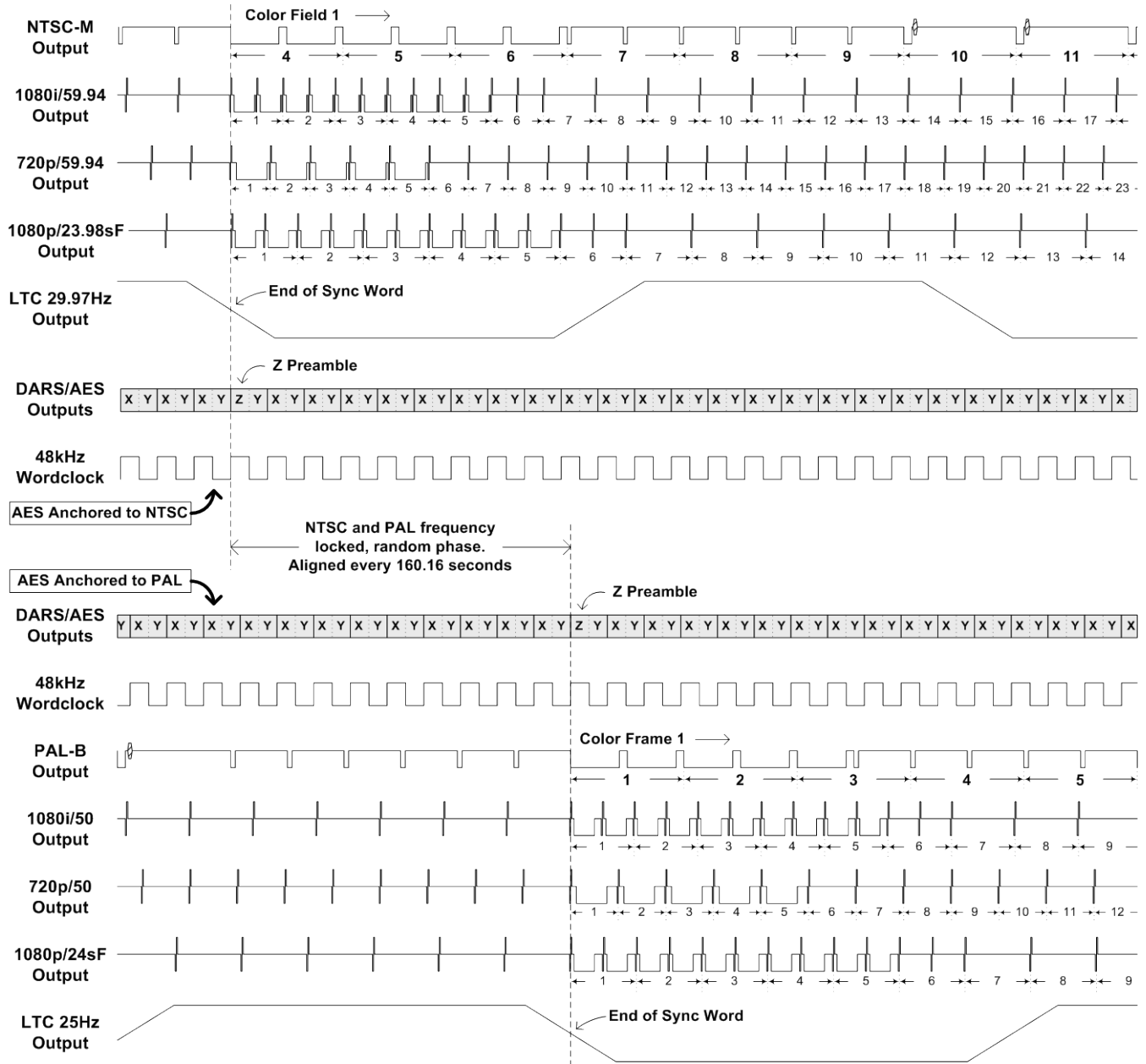
Figure 2-12: Lock Diagram #5 - 10MHz and Internal Frequency References

The 5601MSC can use either 10MHz or 5MHz continuous wave (CW) frequencies as a reference. These signals are applied to the reference input BNCs and the frequency is automatically detected by the 5601MSC. With CW signals, the main oscillator frequency is locked to the incoming reference but absolutely no phasing information is supplied. The 5601MSC will arbitrarily pick an internal phase reference point once frequency lock is obtained. Lock diagram #5 (Figure 2-12) illustrates the generation of signals when locked to a reference that provides no phasing information.

While outputs of the same standard will be phased correctly to each other, they will not be phased deterministically. The outputs of multiple units locked to a CW reference cannot be guaranteed to be in phase. Furthermore, if the 5601MSC unit is restarted the phase relationships can change as a new phasing point is chosen. Likewise if the CW reference is lost, any drift accumulated during the time the reference is absent cannot be corrected for once the reference is regained.

In order to align the output phase of two 5601MSC units that are locked to a stable CW reference, the *Ten MHz Global Phase* controls can be used. See section 2.1.5 for more information. When the *Ten MHz Global Phase* is enabled, the 5601MSC outputs can be phased manually to align them with another source. In this configuration, the unit will maintain a stable phase relationship as long as the CW reference is uninterrupted and the unit is not restarted. If a restart does occur, the 10MHz Global Phase controls are automatically disabled and reset to zero at startup.

When a CW reference is used, the phase of the DARS and AES outputs can be anchored to either NTSC or PAL standards. This is chosen using the *AES/DARS/WC lck* menu item in the *AES Audio* menu. This menu item should be set to the dominant video standard that will be used in the particular installation.

When the CW reference is lost, the 5601MSC will free-run on its active oscillator, selected by the *Genlock Range* menu item (see section 4.3.2). The *Lock type* menu item controls how the 5601MSC responds when the reference is regained (see section 2.2.4).

2.2.12.1. Internal Frequency Reference

When *Internal Ref* is selected for the frequency reference, the 5601MSC will free-run on the 10MHz output of its high-stability OCXO oscillator, regardless of the *Genlock Range* menu item setting. The locking operation is similar to when locking to CW signals. The 5601MSC will pick an arbitrary phase reference to generate all outputs. This phase reference will be different between multiple 5601MSC units set to free-run, and will change if the unit is restarted.

The output phase of a 5601MSC that is running off its internal reference can be adjusted by using the *Internal Global Phase* controls. When enabled, these controls will allow for **temporarily** bringing a free-running 5601MSC into phase with another piece of equipment. Although the internal oscillator of a 5601MSC is very stable, it will inevitably drift away from another reference due to the slight variation in frequency of its internal oscillator.

2.2.13. GPS Frequency Reference
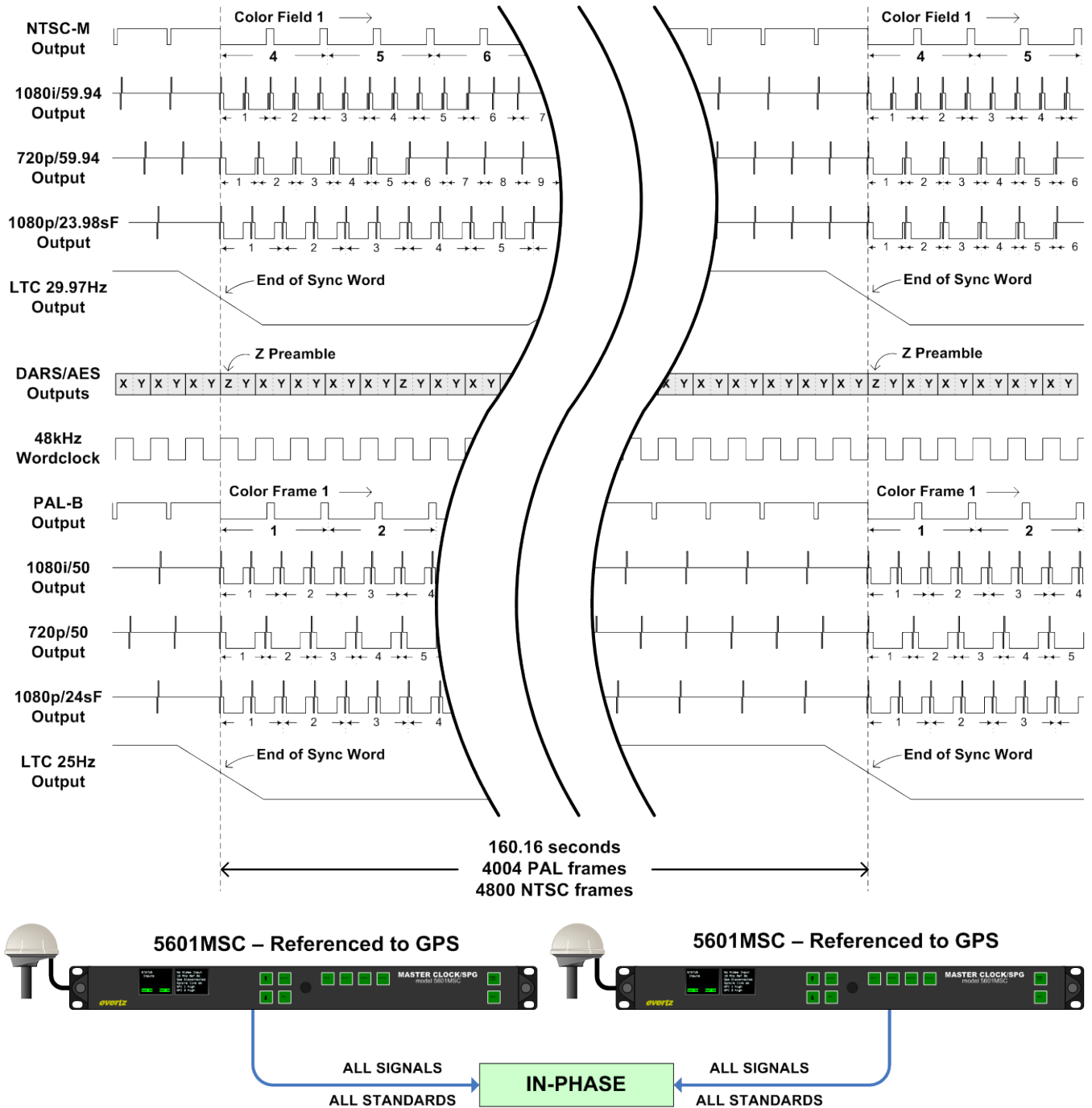
Figure 2-13: Lock Diagram #6 - GPS Frequency Reference

When the 5601MSC has been ordered with a GPS receiver (GP option), the unit can lock in frequency and phase to the high-accuracy timing provided by the GPS satellites. The main oscillator frequency is locked to the 1 pulse per second (PPS) timing pulse provided by the receiver. Because of the low rate of this timing pulse, only the high-stability OCXO oscillator can be used and the *Genlock Range* control will be forced to Narrow regardless of the menu setting.

The GPS receiver also provides highly accurate time. The 5601MSC uses the time information to set the phase of all outputs. This is done by choosing a moment in GPS time when all standards started at their initial phase. By working backwards to that moment, the instantaneous phase of any standard can be determined for any point in time. This allows true deterministic cross-standard phasing. See Figure 2-13 for the timing relationship between multiple standards when locked to GPS.

> **Because the 5601MSC uses GPS time to determine the phase of the outputs, the time reference will be forced to use GPS, regardless of the time *Reference Src* menu item setting.**

Using GPS as a frequency reference is the only way to guarantee that all outputs across multiple standards will be phased to each other across multiple units. Furthermore, when two 5601MSC units are separated by a large distance, using GPS receivers can assure they will be phased to within 100ns of each other. Note than when using multiple units the antenna cable lengths should be matched as closely as possible to eliminate any cable length propagation delay effects that may cause phase errors between them.

If the GPS receiver is unplugged, or if the number of satellite signals being received drops to 0, the 5601MSC will free-run on its high stability OCXO. The *Lock type* menu item controls how the unit will respond when the GPS signal is restored (see section 2.5.3). When the unit first starts up, the phase of its outputs are random until GPS lock is acquired. Refer to section 2.5.2 for more information on how the 5601MSC locks when using the GPS receiver as a reference.

While GPS provides a convenient way to lock the 5601MSC in all standards simultaneously and ensure extremely good frequency accuracy, there can be issues dealing with limited availability and phase errors. A GPS reference can be described as a "soft" lock. As more satellite signals are discovered, the phase accuracy of the GPS lock improves. However, there will always be some "wander" associated with GPS lock due to uncontrolled variables such as atmospheric disturbances and terrestrial interference. This can cause problems when two different units are locked to separate GPS receivers.

Under ideal conditions, with 8 satellite signals being received, the maximum wander in phase between two units locked to two separate GPS antennas can be up to 15ns. This is greater than the duration of a single sample of serial digital HD video which may cause problems for router installations that require sample-accurate timing. During poor weather conditions, the satellite signal strength will drop which will cause fewer satellite signals to be available for phase corrections. This is why mounting of the GPS receiver is extremely critical in order to get the best phase locking performance. If the receiver does not have a clear view of the sky or is subject to multipath interference due to reflections off buildings, the phase wander between units can quickly climb to unacceptable levels. The unpredictability of such variations can be difficult to troubleshoot so these characteristics must be taken into account during the design phase of any system.

2.3. TIMEKEEPING

The 5601MSC contains a **system clock** to keep track of time and date. The *stability* of this clock is equal to the selected frequency reference. The *accuracy* of this clock is determined by the selected time reference and lock mode. The 5601MSC can access time references through the GPS receiver, modem dial-up, syncro connection to another 5601MSC, LTC input, SNTP, or VITC read from a black burst reference. See section 2.3.3. The **system clock** should always be set to Coordinated Universal Time (UTC). See section 2.3.2 for a note on UTC. Time zone offsets can be applied to the timecode outputs to provide local time.

The **system clock** is synchronized to the selected time reference by performing a *time jam*. This is different than the continuous PLL process that is used for frequency references. The **system clock** in the 5601MSC runs independently at the frequency provided by the **master oscillator**. Ideally, once the **system clock** has been set, it should keep perfect time forever. In practice stability errors, however slight, creep in and accumulate over time. Even when locked to GPS or an atomic frequency standard, leap seconds will occur in UTC time requiring the **system clock** to be occasionally adjusted.

The 5601MSC has several timecode outputs, each of which possess their own clock that runs independently from the **system clock**. Each of the two LTC outputs and each sync output (including 10MHz and Wordclock) and test generator output have their own independent clock. The timecode clocks are synchronized to the **system clock** once a day at user specified times. This allows for timecode rates that do not count in real-time. Note that NTP and IRIG time is derived directly from the **system clock**.
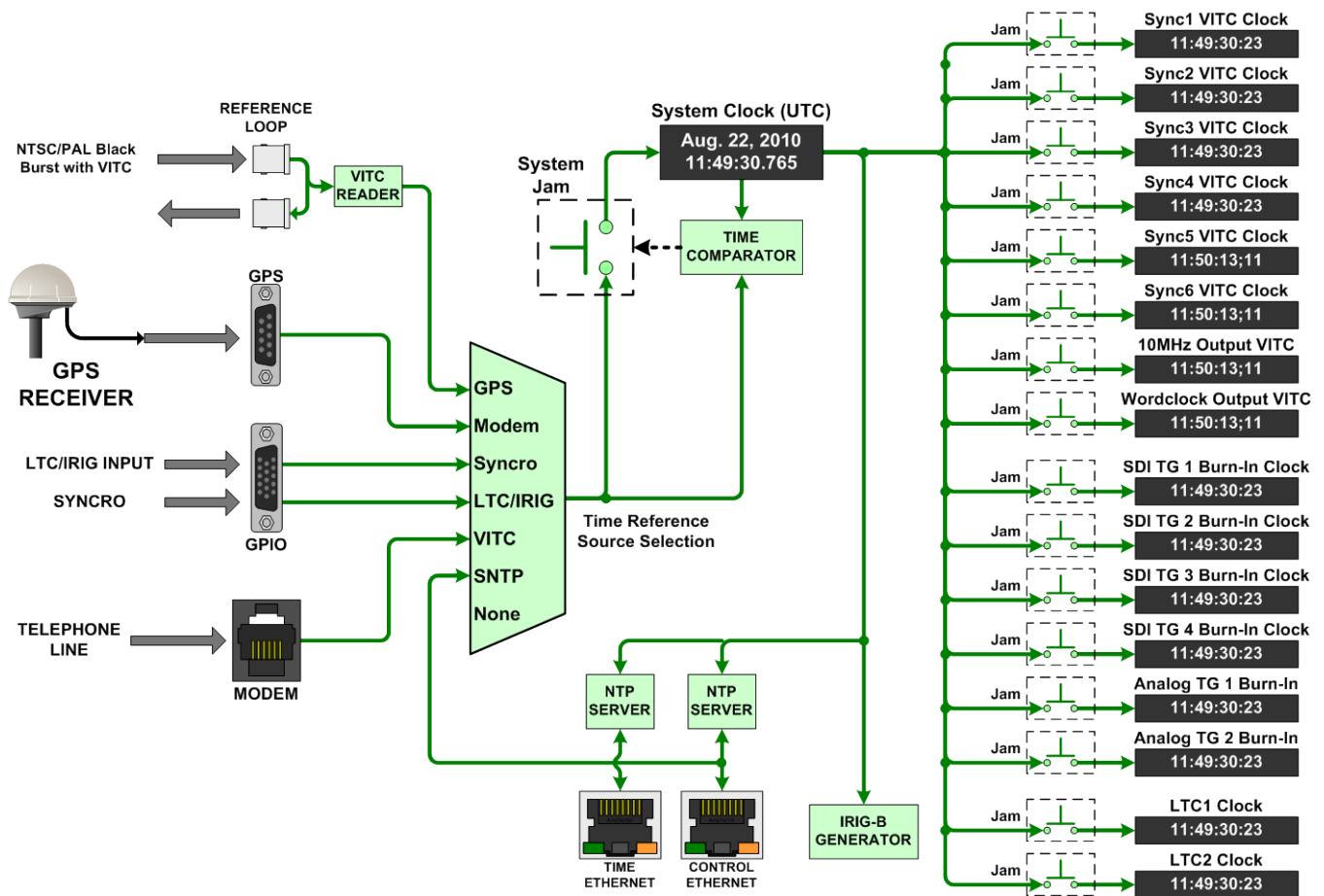
Figure 2-14: Time Locking Block Diagram

The **system clock** time/date is constantly compared to the time/date that is provided by the selected time reference. Whenever a significant difference is detected, a *system time jam* will be required to bring the **system clock** back into sync with the time reference. A *system time jam* effectively jams the time and date acquired from the time reference into the system clock. This effect ripples to all timecode output clocks jamming them as well. Exactly when a *system time jam* is allowed to take place is determined by the *Lock Type* that is selected (see section 4.3.10). The amount of difference between the **system clock** and the time reference must exceed a certain threshold before a system time *jam* is declared necessary. This threshold is different for each time reference type.

2.3.1. Time Lock Types

The 5601MSC **system clock** runs independently from the time reference. When a difference that exceeds the threshold is detected between the **system clock** and the time reference, a time jam is required to set the system clock to the time reference. How and when such a *jam* occurs is configured by the *Lock Type* menu item located in the *Time* menu off the **INPUT** root menu. The three *jam* modes are shown below with detailed descriptions.

```
INPUT                    User
 Time                    Never
  Lock Type             >Always


Sys Ok       Ref Ok
```
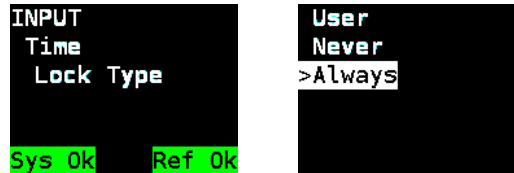
Always - Whenever the **system clock** is different than the time reference**,** a *jam* will automatically be performed. In this mode, the **system clock** will continuously track the time reference. Any change in the time reference will immediately affect all timecode clocks. This mode is most useful when the time reference is known to be reliable and stable such as with GPS.

Never - In this mode, the time comparator is effectively shut off and the **system clock** will run independently from the time reference. No jam warnings will be generated. It is still possible to synchronize the system clock to the time reference by performing a manual time *jam*. This mode is useful when a time reference is not being used or is not always available.

User - When the time comparator detects a difference between the **system clock** and the time reference, it will notify the operator with a jam warning. The message "TIME JAM NEEDED" will be displayed on the front panel, and optionally an SNMP trap can be sent. The operator can then decide if and when to perform a *jam* in order to cause minimum disruption to systems. This mode should be selected when the time outputs of the 5601MSC require absolute minimum disruptions.

Daily - The time comparator is shut off in this mode. A *jam* will be performed once a day at the time specified by the *Input Jam Time* control. This way the **system clock** can be brought into sync with the reference regularly, at time of day when any disruptions would go unnoticed. This mode is not applicable when time source is MODEM.

> ✎ **When the Time Reference is set to SNTP, the Time Lock Type is forced to Daily.**

> ✎ **A manual time jam can be initiated using the *Jam Time* menu item (see section 4.3.12). When a *time jam* is performed, all timecode clocks are also *jammed*. Exercise caution before initiating a *jam*.**

2.3.2. Coordinated Universal Time (UTC)

Coordinated Universal Time (UTC) is used worldwide as the basis of civil time and runs at the same rate as International Atomic Time (TAI). Unlike atomic time, Coordinated Universal Time is kept within one second of *mean solar time*, or Greenwich Mean Time (GMT). The rotation of the earth is very slightly slowing which causes the solar day to lengthen by a fraction of a second. This introduces a slight error between atomic time and solar time. Over weeks, months, and years, the error can add up until atomic time is a full second ahead of solar time. Because UTC runs at the same rate as atomic time, it must be slowed down if it is to match solar time.

Leap seconds are introduced periodically and cause UTC clocks to count one extra second in a day to slow them down. The rotation of the earth is unpredictable which means the need for a leap second cannot be predicted more than six months in advance. If a leap second is necessary, it will occur at the end of the day usually on either June 30th, or December 31st. Refer to www.iers.org for more information and bulletins on upcoming leap seconds. Leap seconds can cause complications with 25Hz LTC or PAL VITC. See the timecode note in section 2.3.4.2.3 for more information.

The 5601MSC expects that the time reference provides UTC time. This is a requirement for the NTP server or modem hosting using the NRC protocol. When either of these options are utilized, the time reference source must provide UTC time.

2.3.3. Time Reference Sources

The **system clock** can be referenced in one of several ways. The reference type is selected in the *Time* menu located in the **INPUT** root menu. The *Reference Src* menu item is used to select between GPS, Modem, Syncro, LTC, VITC, IRIG, SNTP and None. See sections 2.3.3.1 to 2.3.3.8 for detailed descriptions of each time reference type. Note that the time reference will be forced to GPS if the frequency reference has been set to GPS, no matter what has been selected here.

```
INPUT                    >GPS
 Time                     Modem
  Reference Src           Syncro
                          LTC
                          VITC
Sys Ok      Ref Ok        None
```
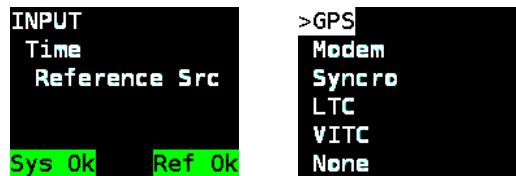
2.3.3.1. GPS Time Reference

When GPS is selected as the time reference, time and date are obtained from the GPS receiver that is connected to the 5601MSC. The GPS time provided by the receiver is then converted to UTC time by adding leap seconds. This time reference is extremely accurate and once the **system clock** has been jammed to the GPS receiver, it should remain in sync for a very long time without requiring further jams, provided the selected frequency reference is also accurate.

Of all the time reference sources, GPS is the most accurate and reliable. When a difference of greater than 2 milliseconds is detected between the **system clock** and the time from the GPS receiver, the 5601MSC will generate a *jam* event or jam warning, depending on the Lock Type setting. Such a difference can be caused by accumulated stability errors or by the introduction of a leap second. For information on installing the GPS receiver and a detailed description of its operation see section 2.5.2.

> **When the frequency reference has been set to GPS, the time reference is also forced to GPS.**

2.3.3.2. Modem Time Reference

If the 5601MSC has been equipped with a modem module, it can receive time and date by dialing into a high-level time standards service. The two protocols supported at this time are NIST Automated Computer Time Service, and NRC Computer Time & Date. The modem is configured using the *Modem* menu in the **GENERAL** root menu as described in section 4.5.6.

After a time service has been selected, the phone number is entered and the 5601MSC can be configured to automatically dial at a specific time once a day or once a week. The dial time should be selected so that any correction to the **system clock** will cause minimum disruption. The modem can also be dialed manually.

When the modem dials successfully into a time standards service, it subtracts the round-trip delay and *jams* the **system clock** and all timecode clocks to within a few milliseconds of UTC. If the call fails, it can be configured to retry a number of times until a successful negotiation is achieved.

Upon acquiring valid time, a countdown timer is started and the **system clock** is considered valid for a period of 10 days. If the timer expires before another successful dial-up then the **system clock** will be considered unlocked. This will generate a time reference fault and also affect NTP packets being sent out by the NTP server.

See section 4.5.6 for information on configuring the modem. Section 4.1.2 describes the modem status screen. In NRC mode, the modem can also be configured to answer calls and act as a time service host no matter which time reference is selected.

NIST ACTS: http://www.nist.gov/physlab/div847/grp40/acts.cfm
NRC: http://www.nrc-cnrc.gc.ca/eng/services/inms/time-services/time-date.html

2.3.3.3. Syncro Time Reference

When two 5601MSC units are connected through a 5601ACO2 automatic changeover, a syncro connection is established. Syncro is enabled using the *Syncro* menu item in the **GENERAL** root menu. One of the 5601MSC units is designed the master and the other is the slave. The slave unit can receive time and date from the master unit through syncro. See section 3.4 for information on syncro.

Syncro allows two 5601MSC units to share a single time reference such as GPS. The timestamp is passed through the syncro connection and guarantees that the system clocks of the two units will be synchronized. If the system clock of the slave units drifts more than 20 milliseconds from the master unit, the slave unit will generate a *jam* event or jam warning, depending on the *Lock Type* setting. If the syncro link is lost the slave unit will report a time unlocked fault.

2.3.3.4. LTC Time Reference

The 5601MSC can obtain time and date from an LTC input present on the GPIO DB15 connector. See section 3.1.7 for wiring information. All output frame rates in Table 2-7 are supported as references. Note that non real-time rates such as 23.98 and 29.97 nondropframe should be used with caution. See section 2.3.4.1 for information on using dropframe timecode and the considerations required.

Date information can be decoded from the user bits (binary groups) of the LTC input. There are several date formats in use and the date decoding method can be selected using the *VitcLtc Date* menu item. Automatic detection of the date format is reliable for Legacy and SMPTE formats but may not work well for Production date formats. If the user bits of the incoming LTC are not defined, or do not contain date information the date decoder must be disabled (put into *No date* mode) to prevent false date decoding and spurious *jam* events. When date decoding is disabled, the date can be set manually using the *Set System Date* menu item located in the **GENERAL** root menu.

The 5601MSC will continuously compare the **system clock** to the incoming LTC time and date. When a difference of more than 2 milliseconds is detected the 5601MSC will generate a *jam* event, or a jam warning depending on the *Lock Type* setting. When a *jam* event occurs, the time read from the LTC input is jammed into the **system clock**. At the same time, the LTC input time is jammed into the timecode output clocks.

When the incoming LTC is jammed into a particular output timecode clock, it may be adjusted to maintain color frame alignment and to match the output frame rate. See section 2.3.4.2 for more information. If a particular timecode output is the same frame rate as the incoming LTC, the time is copied directly into the output's clock. If the timecode output is running at a different frame rate than the LTC input, then the time is rounded to the nearest frame before being jammed into the output's timecode clock.

2.3.3.5. VITC Time Reference

The 5601MSC can read Vertical Interval Time Code (VITC) from a SMPTE ST 318 compliant color black signal that is applied to the reference loop input. The VITC can be on any line of the incoming color black video from line 6 to line 31. The VITC reader line is set by the *Vitc Line* menu item. The 5601MSC can read 25Hz VITC extracted from a PAL-B reference signal, and 29.97Hz dropframe VITC extracted from an NTSC-M reference signal. See section 2.3.4.2 for information on using dropframe timecode.

Date information can be decoded from the user bits of the VITC. The date format is selected using the *VitcLtc Date* menu item. The automatic detection mode works well for Legacy and SMPTE formats, but may not work reliably for Production date formats. If there is no date information on the incoming VITC

or if the user bits are being used for another purpose, the date decoder must be disabled by setting it to *No Date*. This prevents false date decoding that may trigger spurious *time jam* events or warnings. When the date decoder is disabled, the date can be manually set using the *Set System Date* menu item in the **GENERAL** root menu.

The 5601MSC will continuously compare the **system clock** to the incoming VITC timecode. When a difference of more than 2 milliseconds is detected the 5601MSC will generate a *jam* event, or a jam warning depending on the *Lock Type* setting. When a *jam* event occurs, the time read from the VITC input is jammed into the **system clock**. At the same time, the VITC input time is jammed into the timecode output clocks.

When the incoming VITC is jammed into a particular output timecode clock, it may be adjusted to maintain color frame alignment and to match the output frame rate. See section 2.3.4.2 for more information. If a particular timecode output is the same frame rate as the incoming VITC, the time is copied directly into the output's clock. If the timecode output is running at a different frame rate than the VITC input, then the time is rounded to the nearest frame before being jammed into the output's timecode clock.

> **In order to use VITC as a time reference, the frequency reference must be set to** *Video*.

2.3.3.6. IRIG Time Reference

When the *IRIG* option is installed, the 5601MSC will be able to read IRIG-B timecode that is applied to the LTC input on the GPIO connector. The IRIG type is auto-detected. Refer to section 2.3.5 for more information on the IRIG-B formats supported and how to connect IRIG to the LTC input. Only the IRIG-B124 and IRIG-B127 formats supply complete date information. If other formats are used, the system date will have to be set manually using the *Set System Date* menu item in the **GENERAL** root menu.

The **system clock** is continuously compared with the incoming IRIG timecode. When a difference of more than 5.5 milliseconds is detected the 5601MSC will flag that a time *jam* is required. The time *Lock Type* menu item controls how the 5601MSC responds when a time *jam* is needed. See section 2.3.1 for more information.

2.3.3.7. SNTP Time Reference

The 5601MSC can jam its **system clock** to an external NTP server. Unlike with other time references, this synchronization is not continuous and happens once a day. The time *Lock Type* is forced to *Daily*, and the *Input Jam Time* control sets the time of day the synchronization happens. Up to eight external NTP servers can be defined. All enabled NTP servers will be contacted and the server response with the best stratum and dispersion values will be chosen to jam the system clock.

2.3.3.8. No Time Reference

When the time reference source is set to *None*, the 5601MSC will ignore all time reference sources and the **system clock** will freerun. The time and date must be set manually using the *Set System Time* and *Set System Date* menu items located in the **GENERAL** root menu. It is recommended to set the system clock time to UTC rather than to local time. Local time can then be specified using a time zone offset from UTC on the timecode outputs. The IRIG-B124 and IRIG-B127 formats also include the current year as a two-digit number (e.g. 2011 = 11).

The "eyeball and wristwatch" method of setting the **system clock** cannot be considered accurate time. The NTP server will report an unlocked condition (LI_Alarm) unless spoofing is enabled. See section 2.4 for more information.

2.3.4. LTC and VITC Timecode

The primary purpose of LTC and VITC timecode is to count frames. Each LTC count relates to one frame of video. The Linear Time Code output waveforms are aligned to video so that the end of the sync word lines up with the start of the field1 vertical sync. This occurs on line 4 for the NTSC standard, and line 1 for the PAL standard. Vertical Interval Time Code can be inserted onto any black burst sync output and is inserted onto a vertical blanking line once per field, twice per frame. See Figure 2-15 for LTC and VITC timing relationships. Note that VITC is inserted once per field allowing VITC timecode to count fields. LTC timecode has one count per frame and does not count fields.
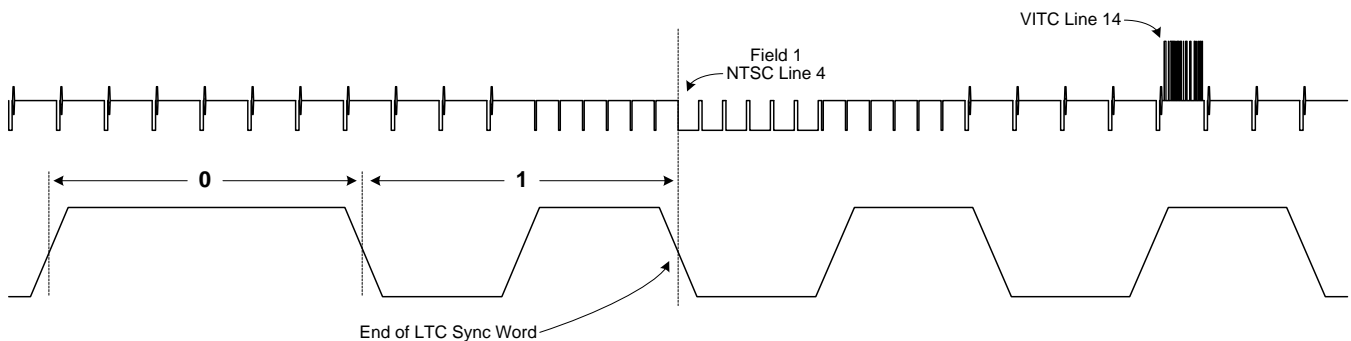
Figure 2-15: Detail of 29.97Hz LTC Waveform Alignment to NTSC Video

The LTC/VITC timecode rates supported by the 5601MSC are summarized in Table 2-7. All of these rates maintain alignment to their respective video standards. When VITC is inserted onto a PAL black burst sync output, it runs at 25Hz. When VITC is inserted onto an NTSC black burst sync output it runs at 29.97Hz. In addition to video alignment, the LTC and VITC timecode for the 25Hz and 29.97Hz rates can be adjusted to maintain color frame alignment as per SMPTE ST 12-1. Refer to section 2.3.4.2 for more information on how color frame alignment is performed.

Name	Counting Rate	Frame counts per second	Time to count one frame	Time to count one second worth of frames	Number of frame counts in a 24-hour period	Color frame Alignment
23.98 FPS	24/1.001 Hz	24	41.708 ms	1.001 seconds	2,073,600	No
24 FPS	24 Hz	24	41.67 ms	1 second	2,073,600	No
25 FPS	25 Hz	25	40 ms	1 second	2,160,000	PAL
29.97 FPS	30/1.001 Hz	30	33.367 ms	1.001 seconds	2,592,000	NTSC
29.97DF FPS	30/1.001 Hz	30	33.367 ms	1.001 seconds	2,589,408	NTSC
30 FPS	30 Hz	30	33.33 ms	1 second	2,592,000	No

Table 2-7: Supported LTC Frame Rates Summary

Relating LTC/VITC frame counts to real time can get quite complex. The LTC rates of 24Hz and 30Hz run at real-time and do not suffer from color frame alignment rules. They take exactly one second to reach their full count of either 24 or 30 frames. The 25Hz rate also runs at real-time but may be adjusted to maintain color frame alignment to PAL video (see section 2.3.4.2.3 for the implications of this).

The 23.98Hz and 29.97Hz rates run slightly slower than real-time. They take slightly longer than one second (1.001 seconds) to count a full second worth of frames. This means that every minute they will lag behind real-time by 0.06 seconds. Every hour they will be behind 3.6 seconds. After a 24-hour period they will be 86.4 seconds behind real-time. These rates are unsuitable for timekeeping purposes. They are only useful for counting frames.

2.3.4.1. Dropframe Counting

Because the 29.97Hz rate is used extensively as timecode for video reference signals, a method was developed to allow reasonably precise time keeping with the non real-time rate. This method involves dropframe counting. Since the 29.97Hz rate runs slower than real-time, dropframe counting skips over certain frame counts in order to periodically catch up to real time. Frame counts are always skipped over in pairs so as not to disrupt any color frame alignment. Two frame counts are skipped over at the beginning of every minute, except minutes 00, 10, 20, 30, 40, and 50. This pattern can be seen in Figure 2-16.

Dropframe counting ensures that 29.97Hz timecode accumulates just 86.4 milliseconds of error per day and always stays within 200 milliseconds of real-time. Figure 2-17 illustrates the drift and catch-up cycle that dropframe counting goes through over the course of a day. Real-time is represented by the solid X-axis in the graphs. See section 2.3.4.2.2 for information on synchronizing multiple dropframe timecode outputs.

To maintain a long-term correlation to real time, all LTC and VITC timecode outputs are *jammed* to the **system clock** once per day. This limits the amount of accumulated error for non real-time rates. Daily jamming is also required for real-time rates to prevent accumulation of stability errors and to keep synchronized should a leap second occur. The time at which this daily jam occurs is controlled by the *Jam Time* menu item present in all LTC and sync output menus. The daily *jam* should be scheduled to occur at a time when it would be least likely to affect system operation. The timecode clock will *jam* when the LTC or VITC timecode count matches the *Jam Time* value.
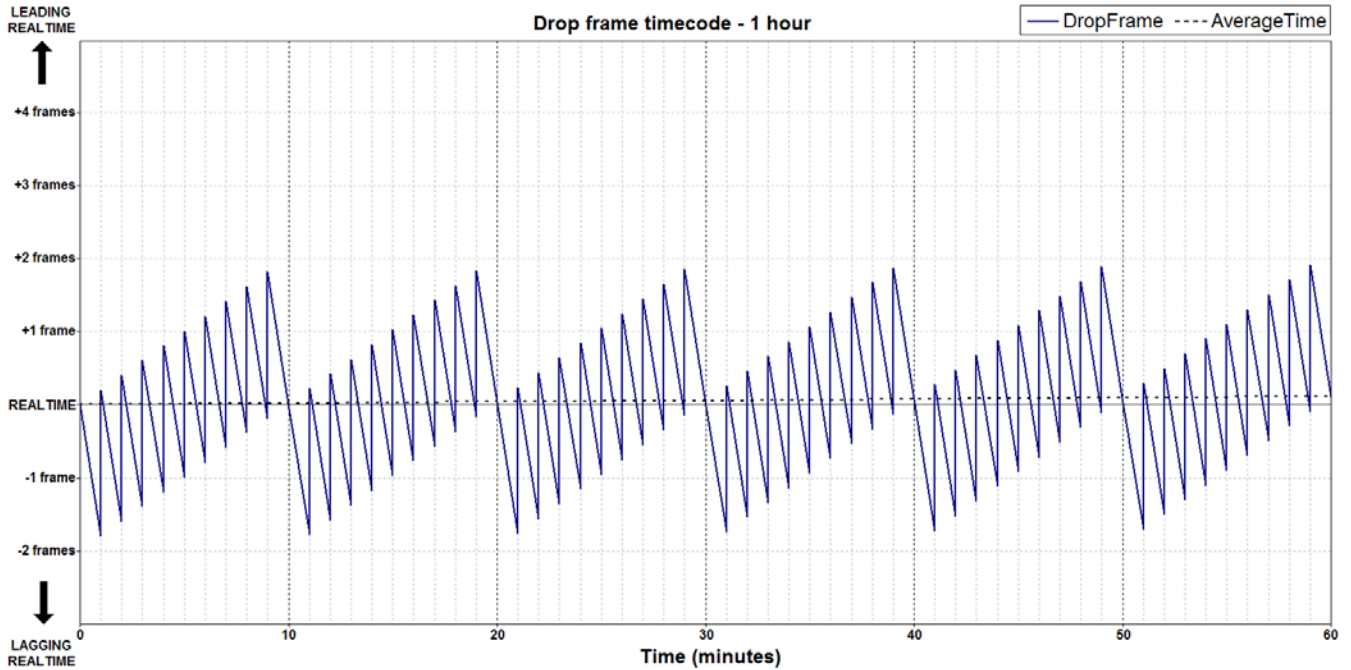
Figure 2-16: Dropframe Timecode with Respect to Real-time Over 1-Hour Period
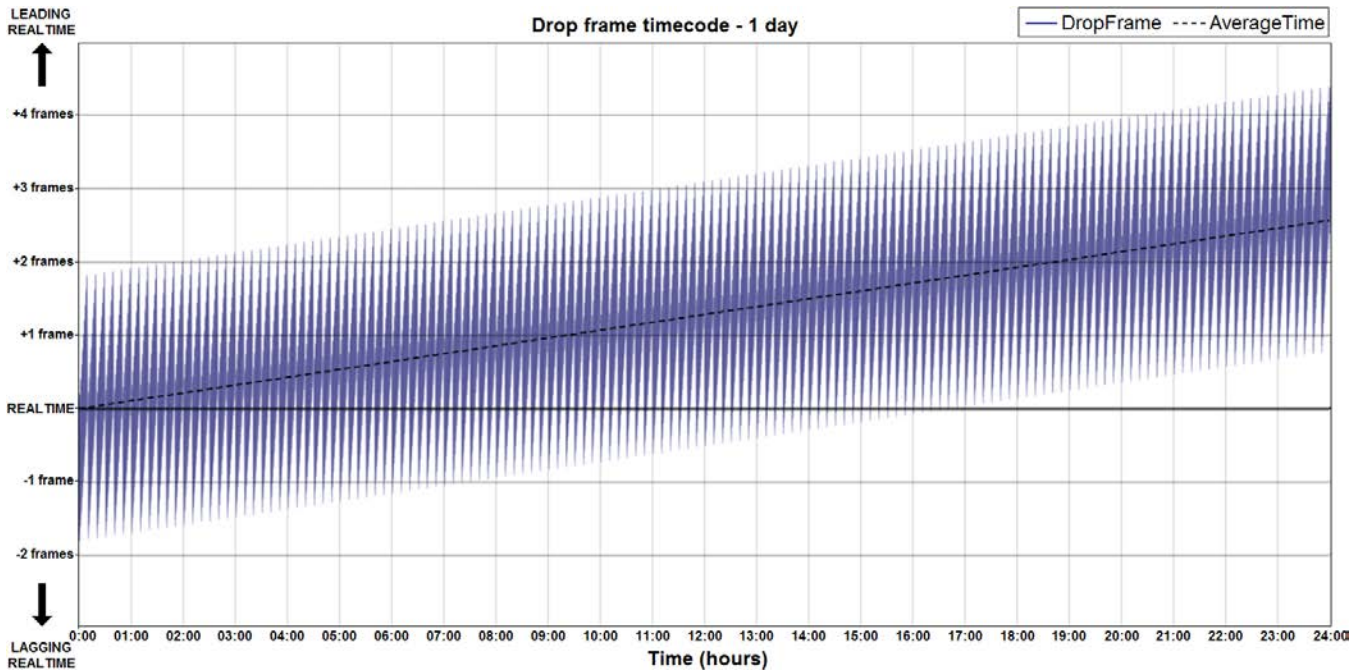
Figure 2-17: Dropframe Timecode with Respect to Real-time over a 24-Hour Period

2.3.4.2. LTC/VITC Timecode Color Framing

If the Color Frame control is turned on, the 25Hz and 29.97Hz LTC timecode rates will have their counts adjusted by the 5601MSC so that they maintain color frame alignment to the selected frequency reference as per SMPTE ST 12-1. If a black burst sync output has its Color Frame control turned on, the VITC timecode is adjusted to same way to maintain color frame alignment to that particular black burst sync output. See the pulse diagrams in Figure 2-4 and Figure 2-5 for examples of timecode color frame alignment.

2.3.4.2.1. Color Frame Alignment to NTSC

Color frame alignment can be enabled for any NTSC sync output and for LTC timecode that runs at 29.97 frames per second. Even frame counts must coincide with color fields 1 and 2. Odd frame counts must coincide with color fields 3 and 4. When a system time jam event occurs, the timecode output clock is jammed to system time and then adjusted, if necessary, to match the color frame phase of the particular LTC or sync output.

The consequence of color frame alignment is that the LTC/VITC timecode may be jammed one frame count off of real-time, depending on the phase of the frequency reference and the phase of the LTC or sync output. See Figure 2-18 for an example of daily time jamming involving dropframe timecode.

2.3.4.2.2. Multiple LTC/VITC Outputs with Dropframe Counting

It should be evident that dropframe timecode maintains only a loose correlation to real-time, and cannot always be jammed exactly to real-time. Dropframe timecode counts an entire 24-hour period 86.4 milliseconds faster than real-time. This is the equivalent of 2.59 frames of video. At the daily jam event, when the timecode clock is jammed to the system clock, some extra frame counts will have to be inserted to bring the timecode closer to real-time. It is not possible to adjust by fractional frame counts. Either 2 or 3 frame counts must be added, which means the timecode output cannot be jammed exactly to the system clock and some error will occur. If color frame alignment is enabled, the extra frame counts can only be inserted in pairs. Therefore, 2 or 4 frame counts will be inserted, depending on the error accumulated from the previous daily jam.

See Figure 2-18 for an example of a daily *jam* event for LTC1 in 29.97Hz dropframe counting mode. When the timecode of LTC1 hits the daily jam time, a *jam* to the real-time **system clock** is performed. However, the number of extra counts inserted is adjusted to maintain color frame alignment to the frequency reference (either GPS or NTSC). If the timecode output was VITC, the adjustment would also have to factor in any phase offset that may have been applied to the respective sync output.
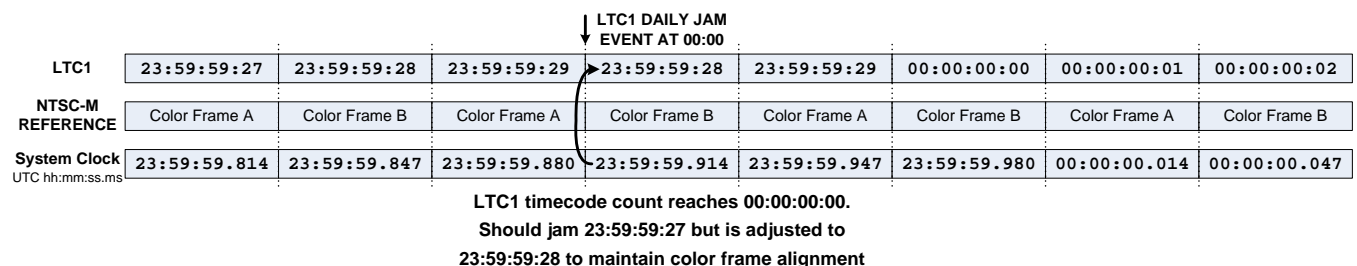
Figure 2-18: Daily Time Jam Event for 29.97Hz Dropframe Timecode

Every time the daily jam event occurs, the 5601MSC will attempt to bring the dropframe timecode as close to system time as possible, while optionally maintaining color frame alignment. The amount of frames adjusted depends on the error accumulated from the previous daily time jam. See Figure 2-19 for an example of a week worth of daily time jams on a dropframe 29.97Hz timecode output. The pattern of 2 frame and 4 frame adjustments runs over a period of a couple months.

If multiple timecode outputs are set to dropframe counting mode, it is possible that they may jam differently from each other at the daily time jam event, even if they are set to jam at the exact same time. This can occur if they were initialized at different times. To prevent this from happening, use the "Jam all VitcLtc" menu item which forces all timecode outputs to jam at the same instant. This manual jam is typically done at an innocuous time of day. There is currently no method of forcing multiple units to jam together at the same time. It can be expected that eventually a 2-frame offset may appear between dropframe timecode across multiple 5601MSC units.
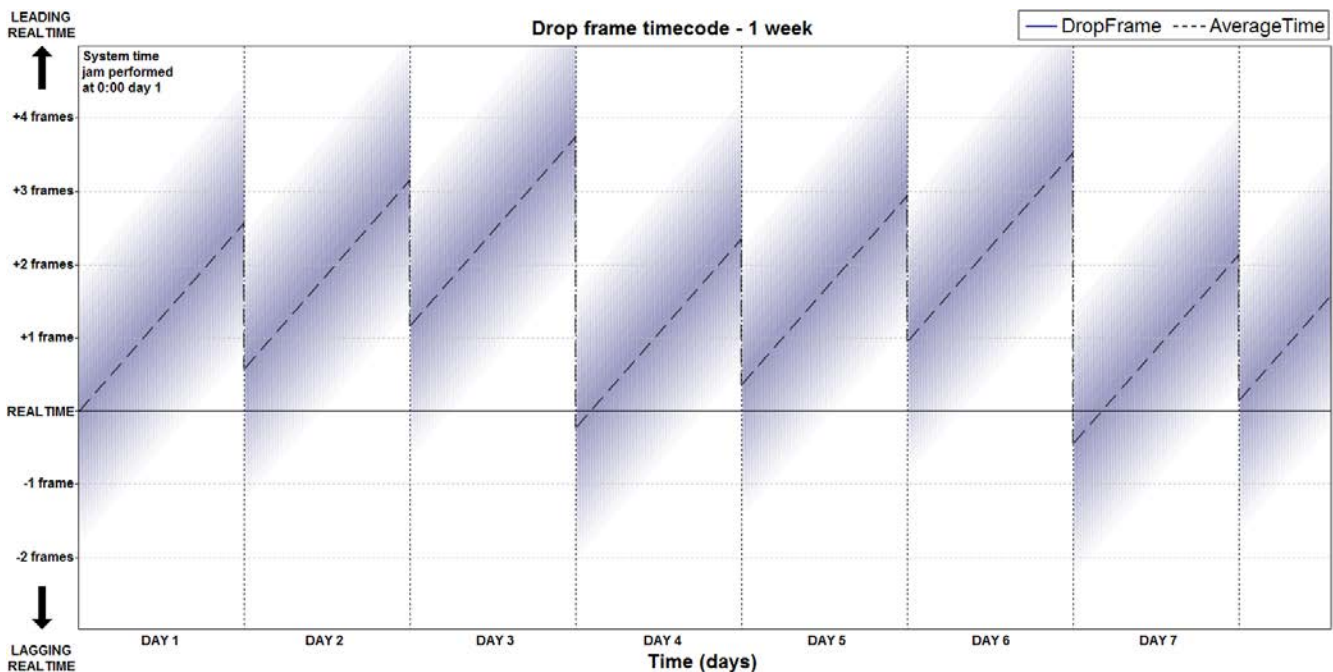
Figure 2-19: Dropframe Timecode with Respect to Real-time over One Week

2.3.4.2.3. Color Frame Alignment to PAL

Color frame alignment to PAL video can be enabled for 25Hz LTC timecode and for any PAL sync (VITC) output or PAL analog TG output (burn-in window). The 25Hz timecode runs at exactly real time which means it is always possible to *jam* the timecode output exactly to the **system clock**. However, the color frame alignment rule adds additional complexity. The color frame sequence in PAL runs over 4 frames (8 fields), which does not divide evenly into a 25 frame per second count. This means that color frame 1 lines up with the same frame count only once every four seconds. Therefore color frame alignment occurs once every 4 seconds.

When a time *jam* event occurs, the timecode output clock is jammed to the **system clock** and then may be adjusted up or down one or two frame counts to match the color frame phase of the reference or particular black burst sync output. If the frequency reference to the 5601MSC is not phased correctly with respect to the time reference this can cause a static one or two frame shift for 25Hz timecode outputs, with respect to the **system clock**.

If the frequency reference of the 5601MSC is set to GPS, the time reference will also be forced to GPS. The system phase reference is derived from GPS time, but the **system clock** is set to UTC time, which is offset from GPS time by the total number of leap seconds that have occurred since the year 1980. Because the PAL color frame to timecode relationship runs over 4 seconds, this produces a unique problem when aligning UTC-locked timecode to the PAL color frame.

The **system clock** of the 5601MSC is always set to UTC time. The PAL reference phase is tied to GPS time which is not affected by leap seconds. Whenever a leap second occurs, UTC time counts an extra second, slowing it down. At the next *jam* event, the PAL timecode clock could *jam* to the system clock causing it to shift backwards by one second. If done this way, it would break the timecode to color frame relationship. However, the 5601MSC must adjust the time that is jammed into the 25Hz LTC/VITC clocks in order to maintain color frame alignment. This means is that a static, positive or negative, 1 or 2 frame offset may be introduced between real time and 25Hz timecode even when the 5601MSC is locked to GPS. This static offset will change every time a leap second occurs.

2.3.5. IRIG Timecode

When equipped with the **IRIG** option, the 5601MSC is capable of generating IRIG-B timecode from the LTC outputs and can also read IRIG-B timecode on the LTC input. The IRIG-B formats supported are shown in Table 2-8. All IRIG-B formats are based on 100-bit timecode that is amplitude modulated with a 1kHz sine wave carrier. The differences between the four formats are in what additional information is carried besides the Time-of-Year timestamp. All control flag bits, if present, are set to zero.

Format Name	Information Carried
IRIG-B120	Time-of-Year, Control Flags, Straight Binary Seconds
IRIG-B122	Time-of-Year
IRIG-B123	Time-of-Year, Straight Binary Seconds
IRIG-B124	Time-of-Year, Year, Control Flags, Straight Binary Seconds
IRIG-B127	Time-of-Year, Year, Straight Binary Seconds

Table 2-8: Supported IRIG Timecode Formats

The IRIG-B outputs are aligned to the IRIG Datum pulse as shown in Figure 2-20. For an overall view of the entire IRIG waveform, refer to Figure 2-2. The output waveform consists of a 1kHz carrier that is amplitude modulated to the IRIG pulse waveform. The frame reference bit (P_R) leading edge coincides with the IRIG Datum pulse output from the 5601MSC. When locked to GPS, IRIG will be aligned within 20 microseconds of the 1pps pulse from the GPS receiver (with no global phase offset).
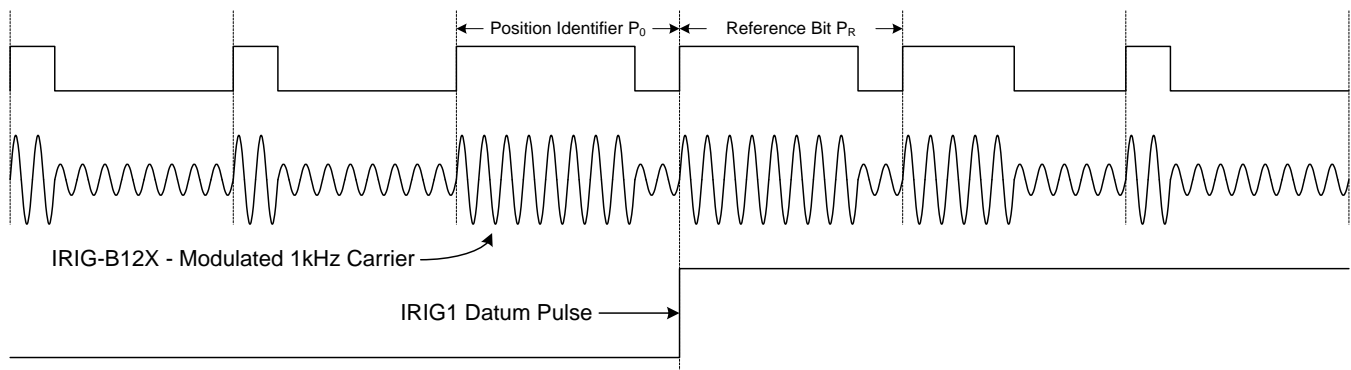
Figure 2-20: Detail of IRIG Alignment to IRIG Datum Pulse

Depending on the IRIG format selected, different types of information may be placed in the IRIG frame. The Time-of-Year portion is always present and indicates the current system clock time in seconds, minutes, hours, and day of the year. The IRIG-B120, IRIG-B123, and IRIG-B127 formats include a straight binary seconds counter which gives the current time of day in seconds. The IRIG-B127 format also includes the current year as a two-digit number (e.g. 2011 = 11). The IRIG timecode is generated directly from the system clock, which should be set to UTC.

Either LTC output (LTC1 and/or LTC2) can be configured to one of the four IRIG formats in their respective menus. See section 4.4.1 for a description of the menu settings. The IRIG signal amplitude can be controlled by the *Output Level* menu item. When an LTC output has been configured to an IRIG output mode, both primary and secondary outputs will provide the same IRIG signal.

The 5601MSC can also be configured to the IRIG-B as a time reference. The time reference source must first be set to IRIG. See section 4.3.4 for information on configuring the time reference source. The *Irig Mode* menu item selects which IRIG format to use as a reference and can also enable auto detection. Only IRIG-B127 can provide full date information.

Both IRIG input and output circuitry is balanced. To connect an unbalanced IRIG source to the LTC input, or to use the LTC outputs to drive an unbalanced IRIG cable, refer to Figure 2-21 for examples on how to make these connections.
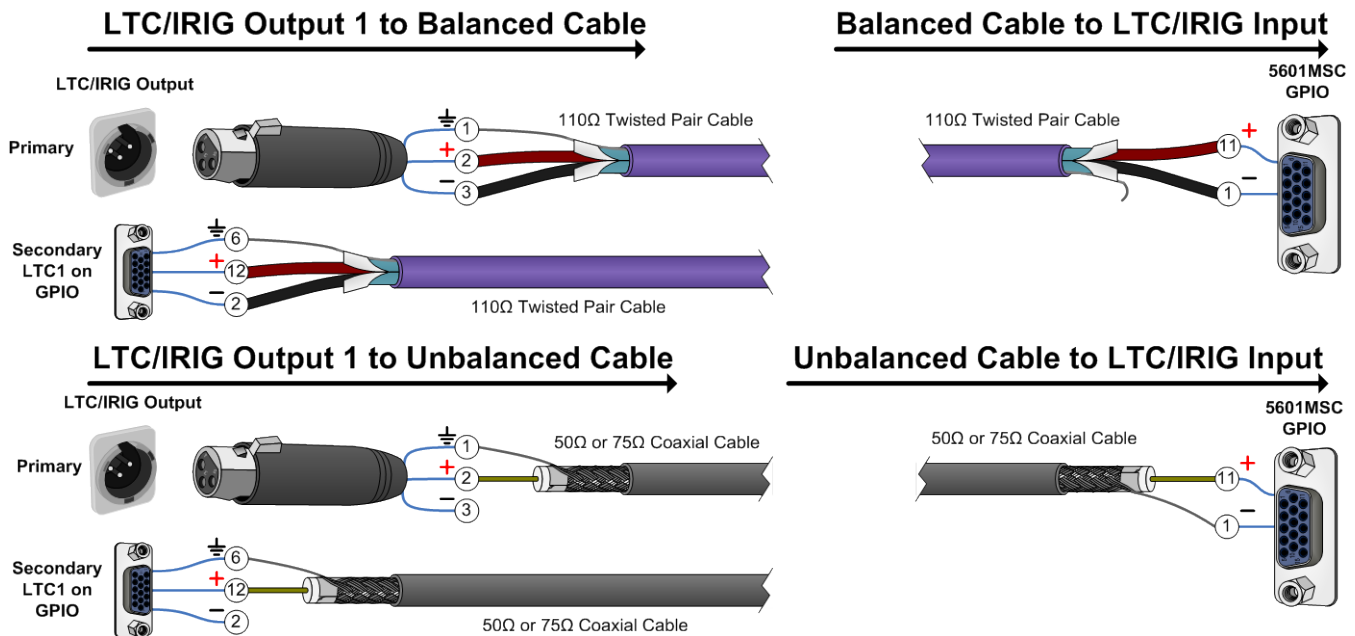
Figure 2-21: IRIG Input and Output Connections

2.4. NETWORK TIME PROTOCOL (NTP)

If the 5601MSC is equipped with the **T** option, it will have an available Network Time Protocol (NTP) server. The NTP server runs on both the CONTROL and the TIME Ethernet ports using the IP address assigned each port. The NTP features are configured in the *NTP Rules* menu located in the **GENERAL** root menu (see section 0).

The 5601MSC implements version 3 of the NTP protocol as defined in RFC 1305. The NTP server uses the **system clock** as its source of time. This requires the system clock to be set to UTC in order to generate a valid NTP timestamp. The NTP server also sends out unsolicited broadcast time packets every 30 seconds on the CONTROL Ethernet port only. This is done to reduce traffic on the TIME network. The contents of the packets are largely determined by the chosen time reference and the lock status.

If the 5601MSC is not locked to the selected time reference, the LI_Alarm flag in all outgoing NTP packets will be set. This informs clients that the NTP reference clock in the 5601MSC is not locked to a reference. This flag is also set when the time reference is set to *None*. When this flag is set, most clients will reject the time packet provided by the 5601MSC. This flag can be deactivated by enabling NTP spoofing (see section 4.5.13.1). NTP spoofing should only be used for testing and troubleshooting purposes as it technically breaks compliance with the NTP standard.

When an incoming client request for NTP time is received by the 5601MSC, the source IP address is checked against a list of NTP restrictions (see section 4.5.13.2). There are a total of eight restrictions and they are checked sequentially. If the incoming request passes all eight restrictions, the NTP server will respond.

It is possible to perform a quick validation of NTP operation 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 to use the "w32tm" utility 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". Enter the command "w32tm /monitor /computers:172.21.1.56". In this case 172.21.1.56 is the IP address of the 5601MSC.

```
C:\WINDOWS>w32tm /monitor /computers:172.21.1.56
172.21.1.56 [172.21.1.56]:
    ICMP: 0ms delay.
    NTP: +35.0868750s offset from local clock
        RefID: 'GPS [71.80.83.0]
```

Figure 2-22: Testing the NTP Server

In the example above, the NTP server in the 5601MSC at 172.21.1.56 was successfully contacted. The PC clock is 35 seconds advanced from the time provided by the 5601MSC. The RefID indicates that the 5601MSC is locked to GPS time.

2.5. GLOBAL POSITIONING SYSTEM

When operating with the optional GPS receiver, the 5601MSC can be both frequency and time locked to the Global Positioning System (GPS). The following section describes the basics of the GPS system and the operation of the 5601MSC when it is locking to the GPS satellites. See section 3.5 for information about installing the GPS head and connecting it to the 5601MSC. Refer to section 2.2.13 for the timing diagram when locked to GPS.

2.5.1. 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 31 satellites in orbit providing worldwide 24 hour coverage. Presently GPS is the most accurate technology available for marine and land navigation and it is the technology of choice in timing applications including remote site and network synchronization.

Each GPS satellite Space Vehicle (SV) contains four onboard atomic clocks. These clocks are averaged and are used to transmit GPS time, along with the positions of all satellites (the almanac) and fine tracking data (the ephemeris). To acquire GPS time, the receiver only needs to track one satellite. The position of the satellite is known and the transmission delay can be subtracted to obtain GPS time with millisecond accuracy.

In order to obtain a three-dimensional position, the ranges from multiple satellites must be compared. If the receiver had perfect timing, three satellite ranges would be sufficient to calculate a position. In real-world applications, the clock in the receiver will not be an atomic clock and the smallest error in frequency will cause huge errors in positioning. Consequently, a fourth satellite range is incorporated to solve for timing error in the receiver. This allows the receiver to correct its clock and synchronize it to within nanoseconds of the GPS constellation. The 5601MSC is more involved with this clock correction/synchronization feature of the GPS process than it is with the positioning aspect.

2.5.2. GPS Lock Operation

The GPS receiver is a Trimble Accutime Gold which is designed for maximum accuracy in static (antenna not moving) mounting applications. The receiver will also function when mobile with decreased precision.

When the GPS receiver is first connected, it will try to track satellite signals using its stored almanac. The status display will report "GPS Searching" during this initialization stage. If the receiver has been powered off for a while, or has been moved a significant distance, it may need to download a new almanac. This can require up to 15 minutes of continuously tracking a satellite to complete.

It should be noted here that when GPS is being used for a time reference only, contact with just a single satellite is enough to provide accurate time. A GPS time reference will start working as soon as a single satellite is tracked. For frequency synchronization, a more complex process is involved.

When the almanac is determined to be valid, the receiver will attempt to complete a self-survey. This is done by averaging up to 300 positional readings to obtain precise locational data for the antenna. This process can take up to 5 minutes.

Obtaining a position requires the receiver to track at least four satellites. Satellites which do not meet the minimum quality criteria (elevation, signal strength, dilution of precision) cannot be used during a self-survey. The status display will read "GPS Poor Signal" if four healthy satellite signals cannot be found. These requirements are more stringent when performing a self-survey than they are when in normal operation.

When the self-survey is complete, the GPS receiver will begin to send out a 1pps pulse to the 5601MSC. The 5601MSC will frequency-lock its ovenized oscillator to the pulse edges, and phase-lock to GPS time. Once the GPS receiver knows its precise location, it can substitute its position into the equation and solve only for clock error and clock bias. In this mode, it can operate with just one satellite and still provide accurate timing to the 5601MSC.

The status of the GPS lock progress can be monitored in the *Lock Status* and *Inputs* status screens (see section 4.1.2). The messages are shown in Table 2-9 along with a description.

Status Display	Description
GPS Disconnected	The 5601MSC cannot communicate with the GPS receiver.
GPS No Almanac	The receiver is updating its GPS almanac. Can take up to 15 minutes to complete.
GPS Searching	The receiver has not yet detected any satellites and is searching.
GPS No Sat Found	No satellites are being tracked
GPS Only 1 Sat	The receiver is waiting until four satellites are detected to complete a self-survey of its position.
GPS Only 2 Sats	
GPS Only 3 Sats	
GPS Poor Signal	One or more satellites do not meet the elevation, SNR, or PDOP criteria and cannot be used. Attempting to detect more satellites.
GPS Ok. Sig OK	The receiver has completed a self-survey and as operating normally.
GPS 1 Good Sat	The receiver has previously completed a self-survey and is maintaining synchronization while tracking just one satellite.
GPS 8 Good Sats	The receiver is operating in over determined clock mode, weighting the results from 8 different satellites that meet the minimum signal strength and position requirements to obtain maximum accuracy.
GPS 0 Good Sats	The receiver has lost contact with all satellites. This will trigger a reference fault condition as timing accuracy cannot be guaranteed.

Table 2-9: GPS Status Messages

As more satellite signals are detected, the receiver will enter over determined clock mode. Up to 12 satellites can be tracked, using their signal strength and position in the sky to give them more or less weight in contributing to the solution. The quality criteria are more relaxed than when performing a self-survey and each available satellite will improve timing precision. If the receiver is moving, such as in a mobile application, the receiver will enter dynamic mode and still provide reasonably high precision.

After the 5601MSC has locked to the GPS receiver and is in a steady state condition for longer than 20 minutes the master oscillator will be phase locked to within 15ns to 90ns of the GPS system time reference, depending on the number of healthy satellites that are tracked. When using multiple 5601MSC units referenced to GPS, it is important to make sure both receivers are mounted equally so that they detect a similar number of satellites, and that the antenna cable lengths are matched as closely as possible to limit signal path propagation delays to match their phases as closely as possible.

If the GPS receiver is disconnected, the ovenized oscillator within the 5601MSC may drift very slowly over time. The maximum frequency drift of the oscillator 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.

2.5.3. GPS Re-Lock in *Slow* Mode

When the frequency lock mode is set to Slow (see section 2.2.4), the 5601MSC can provide a very smooth recovery of phase upon reconnection of the GPS antenna. There will be a very smooth transition of the 5601MSC's phase back to the GPS system time reference. This transition is very gradual with no non-linear jumps. Because the phase period when locked to GPS is very long (160 seconds – see Figure 2-13) this relock process can take a long time when the phase is considerably far off. 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 receiver is removed for 5 minutes and then returned, the unit will take nominally less then 5 minutes to fully re-lock. If the GPS receiver is removed for 15 minutes and then returned, the unit will take nominally less than 20 minutes to fully phase-lock to the GPS system time.

2.5.4. GPS Position Insertion into Timecode

The 5601MSC can insert the current position of the GPS antenna into the user bits of the LTC and VITC outputs. This is controlled by the *VitcLtc dte fmt* menu item in the *GENERAL* root menu (see section 4.5.4). Timecode with even numbered frames contain longitude in the user bits, and timecode with odd numbered frames contain latitude.

The format for latitude is wxxxyyzz 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

latitude: 20432348   longitude: 30794623

This corresponds to:

North (+) 043 degrees, 23.48 minutes

West (-) 079 degrees, 46.23 minutes

It can be entered into Google maps using the format "+43 23.48 -79 46.23".

2.6. AUTOMATIC CHANGEOVER OPERATION (5601ACO2)

For critical infrastructure requirements a 5601ACO2 can be used to connect two 5601MSC units in a dual redundant configuration. The 5601ACO2 monitors signal health to decide which of the 5601MSC units will be connected to the downstream outputs. See the connection diagram below.
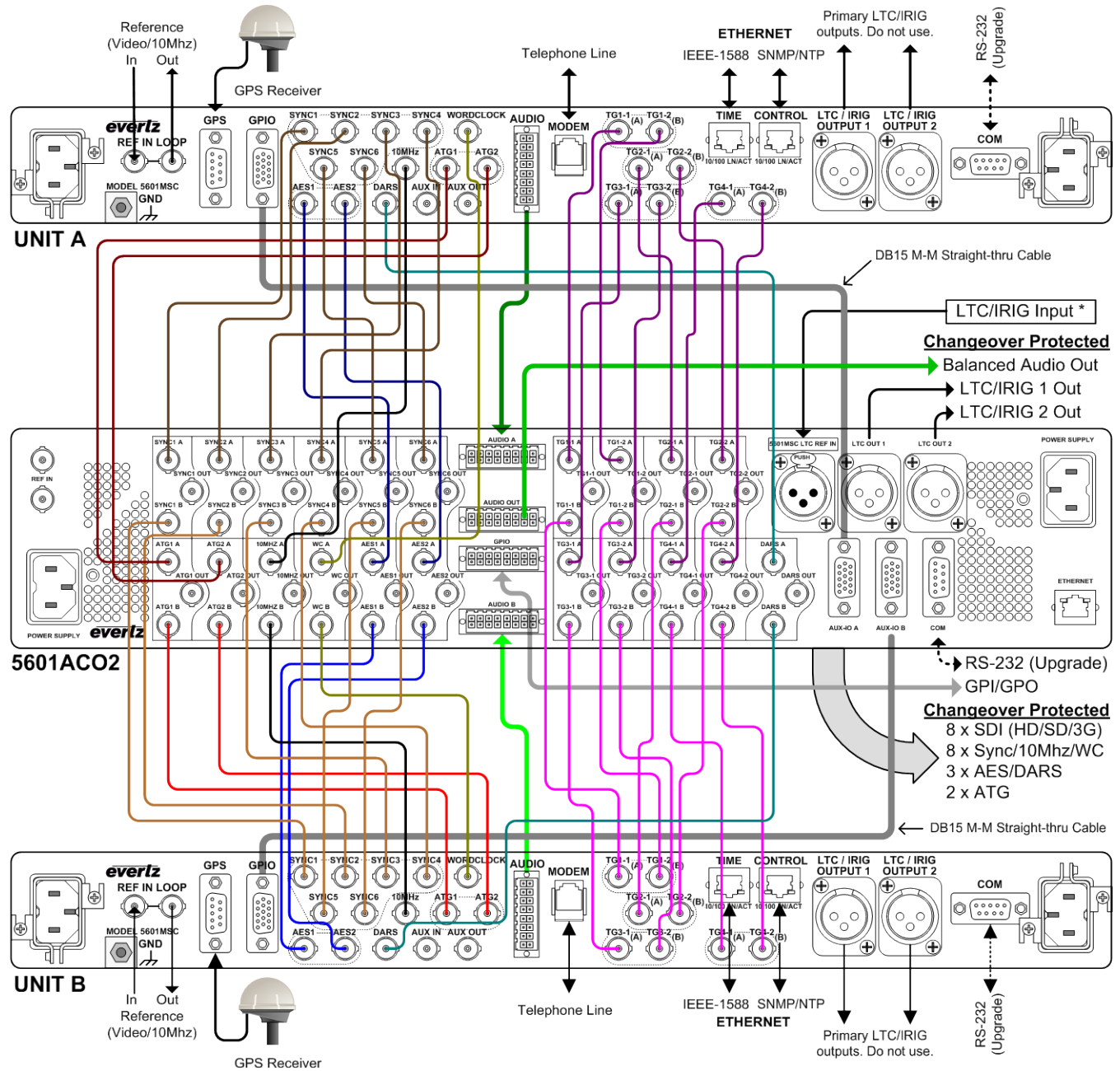
Figure 2-23: Redundant Master Clock/SPG with Auto Changeover System Diagram

✎ * **When the units are connected via DB15 cables as shown, this LTC input can be used to apply a single LTC or IRIG reference to both 5601MSC units. If independent timecode references are desired, then one of the DB15 cables must be modified to break out the LTC/IRIG wires for connection to a separate timecode reference source.**

The 5601ACO2 allows for a dual-redundant installation of two 5601MSC units. Normally one of the 5601MSC units is designated to the *master*, and its 28 outputs are connected to Bank A of the 5601ACO2. The second 5601MSC unit is designated as the *slave* (or backup), and its 28 outputs are connected to Bank B of the 5601ACO2. The 5601ACO2 then provides 28 relay-protected outputs to feed downstream equipment. The 5601ACO2 can be switched manually (locally via front panel or remotely via SNMP), or can be put into automatic mode where the outputs will be switched to the slave unit if a problem is detected with the master.

In order for a seamless switch to occur, both 5601MSC units must be running at the same frequency and phase. Ideally, this is done by locking both units to the same reference. It is possible to lock the slave unit to the master but this reduces the protection offered by the ACO should a problem develop with the master unit. Additionally, it is required that both 5601MSC units are configured identically so that their outputs settings match. A *syncro* connection is automatically made inside the 5601ACO2 that allows the master unit to communicate its settings to the slave unit. Implementing one of the syncro modes, as described in section 2.3.3.3, allows the slave unit to synchronize all of its OUTPUT menu item settings with the master unit. Any configuration change made on the master unit will be copied to the slave unit automatically. This assures minimum impact should a changeover event occur.

The 5601ACO2 simplifies wiring by providing a single point of entry for an LTC reference, and GPIs for both 5601MSC units. The LTC input to the 5601ACO2 is internally split to both master and slave units. Similarly, the GPI inputs are split to both units, allowing any GPI trigger to affect both units simultaneously.

The 5601ACO2 uses latching relays to provide a fail-safe signal path. These relays will maintain their last state should the 5601ACO2 experience a power supply failure or main board failure. This ensures glitch-free failure events and glitch-free recovery from failure.

All inputs from both 5601MSC units are *passively* monitored by the 5601ACO2. There are no active components in the signal path. This is accomplished by splitting a small portion of the incoming signal to the control/monitoring circuitry of the 5601ACO2. The high-speed SDI TG signals are treated differently. When connected to a 5601ACO2, the SDI TGs must be set to highdrive mode. This is done with the *Output Drive* control (see section 0). The higher amplitude provided by highdrive allows the 5601ACO2 to passively monitor the SDI TG outputs while still providing a SMPTE compliant serial digital signal to downstream equipment.

All 28 outputs from the 5601MSC can be connected to the 5601ACO2, with the exception of the LTC1 and LTC2 primary XLR outputs (see note in section 3.1.4). These outputs are not isolated from the secondary outputs on the GPIO connector and should be left unconnected for full protection of the LTC1 and LTC2 outputs. The exception is when LTC1 power is turned on, in which case the LTC1 XLR output is driven independently and may be used as an unprotected LTC output for downstream clocks. The 5601ACO2 continually monitors the health of all signals with the exception of the analog audio outputs. Refer to the 5601ACO2 instruction manual for a more detailed explanation of the monitoring and switching modes available.

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3. INSTALLATION

3.1. REAR PANEL

Figure 3-1 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 3.1.1 to 3.1.11 describe the specific signals that should be connected to the 5601MSC.
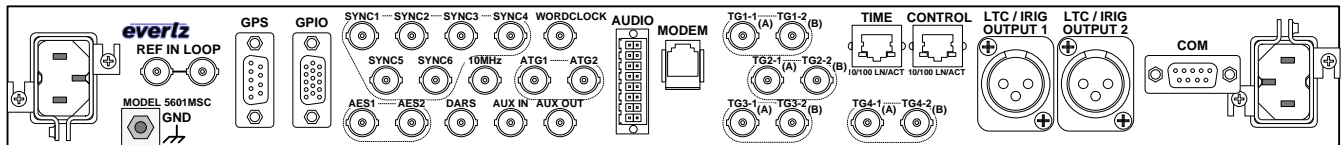
Figure 3-1: 5601MSC Rear Panel

3.1.1. Reference Loop Connections

The two **REF IN LOOP** BNC connectors provide a reference loop input for black burst, tri-level, and 5MHz/10MHz signals. The BNCs are isolated from chassis ground. 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 4.3 for more information. The loop is high impedance and will need to be properly terminated with 75 ohms using an external termination.

3.1.2. 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 4.4.2.

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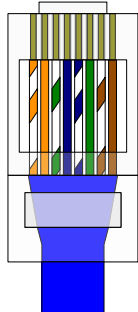
WORDCLOCK - This BNC connector provides a 48kHz wordclock signal but can also be programmed as another sync output. It is recommended that this output be configured as a wordclock output when used in conjunction with a 5601ACO2 to simplify wiring. It is configured using the Wordclock sub-menu in the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

3.1.3. Ethernet Connections

The 5601MSC is equipped with two 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 an Ethernet hub or switch. The CONTROL port hosts an NTP server (with periodic broadcasts) and an SNMP server for remote monitoring and control.

The TIME Ethernet port must be configured to be on a different subnet than the CONTROL port. The TIME also runs an SNMP service but should be connected to a network that is dedicated only to time protocol traffic. The NTP server also runs on the TIME network but does not perform broadcasts to keep traffic at a minimum which is desirable to reduce packet latencies and increase time reference accuracy. The TIME port hardware is capable of supporting a future implementation of IEEE 1588 PTP.

The straight-through Ethernet cable can be purchased or can be constructed using the pinout information in Table 3-1. A color code wiring chart is provided in Table 3-1 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 3-1: 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; the same crossover cable 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 a valid link. This gives a good indication that the segment is wired correctly. The LED will BLINK when sending or receiving data. The LED will be OFF if there is no valid connection. The link status can also be seen in the *ControlEthernet* status screen.

Note that on the Time Ethernet port, the function of the LEDs is reversed. The 10/100 LED is Green, and the LN/ACT LED is Amber.

3.1.4. Linear Time Code and IRIG Connections

The *LTC 1* and *LTC 2* groups of sub-menus in the *OUTPUT* root menu are used to configure the LTC and IRIG outputs. See section 4.4.1. The LTC output level is adjustable from approximately 0.8V to 9.0V using the *Output Level* menu item. The IRIG output level is controllable from approximately 1.0V to 8.3V. This assumes a load impedance of greater than 1kΩ.

There are two 3-pin male XLR connectors for SMPTE/EBU Linear Time Code. When the **IRIG** option is installed, these outputs will also be able to provide IRIG timecode. They are labelled LTC OUT 1 and LTC OUT 2. These XLR connectors are the primary copies for each timecode output. The LTC OUT 1 connector is capable of driving +12 V_{DC} power for downstream Evertz clocks (see section 4.4.1.1).

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

Table 3-2: LTC OUT 1 and LTC OUT 2 XLR Pin Definitions

Secondary copies of the two LTC/IRIG outputs are available on the GPIO 15-pin female 'D' connector. The pinout of this connector is shown in Table 3-5. 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. For details on wiring IRIG timecode, see section 2.3.5.

> **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).**

3.1.5. Serial Port Connection

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 3-3 shows the pinout of the serial port in its default RS-232 DCE configuration. See section 5.2 for information on upgrading the firmware in the unit.
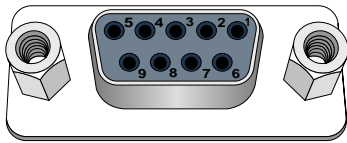
Pin #	Name	Description
1		
2	TxD	RS-232 Transmit Output
3	RxD	RS-232 Receive Input
4		
5	Signal Gnd	RS-232 Signal Ground
6		
7	RTS	RS-232 RTS Input
8	CTS	RS-232 CTS Output
9		

Table 3-3: COM Port Pin Definitions

3.1.6. GPS Connection

A 9-pin female 'D' connector for connecting the optional GPS receiver (GP option). Table 3-4 shows the pinout of the port. See section 3.5 for information about mounting and connecting the GPS receiver.
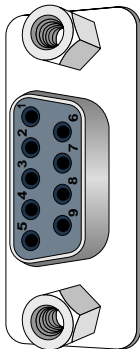
Pin #	Name	Description
1	GND	Chassis ground
2	Tx-	Transmit A (Tx-) Output
3	Rx+	Receive B (Rx+) Input
4	PPS+	1 PPS + Input
5	+VDC	+ 12 Volts DC out to supply GPS receiver
6	PPS-	1 PPS - Input
7	Tx+	Transmit B (Tx+) Output
8	Rx-	Receive A (Rx-) Input
9	GND	Chassis ground

Table 3-4: GPS Serial Port Pin Definitions

3.1.7. GPIO Connections (LTC Input, Secondary LTC Outputs, and Syncro Connections)

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 3-5.
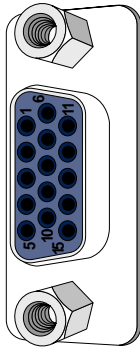
Pin #	Name	Description
1	LTC Input -	Linear Time Code Input -
2	LTC1 Out -	Secondary Linear Time Code Output 1 -
3	LTC2 Out -	Secondary Linear Time Code Output 2 -
4	GPO 1	General Purpose Output 1
5	GPO 2	General Purpose Output 2
6	GND	Signal Ground
7	GND	Signal Ground
8	Syncro Tx	Syncro Transmit
9	Syncro 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 3-5: GPIO Pin Definitions

3.1.8. Unbalanced Audio Connections

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.

3.1.9. Balanced Audio and Modem Connections

The **AUDIO** 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 strip using a small screwdriver. The removable terminal block (Weidmuller part #174822) is then inserted into the rear panel and secured using the flange screws. The pinout of this connector is shown in Table 3-6.

Right +			Left +
Right -			Left -
GND			GND
SNSA			SNSB
GND			GND
AES 1 +			AES 1 -
AES 2 +			AES 2 -
DARS +			DARS -
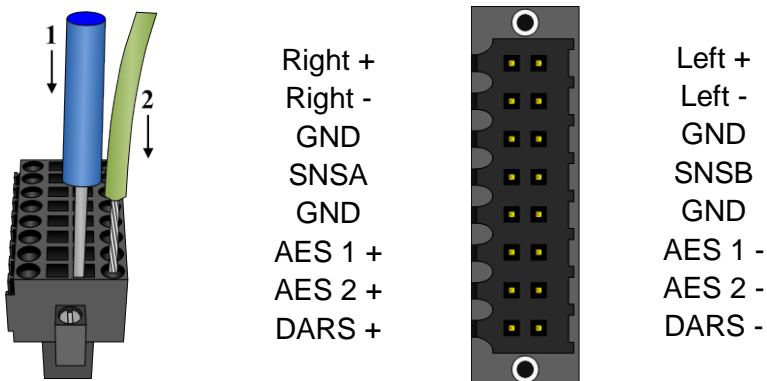
Table 3-6: AUDIO Removable Terminal Block Pin Definitions

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:
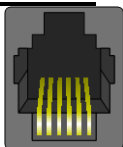
The **MODEM** RJ11 jack is used to connect the optional internal modem (**M** option) to the telephone line. The Modem sub-menu off the *GENERAL* root menu is used to configure the modem. See section 4.5.5 for more information.

✎ **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.**

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

3.1.10.1. Serial Digital Video Test Generators

There are four independent SDI test generators each with two output BNCs. These are enabled with the **SDTG** option and produce SMPTE ST 259 serial digital video. The **HDTG** option adds support for HD video (SMPTE ST 292-1 and SMPTE ST 372) to all four test generators. The **3GTG** option adds support for 3G Level-A and Level-B (SMPTE ST 424) 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)

3.1.10.2. Analog Video Test Generators

There are two independent composite analog video test generators, each with a single BNC output. The output formats are compatible with SMPTE ST 170 or ITU-R BT.1700-1. The *ATG1 and ATG2* sub-menus in the *OUTPUT* root menu are used to configure these outputs.

BNCs: Analog Test Generator 1 BNC is labeled ATG1
Analog Test Generator 2 BNC is labeled ATG2

3.1.11. 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.**

3.1.12. 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.

3.2. 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.

3.3. 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. Note that in event of power being removed from the 5601MSC, the GPOs will appear to be a 20K sink to ground.

Figure 3-2 and Figure 3-3 shows the circuitry for each of the I/O pins.
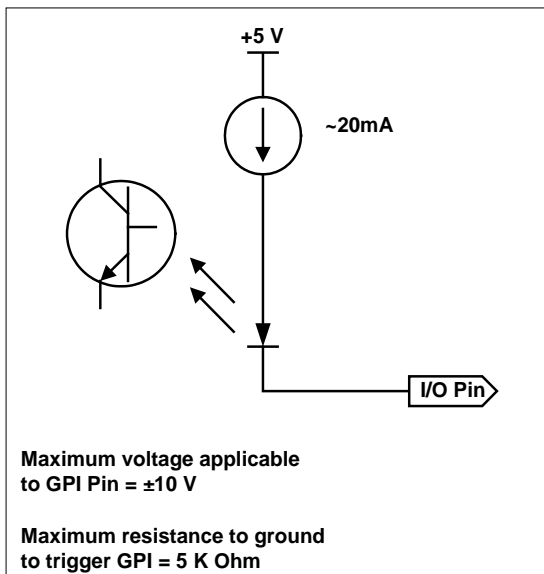
Figure 3-2: Typical GPI Circuitry
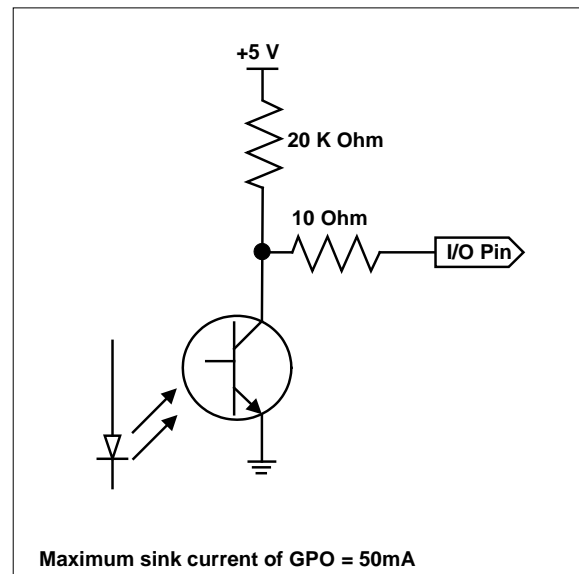
Figure 3-3: Typical GPO Circuitry

3.4. 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 4.5.5 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 4.3.4 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 4.4.3.9 and 0).

3.5. 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.

3.5.1. 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 3-4. 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**
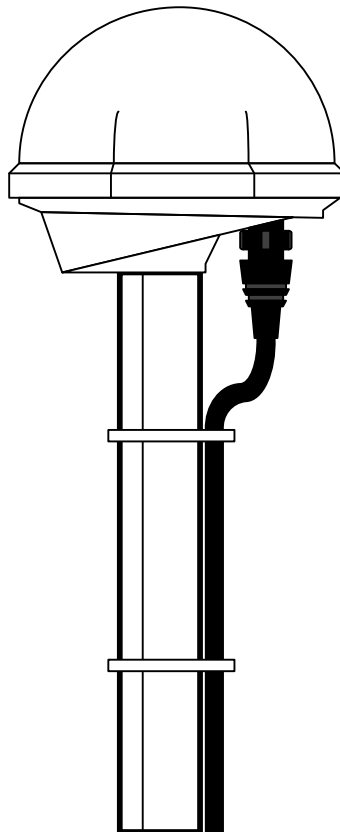
Figure 3-4: Pole Mounting the Smart Antenna

3.5.2. 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 Deutsch IMC21 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 Table 3-7. 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 Table 3-8.

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. Fasten finger-tight until snug. Using tools will damage it.**

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.**
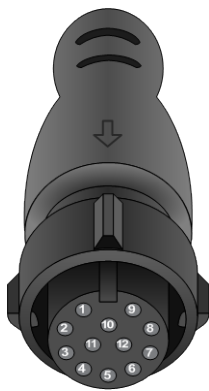
Trimble Antenna Deutsch IMC-series 12-pin (female)		Cable Wire	Evertz 5601MSC 9-pin D-Sub (male)	
DC Ground	9	Black	1	Chassis Ground
Receive Port (Rx-)	2	Violet	2	Tx A -
Transmit Port (Tx+)	5	Yellow	3	Rx B +
Timing Pulse (1pps+)	11	Orange+White	4	1pps + in
DC Power	1	Red	5	+12 V DC
Timing Pulse (1pps-)	12	Black+White	6	1pps - in
Receive Port (Rx+)	3	Orange	7	Tx B +
Transmit Port (Tx-)	4	Brown	8	Rx A -
	----	Drain Wire	shell	
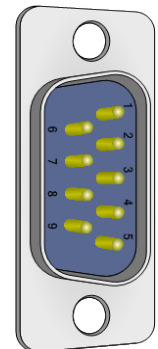
Table 3-7: Evertz-provided GPS Cable (part WA-T09) Internal Wiring
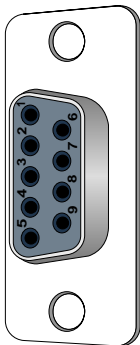
9-pin Female D-Sub Pin	Cable Pair	9-pin Male D-Sub Pin	Description
7	1	7	TX B +
2		2	TX A -
8	2	8	RX A -
3		3	RX B +
4	3	4	1 PPS +
6		6	1 PPS -
5	4	5	+12 V DC
1		1	Ground
-----------	Drain	------------	Shield
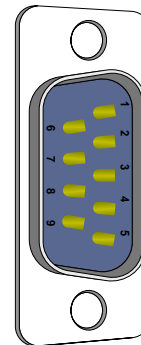
Table 3-8: Accutime Gold Extender Cable

> **When making your own extender cable be sure to use low capacitance twisted pair cable and adhere to the pairing shown in Table 3-8.**

3.5.3. 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. Refer to section 2.5.2 for more information. During this time the *Lock Status* and *Inputs* status screens on the front panel will show the various stages of initialization (see section 4.1.2). For complete information on configuring the 5601MSC to operate with the GPS Smart antenna see section 4.3.1 of this manual

4. 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.

4.1. FRONT PANEL CONTROLS
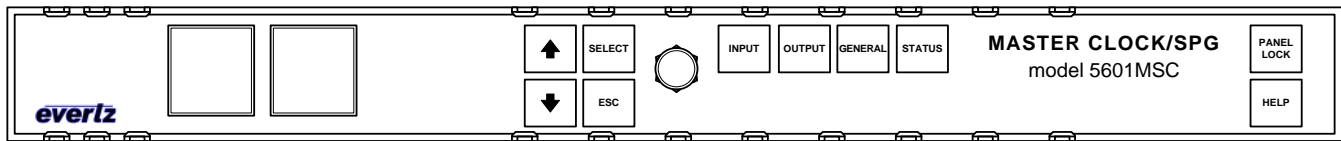
Figure 4-1: Model 5601MSC Front Panel Layout

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 4.3 to 4.5 give detailed information on the specific operations required to control the 5601MSC.

4.1.1. 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 4.1.3). 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 4.3.

OUTPUT - Enters the *OUTPUT* menu that is used to configure the Sync and test generator outputs of the 5601MSC. See section 4.4.

GENERAL - Enters the *GENERAL* menu that contains controls for configuring the Syncro, GPOs, Modem, DST, SNMP, and NTP features of the 5601MSC. See section 4.5.

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 - 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.**

4.1.2. The Status Screens

There are several status screens available on the 5601MSC that can be accessed by pressing the **STATUS** button on the front panel. Each screen displays relevant information about the subsystem it represents. At the root level, the screens are listed just like menu items. Press the ↑ and ↓ buttons or turn the control knob to move the selection cursor to the desired status screen. Press **SELECT** to view the status screen. The **ESC** button will return to the status screen list.

> **The status screens are still accessible even when the front panel is locked.**

The status screen list can be used to quickly locate the source of a fault within the 5601MSC. Each status screen name will be shown in normal text if the subsystem it represents is functioning normally. The status screen name will be shown with a *yellow* background if one of the items inside is in a warning condition. The status screen name will have a *red* background if one of the subsystems is faulted. By scrolling through the status screen list, any faults can be quickly identified. Refer to Figure 4-2. In this example, the *Lock status* screen is shown with a yellow background to warn that an item inside has a problem. The *Fan/PS status* screen is shown with a red background to indicate that one of the power supplies is not functioning.
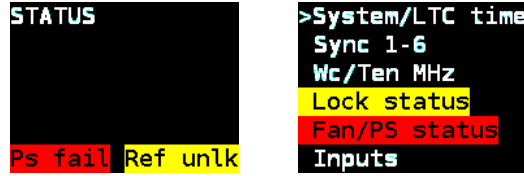
Figure 4-2 : Status Screen Highlighting to Indicate Warnings and Faults

The status screens are described in detail below. Each status screen can display multiple messages depending on the configuration of the 5601MSC.

> ✐ **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.**

System / In time

hh:mm:ss:ff
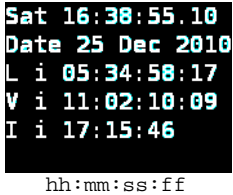
The *System/In time* status screen shows the system clock time and date on the first two lines.

The third line, prefixed with "L i", shows the current LTC timecode being read from the LTC/IRIG input (if present). If the LTC input is lost, the time shown here will be replaced with "--:--:--:--". If drop frame is detected, the last colon ':' will be replaced with a period '.'.

The fourth line, prefixed with "V i", shows the current timecode being read from VITC on the reference input. If the VITC input is lost, the time shown here will be replaced with "--:--:--:--". If drop frame is detected, the last colon ':' will be replaced with a period '.'.

The fifth line, prefixed with "I", shows the current IRIG timecode being read from the LTC/IRIG input (if present). If the IRIG input is lost, the time shown here will be replaced with "--:--:--:--".

Sync 1-6

```
S1  13.15:46.26
S2  17:15:46.26
S3  17:15:46.26
S4  18:15:46:26
S5  19:15:46:26
S6  20:15:46:26
     hh:mm:ss:ff
```

The *Sync 1-6* status screen shows the VITC clocks for the sync outputs in "hours:minutes:seconds:frames" format. The delimiter between the hours and minutes indicates whether Daylight Saving Time is being applied to that output. It will be a period "." when DST is enabled and a colon ":" otherwise. The delimiter between the seconds and frames indicates whether dropframe counting is being used on the VITC output. It will be a period "." when dropframe counting is enabled, and a colon ":" otherwise.

In the example to the left, the VITC on sync output 1 has been set to Eastern Standard Time (Time Zone to UTC –5:00) and has DST enabled (1 hour advanced). Sync outputs 1 to 3 are all in dropframe counting mode. The timecode clocks for sync outputs 5, 6, and 7 are dimmed because they are set to an output mode which doesn't support VITC. Although VITC is not being inserted onto these sync outputs, the timecode clocks continue running.

LTC/Wc/Ten MHz

```
L1  17:15:46.26

Wc  21:15:46:26
TMz 22:15:46:26

I2  17.15:46
 hh:mm:ss:ff
```

The LTC/*Wc/Ten MHz* status screen shows the LTC/IRIG output clocks and the VITC output clocks for the wordclock and 10MHz outputs. If the LTC/IRIG outputs have been configured to output LTC, the current output timecode will be shown on lines 1 or 2 prefixed with "L1" or "L2". If they have been configured to output IRIG, the current output timecode will be shown on lines 4 or 5 prefixed with "I1" or "I2".

If the Wordclock or 10MHz outputs have been configured to output black burst with VITC enabled, these clocks will be displayed on lines 3 and 4 as bright white. In the example to the left, the Wordclock and 10MHz output have been left in their default modes (cannot insert VITC onto a wordclock or 10MHz CW signal). The VITC timecode clocks are dimmed to show that the timecode is not being inserted.

On all timecode lines, the delimiter between the hours and minutes indicates whether Daylight Saving Time is being applied to the output. It will be a colon ":" if DST is disabled, and a period "." If DST is enabled (see I2 in example to the left).

For VITC/LTC timecodes, the delimiter between the seconds and frame counts indicates whether dropframe counting is enabled. It will be a period "." If dropframe counting is being used, and a colon ":" otherwise (see L1 in example to the left).

SDI 1-4 ATG 1-2

```
Sd1 13.15:46:26
Sd2 17:15:46:26
Sd3 17:15:46:26
Sd4 18:15:46:26
At1 19:15:46:26
At2 20:15:46:26
     hh:mm:ss:ff
```

The *SDI 1-6 ATG 1-2* status screen shows the clocks for each of the test generator burn-in displays in "hours:minutes:seconds:frames" format. The delimiter between the hours and minutes indicates whether Daylight Saving Time is being applied to that output. It will be a period "." when DST is enabled and a colon ":" otherwise. The delimiter between the seconds and frames indicates whether dropframe counting is being used on the time output. It will be a period "." when dropframe counting is enabled, and a colon ":" otherwise.

Lock status

Unlocked → **Locked**

```
Freq Ref 10M wid    Freq Ref 10M wid
5/10 MHz ref N/A    Frequency Locked
Wide center+4.3%    Wide center+4.3%
Time No Ref         Time No Ref
```
[#1] 10MHz frequency ref, no time ref

```
Freq Ref GPS        Freq Ref GPS
GPS ref N/A         Freq Phase Lockd
OCXO center+0.5%    OCXO center+0.5%
Time Unlocked       Time GPS Locked
Gps Disconnected    Gps Ok.  Sig Ok
0 Sats Tracked      Gps 7 Good Sats
```
[#2] GPS frequency ref, GPS time ref

```
Freq Ref Intern     Freq Ref Intern
Freerunning         Freerunning
OCXO center-5.9%    OCXO center-5.9%
Time Unlocked       Time Locked
```
[#3] No frequency ref, Modem time ref

```
Freq Ref GL narr    Freq Ref GL narr
Video ref N/A       Freq Phase Lockd
OCXO center+5.9%    OCXO center-5.9%
Time Unlocked       Time Locked
```
[#4] Video frequency ref, VITC time ref

The *Lock Status* screen displays the current status of the selected frequency and time references for the 5601MSC.

The first line indicates which frequency reference has been selected, and if the unit is using the narrow or wide oscillator (see section 2.2.3).

The second line shows the overall lock status of the 5601MSC to the selected frequency reference. This line will display "Lock progrs x%" while locking to show the current progress in locking the oscillator to the reference. This line also indicates if the 5601MSC has locked to frequency only, or has both frequency and phase locked to the reference.

The third line indicates the current tuning position of the selected oscillator when locked to the reference. See section 2.2.3 for a more detailed explanation on what this means.

The fourth line displays the current lock status of the system clock to the time reference. See section 0 for an explanation on how the 5601MSC locks to time references.

The fifth and sixth lines display the status of the GPS receiver when GPS has been selected as a frequency or time reference. The fifth line displays the current GPS lock state, and the sixth line displays how many healthy satellite signals the GPS antenna is receiving. See section 2.5.2 for an explanation on the GPS lock process.

Fan/PS status

```
PS L Ok PS R Ok
Fan Left F Ok
Fan Left R Ok
Fan Right F Ok
Fan Right R Ok
Temperature Ok
```
Dual power supplies

```
Power Supply Ok
Fan Left F Ok
Fan Left R Ok
Fan Right F Ok
Fan Right R Ok
Temperature Ok
```
Single power supply

The *Fan/PS status* screen displays the status of the power supplies and exhaust fans at a glance. The first line indicates the status of the power supplies. The text "PS L Ok" indicates that the left power supply is operating normally and the text "PS R Ok" indicates that the right power supply is operating normally. These statuses will be highlighted red if a failure is detected. For installations with a single power supply, the text "Power Supply OK" will be shown. See section 4.5.9.5 for more information on how to configure the number of power supplies the 5601MSC will monitor.

The next four lines show the status of the front and rear fans for the left and right power supplies (or fan modules). If a fan has failed, the line will be highlighted yellow and trigger a system warning. Depending on ambient temperature, this may or may not cause the system temperature to exceed maximum operating levels.

The last line displays the system temperature monitor. If the main processor temperature exceeds operating limits, this line will be highlighted red and indicate "Temp too high". This is a critical system fault and required immediate attention. It can be caused by high ambient temperatures or by fan failures.

Inputs

The *Inputs* status screen displays the status of the reference inputs, syncro link, and General Purpose Inputs.

The first line displays the name of the detected video reference that is present on the reference loop input. See section 2.2.5 for a list of valid reference types.

```
NTSC-M    SCH=+1
No 5/10 MHz Ref
Gps Ok.  Sig OK
Syncro disabled
LTC ok  IRIG n/a
GPI1 HI  GPI2 HI
```
NTSC ref with GPS

For NTSC-M and PAL-B black burst references, an approximate Subcarrier to Horizontal (SCH) measurement of the input will be shown. If the SCH error is greater than 35⁰, this line will alternate between "(SCH>35)" and "H-lock" to indicate that the 5601MSC has fallen back to locking to horizontal sync only. If the burst phase cannot be measured reliably, it will display "unlockable".

```
1080i/59.94
No 5/10 MHz Ref
Gps Ok.  Sig OK
Syncro disabled
LTC ok  IRIG n/a
GPI1 HI  GPI2 HI
```
1080i ref with GPS

The second line displays the detection of a 10MHz or 5MHz continuous wave (CW) frequency on the reference loop input.

The third line displays the current status of the GPS receiver. This is the same status that is displayed on line 5 of the *Lock Status* screen.

```
No Video Input
10 MHz Ref Ok
Gps Disconnected
Syncro link ok
LTC ok  IRIG n/a
GPI1 HI  GPI2 HI
```
10MHz ref with Syncro

The fourth line shows the current status of the syncro link (if enabled) that is available when two 5601MSC units are connected through a 5601ACO2. See section 2.3.3.3 for more information on syncro.

The fifth line displays the status of the LTC/IRIG input. If LTC is present it will show "LTC ok IRIG n/a". If IRIG is present it will show "LTC n/a IRIG ok"

The sixth line shows the status of the General Purpose Inputs. These GPI inputs are activated by connection to ground. The status will be "GPI1 LO" or "GPI2 LO" when either GPI has been activated. See section 3.3 for information on the GPIs.

Modem/ACO2/Hw

The *Modem/ACO2/hw* status screen displays various information about the 5601MSC including the modem state, SNMP status, connection to a 5601ACO2, and also any critical hardware failure messages.

```
no modem
SNMP status only
5601ACO2 status
   Not found
```
No modem option, SNMP read only

The first line displays the current status of the modem. When dialing the modem, it is useful to view this status line to watch the progress of the synchronization. After a successful negotiation this line will display "Last mdm Xd h:mm" to show how many days, hours and minutes have elapsed since the system clock was synchronized by the modem. If more than 10 days have elapsed, this line will be highlighted yellow and trigger a system warning to indicate the system clock may no longer be considered accurate. See section 2.3.3.2 for information on how modem dial-up time synchronization works.

```
Modem on hook
SNMP on
5601ACO2 status
   A channel
```
Modem inactive, SNMP fully enabled, link to 5601ACO2 bank A detected

The second line shows the state of the SNMP, whether it has been disabled, fully enabled (read/write), or enabled for status reporting only (read-only).

The third and fourth lines show whether connection to a 5601ACO2 has been detected with the SNSA and SNSB lines on the AUDIO connector. This feature can be used to enable automatic highdrive (see section 0).

Modem/ACO2/Hw

```
Last mdm 5d 1:37
SNMP disabled
5601ACO2 status
   Not found
```

Modem dialed 5 days ago, SNMP disabled.

The last two lines are reserved for reporting hardware problems with the main oscillators in the unit (refer to section 2.2.3). Any such message will be displayed with a blinking red/violet background and will trigger a system fault.

Control Ethernet / Time Ethernet

```
A172. 21.  1. 87
M255.255.255.  0
G172. 21.  1.  1
Mac add 00-02-c5
        10-6d-c8
Ethernet link ok
```
Control Ethernet

```
A172. 21.  1. 87
M255.255.255.  0
G172. 21.  1.  1
Mac add 00-02-c5
        10-6d-c9
No Ethernet link
```
Time Ethernet

The *Control Ethernet* status screen displays the current IP settings for the CONTROL Ethernet port. The *Time Ethernet* status screen shows the same information about the TIME Ethernet port. These items are configured in the *IP Control* menu item (see section 4.5.12).

The first line, prefixed with an "A" is the active IP Address for the port.

The second line, prefixed with an "M" is the current subnet Mask.

The third line, prefixed with a "G" is the active Gateway IP address.

The fourth and fifth lines display the Ethernet MAC address for the port.

The last line shows the Ethernet link status. It will show "Ethernet link ok" if an Ethernet connection is established, and "No Ethernet link" otherwise.

NTP

```
stratum : 1
precision :   -9
Synchronzed
ref : GPS
```

The *NTP* status screen displays information about the NTP server. It shows stratum, precision, lock status, and reference.

It will also show if there are issues with the NTP. The HELP button will offer suggestions if there is a configuration issue. If the NTP server is Not Synchronized the lock indicator alarm bit (LI_ALARM) will be set in outgoing packets. This may cause clients to refuse to synchronize to the NTP server.

Press HELP for more information on the current status.

Options Firmware

```
Standard plus
3g/hd/sd testgen
modem
dual powersupply
ntp     irig
Ver 2.0 B 29
```

The *Options Firmware* status screen displays information about the installed options in the 5601MSC as well as the current firmware version.

The possible options are 3G, HD, or SD test generators, modem and NTP server or IRIG. See section 5.1.16 for a list of the available options.

The last line shows the current firmware version and build number that is installed in the 5601MSC in the format of: Version X.X Build XX.

4.1.3. Panel Lock Function

Pressing the **PANEL LOCK** 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. Note that pressing HELP and **PANEL LOCK** at the same time will also turn off the panel lock.

4.1.4. Front Panel LCD Displays

There are two full color LCD displays on the front panel. The left LCD indicates 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. Figure 4-3 below shows the layout of the LCD screens.

System Status   Frequency Reference Status
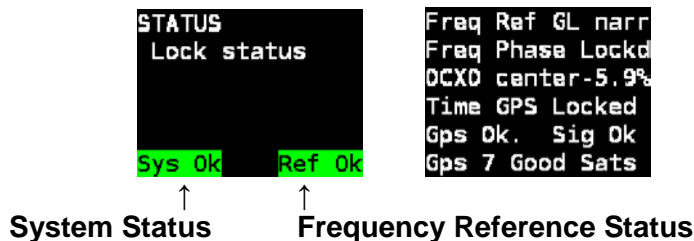
Figure 4-3: LCD Displays in Status Screen

The left LCD display shows 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 4-1 in order of severity:

Message	Description
Hw fail	Appears blinking red in the bottom-left corner. Indicates that an internal hardware problem has been detected. It is advisable not to remove power from the unit and to contact the factory immediately. See 2.2.3 for more information.
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 4.5.9.5).
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 4-1: 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 4.3.12 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.

4.2. FRONT PANEL MENU SYSTEM

The 5601MSC menu system consists of three root menus. 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. Likewise the Output or General menus can be entered by pressing the **OUTPUT** or **GENERAL** buttons. 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 4-4 below:

```
INPUT              >GPS
 Frequency Ref      Ten MHz
  Reference Src     Video
                    Internal


Sys Ok     Ref Ok
```

Figure 4-4: Menu System and Selection List

When a menu item is selected, there can be several different formats to modifying the value of the selected setting. The most common is the selection list (see Figure 4-4). 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 4.3.12) or saving a preset (see section 4.5.11). Use caution with such menu items. Refer to Figure 4-5 below for an example.

```
GENERAL            >Get preset USA
 Presets
  Get preset USA


Live control
Sys Ok     Ref Ok
```

Figure 4-5: 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 4-6 below as an example.
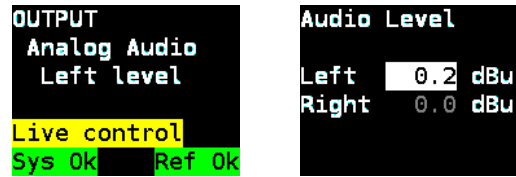
Figure 4-6: Adjustment Live Control

Sections 4.3 to 4.5 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.

4.2.1. Menu Reference Guide

Level 1	Level 2	Level 3	Level 4	Level 5	Level 6

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`
			`IRIG`
			`SNTP`		

		Vitc Line	`line 14`		

		VitcLtc Date	`Auto Mode`
			`No date`
			`Legacy`
			`Production`
			`SMPTE 309 BCD`
			`SMPTE 309 MJD`		

		Irig Mode	`B12* AUTO`
			`B120 to B123`
			`B124 to B127`		

		Time IP	`NTP IP 1`
			`NTP IP 2`
			`NTP IP 3`
			`NTP IP 4`
			`NTP IP 5`
			`NTP IP 6`
			`NTP IP 7`
			`NTP IP 8`
				`NTP IP Mode`
				
				`NTP IP Address`
					`IP disabled`
					`IP enabled`
					`10.0.0.1`

		Lock Type	`User`
			`Never`
			`Always`
			`Daily`		

		Input Jam Time	`Input Jam Time`
			
			`   0:00`		

	Jam Input	Jam Reference [LIVE]			
		Jam Time [LIVE]			

Table 4-2: Input Menu System Tree

Level 1	Level 2	Level 3	Level 4	Level 5
OUTPUT	**LTC 1** & **LTC 2** or **LTC/IRIG 1 and LTC/IRIG 2**	Power Applied (LTC 1 Only)	`Power Off` `Power On`	

		Frame Rate/Irig	`23.98 FPS`
			`24 FPS`
			`25 FPS`
			`29.97 FPS`
			`29.97DF FPS`
			`30 FPS`
			`IRIG`	

		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`	

		Irig mode	`B122`
			`B123`
			`B124`
			`B127`	

		Irig offset [LIVE]	`0 seconds`	

	SYNC 1 (1, 2, 3, 4, 5, 6) Or **10 MHz** Or **Wordclock**	Mode	`PAL-B`
			`NTSC-M`
			`1080i/50`
			`1080i/59.94`
			`1080i/60`
			`1080p/23.98`
			`1080p/23.98sF`
			`1080p/24`
			`1080p/24sF`
			`1080p/25`
			`1080p/29.97`
			`1080p/30`
			`1080p/50`
			`1080p/59.94`
			`1080p/60`
			`720p/24`
			`720p/30`
			`720p/50`
			`720p/59.94`
			`720p/60`
			`625i/48`
			`625i/47.95`
			`480p/59.94`
			`576p/50`
			`PAL color frame`
			`1 Hz`
			`1/1.001 Hz`
			`6/1.001 Hz`
			`IRIG datum`
			`5 MHz`
			`10 MHz`
			`NTSC-M subcarr.`
			`PAL-B subcarr.`
			`Wordclock`	

		Vitc Ctl	`Off` `On`	

OUTPUT (continued)	**SYNC OUTPUTS** (continued)	Vitc Line 1	`line 1 = 14`	
		Vitc Line 2	`line 2 = 16`	
		Dropframe Ctl	`Off` `On`	
		Color Frame	`Color Frame Off` `Color Frame 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`	
		Hor phase [LIVE]		
		Vert phase [LIVE]	`Cf   v   h fine%` `0   0   0   0.0`	
		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`	

	SDI TG 1 (1, 2, 3, 4)	Signal	`BLACK`
			`WHITE`
			`FIELD IDENT. (B=1, W=2)`
			`FRAME IDENT.`
			`100% COLORBARS`
			`75% COLORBARS`
			`75% BARS W. 100% WHITE`
			`RP219 COLORBARS`
			`LAB BARS, MOVING BOX`
			`VALID RAMP`
			`100% WHITE WINDOW`
			`50% WHITE WINDOW`
			`20% WHITE WINDOW`
			`SDI CHECKFIELD`
			`GREY (QUIET)`
			`GREY (ALL BITS ACTIVE)`
			`FULL FIELD PLUGE`
			`10 FRAME SEQUENCE`
			`BOUNCING BOX`
			`30Fps 4 FILM FRAME SEQ.`
			`1s & 5s IDENT. W. AUDIO`
			`60% Y LINE SWEEP 30MHZ`
			`MULTIPULSE`
			`Y MULTIPULSE`
			`CIRCLE WITH CENTER CROSS`
			`CLEAN APERTURE WITH GRAT`	

		Format	Interface	`Single Link HD`
				`3G Level A`
				`3G Level B`
				`Dual Link HD`
				`Standard Def`

OUTPUT (continued)	**SDI TG 1 (1, 2, 3, 4)** (continued)	Format (continued)	Image Format	`525i`
				`625i`
				`1920x1080i/59`
				`1920x1080p/23`
				`1920x1080p/29`
				`1920x1080p/23sF`
				`1920x1080p/29sF`
				`2048x1080p/23`
				`2048x1080p/23sF`
				`1280x720p/59`
				`1920x1080i/50`
				`1920x1080p/25`
				`1920x1080p/25sF`
				`1280x720p/50`
				`1920x1080i/60`
				`1920x1080p/24`
				`1920x1080p/30`
				`1920x1080p/24sF`
				`1920x1080p/30sF`
				`2048x1080p/24`
				`2048x1080p/24sF`
				`1280x720p/60`
				`1920x1080p/59`
				`1920x1080p/50`
				`1920x1080p/50`

			Sample Struct	`422/10 YCbCr`
				`444(4)/10 YCbCr`
				`444(4)/10   RGB`
				`444/12 YCbCr`
				`444/12   RGB`
				`422/12 YCbCr`

		Hor Phase [LIVE]	`Phase value`	
		Vert Phase [LIVE]	`Vert  hor` `0    0`	
		Audio Group 1, 2, 3, 4	Group Ctl	`Off` `On`
			Ch 1 frequency	`1.0 kHz`
			Ch 1 level	`-20 dBFS`
			Ch 2 frequency	`1.0 kHz`
			Ch 2 level	`-20 dBFS`
			Ch 3 frequency	`1.0 kHz`
			Ch 3 level	`-20 dBFS`
			Ch 4 frequency	`1.0 kHz`
			Ch 4 level	`-20 dBFS`

		Message Ctl	`Message Off`
			`Message 1 line`
			`Message 2 lines`	

		H Position [LIVE]	`Message Position`	
		V Position [LIVE]	`vert.  hor.` `2     1`	
		Message 1	`EVERTZ 5601MSC`	
		Message 2	` Master Sync`	
		Message font	`Normal size` `Large size`	
		TC Burn in	`Off` `On`	
		Dropframe Ctl	`Off` `On`	
		Set Jam Time	`0:00`	

OUTPUT (continued)	**SDI TG 1 (1, 2, 3, 4)** (continued)	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 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`
			`CCIR 17`
			`CCIR 18`
			`CCIR 330`
			`2T 3T 20T PULSE AND BAR`
			`100% Y SWEEP`
			`60% Y SWEEP`
			`75% COLOR BARS`
			`100% COLOR BARS`
			`SMPTE BARS`
			`NTC7 COMPOSITE`
			`NTC7 COMBINATION`
			`FCC COMPOSITE`
			`FCC MULTIBURST`
			`60% EXTENDED MB`
			`Y MULTIPULSE`
			`2T PULSE & BAR`
			`SIN(X)/X`
			`COMPOSITE SIGNAL`	

		Image Format	`525 NTSC M` `625 PAL B`	
		Fine phase [LIVE]	`Phase value`	
		Hor phase [LIVE]		
		Vert phase [LIVE]	`cf  v   h fine%`	
		Color phase [LIVE]	`1   1   1   0.0`	

		Message Ctl	`Message Off`
			`Message 1 line`
			`Message 2 lines`	

		H position [LIVE]	`Message Position`	
		V position [LIVE]	`vert.  hor.` `2     1`	
		Message 1	`EVERTZ 5601MSC`	
		Message 2	`Master Sync`	
		Message font	`Normal size` `Large size`	
		TC Burn in	`Off` `On`	
		Dropframe Ctl	`Off` `On`	
		Color Frame		
		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`
	ATG 1 (1, 2) (continued)	DST Ctl	`Off` `On`
		Syncro	`Include syncro` `Exclude syncro`
		Left frequency	`20Hz – 12.0kHz`
		Right frequency	`20Hz – 12.0kHz`
		Left level [LIVE]	`Audio Level`
		Right level [LIVE]	`Left   10.0 dBu` `Right  10.0 dBu`
		Audio Mode	`Steady tones` `Timed tones`

	Analog Audio	Audio Event 1
		
		Audio Event 2
		
		Audio Event 3
		
		Audio Event 4
		
		Audio Event 5
		
		Audio Event 6
		
		Audio Event 7
		
		Audio Event 8
		
		Audio Event 9
		
		Audio Event 10
			Set Event Time → `Set Event Time`
			
			`   0:00:00.00`
			`  every minute`
			`  every hour`

OUTPUT (continued)			**Audio type** → `mute`
			`constant left`
			`constant right`
			`constant both`
			`beep left`
			`beep right`
			`beep both`
			`bell left`
			`bell right`
			`bell both`
			`beep l const r`
			`beep r const l`
			`bell l const r`
			`bell r const l`

			Left Frequency → `20Hz – 12.0kHz`
			Right Frequency → `20Hz – 12.0kHz`
			Duration → `0.1 Seconds.`
			Test event [LIVE] → `BEEP TEST`
	AES Audio	AES/DARS/WC lck	`PAL/integer` `NTSC/fractional`
		AES coarse [LIVE]	`AES/DARS/WC` `Phasing`
		AES fine [LIVE]	`coarse  fine` `0       0`

		WC phase [LIVE]	`Wordclock`
			`Phasing`
			
			`0`

		AES1 Left Freq	`20Hz – 12.0kHz`
		AES1 Left level	`0 dBFS to -30 dBFS`
		AES1 Right Freq	`20Hz – 12.0kHz`
		AES1 Right levl	`0 dBFS to -30 dBFS`
		AES2 Left Freq	`20Hz – 12.0kHz`
		AES2 Left level	`0 dBFS to -30 dBFS`
		AES2 Right Freq	`20Hz – 12.0kHz`
		AES2 Right levl	`0 dBFS to -30 dBFS`
	Global Pedestal	`Pedestal Off` `Pedestal On`	

OUTPUT (continued)	Global Phasing	GPS phase En	`Global Ph Off` `Global Ph On`	
		GPS mS [LIVE]	`Global phasing`	
		GPS uS [LIVE]	`   MS.   US.   NS.`	
		GPS nS [LIVE]	`    0    0    0`	
		Video ph En	`Global Ph Off` `Global Ph On`	
		Video mS [LIVE]	`Global phasing`	
		Video uS [LIVE]	`   MS.   US.   NS.`	
		Video nS [LIVE]	`    0    0    0`	
		Ten MHz ph En	`Global Ph Off` `Global Ph On`	
		Ten MHz mS [LIVE]	`Global phasing`	
		Ten MHz uS [LIVE]	`   MS.   US.   NS.`	
		Ten MHz nS [LIVE]	`    0    0    0`	
		Internal ph En	`Global Ph Off` `Global Ph On`	
		Internal mS [LIVE]	`Global phasing`	
		Internal uS [LIVE]	`   MS.   US.   NS.`	
		Internal nS [LIVE]	`    0    0    0`	

Table 4-3: Output Menu System Tree

Level 1	Level 2	Level 3	Level 4	Level 5
	Set System Time	Set System Time 16:38:55		
	Set System Date	Set System Date 2010 Dec. 25		
	VitcLtc Userbit	00000000		
	VitcLtc dte fmt	Legacy Production SMPTE - 309 MJD SMPTE - 309 BCD User set bits Lat/Long		
	Syncro	Syncro Off Slave menu Slave time Slave menu/time Master menu Master time Master menu/time		
GENERAL	**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	Modem number 16137453900	
		Auto dial time	Auto dial time 0:00:00	
		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 **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		
	Firmware	Upgrade	ARE YOU SURE?	VERY SURE?
GENERAL	**EngineeringMenu**	Password	5601	

(continued)		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	
		Menu Access Ctl	MASTER Access	All Menus Norma Menu Locks On
			Set Time	Menu Accessible Menu Locked
			Set Date	
			VITC/LTC Userbi	
			VitcLTC dateFmt	
			Syncro Enable	
			Modem	
			GPO 1 mode	
			GPO 2 mode	
			Firmware	
			DST rules	
			Presets	
			IP Control Ctl	
			IP Time Ctl	
			NTP rules	
GENERAL	ENGINEERING MENU	Menu Access Ctl	Freq Ref Source	Menu Accessible

(continued)	(continued)	(continued)	Genlock Range	`Menu Locked`
			Freq Lock Type	
			Time Ref Source	
			Vitc Read Line	
			VITC/LTC Date	
			Irig In Mode	
			Time IP	
			Time Lock Type	
			Input Jam Time	
			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	
			Word Clock	

			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`	
		Reset GPS [LIVE]	`TIME JAMMED`	
	DST rules	DST mode	`day/week/month` `day of month`	
		Start Hour	`DST starts 0000`	
		DST start day	`Sunday – Saturday or` `Day1 – Day31`	

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

		DST start month	`January to December`	
		End Hour	`DST ends 0000`	
GENERAL (continued)	**DST rules**	DST end day	`Sunday – Saturday or` `Day1 – Day31`	

		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	Ctrl IP address	172.21.56.01	
		Ctrl IP netmask	255.255.255.0	
		Time IP address	192.168.56.01	
		Time IP netmask	255.255.255.0	
		IP gateway	0.0.0.0	
		IP gateway en	gateway off gateway on	
		Broadcast mode	ctrl en, time e ctrl rej,time e ctrl en, time r ctrl rej,time r	
	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 4-4: General Menu System Tree

4.3. 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 4.3.1 to 4.3.12 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 4-5: Root Level of the *INPUT* Menu

4.3.1. Selecting the Frequency Reference

```
INPUT
  Frequency Ref
    Reference Src
      GPS
      Ten MHz
      Video
      Internal
```
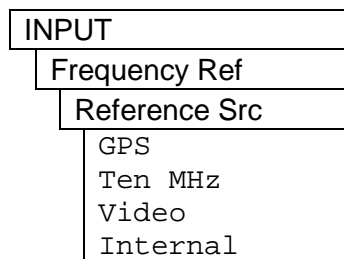
The *Reference Src* menu item in the *Frequency Ref* menu is used to select the frequency reference that the 5601MSC will use to lock its internal oscillator. All outputs are driven from a common oscillator and therefore are clock locked to each other (i.e. they do not drift with respect to each other). 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 the lock diagram in section 2.2.

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. Refer to section 2.2.13 for more information.

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 35°. Burst is not required for Slo-PAL bi-level references. Refer to section 2.2.5 for more information.

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. Refer to section 2.2.12.1 for more information.

4.3.2. 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 2.2.3.

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.

4.3.3. 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. See section 2.2.4 for more information.

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.

4.3.4. Selecting the Time Reference

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

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 2.3.3.1 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. See section 2.3.3.2 for synchronization and section 4.5.6 for the modem configuration menu.

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 sections 2.3.3.3 and 4.5.5 for more information.

When set to *LTC*, the 5601MSC system time will be referenced to time information being read from the LTC input on the GPIO connector. The frame rate of the incoming LTC is auto-detected and must be either 29.97fps dropframe, or 25fps. See section 2.3.3.4 for more information.

When set to *VITC* the 5601MSC system time will be referenced to time read from Vertical Interval Time Code off a black burst reference applied to the REF IN LOOP BNCs. The incoming VITC frame rate can be either 29.97fps dropframe on NTSC-M, or 25fps on PAL-B. The line to read VITC from is selected by the *Vitc Line* menu item (see section 4.3.5). The frequency reference must be set to *Video* in order to use VITC as a time reference.

When the time reference source is set to *None*, the 5601MSC system time will freerun. The operator 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 sections 2.4 and 4.5.13.1).

When set to IRIG, the 5601MSC will obtain time information from an IRIG-B signal applied to the LTC input on the GPIO connector. The type of IRIG expected is set using the *Irig Mode* menu item (see section 2.3.3.6).

When set to SNTP, the 5601MSC will obtain time from one of eight NTP time servers. The time *Lock Type* is forced to *Daily*. The *Input Jam Time* control specifies when the daily sync will happen. It is similar in properties to using a modem to do a daily dial up. It is designed this way because NTP is not an adequate reference to do a genlock, and each SNTP synchronization may cause the LTC and VITC outputs to change.

4.3.5. 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.

4.3.6. Configuring the VITC and LTC Time Reference Date Format

```
INPUT
  Time
    VitcLtc Date
      Auto mode
      No date
      Legacy
      Production
      SMPTE 309 BCD
      SMPTE 309 MJD
```

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 timecode 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 ST 309 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 ST 309 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.

4.3.7. Selecting the IRIG Input Mode

```
INPUT
  Time
    Irig Mode
      B12* AUTO
      B120 to B123
      B124 to B127
```

The *Irig Mode* menu item is used to set what format of IRIG to expect. It is valid only when the time reference has been set to IRIG.

See section 2.3.5 for a description on the different IRIG formats supported. Select *B12* AUTO* to auto-detect the IRIG type. Otherwise the input IRIG format can be forced using this control. Note that only IRIG-B127 provides year information.

4.3.8. Selecting the SNTP IP Enable

INPUT
Time
Time IP
NTP IP 1
NTP IP 2
NTP IP 3
NTP IP 4
NTP IP 5
NTP IP 6
NTP IP 7
NTP IP 8
NTP IP Mode
`IP disabled` `IP enabled`

The *NTP IP Mode* is to enable or disable the eight servers that can be used as an SNTP time reference. These are valid only when the time reference has been set to SNTP.

Up to 8 servers can be set up. During the daily time sync to SNTP, the 5601MSC will contact each server that is enabled and chose the one with the best time, based on the data provided by the servers.

4.3.9. Selecting the SNTP IP Address

INPUT
Time
NTP IP
NTP IP 1
NTP IP 2
NTP IP 3
NTP IP 4
NTP IP 5
NTP IP 6
NTP IP 7
NTP IP 8
NTP IP Address
`10.0.0.1`

The *NTP IP address* defines the IP address of one of the eight NTP servers that can be used as an SNTP time reference. These are valid only when the time reference has been set to SNTP.

Up to 8 servers can be set up. During the daily time sync to SNTP, the 5601MSC will contact each server that is enabled and chose the one with the best time, based on the data provided by the servers.

4.3.10. Selecting the Time Reference Lock Type

```
INPUT
  Time
    Lock Type
      User
      Never
      Always
      Daily
```

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.

If *Daily* is selected, the 5601MSC system clock will run independently from the time reference and *jam* once daily at the time of day specified by the *Input Jam Time* control.

> ✎ **If the time reference has been set to SNTP, the time lock type is forced to Daily, no matter what this control has been set to.**

4.3.11. Setting the Daily Jam Time for the Time Reference

```
INPUT
  Time
    Input Jam Time
      Input Jam Time

         0:00
```

When the *Lock Type* is set to *Daily*, the 5601MSC system time will run independently from the time reference and *jam* to it once a day. This menu item is ignored if the *Lock Type* is set to anything other than *Daily*.

If the time reference is set to SNTP then this sets the time to do a daily SNTP synchronization, and the Lock Type is not applicable.

Enter the time of day in 24-hour format that the 5601MSC should perform this daily *jam*. When the jam occurs, the update will ripple to all output timecode clocks. The NTP server and IRIG outputs will also be affected. The time specified should be during a period when it will have a minimum effect on system operation.

4.3.12. 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 4.3.3 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 4.3.12). 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.

Note that if the time reference is set to SNTP then this forces an immediate SNTP synchronization.

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 any jam warning messages to clear.

4.4. 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 4.4.1 and 4.4.2 give detailed information about each of the sub-menus.

LTC 1	Configures LTC/IRIG output 1
LTC 2	Configures LTC/IRIG 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 controls for GPS, Video, 10MHz, and Internal lock modes

Table 4-6: Top Level of the Output Setup Menu

4.4.1. 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 4.4.1.1. If the IRIG option is installed, either of the LTC outputs can be put into IRIG mode. For the sake of simplicity only the menus for LTC output 1 will be described in the manual.

4.4.1.1. 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 ST 12-1 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.

4.4.1.2. Setting the LTC Output Frame Rate and IRIG

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

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 timecode 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 timecode disruptions will have the least effect in the television plant (See section 4.4.1.3).

Select *30 FPS* to generate timecode 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 timecode 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 timecode 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 timecode 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 timecode that counts at a nominal 30 frames per second using the SMPTE Dropframe 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 timecode 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 timecode 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 timecode will be synchronous to video sync pulse outputs in the PAL-B, 1080i/50, and 720p/50 video standards.

Select *24 FPS* to generate timecode 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 timecode 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 timecode will be synchronous to video sync pulse outputs in the 1080p/23.98, and 1080p/23.98sF video standards.

If the **IRIG** option is installed, selecting *IRIG* will generate IRIG-B timecode in the format chosen by the *Irig Mode* menu item. The amplitude of the IRIG signal can be controlled by the *Output Level* menu item. See section 2.3.5 for more information on the IRIG formats available.

4.4.1.3. 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 timecode 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 4.4.1.4). All LTC and VITC timecode outputs can be synchronized to system time in one shot using the *Jam all VitcLtc* menu item (see section 4.4.1.5).

4.4.1.4. 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 4.4.1.3).

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.**

4.4.1.5. 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.

4.4.1.6. Setting the LTC Frame Offset

```
OUTPUT
```

This menu item allows the user to set an offset between the system time

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

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 4.4.1.7) and the Daylight Saving Time correction (see section 4.4.1.8) to obtain the final LTC output time. To advance the LTC earlier than the system time set the offset to a negative (-) value.

4.4.1.7. 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 4.4.1.8) and the LTC frame offset (see section 4.4.1.6) 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.

4.4.1.8. 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 4.5.9.5).

4.4.1.9. Setting the LTC/IRIG Output Level

```
OUTPUT
  LTC 1
    Output Level
      Level = 1
```

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 3.1.4 for more information. This menu item also controls the amplitude of the IRIG output where a level of 1 corresponds to approximately 1.0V and a value of 15 to 8.3V.

4.4.1.10.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.

4.4.1.11.Enabling the LTC Output Color Frame Bit

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

This menu item allows the user to control whether the color frame flag is set on the LTC output. When the color frame flag is on, the 5601MSC will ensure that the timecode is aligned according to SMPTE ST 12-1 to the applicable video standard. This alignment is performed for 29.97 rates (dropframe and nondropframe) to NTSC, and 25 FPS rates to PAL.

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 and the timecode will be forced to align to its respective video standard.

4.4.1.12.Selecting the IRIG Output Format

```
OUTPUT
   LTC 1
      Irig mode
         B122
         B123
         B124
         B127
```

This menu item selects the IRIG-B output format. It is only applicable if the **IRIG** option is installed and the *Frame Rate/Irig* menu selection has been set to *IRIG*.

Refer to section 2.3.5 for information on the different IRIG formats.

4.4.1.13.Setting a Time Offset to the IRIG Output

```
OUTPUT
   LTC 1
      Irig offset
         0 seconds
```

This menu item allows the user to add an offset, in seconds, to the IRIG output. This allows the IRIG timecode to be advanced or delayed from system time. The range is -59 seconds to +59 seconds.

4.4.2. 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.

4.4.2.1. Selecting the Standard of the Sync Outputs

```
OUTPUT
  Sync 1
    Mode
      PAL-B
      NTSC-M
      1080i/50
      1080i/59.94
      1080i/60
      1080p/23.98
      1080p/28.98sf
      1080p/24
      1080p/24sf
      1080p/25
      1080p/29.97
      1080p/30
      1080p/50
      1080p/59.94
      1080p/60
      720p/24
      720p/30
      720p/50
      720p/59.94
      720p/60
      625i/48
      625i/47.95
      480p/59.94
      576p/50
      PAL colr frme
      1 Hz
      1/1.001 Hz
      6/1.001 Hz
      IRIG datum
      5 MHz
      10 MHz
      NTSC-M subcar
      PAL-B subcar.
      Wordclock
```

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

The PAL-B and NTSC-M selections are black burst outputs compliant with SMPTE ST 318. 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 4.4.2.2 for more information.

There are numerous HD tri-level standards that can be output compliant with SMPTE ST 274, SMPTE ST 296, and SMPTE ST 292-1.
For 1080p/25sF use the 1080i/50 format
For 1080p/29.97sF or 1035i/59.94 use the 1080i/59.94 format
For 1080p/30sF or 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. See the pulse diagrams of Figure 2-4 and Figure 2-5 for more detail. 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 and is also aligned with NTSC color field 1. 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 *IRIG1 datum* pulse will be aligned with the IRIG outputs and the rising edge indicates the start of the IRIG reference bit. The pulse type is controlled by the *Pulse type* menu item (see section 4.4.2.2.12).

Wordclock is a 48kHz sampling rate clock that can be phased separately to the AES/DARS outputs. The amplitude is controlled by the *Wordclock levl* menu item (see section 4.4.2.2.14).

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 4.4.2.2.13). 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.

4.4.2.2. Configuring the VITC Generator for the Color Black Outputs

4.4.2.2.1. Enabling VITC on the Video Output

```
OUTPUT
```

This menu item controls whether Vertical Interval Time Code will be inserted

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

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).

4.4.2.2.2. **Selecting the VITC Insertion Lines**

```
OUTPUT
  Sync 1
    Vitc Line 1
      line 1 = 14
    Vitc Line 2
      line 2 = 16
```

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.

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).

4.4.2.2.3. **Enabling Dropframe Counting for NTSC VITC**

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

This menu item allows the user to control whether the dropframe 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).

4.4.2.2.4. **Enabling Colorframe Alignment of VITC**

```
OUTPUT
  Sync 1
    Color Frame
      Color Frame Off
      Color Frame On
```

This menu enables or disables color frame alignment of VITC timecode to the black burst sync it is being embedded on. This menu item is only applicable when the sync mode is NTSC-M or PAL-B.

When turned on, the Color Frame bit in VITC will be set to indicate that color frame alignment is being performed. The VITC timecode count will be adjusted to maintain a correlation to the color field it is inserted on according to SMPTE ST 12-1 (see section 2.3.4.2 for more detail).

4.4.2.2.5. **Selecting When the VITC Time is Synchronized to the System Time**

OUTPUT
Sync 1
Set Jam Time
0:00

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 4.4.2.2.6). All LTC and VITC timecode outputs can be synchronized to system time in one shot using the *Jam all VitcLtc* menu item (see section 4.4.2.2.7).

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).

4.4.2.2.6. **Synchronizing the VITC to System Time Immediately**

OUTPUT
Sync 1
Jam Output
TIME JAMMED

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 4.4.2.2.5). **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.**

4.4.2.2.7. **Synchronizing all the VITC, LTC, and Burn-In Clocks 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).

4.4.2.2.8. **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 4.4.2.2.9) and Daylight Saving Time correction (see section 4.4.2.2.10) 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).

4.4.2.2.9. **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 4.4.2.2.10) and the VITC frame offset (see section 4.4.2.2.8) 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).

4.4.2.2.10. **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 4.5.9.5).

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).

4.4.2.2.11. **Enabling Insertion of the Ten Field Reference**

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

This menu item controls insertion of a SMPTE ST 318 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).

4.4.2.2.12. **Selecting the Pulse Type**

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

This menu item allows the user to set the pulse type for the pulse formats (see section 4.4.2.1). 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)

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.

4.4.2.2.13. **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).

4.4.2.2.14. **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 an unterminated output.

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

4.4.2.3. Setting the Phase of the Sync Outputs

The phase of the sync outputs is set independently of each other. There are four menu items that are used to set the phase. Figure 4-7 and Figure 4-8 show the default video sync alignment (V phase = 1, H phase = 1, fine phase = 0.0%) for 59.94Hz and 50Hz systems respectively.
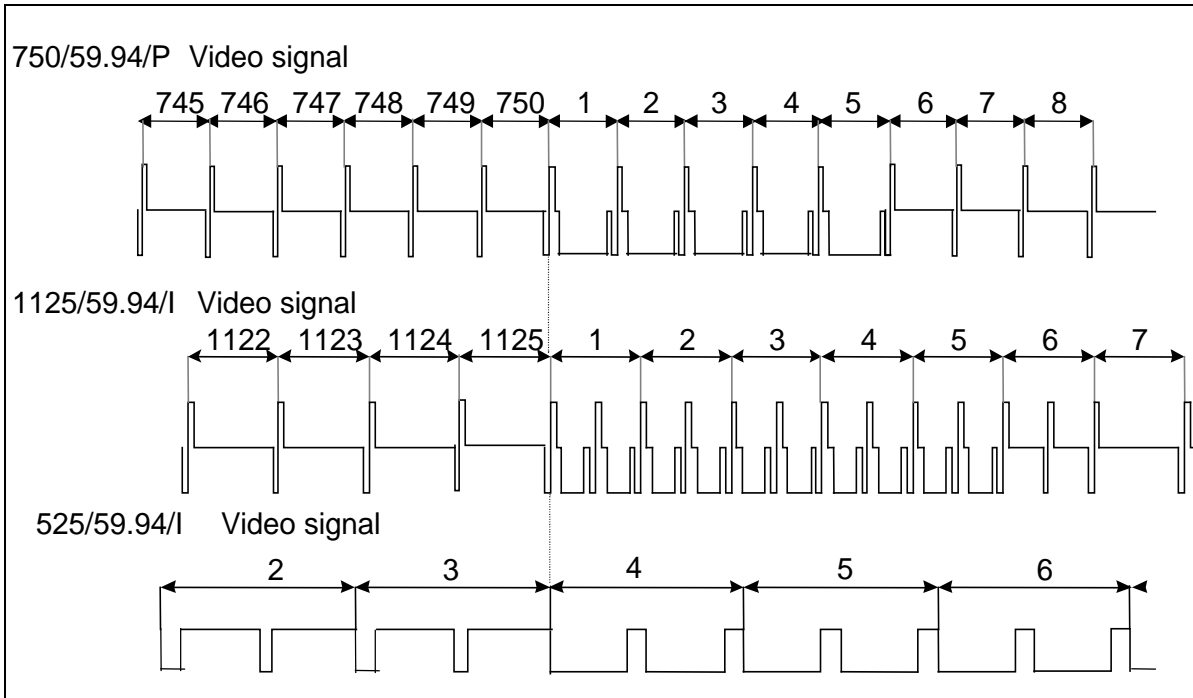
Figure 4-7: Video Sync Phase Alignment in 59.94Hz Field Rate Systems
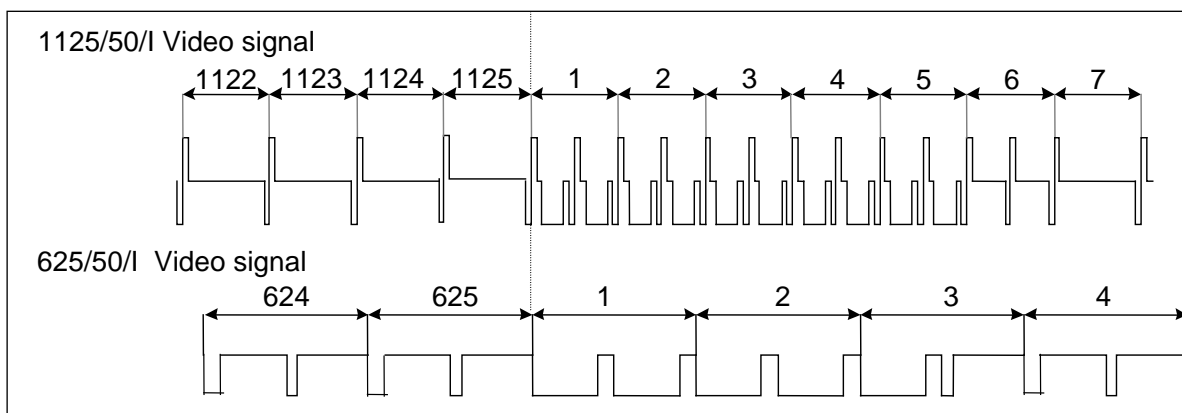
Figure 4-8: Video Sync Phase Alignment in 50Hz Field Rate Systems

> 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
    ┌─────────────────────┐
    │ Phase value         │
    │                     │
    │ v   h fine%         │
    │ 1   1   0.0         │
    │                     │
    └─────────────────────┘
      HD TRILEVEL PHASE
```

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. The wordclock phase is controlled in the AES Audio menu (see section 0).

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. 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.

Note: Increasing a phase value (↑) **delays** the respective output. Decreasing a phase value (↓) **advances** the respective output.

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 black burst sync output has been changed, a JAM of the VITC must be performed in order to ensure proper video to timecode alignment.

4.4.3. 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.

4.4.3.1. Selecting the SDI Test Generator Test Pattern

```
OUTPUT
  SDI TG 1
    Signal
      BLACK
      WHITE
      FIELDID(B=1,W=2)
      FRAME IDENT
      100% COLOR BARS
      75% COLOR BARS
      RP219 COLORBARS
      VALID RAMP
      100%WHITE WINDOW
      50% WHITE WINDOW
      20% WHITE WINDOW
      SDI CHECKFIELD
      GREY (QUIET)
      GREY (ACTIVE)
      10 FRAME SEQUNCE
      BOUNCING BOX
      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.

See section 4.4.5 for a complete list of test signals included with the 5601MSC firmware and those that can be added by loading a CompactFlash card and inserting it into the unit.

4.4.3.2. Selecting the Interface Type of the SDI Video Test Generator

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

The *Interface* 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 ST 292-1) interface speed for 1080i/1080p (SMPTE ST 274), 720p (SMPTE ST 296), and 2k DCDM (SMPTE ST 428) image formats. Both BNCs will contain the same video.

Select *3G Level A* for a 2.97Gb/s (SMPTE ST 424) interface speed for direct image format mapping (SMPTE ST 425-1 Level A).

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

Select *Dual Link HD* for a 1.48Gb/s (SMPTE ST 292-1) interface speed for dual-link image formats (SMPTE ST 372). In this format the BNC labelled (A) will be Link A and the BNC labelled (B) will be Link B.

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

4.4.3.3. Selecting the Image Format of the SDI Video Test Generator

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

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 setting of the *Interface* menu item is. Move the selection cursor to a format and press the **HELP** button to obtain more information.

4.4.3.4. Selecting Sampling Structure of the SDI Video Test Generator

```
OUTPUT
  SDI TG 1
    Format
      Sample Struct
        422/10 YCbCr
        444(4)/10 YCbCr
        444(4)/10   RGB
        444/12 YCbCr
        444/12   RGB
        422/12 YCbCr
```

The *Sample Struct* menu item is located within the *Format* sub-menu and controls the video sample structure of the Dual-Link or 3G Level B video output. This menu item will be forced to *422/10 YCbCr* for *Single Link HD* and *Standard Def* interfaces. Move the selection cursor to a format and press the **HELP** button to obtain more information.

4.4.3.5. 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 4-7 and Figure 4-8 for the default video sync alignment for 59.94Hz and 50Hz systems respectively.

```
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.

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 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.

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

Note: Increasing a phase value (⬆) **delays** the respective output. Decreasing a phase value (⬇) **advances** the respective output.

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.

4.4.3.6. 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 ST 272 (SD) and SMPTE ST 299-1 (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.

4.4.3.6.1. 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.

4.4.3.6.2. **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.

4.4.3.6.3. **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

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.

4.4.3.7. 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 the SDI test generators. There are six menu items used to control the message displayed and are described below.

4.4.3.7.1. 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 overlaid onto the SDI test generator output.

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 overlaid onto the SDI test generator video output.

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

4.4.3.7.2. 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.

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.

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

```
OUTPUT
  SDI TG 1
    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 16 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.

4.4.3.7.4. **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.

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

4.4.3.7.5. **Enabling On-Screen Burn in for the SDI TG**

```
OUTPUT
  SDI TG 1
    TC Burn in
      Off
      On
```

This menu item controls whether the on screen timecode burn in window will be placed at the bottom of the SDI TG output image. This burn in window is useful for tagging each frame with a unique timecode ID. The timecode numbers replace image data hence they are "burned-in" to the picture.

Note that enabling the burn in window does not insert any VITC or ancillary timecode packets into the video.

4.4.3.7.6. **Enabling Dropframe Counting for SDI TG**

```
OUTPUT
  SDI TG 1
    Dropframe Ctl
      Off
      On
```

This menu item allows the user to control whether the dropframe counting mode will be used for the burn in timecode.

This menu item is only applicable to 29.97Hz and 59.94Hz video standards.

4.4.3.7.7. **Selecting When the Burn in Time is Synchronized to the System Time**

```
OUTPUT
  SDI TG 1
    Set Jam Time
      0:00
```

This menu item allows the user to set the time of day when the SDI burn in timecode clock will be synchronized to system time. This synchronization is necessary once per day to maintain a long-term correlation between the SDI burn in time and system time for 29.97 and 59.94 frame per second rates.

Also, when the time reference is set to *GPS*, the SDI burn in time will have to be synchronized to the system time to correct for leap seconds.

Enter the hour and minute with the ⬆ and ⬇ buttons or by turning the control knob.

The burn in clock can be synchronized to system time immediately using the *Jam Output* menu item (see section 4.4.2.2.6).
All LTC, VITC and burn in timecode outputs can be synchronized to system time in one shot using the *Jam all VitcLtc* menu item (see section 4.4.2.2.7).

4.4.3.7.8. **Synchronizing the Burn In Time to System Time Immediately**

```
OUTPUT
  SDI TG 1
```

This menu item allows the user to synchronize the SDI burn in timecode clock to system time immediately. This synchronization will also happen

Jam Output
TIME JAMMED

once per day at the time specified using the *Set Jam Time* menu item (see section 4.4.2.2.5).
Caution: This menu item is a live control.

To synchronize the SDI burn in timecode 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.

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

4.4.3.7.9. **Synchronizing all the VITC, LTC, and Burn-In Clocks to System Time Immediately**

OUTPUT
SDI TG 1
Jam all VitcLtc
ALL TIMES JAMMED

This menu item allows the user to synchronize all LTC, VITC, and burn in clocks to system time simultaneously.
Caution: This menu item is a live control.

To synchronize all the LTC, VITC and TG burn in clocks 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.

4.4.3.7.10. **Setting the SDI Burn in Frame Offset**

OUTPUT
SDI TG 1
Time offset
0 frames

This menu item allows the user to set an offset between the system time and the SDI burn in 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 4.4.2.2.9) and Daylight Saving Time correction (see section 4.4.2.2.10) to obtain the final VITC time. To advance the SDI burn in time earlier than the system time, set the offset to a negative (-) value.

4.4.3.7.11. **Selecting the SDI Burn In Time Zone Offset**

OUTPUT
SDI TG 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 SDI burn in 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 4.4.2.2.10) and the SDI burn in time frame offset (see section 4.4.2.2.8) to obtain the final SDI burn in 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.

4.4.3.7.12. **Enabling Daylight Saving Time for the SDI Burn In Time**

OUTPUT

This menu item allows the user to control whether Daylight Saving Time

```
┌─────────────────────────┐
│ SDI TG 1                │
│  ┌──────────────────────┤
│  │ DST Ctl              │
│  │  ┌───────────────────┤
│  │  │ Off               │
│  │  │ On                │
└──┴──┴───────────────────┘
```

(DST) compensation will be applied to the SDI burn in.

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

When set to *On* the rules set by the *DST rules* menu in the *GENERAL root* menu will be used to adjust the SDI burn in time (see section 4.5.9.5).

4.4.3.8. 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 3.1.8).
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.**

4.4.3.9. 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.

4.4.4. Configuring the Analog Video Test Generator Outputs (SDTG, HDTG, 3GTG Options)

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

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

```
┌─────────────────────────┐
│ OUTPUT                  │
└─────────────────────────┘
```

This menu item selects the picture content for the analog video test

```
ATG 1
  Signal
    BLACK
    GREY
    WHITE
    FIELDID (B=1,W=2)
    10 Y STEP
    Y RAMP
    SHALLOW Y RAMP
    MODULATED RAMP
    CCIR 17
    CCIR 18
    75% COLOR BARS
    100% COLOR BARS
    SMPTE BARS
    NTC7 COMPOSITE
    NTC7 COMBINATION
    FCC CCOMPOSITE
    FCC MULTIBURST
    60% EXTENDED MB
    Y MULTIPULSE
    2T PULSE & BAR
    SIN(X)/X
    COMPOSITE SIGNAL
    more ...
```

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.

See section 4.4.5 for a complete list of test signals included with the 5601MSC firmware and those that can be added by loading a CompactFlash card and inserting it into the unit.

4.4.4.2. 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.

4.4.4.3. 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 4-7 and Figure 4-8 to see the default alignment for 59.94Hz and 50Hz systems respectively.

```
OUTPUT
  ATG 1
    Fine phase
    Hor phase
    Vert phase
    Color phase
     Phase value

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

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.

Note: Increasing a phase value **delays** the respective output. Decreasing a phase value **advances** the respective 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.**

4.4.4.4. Configuring the On-Screen Message of the Analog Video Test Generator

It is possible to overlay a user-defined text message onto the output of the analog video test generators. There are six menu items used to control the message displayed and are described below.

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

```
OUTPUT
  ATG 1
    Message Ctl
      Message off
      Message 1 line
      Message 2 lines
```

This menu item is used to enable the on-screen message for the ATG and to select how many lines will be overlaid 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 overlaid onto the picture of the ATG output.
When set to *Message 2 lines*, there will be two lines of text overlaid onto the picture of the ATG output.

4.4.4.4.2. Setting the On-Screen Message Position for the Analog Video Test Generator

```
OUTPUT
  ATG 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 ATG 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.

4.4.4.4.3. Setting the Text for the On-Screen Message of the Analog Video Test Generator

```
OUTPUT
  ATG 1
    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 16 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.

4.4.4.4.4. Setting the Font Size for the On-Screen Message of the Analog Video Test Generator

```
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.

4.4.4.4.5. Enabling On-Screen Burn in for the Analog Video Test Generator

```
OUTPUT
   ATG 1
      TC Burn in
         Off
         On
```

This menu item controls whether the on-screen timecode burn in window will be placed at the bottom of the analog test generator output image. This burn in window is useful for tagging each frame with a unique timecode ID. The timecode numbers replace image data hence they are "burned-in" to the picture.

Note that enabling the burn in window does not insert any VITC into the analog test generator output.

4.4.4.4.6. Enabling Burn in Timecode Dropframe counting for the Analog Video Test Generator

```
OUTPUT
   ATG 1
      Dropframe Ctl
         Off
         On
```

This menu item allows the user to control whether the dropframe counting mode will be used for the burn in timecode clock.

This menu item is only applicable to the NTSC image format.

4.4.4.4.7. Enabling Burn in Timecode Colorframe Alignment for Analog Video Test Generator

```
OUTPUT
   ATG 1
      Color Frame
         Off
         On
```

This menu enables or disables color frame alignment of the burn-in timecode clock to the analog test generator output video.

When turned on, the timecode that is burned into the picture will be adjusted to maintain a correlation to the color field it is inserted on according to SMPTE ST 12-1 (see section 2.3.4.2 for more detail).

4.4.4.4.8. Selecting When the Burn in Time is Synchronized to the System Time

```
OUTPUT
   ATG 1
      Set Jam Time
         0:00
```

This menu item allows the user to set the time of day when the analog video test generator burn in timecode on the SCI output will be synchronized to the system time. This synchronization is necessary once per day to maintain a long-term correlation between the analog video test generator burn in time and system time for the NTSC image format.

When the time reference is set to *GPS*, the analog video test generator burn in time will have to be synchronized to the system time to correct for leap seconds.

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

The TG/VITC/LTC can also be synchronized to system time immediately using the *Jam Output* menu item (see section 4.4.2.2.6). All LTC, VITC and burn in timecode outputs can be synchronized to system time in one shot using the *Jam all VitcLtc* menu item (see section 4.4.2.2.7).

4.4.4.4.9. **Synchronizing the Analog Test Generator Burn In Clock to System Time Immediately**

```
OUTPUT
  ATG 1
    Jam Output
      TIME JAMMED
```

This menu item allows the user to synchronize the burn in clock for the analog test generator 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 4.4.2.2.5).

Caution: This menu item is a live control.

To synchronize the analog video test generator burn in clock 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.

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

4.4.4.4.10. **Synchronizing all the VITC, LTC, and Burn-In Clocks to System Time Immediately**

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

This menu item allows the user to synchronize all LTC, VITC, and burn in clocks (SDI and analog test generators) to system time simultaneously.

Caution: This menu item is a live control.

To synchronize all the LTC, VITC and TG burn in clocks 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.

4.4.4.4.11. **Setting the Analog Video Test Generator Burn in Timecode Frame Offset**

```
OUTPUT
  ATG 1
    Time offset
      0 frames
```

This menu item allows the user to set an offset between the system time and the analog video test generator burn in 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 4.4.2.2.9) and Daylight Saving Time correction (see section 4.4.2.2.10) to obtain the final VITC time.

To advance the analog video test generator burn in time earlier than the system time, set the offset to a negative (-) value.

4.4.4.4.12. **Selecting the Analog Video Test Generator Burn In Timecode Time Zone Offset**

```
OUTPUT
  ATG 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 analog video test generator burn in 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 4.4.2.2.10) and the analog video test generator burn in time frame offset (see section 4.4.2.2.8) to obtain the final SDI burn in 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.

4.4.4.4.13. **Enabling Daylight Saving Time for the Analog Video Test Generator Burn in Clock**

```
OUTPUT
  ATG 1
    DST Ctl
      Off
      On
```

This menu item allows the user to control whether the Daylight Saving Time (DST) adjustment will be applied to the analog video test generator burn in.

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

When set to *On* the rules set by the *DST rules* menu in the *GENERAL root* menu will be used to adjust the analog video test generator burn in time (see section 4.5.9.5).

4.4.4.5. **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.

4.4.5. Test Signals Available

The 5601MSC firmware contains a comprehensive set of test patterns for each video standard. Additional test patterns can be loaded using a CompactFlash card (see section 1.1.9). The full list of test patterns is shown here for firmware v2.0 b30. The list may change with future releases of firmware.

4.4.5.1. Signal List for 525, and NTSC

```
BLACK                           VALID RAMP              60% EXTENDED MB
GREY                            MODULATED RAMP          Y MULTIPULSE
WHITE                           75% COLOR BARS          2T PULSE & BAR
FIELD ID (B=1, W=2)             100% COLOR BARS         SIN(X)/X
10 Y STEP                       SMPTE BARS              BOWTIE
1 SEC AND 5 SEC IDENT. W. AUDIO NTC7 COMPOSITE          SDI CHECKFIELD (SDI ONLY)
WHITE FLASH W. AUDIO            NTC7 COMBINATION        FULL AMPLITUDE FAST EDGES
Y RAMP                          FCC COMPOSITE           COMPOSITE SIGNAL
SHALLOW Y RAMP                  FCC MULTIBURST
```

4.4.5.2. Signal List for 625, and PAL

```
BLACK                   100% COLOR BARS         100% Y SWEEP
GREY                    SMPTE BARS              60% Y SWEEP
WHITE                   MODULATED RAMP          SDI CHECKFIELD (SDI ONLY)
FIELD ID (B=1, W=2)     CCIR 17                 FULL AMPLITUDE FAST EDGES
WHITE FLASH W. AUDIO    CCIR 18                 1 SEC AND 5 SEC IDENT. W. AUDIO
Y RAMP                  CCIR 330                COMPOSITE SIGNAL
75% COLOR BARS          2T 4T 20T PULSE AND BAR
```

4.4.5.3. Signal List for HD, 1920x1080

```
BLACK                       100% WHITE WINDOW       24Fps 4 FRAME SEQUENCE
WHITE                       50% WHITE WINDOW        20Fps 4 FILM FRAME SEQ.
FIELD IDENT. (Blk=1, Wht=2) 20% WHITE WINDOW        1 SEC AND 5 SEC IDENT.W.AUDIO
FRAME IDENT.                SDI CHECKFIELD          60% Y LINE SWEEP TO 30 MHz
100% COLORBARS              GREY (QUIET)            60% Y LINE SWEEP TO 60 MHz
75% COLORBARS               GREY (ACTIVE)           MULTIPULSE
75% BARSW. 100% WHITE       FULL FIELD PLUGE        Y MULTIPULSE
RP219 COLORBARS             10 FRAME SEQUENCE       CIRCLE WITH CENTER CROSS
LAB BARS, MOVING BOX        8 FRAME SEQUENCE        CLEAN APERTURE WITH GRATICULE
VALID RAMP                  BOUNCING BOX
```

4.4.5.4. Additional Test signals in CompactFlash for HD, 1920x1080

```
COLOR WHEEL WITH RAMPS   Y RAMP AT VARIOUS BIT RESOLNS    FULL AMPLITUDE FAST EDGES
107% WHITE WINDOW        CB RAMP AT VARIOUS BIT RESOLNS   60% Y MULTIBURST (LOW)
90% WHITE WINDOW         CR RAMP AT VARIOUS BIT RESOLNS   60% Y MULTIBURST (MID)
80% WHITE WINDOW         CLEAN APERTURE WITH GRATICULE    60% Y MULTIBURST (HIGH)
70% WHITE WINDOW         GRATICULE WITH 3D REGISTRATION   60% MULTIBURST (LOW)
60% WHITE WINDOW         GRATICULE WITH 3D REG. (T/B)     60% MULTIBURST (MID)
40% WHITE WINDOW         GRATICULE WITH 3D REG. (L/L)     60% MULTIBURST (HIGH)
30% WHITE WINDOW         GRATICULE WITH 3D REG. (L/R)     SUNDANCE 3D
12% WHITE WINDOW         GRATICULE WITH 3D REG. (L/R)     SUNDANCE 3D WITH TEXT
10% WHITE WINDOW         INTER-OCULAR CROSSTALK BANDS     SUNDANCE 3D (T/B)
SDI EQ STRESS            1 SEC AND 5 SEC IDENT. W.AUDIO   SUNDANCE 3D (PROGRESSIVE)
SDI PLL STRESS           4 FILM FRAME SEQUENCE (30Hz)     SUNDANCE IMAGE (PROGRSVE)
WHITE FLASH W. AUDIO     4 FILM FRAME SEQUENCE (60Hz)     SUNDANCE IMAGE
4 FRAME SEQUENCE         4 FILM FRAME, 1 FLASH (30Hz)     ZONE PLATE
4 FRAME, FLASH F1        4 FILM FRAME, 1 FLASH (60Hz)
```

4.4.5.5. Signal List for HD, 1280x720

BLACK	LAB BARS, MOVING BOX	1 SEC AND 5 SEC IDENT. W.AUDIO
WHITE	VALID RAMP	MULTIPULSE
FULL FIELD PLUGE	SDI CHECKFIELD	60% Y LINE SWEEP TO 30MHz
75% COLORBARS	GREY (QUIET)	CIRCLE WITH CENTER CROSS
75% COLORBARS W.100% WHITE	GREY (ACTIVE)	CLEAN APERTURE WITH GRATICULE
100% COLORBARS	10 FRAME SEQUENCE	
RP219 COLORBARS	Y MULTIPULSE	

4.4.5.6. Additional Signals in CompactFlash for HD, 1280x720

FRAME ID	12% WHITE WINDOW	60% Y MB: 10,12,14,16,18,20MHz
107% WHITE WINDOW	FULL AMPLITUDE FAST EDGES	60% Y MB: 20,22,24,26,28,30MHz
100% WHITE WINDOW	BOUNCING BOX	60% MB: 1,2,4,6,8,10MHz
80% WHITE WINDOW	WHITE FLASH W.AUDIO	60% MB: 10,12,14,16,18,20MHz
50% WHITE WINDOW	60% Y LINE SWEEP 15 TO 30MHz	60% MB: 20,22,24,26,28,30MHz
20% WHITE WINDOW	60% Y MB: 1,2,4,6,8,10MHz	PRODUCTION APERTURE

4.4.5.7. Signal List for 2048x1080, 3GB and Dual Link

BLACK	RP219 COLORBARS	8 FRAME SEQUENCE
WHITE	VALID RAMP	MULTIPULSE
FRAME IDENT.	SDI CHECKFIELD	Y MULTIPULSE
100% COLORBARS	GREY (QUIET)	CLEAN APERTURE WITH GRATICULE
75% COLORBARS	GREY (ALL DATA BITS ACTIVE)	
75% BARS, 100% WHITE	FULL FIELD PLUGE	

4.4.5.8. Additional Signals in CompactFlash for 2048x1080, 3GB and Dual Link

LAB BARS, MOVING BOX	Y RAMP TO MAX AND BACK	INTEROCULAR CROSTALK BANDS
BLACK AND BARS	Y RAMP AT VARIOUS BIT RESOLNS	CAMERA SUNDANCE
FULL FIELD PLUGE	CB RAMP AT VARIOUS BIT RESOLNS	SUNDANCE 3D DUAL LINK
VALID RAMP	CR RAMP AT VARIOUS BIT RESOLNS	RED RAMP
WHITE FLASH W. AUDIO	DUAL LINK SDI CHECKFIELD	GREEN RAMP
107% WHITE WINDOW	3G LEVEL B SDI CHECKFIELD	BLUE RAMP
100% WHITE WINDOW	CLEAN APERTURE WITH GRATICULE	CIRCLE WITH CENTER CROSS
80% WHITE WINDOW	GRATICULE WITH 3D REG.	PRODUCTION APERATURE
50% WHITE WINDOW	3D ALIGNMENT SIGNALS	60% Y LINE SWEEP TO 30MHz
20% WHITE WINDOW	ROLLING 11 FRAME STEREO BOX	Y MULTIPULSE
12% WHITE WINDOW	ROLLING 3:2 FILM STEREO BOX	MULTIPULSE
Y MULTIPULSE	ROLLING 11 FIELD STEREO BOX	

4.4.6. 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. These outputs are provided on the AUDIO terminal block on the rear of the 5601MSC (see section 3.1.8). These outputs can be driven in two different modes chosen by the *Audio Mode* menu item. They can generate steady tones, or can be driven in event mode to generate timed tones of different types and durations.

4.4.6.1. 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. These controls are only valid when the *Audio Mode* is set to *Steady tones*. Move the selection cursor (**>**) to the desired frequency and press the **SELECT** button to apply it to the output.

4.4.6.2. Configuring the Analog Audio Tone Level

```
OUTPUT
  Analog Audio
    Left level
    Right level
      Audio Level

      Left  10.0dBu
      Right  0.0dBu
```

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.

4.4.6.3. Setting the Analog Audio Generation Mode

```
OUTPUT
  Analog Audio
    Audio Mode
      Steady tones
      Timed tones
```

There are two output modes for the Analog Audio outputs.
Select *Steady tones* to generate continuous audio tones as defined by the *Left Frequency* and *Right Frequency* controls. These tones will be very pure with a low total harmonic distortion.

Select Timed toned for event driven tone generation. There are a total of ten audio events that can be configured to activate at different times for adjustable durations. These tones can be programmed to go off at a certain time of the day, or periodically every hour or every minute.

4.4.6.4. Configuring the Analog Audio Events

There are ten different audio events, each one with similar menu settings. Note that audio events with a lower number have a higher priority than audio events with a higher number. For the sake of simplicity, only the menu items for *Audio Event 1* will be described in the manual.

4.4.6.4.1. Setting the Analog Audio Event Activation Time

```
OUTPUT
   Analog Audio
      Audio Event 1
      Set Event Time
         Set Event Time

            0:00:00.00
          every minute
          every hour
```

The *Set Event Time* menu item is used to set the time of day that the audio event will occur. The time specified here is goes by the **system clock** which is normally set to UTC.

Specify the time in hours:minutes:seconds.milliseconds

Note that by setting the hour or minute higher than 60 will cause the event to trigger every hour, or every minute (or both).

4.4.6.4.2. Selecting the Analog Audio Event Tone Type

```
OUTPUT
   Analog Audio
      Audio Event 1
      Audio Type

         mute
         constant left
         constant right
         constant both
         beep left
         beep right
         beep both
         bell left
         bell right
         bell both
         beep l const r
         beep r const l
         bell l const r
         bell r const l
```

The Audio Type menu item selects the type of tone that will be generated when the audio event is activated. The audio event can affect the left, right, or both left and right analog audio outputs.

Choosing *mute* effectively disables this audio event.

A *constant* tone generates a pure tone at the specified frequency. The *Duration* menu item is ignored and the output will constantly produce the tone and can only be overridden by an audio event of a lower number.

A *beep* tone generates a pure tone for the duration specified by the *Duration* menu item, after which the output will be muted.

A *bell* tone generates a shaped tone with a large attack value and slow decay for the duration specified by the *Duration* menu item, after which the output will be muted.

A mix of beep/bell and constant tone types are available so that different settings are applied to the left and right channel.

4.4.6.4.3. Setting the Analog Audio Event Tone Frequency

```
OUTPUT
   Analog Audio
      Audio Event 1
      Left Frequency
      Right Frequency
         12.0kHz
```

There are two menu items to control the frequency of the tone produced during the audio event for the left and right analog audio outputs. The tone can be set from 20kHz to 12.0kHz.

The Left Frequency menu item selects the tone frequency for the left analog audio output. The Right Frequency menu item selects the tone frequency for the right analog audio output.

4.4.6.4.4. **Setting the Analog Audio Event Duration**

```
OUTPUT
  Analog Audio
    Audio Event 1
      Duration
        10.0 Seconds
```

The Duration menu items sets the duration of the analog audio event. If the left or right channel is set to the *constant* tone type, this duration is ignored for that channel and a pure tone will be produced indefinitely until it is affected by another audio event with a higher priority (lower number). The duration can be set anywhere from 0.1 seconds to 10.0 seconds.

4.4.6.4.5. **Testing the Analog Audio Event**

```
OUTPUT
  Analog Audio
    Audio Event 1
      Test event
        BEEP TEST
        BELL TEST
```

The *Test event* menu item allows testing the audio event to hear what it will sound like. This can be used during setup to verify that the tone frequency, duration and volume are correct. Not valid for testing *constant* tone types.

Caution: This menu item is a live control and will immediately test the audio event when selected.

4.4.7. **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.

4.4.7.1. **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.

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 ST 318 ten-field reference, this mode will make use of it to align the digital audio.

4.4.7.2. 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 only applicable when in the PAL/integer lock mode.

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

4.4.7.3. 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).

4.4.7.4. 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.

4.4.7.5. 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
      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).

4.4.8. 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.

4.4.9. Configuring Global Phase

The *Global Phasing* menu allows a simultaneous phase offset to be applied to most outputs of the 5601MSC (see section 2.1.5). 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). There are four separate global phase controls, one for each of the frequency lock modes (GPS, Video, 10MHz, and Internal). Each global phase control can be programmed with a different offset and can be enabled and disabled separately. Note that after a restart, the global phase controls for 10MHz and Internal modes will be disabled and reset to 0 (see section 2.1.5).

4.4.9.1. Enabling or Disabling the Global Phase Offset

OUTPUT
Global Phasing
GPS phase En
Video ph En
Ten MHz ph En
Internal ph En
Global Ph Off
Global Ph On

There are four menu items used to enable or disable applying of the global phase offset to all outputs of the 5601MSC when locked to different reference sources.

Select *Global Ph Off* to turn off global phasing when locked to GPS. This disables the global phase offset on all outputs.

Select *Global Ph On* to enable the global phase offset when locked to GPS. Any offset entered will immediately affect all outputs of the 5601MSC.

4.4.9.2. Entering a Global Phase Offset

OUTPUT
Global Phasing
GPS mS
GPS uS
GPS nS
Video mS
Video uS
Video nS
Ten MHz mS
Ten MHz uS
TenMHz nS
Internal mS
Internal uS
Internal nS
Global Phasing
MS. US. NS.
0   0   0

There are three menu items that are used to set the global phase offset for each of the lock types. 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.

Note: Increasing a global phase value **delays** the outputs of the 5601MSC. Decreasing a global phase value **advances** the outputs of the 5601MSC.

The *mS* menu item adjusts the global phase offset in steps of 1 millisecond

The uS menu item adjusts the global phase offset in steps of 1 microsecond

The nS menu item adjusts the global phase offset in steps of 1 nanosecond.

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

4.5.   GENERAL CONFIGURATION ITEMS

The *GENERAL* setup menu is used to set up various items related to the overall operation of the 5601MSC. Table 1-1 shows the items available in the *GENERAL* setup menu. Sections 4.5.1 to 4.5.14 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.
Leap Seconds	Used to set the number of leap seconds.
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.
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.
PTP master	Configures the Precision Time Protocol settings on the unit.

Table 1-7: Top Level of the General Setup Menu

4.5.1.   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.

4.5.2.   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.

4.5.3.   Setting the Leap Seconds

```
GENERAL
  Leap Seconds
```

This menu item sets the current number of leap seconds. It is overwritten if time is received from a GPS/GLONASS Satellite. Warning: this will cause a

```
New Value
16 leap seconds


Set value
16 leap seconds
```

change in both time and genlock if changed.

4.5.4. 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.

4.5.5. 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 timecode 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 ST 309 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 ST 309 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. This is useful for mobile applications and remote site filming. See section 2.5.4 for more information.

4.5.6. Enabling Syncro Mode

```
GENERAL
  Syncro
    Syncro Off
    Slave menu
    Slave time
    Slave menu/time
    Master menu
    Master time
    Master menu/time
```

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 *Syncro Off* to disable the syncro feature completely and to ignore any communications on the syncro port.

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

4.5.7. 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 3.3 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, time 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.

4.5.8. 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 5.2 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.

4.5.9. 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.

4.5.9.1. Entering the Engineering Menu Password

```
GENERAL
  EngineeringMenu
    Password
      Password
      5601
```

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 re-entered to access the menu again.

4.5.9.2. Changing the Engineering Menu Password

```
GENERAL
  EngineeringMenu
    Set Password
      Set 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.

> **Note: The password is stored as a number. This means that passwords of "2" and "002" are considered identical.**

4.5.9.3. 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.

4.5.9.3.1. Enabling and Disabling SNMP

```
GENERAL
  EngineeringMenu
    SNMP
      SNMP Ctl
        SNMP off
        SNMP status
        SNMP on
```

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.

4.5.9.3.2. Changing the SNMP Read and Write Community Strings

```
GENERAL
  EngineeringMenu
    SNMP
      Com string Rd
      Com string Wr
```

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

```
Com string Rd

public
```

```
Com string Wr

private
```

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.

4.5.9.3.3. **Configuring the SNMP Trap Destinations**

GENERAL
EngineeringMenu
SNMP
Trap 1 Ctl
Trap 2 Ctl
Trap 3 Ctl
Trap 4 Ctl
` Trap IP disabld` ` Trap IP enabled`
Trap1 IP Add
Trap2 IP Add
Trap3 IP Add
Trap4 IP Add

` Trap1 IP Add`
 	
` xxx.xxx.xxx.xxx`

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.

4.5.9.3.4. **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
      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
        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.

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.

4.5.9.4. 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.

4.5.9.4.1. **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 4.5.9.4.2.

4.5.9.4.2. **Setting the Front Panel Menu Restrictions**

GENERAL
EngineeringMenu
Menu Access Ctl
Set Time
Set Date
VITC/LTC Userbi
VitcLTC dateFmt
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
Irig In Mode
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 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.

4.5.9.5. 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.

4.5.9.6. Resetting the GPS Receiver

```
GENERAL
    EngineeringMenu
        Reset GPS
            GPS RESET
```

This menu item can be used to reset the GPS receiver connected to the 5601MSC. This should only be used when the 5601MSC is down for maintenance and the GPS receiver is showing symptoms that it may be stuck in a bad state. It can also be used to confirm that the GPS receiver is programmed with the correct settings as provided by the Evertz factory.

Caution: This menu item is a live control. When selected, the GPS receiver will be reset and reprogrammed with factory default settings

4.5.10. 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.

4.5.10.1.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:
Sunday 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)

4.5.10.2.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.

4.5.10.3.Setting the DST Start Day

```
GENERAL
   DST rules
      DST start day
         Day1 – Day31
         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.

4.5.10.4.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".

4.5.10.5. 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.

4.5.10.6. 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.

4.5.10.7. Setting the DST End Day

GENERAL
DST rules
DST end day
Day1 – Day31
Sunday
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday

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

4.5.10.8. 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".

4.5.10.9. Setting the DST End Month

GENERAL
DST rules
DST end month

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

```
January
December
```

4.5.10.10. 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.

4.5.11. 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.

4.5.11.1. Recalling a User Defined Preset

```
GENERAL
  Presets
    Get preset 1
    Get preset 2
    Get preset 3
      Live control
      Are you sure?
      Very sure?
```

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.

4.5.11.2. Recalling a Factory Preset

```
GENERAL
  Presets
    Get preset USA
    Get pre EUROPE
      Live control
      Are you sure?
      Very sure?
```

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.

4.5.11.3.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, overwriting the settings of any preset that was saved previously. The preset will be saved immediately when the SELECT button is pressed.

4.5.12. Configuring the IP Settings for the CONTROL and TIME Ethernet Ports

The following sections will provide the user with instructions on how to configure the CONTROL and TIME Ethernet ports. The two ports must be configured to different subnets. Although both ports support SNMP and NTP protocols, the TIME port should be placed on a network with as little traffic as possible, ideally only time protocol related packets. The CONTROL network should be used for SNMP monitoring and control.

4.5.12.1.Setting up the IP Address for the CONTROL Ethernet Port

```
GENERAL
  IP Control
    Ctrl IP address
        IP address

        172.21.1.56
```

This menu item sets the unique Internet Protocol (IP) address of the CONTROL Ethernet port. An example of a private (internal) reserved IP address is 172.21.X.X or 192.168.X.X.

The IP address chosen should be an unused address that is compatible with your networking scheme.

4.5.12.2.Setting up the Internet Protocol Subnet Mask for the CONTROL Ethernet Port

```
GENERAL
  IP Control
    Ctrl IP netmask
        IP netmask

        255.255.255.0
```

This menu item defines the IP subnet mask for the CONTROL Ethernet port. Specifically, this parameter defines all the IP addresses that the 5601MSC can directly communicate with on the CONTROL port, without having to go through the gateway. When the 5601MSC responds to an IP address outside its subnet it will forward the packet to the gateway address, if enabled. This parameter is usually set to 255.255.255.0 for a private network.

4.5.12.3.Setting up the IP Address for the TIME Ethernet Port

```
GENERAL
  IP Control
    Time IP address
        IP address

        172.21.1.56
```

This menu item sets the unique Internet Protocol (IP) address of the TIME Ethernet port. An example of a private (internal) reserved IP address is 172.21.X.X or 192.168.X.X.

The IP address chosen should be an unused address that is compatible with your networking scheme.

4.5.12.4.Setting up the Internet Protocol Subnet Mask for the TIME Ethernet Port

```
GENERAL
  IP Control
    Time IP netmask
      IP netmask

      255.255.255.0
```

This menu item defines the IP subnet mask for the TIME Ethernet port. Specifically, this setting defines the IP addresses that the 5601MSC can directly communicate with on the TIME port, without having to go through the gateway. When the 5601MSC responds to an IP address outside its subnet it will forward the packet to the gateway address, if enabled. The subnet mask is usually set to 255.255.255.0 for a private network.

4.5.12.5.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.Y.

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 menu item is ignored if the gateway is not enabled.

4.5.12.6.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.

4.5.12.7.Configuring IP Broadcast Packet Handling

```
GENERAL
  IP Control
    Broadcast Mode
      ctrl en, time e
      ctrl rej,time e
      ctrl en, time r
      ctrl rej,time r
```

This item is used to control how the 5601MSC responds to broadcast packets on each of the Ethernet ports.

When set to *ctrl en, time e*, the 5601MSC will respond to all broadcast packets on both Ethernet ports. This is the default mode of operation but may cause the Ethernet ports to become overloaded if there is a large amount of broadcast traffic on the networks.

When set to *ctrl rej, time e*, the 5601MSC will reject broadcast packets on the CONTROL port, and reply to broadcast packets on the TIME port.

When set to *ctrl en, time r*, the 5601MSC will respond to broadcast packets on the CONTROL port, but reject broadcast packets on the TIME port.

When set to *ctrl rej, time r*, the 5601MSC will reject broadcast packets on both the CONTROL port and the TIME port.

4.5.13. 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. See section 2.4 for more information on how the NTP server operates. 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 4.5.12 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.

4.5.13.1. 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.

4.5.13.2. Configuring the NTP Restrictions

Restrictions define which IP addresses will be ignored by the NTP server. There are 8 restriction entries 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 0 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 1's

Restrict IpAdd = 172.21.1.70   Restrict IpMsk=255.255.255.255

To restrict all IP addresses beginning with a certain prefix (e.g. 172.21.1.XXX):

Restrict IpAdd = 172.21.1.0   Restrict IpMsk=255.255.255.0

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

4.5.13.2.1. **Setting the NTP Restriction Mode**

GENERAL
NTP rules
NTP restricts1
Restrict mode
Restrict permit Restrict deny
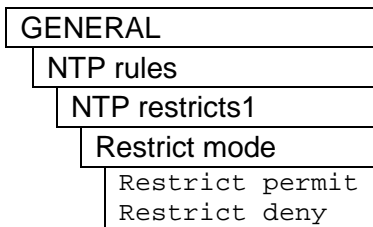
This item is used to enable or disable the current restriction rule. Set it to *permit* to effectively disable the rule, or set it to *deny* to apply the rule to incoming NTP traffic.

4.5.13.2.2. **Setting the NTP Restriction IP Address**

GENERAL
NTP rules
NTP restricts1
Restrict IpAdd
Restrict IpAdd 172.21.1.70
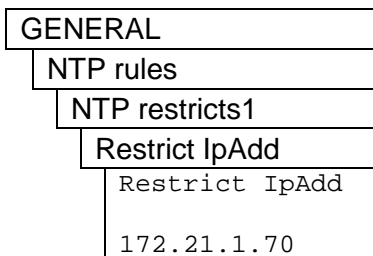
This menu item is used to enter the IP Address portion of the restriction rule. It is used with the IP Mask to determine the range of IP addresses that will be ignored by the NTP server. Only effective when the Restrict mode is set to *deny*.

4.5.13.2.3. **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*.

4.5.14. **Configuring the Precision Time Protocol Master**

The *PTP Master* sub-menu is used to configure the PTP master protocol on the Time Ethernet port of the 5601MSC. Note that the master mode does not operate if time or frequency reference is PTP.

✎ | **Note: Status PTP needs to be installed on the module to enable this sub-menu.**

4.5.14.1. **Master En**

```
GENERAL
  PTP Master
    Master en
      PTP master
       off
      PTP master on
```

This menu item is used to turn the PTP master broadcast packets on or off.

4.5.14.2. **Master Mode**

```
GENERAL
  PTP Master
    Master mode
      IEEE1588
       annexj
      SMPTE 2059
```

This menu item is used to set the PTP profile to IEEE-1588 annex J, or SMPTE 2059. It affects the range of the rates for sync and announce messages.

4.5.14.3.Setting the PTP DSCP value

```
GENERAL
  PTP Master
    DSCP
      dscp 56
```

This menu item is used to set the PTP Differentiated Services Code Point (DSCP) value. Note that only 16, 18, 20, 24, 32, 24, 28, 40, 48, 52, 54, and 56 should be used. Other values are available for user defined systems. The range is 0 to 63.

4.5.14.4. Setting the Sync Rate

```
GENERAL
  PTP Master
    Sync Rate
      1 per 2 sec
      1 per sec
      2 per sec
      4 per sec
      8 per sec
      16 per sec
      32 per sec
      64 per sec
      128 per sec
```

This menu item sets the rate at which to send master broadcast packets. If Master mode is set to Annex J, the range is 1 per 2 seconds to 2 per second. If Master mode is set to SMPTE 2059, the range is 2 per second to 128 per second.

4.5.14.5. Setting the Announce Rate

```
GENERAL
  PTP Master
    Announce Rate
      1 per 16 secs
      1 per 8 secs
      1 per 4 secs
      1 per 2 secs
      1 per sec
```

This menu item is used to set the rate at which to send master announcement packets. If Master mode is set to Annex J, the range is 1 per 16 seconds to 1 per 2 seconds. If Master mode is set to SMPTE 2059, the range is 1 per 2 seconds to 8 per second.

4.5.14.6. Setting the Timeout Value

```
GENERAL
  PTP Master
    Timeout
      3 announces
```

This menu item sets the timeout value for received announcement packets. It is in units of time of sent announce packets. Its range is 2 to 10.

4.5.14.7. PTP Priority 1

```
GENERAL
  PTP Master
    PTP Priority 1
      priority 1 128
```

This menu item sets the priority 1 value for the BMC. Its range is 0 to 255.

4.5.14.8. PTP Priority 2

```
GENERAL
  PTP Master
    PTP Priority 2
      priority 2 128
```

This menu item sets the priority 2 value for the BMC. Its range is 0 to 255.

4.5.14.9. Setting the PTP Domain

```
GENERAL
  PTP Master
    Domain
      domain 127
```

This menu item sets the domain of the PTP for master and slave operations.

4.5.14.10. GMP Enable

```
GENERAL
  PTP Master
    GMP Enable
      GMP off
      GMP on sync 1
      GMP on sync 2
      GMP on sync 3
      GMP on sync 4
      GMP on sync 5
      GMP on sync 6
      GMP on 10 MHz
      GMP on WC
```

This menu item controls the output of GMP Ethernet packets for a specific output. These packets describe the exact time of the sync edge for a sync output. They are output as a TLV extension in the IEEE-1588 announce packet. They may be enabled for use with Evertz "Grand Master Proxy" products to enhance the time accuracy.

Select *GMP off* to disable outputting GMP TLVs.

Select *GMP on sync <1,6>* to enable outputting GMP Ethernet packets for sync <1,6> output if it is set to NTSC or PAL.

Select *GMP on 10 MHz* to enable outputting GMP Ethernet packets for 10 MHz output if it is set to NTSC or PAL.

Select *GMP on WC* to enable outputting GMP Ethernet packets for Word Clock output if it is set to NTSC or PAL.

4.5.14.11. PTP

PTP (also called IEEE-1588) is a multi master/multi slave time distribution method.

PTP uses UDP packets. The unique properties that give it its accuracy is the hardware's ability to timestamp the Ethernet packets, instead of the software. Additionally, network hardware may be aware of PTP packets, and can modify them appropriately to improve timing accuracy. Note that there is nothing to preclude using an entirely software-based approach and ordinary network switches; however this will severely degrade the accuracy of the system. Lastly, there is a Best Master Clock (BMC) algorithm that allows masters and slaves to all agree on who will be the grand master.

4.5.14.12. Accuracy

The accuracy of PTP is determined by several factors. They are the base accuracy of the MASTER, the network, and the SLAVE and its associated hardware.

Largely, the dominating factor is the network. Accuracy can range from about 100 ns for a single hop using a transparent switch, up to milliseconds on ordinary switches. It is up to the user to ensure the network switches are adequate to the requirements.

Fortunately, modern facilities do not require the same levels of timing accuracy that old analogue video networks required. It is up to the end user to determine their accuracy requirements and associated network configurations. A careful review of the switch manuals with respect to PTP should be done before deploying.

4.5.14.13. Parts

The parts are:

1. **End point hardware and firmware:** This is the firmware that generates packets and the hardware that timestamps the outgoing and incoming packets.

2. **Network switches that pass PTP packets:** There are 3 types of switches. "Ordinary" switches treat PTP packets the same as any UDP packet. "Transparent" switches, which measure the time that the packet resides in the switch and modifies the packet to add this information, or generates a follow-up packet to let the downstream device, have this information. "Boundary" switches act as a PTP SLAVE, and on the other ports act as a MASTER to send PTP packets to downstream devices.

3. **Best Master Clock algorithm:** This is a set of agreed rules to determine who the best master is. It comprises of a Priority 1, which is a user configurable number. The master with the highest Priority 1 is always the master. If all masters have the same Priority 1, then the clock quality is looked at. This is a combination of reference type and distance from the reference. It is encoded as a number based on ranges. If all the Priority 1s and clock qualities are the same, then it looks at Priority 2. If Priority 1, clock quality, and Priority 2 are all the same then the master with the lowest MAC address is the best master.

4.5.14.14. Configuring PTP

Master enable must be set to on.

Master mode should be set as appropriate. Annex J will give slower rates of sync and announce messages. Use SMPTE if the slaves require higher packet rates.

DSCP is the PTP Differentiated Services Code Point value. Note that only 16, 18, 20, 24, 32, 24, 28, 40, 48, 52, 54, and 56 should be used. Other values are available for user defined systems. The range is 0 to 63. It is used to tell the network to give a preference to this type of packet. Usually this should be set to 56.

Sync rate should be set up based on the slave device requirements. It is good practice to have it set at the same rate as all the other potential MASTERS.

Announce rate and timeout should be based on the changeover requirements. The timeout multiplied by the announce rate gives the time the 5601MSC will go before becoming a MASTER when

the current MASTER stops sending announce messages for any reason. Good practice is to have them set the same as all the other potential MASTERS.

Priority 1 is the first item in the BMC algorithm. It is usually set the same as all the other potential MASTERS, but may be set lower to force this unit to become a MASTER, or lower to make sure it is the last MASTER to be chosen.

Clock quality is the second item in the BMC algorithm. It is determined by reference type and lock, and is not user settable.

Priority 2 is the third item in the BMC algorithm. It can be set higher or lower than other MASTERS if there is a preference of MASTERS, given all other items are the same. If there is no preference, set this to the same as the other potential MASTERS.

Domain must be set the same as all other MASTERS and SLAVES in the system. Any will only look at packets from other devices on the same domain.

GMP enable is used to add a TLV to the announce message. It should only be enabled if there is an Evertz GMP product in use. The Evertz product will get NTSC or PAL sync from this 5601MSC. It should be set to the channel of sync that is providing this sync source. Note that the GMP must be connected to this 5601MSC via an ordinary switch, or a transparent switch. It will not work through a boundary switch.

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4.6. SNMP REMOTE CONTROL WITH VISTA*LINK*®

The 5601MSC supports the Simple Network Management Protocol (SNMP) for remote monitoring and control through an IP network. The 5601MSC implements SNMP version 1 as outlined in RFC 1157 and RFC 1213. The protocol works by exchanging SNMP messages between an SNMP client (normally a computer running an SNMP client program) and a device such as the 5601MSC (sometimes called a *network element*).

There are three main types of SNMP messages. An SNMP **Get Request** is sent from a client to a device and is used to read a value from the device. An SNMP **Set Request** is sent from a client to a device and is used to change a value on the device. An **SNMP Trap** is sent from a device to a logging client whenever a certain event takes place. Traps are usually sent in order to notify the client that an error or other event has occurred on the device that requires attention.

Evertz offers Vista*LINK*® Pro, a powerful software suite for SNMP monitoring and control suitable for management of both small and large systems. The Vista*LINK*® Pro client is a powerful SNMP client that is offered as a free download from the Evertz website (www.evertz.com). It can be used for monitoring and configuring Evertz gear. The full version of Vista*LINK*® provides a server application for centralized alarm management, which monitors, reports, and logs all incoming trap events and dispatches alerts to all the Vista*LINK*® clients connected to the server. Advanced scripting, customizable graphical user interfaces, and more can be created for advanced automation and control purposes.

Device configuration through the Vista*LINK*® Pro client can be performed on an individual or multi-unit basis. The configuration of devices can be managed using simple copy and paste functions, which reduces the time required to configure each unit separately. VistaLINK® allows the user to configure all devices on the network from a central station using simple visual controls and receive feedback that the configuration has been successfully carried out.

All SNMP functionality in the 5601MSC is disabled by default. Refer to sections 4.5.9.3 and 4.5.9.3.4 for information on enabling the SNMP related features in the 5601MSC. The SNMP feature can also be set to *Status Only* mode whereby the configuration of the 5601MSC may be remotely monitored but not altered in any way. The SNMP service runs on both the CONTROL and TIME Ethernet ports.

4.6.1. Updating VistaLINK® with a New JAR File

The VistaLINK® Pro client provides an interactive and visual interface to configure and monitor the 5601MSC. This interface is stored in a *JAR* file. The *JAR* file for the 5601MSC is named "**VLProProd_MSC5601.JAR**". In order to recognize and display the graphical configuration for the 5601MSC, Vista*LINK*® Pro must first be updated with this *JAR* file. Future versions of Vista*LINK*® Pro will have the 5601MSC *JAR* built-in, however newer versions of the *JAR* will occasionally be released by Evertz, usually in conjunction with new versions of firmware.

To see which version of the JAR is being used, open the Vista*LINK*® Pro client and select the "Help" menu. Choose the "Version Information…" menu item.

> All JAR updates are available to download from the Evertz website (www.evertz.com). The 5601MSC is listed under "5000 Series".
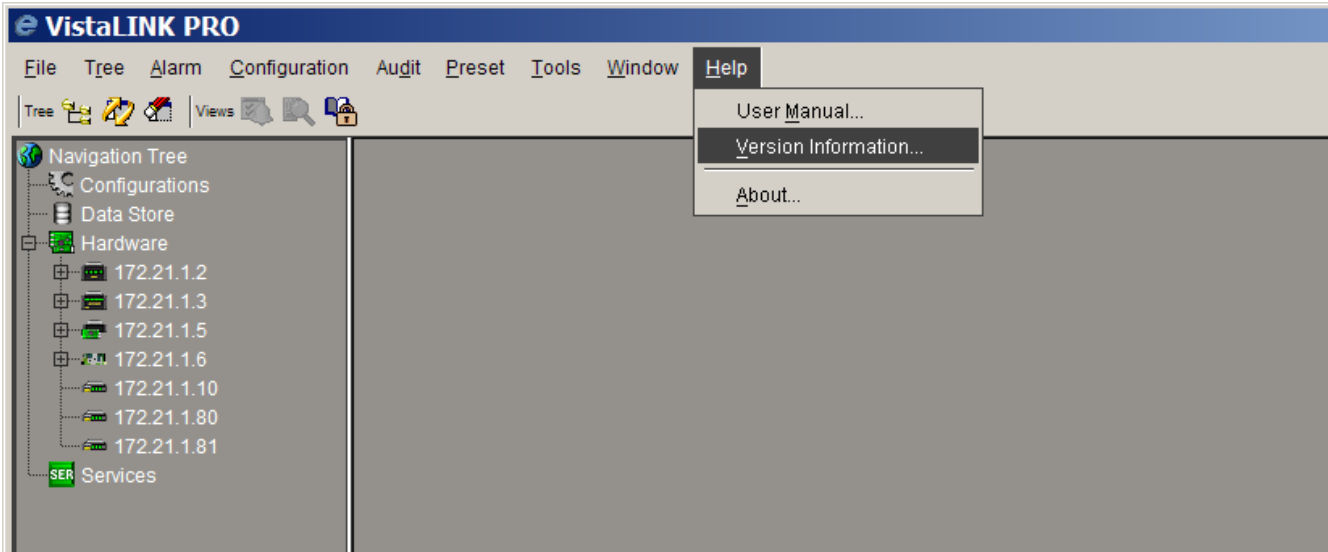
Figure 4-9: Selecting the Version Information Menu Item

Figure 4-10: Version Information Dialog
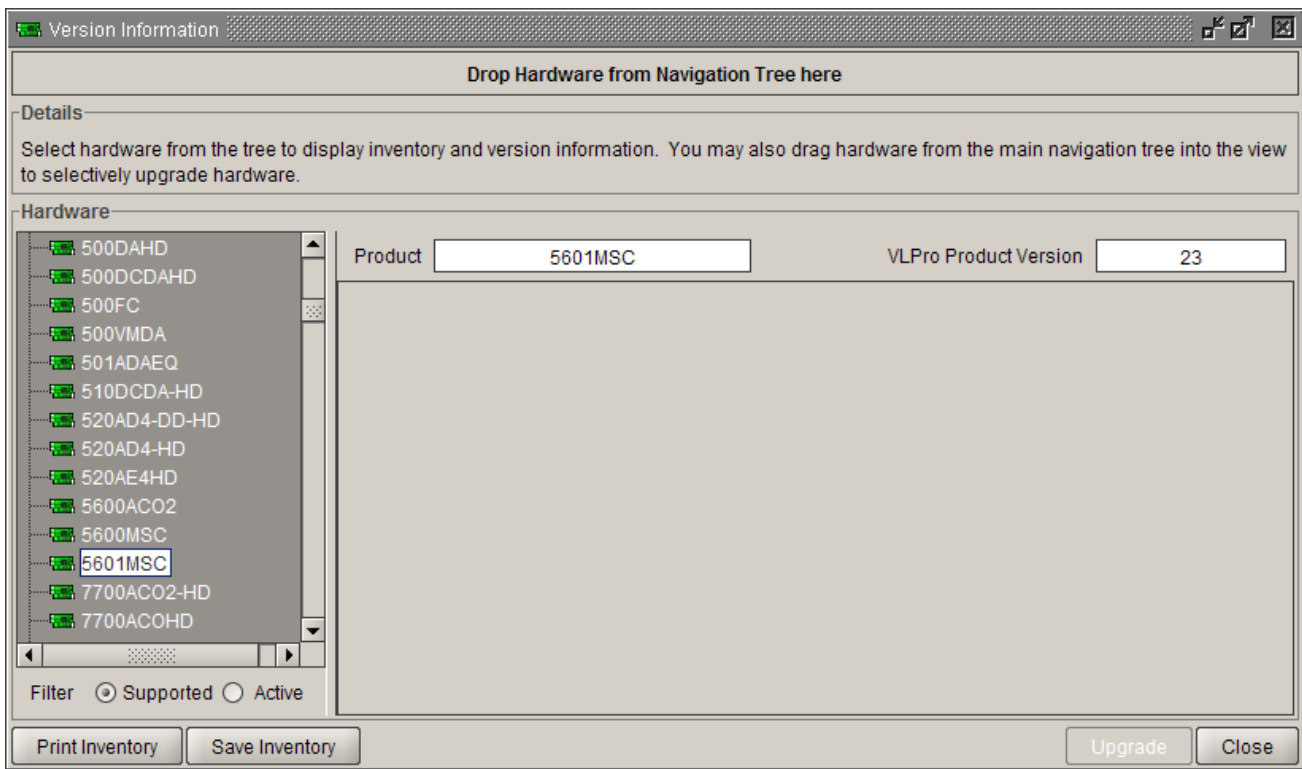
In the Version Information dialog window, all of the JAR files that are contained within the Vista*LINK*®
Pro client are listed on the left. Scroll down the list to the 5601MSC. Once selected, the product version
is displayed. In the example above, the 5601MSC JAR file version 23 is being used. If the 5601MSC
does not appear in the list, then Vista*LINK*® will have to be updated.

4.6.1.1. Applying a JAR update to the VistaLINK® Pro Server

The Vista*LINK*® Pro software runs a separate application for the server to which multiple clients can connect. The client software may be run on the same computer, or on a different computer connected to the network. The *JAR* file update is applied to the server software, after which any client connecting to it will be automatically updated with the newer *JAR*. The client-only version of Vista*LINK*® Pro is a standalone version which does not support logging of traps. To update the client-only version of Vista*LINK*® Pro, skip down to section 4.6.1.2.

To update the VistaLINK® Pro server, activate the "Help" menu then select the "Apply Update…" menu item. In the next pop-up menu, choose "Product…". Browse to the folder containing the *JAR* update and select the **VLProProd_MSC5601.JAR** file.
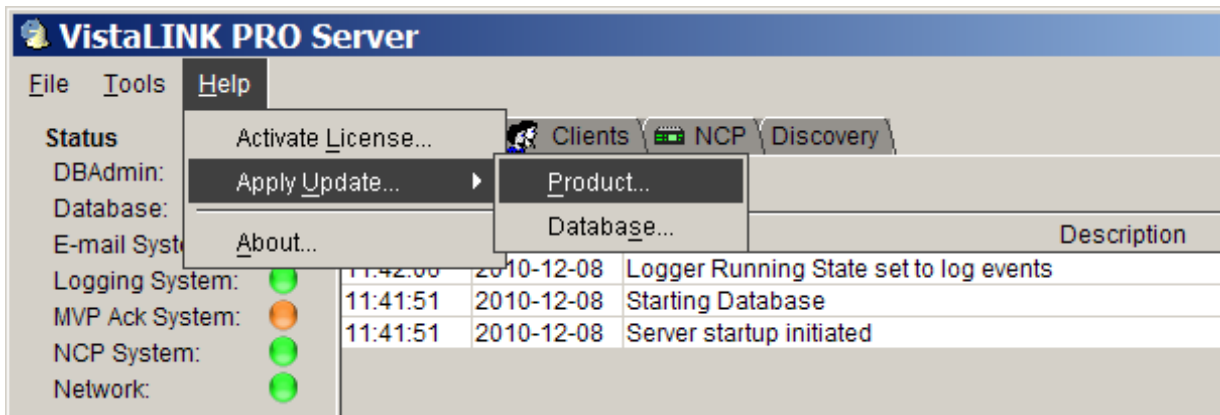

Figure 4-11: Updating the Vista*LINK*® Pro Server with a new JAR file

Once updated a message will appear stating that the server software must be restarted before the update can be applied. The restart can be performed at any convenient time by closing and re-opening the server application. Note that when the server is restarted it will force any clients that are currently connected to terminate.
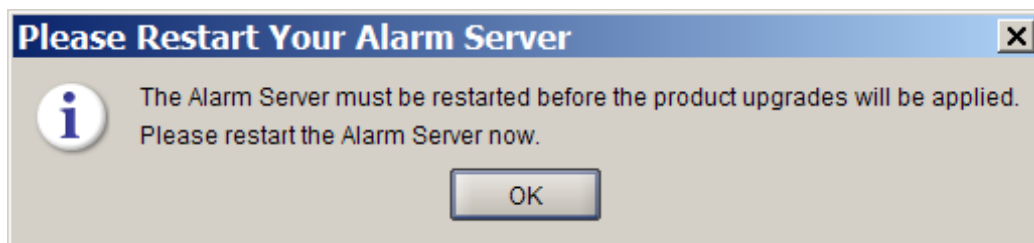

Figure 4-12 : Server Restart Warning

Once the server application has been restarted, any client that connects to it will receive the JAR update automatically. This will be indicated by a message stating that the product information has been updated during the initialization of the client software.
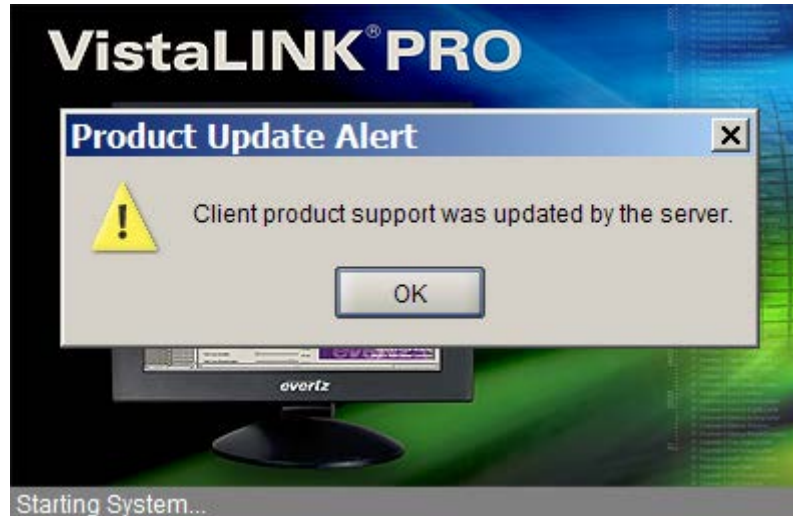
Figure 4-13: Client Notification of JAR Update from Server

4.6.1.2. Applying a JAR Update to the Client-Only Version of VistaLINK® Pro

The client-only version of Vista*LINK*® Pro runs as a standalone client which does not require a Vista*LINK*® server to connect to. It is available as a free download from the Evertz website (www.evertz.com) and supports basic configuration and monitoring features. In order to update the client-only version, it must first be shut down. The JAR file must then be copied into the "`lib\products`" directory located in the installation folder. This is usually "`C:\Program Files\VistaLinkPro\lib\products`". If the JAR file already exists, it should be overwritten.

Once the JAR file has been successfully copied, it may be required to find and delete the "`VistaLinkAgentStandaloneInfo.xml`" file from the "`config`" directory. This file may have the "hidden" attribute turned on. In a typical installation the file is normally located at "`C:\Program Files\VistaLinkPro\config\`". This file is generated automatically at startup and does not contain any critical information. Once all the steps have been complete, restart the Vista*LINK*® standalone client and the 5601MSC should appear in the Version Information dialog (see Figure 4-9 and Figure 4-10).

4.6.2. VistaLINK® Pro Control Screens for the 5601MSC

When the Vista*LINK*® Pro software has been updated with the latest JAR, the client should automatically detect any 5601MSC units connected to the network during the next discovery. Open the "Tree" menu and select "Refresh" to perform a network discovery immediately. Discovered devices are displayed on the left side of the screen in the Navigation Tree under the Hardware node. If the navigation tree is not visible, make sure it has not been hidden by opening the "Tree" menu and selecting "Hide/Show Tree". If the hardware node is not visible, check that it is enabled in the "Tree" menu under "Properties…". The 5601MSC should show up as a 1RU network graphic, listed by its IP address: . The network tree entry for the 5601MSC can be renamed to any helpful description by choosing the "Update Description…" menu item.
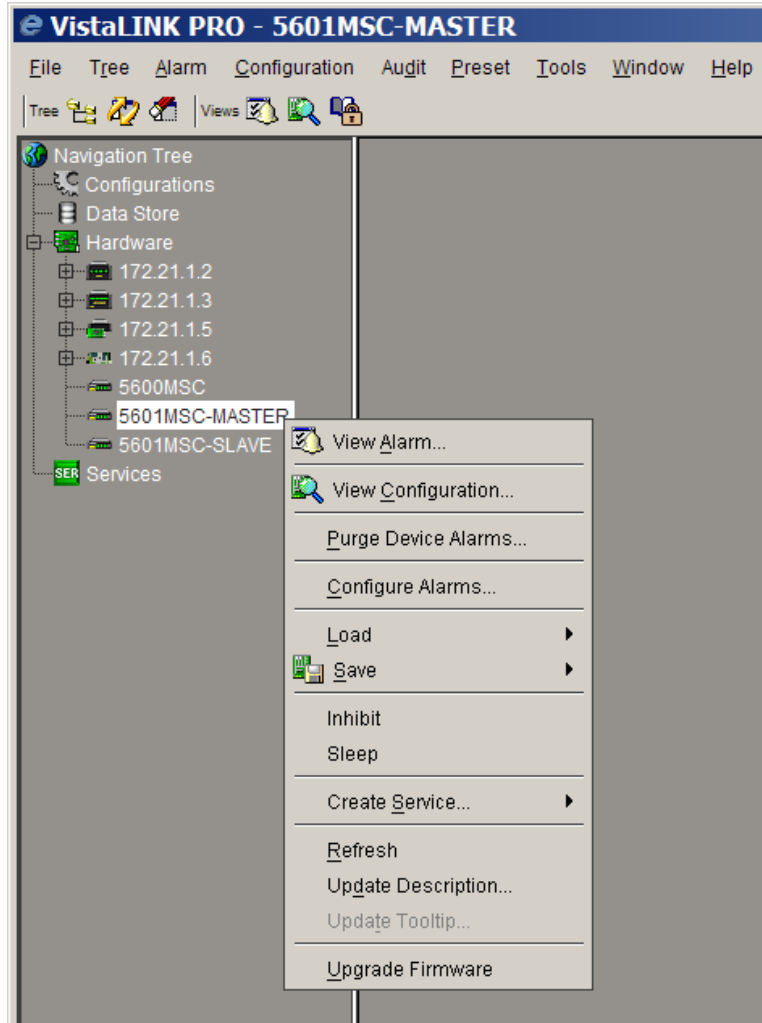
Figure 4-14: Vista*LINK*® Right-Click Pop-Up Menu

4.6.2.1. Alarm View Screen

The Alarm view can be accessed by right-clicking on the 5601MSC in the Navigation Tree and selecting "View Alarm". This will open up an alarm window that pulls the alarm log from the Vista*LINK*® Pro server. The server is responsible for logging all traps it receives from the 5601MSC and provides this information to the clients. The Alarm view is not available in the client-only version of Vista*LINK*®.

Figure 4-15: Vista*LINK*® Pro Alarm View

Alarms are listed in the order which they were received. The "Cor" column shows which faults have since corrected or cleared themselves. When an alarm is received, the border of the client will flash red, as will the device icon under the navigation tree. When the fault is cleared, the flashing will change to a green color. To clear the fault, it must be acknowledged by clicking the button in the "Ack" column.

4.6.2.2. Control View Screens

The configuration view is used to graphically configure and monitor the settings on the 5601MSC. It can be accessed by right-clicking on the device in the navigation tree and selecting "View Configuration…". The configuration view will appear and automatically load all settings from the 5601MSC. The refresh operation may take a few seconds, depending on network traffic conditions.
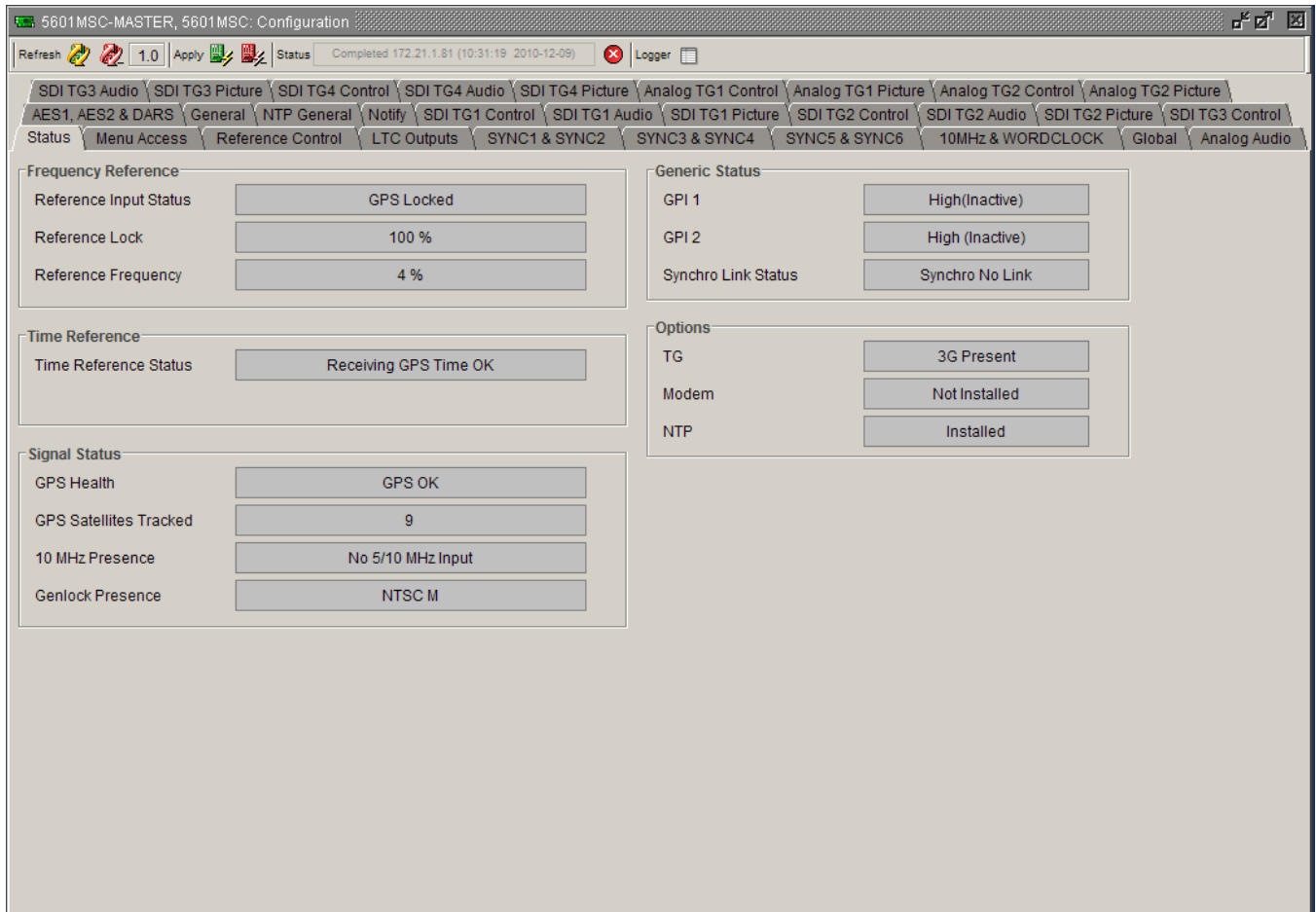
Figure 4-16: Vista*LINK*® Tabbed Control View

The configuration view has multiple tabs at the top. Each tab contains configuration items for a different section of the 5601MSC. The tabs are listed below, with a summary defining which subsection of the 5601MSC is monitored or controlled.

Tab Name	Description
Status	Displays the status of the reference, GPI, and syncro inputs
Menu Access	Configures front panel menu restrictions
Reference Control	Contains the frequency and time reference settings
LTC Outputs	Settings for LTC/IRIG outputs (LTC1 and LTC2)
SYNC1 & SYNC2	Contains all controls for the Sync1 and Sync2 outputs
SYNC3 & SYNC4	Contains all controls for the Sync1 and Sync2 outputs
SYNC5 & SYNC6	Contains all controls for the Sync1 and Sync2 outputs
10MHZ & WORDCLOCK	Contains all controls for the 10MHz and Wordclock outputs
Global	Global phasing/pedestal controls and system presets
Analog Audio	Controls for configuring the analog audio outputs
AES1, AES2 & DARS	Controls for configuring the digital audio outputs
General	Settings involving DST, Modem, GPIO, and passwords
NTP General	Configures the NTP restrictions
Notify	Configures and displays the status of the traps/alarms
SDI TG1 Control	Output format, phasing, and message controls for SDI TG1
SDI TG1 Audio	Embedded audio configuration for SDI TG1
SDI TG1 Picture	Test pattern selection for SDI TG1
SDI TG2 Control	Output format, phasing, and message controls for SDI TG2
SDI TG2 Audio	Embedded audio configuration for SDI TG2
SDI TG2 Picture	Test pattern selection for SDI TG2
SDI TG3 Control	Output format, phasing, and message controls for SDI TG3
SDI TG3 Audio	Embedded audio configuration for SDI TG3
SDI TG3 Picture	Test pattern selection for SDI TG3
SDI TG4 Control	Output format, phasing, and message controls for SDI TG4
SDI TG4 Audio	Embedded audio configuration for SDI TG4
SDI TG4 Picture	Test pattern selection for SDI TG4
Analog TG1 Control	Video format, phasing, and message controls for ATG1
Analog TG1 Picture	Test pattern selection for the ATG1 output
Analog TG2 Control	Video format, and phasing controls for ATG2
Analog TG2 Picture	Test pattern selection for the ATG2 output

Table 4-8: Vista*LINK*® Control Screens

Changing a setting is accomplished by clicking on the desired item and selecting a different setting. Press the green Apply button at the top to send the changes to the 5601MSC. For making live changes, *Dynamic Apply* can be turned on by clicking on the red Apply button. When Dynamic Apply is turned on, any change made will be immediately sent to the 5601MSC. This is useful when adjusting phase, for example.

Once the desired changes have been made, press the refresh button to refresh the configuration screen by pulling the settings from the 5601MSC.

5. TECHNICAL DESCRIPTION

5.1. SPECIFICATIONS

5.1.1. Analog Sync Outputs

<u>Output Standards:</u>

Black Burst:	SMPTE ST 170 (NTSC-M), ITU-R BT.1700-1 (PAL-B)
Bi-Level:	480p (SMPTE 293M), 576p (ITU-R BT.1358), Slo-Pal 625i/48, 625i/47.95
HD Tri-Level:	SMPTE ST 274 (1080i/59.94, 1080i/60, 1080i/50, 1080p/59.94, 1080p/60, 1080p/50, 1080p/25, 1080p/30, 1080p/29.97, 1080p/24, 1080p/24sF, 1080p/23.98, 1080p/23.98sF)
	SMPTE ST 296 (720p/24, 720p/30, 720p/50, 720p/59.94, 720p/60)
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

<u>Signal Level:</u>

Black Burst:	Sync level –300mV ± 5mV (PAL-B, 75Ω terminated)
HD Tri-Level:	-300mV to +300mV ± 5mV (75Ω terminated)
CW Signals:	2 selections: +/-1V or +/-2V (unterminated)
Pulse Signals:	3 selections: 5V CMOS, +/-2V bi-level, +2/0/-2V tri-level (unterminated)
Wordclock:	2 selections: 5V CMOS, +/-2V (unterminated)
Wordclock Rise Time:	< 35ns
10MHz SFDR:	> 50dBc
DC Offset:	< 50mV (except when 5V CMOS level is selected)
Return Loss:	>40dB to 10MHz
SNR:	>75dBrms
Freerun Stability:	Narrow ±10ppb
	Wide ±25ppm

5.1.2. LTC/IRIG Outputs

Standard:	SMPTE ST 12-1 or IRIG 200-04
Frame Rate:	24, 25, and 30 (dropframe and nondropframe)
Number of outputs:	2
Connectors:	3-pin male XLR type, Female DB9
Signal Level:	
LTC Unpowered:	Adjustable, $0.8V_{(p-p)}$ to $9.0V_{(p-p)}$ into 1kΩ termination
LTC1 XLR Power On:	$2V_{(p-p)}$ with $11.5V_{DC}$ offset to drive downstream 1200 series slave clocks
IRIG-B:	Adjustable, $1.0V_{(p-p)}$ to $8.0V_{(p-p)}$ into 1kΩ termination
LTC1 Power Current Limit:	0.8A max (8 Watts)
Output Impedance:	66Ω balanced (un-powered)
Rise Time:	40µs ± 10µs
Jitter:	< 2 µsec

5.1.3. Communications and Control

5.1.3.1. Serial Port:

Connector:	Female DB-9

Level:	RS232
Baud Rate:	115200 baud
Format:	8 data bits, no parity, 2 stop bits

5.1.3.2. 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)

5.1.3.3. 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, NTP broadcasts, and SNMP Vista*LINK*® Control
TIME Port:	NTP server and SNMP (low traffic, low latency network)
NTP Standard:	RFC-1305 compliant, broadcast and server mode support
SNMP Standard:	SNMP v1 compliant (RFC-1157, RFC-1213)

5.1.4. GPS Receiver (GP option installed)

Receiver:	Trimble Accutime Gold
General:	12-channel, L1 frequency, CA/code(SPS)
Accuracy:	15ns UTC (static), 90ns UTC (dynamic)
Operating Temperature:	-40°C to +85°C
Humidity:	95% Relative Humidity, non-condensing at 60°C
Dimensions:	3.74" (100mm) Diameter, 2.85" (72mm) Height

5.1.5. 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:	75Ω unbalanced
Balanced:	110Ω 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

5.1.6. Reference Loop and Genlock

Absolute Maximum Rating: -5V to +5V
Supported References: Black Burst (NTSC-M or PAL-B)
(auto-detected) 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 / sub-carrier lock with NTSC-M and PAL-B

5MHz/10MHz Reference:
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)

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

Standard:	SMPTE ST 170 (NTSC-M), ITU-R BT.1700-1 (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:	< 50mV
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:	75Ω
Return Loss:	> 30dB to 10MHz
SNR:	> 75dB$_{(RMS)}$

5.1.8. 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:	< 50mV
THD+N Ratio:	< -100dB (1kHz tone at +10.0dBu)

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

SDI Standard:	SMPTE ST 259-C (270 Mb/s) 4:2:2 10 Bit YCbCr
Image Standards:	SMPTE ST 125 (525 line and 625 line 13.5 MHz sampling)
Number of Outputs:	4 individual test generators with 2 outputs each (8 total)
Embedded Audio:	Up to 4 groups as specified in SMPTE ST 272
	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)

5.1.10. HDTV Test Generator Outputs (HDTG option installed)

SDI Standards:	SMPTE ST 259-C (270Mb/s) 4:2:2 10 Bit YCbCr
	SMPTE ST 292-1 (1.485 Gb/s) 4:2:2 10 Bit YCbCr
Image Standards:	SMPTE ST 125 (525 line and 625 line 13.5 MHz sampling)
	SMPTE ST 274 (1080i/59.94, 1080i/60, 1080i/50, 1080p/30, 1080p/25, 1080p/23.98, 1080p/23.98sF, 1080p/24, 1080p/24sF, 1080p/29.97)
	SMPTE ST 296 (720p/24, 720p/30, 720p/50, 720p/59.94, 720p/60)
	SMPTE ST 2048-2 (2048x1080p/23.98, 2048x1080p/24, 2048x1080p/25, 2048x1080p/29.97, 2048x1080p/30)
Number of Outputs:	4 individual test generators with 2 outputs each (8 total)
Embedded Audio:	Up to 4 audio groups as specified in SMPTE ST 299-1
	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 (270 Mb/s),
	< 270ps (1.485 Gb/s)
Rise and Fall Overshoot:	< 10% of amplitude
Return Loss:	> 15 dB to 1.5GHz
Wide Band Jitter:	< 0.20 UI (10Hz high-pass filter)

5.1.11. 3GTV Test Generator Outputs (3GTG option installed)

SDI Standards:	SMPTE ST 259-C (270Mb/s) 4:2:2 10 Bit YCbCr
	SMPTE ST 292-1 (1.485 Gb/s) 4:2:2 10 Bit YCbCr
	SMPTE ST 372 (Dual Link 1.485 Gb/s) 4:2:2 10 Bit YCbCr and 4:4:4 GBRA or YCbCr
	SMPTE ST 292-2 (Stereoscopic 3D Dual Link 1.485 Gb/s) 4:2:2 10 Bit YCbCr
	SMPTE ST 425-1 Level A 4:2:2 10 Bit YCbCr, SMPTE ST 425-1 Level B-DL 4:2:2 10 Bit YCbCr and 4:4:4 GBRA or YCbCr
	SMPTE ST 425-2 (Stereoscopic 3D 2.97 Gb/s) 4:2:2 10 Bit YCbCr
	SMPTE ST 424 (2.907 Gb/s)
Image Standards:	SMPTE ST 125 (525 line and 625 line 13.5 MHz sampling)
	SMPTE ST 274 (1080i/59.94, 1080i/60, 1080i/50, 1080p/30, 1080p/25, 1080p/29.97, 1080p/23.98, 1080p/23.98sF, 1080p/24, 1080p/24sF, 1080p/50, 1080p/59.94, 1080p/60)
	SMPTE ST 296 (720p/24, 720p/30, 720p/50, 720p/59.94, 720p/60)
	SMPTE ST 2048-2 (2048x1080p/23.98, 2048x1080p/24, 2048x1080p/25, 2048x1080p/29.97, 2048x1080p/30, 2048x1080p/47.98, 2048x1080p/48, 2048x1080p/50, 2048x1080p/59.94, 2048x1080p/60)
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
	In 3G mode each TG has 2 identical outputs
Embedded Audio:	Up to 4 groups of audio as specified in SMPTE ST 299-1.
	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:	400ps to 800ps (270 Mb/s),
	< 270ps (1.485 Gb/s)
	< 135ps (2.97 Gb/s)
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)

5.1.12. 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

5.1.13. Power Supplies

Voltage:	Auto-ranging 100 - 240 Volts AC, 50/60Hz
Power Factor:	> 0.7
Configuration:	Optional redundant supply available with **PS** option

Power Consumption

Warm-Up:	75 watts max (with all options installed and max LTC1/GPS power draw)
LTC1 power on:	65 watts typical (warmed up and operating with all options installed)
LTC1 power off:	57 watts typical (warmed up and operating with all options installed)

5.1.14. Compliance

Safety:	ETL Listed, complies with EU low voltage directive
EMI/RFI:	Complies with FCC Part 15 Class A regulations
	Complies with EU EMC directive
CE Marked	
ROHs:	Complies with EU ROHs directive

5.1.15. 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 (3.6kg)
Mounting Clearance:	Requires 2" (5cm) clearance around fan exhaust on both sides
Operating Temperature:	0ºC to +40ºC (32ºF to 104ºF) ambient

5.1.16. 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)
+IRIG IRIG-B Timecode Support (1x Input and 2x Outputs)
+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)

5.2. UPGRADING THE FIRMWARE

5.2.1. Overview and Setup

The firmware in the 5601MSC is contained on a FLASH EEPROM. 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 PC with a COM port built into the motherboard 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.

5.2.2. 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.**

5.2.3. 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

5.2.4. Uploading the Firmware using FTP over Ethernet.

To use this feature from a DOS command or Unix, enter *ftp IP*; where IP is the IP address of the 5601MSC, for example "ftp 192.168.192.175". When promted to enter the user and password take the following steps: for *User* press enter, and for *Password* use the password of the 5601MSC (Note: the default is 5601). Either of the Ethernet ports may be used for FTP.

The following are commands to work with the FTP feature: *dir, send, get, delete.*

To send the application, the ftp must be enabled. To do this enter *GENERAL*, then enter *Firmware*, then enter *Enable FTP.* This will enable sending files to the 5601MSC for 15 minutes.

To send the application, enter *send filename a:\5601MSC.bin.* Where filename is the name of the file in the computer, for example *send 5601MSC_2v5b4.bin A:\5601MSC.bin.* It is recommended to use the hash command if in DOS command, to show activity. It will take about 6 seconds to send the application. After it has been sent, enter *bye* to exit ftp.

At this time, the 5601MSC will store the downloaded file into its flash memory, and reboot. It will take about 3 minutes to store the application. During this time, **DO NOT TURN OFF THE POWER TO THE 5601MSC**. If power is interrupted, the code will have to be reloaded via the com port. Progress can be seen on the front panel.

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

5.3.   SERVICING INSTRUCTIONS AND TROUBLESHOOTING

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.

5.3.1.   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.

5.3.2.   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 5.3.2.1.

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.**

5.3.2.1. 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.

5.3.2.2. 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

5.3.3. Troubleshooting Issues

This section contains tips on common issues that can be encountered when operating a 5601MSC system. Please consult the issues listed here to see if you can resolve your problem before contacting customer service. Evertz customer support is available at +1 905 335 7570, or service@evertz.com.

5.3.3.1. Intermittent Errors on Devices Connected to the SDI Test Generator Outputs (SD/HD/3G)

Errors are being reported on the SDI test generator outputs such as CRC or EDH errors, which possibly manifest as flicking in the video. They may also manifest as loss of video lock:

1. Check that *highdrive* is disabled (see section 0). Highdrive must only be enabled when the 5601MSC is connected to a 5601ACO2 automatic changeover unit. In all other cases highdrive should be turned off. The higher amplitude SDI output can cause problems with equipment not designed to handle it and may cause problems from occasional errors to complete loss of lock in such devices.

2. If the unit is configured to lock to video or 10MHz and the *Genlock Range* control is set to *Wide* mode, verify that the unit is locked to a stable reference. See section 2.2.3. The Wide oscillator is capable of locking or freerunning at frequencies beyond ±10ppm from nominal. This may cause problems with receivers on some equipment.

5.3.3.2. GPS Related Issues

5.3.3.2.1. GPS Receiver Problems – GPS Disconnected Status

The GPS receiver is connected to the 5601MSC, but the status screen reports "GPS Disconnected":

1. This indicates no communication with the GPS head. This could indicate a bad cable. Check that all connections are secure. Check the wiring of the GPS antenna cable (see section 3.5.2). The GPS head may not be getting +12V power from the 5601MSC, or the RS422 Tx and Rx pins are miswired. Verify that none of the wires are pinched or broken inside the DB9 backshell.

5.3.3.2.2. GPS Receiver is Reporting Good Status, but the 5601MSC Does Not Fully Lock

The 5601MSC is reporting in the Lock Status screen a low lock progress that never goes higher than 50%.

1. This indicates good RS422 communication with the GPS receiver, but a possible problem in the 1pps signal pins. If an extension cable is being used, check that the cable is not damaged, of good quality, and is wired correctly.

2. If the unit is in *Slow* lock mode, the unit could be correcting for a shift in the reference. This can happen if the GPS lock has been lost for a prolonged period of time. A manual jam to the frequency reference may be required. Refer to section 2.2.4 for more information.

5.3.3.2.3. **GPS Receiver is not Detecting Enough Satellites**

1. The number one cause of poor GPS satellite reception is caused by a bad mounting location for the antenna. See section 3.5.1 for mounting recommendations.

2. At any time there should be at least four satellites in the sky with the usual number being 8 satellites. The GPS receiver however, rejects satellite signals that may introduce error into the timing calculations. Satellites that are at too low of an elevation (<10º) are ignored. Satellites that have a poor Signal-to-Noise ratio are also rejected. The mounting location of the antenna must provide the clearest, and widest view of the sky with no large structures nearby that may cause multipath interference (reflections) and no high power transmitters nearby.

3. During poor weather conditions the number of acceptable satellite signals may decrease. This can be exacerbated by a poor mounting location. During severe weather conditions it is normal for the number to decrease. If the number of satellites falls below three in fair conditions such as overcast skies or slight drizzle then the mounting location should be reviewed.

5.3.3.3. **Front Panel Issues**

5.3.3.3.1. **Front Panel Inoperable**

The front panel menu system is not working, but the panel otherwise appears to be powered up with LCD displays working

1. Check and make sure the front panel is not locked. This is usually indicated by the **PANEL LOCK** button being illuminated. When the front panel is locked, only the STATUS menu will be functional. In order to unlock the panel, hold down the **SELECT** button while pressing the **PANEL LOCK** button (see section 4.1.3).

5.3.3.3.2. **The LCD Displays are not Working or the Buttons are not Illuminating When Pressed**

1. Check that the front panel has been securely attached to the unit. It must be pushed in completely so that the top and bottom copper gaskets are no longer visible. If the panel is attached properly but still not working, a panel reset can be performed by pressing the **PANEL LOCK** and **HELP** buttons simultaneously.

5.3.3.3.3. **Cannot Access Some Menu Items (Greyed Out)**

1. Menu items will be displayed in dark text to indicate they are not accessible. There are several reasons why a menu item might be disabled. For example, if a sync output has been set to output tri-level sync, the VITC timecode related menu items will be disabled to show they are not applicable in the current sync output mode (VITC cannot be inserted into HD tri-level sync).

2. It is also possible that a menu item has been restricted. Refer to section 4.5.9.4 for information on menu restrictions. The menu restrictions are configured through the password-protected engineering menu.

5.3.3.3.4. **Incorrect Password for Engineering Menu**

1. The Engineering Menu located off the **GENERAL** root menu is protected by a numerical password. The default password is **5601**. The password can be changed to any user defined number from 1 digit to 9 digits long.

2. If the password has been set accidentally to an unknown value, try entering **0**. If that does not work, contact Evertz customer support for a password recovery procedure.

5.3.3.3.5. **When a Menu Item is Changed it Reverts Back After Several Seconds**

If the 5601MSC has been configured with Syncro enabled in slave mode, the unit will attempt to pull settings from a master 5601MSC connected through a 5601ACO2 automatic changeover unit. This will prevent the user from making any changes in the **OUTPUT** root menu. Any changes will revert back to value that has been set on the master unit after a couple seconds. If the unit is not connected to a 5601ACO2 or syncro operation is not desired, syncro should be disabled. See section 3.4 for more information on configuring syncro.

5.3.3.4. *VistaLINK® Pro Issues - SNMP Problems*

5.3.3.4.1. **Cannot Connect to the 5601MSC Using VistaLINK® Pro**

1. Check the IP settings of the 5601MSC. In the *ControlEthernet* status screen (see section 4.1.2) verifies that the *Ethernet link ok* message is shown. If not, this could indicate an Ethernet cabling problem. There are two Ethernet ports on the rear of the 5601MSC. The CONTROL port is used for SNMP communication. Verify that the proper Ethernet cable is connected to the CONTROL port.

2. Check that the IP settings are correct for your network's addressing scheme.

3. Attempt to *ping* the 5601MSC from the computer that is running Vista*LINK*® Pro. Open a command prompt window. Enter the command "`ping X.X.X.X`", substituting the IP address of the 5601MSC for the X.X.X.X. If you see the message "`Request timed out`" this usually means there is some type of network configuration error.

4. Check that the computer is configured with a compatible IP scheme. In the command prompt enter "`ipconfig`" to see the IP settings of the network card(s). The 5601MSC must be located on the same subnet in order to respond to ping requests. Contact your network administrator for assistance or double-check the IP settings of the 5601MSC control port.

5. Once the ping test has been successful, check that the SNMP has been enabled on the 5601MSC. Refer to section 4.5.9.3.1. The SNMP is enabled in the password-protected engineering menu off the **GENERAL** root menu. Set the *SNMP ctl* menu item to *SNMP status* or *SNMP on*. The *SNMP status* setting only allows SNMP *get* commands and does not allow SNMP *set* commands. Once SNMP has been enabled, refresh the Navigation Tree, if using the Vista*LINK*® Pro client. The 5601MSC should be discovered and listed by its IP address.

6. If the 5601MSC is not discovered, attempt to add it manually to the tree. Right-click on the *Hardware* item in the Navigation Tree or go the *Tree* menu. Select *Add/Update Agent*. Enter the IP address of the 5601MSC and click OK. The IP address should show up in the Navigation Tree. If it shows up as an unclassified agent (172.21.1.56), this means that the VistaLINK® Pro software must be updated with the latest "VLProProd_MSC5601.JAR" file that is available to download from the Evertz website. See the SNMP section 4.6.1 for information on performing a JAR file update. If the device could not be contacted it will show up in grey text as either 172.21.1.56 or 172.21.1.56 and further troubleshooting is required.

7. If SNMP is still not working, verify that the community strings that the Vista*LINK*® Pro client is using match those that have been set on the 5601MSC. See section 4.5.9.3.2 for information on setting the community strings on the 5601MSC. The *Read* community string is normally set to "public" (lower-case letters). The *Write* community string is normally set to "private" (lower-case letters). In the Vista*LINK*® Pro client, these strings are set by going to the *File* menu and accessing *Discovery Settings*.

8. If the community strings on the 5601MSC match those on the Vista*LINK*® Pro client, check to see if there is an IP address conflict between the 5601MSC and another device on the network. Perform another ping test to the 5601MSC and then run the command "arp –a". Scan the ARP table and find the IP address assigned to the 5601MSC and verify that the MAC address (physical address) displayed beside it matches the MAC address shown on the *ControlEthernet* status screen. If a different MAC address is shown, then the computer is actually communicating with another device on the network that is configured with the same IP address as the 5601MSC.

9. If further troubleshooting is required, it may be useful to download the NET-SNMP tool set (www.net-snmp.org). These are command-line utilities that can be used to diagnose problems with SNMP. For example, executing "snmpwalk –v 1 –c public 172.21.1.56" should contact a 5601MSC at 172.21.1.56 and display a list of the basic SNMP objects. Possible sources of problems could be network settings on the SNMP client computer, firewall restrictions, or IP routing configuration problems (if the 5601MSC is located on a different subnet).

5.3.3.4.2. *VistaLINK®* Not Receiving SNMP Traps from the 5601MSC

1. Verify that the trap destinations have been configured. Every time a trap event occurs, the 5601MSC sends an SNMP trap to up to four destinations. Each trap destination must have an IP address entered and must be enabled. This is done in the *SNMP* menu located in the password-protected engineering menu. Refer to section 4.5.9.3.3 on configuring traps.

2. Check that the desired trap events have been enabled. The 5601MSC can send traps based on several events. In order for a trap to be sent, one or more trap events must be enabled. See section 4.5.9.3.3.

3. Restart the Vista*LINK*® Pro server and observe the server log. Pay attention to any error with the logging system or trap listening. All SNMP traps are sent using UDP to port 162. Only one program can be listening on this port at a time. If another program has previously opened port 162, this will block the Vista*LINK*® Pro server from accessing that port. Open a command prompt window and enter the command "`netstat –a –b –n –p udp`". This will list all UDP ports open by all programs on the computer. The command may take a while to fully complete. Look for the line that indicates port 162. It should show that a "javaw" process (Vista*LINK*®) has port 162 open (see example below). If another program has captured the port it must be terminated before VistaLINK® Pro can receive traps.

```
Proto   Local Address          Foreign Address    State     PID

UDP     0.0.0.0:162            *:*                          1048
```

Figure 5-1 : Example of the VistaLINK(R) Pro Server Sucessfully Binding Port 162

If the Vista*LINK*® Pro server or other SNMP trap logging software is still not receiving traps, check that the broadcast address has been set properly on the 5601MSC. If the logging computer is on a different subnet than the 5601MSC you may need to contact your network administrator to allow SNMP trap broadcasts to be routed to the logging computer.

5.3.3.5. Unit is not Locking to the Frequency Reference

1. If the 5601MSC is not achieving 100% lock to the reference, first verify that the frequency reference supplied is within the Genlock Range selected (see section 2.2.3). If the lock mode is set to "Slow", it is possible that the 5601MSC is in the process of rephasing its oscillator to match to reference. This "Slow" process gradually slews the oscillator to avoid any sudden shifts or jumps that may cause problems downstream. If this is the case, the warning "REF JAM NEEDED" will be displayed on the front panel and the "Reference Jam Required" fault will be active. See section 2.2.4 for more information on Slow mode.

2. If the 5601MSC has reported 100% lock to the reference but is not in phase with the reference, check that the Global Phase has not been enabled. The Global Phase settings shift the phase of most outputs by a specified amount of time. See section 2.1.5 for more information on the Global Phase controls.