AVENUE

Avenue™ signal integration system

Model 5400
Dual Sync Generator
and Test Signal
Generator
Data Pack

ENSEMBLE
D E S I G N S

Revision 5.1   SW v2.0

This data pack provides detailed installation, configuration and operation information for the **5400 Dual Sync Generator and Test Signal Generator** as part of the Avenue Signal Integration System.

The module information in this data pack is organized into the following sections:

- Module Overview
- Applications
- Installation
- Cabling
- Module Configuration and Control
  - Front Panel Controls and Indicators
  - Avenue PC Remote Control
  - Avenue Touch Screen Remote Control
- Troubleshooting
- Software Updating
- Warranty and Factory Service
- Specifications

MODULE OVERVIEW

The 5400 module is a stable timing source suitable for local reference generation for use in broadcast, remote trucks and post-production. Dual outputs, available simultaneously in analog composite and serial digital and an HD tri-level sync reference output are provided. In addition, more than twenty internally-generated test signals, including black and color bars, and EDH Error generation are available.

The 5400 can operate from an internal precision frequency reference as a stand alone master sync generator or lock to a video reference from an external source. The module can also lock to an external 10 MHz source such as an atomic standard or GPS receiver for more precision.

Two sets of composite outputs and serial outputs are provided. One serial output together with a pair of composite outputs form the primary sync generator. A second serial output together with an associated pair of composite outputs form a separate secondary sync generator.

The test signal generator is always output to the primary outputs. An ID slate with user programmable text can be overlayed on the test pattern. The secondary sync generator always outputs color black.

The Primary and Secondary outputs can be timed with respect to the reference to any point in the television frame. Color framing tracks the reference signal. Timing adjustments for primary and secondary outputs are configured independently and the 5400 can be configured to output 525 and 625 standards simultaneously.

An optional submodule, the 5410, can be installed to provide audio test signals, AES3id, word clock or 6 Hz output, analog tone and embedded audio reference outputs. The AES outputs are synchronous to the 525 and 625 outputs as they share the same time base. The Primary 601 output will have EDH checksums inserted.

Another feature available when the 5410 submodule is installed is the Make EDH Error function which deliberately introduce different types of errors in the Primary SDI output. EDH (Error Detecting and Handling) is a method to detect and indicate loss of data path integrity and corruption. A CRC (Cyclic Redundancy Character) checksum is computed at the point of transmission and inserted in a special data packet in the vertical interval of the signal. At downstream locations, this CRC can be recovered and checked against a value which has been locally re-computed from the same video data stream. If the transmitted CRC and the re-computed CRC values match, there have been no errors in transmission.

As shown in the block diagram on the following page, the time base reference is selected from either the Master or Genlock (external) reference. The selected reference passes through a precision sync separator to derive the required sync components. The separated sync signal provides the timing reference for the PLLs.

These primary timing signals then pass through timing adjustment and burst detection circuitry to determine color field sequence. They are then used to generate the test signal pattern and black test signals in their respective generators. The test signals pass to the Primary and Secondary serial outputs and also enter composite encoders to provide the Primary and Secondary composite analog outputs.

The Tri-Level Sync output is analog timing reference intended for use with high definition equipment. It uses the same time base as the Primary sync generator and can be frame-synchronized when their output standard match.

If the optional 5410 submodule is installed, the reference signal passes to the submodule where an AES tone and word clock are derived. This audio information can be embedded into Group 1 of the Primary serial output and also passes to the output BNCs as the audio references. It is also sent to a D-to-A converter where it is converted to analog composite audio and feeds the rear Audio Out 15-pin connector.

Test patterns can be overlayed with an ID slate configurable in the remote Avenue PC or Touch screen option interfaces. The slates can also be enabled by remote control with GPI closures accessible from the 15-pin Audio Out connector.

A special feature that adds motion to the test signal can also be inserted along with the Slate ID or, independently of it. This feature, called Cyclops, indicates true frame motion from the test signal with an on-screen indicator that moves from side to side. It can indicate whether the signal is live or has frozen, such as when a frame synchronizer loses it input and freezes. Additionally, audio left and right channel indicators can be enabled to synchronize with the Cyclops to verify audio connectivity and timing.

Power is derived from the ± 12 volt frame power. It is regulated to the required +5 volts for the module by on-board regulator. The module is fused with a resettable fuse device. If the fuse opens due to an overcurrent condition, the module will lose power. After pulling the module, the fuse will reset automatically requiring no replacement fuse.
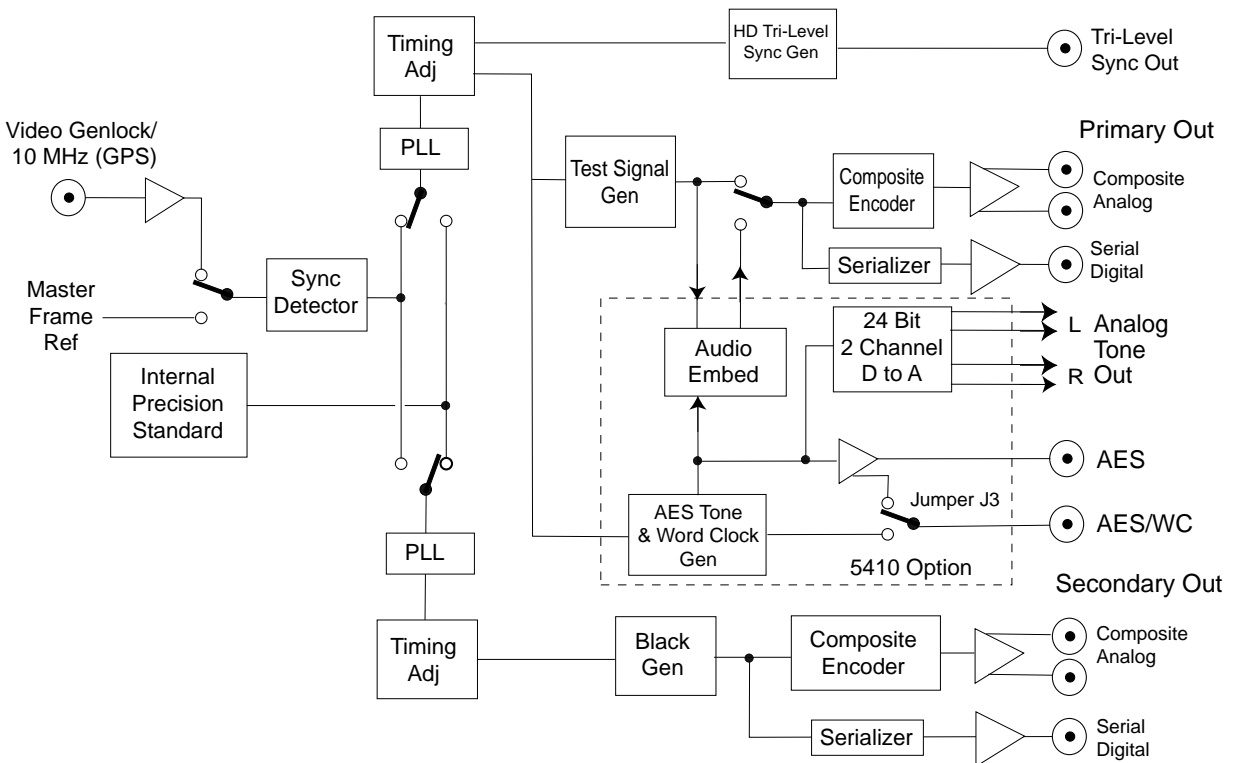
**5400 Dual Sync Generator and TSG Block Diagram**

The on-board CPU can monitor and report module ID information (slot location, software version and board revision), and power status to the optional frame System Control module. This information can be accessed by the user or set to register an alarm if desired using the remote control options available.

APPLICATIONS

Simultaneous References

As shown in the application below, the 5400 module can provide simultaneous 525, 625 and AES reference outputs, all derived from the same time base, all from the same module.
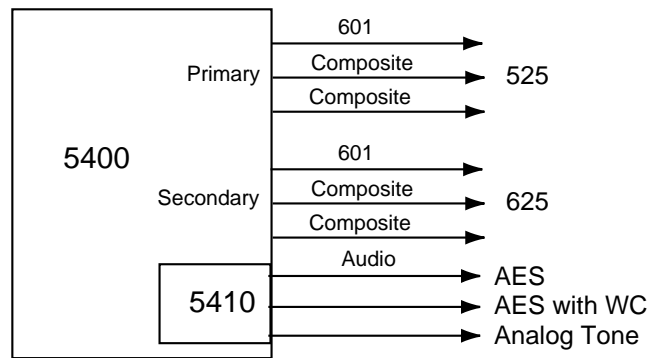
5400 Providing Simultaneous Reference Outputs

Digital, Analog and Audio Reference Generation and Distribution

Another application shown below, illustrates how the 5400 module can provide digital, analog and audio reference outputs which can then be distributed throughout a facility when combined with the 5125 Dual DA and the 5150 DA. Audio reference signals are available when the 5410 submodule is installed.
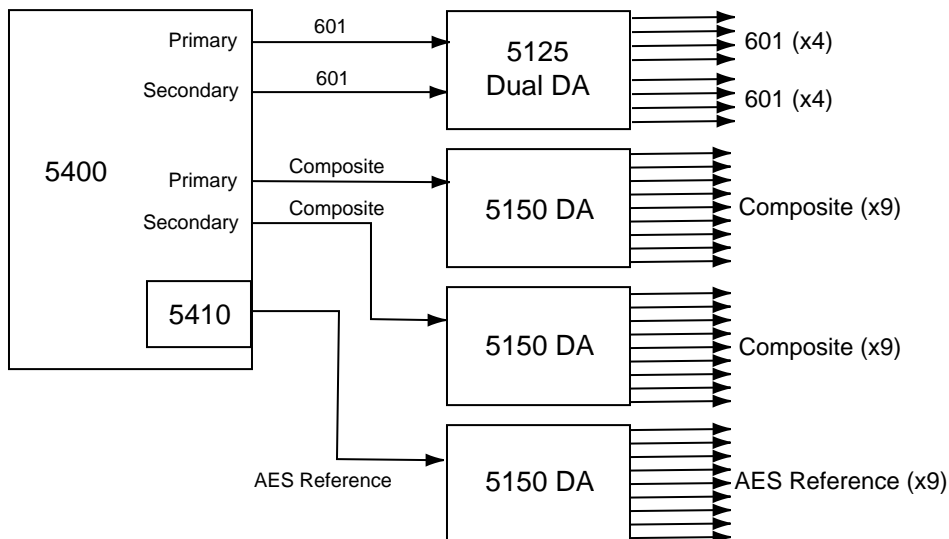
5400 Providing Digital, Analog and Audio Reference Outputs

Analog Composite References

Another application for the 5400 is to combine it with the 5405, a Dual Analog Sync Generator, to output a set of independently timed composite outputs to provide a master genlock reference for an entire facility. As shown below, the 5400 Primary and Secondary analog composite outputs feed Master Control destinations and the 5405 which is then sent to other facility locations.
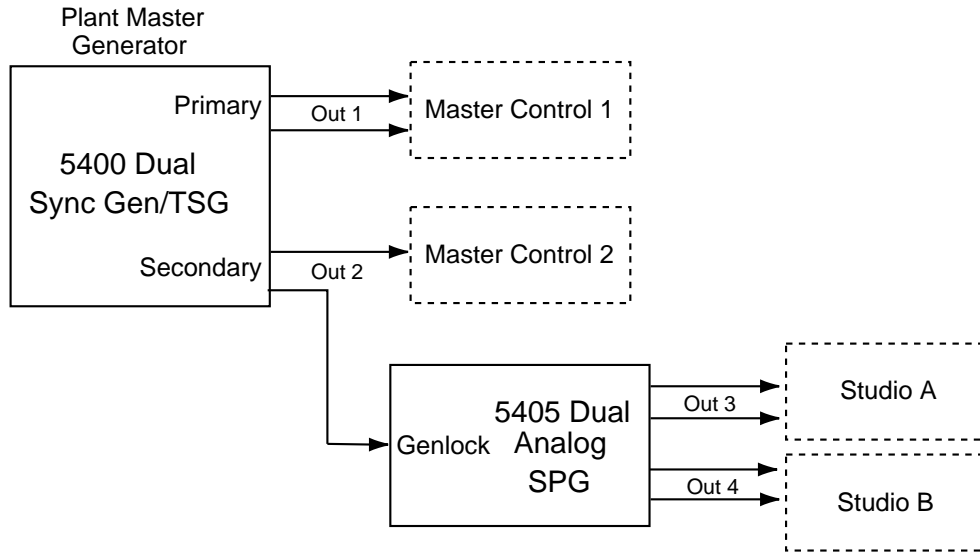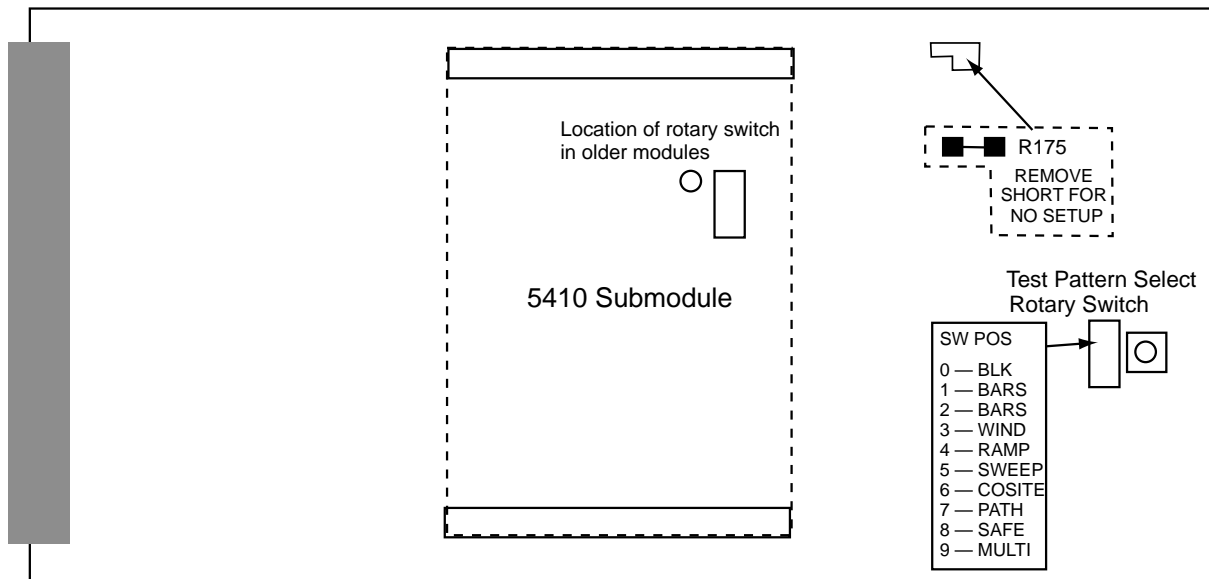

5400 With 5405 Providing Composite Reference Outputs

INSTALLATION

Local Setup

If you will be using the module in Local mode, you will need to use the rotary switch shown in the figure below to select the test pattern. Make your test pattern selection from the choices shown. Refer to Appendix A for test pattern descriptions. (In older module versions, the rotary switch is located under the 5410 submodule).

Local Mode Setup Removal: A setup removal jumper is provided for removing setup in Local mode when operating in 525/60 Hz mode. To remove setup, cut the trace connecting the two sides of R175 as shown below. In remote mode this is not required.

Location of rotary switch
in older modules

5410 Submodule

R175
REMOVE
SHORT FOR
NO SETUP

Test Pattern Select
Rotary Switch

SW POS

0 — BLK
1 — BARS
2 — BARS
3 — WIND
4 — RAMP
5 — SWEEP
6 — COSITE
7 — PATH
8 — SAFE
9 — MULTI

Local Mode 5400 Setup

5410 Submodule

Install the 5410 submodule by lining up the connectors on the submodule with the connectors on the 5400 module. The connector is keyed to prevent installing it incorrectly.

AES B Out Jumper

A jumper, AES B OUT, J3, on the 5410 submodule (shown below) allows the user to select the type of audio output on the AES Out 2/Wordclock BNC on the rear of the module. When **AES** is selected, the output will be an AES3id signal from the BNC. Setting J3 to **WD_CLK**, allows either a Wordclock output or a 6 Hz 4.5 align pulse, used in telecine applications. When set to **WD-CLK**, the pulse type must be selected in the **Pulse Select** pulldown in the Avenue PC or Touch Screen **Config** menu.
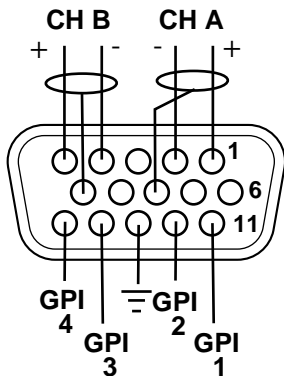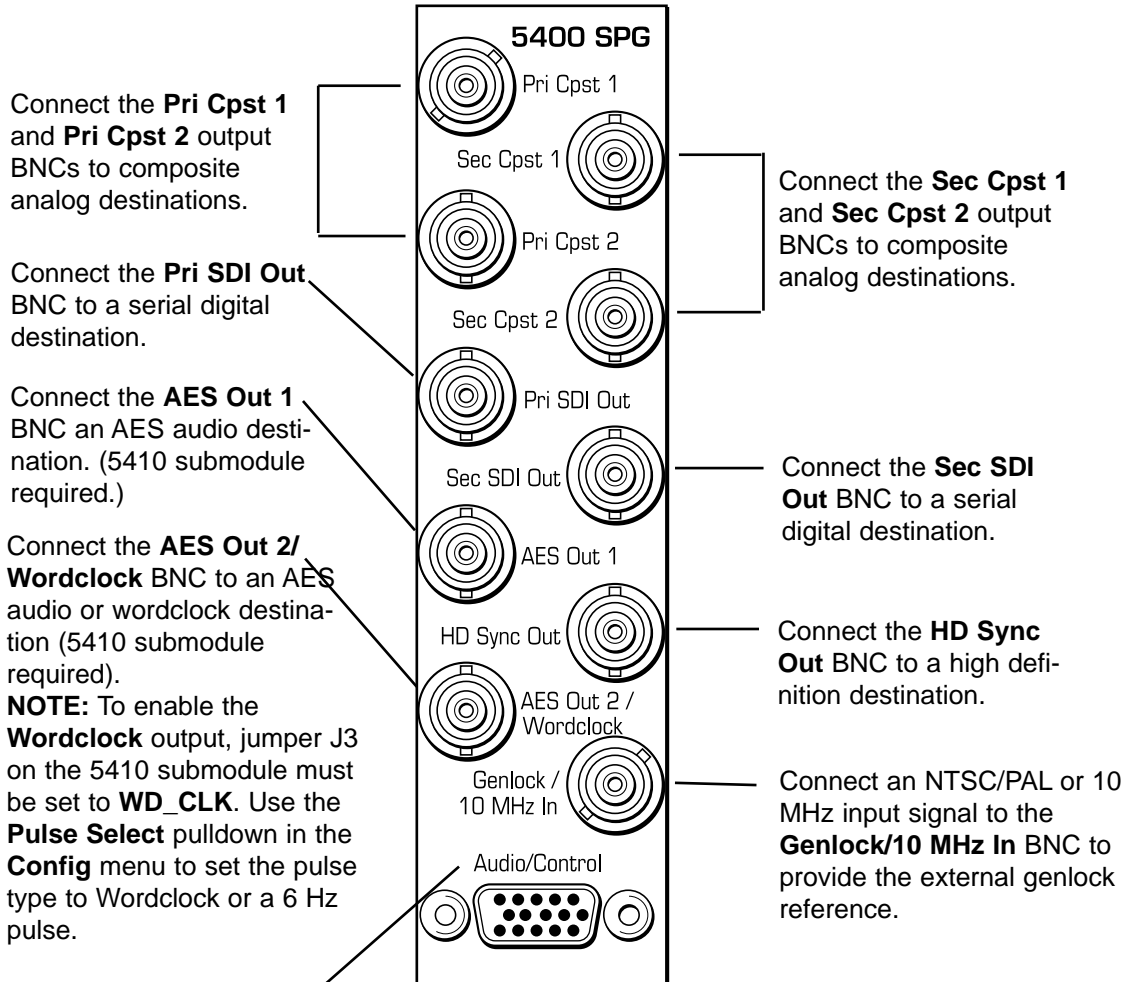

5410 Jumper Setting
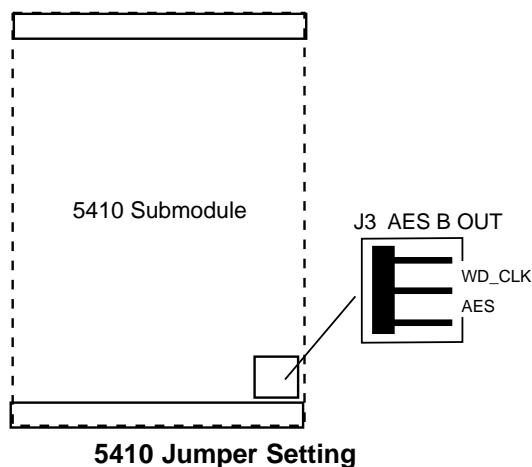
5400 Module

Plug the 5400 module into any one of the slots in the 3 RU frame and any slot except Slot 3 in the 1 RU frame. Install the plastic overlay provided onto the corresponding group of rear BNC connectors associated with the module location. Note that the plastic overlay has an optional adhesive backing for securing it to the frame. Use of the adhesive backing is only necessary if you would like the location to be permanent and is not recommended if you need to change module locations. This module may be hot-swapped (inserted or removed) without powering down or disturbing performance of the other modules in the system.

CABLING

Refer to the 3 RU and 1 RU backplane diagrams of the module on the next page for cabling instructions. Note that unless stated otherwise, the 1 RU cabling explanations are identical to those given in the 3 RU diagram.

3 RU Backplane

5400 SPG

Pri Cpst 1

Sec Cpst 1

Pri Cpst 2

Sec Cpst 2

Pri SDI Out

Sec SDI Out

AES Out 1

HD Sync Out

AES Out 2 / Wordclock

Genlock / 10 MHz In

Audio/Control

Connect the **Pri Cpst 1** and **Pri Cpst 2** output BNCs to composite analog destinations.

Connect the **Pri SDI Out** BNC to a serial digital destination.

Connect the **AES Out 1** BNC an AES audio destination. (5410 submodule required.)

Connect the **AES Out 2/ Wordclock** BNC to an AES audio or wordclock destination (5410 submodule required).
NOTE: To enable the **Wordclock** output, jumper J3 on the 5410 submodule must be set to **WD_CLK**. Use the **Pulse Select** pulldown in the **Config** menu to set the pulse type to Wordclock or a 6 Hz pulse.

Connect the **Sec Cpst 1** and **Sec Cpst 2** output BNCs to composite analog destinations.

Connect the **Sec SDI Out** BNC to a serial digital destination.

Connect the **HD Sync Out** BNC to a high definition destination.

Connect an NTSC/PAL or 10 MHz input signal to the **Genlock/10 MHz In** BNC to provide the external genlock reference.

CH B   CH A
+   -   -   +
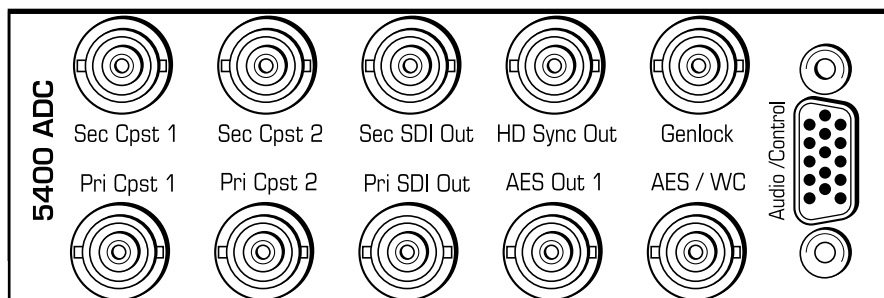
1
6
11

GPI 4   GPI 2
GPI 3   GPI 1

With the 5410 submodule installed, you can access the **CH A** and **CH B** analog tone outputs according to the pinout at left.

You may connect an external device to the GPI inputs at pins 11, 12, 14 and 15 of the Audio Out connector to remotely control one of four slates.

There are two channels of audio. Channel A is on pins 1 and 2 and the associated ground is pin 8. Pin 1 is positive. Channel B is on pins 4 and 5 and the associated ground is on pin 10. Pin 5 is positive.

1 RU Backplane

5400 ADC

| Sec Cpst 1 | Sec Cpst 2 | Sec SDI Out | HD Sync Out | Genlock | |
| Pri Cpst 1 | Pri Cpst 2 | Pri SDI Out | AES Out 1 | AES / WC | Audio /Control |

MODULE CONFIGURATION AND CONTROL

The configuration parameters for each Avenue module must be selected after installation. This can be done remotely using one of the Avenue remote control options or locally using the module front panel controls. Each module has a **REMOTE/LOCAL** switch on the front edge of the circuit board which must first be set to the desired control mode.

The configuration parameter choices for the module will differ between **Remote** and **Local** modes. In **Remote** mode, the choices are made through software and allow more selections. The **5400 Parameter Table** on the following page summarizes and compares the various configuration parameters that can be set remotely or locally and the default/factory settings. It also provides the default User Levels for each control. These levels can be changed using the Avenue PC application.

If you are not using a remote control option, the module parameters must be configured from the front panel switches. Parameters that have no front panel control will be set to a default value. The **Local** switches are illustrated in the **Front Panel Controls and Indicators** section following the **5400 Parameter Table**.

Avenue module parameters can be configured and controlled remotely from one or both of the remote control options, the Avenue Touch Screen or the Avenue PC Application. Once the module parameters have been set remotely, the information is stored on the module CPU. This allows the module be moved to a different cell in the frame at your discretion without losing the stored information. Remote configuration will override whatever the switch settings are on the front edge of the module.

For setting the parameters remotely using the Avenue PC option, refer to the **Avenue PC Remote Configuration** section of this document.
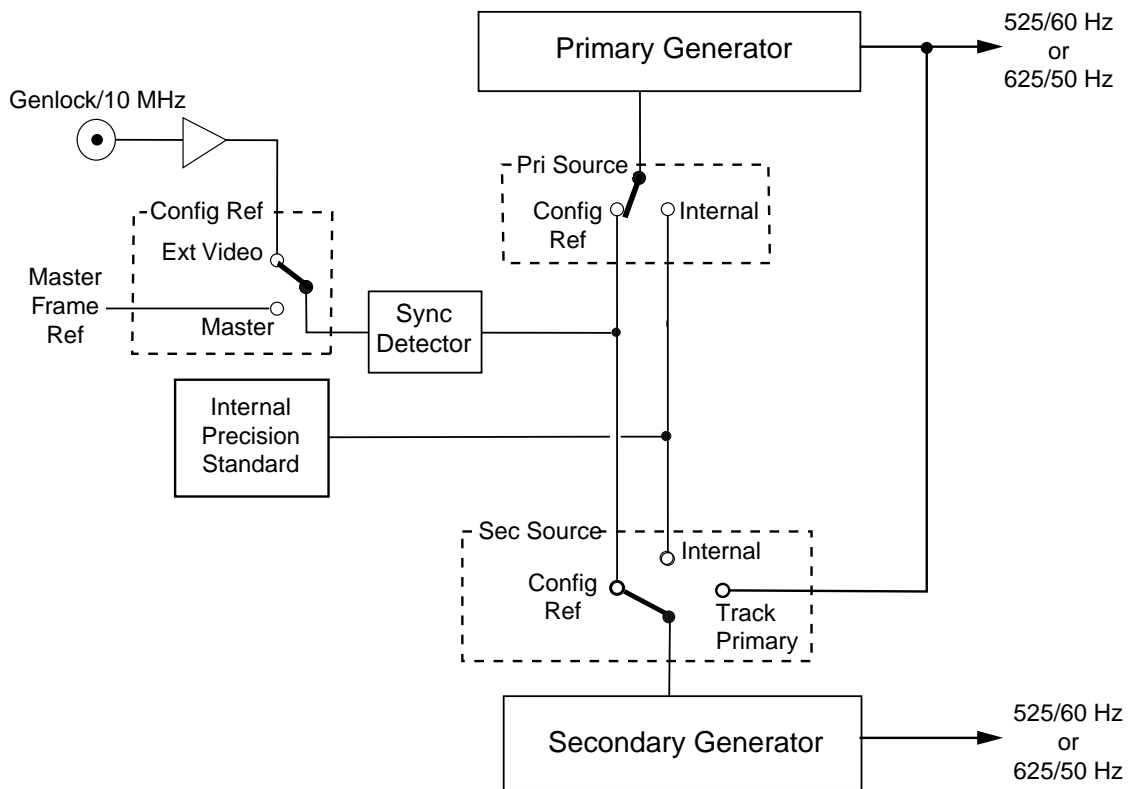
For setting the parameters remotely using the Avenue Touch Screen option, refer to the **Avenue Touch Screen Remote Configuration** section of this data pack following Avenue PC.

Making Reference Choices

Each generator can be independently set to operate either as a Master Sync Generator (using an internal precision frequency reference), or genlocked to an external reference source of either composite video or a 10 MHz sine or square wave. In addition, the secondary generator can be set to lock to the primary generator in tracking mode. These choices are made using the **Pri** and **Sec Source** controls in the **Primary** and **Secondary** menus. Refer to the block diagram below.

When a generator is set to be genlocked (by selecting **Config Ref** in the **Pri** or **Sec Source** menu), a further selection must be made to configure the module to use either its external genlock BNC (labeled **Genlock/10 Mhz In** on the module backplane) or the Master Frame Reference which is distributed through the Avenue frame backplane. This choice is made in the **Config** menu and provides the configured reference for both generators. The module will accept analog composite NTSC (525) or PAL (625), or a 10 MHz sine or square wave as an external genlock signal.

In order to provide the ultimate in flexibility, the television line standard output for each generator can then be set to either 525/60 Hz or 625/50 Hz. These output choices are possible even when the generators are locked to a genlock input in a different standard.

Primary and Secondary Reference Source Detail

5400 Parameter Table

CONTROL	LOCAL	REMOTE	DEFAULT	DEFAULT USER LEVEL
Primary Source	Switch 1: Internal GL	Internal Config Ref	Config Ref	Admin
Primary Standard	Switch 2: 525 625	525 – 60 Hz 625 – 50 Hz	525 – 60 Hz	Admin
Setup	N/A	On Off	On	User 2
Secondary Source	N/A	Internal Config Ref Track Primary	Config Ref	Admin
Secondary Standard	Switch 4: 525 625	525 – 60 Hz 625 – 50 Hz	525 – 60 Hz	Admin
Setup	N/A	On Off	On	User 2
Pattern Type (2 pulldown choices)	Rotary Switch: 0 Black 1 SMPTE 75% 2 Split Field 75% 3 Window 4 Video Ramp 5 Sweep w/Fdl Mrkrs 6 Cosite 7 Pathological 8 SafeTitle 9 Multipattern	**Bars** – Split Field 75 Split Field 100 SMPTE 75 SMPTE 100 Full Field 75 Full Field 100 **Black** – Black Flat Field 50 Flat Field 80 White **Ramp** – Video Ramp Data Ramp Shallow 5 Step DAC Test **Sweep** – w/Markers Full Field Multiburst **Pulse & Bar** – Window Full Field Component Window 100 Window 20 **Timing** – Analog Blanking Digital Blanking Cosite Interlace BowTie **Misc** – Black Crosshatch Safe Title Unit Circle Multi Pattern Multi Cpst Pathological 16 by 9	Bars	Admin

5400 Parameter Table (Con't)

CONTROL	LOCAL	REMOTE	DEFAULT	DEFAULT USER LEVEL
Y/Cr/Cb Channel Enable	N/A	On Off	On	User 1
Audio Select	N/A	Tone Pop Beep Silent	Tone	User 2
Embed	Switch 3: Embed Tone No Tone	On Off	On	User 2
Slate Select	N/A	Off Slate 1 Slate 2 Slate 3 Slate 4 GPI Low GPI High	Off	User 2
Cyclops	N/A	On Off	Off	User 2
Pri Vert Timing	N/A	± 525 lines	0 lines	User 2
Pri Horiz Timing	N/A	± 1716 clocks	0 clocks	User 2
Pri Fine Phase	N/A	± 35 nsec	0 nsec	User 2
Pri Color Frame	N/A	Normal Field 3 Field 5 Field 7	Normal	User 2
Sec Vert Timing	N/A	± 525 lines	0 lines	User 2
Sec Horiz Timing	N/A	± 1716 clocks	0 clocks	User 2
Sec Fine Phase	N/A	± 35 nsec	0 nsec	User 2
Sec Color Frame	N/A	Normal Field 3 Field 5 Field 7	Normal	User 2
HD Standard	Switch 5: 1080 720p Switch 6: 1080i 1080sf	720p/50 Hz 720p/59.94 Hz 720p/60 Hz 1080i/50 Hz 1080i/59.94 Hz 1080i/60 Hz 1080p/23.98 Hz 1080p/24 Hz 1080p/25 Hz 1080sf/23.98 Hz 1080sf/24 Hz 1080sf/25 Hz	1080i/59.94 Hz	User 2
HD Vert Timing	N/A	± 1125 lines	0 lines	User 2
HD Hor Timing	N/A	± 688 lines	0 lines	User 2
Config Ref	N/A	Ext Video Master Ref	Ext Video	User 2

5400 Parameter Table (Con't)

CONTROL	LOCAL	REMOTE	DEFAULT	DEFAULT USER LEVEL
Pulse Select	N/A	AES Word Clock 6 Hz 4:5 Align	AES Word Clock	User 2
Make EDH Error	N/A	No Errors AP CRC Error FF CRC Error AP EDH Error FF EDH Error AP EDA Error FF EDA Error	No Errors	User 2
AES Ref Level	N/A	-20 dB -18 dB	-20 dB	User 2
Analog Ref Level	N/A	-10 dB -6dB -4 dB 0 dB +4 dB +8 db	AES Word Clock	User 2

Front Panel Controls and Indicators

Each front edge indicator and switch setting is shown in the diagram below:

Ref 525, 625 and 10 MHz
green LEDs:
One LED will light to indicate
which reference rate is currently
being detected.
OFF when rate is not detected.

Pri 525/625 green LEDs:
One LED will light to indicate
the Primary output line standard
and that it is locked to its timing
source.
If no LED is lit, the Primary
generator is not locked to its
timing source.

Remote/Local switch:
Set to the mode you
will be using.

Run green LED:
OFF:
A power fault or halted CPU
ON:
A halted CPU
FAST BLINK:
CPU Run error
SLOW BLINK:
System OK. (If SPI control is
active from the main frame
System Control Module, all
Run indicators will be syn-
chronized.).

Pwr green LED:
Indicates the presence (**ON**) or
absence (**OFF**) of power (+5V).

**5400
Dual
SPG /
TSG**

ENSEMBLE
D E S I G N S

Ref ○ 525
○ 625
○ 10 MHz

Pri ○ 525
○ 625

Sec ○ 525
○ 625

○ Error
Remote
Local

Pri | Ref   Internal/GL
              525/625
              Aud Insert
HD | Sec   525/625

              1080/720p
              1080i/sf

Run ○
Pwr ○
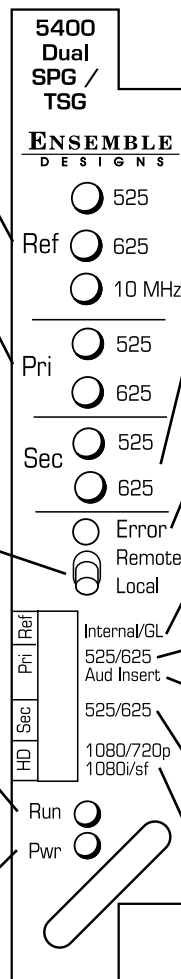
Sec 525/625 green LEDs:
One LED will light to indicate
the Secondary output line
standard and that it is locked to
its timing source.
If no LED is lit, the Secondary
generator is not locked to its
timing source.

Error red LED:
Indicates a genlock or
synchronization problem.

Ref (Reference)
Internal/GL switch:
Set the reference source to **Internal**
(left) or **GL**, Genlock, (right) if using
the external reference input as the
timing source.
Pri (Primary Generator)
525/625 switch:
Set the Primary output line rate to
525 (left) or **625** (right).
Aud Insert switch:
Set the switch to **On** (left) to embed
an audio tone into the Primary serial
output or **Off** (right) for no tone
Sec (Secondary Generator)
525/625 switch:
Set the Secondary generator output
line rate to **525** (left) or **625** (right).
HD (High Definition)
1080/720p switch:
Set to either **1080** (left) or **720p**
(right) for the type of tri-level HD
sync output desired.
1080i/sF switch:
For 1080 signals, select either
1080i (left) for interlaced or **1080sF**
(right) for segmented frame.
(Note: The frame rate will match the
Primary.)

Avenue PC Remote Configuration

The Avenue PC remote control status menu for this module is illustrated and explained below. Refer to the **5400 Parameter Table** for a summary of available parameters that can be set remotely through the menus illustrated. For more information on using Avenue PC, refer to the Avenue PC Control Application Software data pack that came with the option.

Parameter fields that are grayed out can indicate one of the following conditions:

- An option is not installed.
- The function is not active.
- The module is locked.
- The User Level set with Avenue PC is not accessible from the current User Level.

5400 Avenue PC Menus

The **Primary** menu screen shown below allows you to set the following parameters for the Primary generator output:

- **Pri Source** – select the Primary generator reference source from either **Config Ref** (as defined in the **Config** menu) or **Internal**.

- **Standard** – select the desired line standard output from **525–60 Hz** or **625–50 Hz**.

- **Setup** – sets setup to **On** or **Off** for 525–60 Hz line output signals.

The **Sync Lock** window shows what standard the module is locked to or **No Lock**.

The **Secondary** menu screen shown below allows you to set the following parameters for the Secondary generator output:

- **Sec Source** – select the Secondary generator reference source from either **Config Re**f (defined in the **Config** menu), **Internal** or the choice to **Track Primary**.

- **Standard** – select the desired line standard output from **525–60 Hz** or **625–50 Hz**.

- **Setup** – sets setup to **On** or **Off** for 525–60 Hz line output signals.

The **Sync Lock** window shows what standard the module is locked to or **No Lock**.

The **Test Pat** menu allows you to set the type of test pattern desired for the Primary output. Refer to Appendix A of this data pack for a complete description of each test pattern.

Use the controls to set the following:

- **Pattern Type** – select the test signal type in the first window and the test signal parameters in the second window. Refer to the **5400 Parameter Table** given earlier for a complete listing of the available test signals and their parameters.

You may choose to turn off the **Y**, **Cr** and/or **Cb** Channels of some video signals if desired for test purposes (such as the need for a monochrome signal for example). To turn off one or more channels, deselect the **Enabled** check box.

When the 5410 optional audio submodule is installed, you may embed an audio tone, pop, beep or silent in the Primary serial output with the following controls:

- **Aud Select** – selects the format of the audio test signal to be output on the AES and analog audio outputs. Choices for the audio test signal include the following:

  Silent – digital audio equivalent of a color black signal.

  Tone – continuous 1 KHz tone.

  Pop – continuous tone with one and two beat interrupts representing Channel 1 and Channel 2 respectively.

  Beep – silent with one and two beat beeps representing Channel 1 and Channel 2 respectively.

- **Embed** – select whether or not to embed the audio test signal selected above in the Primary serial output.

The **Slate** menu screen shown below allows you to define four different text overlays
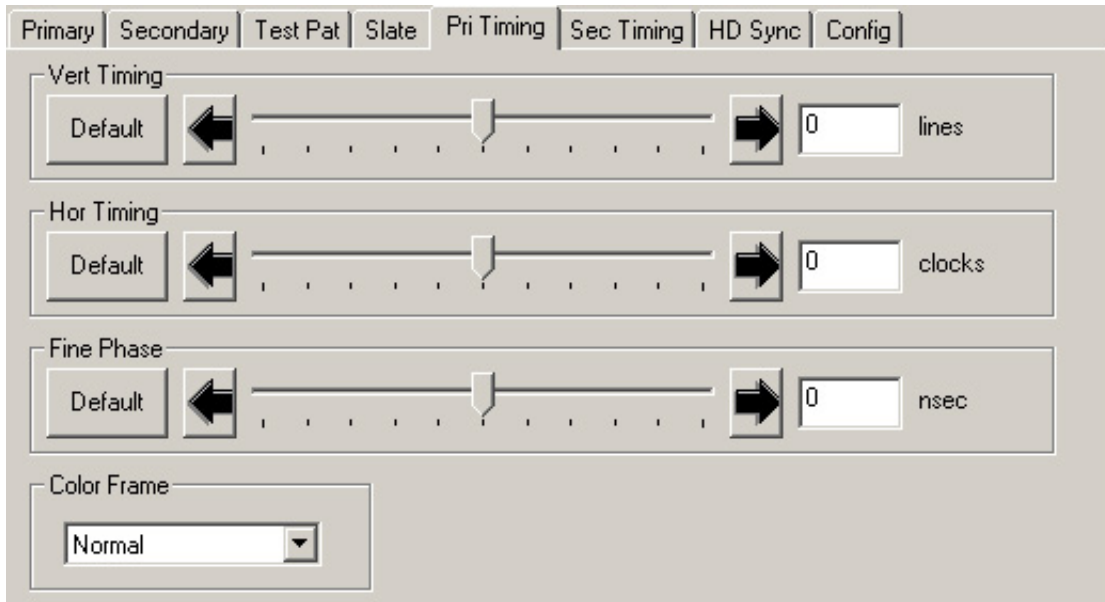Use the controls to set the following:

- **Slate Select** – select **Off** or the number of the slate to be defined from **Slate 1-–4** or select **GPI High** or **GPI Low** to indicate to the external GPI device what state will trigger a GPI input. Four GPI inputs are available corresponding to the four slates.

- **Top Line** – clicking in this window will bring up an alphanumeric pad which allows you to define the top line of the slate text.

- **Bot Line** – clicking in this window will bring up an alphanumeric pad which allows you to define the bottom line of the slate text.

- **Cyclops** – adds a motion element to the video test signal which proves that the signal reaching this destination is a true live signal and not a freeze frame from a frame synchronizer that has lost its input. If an audio pop or beep has been selected in the previous menu, it will synchronize with audio outputs (left is channel 1, right is channel 2).
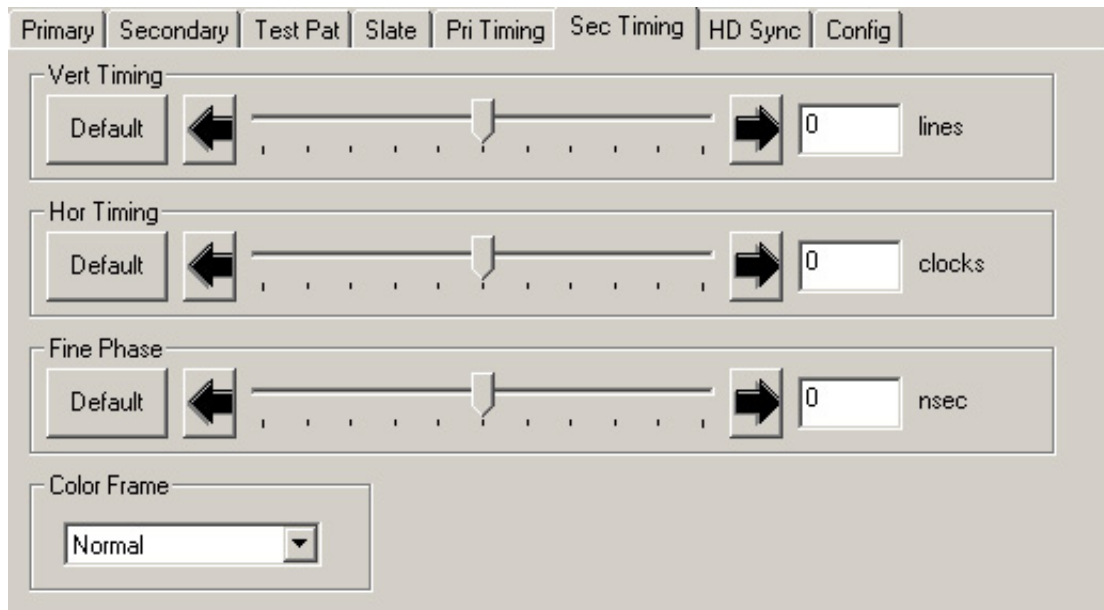
The **Pri Timing** menu shown below allows you to set the timing of the Primary composite output in relation to the reference with the following controls. For numerical choices, use the slider control to select a value or enter a value into the number field at right and press the **Enter** key on your PC.

- **Vert Timing** – set the vertical timing in lines.
- **Hor Timing** – set the horizontal timing in clocks.
- **Fine Phase** – set the fine phase of the Primary output in nanoseconds.
- **Color Frame** – set the color framing for the Primary output signal.
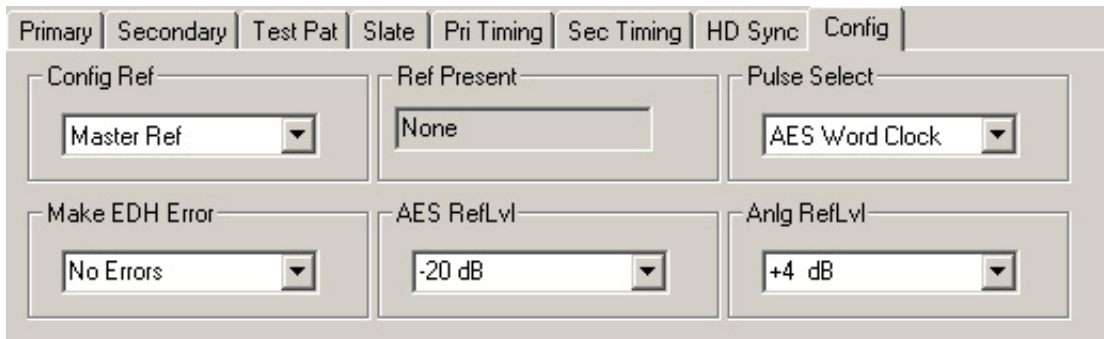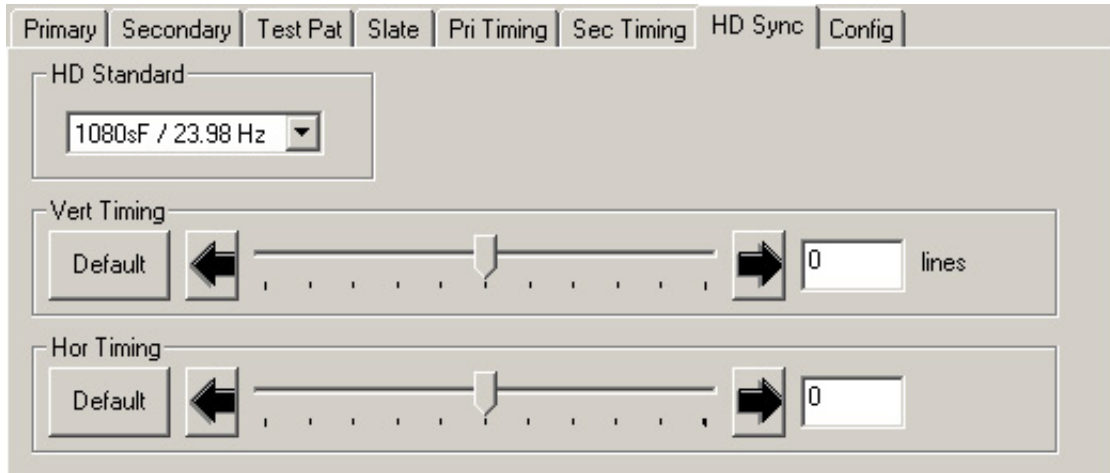
The **Sec Timing** menu shown below allows you to set the timing of the Secondary composite output in relation to the reference or the Primary Source with the following controls. For numerical choices, use the slider control to select a value or enter a value into the number field at right and press the **Enter** key on your PC.

- **Vert Timing** – set the vertical timing in lines.
- **Hor Timing** – set the horizontal timing in clocks.
- **Fine Phase** – set the fine phase of the Secondary output.
- **Color Frame** – set the color framing for the Secondary output signal.

The **HD Sync** menu allows you to set the HD standard and timing of the HD Sync output in relation to the Primary serial output with the following controls. For numerical choices, use the slider control to select a value or enter a value into the number field at right and press the **Enter** key on your PC.

- **HD Standard** – select the desired high definition standard for the sync output.
- **Ver Timing** – set the vertical timing in relation to the Primary serial output in clocks.
- **Hor Timing** – set the horizontal timing of the HD sync output in relation to the Primary serial output.

The **Config** menu allows you to configure the reference from the external input (525, 625 or 10 MHz sine wave) or the Master Frame Reference:

- **Config Ref** – select the desired module reference from the external input (525, 625 or 10 MHz sine wave) or Master Ref (Frame Reference).

  The presence of the reference will be reported in the adjacent window.

- **Pulse Select** – set the type of pulse output desired for the AES Out 2/Wordclock BNC on the rear of the frame. (Note that to enable a Wordclock or 6 Hz Pulse output, jumper J3 must be set to **WDCLK** on the 5410 submodule. Refer to the Installation section of this data pack for an illustration of this jumper.)

- **Make EDH Error** – this function allows introduction of specific EDH errors into the SDI output stream for.testing downstream equipment. when the 5410 option is present It can also be used to verify that corrective action or alarms are generated at those downstream points as needed or expected. This mode resets to **No Errors** upon reset or power is cycled (setting is not stored in non-volatile memory.) Error types are summarized as follows:

  - **AP CRC Error** – causes incorrect CRC for active picture to be transmitted in EDH packet. Simulating a bit error, this should be detected as an EDH error by downstream equipment.
  - **FF CRC Error** – same as AP CRC Error above except it is the Full Frame which is transmitted incorrectly.
  - **AP EDH Error** – causes the AP EDH flag in the EDH packet to be set. This simulates an error which was previously detected by upstream equipment. The actual CRC will be correctly computed. This should be detected downstream as an EDA error (Error Detected Already).
  - **FF EDH Error** – same as AP EDH Error above except the Full Frame flag is also set.
  - **AP EDA Error** – causes the AP EDH flag to be set. This simulates a stream where an error was detected by previous equipment. This error should continue to be reported as EDA at every subsequent downstream location.
  - **FF EDA Error** – same as AP EDA Error above except also sets the Full Frame flag.

- **AES RefLvl** – set the AES reference level to either -20 dB or -18 dB depending on the audio requirement.

- **Anlg RefLvl** – set the analog reference level from –10 dBu to +8 dBu for the Analog Tone Output.

Avenue Touch Screen Remote Configuration

The Avenue Touch Screen remote control status menu for this module is illustrated and explained below. Refer to the **5400 Parameter Table** for a summary of available parameters that can be set remotely through the menus illustrated. For more information on using Avenue Touch Screen, refer to the Avenue Touch Screen data pack that came with the option.

Parameter fields that are grayed out can indicate one of the following conditions:

- An option is not installed.
- The function is not active.
- The module is locked.
- The User Level set with Avenue PC is not accessible from the current User Level.

5400 Avenue Touch Screen Menus

The **Primary** menu screen shown below allows you to set the following parameters for the Primary generator output:

- **Pri Source** – select the Primary generator reference source from either **Config Ref** (defined in the **Config** menu) or **Internal**.

- **Standard** – indicates what line standard the generator is locking to.

- **Setup** – sets setup to **On** or **Off** for 525–60 Hz line output signals.

The **Sync Lock** window shows what standard the module is locked to or **No Lock**.
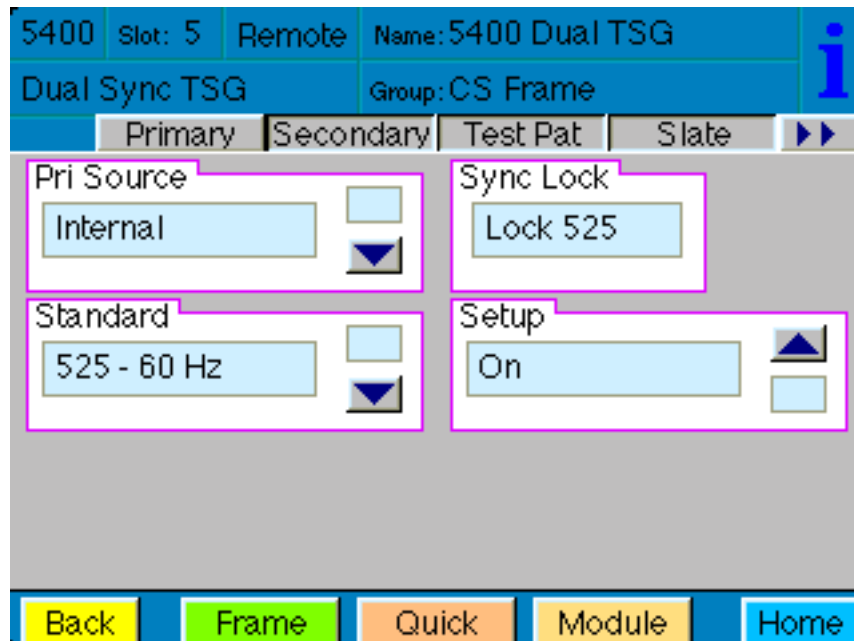
The **Secondary** menu screen shown below allows you to set the following parameters for the Secondary generator output:

- **Sec Source** – select the Secondary generator reference source from either **Config Re**f (defined in the **Config** menu), **Internal** or the choice to **Track Primary**.
- **Standard** – indicates what line standard the generator is locking to.
- **Setup** – sets setup to **On** or **Off** for 525–60 Hz line output signals.

The **Sync Lock** window shows what standard the module is locked to or **No Lock**.
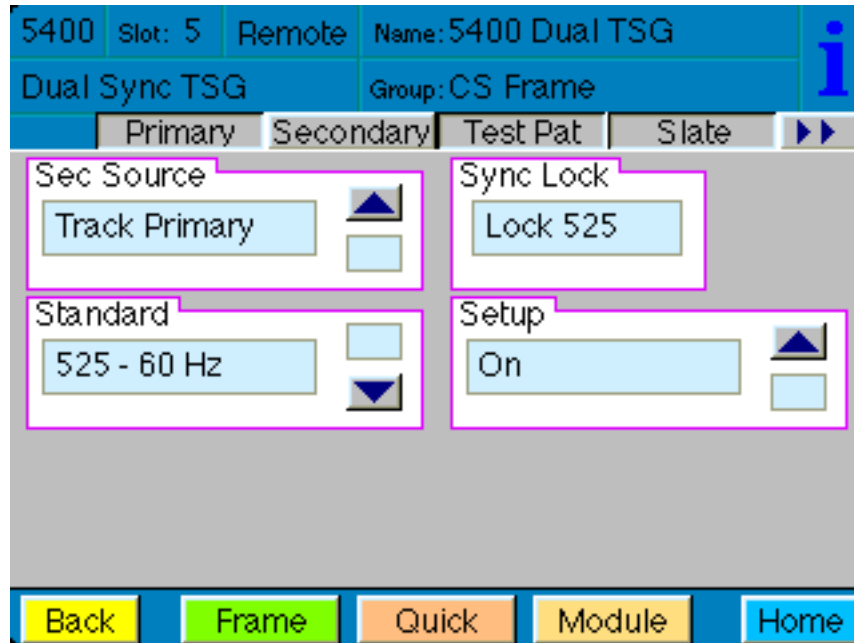
The **Test Pattern** menu screen shown below allows you to set the type of test pattern desired for the Primary output. Refer to Appendix A for a complete description of each test pattern.
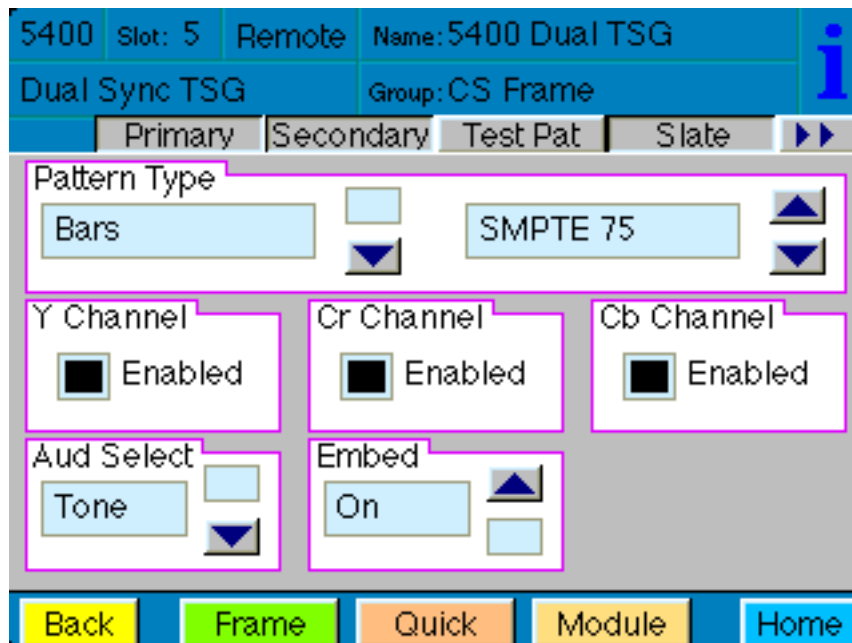
Use the controls to set the following:

- **Pattern Type** – select the test signal type in the first window and the test signal parameters in the second window. Refer to the **5400 Parameter Table** shown earlier for a complete listing of the available test signals and their parameters.

You may choose to turn off the **Y**, **Cr** and/or **Cb** Channels of some video signals if desired for test purposes (such as the need for a monochrome signal for example). To turn off one or more channels, deselect the **Enabled** check box.
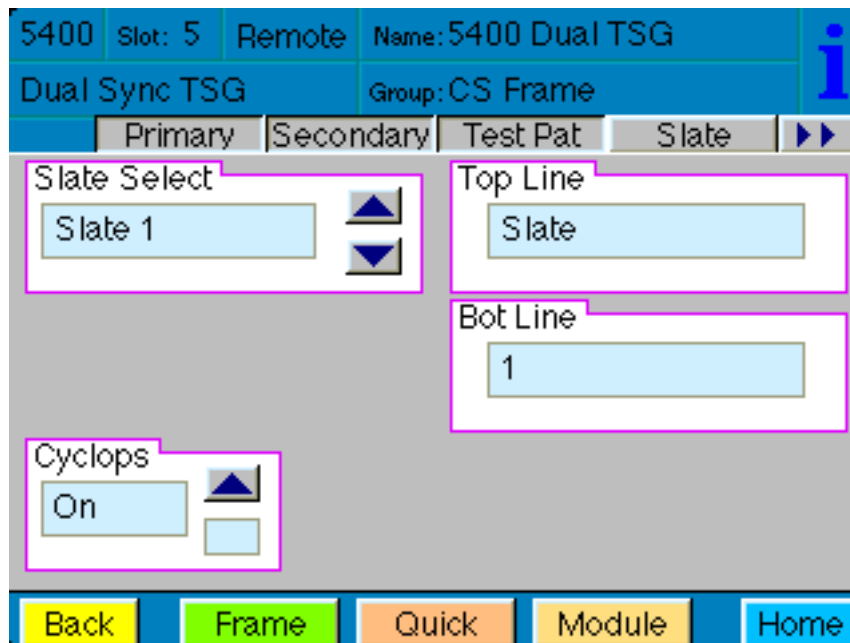
When the 5410 optional audio submodule is installed, you may embed an audio tone, pop, beep or silent in the Primary serial output and set the analog reference level with the following controls:

- **Aud Select** – selects the format of the audio test signal to be output on the AES and analog audio outputs. Choices for the audio test signal include the following:

  Silent – digital audio equivalent of a color black signal.

  Tone – continuous 1 KHz tone.

  Pop – continuous tone with one and two beat interrupts representing Channel 1 and Channel 2 respectively.

  Beep – silent with one and two beat beeps representing Channel 1 and Channel 2 respectively.

- **Embed** – select whether or not to embed the audio test signal selected above in the Primary serial output.

The **Slate** menu screen shown below allows you to define four different text overlays Use the controls to set the following:

- **Slate Select** – select **Off** or the number of the slate to be defined from **Slate 1-–4** or select **GPI High** or **GPI Low** to indicate to the external GPI device what state will trigger a GPI input. Four GPI inputs are available corresponding to the four slates.

- **Top Line** – clicking in this window will bring up an alphanumeric pad which allows you to define the top line of the slate text.

- **Bot Line** – clicking in this window will bring up an alphanumeric pad which allows you to define the bottom line of the slate text.

- **Cyclops** – adds a motion element to the video test signal which proves that the signal reaching this destination is a true live signal and not a freeze frame from a frame synchronizer that has lost its input. If an audio pop or beep has been selected in the previous menu, it will synchronize with audio outputs (left is channel 1, right is channel 2).
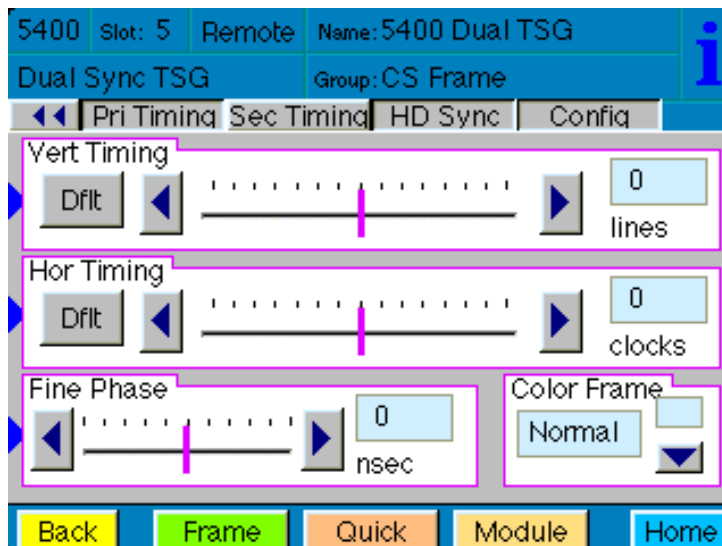
The **Pri Timing** menu screen allows you to set the timing of the Primary composite output in relation to the reference with the following controls. For numerical choices, use the slider control to select a value or touch the number field at right to bring up a pop-up keypad. Enter a value and press the **Enter** key.

- **Vert Timing** – set the vertical timing in lines.
- **Hor Timing** – set the horizontal timing in clocks.
- **Fine Phase** – set the fine phase of the Primary output in nanoseconds.
- **Color Frame** – set the color framing for the Primary output signal.
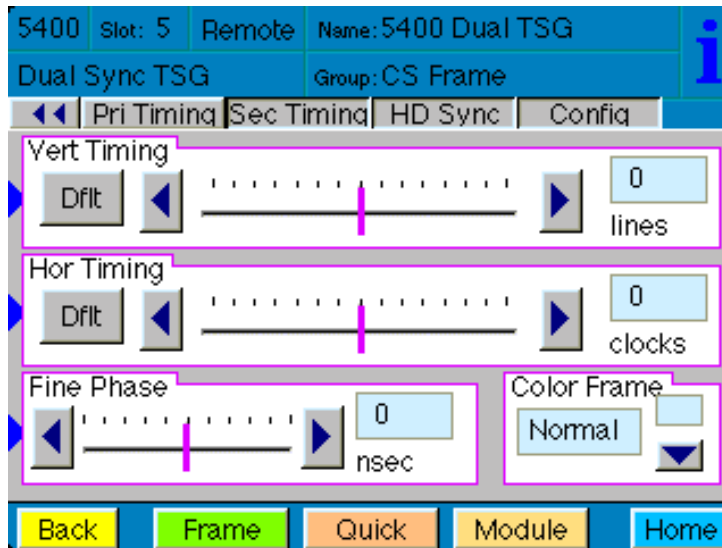
The **Sec Timing** menu allows you to set the timing of the Secondary output in relation to the reference or the Primary Source with the following controls. For numerical choices, use the slider control to select a value or touch the number field at right to bring up a pop-up keypad. Enter a value and press the **Enter** key.

- **Vert Timing** – set the vertical timing in lines.
- **Hor Timing** – set the horizontal timing in clocks.
- **Fine Phase** – set the fine phase of the Secondary output.
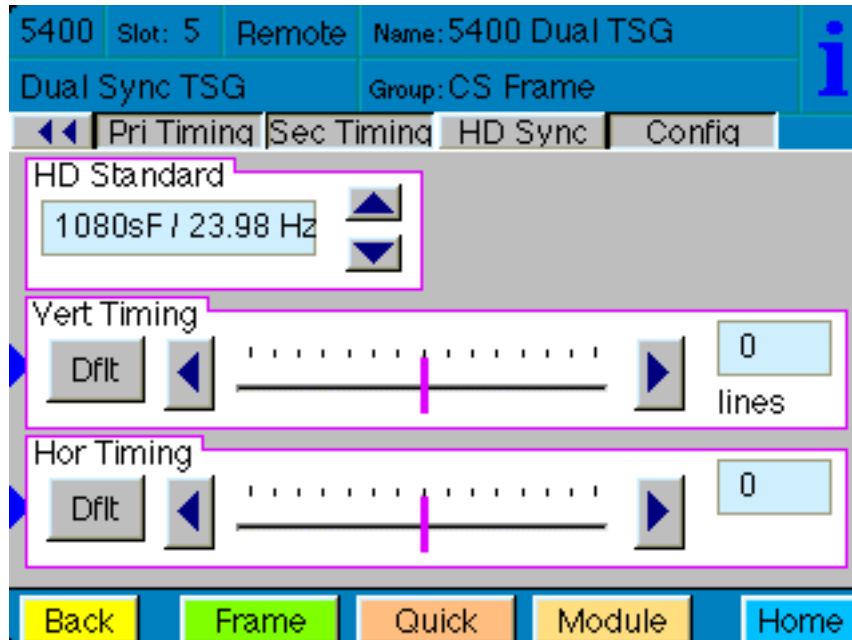- **Color Frame** – set the color framing for the Secondary output signal.

The **HD Sync** menu screen shown below allows you to set the HD standard and timing of the HD Sync output in relation to the Primary serial output with the following controls. For numerical choices, use the slider control to select a value or touch the number field at right to bring up a pop-up keypad. Enter a value and press the **Enter** key.

- **HD Standard** – select the desired high definition standard for the sync output.
- **Ver Timing** – set the vertical timing in relation to the Primary serial output in clocks.
- **Hor Timing** – set the horizontal timing of the HD sync output in relation to the Primary serial output.
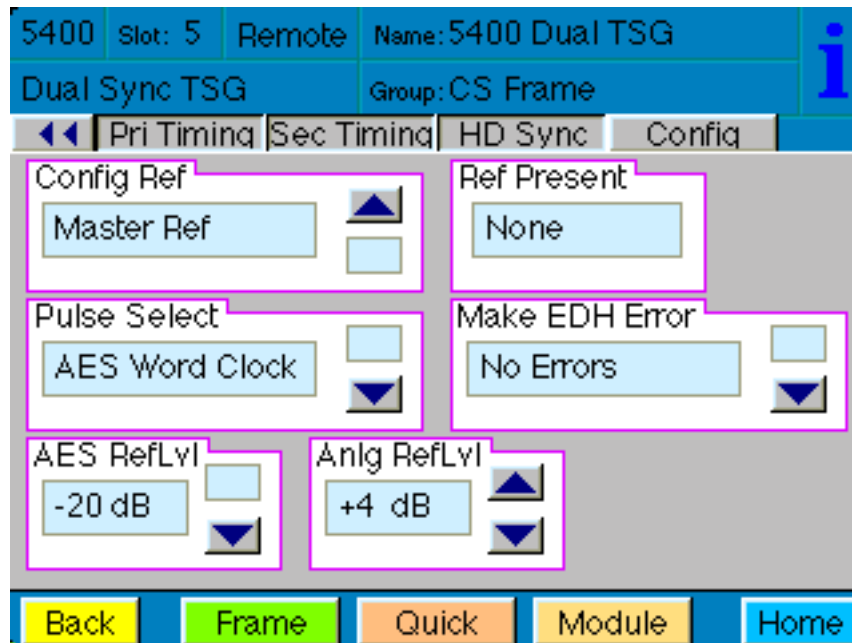

The **Config** menu allows you to configure the reference from the external input (525, 625 or 10 MHz sine wave) or the Master Frame Reference:

- **Config Ref** – select the desired module reference from the external input (525, 625 or 10 MHz sine wave) or Master Ref (Frame Reference).

  The presence of the reference will be reported in the adjacent window.

- **Pulse Select** – set the type of pulse output desired for the AES Out 2/Wordclock BNC on the rear of the frame. (Note that to enable a Wordclock or 6 Hz Pulse output, jumper J3 must be set to **WDCLK** on the 5410 submodule. Refer to the Installation section of this data pack for an illustration of this jumper.)

- **Make EDH Error** – this function allows introduction of specific EDH errors into the SDI output stream for.testing downstream equipment. when the 5410 option is present It can also be used to verify that corrective action or alarms are generated at those downstream points as needed or expected. This mode resets to **No Errors** upon reset or power is cycled (setting is not stored in non-volatile memory.) Error types are summarized as follows:

  - **AP CRC Error** – causes incorrect CRC for active picture to be transmitted in EDH packet. Simulating a bit error, this should be detected as an EDH error by downstream equipment.

- **FF CRC Error** – same as AP CRC Error above except it is the Full Frame which is transmitted incorrectly.
- **AP EDH Error** – causes the AP EDH flag in the EDH packet to be set. This simulates an error which was previously detected by upstream equipment. The actual CRC will be correctly computed. This should be detected downstream as an EDA error (Error Detected Already).
- **FF EDH Error** – same as AP EDH Error above except the Full Frame flag is also set.
- **AP EDA Error** – causes the AP EDH flag to be set. This simulates a stream where an error was detected by previous equipment. This error should continue to be reported as EDA at every subsequent downstream location.
- **FF EDA Error** – same as AP EDA Error above except also sets the Full Frame flag.
- **AES RefLvl** – set the AES reference level to either -20 dB or -18 dB depending on the audio requirement.
- **Anlg RefLvl** – set the analog reference level from –10 dBu to +8 dBu for the Analog Tone Output.

TROUBLESHOOTING

As a troubleshooting aid, the reference signal status and presence, power and CPU status can be easily monitored from the front panel of this module using the front panel indicators.

Refer to the overall troubleshooting tips given below for the **5400** module:

Error light is lit on front panel:

- Module is not locking to a selected reference. At least one of the **Ref** LEDs should be lit to indicate presence and status of reference input

No Pri or Sec LED indication:

- Module is not locking to 525 or 625. At least one of the **Pri** or **Sec** LEDs LEDs should be lit to indicate locking status.

Can't control module:

- Check status of CPU **Run** green LED. Should be blinking slowly and in unison with other modules if System module is present. If not, try removing it and plugging it in again to be sure it is seated properly.
- System module may not be working properly if installed.

Module controls are grayed out:

- Module is locked or access to module controls is restricted by User Level.
- Local/Remote switch on module is in the **Local** position.

No signal out of module:

- Check status of **Ref** green LEDs. One should be lit. If not, check the reference input or master frame signal for presence and quality.
- Check cabling to input of module.

You may also refer to the technical support section of the Ensemble Designs web site for the latest information on your equipment at the URL below:

http://www.ensembledesigns.com/support

SOFTWARE UPDATING

Software upgrades for each module can be downloaded remotely if the optional System Control module is installed. These can be downloaded onto your PC and then Avenue PC will distribute the update to the individual module. (Refer to the Avenue PC documentation for more information) Periodically updates will be posted on our web site. If you do not have the required System Control Module and Avenue PC, modules can be sent back to the factory for software upgrades.

WARRANTY AND FACTORY SERVICE

Warranty

This module is covered by a five year limited warranty, as stated in the main Preface of this manual. If you require service (under warranty or not), please contact Ensemble Designs and ask for customer service before you return the unit. This will allow the service technician to provide any other suggestions for identifying the problem and recommend possible solutions.

Factory Service

If you return equipment for repair, please get a Return Material Authorization Number (RMA) from the factory first.

Ship the product and a written description of the problem to:

Ensemble Designs, Inc.

Attention: Customer Service RMA #####

870 Gold Flat Rd.

Nevada City, CA. 95959 USA

(530) 478-1830

Fax: (530) 478-1832

service@endes.com

http://www.ensembledesigns.com

Be sure to put your RMA number on the outside of the box.

SPECIFICATIONS

5400 Dual Sync Generator/TSG

Reference Input Signal:

Number:	Two: External or Frame Master Reference
Signal Type:	1 V p-p NTSC, PAL or 10 MHz
Impedance:	75 ohm
Return Loss:	>40 dB

Composite Outputs:

Number:	Two Primary, Two Secondary
Signal Type:	NTSC/PAL
Impedance:	75 ohm
Return Loss:	>40 dB
Frequency Response:	±0.1 dB 10 KHz to 5.0 MHz
Output DC:	< 50 mV
K Factors:	< 1.0% signal type
Differential Phase:	< 1.0 degree
SCH Phase:	± 2 degrees
Delay:	Adjustable over a full frame in subdegree steps
Color Framing:	Tracks reference, user-selectable

Timing Stability:

Internal TCXO:	± 1 Hz of F_{SC}
External Ref:	Follows reference
Timebase Error:	< 1 ns

Serial Outputs:

Number:	One Primary, One Secondary
Signal Type:	Serial Digital, SMPTE 259M
Impedance:	75 ohm
Return Loss:	> 15 dB

Tri-level Sync Output:

Number:	One, 75 Ω
Type:	1080i (SMPTE 274M_4, 5, 6)
	50, 59.94 or 60 Hz
	720p (SMPTE 296M_1, 2, 3)
	50, 59.94 or 60 Hz
	1080p (SMPTE 274_9, 10, 11)
	23.98, 24 or 25 Hz
	1080sF (SMPTE RP211_14, 15, 16)
	23.98, 24 or 25 Hz
DC:	± 50 mV
Return Loss:	> 30 dB to 30 MHz

AES Audio Output (Optional with 5410)

Number:	Two
Type:	AES3id 1kHz tone or silent
Resolution:	24 bit

Analog Audio Output (Optional with 5410)

Number:	One stereo pair or two mono
Type:	1 kHz tone or silent
Impedance:	30 Ω, balanced
Reference Level:	- 10 to +8 dBu, Adjustable

General Specifications:

Power Consumption:	10 Watts
Temperature Range:	0 to 40 degrees C ambient (all specs met)
Relative Humidity:	0 to 95% noncondensing
Altitude:	0 to 10,000 ft
Fusing:	1.5 Amp PTC resettable fuse

Due to ongoing product development, all specifications subject to change.

APPENDIX A

This appendix is provided to give details on each of the test patterns available on the 5400 module. The primary generator provides test patterns which can be used for evaluation of analog and digital video systems. Section A.1 lists the test patterns provided, and Section A.2 provides a description of test patterns.

A.1 Test Patterns

All of the test patterns listed are available when using an Avenue remote control options such as Avenue PC or a Touch Screen Panel. The nine patterns that are available in Local mode are identified with the corresponding rotary switch position for selecting them.

Color Bars

     Full Field 75%
     Full Field 100%
     Split Field w/Pluge 75%
     Split Field w/Pluge 100% (Rotary Switch Setting 2)
     SMPTE 75% (Rotary Switch Setting 1)
     SMPTE 100%

Black

     Black (Rotary Switch Setting 0)
     50% Gray
     80% Gray
     White

Ramp

     Video Ramp (Rotary Switch Setting 4)
     Data Ramp
     Shallow Ramp
     5 Step
     DAC Test

Sweep

     Full Field
     Sweep w/ Markers (Rotary Switch Setting 5)
     Multiburst

Pulse & Bar

     Window (Rotary Switch Setting 3)
     Full Field
     Component
     Window 100
     Window 20

Timing

     Analog Blanking Markers
     Digital Blanking Markers
     Cosite (Rotary Switch Setting 6)
     Interlace
     Bowtie

Miscellaneous

Black
CrossHatch
SafeTitle (Rotary Switch Setting 8)
Unit Circle
Multi pattern (Rotary Switch Setting 9)
Multi composite
Pathological (Rotary Switch Setting 7)
16 by 9

A.2 TEST PATTERN DESCRIPTIONS

Color Bars

All of the color bar patterns include peak white, black, and the six vector colors (yellow, cyan, green, magenta, red, and blue), either at 75% or 100%.

Full Field Bars

Full field bars is sometimes called simple bars as it does not include anything else. It is color bars from the top of the field to the bottom.

100% is usually used for component signals as the amplitude of the Cb and Cr signals is the same as the Y signal. A waveform monitor can be used to align Y, Cb, and Cr gain.

75% is more commonly used with composite--when viewed on a waveform monitor, the chroma yellow and cyan envelope is lined up with the peak white level. As such, a waveform monitor can be used to align luminance and chrominance gain, and a vector display can be used to align chroma phase.

Split Field w/Pluge

Pluge, or level reference is added to the color bars to make a split field. The pluge is used to adjust monitor brightness and to check for clipping in digital systems. The pluge includes +/- 2 IRE levels around black, four luminance steps, and a 5 IRE "top hat" above peak white.

In composite systems, monitor brightness can be adjusted using the +/- 2 IRE levels around black by making the right-most level disappear in the adjacent black while making the left-most level just visible.

In digital systems, the number of steps of dynamic range is limited by the number of bits used to represent them. Black is represented by 040h and white is represented by 3ACh. If clipping occurs in the digital processing of a signal, the "top hat" and/or the 2 IRE superblack level can be clip off.

SMPTE Color Bars

In addition to pluge, SMPTE Color Bars includes a reverse sequence of bars.

The reverse sequence helps adjust monitor levels on monitors that provide blue only displays. Hue can be aligned by balancing the chroma bars, and chroma can be set by matching the chroma bars to the white bars.

Black Test Patterns

These test patterns are field field luminance reference levels. Black can be used as a color black reference signal and the others can be used as flat luminance mattes.

Black

The composite black test pattern has characteristics that are described in the following table:

Characteristic	Requirement
Black Level	7.5 +/- 1 IRE (NTSC)
	0 +/- 1 IRE (PAL and Japan*)
Blanking Width	10.9 +/- 0.2 uSec
Sync Level	-40 +/- 2 IRE (NTSC)
	-300 +/- 15 mV (PAL)
Sync Width	4.7 +/- 0.1 uSec
Burst Level	40 +/- 1 IRE (NTSC)
	300 +/- 15 mV (PAL)
Burst Frequency	3.579545 MHz (NTSC)
	4.43361875 MHz (PAL)
SCH Phase	0 +/- 3 degrees
Color Field Sequence	4 Fields (NTSC)
	8 Fields (PAL)

* Setup is removed with an on board jumper

The serial black pattern has a narrower blanking width of 10.2 uSec.

50%, 80%, and Peak White

These full field luminance mattes have 10 bit luminance levels of 1F6h, 2FDh, and 3ACh.

Ramp Test Patterns

Ramp test patterns are very useful for evaluating linearity, missing bits, timing errors, and dynamic range.

If there is a problem with linearity, the ramp will not be a straight line. If there is a missing bit, the ramp will be broken up into smaller ramps. If there is a timing error, vertical lines which are often noisy can appear. If there is a dynamic range problem, clipping will occur at the top or the bottom of the ramp.

Video Ramp

The video ramp test pattern goes from black to peak white across the line (040h to 3ACh for luminance and 040h to 3C0h for chrominance). Because there are more samples in an active digital line than levels of gray and chroma, there are some repeated steps across the line. This pattern is used especially for linearity, missing bit levels, and timing errors.

Data Ramp

The data ramp test pattern goes from minimum to maximum legal digital values (004h to 3FBh) in one step per sample increments. The ramp therefore restarts part of the way across the line. Because it uses the entire dynamic range, it is especially useful to check for clipping in each of the component channels, Y, Cb, and Cr.

Shallow Ramp

The shallow ramp test pattern goes from 1E2h to 21Dh passing through the critical 1FFh/200h point where all 10 bits change state. This pattern can be examined closely using a waveform monitor to evaluate DAC/ADC step size uniformity and can be used to detect timing errors.

5 Step Ramp

The five step ramp test pattern has five steps:

> Step 0: 040h and 040
>
> Step 1: 0F0h and 0F4h
>
> Step 2: 1A0h and 1A8h
>
> Step 3: 252h and 25Ch
>
> Step 4: 300h and 310h
>
> Step 5: 3B0h and 3C4h

This pattern is used for aligning display systems such as a projector.

DAC Test

The DAC Test Pattern is alternating vertical bands of 1FFh and 200h across the line.

At the transitions between 1FFh and 200h, all 10 bits of a digital signal change, which can be problematic in DACs. Normally this step should not be visible on a monitor, but if there is a problem, then vertical stripes will appear.

Sweep Test Patterns

Sweep test patterns are used to evaluate frequency response by examining the envelope of the waveform on a waveform monitor.

Full Field Sweep

Luminance sweeps to 5.75 MHz and chrominance sweeps to 2.75 MHz.

Sweep with Markers

The addition of markers at 0.5, 1, 2, 3, 4, and 5 MHz in the luminance channel and 0.25, 0.5, 1, 1.5, 2, and 2.5 MHz in the chrominance channel assist in evaluating response.

Multiburst

Instead of continuous sweep, discrete frequencies are positioned across the line. Luminance frequencies are 0.5, 1, 2, 3, 4, and 5.75 MHz, and chrominance frequencies are 0.5, 1, 1.5, 2, 2.5, and 2.75.

Pulse and Bar Test Patterns

These test patterns are used to evaluate transient response and clamp performance. Chroma-to-luminance delay, short-term distortion, gain, response, and tilt can be measured.

Window

The window test pattern is comprised of a 2T pulse, a modulated 12.5T pulse and a window bar.

The 2T pulse is used to measure short term distortion such as K2T, and transient response such as KPB.

The modulated 12.5T pulse is used to evaluate chroma-to-luminance delay. When viewed on a monitor, the bottom of the chroma envelope ideally appears as a flat line. Group delay can distort the bottom of the envelope and, with the appropriate waveform monitor graticule, can be measured.

The bar can be used to measure gain, and is also used to measure short-term distortion such as K_{SD} and tilt such as K_{BAR}.

Full Field Window

The window bar in this test pattern extends vertically for the full field.

Component Window

The component window test pattern has window bars added to the pattern. The leading and trailing edges of the bars use T steps for both luminance and chrominance edges. Since the sampling frequency for chrominance is half that of luminance however, the chrominance rise time is half that of the luminance. The window bar also has an inverted 2T pulse in its midpoint.

The amplitudes of the three components are: Y-3ACh, Cb-3C0h, and Cr-040h.

Window 100/20

These window test patterns can be used for color balancing video monitors. Window 20 provides a centered window with a luminance level of exactly 20% of full white. Your monitor manufacturer will have provided instructions on the use of test patterns such as these.

Timing Test Patterns

Timing test patterns are used to evaluate blanking area, field location, relative luma and chroma timing, and cositing.

Analog Blanking Markers

The analog blanking markers test pattern draws a box around each field to show the limits of blanking in composite systems. The size of the box is different for NTSC than for PAL. In NTSC, the top of the field is at 21/284 and the bottom is at 262/525. In PAL, the top of the field is at 24/337 and the bottom is at 310/622.

The left and right markers are separated from digital blanking, which is narrower, by a step so that actually blanking edges can be observed after passing through a process that imposes blanking.

Digital Blanking Markers

The digital blanking markers test pattern draws a box around each field to show the limits of blanking in digital systems. The size of the box is different for NTSC than for PAL. In NTSC, the top of the field is at 20/283 and the bottom is at 262/525. In PAL, the top of the field is at 23/336 and the bottom is at 310/623.

The left and right markers are immediately inside EAV and SAV.

Cosite

The cosite test pattern assists in determining that the luminance and chrominance parts of a digital signal are occurring in the appropriate relative time.

The vertical magenta pinstripe consists of a single cosite pulse in Y, Cb and Cr. Because they are cosited and are only one sample wide, a mistiming of these components will not appear magenta on a monitor. Cb and Cr can be determined easily on a waveform monitor because Cb is smaller than Cr. The levels are as follows: Y-1B7h, Cb-3C0h, Cr-340h. The pinstripe is also useful because it is in the middle of the line.

Interlace

The interlace test pattern is helpful to show that field 1 and field 2 are occurring in the correct relationship to each other. A horizontal field timing strip and field 1/2 markers are included.

The horizontal field timing strip can be used to show that field 1 and field 2 are cosited in time. The middle segment of the strip, which happens during field 1, should occur between the outer segments, which happen during field 2. If it does not, then the relative timing is shifted or the fields are swapped or missing.

The field markers help to identify which field is which. Field 1 has a roman numeral "I" in it, and field two a roman numeral "II". If a field is missing, as in a frame store in field mode, one of these markers will be missing. When viewed on a waveform monitor or oscilloscope, the fields can also be identified. The field 1 marker has chroma content while the field 2 marker does not.

Bowtie

The bowtie test pattern is used to accurately measure the chroma to luma delay in component systems in conjunction with a waveform monitor that is designed to use it.

Miscellaneous Test Patterns

The following test patterns have special purposes.

Crosshatch

The crosshatch test pattern consists of horizontal and vertical lines organized in a grid. This test pattern is used to evaluate monitor linearity and distortion.

SafeTitle

The safetitle test pattern identifies safe area in a video monitor for titles. If the title stays inside the safe area, then monitors will always show the complete title uncropped. The safe title pattern also shows the center of the visible area.

Unit Circle

When viewed on a component vectorscope, the unit circle test pattern displays a circle of constant radius. This test pattern is useful for evaluating systems that manipulate chroma such as chroma keyers.

Multi pattern

The multi pattern test pattern contains horizontal strips of other test signals, including bars, reverse bars, pluge, video ramp, shallow ramp, sweep, markers for sweep, multiburst, window, interlace, unit circle, and pathological patterns.

Viewed on a monitor, problems in a video system can often be discovered because of the wide variety of signals present.

This single pattern can be used in conjunction with a waveform monitor that is equipped with a line selector to display each of these patterns by selecting the line to be viewed.

Multi composite

This test pattern is the same as the multi pattern above except the composite version has the chroma channels of the ramp at reduced amplitude so that they do not create illegal waveforms in composite.

Pathological

The pathological test pattern consists of a flat field of magenta color that is precisely chosen because it produces long sequences of ones and zeroes in serial digital systems. Because some systems are not tolerant of long sequences, this pattern can help to identify those systems.

When a pathological error occurs, this test pattern shows horizontal, intermittent black lines.

16 by 9

This pattern is intended for use in standard definition systems that are producing anamorphic material for 16:9 HD viewing. This pattern provides safetitle marking for both SD and HD aspect ratios. It also includes a color bar pattern which is horizontally compressed such that when displayed on a 16:9 monitor, the color bar portion will have a 4:3 aspect ratio.