

7600 SD/HD/MHD-REF

REFERENCE GENERATOR

Instruction Manual

SOFTWARE VERSION 2.0.0.X

071860000
OCTOBER 2007



Affiliate with the N.V. KEMA in The Netherlands

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Grass Valley, Inc.

400 Providence Mine Road
Nevada City, CA 95945
United States

15655 SW Greystone Ct.
Beaverton, OR 97006
United States

10 Presidential Way
3rd Floor, Suite 300
Woburn, MA 01801
United States

Nederland B.V.
4800 RP BREDA
The Netherlands

Weiterstadt, Germany
Brunnenweg 9
D-64331 Weiterstadt
Germany

Rennes, France
Rue du Clos Courtel
Cesson-Sevigne, Cedex
France

Technopole Brest Iroise
CS 73808
29238 Brest Cedex 3
France

17 rue du Petit Albi-BP 8244
95801 Cergy Pontoise
Cergy, France

2300 South Decker Lake Blvd.
Salt Lake City, UT 84119
United States

7140 Baymeadows Way
Suite 101
Jacksonville, FL 32256
United States

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KEMA-Registered Quality, Inc.
4377 County Line Road
Chalfont, PA 18914
Ph: (215)997-4519
Fax: (215)997-3809
CRT 001 073004

Accredited By:
ANAB



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Contacting Grass Valley

International Support Centers	France 24 x 7	+800 8080 2020 or +33 1 48 25 20 20 +800 8080 2020 or +33 1 48 25 20 20	United States/Canada 24 x 7	+1 800 547 8949 or +1 530 478 4148
Local Support Centers (available during normal business hours)	Asia	Hong Kong, Taiwan, Korea, Macau: +852 2531 3058 Indian Subcontinent: +91 22 24933476 Southeast Asia/Malaysia: +603 7805 3884 Southeast Asia/Singapore: +65 6379 1313 China: +861 0660 159 450 Japan: +81 3 5484 6868		
		Australia and New Zealand: +61 1300 721 495	Central/South America: +55 11 5509 3443	
		Middle East: +971 4 299 64 40 Near East and Africa: +800 8080 2020 or +33 1 48 25 20 20		
	Europe	Belarus, Russia, Tadzikistan, Ukraine, Uzbekistan: +7 095 2580924 225 Switzerland: +41 1 487 80 02 S. Europe/Italy-Roma: +39 06 87 20 35 28 -Milan: +39 02 48 41 46 58 S. Europe/Spain: +34 91 512 03 50 Benelux/Belgium: +32 (0) 2 334 90 30 Benelux/Netherlands: +31 (0) 35 62 38 42 1 N. Europe: +45 45 96 88 70 Germany, Austria, Eastern Europe: +49 6150 104 444 UK, Ireland, Israel: +44 118 923 0499		

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Grass Valley Web Site

The www.thomsongrassvalley.com web site offers the following:

Online User Documentation — Current versions of product catalogs, brochures, data sheets, ordering guides, planning guides, manuals, and release notes in .pdf format can be downloaded.

FAQ Database — Solutions to problems and troubleshooting efforts can be found by searching our Frequently Asked Questions (FAQ) database.

Software Downloads — Download software updates, drivers, and patches.



END-OF-LIFE PRODUCT RECYCLING NOTICE

Grass Valley's innovation and excellence in product design also extends to the programs we've established to manage the recycling of our products. Grass Valley has developed a comprehensive end-of-life product take back program for recycle or disposal of end-of-life products. Our program meets the requirements of the European Union's WEEE Directive, the United States Environmental Protection Agency, and U.S. state and local agencies.

Grass Valley's end-of-life product take back program assures proper disposal by use of Best Available Technology. This program accepts any Grass Valley branded equipment. Upon request, a Certificate of Recycling or a Certificate of Destruction, depending on the ultimate disposition of the product, can be sent to the requester.

Grass Valley will be responsible for all costs associated with recycling and disposal, including freight. However, you are responsible for the removal of the equipment from your facility and packing the equipment to make it ready for pickup.



For further information on the Grass Valley product take back system please contact Grass Valley at + 800 80 80 20 20 or +33 1 48 25 20 20 from most other countries. In the U.S. and Canada please call 800-547-8949 or 530-478-4148, and ask to be connected to the EH&S Department. Additional information concerning the program can be found at: www.thomsongrassvalley.com/environment



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Preface

About This Manual

This manual covers the complete details of the 7600REF Reference Generator, including installation, setup, operation, and specifications.

In addition to this manual, a *7600REF Installation and Safety Manual* is included with every frame to ensure that the required regulatory and safety information for this product is available when the frame is received.

All documentation relating to this product and other Grass Valley Modular products can be found on-line in PDF format at this URL:

www.thomsongrassvalley.com/docs/modular

Safety Summary

Read and follow the important safety information below, noting especially those instructions related to risk of fire, electric shock or injury to persons. Additional specific warnings not listed here may be found throughout the manual.

WARNING Any instructions in this manual that require opening the equipment cover or enclosure are for use by qualified service personnel only. To reduce the risk of electric shock, do not perform any servicing other than that contained in the operating instructions unless you are qualified to do so.

Safety Terms and Symbols

Terms in This Manual

Safety-related statements may appear in this manual in the following form:

WARNING Warning statements identify conditions or practices that may result in personal injury or loss of life.

CAUTION Caution statements identify conditions or practices that may result in damage to equipment or other property, or which may cause equipment crucial to your business environment to become temporarily non-operational.

Terms on the Product

The following terms may appear on the product:

DANGER — A personal injury hazard is immediately accessible as you read the marking.

WARNING — A personal injury hazard exists but is not immediately accessible as you read the marking.

CAUTION — A hazard to property, product, and other equipment is present.

Symbols on the Product

The following symbols may appear on the product:



Indicates that dangerous high voltage is present within the equipment enclosure that may be of sufficient magnitude to constitute a risk of electric shock.



Indicates that user, operator or service technician should refer to product manual(s) for important operating, maintenance, or service instructions.



This is a prompt to note fuse rating when replacing fuse(s). The fuse referenced in the text must be replaced with one having the ratings indicated.



Identifies a protective grounding terminal which must be connected to earth ground prior to making any other equipment connections.



Identifies an external protective grounding terminal which may be connected to earth ground as a supplement to an internal grounding terminal.



Indicates that static sensitive components are present which may be damaged by electrostatic discharge. Use anti-static procedures, equipment and surfaces during servicing.

Warnings

The following warning statements identify conditions or practices that can result in personal injury or loss of life.

Dangerous voltage or current may be present — Disconnect power and remove battery (if applicable) before removing protective panels, soldering, or replacing components.

Do not service alone — Do not internally service this product unless another person capable of rendering first aid and resuscitation is present.

Remove jewelry — Prior to servicing, remove jewelry such as rings, watches, and other metallic objects.

Avoid exposed circuitry — Do not touch exposed connections, components or circuitry when power is present.

Use proper power cord — Use only the power cord supplied or specified for this product.

Ground product — Connect the grounding conductor of the power cord to earth ground.

Operate only with covers and enclosure panels in place — Do not operate this product when covers or enclosure panels are removed.

Use correct fuse — Use only the fuse type and rating specified for this product.

Use only in dry environment — Do not operate in wet or damp conditions.

Use only in non-explosive environment — Do not operate this product in an explosive atmosphere.

High leakage current may be present — Earth connection of product is essential before connecting power.

Dual power supplies may be present — Be certain to plug each power supply cord into a separate branch circuit employing a separate service ground. Disconnect both power supply cords prior to servicing.

Double pole neutral fusing — Disconnect mains power prior to servicing.

Use proper lift points — Do not use door latches to lift or move equipment.

Avoid mechanical hazards — Allow all rotating devices to come to a stop before servicing.

Cautions

The following caution statements identify conditions or practices that can result in damage to equipment or other property

Use correct power source — Do not operate this product from a power source that applies more than the voltage specified for the product.

Use correct voltage setting — If this product lacks auto-ranging power supplies, before applying power ensure that the each power supply is set to match the power source.

Provide proper ventilation — To prevent product overheating, provide equipment ventilation in accordance with installation instructions.

Use anti-static procedures — Static sensitive components are present which may be damaged by electrostatic discharge. Use anti-static procedures, equipment and surfaces during servicing.

Do not operate with suspected equipment failure — If you suspect product damage or equipment failure, have the equipment inspected by qualified service personnel.

Ensure mains disconnect — If mains switch is not provided, the power cord(s) of this equipment provide the means of disconnection. The socket outlet must be installed near the equipment and must be easily accessible. Verify that all mains power is disconnected before installing or removing power supplies and/or options.

Route cable properly — Route power cords and other cables so that they are not likely to be damaged. Properly support heavy cable bundles to avoid connector damage.

Use correct power supply cords — Power cords for this equipment, if provided, meet all North American electrical codes. Operation of this equipment at voltages exceeding 130 VAC requires power supply cords which comply with NEMA configurations. International power cords, if provided, have the approval of the country of use.

Use correct replacement battery — This product may contain batteries. To reduce the risk of explosion, check polarity and replace only with the same or equivalent type recommended by manufacturer. Dispose of used batteries according to the manufacturer's instructions.

Troubleshoot only to board level — Circuit boards in this product are densely populated with surface mount technology (SMT) components and application specific integrated circuits (ASICs). As a result, circuit board repair at the component level is very difficult in the field, if not impossible. For warranty compliance, do not troubleshoot systems beyond the board level.

Regulatory Notices

Certifications and Compliances

FCC Emission Control

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. Changes or modifications not expressly approved by Grass Valley Group can affect emission compliance and could void the user's authority to operate this equipment.

Canadian EMC Notice of Compliance

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la classe. A prescrites dans le Règlement sur le brouillage radioélectrique édicte par le ministère des Communications du Canada.

EN55022 Class A Warning

In a domestic environment, products that comply with Class A may cause radio interference in which case the user may be required to take adequate measures.

Canadian Certified Power Cords

Canadian approval includes the products and power cords appropriate for use in the North America power network. All other power cords supplied are approved for the country of use.

Canadian Certified AC Adapter

Canadian approval includes the AC adapters appropriate for use in the North America power network. All other AC adapters supplied are approved for the country of use.

FCC Emission Limits

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device must cause not interference, and (2) this device must accept any interference received, including interference that may cause undesirable operation.

Certifications

Safety – This product has been evaluated and meets the following Safety Certification Standards listed under the Safety category in the table below.

EMI – TThis product has been evaluated for Electromagnetic Compatibility under the EN 55022 / EN 55024 standards for Emissions and Immunity and meets the requirements listed under the EMI Category in the table below. This product complies with Class A. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Category	Standard	Designed/tested for compliance with:
Safety	ANSI / UL60950	"Standard for Safety of Information Technology Equipment - Safety - Part 1: General Requirements", (ANSI/UL 60950-1, First Edition, Dated April 1, 2003, with revision through and including November 26, 2003.)
	IEC 60950	"Standard for Safety for Information Technology Equipment - Safety - Part 1: General Requirements", (IEC 60950-1, First Edition, 2001, Corrigendum 1:10-2002)
	CAN/CSA C22.2, No. 60950	"Standard for Safety of Information Technology Equipment - Safety - Part 1: General Requirements", (CAN/CSA-C22.2 No. 60950-1-03, First Edition Dated April 1, 2003, with revisions through and including November 26, 2003)
	EN60950	Safety of Information Technology Equipment, including Electrical Business Equipment.
	73/23/EEC	Low Voltage Directive

Category	Standard	Designed/tested for compliance with:
EMI	EMC Directive 89/336/EEC	Information and Technology Equipment
	EN 55022: 1998, Inc. A1:2000 & A2:2003 Radio Disturbance Characteristics	Electromagnetic compatibility. Product family standard for Information and Technology equipment for professional use. Emissions, Class A EN 61000-3-2: Power Line Harmonic Emissions, Radiated Magnetic Field Emissions, Peak Inrush Current EN61000-3-3: Mains voltage flicker and manual switching (Dmax = 4%)
	EN 55024:1998, Inc. A1:2000 & A2:2003 Immunity Characteristics	Electromagnetic compatibility--Product family standard for Information and Technology equipment for professional use. EN 61000-4-2: Electrostatic Discharge "ESD" Immunity EN 61000-4-3: Radiated RF Electromagnetic Field Immunity EN 61000-4-4: Electrical Fast Transient/Burst "EFT" Immunity EN 61000-4-5: Surge Immunity EN 61000-4-6: Conducted RF Immunity EN 61000-4-11: Voltage Dips, Short Interruptions and Voltage Variations
	US FCC Class A Canada FCC Industry Canada	CISPR Pub. 22 (1997 Class A)
	Australia & New Zealand:	AS/NZS 3548

7600 SD-/HD-/MHD-REF Reference Generator

Product Overview

The 7600REF Synchronizing Pulse Generator is one of the most flexible SPG units available on the market today. It is suitable for any digital or mixed format environment where a high quality digital SPG is required. This manual covers the installation and operation of the three available models along with full technical specifications.

Refer to [7600REF Models on page 18](#) for specific functionality available for each of the model types: 7600 SD-REF, 7600 HD-REF, and 7600 MHD-REF.

Each 7600REF model has the following basic functionality:

- Oven-controlled reference oscillator allowing the unit to be used either as a master reference, or to follow another unit,
- Five analog outputs,
- Three SD SDI black outputs with four channels of embedded AES silence and EDH,
- Two AES silence outputs,
- Each output selectable to either 525 or 625 operation,
- Each input individually timed,
- Dual power supplies that auto-sense line rates with separate mains connections for power backup in the case of one power supply failure,
- Selectable clock output of 10 MHz/27 MHz/Word Clock,
- Looping Genlock input,
- 10 MHz Reference input
- ANALOG AUDIO/REMOTES connector that provides:
 - A serial communication port,
 - Analog audio output test tones,
 - Power fail output status,
 - Fan failure status, and GPI input output control connections.

7600REF Models

Functionality specific to the three different 7600REF models is described below.

7600 SD-REF Reference Signal Generator

This model features the following functionality:

- SD-SDI and analog video test signal patterns,
- Analog and AES audio test tones (including GLITS), and
- Full-field test patterns.

7600 HD-REF Reference Signal Generator

This model provides the same features as the SD version in addition to the following:

- HD-SDI video test patterns, and
- A one slot HD Tri-level sync module provides 4 tri-level sync outputs, each output individually configured from the front panel.

7600 MHD-REF Master HD Reference Signal Generator

This module expands the 7600 HD-REF model to include the following:

- A one slot GPS receiver module with a GPS antenna input and a GPS 1 PPS output allows for locking to a high stability time and oscillator reference,
- Two LTC timecode outputs available on the LTC D-25 connector and the addition of VITC timecode to the SDI signal, and
- Network Time Protocol (NTP) with both Client and Server modes. NTP is intended for synchronizing function for changeover units (such as the 7620PX) to keep them both in sync.

Installation

Follow the instructions below to unpack, install, and cable the 7600REF frame.

Unpacking

Carefully unpack the unit from its packing box and check for signs of damage. Check the contents of the box against the packing list and your original order to ensure that you have received the correct parts.

In the event the unit has been damaged or does not match your order, contact the Thomson Grass Valley Sales office listed on *Contacting Grass Valley on page 4*.

Module/Software Installation

All hardware modules are installed at the factory and shipped inside the unit. Module functionality included in the model configuration depends on the model type (see *7600REF Models on page 18*). Any software functionality included with the model is already installed and enabled.

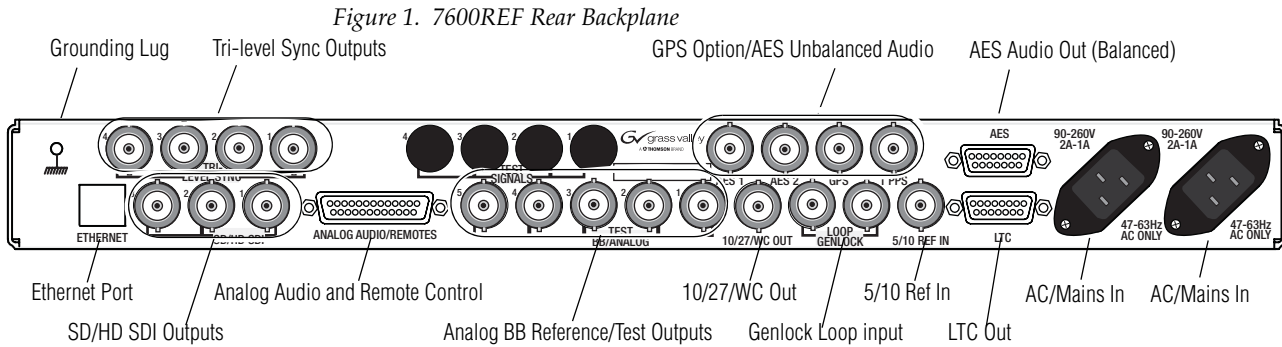
Rack Mounting

The 1 RU rack frame has integral rack mounting ears on the frame front cover for direct mounting into a standard 19 inch rack. Carefully place the unit in your rack and firmly attach it to the rack using four standard rack screws (not provided).

CAUTION This unit has air intakes on one side of the unit and fan-assisted exhaust vents on the other side of the unit. Ensure that these have an unobstructed air flow, otherwise the unit will overheat. Pay particular attention to ensure that any rack wiring or cable trays do not obstruct the vent. 60 mm (2.36 in.) of clear space should be allowed between the vents and any potential obstruction.

Rear Panel Connections

The rear connectors for the 7600REF frame are shown in [Figure 1](#). Presence of hardware and software functionality depends on the model you have purchased (see [7600REF Models on page 18](#)). Cabling instructions for each of the connectors are explained in detail in this section.



Grounding Lug

The unit is provided with a single 4 mm (0.16 in.) ground lug on the far left of the rear panel. Incoming mains ground from the IEC connector is internally bonded to both the chassis and technical 0V to meet safety requirements and performance specifications. The stud allows the addition of an ground strap, if required, for rack installations.

Ethernet Port

Each 7600REF model is equipped with a 10/100 base-T Ethernet port. This port may be configured for either dynamic (DHCP) address mode or static address mode. Configuration is done in the Setup menu (see [Setup Menu on page 47](#)). The 7600REF should be connected to the network in the same way as other networked devices (such as a computer or printer) with a 1:1 CAT 5 RJ-45 cable.

Tri-Level Sync Reference (7600 HD-REF and MHD-REF Models)

The TRI-LEVEL SYNC REFERENCE BNCs will output four independently configured tri-level sync outputs. Setup is done in the Options menu ([HD Tri-Level Sync \(7600 HD-REF and 7600 MHD-REF Models\) on page 69](#)).

HD/SD SDI Test Outputs

The outputs from the SD/HD SDI TEST BNCs 1, 2, and 3, provide three independently configured test signals. If the HD video capability is present, further HD video formats are available. The three outputs are configured in the Digital Video menu ([Digital Video Menu on page 33](#)).

These outputs also offer a combination of the following LTC (Longitudinal Timecode) features with LTC capability (7600 MHD-REF model):

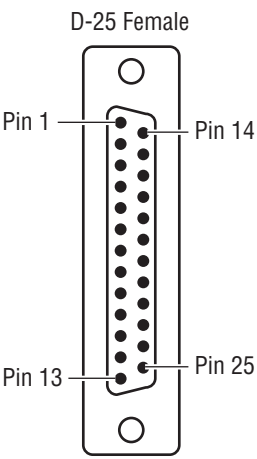
- Digital VITC (SMPTE S266) for standard definition signals only, and
- ATC (SMPTE RP188) for standard definition or high definition SD signals.

Analog Audio/Remotes

The 25 pin Sub-D connector labeled ANALOG AUDIO/REMOTES provides a serial communication port, the analog audio output tones, power fail output status, fan failure status, and the GPI connections.

Pinouts for the ANALOG AUDIO/REMOTES connector are given in [Table 1](#). Each of the connector function is described in detail in this section.

Table 1. ANALOG AUDIO/REMOTES Connector Pinouts

ANALOG AUDIO/REMOTES		Pin	Function	Pin	Function
 <p>D-25 Female</p> <p>Pin 1</p> <p>Pin 14</p> <p>Pin 13</p> <p>Pin 25</p>	1	Fan OK -1 (Pair with pin 16. Closed if OK)	14	Power OK 1	
	2	RS422 CTS – (minus)	15	Power OK 2	
	3	RS422 RXD + (plus)	16	Fan OK - 2	
	4	RS422 TSD + (plus)	17	GPIO - Output 1	
	5	RS422 RTS – (minus)	18	GPIO - Input 2	
	6	RS422 TXD – (minus)	19	GPIO - Input 1	
	7	GND	20	RS422 CTS + (plus)	
	8	RS422 RXD – (minus)	21	GPIO - Output 2	
	9	GND	22	RS422 RTS + (plus)	
	10	+ 12V DC / 0.3A	23	Analog Audio Out 1 – (minus)	
	11	Analog Audio Out 1 + (plus)	24	Analog Audio Out 2 – (minus)	
	12	Analog audio Out 2 + (plus)	25	GND	
	13	GND			

Fan Failure Output

This open collector output senses the current drawn by the cooling fans fitted to the enclosure. The detector indicates a failure if a fan is stuck and/or an open circuit is detected.

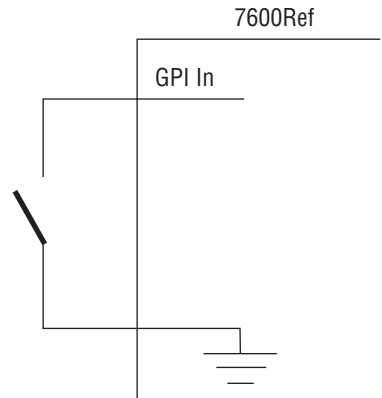
GPI Inputs 1 and 2

The General Purpose Interface (GPI) inputs 1 and 2 are configured in software using the menus described in [GPI Inputs 1 and 2 on page 22](#) to provide any of the following functions:

- Force freerun mode
- Force Genlock mode
- Force external 10MHz lock mode
- Step through SDI output 1 test patterns
- Step through SDI output 2 test patterns
- Step through SDI output 3 test patterns
- Step through setup memories

The single-ended 7600 GPI inputs are activated when connected to a ground connection on the 25 pin Sub-D connector as shown in [Figure 2](#). The two GPI inputs are pin 18 and pin 19 as listed in [Table 1 on page 21](#). The inputs can withstand +/- 20V and draw approximately 600uA when activated.

Figure 2. Connection to GPI Inputs



GPI Outputs 1 and 2

The General Purpose Interface (GPI) outputs 1 and 2 are configured in software using the menus described in [GPI Outputs 1 and 2 on page 23](#) to provide any of the following functions:

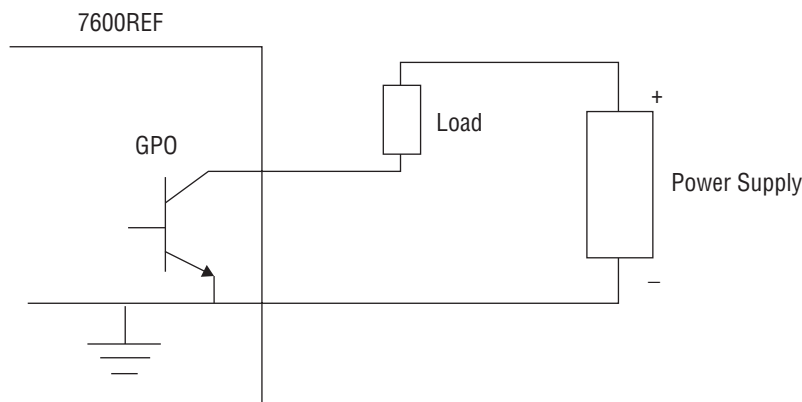
- Loss of genlock input
- Loss of external 10MHz reference
- Line lock error
- Field lock error
- Subcarrier lock error
- Illegal input ScH
- Diagnostic state alert
- Currently locked to external 10MHz
- Currently locked to external genlock
- Currently internal/freerun mode

The GPI outputs are single-ended open collector outputs with a 50V/200mA rating not to exceed 600 mW. The two GPI outputs are pin 17 and pin 21 as listed in [Table 1 on page 21](#). It is intended that the GPO be activated when one or more of the above conditions is true (for example, loss of genlock input and/or line lock error).

To use an output, a load should be connected between the output and an external power supply, with the negative end of the power supply connected back to the ground pin on the 25 pin Sub-D connector.

As an alternate to an external power supply, a +12V, 300mA feed is available on pin 10 of the Sub-D connector.

Figure 3. Connection to GPI Outputs



Analog BB Reference/Test

The five ANALOG BB REFERENCE/TEST BNCs provide independent black burst reference signals and/or video test signal outputs as configured in the Analog Video menus (see [Analog Video Menu on page 36](#)).

10/27/WC Output

The 10/27/WC BNC provides either a 10MHz, 27MHz, or Word Clock output. The output type is configured in the Setup/Clock Output menu ([Setup Menu on page 47](#)).

Genlock Loop Input

The GENLOCK LOOP BNCs provide an external genlock reference input to the device. Genlock configuration is done in the Lock menu ([Lock Mode Menu on page 44](#)).

5/10 Ref In

The 5/10 REF IN BNC accepts either a 5MHz or 10MHz reference input.

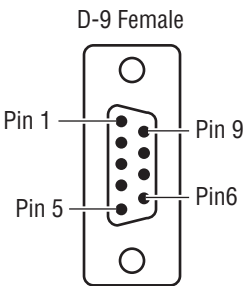
AES 1/AES 2 and GPS BNCs (7600 MHD-REF Model)

The blanks for AES 1 and AES 2 unbalanced outputs and the GPS and 1PPS BNCs shown in [Figure 8 on page 35](#) are present with the 7600 MHD-REF model. Setup for AES outputs is described in [Digital Video – AES on page 35](#). GPS setup is described in [GPS Setup \(7600 MHD-REF\) on page 52](#).

AES Outputs

The AES 9 pin Sub-D female connector provides balanced AES audio 1 and AES 2 outputs. The pinouts and their functions for this connector are shown in [Table 2](#). Setup of these outputs is done in the Audio/AES menu described in [Digital Video – AES on page 35](#).

Table 2. AES Pin Sub-D Pinout

AES Audio Out	Pin	Function
 <p>D-9 Female</p> <p>Pin 1</p> <p>Pin 5</p> <p>Pin 6</p> <p>Pin 9</p>	1	AES 1 + (plus)
	2	AES 1 – (minus)
	3	Shield
	4	N/C
	5	0V GND
	6	Shield
	7	AES 2 + (plus)
	8	AES 2 – (minus)
	9	Shield

AES audio may also be accessed through the unbalanced AES 1 and AES 2 BNCs when they are present. This requires the GPS function with the 7600 MHD-REF model. See [GPS Setup \(7600 MHD-REF\) on page 52](#).

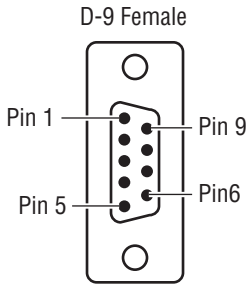
LTC Output (7600 MHD-REF Model)

The LTC (Longitudinal Timecode) 9 pin Sub-D female connector provides LTC 1 and LTC 2 outputs with the 7600 MHD-REF model. The LTC function provides the following:

- Two outputs of LTC
- Vertical Interval Timecode (VITC) superimposed on analog waveforms. This is enabled or disabled in accordance with the current group arrangement of the analog signal outputs.
- SDI outputs (see [HD/SD SDI Test Outputs on page 20](#)) will offer a combination of Digital VITC (SMPTE S266) for standard definition signals only and ATC (SMPTE RP188) for standard definition or high definition SD signals.

The pinouts and their functions for this connector are shown in [Table 3](#). Configuration is done from the Setup/LTC menu. Refer to [Timecode Functionality \(7600 MHD-REF\) on page 58](#).

Table 3. LTC Output Sub-D Pinout

LTC Out	Pin	Function
 <p>D-9 Female</p> <p>Pin 1</p> <p>Pin 5</p> <p>Pin 6</p> <p>Pin 9</p>	1	LTC 1 + (plus)
	2	LTC 1 – (minus)
	3	Shield
	4	N/C
	5	0V GND
	6	Shield
	7	LTC 2 + (plus)
	8	LTC 2 – (minus)
	9	Shield

AC Mains Connection and Fusing

CAUTION The power supply cord is used as the main power disconnection device. Ensure that the socket outlet is located/installed near the equipment and is easily accessible.

ATTENTION Le cordon d'alimentation est utilisé comme interrupteur général. La prise de courant doit être située ou installée à proximité de l'équipement et être facile d'accès.

Each 7600REF model is fitted with two independent AC mains power supplies. Each power supply has its own dedicated IEC mains plug on the rear of the unit.

The correct power cords for the line standard of the region the product has been shipped to are included in the shipping box. The power supplies used in this the unit are a switch mode design and are auto-sensing to handle a wide input voltage range. See [Power \(page 79\)](#) in the Specifications table for the voltage and frequency ranges.

Power Supply Replacement

If one of the power supplies fails, a replacement unit can be acquired from Customer Service and can be installed by the customer in the field.

To replace a 7600REF power supply:

CAUTION Make sure power to the unit is completely disconnected by removing both AC cords from both power supply connections on the rear of the unit.

1. Remove the top cover of the frame by removing the 13 screws holding the cover to the frame. Determine which power supply unit needs to be replaced.
2. Tilt the frame up and on the bottom of the frame remove the two screws holding the defective power supply unit to the frame chassis.
3. On the front of the power supply unit, remove the 2-pin connector labeled J1 coming from the AC Main assembly. Note the orientation of the connector when removing it.
4. On the rear of the power supply unit, remove the 4-pin rear connector labeled J2 from the power supply attached to the cable coming from the rear of the main circuit board. Note the orientation of the connector when removing it.
5. Lift the defective power supply out of the chassis.
6. Install the new unit by reversing the steps above noting cable connector orientation. These connectors are keyed so they cannot be installed improperly.

Operation

This section of the manual will cover using the front panel for configuration and adjustments.

When the unit is powered up by connecting one or both of the AC Mains connections, initialization messages will appear on the LCD display as the unit configures the internal hardware.

Once initialization is complete, the following message indicating a normal operational status will be displayed:

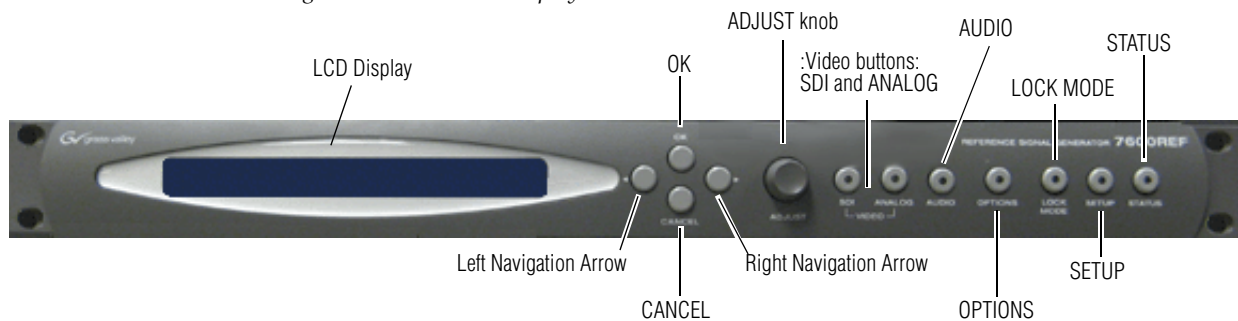
7600REF Main Menu

<Digital Video> Analogue Video Audio ->

Front Panel Control Description

The front panel is shown in [Figure 4](#).

Figure 4. Front Panel Display



The front panel has the following main functional areas (see [Figure 4](#)):

- A Liquid Crystal Display (LCD) used to show information to guide the user through operating the various functions and to show status information.
- Front Panel Buttons
 - Left and right arrow buttons for menu navigation
 - **OK** and **CANCEL** buttons to initiate or exit the currently selected function
 - **ADJUST** knob for parameter adjustment and/or left/right menu navigation
 - Video **SDI** and **ANALOG** function buttons to access SDI or Analog video menus
 - **AUDIO** function button to access menus for analog and AES audio menus

- **OPTIONS** function button to access optional menus (options included depend on model type, see [7600REF Models on page 18](#)).
- **LOCK MODE** function button to set up genlock modes
- **SETUP** function button for miscellaneous configuration options
- **STATUS** button for accessing diagnostic and status information

Basic Operation

There are a number of basic concepts that once understood will simplify the use of the unit as described below:

- Valid button pushes are indicated by a lamp lit inside a button. In most cases, buttons without a lamp will not be prohibited, allowing rapid changes between functions grouped on each button.
- Invalid button pushes will result in an informative message on the LCD.

Selecting a Function

To change any parameter, the appropriate function button must first be pushed. Once a function button is pushed, that button will remain illuminated and the others will turn off to provide a reminder of which function is active.

Pushing a function button that has sub-functions under it will show the name of the function and the first menu choice. For example, pushing the **SDI** function button will bring you to the top of the SDI menu, **SDI: Select Channels**. Use either the **ADJUST** knob or the left or right arrow buttons to select the choices under this menu: **SDI 1**, **SDI 2**, or **SDI 3**.

The selected choice will be surrounded by brackets < > indicating your choice. Once you reach the desired choice, press the **OK** button to enter that menu. Depending on the sub-function chosen, either a further set of sub-functions or the current value of the function is displayed. Where appropriate, the currently selected option is indicated by asterisks, such as * On * or * 1080p/23.98 * for example.

Changing Values

To change the value of a function, the **ADJUST** knob or the left or right arrow buttons can be used.

In the case of numerical values, there are two functional modes:

- If the overall range of an adjustment is small the **ADJUST** knob always alters the value by the smallest amount possible.
- If a wider range of adjustment is required, a Delta value system is used. Use the right arrow button to select the Delta value in brackets and adjust it to the desired resolution by turning the **ADJUST** knob, then press the left arrow button to select the value then adjust it with the **ADJUST** knob.

An example of this would be setting the Line Offset for SDI 1. Scroll down from Digital Video to SDI 1. Select Video Standard then Timing and scroll to Line and press the OK button. The Line Offset menu will be present on the LCD. Note the Delta value on the right of the LCD indicated by a triangle Delta symbol = 1. You may change the Delta resolution value to 10 or 100 with the knob.

Use the left arrow button to select the Pixel choice field and turn the knob to change the values to 1, 10, or 100. Note that when the Delta value is 1, the values change by steps of one pixel. With a Delta value of 10, the pixels change by steps of 10, 20, 30 etc.). Selecting a Delta value of 100 allows you to change the pixels by 100, 200, 300 etc. Change the Delta resolution if you need a finer offset setting.

As the parameter is changed, the new value will be shown on the LCD. For some functions, the unit responds by actually altering the value immediately. Otherwise the new value is applied when the **OK** button is pushed.

Leaving the Selected Function

Once the parameter has been set the unit can be returned to the normal operating mode or another function chosen by one of the following methods:

- Pressing the current (lit) function button will step up through the menu structure until either the top (normal) level is reached or another menu level of the same function is reached, at which point another menu can be accessed by pressing the **OK** button.
- The **OK** button allow you to descend the menu structure and the current function and the **CANCEL** key allows you to ascend the menu structure.
- At any time any other function key may be pressed causing the menu structure to be traversed sideways. For example, having set an **OUTPUT CONTROL** function, the **SETUP** key may be pushed without having to step back up through the menu first.

Menu Timeout

In addition, there is a built-in timeout mechanism that will automatically step back up through the menu structure until the top level is reached if a key is not pressed within a preset time period. In any event, once the top level is reached, the front porch will once again indicate valid functions by lighting the relevant buttons.

The menu system may be set to auto-revert to the top level after a period of inactivity. The option to enable/disable this feature is located in the SETUP>>DISPLAY menu.

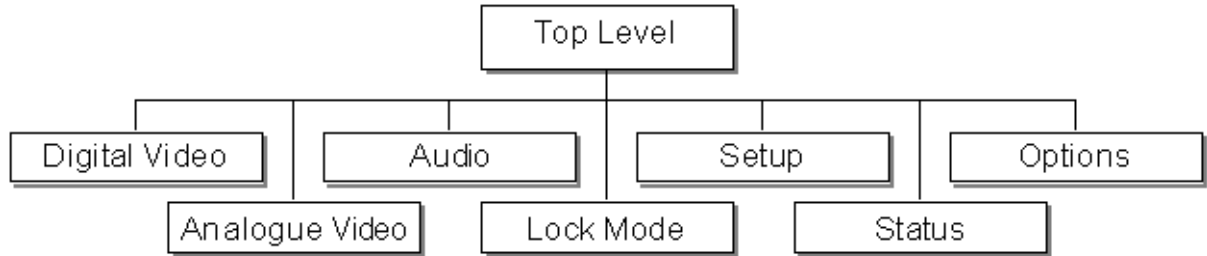
Front Panel Lock

Front panel controls may be locked to prevent inadvertent changing of settings. To lock or unlock the controls, press the Left and Right arrows simultaneously.

Top Level Menu

The top level menu has the menu branches shown in [Figure 5](#).

Figure 5. Top Level Menu



The content and features of each top level choice are summarized below. A more detailed description of each top level choice is given later in this manual. Note that the Options branch (on the right side of [Figure 5](#)) is only displayed if specific options are included in the model. For functionality for each model, refer to [7600REF Models on page 18](#).

Digital Video Menu

The Digital Video (SDI) menu provides full control of the configuration of the three SDI outputs. The video standard, timing and appearance of each output are controlled from this sequence of menus. In addition, the embedded AES audio is enabled and configured for each output. If high definition (HD) is present, additional choices will appear on the menu. See [Digital Video Menu on page 33](#).

Analog Video Menu

The Analog Video menu controls the format of the five analog video signals provided on the Analog BB/Test BNCs on the rear of the frame. These are arranged as a group of three plus a second group of two outputs. This allows the group of three to be set as RGB or YUV in a single operation. See [Analog Video Menu on page 36](#).

Audio Menu

The Audio menu controls both the AES and analog audio outputs. For all outputs, control of frequency and amplitude is available. In addition, for the AES outputs, the sample rate and source ident may also be set. See [Audio Menu on page 41](#).

Lock Mode Menu

The Lock Mode genlock input menu sets the required format of the incoming video signal and defines the behavior of the 7600REF when the genlock signal is applied or removed. See [Lock Mode Menu on page 44](#).

Setup Menu

The system Setup menu provides control of the basic configuration of the 7600REF and will be used primarily during the installation phase. Refer to [Setup Menu on page 47](#) for details.

System setup includes:

- Configuration of the LTC function (7600 MDH-REF model)
- Configuration of the Clock Output
- Comprehensive control of General Purpose Inputs and Outputs, including:
 - the input signal response mode
 - the action resulting from a GPI trigger
 - the event causing a GPO state change
- Check and control of the internal memory
- Setup of the real-time clock (RTC)
- Configuration of the Network Time Protocol (NTP) (7600 MHD-REF)
- Functions under the COMMS menu, including:
 - configuration of the Ethernet port
 - configuration of the Serial port
- Functions under the DISPLAY menu, including:
 - enable and control timing of the menu timeout
 - set the display contrast
- Configure the 7600REF as Slave, allowing settings to be received from a Master

Status Menu

The Status menu provides, for information only, the current version of the software, hardware and firmware of the 7600REF. These three values will be required when speaking to Technical Support.

In addition, a series of status error messages may be enabled for display on the LCD screen. The final option on this menu displays a summary of the current configuration status. See [Status Menu on page 51](#) for details.

Options Menu

The Options menu ([page 32](#)) lists the type of module fitted in each of the three option slots. Options installed depend on the model type. If no option module is installed, the text OPTION will be displayed. The text TLS refers to the Tri-Level Sync option module.

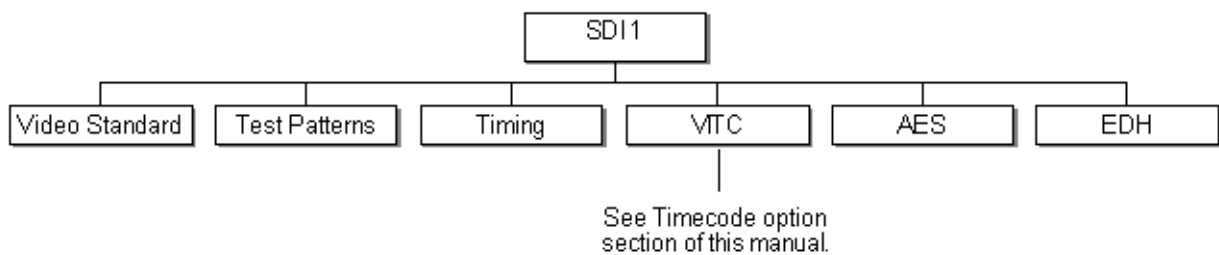
Digital Video Menu

The Digital Video menu provides control and configuration of the three SDI video outputs. In models with HD capability, the menu is extended to include further options.

From the top level, the menu branches to three identical sections. for clarity, only SDI 1 is shown below in [Figure 6](#). SDI 2 and SDI 3 are identical.

The SDI 1 menu then has five menu branches. If the LTC capability is present (7600 MHD-REF), an extra VITC entry is also present. Refer to [VITC Within SDI on page 66](#).

Figure 6. Digital Video – SDI 1 Menu



Digital Video – Video Standard

The currently available digital video standards are listed in [Table 4](#).

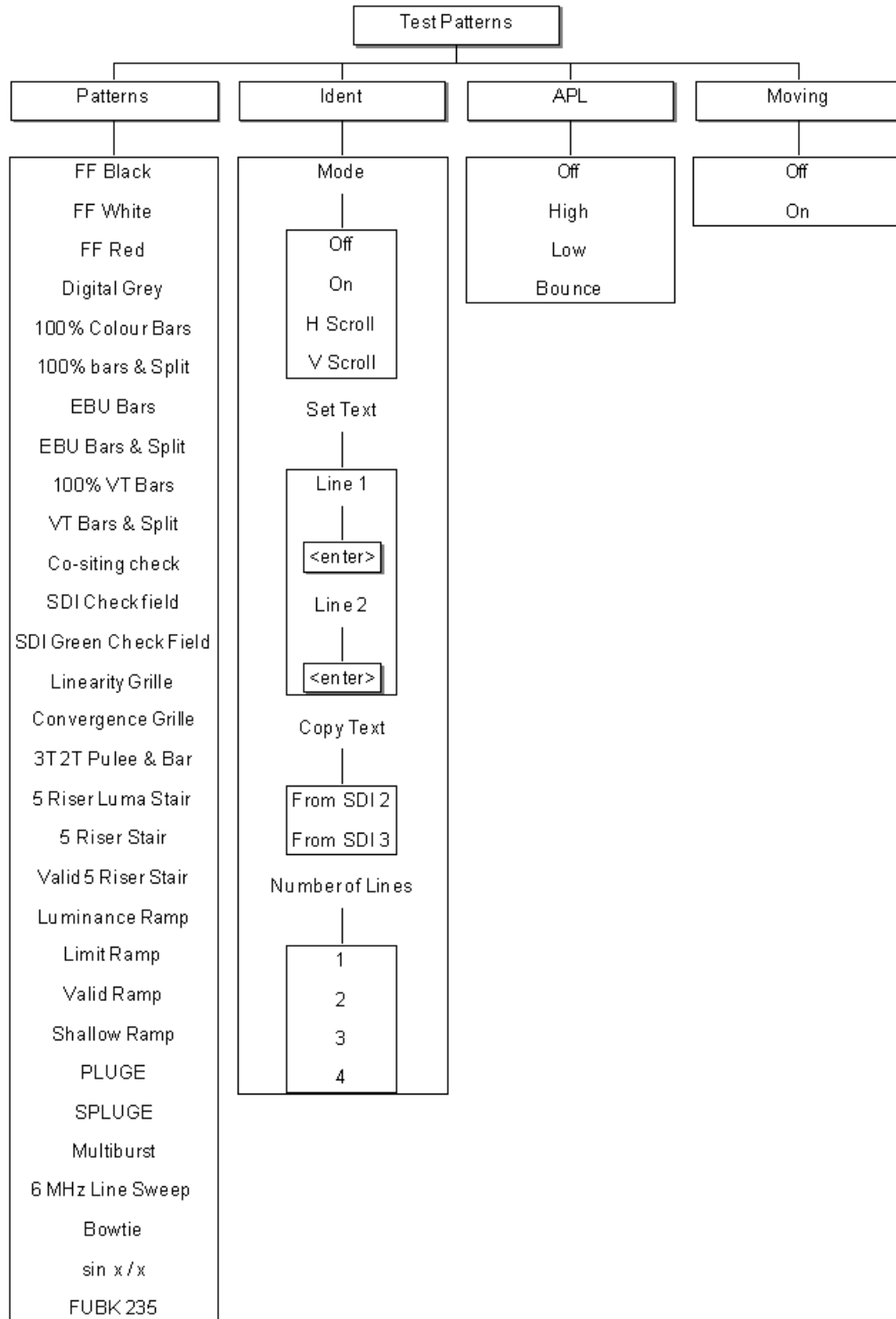
Table 4. Current Digital Video Standards

Description	Lines/Frames	Frame Rate (Hz)	Scan
525			
625			
1080i / 59.94	1080	59.94	Interlaced
1080i / 60	1080	60	Interlaced
1080i / 50	1080	50	Interlaced
1080p / 30	1080	30	Progressive
1080p / 29.97	1080	29.97	Progressive
1080p / 25	1080	25	Progressive
1080p / 24	1080	24	Progressive
1080p / 23.98	1080	23.98	Progressive
720p / 60	720	60	Progressive
720p / 59.94	720	59.94	Progressive
720p / 50	720	50	Progressive
720p / 30	720	30	Progressive
720p / 29.97	720	29.97	Progressive
720p / 25	720	25	Progressive
720p / 24	720	24	Progressive
720p / 23.98	720	23.98	Progressive

Digital Video – Test Patterns

Select the SDI 1 test pattern parameters from the Test Pattern menu shown in Figure 7.

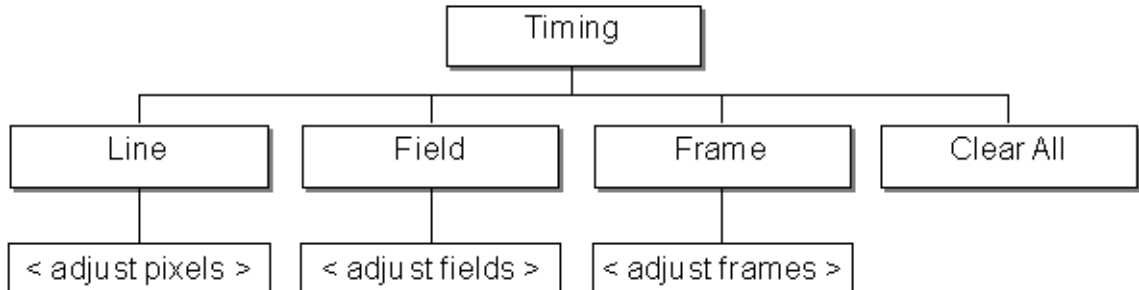
Figure 7. Digital Video – Test Patterns Menu



Digital Video – Timing

Adjust the SDI 1 timing with the Timing menu shown in [Figure 8](#).

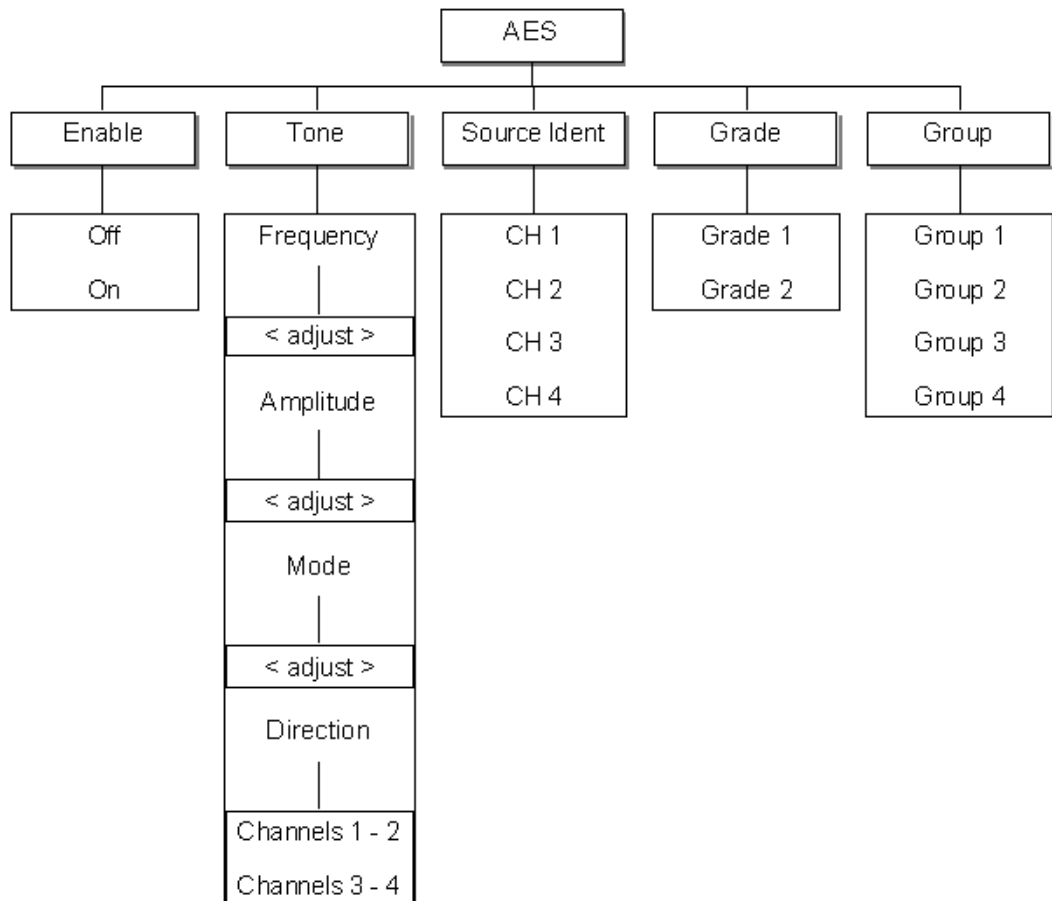
Figure 8. Digital Video – Timing Menu



Digital Video – AES

Configure the AES audio outputs with the AES menu shown in [Figure 9](#).

Figure 9. Digital Video – AES Menu

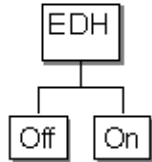


Digital Video – EDH

Enable (On) or disable (Off) EDH with the EDH menu shown in [Figure 10](#).

Note This menu is only visible if the video output standard is set to a Standard Definition signal.

Figure 10. Digital Video – EDH Menu



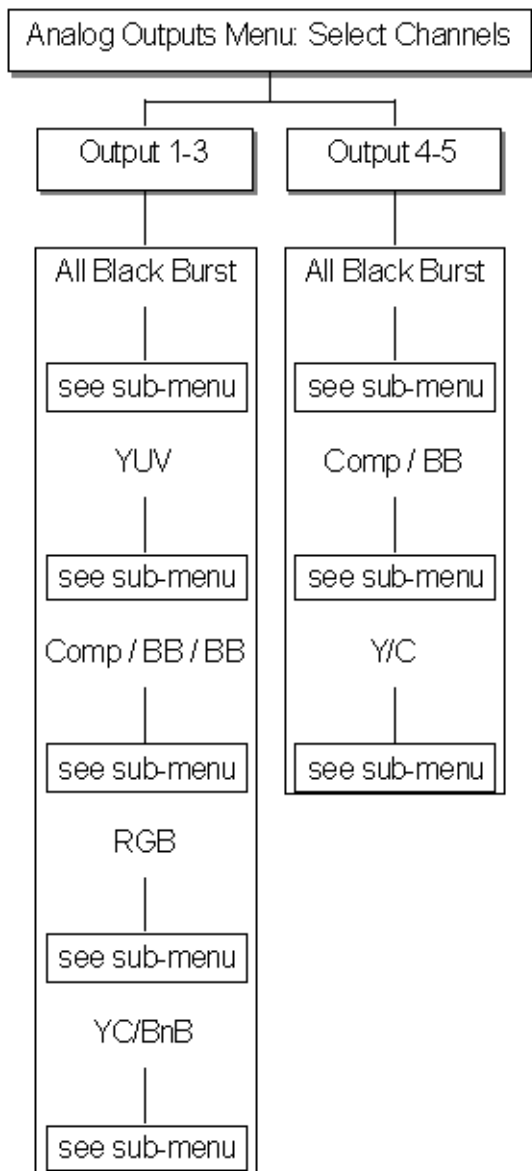
Analog Video Menu

The top level menu is shown in [Figure 11 on page 37](#). The five available analog output connectors are arranged as follows:

- A group of three, configured as:
 - All Black Burst (BB) (see [Analog Video – All Black and Burst on page 38](#))
 - YUV test pattern (see [Analog Video – YUV on page 39](#))
 - A single composite video signal, plus two BB outputs (see [Analog Video – Composite/BB/BE on page 40](#))
 - RGB test pattern ([Analog Video – RGB on page 40](#))
 - A YC test pattern plus a single BB output (see [Analog Video – YC/BB on page 40](#))
- A group of two, configured as:
 - Both Black and Burst
 - A single composite video signal, plus one BB Output

The menus follow two common themes, either for the test pattern signals or for Black Burst configuration as shown in [Figure 11](#).

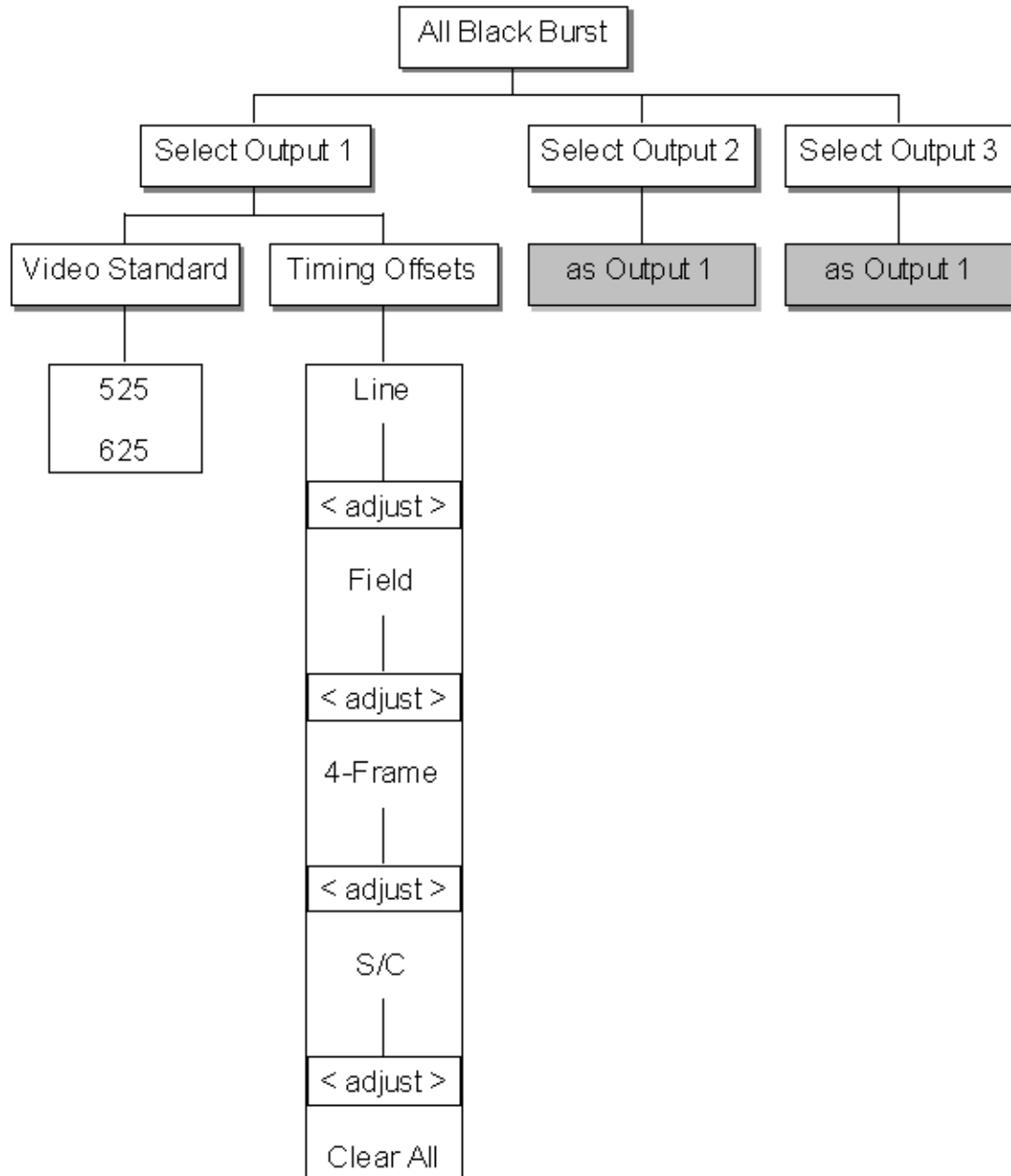
Figure 11. Analog Video – Top Level Menu



Analog Video – All Black and Burst

For configuring the analog outputs for all black burst refer to the menu shown in [Figure 12](#).

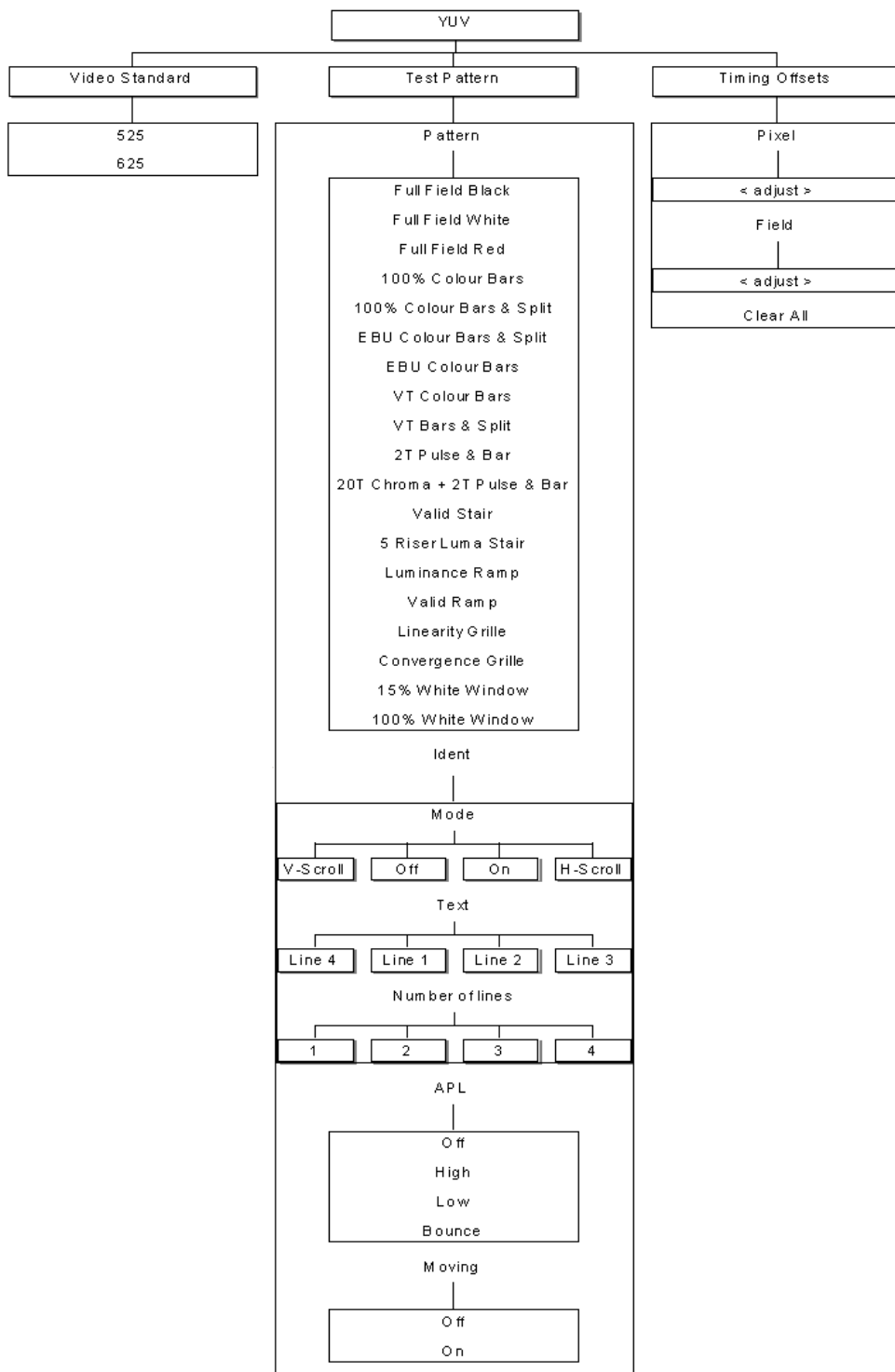
Figure 12. Analog Video – All Black Burst Menu



Analog Video – YUV

For configuring the analog outputs for YUV refer to the menu shown in [Figure 13](#).

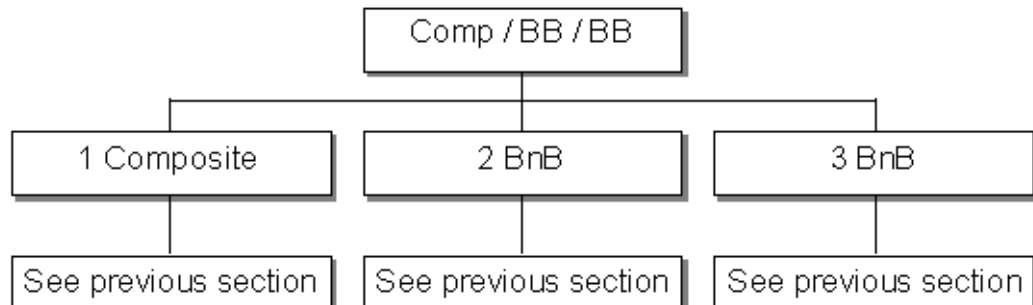
Figure 13. Analog Video – Analog Outputs YUV



Analog Video – Composite/BB/BE

For configuring the analog outputs for 1 composite output, and 2 Black Burst outputs refer to the menu shown in [Figure 14](#).

Figure 14. Analog Video – Composite and Black and Burst



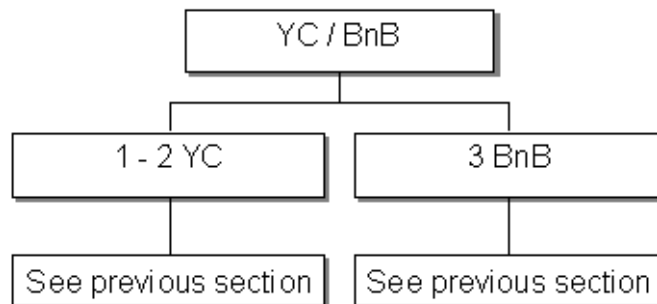
Analog Video – RGB

For configuring the analog outputs for RGB, the menu is the same as [Analog Video – YUV on page 39](#).

Analog Video – YC/BB

For configuring the analog output 1 and 2 for YC and 3 for Black Burst use the menu shown in [Figure 15](#).

Figure 15. Analog Video – Composite and Black and Burst

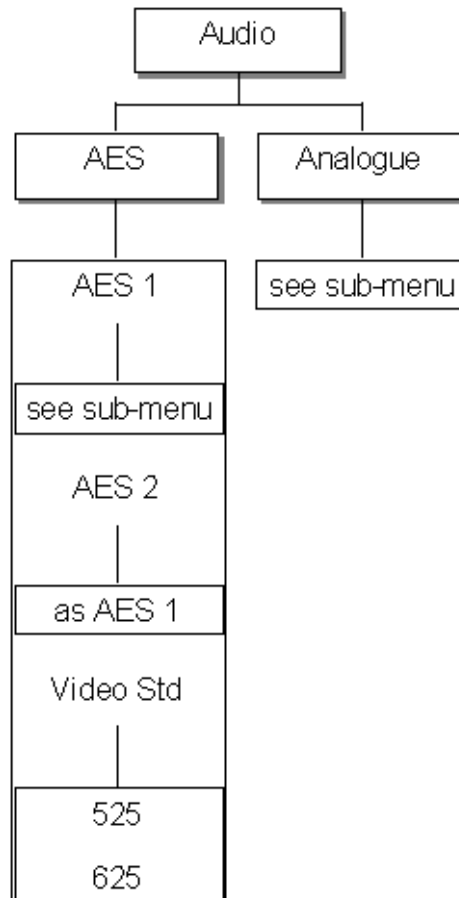


Audio Menu

The top level audio menu has two branches (Figure 16):

- AES
- Analog

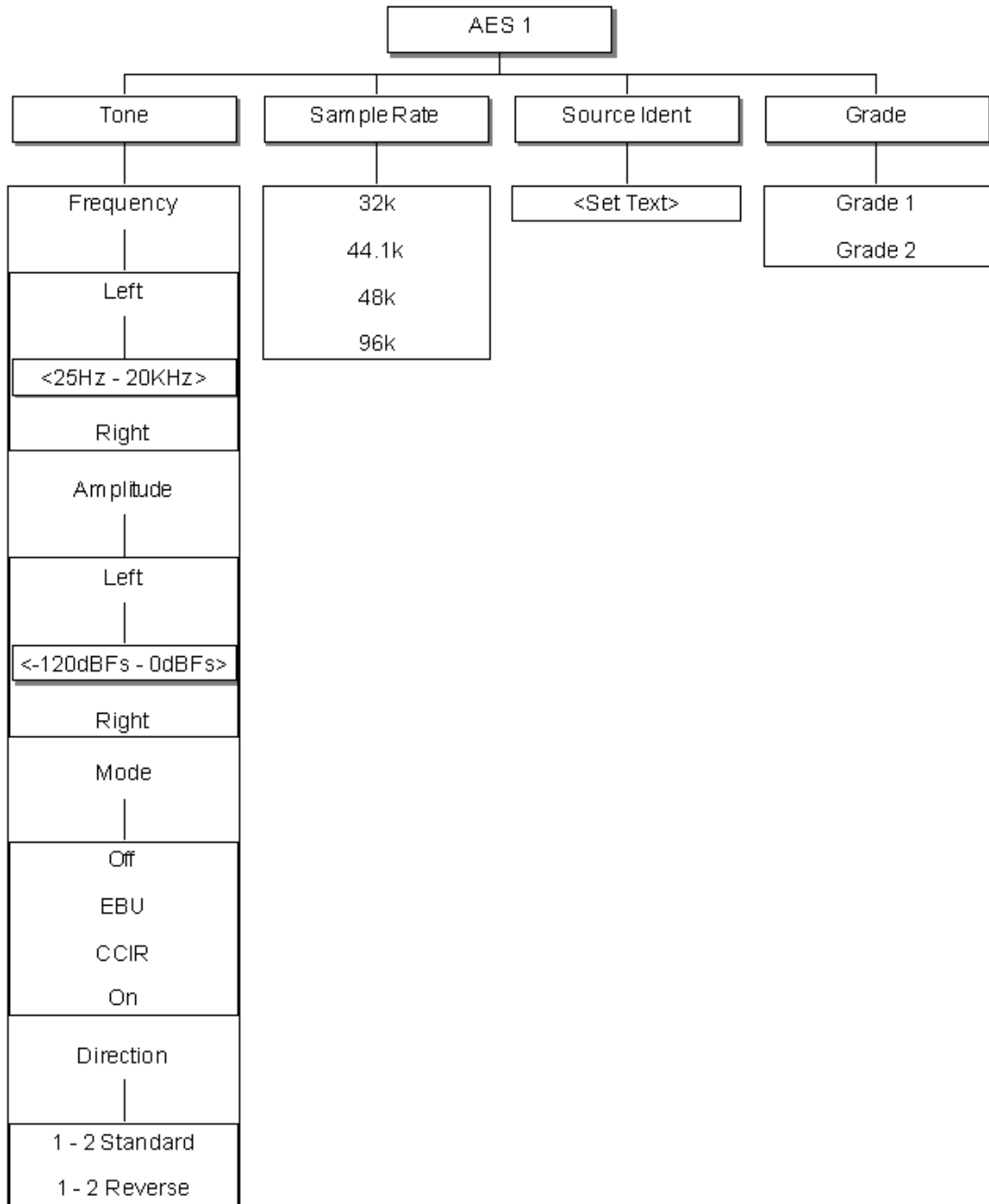
Figure 16. Audio Top Level Menu



Audio – AES 1 and AES 2

Use the menu shown in [Figure 17](#) to set up the AES 1 audio outputs. The menu for AES 2 is identical.

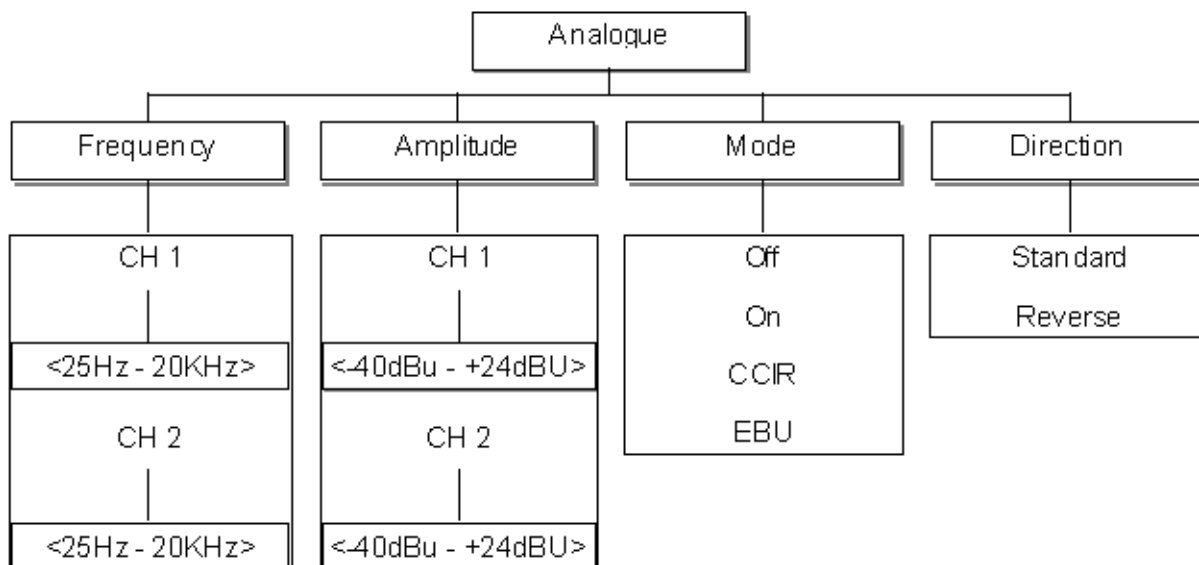
Figure 17. AES 1 Menu



Audio – Analog

Use the menu shown in [Figure 18](#) to set up the Analog audio outputs. The menu for AES 2 is identical.

Figure 18. Analog Audio Menu

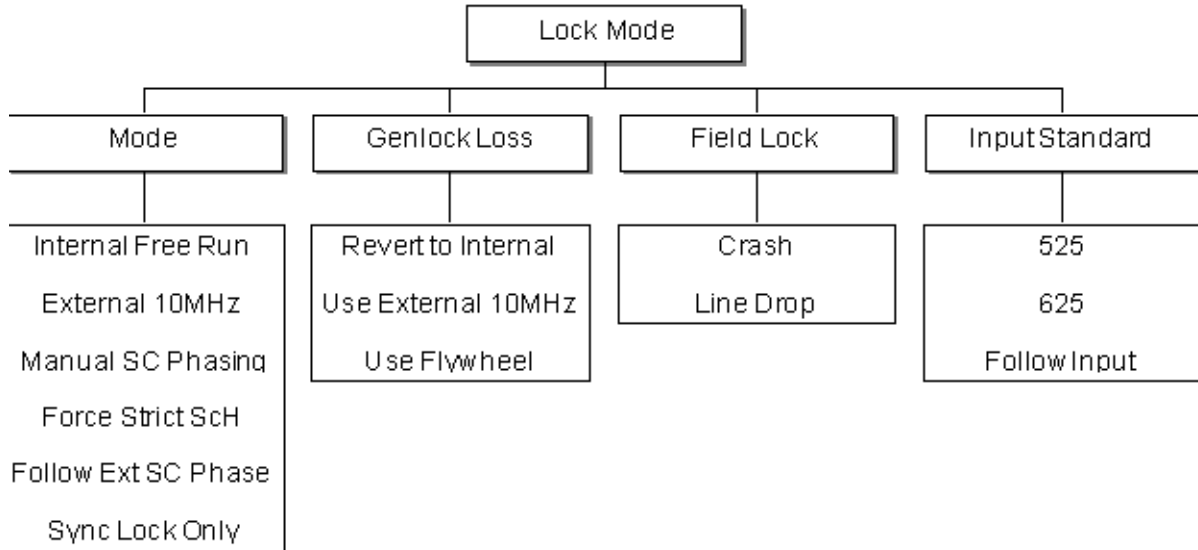


The Direction option swaps the CCIR/EBU tone blips between left and right channels

Lock Mode Menu

The Lock Mode top level menu is shown in [Figure 19](#).

Figure 19. Genlock Top Level Menu



The Lock Mode settings of the unit (for example, the current genlock mode and timing offsets) may be changed by entering the Lock Mode top level menu and setting the following:

- **Mode** – changes the basic genlock mode from the mode selections ([Genlock – Mode on page 45](#)).
- **Genlock Loss** – sets the behavior of the unit following loss of the genlock signal ([Genlock Loss on page 45](#)).
- **Field Lock** – alters the field lock action – instantaneous or slow lock ([Genlock – Field Lock on page 46](#)).
- **Input Standard** – refer to [Genlock – Input Standard on page 46](#).

To enter a sub-menu, scroll to the function and select the **OK** button.

Genlock – Mode

Select the Genlock mode required by using the **Adjust** knob or the **Left** and **Right** arrow buttons. All available modes are discussed below.

Note Please be aware that the mode will change immediately when an option is selected.

- **Internal Free Run** – sets the unit to be free running, relying on the internal oven oscillator for stability. The ScH of the unit will be set to zero.
- **External 10MHz** – sets the unit to genlock to the 10MHz input. There will be no fixed phase relationship with any other units lock to this signal. The ScH of the unit will be set to zero.
- **Manual SC Phasing** – sets the unit to genlock to the video input. The sub-carrier phase offset may be adjusted as required.
- **Force Strict ScH** – sets the unit to genlock to the video input. The ScH of the outputs of the unit is forced to zero regardless of the genlock input ScH. This is achieved by moving the line timing with respect to the genlock input until the correct ScH phase results.
- **Follow External SC Phase** – sets the unit to genlock to the video input. The subcarrier output phase is set to be the same as the input genlock video.
- **Sync Lock Only** – sets the unit to genlock to the video input. The system is genlocked using only the sync information of the genlock video input. the ScH phase of the output is forced to zero (correct).

Genlock Loss

Select the operational mode of the unit following loss of the genlock signal from the following choices:

- **Revert to Internal** – if the external reference signal is removed, the unit will use the internal oven maintained oscillator as its master oscillator.
- **External 10 MHz** – if the genlock video input is removed, the unit will use the 10MHz input as its master oscillator. if the 10Mhz input is not present when the video input fails, the unit will use the internal oven maintained oscillator as its master oscillator.
- **Flywheel** – if the genlock video input is removed, the unit will continue to operate - flywheel - at the same frequency as the genlock input just removed.

Note Note that if the unit is powered up in this mode with no genlock input applied, the 7600REF outputs may not be within specification.

Genlock – Field Lock

Select the mode required from the following choices:

- **Crash** – sets the unit to lock near instantaneously to the field information of an applied genlock input. This is the normal state of operation.
- **Line Drop** – sets the unit to lock to the field information of an applied genlock video input by moving the outputs one line nearer the genlock video input every 5 fields until the unit is locked. This mode is useful if the instant locking of the Crash mode is found to upset any downstream equipment.

Genlock – Input Standard

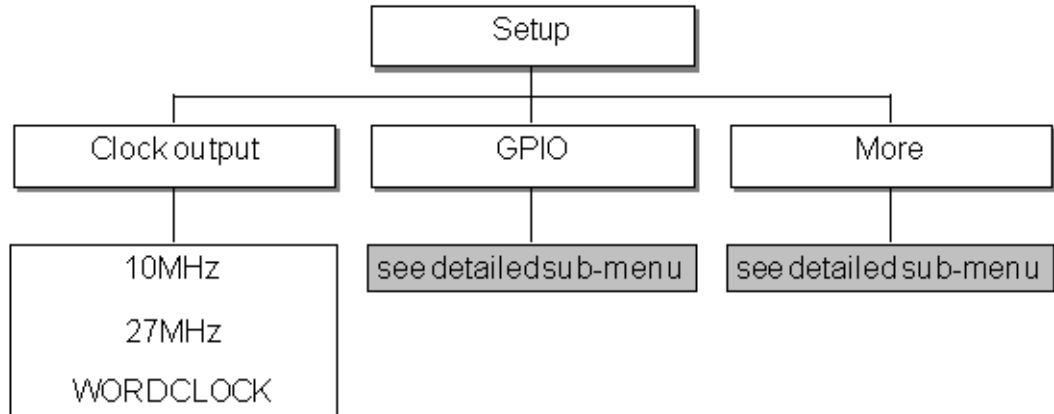
Select the video line standard of the input signal.

- **525**
- **625**
- **Auto detect**

Setup Menu

The Setup top level menu is shown in [Figure 20](#).

Figure 20. Setup Top Level Menu



The Setup menu has the following menu branches:

- Configuration of the Clock Output
- Comprehensive control of General Purpose Inputs and Outputs, including:
 - the input response mode
 - the action resulting from a GPI trigger
 - the event causing a GPO state change

The GPIO sub-menu for setting up GPI control is explained and shown in [Setup – GPI Control on page 48](#).

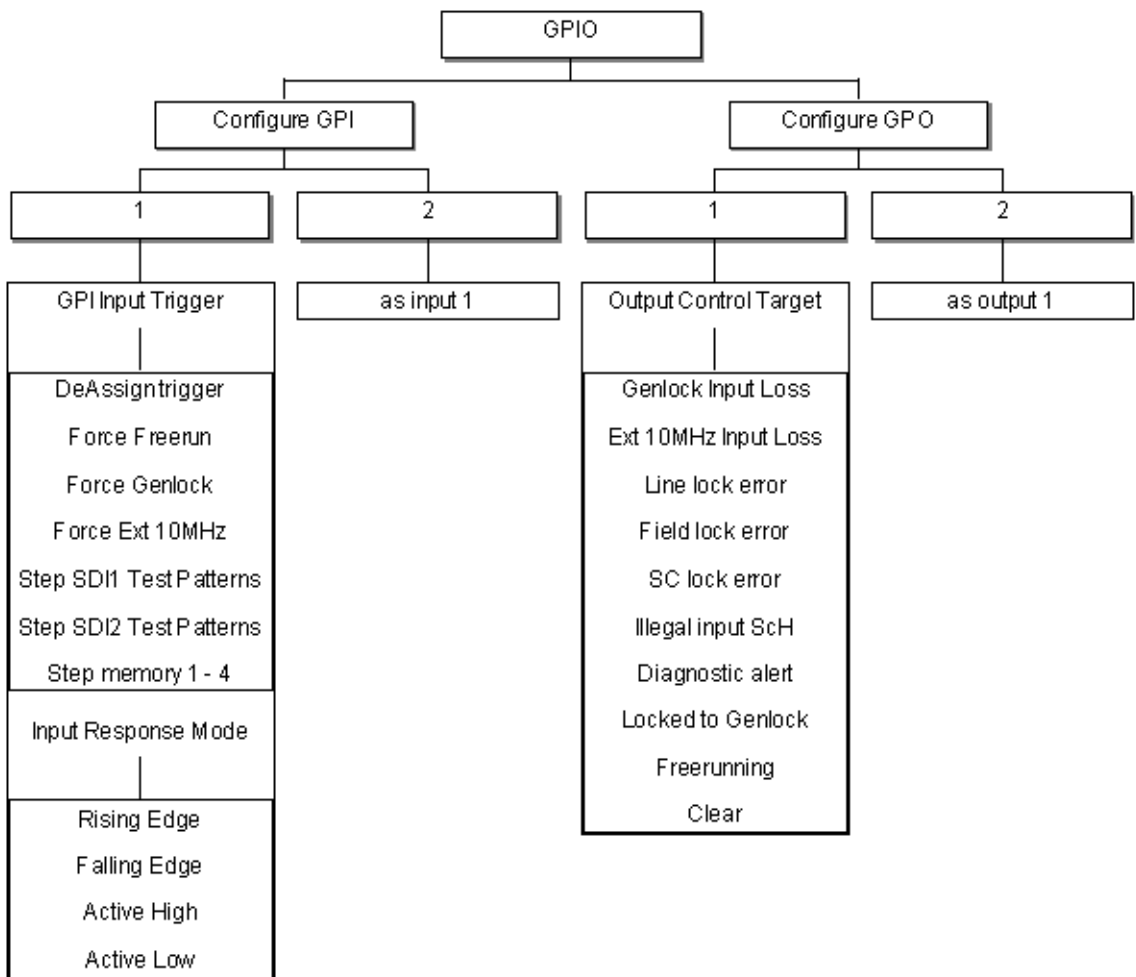
Setup – GPI Control

The menu shown in [Figure 21](#) shows the following:

- Configure GPI – the actions which the 7600REF will carry out when a control signal is applied to GP Input 1 or 2.
- Configure GPO – the signal which will appear on the 7600REF output when a defined condition occurs. As can be seen, this is normally an error or alarm condition.

GPI wiring is described in [GPI Inputs 1 and 2 on page 22](#) and [GPI Outputs 1 and 2 on page 23](#).

Figure 21. GPIO Menu

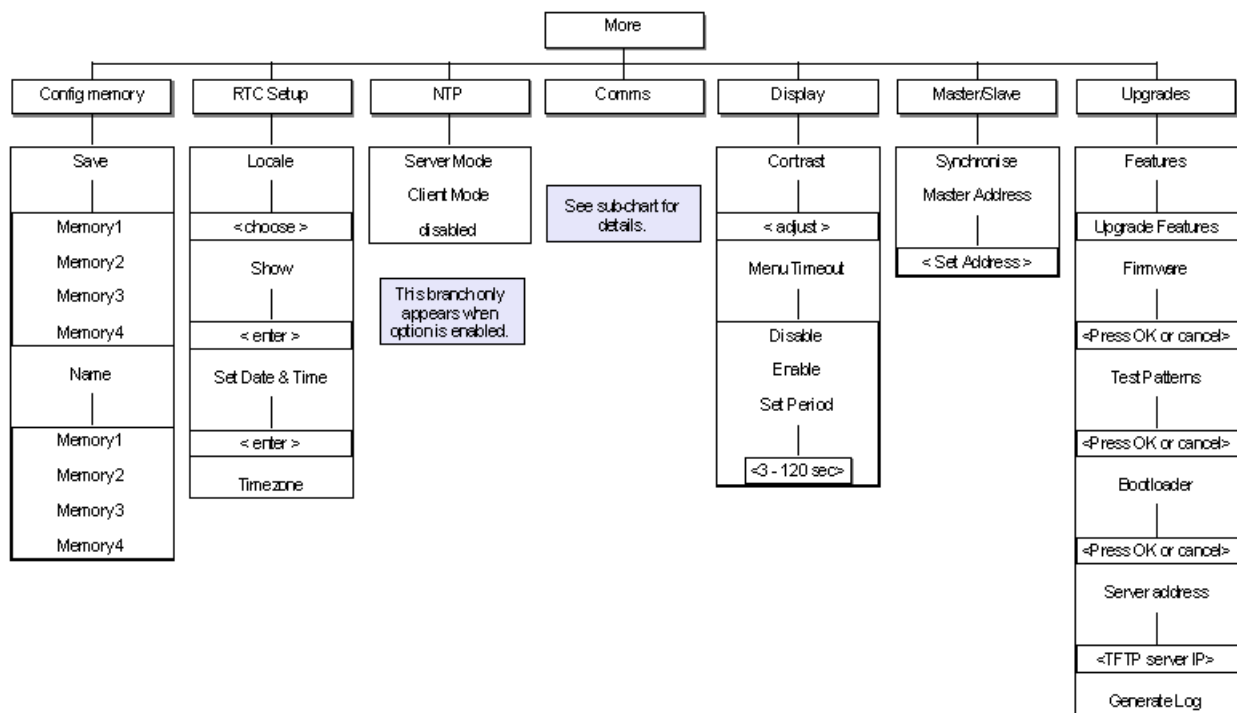


Setup – More

The Setup More menu is shown in [Figure 22](#) and includes options to:

- Manage internal memory banks 1-4. A complete operational setup may be stored or retrieved at any time.
- Setup the real-time clock (RTC).
- Configure the Network Time (NTP) capability (7600 MHD-REF).
- Configure communication with the 7600REF by:
 - Ethernet port
 - Serial port (RS232 or RS422)
- Adjust the LCD display by:
 - Setting the display contrast
 - Controlling the menu time-out
- Configure the 7600REF as Client (Slave), allowing settings to be retrieved from a Server (Master). This is useful when configuring a pair of units in fail-safe mode. Only the Master need be configured; the Slave can request settings from a Master.
- Upgrade the 7600REF, including:
 - Firmware updates

Figure 22. Setup More Menu



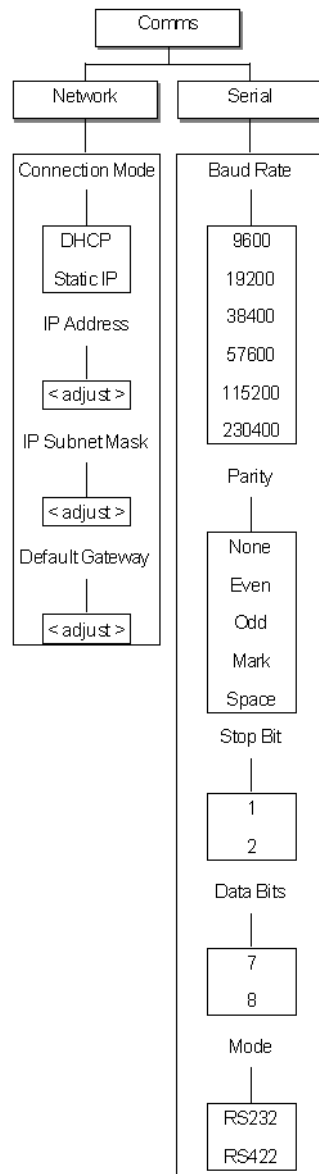
Setup – Comms

The Comms menu (Figure 23) provides network and serial port setup.

The Ethernet Port is used to connect the 7600REF to a LAN, or to a laptop PC when performing upgrades. The settings required are primarily governed by the network arrangements at the site and are explained in [Local Area Networks on page 70](#). A network connection will also be required if the NTP function in the 7600 MHD-REF model is used.

The serial port is used primarily during the manufacturing process but in RS422 mode it offers a range of functions. Contact Technical Support for more information.

Figure 23. Comms Menu

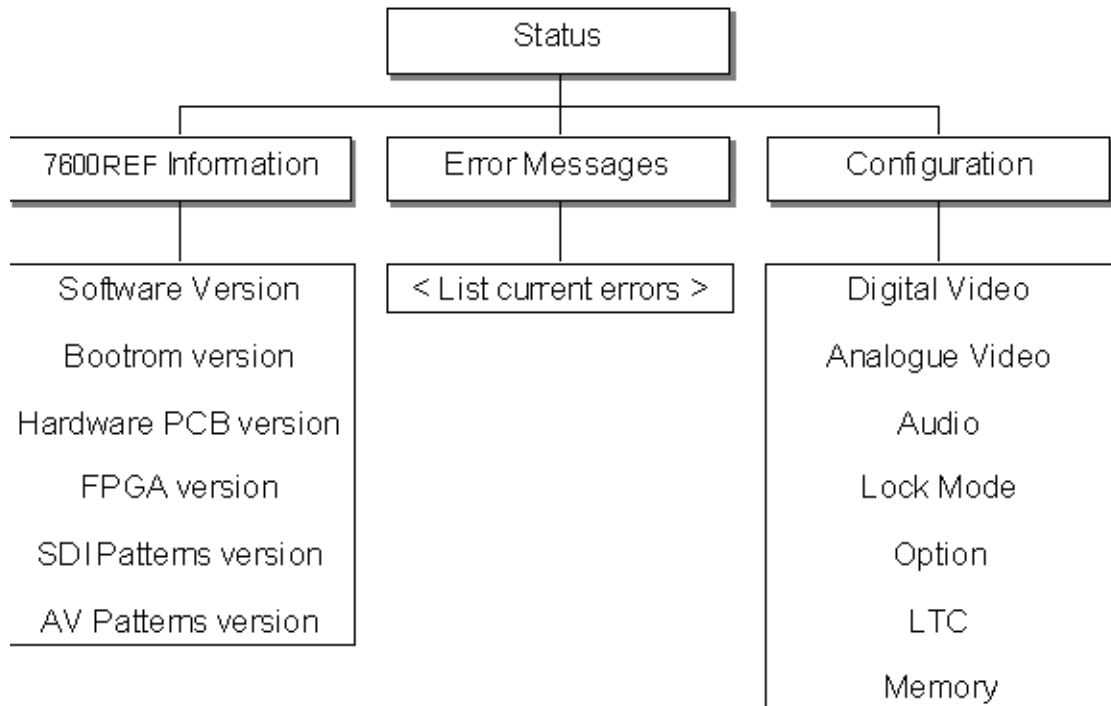


Status Menu

A dedicated **STATUS** button provides diagnostic and status information (Figure 24) in read-only format. Should an error condition such as loss of genlock occur, the lamp in the **STATUS** button will flash to draw the attention of the operator. The display text, which can be displayed by pressing the **STATUS** button, will change to indicate that an error message is available.

Pressing the **STATUS** button at any time will display the unit's current status.

Figure 24. Status Menu



Option Menus

Available options on the different model types are enabled at the factory. An option will appear in the menu trees if it is included in the model. Refer to [7600REF Models on page 18](#) for the list of options included in each model.

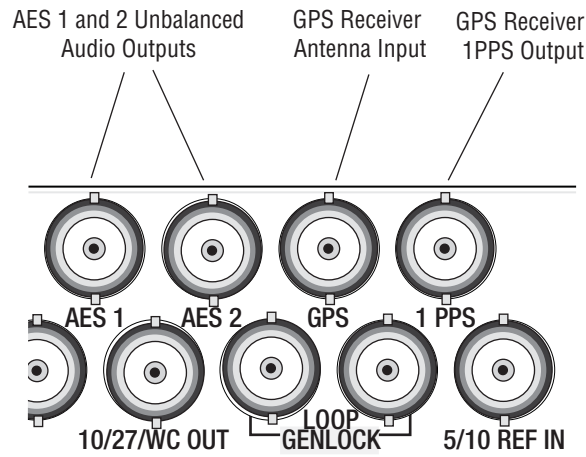
GPS Setup (7600 MHD-REF)

The GPS module comes with the 7600-MHD-REF model and is installed in Slot 1. The Global Positioning System (GPS) is currently the only fully-functional Global Navigation Satellite System. More than two dozen GPS satellites are in medium Earth orbit, transmitting signals allowing GPS receivers to determine the receiver's location, speed, and direction.

GPS also provides a precise time reference used in many applications including synchronization of telecommunications networks.

The GPS BNCs (and the AES unbalanced outputs) active on the 7600 MHD-REF model are shown in [Figure 25](#).

Figure 25. GPS BNCs



- The 1PPS (1 Pulse Per Second) output is a precise TTL level pulse which may be terminated into 75 ohm when connected into external equipment.
- The GPS antenna input should be connected to a high quality 50R GPS antenna.
- The AES 1 and 2 outputs provide an unbalanced duplicate of the signals on the AES 9 pin Sub-D connector ([Table 2 on page 24](#)). These are not related GPS operation and are provided for convenience from this module.

GPS Antenna Requirements

The GPS module requires an external antenna with the following characteristics:

- Active single antenna is power from the 7600REF antenna connector
- 3V DC antenna is required
- Reception frequency optimized for 1575.42 MHz
- 10 dB to 50 dB gain as measured at receiver input (Antenna performance dictated by antenna manufacturer)
- Connection by coaxial cable terminated in 50 ohm BNC male connector
- Maximum cable length controlled by signal strength and location. Trimble cable is 25m/75ft (N.B. standard cable length is 5m or less on some antennas.) Each extra interconnect will attenuate the signal and could increase acquisition/response time.
- Mounting – ideally clear 360 degrees view of sky. Weatherproof material for fixed installation.

Magnetic patch antennas suitable for vehicle mounting will also be satisfactory; the signal may be improved by mounting on minimum 3 inch/75mm square steel plate.

Recommended antenna types See Disclaimer below):

- Trimble Bullet 3 with 75 ft cable. N or F to BNC adapter required. 3V or as required.
- Oncore™ 2000 (Matching connectors and cable will also be required)
- Oncore™ Hawk with BNC
- Super Electronics Co.™ GA001D105001S (fit own male BNC)
- Gilsson™ External GPD Antenna (specify male BNC and cable length)

Disclaimer

Thomson Grass Valley Inc. is not connected in any way with any of the above companies. The information above is given in good faith from information in the public domain at the time of this manual release. Many similar antennae are available and specifications change over time. Some degree of experimentation may be required if the location is shrouded by adjacent structures, buildings, etc. Excessive cable length will adversely affect performance.

Thomson Grass Valley, Inc. has no control over the local conditions in which the equipment is installed and the customer is expected to have carried out a site survey to ensure that sufficient signal can be provided for the equipment to work in a satisfactory manner. Thomson Grass Valley, Inc. will not be held responsible for failures caused by poor installation, main-

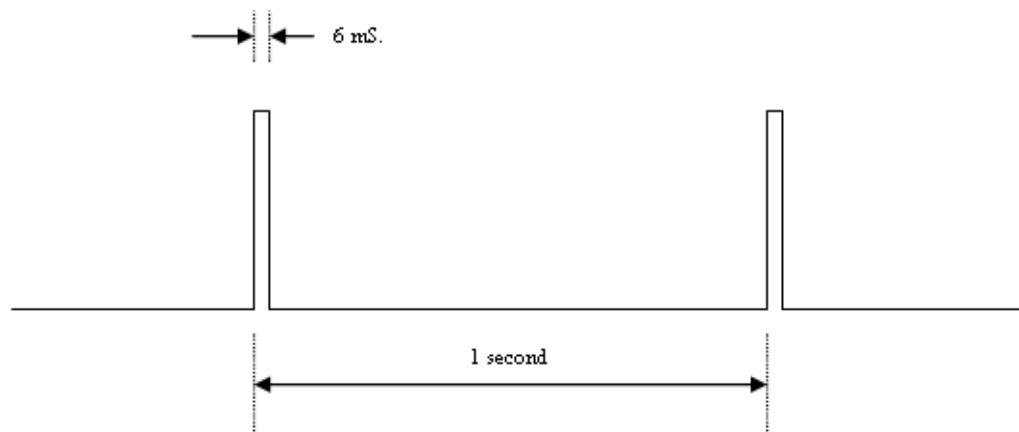
tenance, or changes in local conditions in which the required signals have been degraded such that time synchronization is lost.

Acquisition Process

With satisfactory reception, the acquisition process commences automatically and takes around 15 minutes. An enhanced mode (Site Survey) is suitable for static installation and may be initiated from the Site Survey selection on the GPS menu. A complete Site Survey can take around 2 hours. Once completed, it provides more accurate timing signals.

A 1 Pulse Per Second (1PPS) signal waveform is illustrated in

Figure 26. 1PPS Signal Waveform



The leading edge of the 6 ms wide, positive going pulse provides the timing reference plane for locking external equipment.

Internally, this signal locks the 27MHz PLL Oscillator such that PAL output signals are both frequency locked and phase locked. Any NTSC output signals are frequency locked but cannot be phase locked.

GPS Menu Structure

With the 7600 MHD-REF model, the GPS function will appear on the top level menu. This opens the menu branch shown in [Figure 27 on page 56](#).

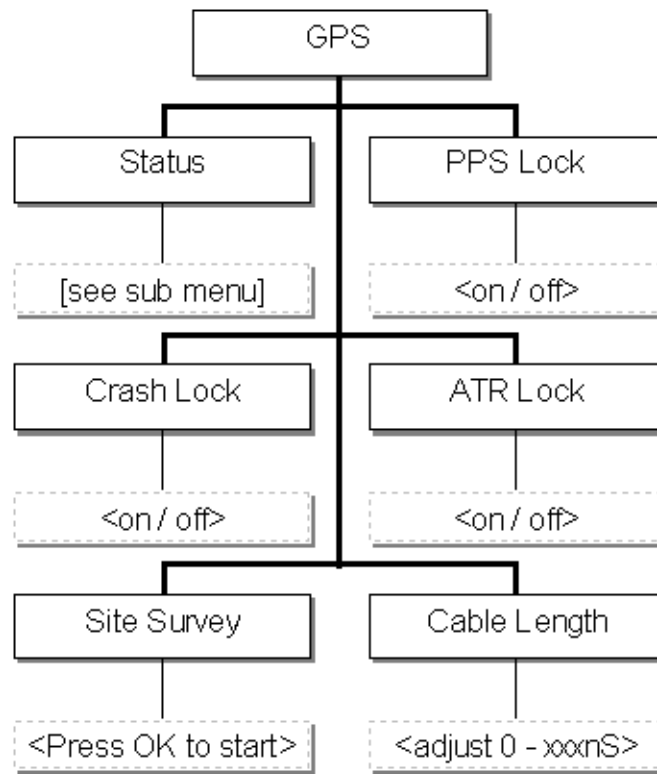
This menu is detailed below.

- **Status** – see [Status Menu on page 51](#).
- **PPS Lock** – if the PPS Lock mode is set to On, it only affects the Internal Free Run mode of genlock. The internal oscillator is then locked to the GPS reference.
- **Crash Lock** – if the Crash Lock mode is set to On, the output signal is subject to a single large disturbance followed by a period of approximately 10 minutes for settling. If the Crash Lock is Off, convergence may take many hours.
- **ATR Lock** – ATR (Absolute Time Reference) is covered by SMPTE Proposal 404 and is also known as SMPTE epoch. It defines a starting point of midnight on January 1st, 1958, at which time all generating equipment is deemed to be phase locked. By accurate determination of current GPS time, any ATR equipment may be locked together again. ATR also provides a time (and date) source for timecode generated by the 7600 unit.

If ATR Lock mode is On, the unit will also perform a Crash Lock, independently of the Crash Lock mode described above.

- **Site Survey** – a site survey can take up to 2 hours to complete. It may be initiated at any time, but would normally only be carried out when the unit is in a fixed installation location with a high quality antenna. Status of the Site Survey is shown in the Status sub-menu shown in [Figure 28 on page 57](#).
- **Cable Length** – provided compensation for the propagational delay of the antenna cable.

Figure 27. GPS Control.Menu



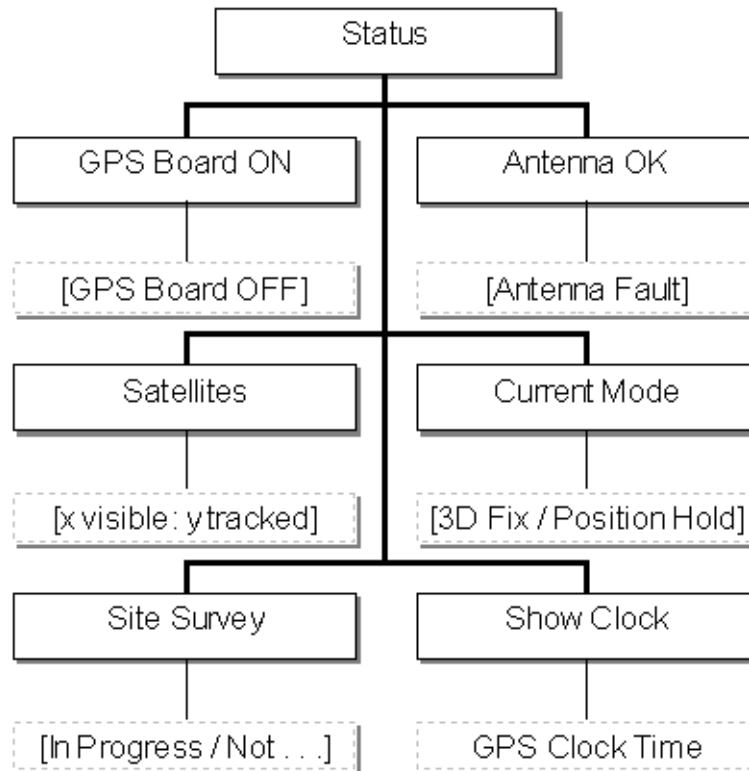
GPS Status

The GPS Status menu shown in [Figure 28](#) is a read-only menu.

Some information about this menu is listed below.

- **Satellites** – the time taken to acquire satellites can be 10 or 15 minutes, since the almanac data is broadcast fairly infrequently.
- **Current Mode** – will be displayed as:
 - **3D Fix Mode** – when a standard lock has been achieved.
 - **Position Hold** – following a successful Site Survey
- **Site Survey** – status is displayed as:
 - **In Progress**
 - **Not In Progress**

Figure 28. GPS Status Menu



Timecode Functionality (7600 MHD-REF)

Timecode is available with the 7600 MHD-REF model and provides the following:

- 2 outputs of Longitudinal Timecode (LTC) on the LTC 9 pin Sub-D connector (refer to [LTC Output \(7600 MHD-REF Model\)](#) on page 25 for connector pinout information).
- Vertical Interval Timecode (VITC) superimposed on analog video waveforms. This is enabled or disabled in accordance with the current group arrangement of the analog signal outputs.
- Each SDI output offers a combination of:
 - Digital VITC (SMPTE S266) for standard definition signals only.
 - ATC (SMPTE PRP188) for standard definition or high definition SD signals.

On the 7600 MHD-REF model, the LTC functions, Timecode JAM and LTC menu branches are accessed from the Setup menu explained below and shown in [Figure 29](#) on page 60.

Timecode Jam

This is the process of setting the time carried on the timecode stream. To avoid discontinuity, it is important to carry this out carefully. The first branch of this submenu list base oscillator frequencies (23.98Hz etc.) used to drive the range of output signals. for example, to Jam the timecode for a 625 signal, select the 25 Hz option.

This submenu has the following modes:

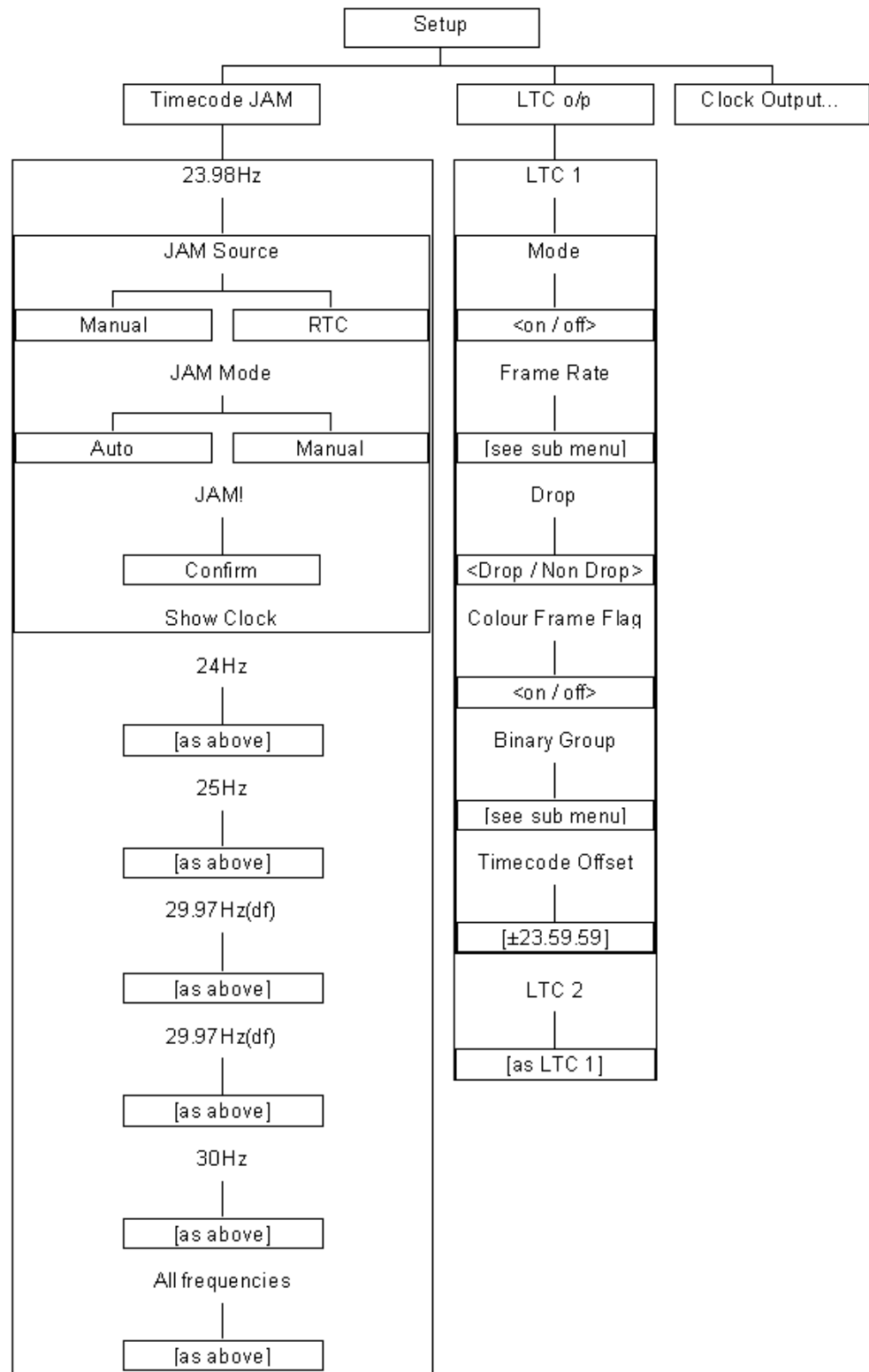
- **Jam Source**
 - Manual: enter values manually
 - RTC: uses the Real Time Clock, with the option to apply a manual offset.
- **JAM Mode**
 - Auto: sets a scheduled time
 - Manual: on command
- JAM!: initiates the JAM procedure.
- Show Clock: shows the time currently carried on the LTC stream.

LTC

This submenu has the following modes:

- **Mode** – turns the timecode On or Off.
- **Frame Rate** – since LTC is not encoded within a video signal, the frame rate must be set either explicitly or by linked association with another system output. Refer to [LTC – Frame Rate Sub Menu on page 61](#).
- **Drop/Non-Drop** – relates to 525/NTSC line timecode and determines whether frames are dropped to compensate for the non-integer number of NTSC frames per second.
- **Color Frame Flag** – this is a single bit within the data stream which indicates whether timecode is related to the video signal. This menu option allows the operator to turn this bit On or Off.
- **Timecode Offset** – an additional offset may be applied to any timecode output with a value between -23h: 59m: 59s and +23h: 59m: 59s. The default is 0h: 0m: 0s. This offset is applied immediately. Timecode outputs using the same oscillator frequency will remain “in-step” using the Timecode JAM settings applied in the Timecode JAM menu.
- **Binary Group Bits** – the primary function of the Flag Bits is to allow the operator to embed a date code within the data stream since timecode represents only embedded time. This conforms to SMPTE S309. Refer to [LTC – Binary Group Sub Menu on page 62](#).

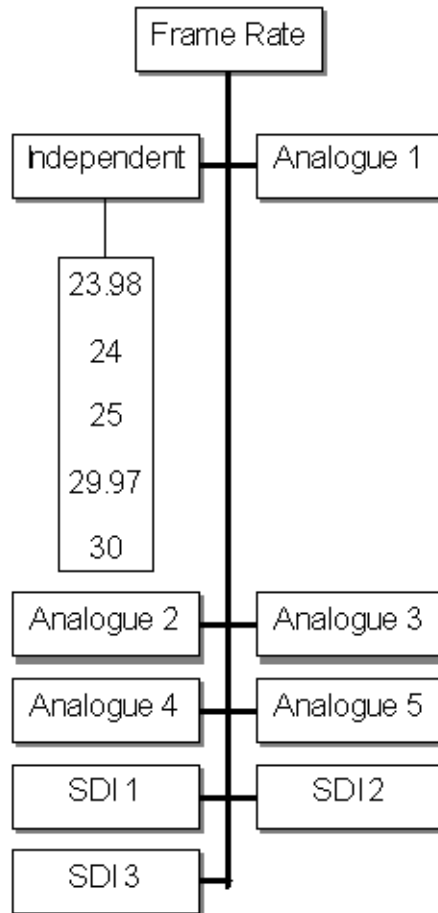
Figure 29. Setup –LTC Menu



LTC – Frame Rate Sub Menu

The Frame Rate sub menu is shown in [Figure 30](#). Since LTC is not contained within a video waveform, the timing must either be set explicitly or allied to one of the signal outputs.

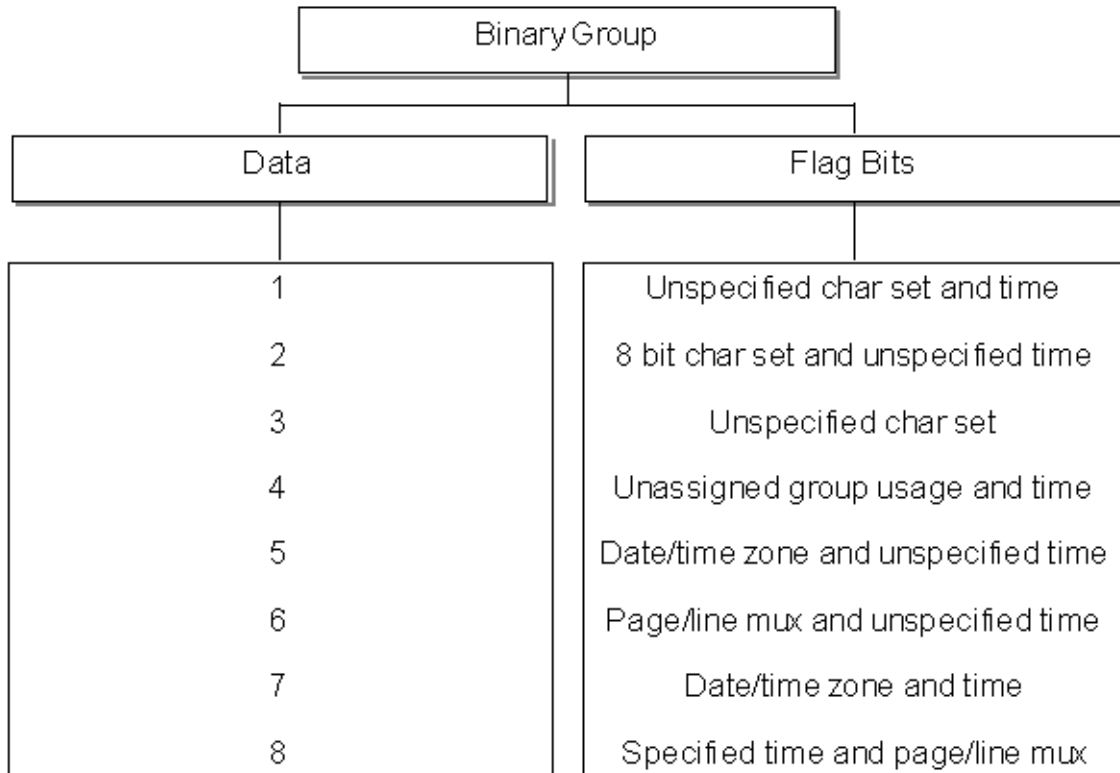
Figure 30. LTC Frame Rate Sub Menu



LTC – Binary Group Sub Menu

The LTC Binary Group sub menu is shown in [Figure 31](#).

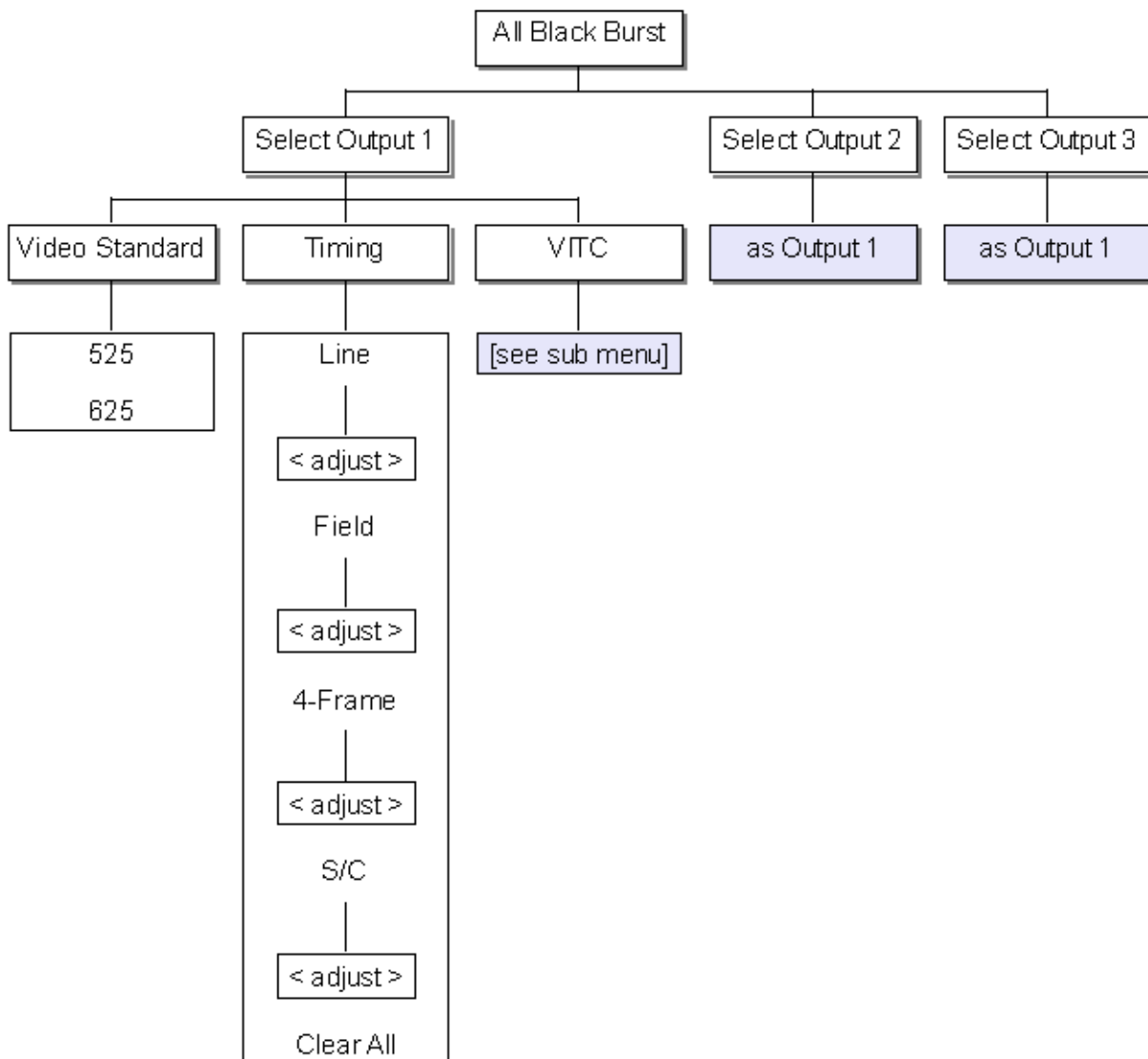
Figure 31. LTC Frame Rate Sub Menu



VITC Within Analog Waveform

With timecode functionality, an extra menu item will appear as appropriate. The example below in Figure 32 shows the VITC item added to the BB1 (Black and Burst Option 1) menu tree.

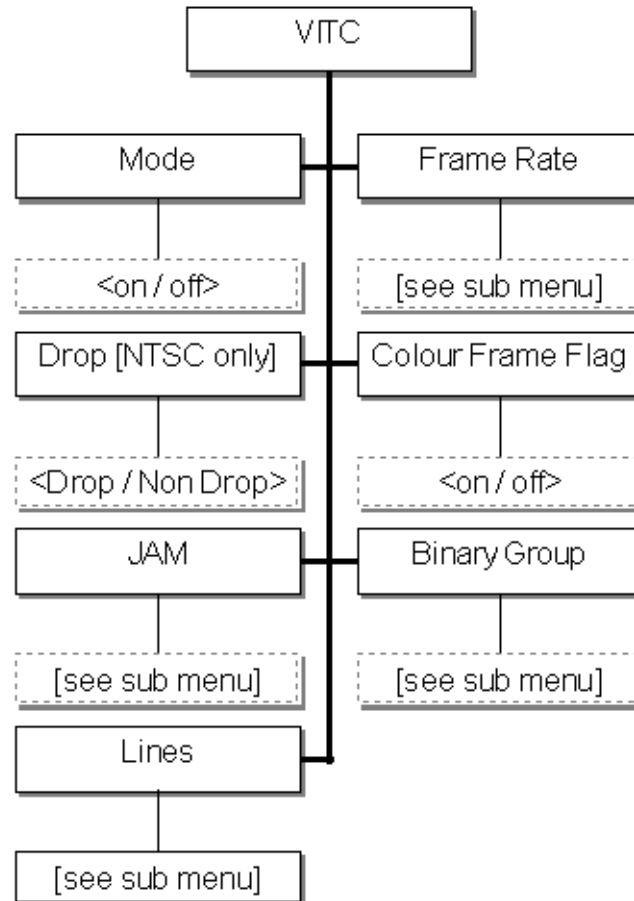
Figure 32. VITC Added to Analog Waveform



The menu shown in [Figure 32 on page 63](#) is essentially identical to the menu shown in *Analog Video – All Black and Burst* on page 38.

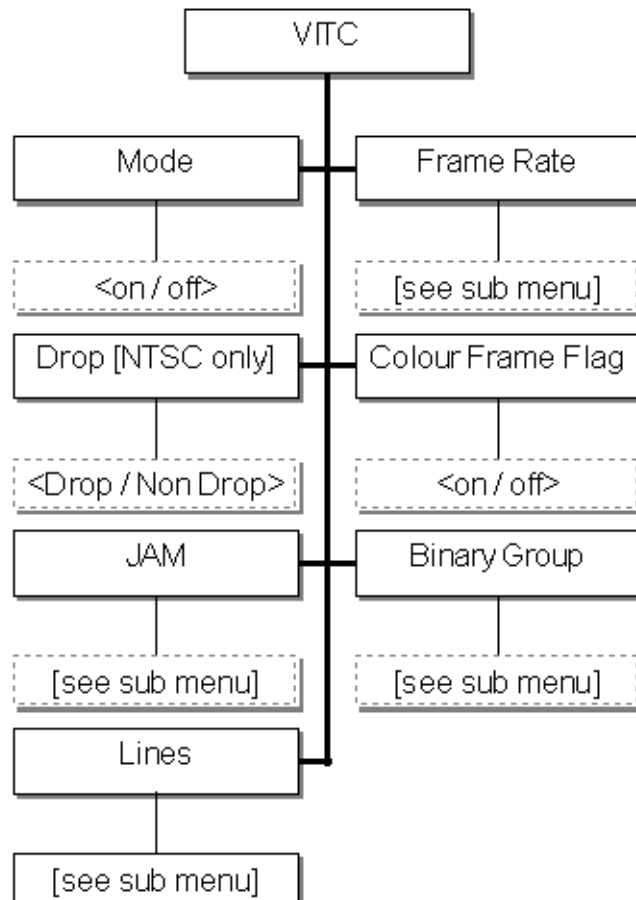
The additional branch for VITC is shown below in [Figure 33](#). The other items in this menu are explained previously in the *Timecode Functionality (7600 MHD-REF)* on page 58.

Figure 33. VITC Menu



The additional branch for VITC is shown below in [Figure 33](#). The other items in this menu are explained previously in the [Timecode Functionality \(7600 MHD-REF\)](#) on page 58.

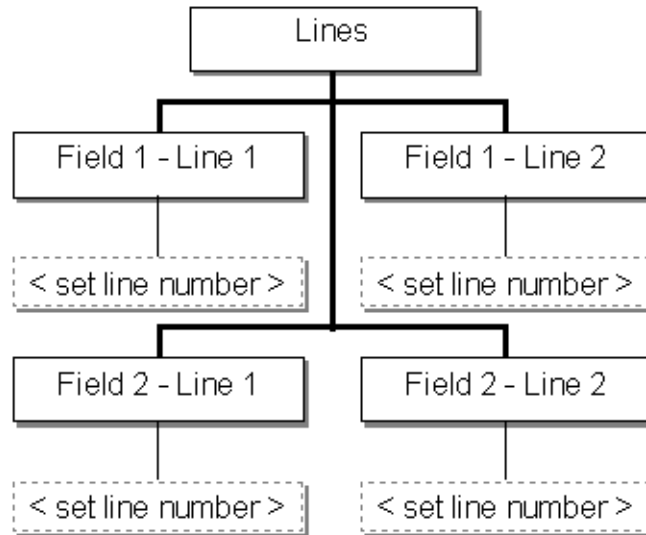
Figure 34. VITC Menu



VITC – Lines Menu

There is no Drop entry on the VITC menu when the output in question is set to PAL mode. However, there is an extra Lines menu option on the VITC menu to allow control over which line the VITC signal is inserted into as shown in [Figure 35](#). Here Line 1 and Line 2 indicates the first and second lines in each field which have VITC inserted.

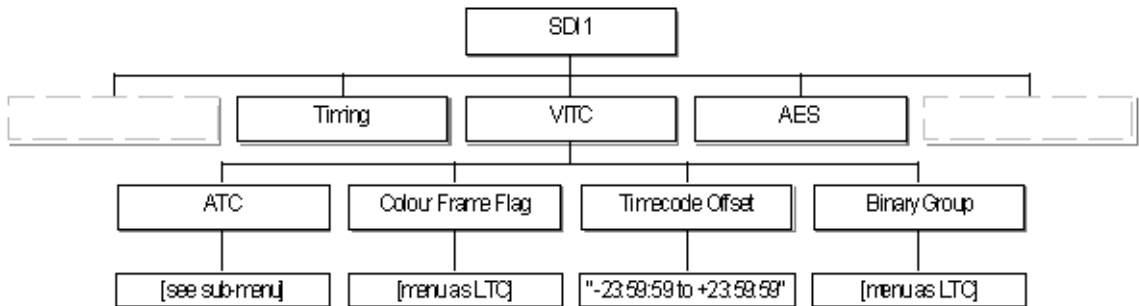
Figure 35. VITC – Line Menu



VITC Within SDI

On the 7600 MHD-REF model with Timecode, an extra menu will appear in the tree for SDI 1 and SDI 2. The menu in [Figure 36](#) is essentially the same as the one for SDI 1 shown in [Figure 6 on page 33](#).

Figure 36. VITC within SDI Menu

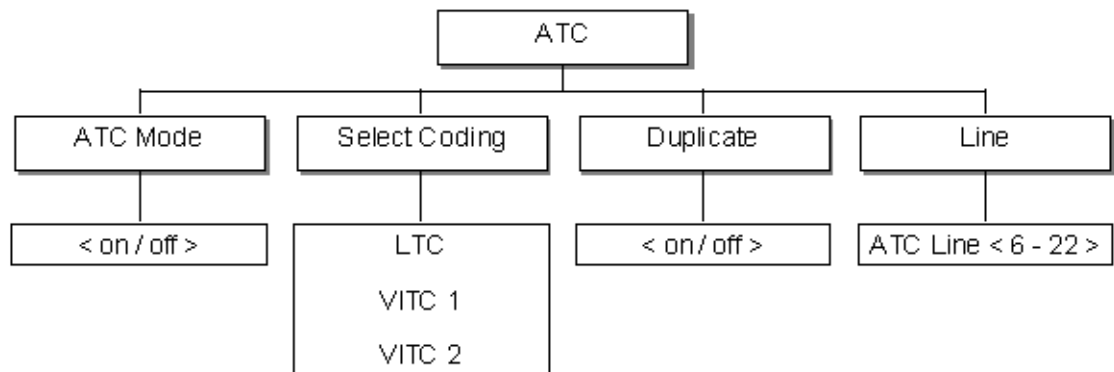


Many of the menus are the same as those in the previous LTC section. The additional ATC menu is shown in [Figure 37](#).

This menu allows selection of the following:

- **ATC Duplicate** – this flag indicates where the ATC data to be re-encoded as a VITC signal appears on 1 or 2 lines in each field.
- **ATC Line** – sets the line number where the ATC data to be re-encoded as a VITC signal will appear.

Figure 37. SDI ATC Menu



Network Time Protocol (NTP) (7600 MHD-REF Model)

This function included with the 7600 MHD-REF model offers the following for Master/Slave operation:

- Both Client and Server modes are available
- If installed, the menu will off Server, Client, and Disabled. Client and Server are mutually exclusive. NTP is intended for change-over units to keep them both in sync.
- The Client can sync to any Internet NTP server.
- When acting as a server the 7600REF should, ideally, have a GPS module installed (included with the 7600 MHD-REF model) but this is not a requirement. Even if the server is free running, a slaved unit can still sync to it.

HD Tri-Level Sync (7600 HD-REF and 7600 MHD-REF Models)

The four available Tri-level BNCs can be individually configured from the menu according to [Table 5](#) below. The first column indicates the number selected from the 7600REF menu. The scan format is indicated by P (Progressive) or I (Interlaced).

Table 5. Tri-Level Sync Configuration

Number	Description	Lines/Frame	Frame Rate	Scan
1	1920x1080/60/1:1	1125	60	P
2	1920x1080/59.94/1:1	1125	60	P
3	1920x1080/50/1:1	1125	50	P
4	1920x1080/60/2:1	1125	60	I
5	1920x1080/59.94/2:1	1125	60	I
6	1920x1080/50/2:1	1125	50	I
7	1920x1080/30/1:1	1125	30	P
8	1920x1080/29.97/1:1	1125	30	P
9	1920x1080/25/1:1	1125	25	P
10	1920x1080/24/1:1	1125	24	P
11	1920x1080/23.98/1:1	1125	24	P
12	1920x1080/30/sF	1125	30	I
13	1920x1080/29.97/sF	1125	30	I
14	1920x1080/25/sF	1125	25	I
15	1920x1080/24/sF	1125	24	I
16	1920x1080/23.98/sF	1125	24	I
17	1280x720/60/1:1	750	60	P
18	1280x720/59.94/1:1	750	60	P
19	1280x720/50/1:1	750	50	P
20	1280x720/30/1:1	750	30	P
21	1280x720/29.97/1:1	750	30	P
22	1280x720/25/1:1	750	25	P
23	1280x720/24/1:1	750	24	P
24	1280x720/23.98/1:1	750	24	P
25	720x483/59.94/1:1	525	60	P
26	6 Hz (30/24)	6HZ	-	-
27	6 Hz (29.97/23.98)	6Hz	-	-
28	625/50	625	50	I
29	525/59.94	525	60	I

Using a TFTP Server

The use of an TFTP server with the 7600REF models allows the customer to upgrade software in the field, and, if necessary, generate a copy of the 7600 log file to send to Technical Support for troubleshooting purposes or option enabling.

The 7600 log is a unique digital signature for each 7600 frame and describes the options that have been enabled. As mentioned earlier, options come already enabled from the factory so using this function to create a log file for enabling options should not be required unless requested by Customer Service.

However, software upgrades may be preformed in the field using the TFTP server. See [Updating 7600 Software on page 73](#).

To prepare a TFTP Server refer to [Preparing a TFTP Server on page 71](#). The suggested shareware application is called Solarwinds and can be downloaded from <http://solarwinds.net/downloads> if required.

Run the installing program, accepting all default options. Note that you may require Administrative rights under Windows to install new applications.

Local Area Networks

In order to communicate with the TFTP server, the 7600REF must have a valid IP Address in the same subnet (range) as the server.

- If communication is via a company network, then IP addresses may be automatically allocated using DHCP.
- If the 7600REF is connected to a small network specifically established for technical equipment, then static IP addresses may be in use and the 7600 should be configured accordingly.
- If the 7600REF is not currently connected to a LAN, Solarwinds may be installed on a laptop which is then connected to the 7600REF with a crossover cable.

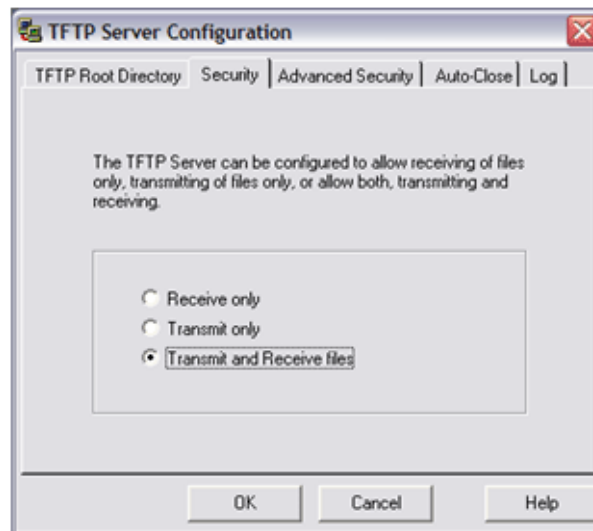
The 7600REF Ethernet port is configured using the Setup menu, then navigating to the Comms menu. Refer to [Setup – Comms on page 50](#).

Preparing a TFTP Server

Application of the supplied file requires the use of a TFTP server.

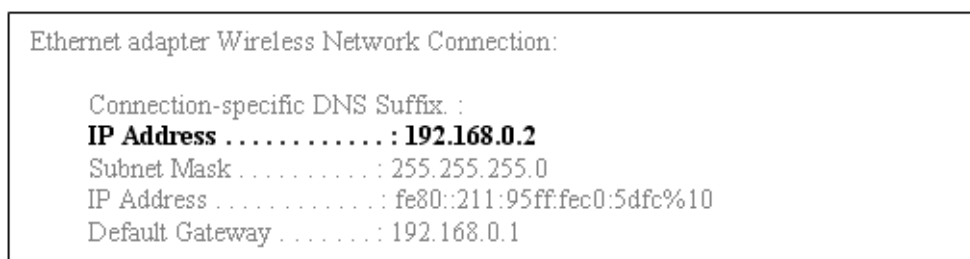
7. Install Solarwinds on a PC which will be accessible by the 7600REF. See the discussion above on [Local Area Networks on page 70](#).
8. After installation, from the Windows Start menu, launch Solarwinds TFTP software and select Configure from the File menu.
9. Select the Security tab ([Figure 38](#)) and ensure that the Transmit and Receive files option is selected.

Figure 38. TFTP Server Configuration



10. Using Windows Explorer, copy the supplied files into the TFTP root folder normally installed at C:\TFTP-root.
11. Note the IP Address of the TFTP server. On the PC, select Run from the Windows Start menu. Type `cmd`, then press **OK**. A command prompt will open. Type `ipconfig` and press **Enter**. From the text which returns, locate the IP address. Refer to the example in [Figure 39](#).

Figure 39. TFTP Server Configuration



Preparing the 7600REF

1. Power up the 7600 and wait for initialization to complete.
2. Navigate to the Setup>>More>>Upgrades>>Server Address menu. Enter the IP address of the TFTP server and press **OK**.

Generating the Log File (Digital Signature)

This process is only necessary when enabling options which is done at the factory. However, at some point this log may be needed when working with Customer Service so the procedure is included here.

1. Navigate the 7600 to Setup>>More>>Upgrades>>Features>>Generate Log.
2. A file will now be created in the TFTP root folder. Retrieve this file and email it to Technical Support as requested.
3. This process is for enabling options which should only be necessary when requested by Customer Service.

Updating 7600 Software

When new software code for the 7600REF is available it can come in three forms:

- Firmware
- Changes to test patterns
- Changes to menu structure

This code may be installed using the TFTP server method (see [Preparing a TFTP Server on page 71](#)) with a series of programming files which are available from Technical Support.

Note It is not necessary to generate the log file as described earlier in the option upgrading explanation.

Preparing to Update

Refer to the following sections to set up your 7600 for TFTP server functionality:

- Download and install TFTP Server (see [Using a TFTP Server on page 70](#))
- Local Area Network considerations (see [Local Area Networks on page 70](#))
- Preparing a TFTP Server (see [Preparing a TFTP Server on page 71](#))

Preparing the 7600REF

1. Power up the 7600REF and wait for initialization to complete.
2. Navigate the 7600 to Setup>>More>>Upgrades>>Server Address.
3. Enter the IP address of the TFTP server as previously noted and press the **OK** button.

Completing the Process

1. Navigate the 7600REF to Setup>>More>>Upgrades and choose the appropriate option for the component being upgraded.
2. The message, upgrade successful, appears on the 7600REF LCD screen once the upgrade process is complete.
3. The unit is now ready for use with the new code installed.

Specifications

Note All measurements are made assuming, where appropriate, that the various offsets controlled from the front panel are set to zero unless otherwise stated.

All signal measurements are made with inputs and outputs terminated in 75 ohm unless otherwise stated.

Table 6. 7600REF Specifications

Parameter	Value
SD-SDI Outputs	
General	
Format	270 Mb/s 10 bits
Standards	ITU-R BT 601, 656, EBU Tech 3267, SMPTE 125M, 244M, 259M, RP165, RP178
Video	
Output impedance	75 ohm
Amplitude	800 mV p-p $\pm 10\%$
Return loss to 270 MHz	> 15 dB
Overshoot	< 10%
Jitter	< 0.2 UI above 10 Hz jitter frequency
Rise/fall times	0.4 to 1.5 ns (20-80%)
DC offset (AC coupled)	0 \pm 0.5V
Time offset with respect to Main black burst signal	< ± 100 ns
Embedded Audio	
Active channels	4
Group	Selectable 1, 2, 3, or 4
Sample Frequency	48kHz
Digital coding	24 bits
Audio tone	25Hz to 20kHz in 25Hz steps
Audio level	0 to -120 dBFS
Tone modes	On, Off, CCIR, and EBU
HD-SDI Outputs	
General	
Standards	SMPTE 272M, 292M, and 296M
Formats	1080i: 60Hz, 59.94Hz, 50Hz 1080p: 30Hz, 29.97Hz, 25Hz, 24Hz, 23.98Hz 1080psF: 30Hz, 29.97Hz, 25Hz, 24Hz, 23.98Hz 720p: 60Hz, 59.94Hz, 50Hz, 30Hz, 29.97Hz, 25Hz, 34Hz, 23.98Hz
Output impedance	75 ohm
Amplitude	800 mV p-p $\pm 10\%$
Return loss	> 15dB, 5MHz to 750MHz > 10dB, 750MHz to 1.485GHz (typical)
Overshoot	< 10%

Table 6. 7600REF Specifications

Parameter	Value
Jitter	< 135 ps
Rise/fall times	< 270 ps (20-80%)
DC Offset (AC coupled)	0 ± 0.5V
Embedded Audio	
Active channels	4
Group	Selectable 1, 2, 3, or 4
Sample Frequency	48kHz
Digital coding	24 bits
Audio tone	25Hz to 20kHz in 25Hz steps
Audio level	0 to -120 dBFS
Tone modes	On, Off, CCIR, and EBU
Analog Video Output Performance	
Output impedance	75 ohm
Sync amplitude	300 mV ± 3 mV (625) 285 mV ± 3 mV (525)
Burst amplitude	300mV ± 9 mV (625) 285mV ± 9 mV (525)
Black level DC	0V ± 20mV
Noise to 20 MHz	< -60dB (with respect to 700 mV)
Noise above 20 MHz	< -40dB (with respect to 700 mV)
ScH accuracy, all controls set to zero	± 5 degrees
Sync edge risetime	250 ns, Gaussian (635) 140 ns, Gaussian (525)
Burst edge risetime	350 ns, Gaussian (635) 300 ns, Gaussian (525)
Difference in timing between any analog video output and any other (all controls set to zero)	± 10 ns
Difference in timing between any black/burst output and the genlock video output (all controls set to zero)	± 10 ns
Generation accuracy	10 bit
Timing accuracy (channel to channel)	< ± 5 ns
Level, 0 dB, p-p	1 V ± 1%
Black level DC	0V ± 25 mV
Chrom/Lum gain	< 1%
Chrom/Lum delay	< 5 ns
Chrom phase accuracy	< ± 5 degrees
Linearity	< 0.25%
Frequency response to 6 MHz	± 2 dB
Differential gain	< 0.5%
Differential phase	< 0.5 degrees
2T K rating	< 0.5% K
ScH accuracy	± 5 degrees

Table 6. 7600REF Specifications

Parameter	Value
Line tilt	< 0.5%
Field tilt	< 0.5%
Channel crosstalk (0 to 5.8 MHz)	< -60 dB
AES/EBU Outputs	
Standard	ANSI S4.40 (AES3)
Output channels	4 (2 AES pairs)
Synchronization	Signal timing is derived from the video clock source, either the internal oven oscillator or the genlock feed. 48kHz signal is related to video frame as per SMPTE/EBU recommendations.
Grade ¹	Meets Grade 1 when genlock mode = internal or stable 10MHz reference used
Clock jitter ¹	< 1 ns
Output connections	DB9 (balanced), BNC (unbalanced)
Signal amplitude	5V ± 0.3V
Impedance	110 ohm ±10%
Tone resolution	24 bit
Tone linearity error	< 1 ppm
Sample frequency control	Selectable 32kHz, 44.1kHz, 48kHz, 96kHz
Tone frequency adjustment	25Hz to 20kHz in 25Hz steps. Left/right channel independent adjustment
Tone amplitude adjustment	0 to -120 dBFS left/right channel independent adjustment
Tone identification	Left/right channels can pulse according to EBU/CCIR recommendations
Grade	Grade bit manually adjustable between grade 1 and grade 2
User data	User configurable
Other	Both channels may be set to silence. Channels can be swapped.
Analog Audio Output Performance	
Signal source	Independent audio generator
Number of channels	2
Output type	Differential, electronically balanced
Output impedance	Low impedance, < 10 ohm
Tone amplitude	+20 dBU to - 40 dBU adjustable
Tone frequency	100Hz to 20kHz in 25Hz steps. Left/right channel independent adjustment
Tone Identification	Left/right channels can pulse according to EBU/CCIR recommendations
Clock Output	
Frequency	Selectable 10MHz, 27MHz or Word Clock
Output impedance	75 ohm ± 1%
Word Clock	CMOS compatible 32kHz, 44.1kHz, 48kHz, or 96kHz (AES1 sample frequency)
10MHz	1.2V ± 100mV
27MHz	1V ± 100 mV

Table 6. 7600REF Specifications

Parameter	Value
Internal Reference Oscillator Stability	
Nominal error	$< \pm 0.5\text{Hz}$ (0.1 ppm)
Temperature stability (over oven operating temperature range)	$< \pm 0.05$ ppm
Ageing range (per year)	< 0.5 ppm
Warm up settling time to < 0.05 ppm	10 minutes @ 25C
Genlock Video Input Performance	
Video input type	2 BNC high impedance loop through
Return loss @ subcarrier	< -40 dB
Video DC range	$< \pm 12\text{V}$
Video signal amplitude (to keep unit within specification)	300 mV sync/burst ± 6 dB (285 mV 525 operation)
Sync attenuation below which signal will be indicated as missing	- 8 dB (with respect to 300 mV/625 or 285 mV 525 operation)
Burst attenuation below which signal will be indicated as monochrome	- 8 dB (with respect to 300 mV/625 or 285 mV 525 operation)
Sync frequency lock range	15.625kHz $\pm 1.5\text{kHz}$ (± 100 ppm) -625 15.734kHz $\pm 1.5\text{kHz}$ (± 100 ppm) -525
Subcarrier lock range	4.43361875MHz (625) 3.579545MHz (525) $\pm 200\text{Hz}$ (± 50 ppm) ²
Genlock video lockup time	< 7 seconds
Output sync jitter with respect to clean genlock video input	$< \pm 3$ ns
Output subcarrier with respect to clean genlock video input, lock mode = EXT 1/2/3	$< \pm 0.25$ degrees
Output subcarrier with respect to clean genlock video input lock mode = EXT 4	$< \pm 2$ degrees
Input video ScH phase over which an ScH error is indicated	$+90 \pm 15$ degrees, -90 ± 15 degrees (approx.)
Genlock video sync to output sync timing accuracy, over full operating temperature range	< 5 ns
Genlock video subcarrier to output subcarrier phase accuracy over full operating temperature range	< 5 degrees
Vertical lockup rate, genlock video to output, when unit set to line drop mode	1 line/5 field
Genlock Operational Control	
Horizontal offset adjustment range	± 32 us
Horizontal offset resolution	1 ns
Horizontal offset accuracy	± 5 ns over full range
Subcarrier phase adjustment range	0 to 359.9 degrees
Subcarrier phase resolution	0.1 degree
Line offset adjustment range	1 line steps over entire 525/626 range

Table 6. 7600REF Specifications

Parameter	Value
10MHz Performance (The lock mode is assumed set to external 10MHz)	
10MHz input type	1 BNC 75 ohm terminated
10MHz input return loss @ 10MHz	< -35 dB
10MHz DC range	< ± 3V
10MHz signal amplitude (to keep unit within specification)	0.5V to 3V p-p terminated
Signal amplitude below which signal will be indicted as missing	0.4V
10MHz frequency lock range	10MHz ± 200 Hz (± 20 ppm)
Lockup time	< 0.1 second
Output sync jitter with respect to clean 10MHz input	< ± 2 ns
Output subcarrier jitter with respect to clean 10MHz input	< ± 0.2 degrees
GPI (General Purpose Interface)	
GPIO Inputs	
Number	2
Type	Grounding
Maximum voltage	± 20V
Operating current	approximately 600 uA
GPI Outputs	
Number	2
Type	Open drain
Maximum voltage	50V
Maximum current	200 mA
Maximum dissipation	600 mW
LTC Timecode	
Standard	SMPTE S12M, S309M
Output channels	2, electronically balanced
Connector	9 way D type
Level	2V p-p into 1k ohm
Impedance	< 25 ohm per leg
Risetime	40 ± 10 us between 10% and 90% points
Jitter	< 2 us
Overshoot	< 5%

Table 6. 7600REF Specifications

Parameter	Value
General	
Width	19 in. rack mounting
Height	44 mm (1.73 in.) 1 Rack Unit
Depth	433 mm (17 in.) excluding connectors
Weight	4kg (8.82 lbs) no option modules 5kg (11 lbs) maximum with option modules
Operating temperature range	0 to 50 degrees C
Storage temperature range	-25 to 70 degrees C
Operating humidity	95% RH non-condensing
Power	
AC Mains input x 2	90-264 VAC, 45-63Hz, 440Hz auto select
Power consumption	60VA (depending on number of modules installed)
Internal fuse	3.15A
Miscellaneous	
Setup data retention when unit not powered	> 1000 hours. Unit must have been powered for > 24 hours prior to this.
Serial communication type	RS422/232 (software configured)
Power fail indication	Relay contact, closed under normal operation, open for any failure state.
Fan fail indication	Relay contact, closed under normal operation, open for any failure state.
Remote inputs	Two grounding inputs provided on Sub-D connector. See Analog Audio/Remotes on page 21 for details.
Remote outputs	Two outputs provided on Sub-D connector See Analog Audio/Remotes on page 21 for further details. Open collector outputs rated at 45V/500mA maximum.
Ethernet	RJ-45 interface. Software configured for DHCP or static IP address.

¹ When the unit is locked to a genlock feed, the frequency stability of the AES signal is dependent on the quality of that feed.

² Assumes 15625hz (15734.268Hz NTSC) line frequency and subcarrier varied about nominal subcarrier frequency.

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