

AVENUE

Avenue™ signal integration system

Model 7405 High Definition Test Signal Generator Data Pack

ENSEMBLE

D E S I G N S

Revision 1.1 SW v1.1.0

This data pack provides detailed installation, configuration and operation information for the **7405 HD 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 7405 module is a high definition test signal generator that provides four identical HD serial outputs and two identical black outputs, all synchronous to one another. In remote mode, vertical and horizontal timing of the six outputs can be adjusted relative to the reference signal. A wide range of HD test patterns are user-selectable, in addition to dedicated black outputs. There are independent enables in the remote control menus for each test signal component so that Y, Cr, and Cb can be controlled separately.

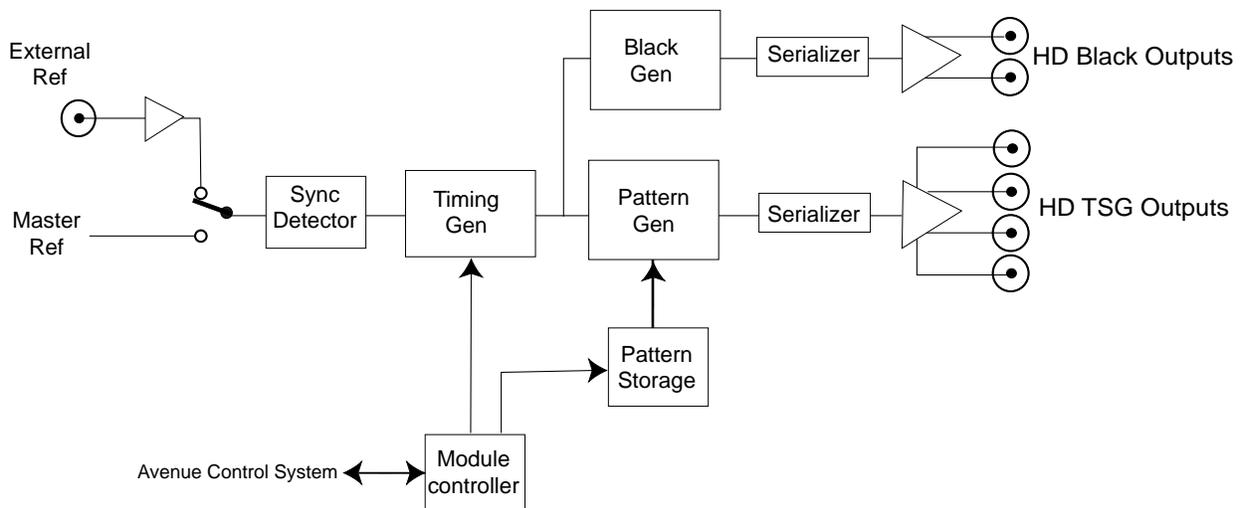
The module can genlock to either a composite video (525/NTSC or 625/PAL) or a HD Tri-level sync signal. The sync reference can be selected to come from the Avenue frame master reference or the external reference BNC on the rear of the module.

As shown in the block diagram below, the selected reference enters a sync detector circuit where information is extracted to determine the format and create the correct synchronizing pulses for the timing generator. The timing generator is used by the test signal generator to synchronize the black and pattern generators. The serializers convert the parallel data stream to a serial differential pair which then passes to the output drivers.

The output drivers feed four identical copies of the selected test signal to BNCs on the rear of the module. Two identical copies of the black signal are also available.

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.

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. The CPU also communicates with the remote control system.

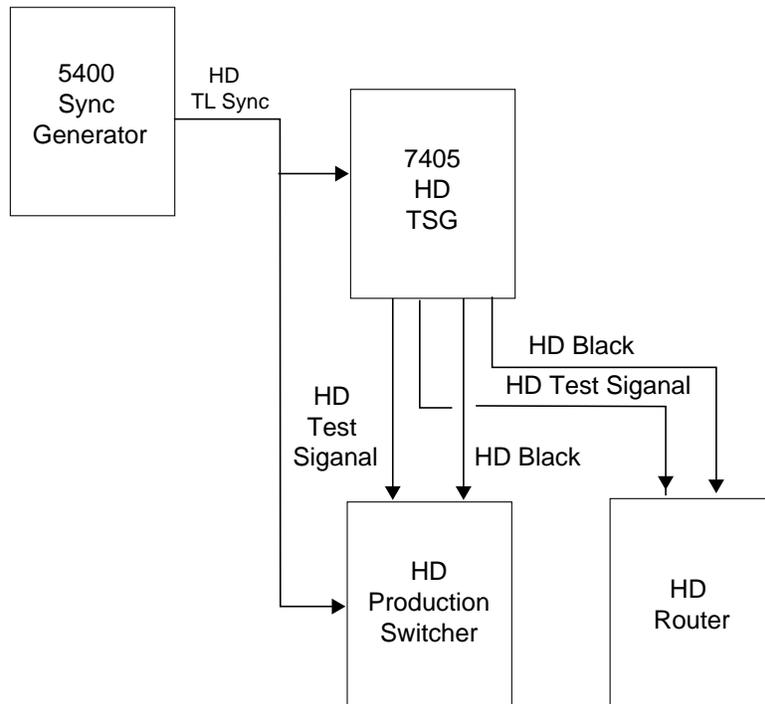


7405 HD TSG Block Diagram

APPLICATIONS

Test Signal and Black Distribution

As shown in the application below, the 7405 module can provide stable HD test signals to facility HD routers and HD production switchers. An Avenue 5400 Dual Sync Generator can provide the Tri-level or SD composite sync reference for the 7405 and then be looped to the HD production switcher and other destinations if required.



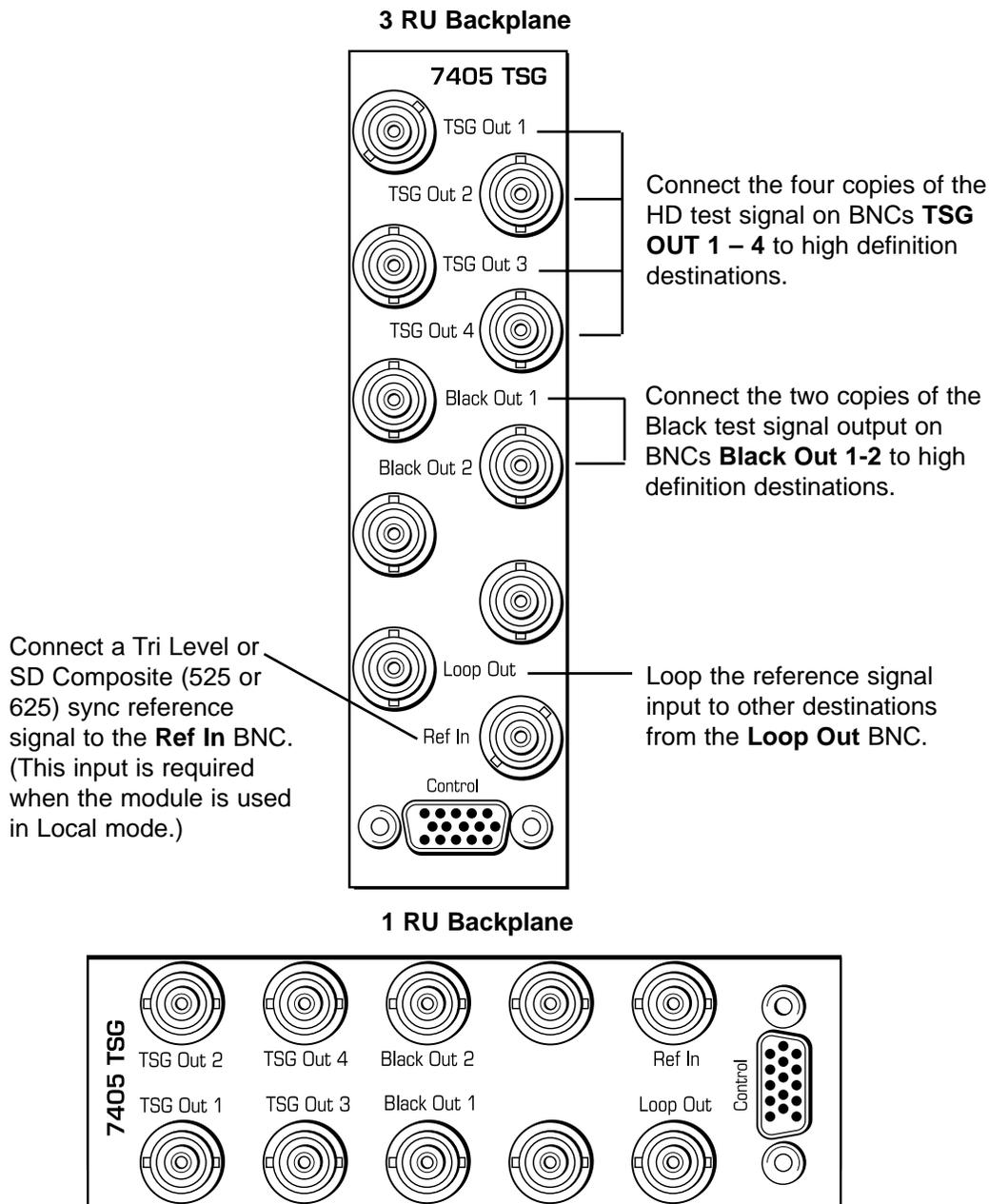
7405 Providing HD Test Signals

INSTALLATION

Plug the 7405 module into any one of the slots in the 1 RU or 3 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 below for cabling instructions. Note that unless stated otherwise, the 1 RU cabling explanations are identical to those given in the 3 RU diagram.



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 **7405 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.

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 **7405 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.

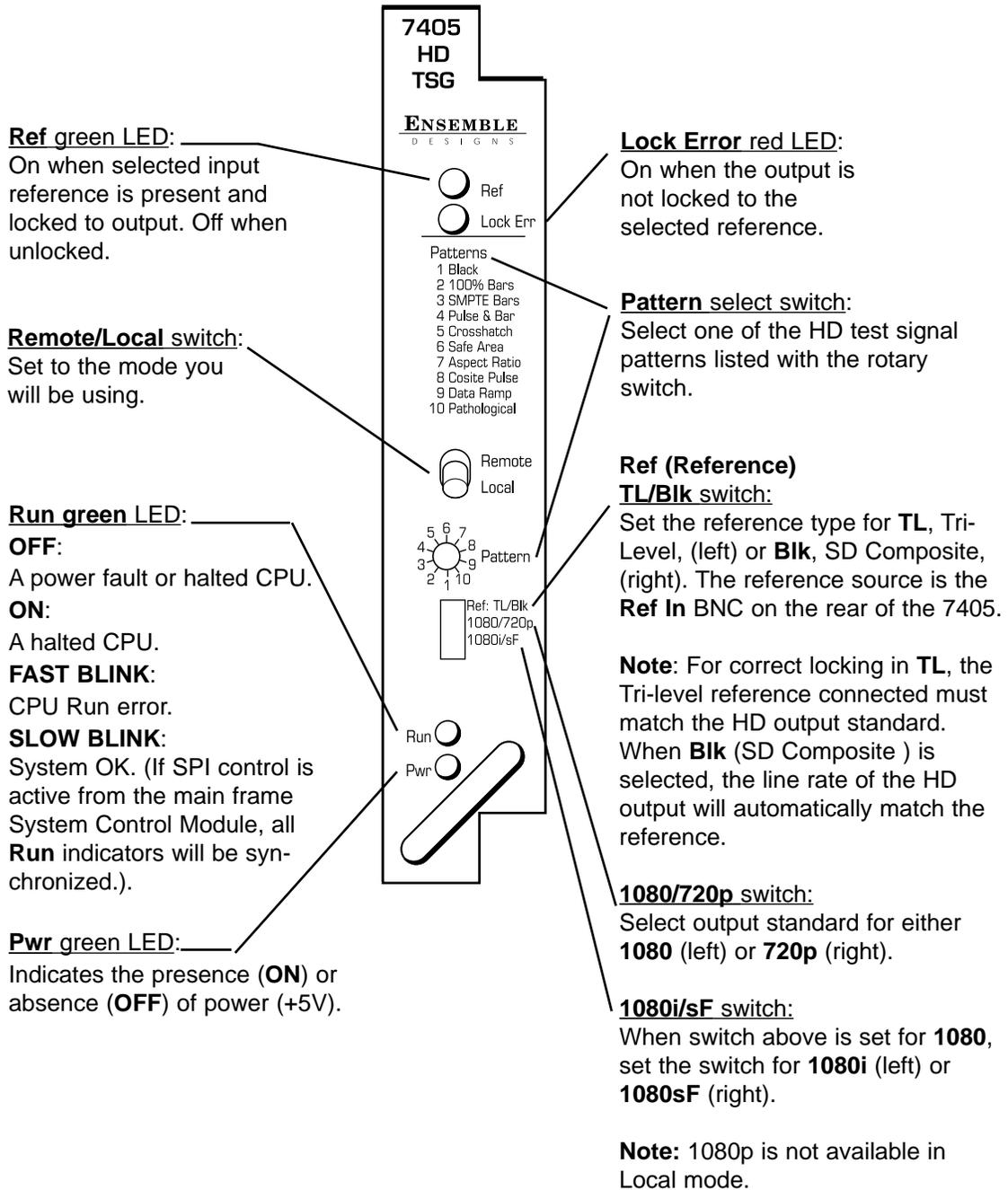
7405 Parameter Table

| CONTROL | LOCAL | REMOTE | DEFAULT/FACTORY |
|--------------------------|--|---|---------------------|
| Pattern Type | Rotary Switch: 1 Black 2 100% Bars 3 SMPTE Bars 4 Pulse & Bar 5 Crosshatch 6 Safe Area 7 Aspect Ratio 8 Cosite Pulse 9 Data Ramp 10 Pathological | Bars: Split Field 75 Split Field 100 Mon Align Full Field 75 Full Field 100 Black: Black Flat Field 50 Ramp: Data Ramp 5 Step Pulse & Bar: Window Timing: Blanking Cosite Misc: Black CrossHatch Aspect Safe Title Checkfield | Bars/Split Field 75 |
| Y Channel | N/A | Enabled/Disabled | Enabled |
| Cr | N/A | Enabled/Disabled | Enabled |
| Cb | N/A | Enabled/Disabled | Enabled |
| Ref Select | Switch 1: TL (left) Blk (right) | Ext Video Master Ref | Ext Video |
| Ref Type | Ext reference only must match Output Std selected below and be connected to Ref In BNC | SD Composite HD Tri-Level | SD Composite |
| Output Std | Switch 2: 1080 (left) 720p (right) When Switch 2 is in 1080: Switch 3: 1080i (left) 1080sF (right) The Frame/Line rate follows the external reference input. Note: No 1080p in Local Mode | 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 |
| Vertical Timing | | +/- 575 Lines | 0 |
| Horizontal Timing | N/A | +/- 2400 Clks | 0 |

N/A

Front Panel Controls and Indicators

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



Avenue PC Remote Configuration

The Avenue PC remote control status menu for this module is illustrated and explained below. Refer to the **7405 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.

7405 Avenue PC Menus

The **Patterns** menu shown below allows you to set the type of test pattern desired for the TSG outputs with the following controls:

- **Pattern Type** – select the HD test signal type in the first window and the test signal parameters in the second window. Refer to the **7405 Parameter Table** shown earlier for a complete listing of the available test signals and their parameters. Refer to Appendix A for a complete description of each test pattern.
- **Y, Cr, Cb Enabled** – deselect to turn off the **Y**, **Cr** and/or **Cb** Channels of the selected pattern type 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.

The screenshot shows a software interface with three tabs: "Patterns", "Config", and "Timing". The "Patterns" tab is active. Under "Pattern Type", there are two dropdown menus. The first dropdown is set to "Bars" and the second is set to "Split Field 75". Below these are three checkboxes, each with the label "Enabled" and a checked box: "Y Channel", "Cr Channel", and "Cb Channel".

The **Config** menu screen shown below allows you to select the module reference, the reference type, and the HD output standard for the test signal with the following controls:

- **Ref Select** – select the source of the reference from **Master Ref** from the Avenue frame or the **Ext Video** reference connected to the **Ref In** BNC on the rear of the 7405 module.
- **Ref Type** – select the reference type from **SD Composite** (525/NTSC or 625/PAL) or **HD Tri-Level**.
- **Output Std** – select the output standard for the test signal. Refer to the **7405 Parameter Table** shown earlier for a complete listing of the available test signal standards.

Refer to the locking rules outlined below for setting the reference remotely:

- When the reference type selected is **SD Composite**, you may use either 525/NTSC or 625/PAL with any HD output standard and the generator will always lock to the reference. The signals however may not be vertically coincident. To guarantee the HD output will be vertically coincident with the reference, use the following guidelines:

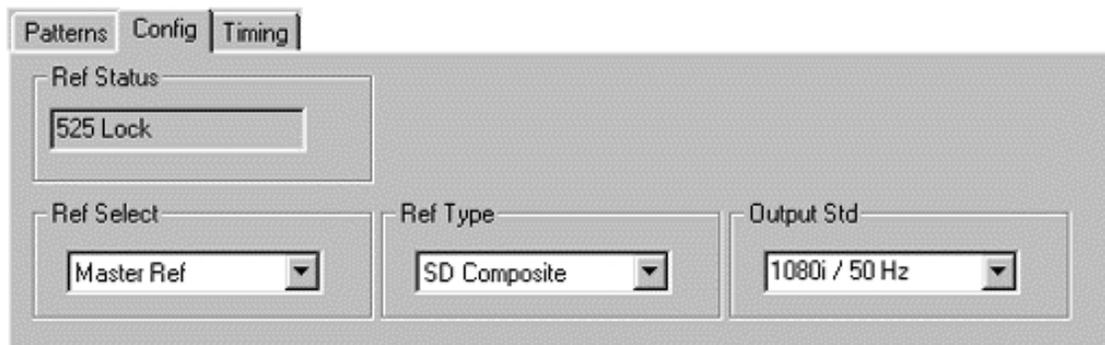
For 525/NTSC reference – set the HD output standard to one of the following:

- 720p/59.94 Hz
- 1080i/59.94 Hz
- 1080p/23.98 Hz
- 1080sF/23.98 Hz

For 625/PAL reference – set the HD output standard to one of the following:

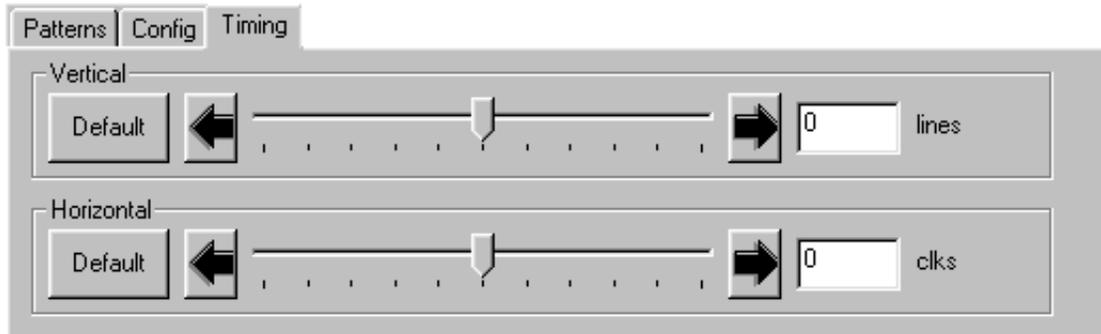
- 720p/50 Hz
- 1080i/50 Hz
- 1080p/50 Hz
- 1080sF/25 Hz

- When the reference type selected is **HD Tri-level**, the incoming HD Tri-level reference (either **Master Ref** or **Ext Video**) must be the same as the selected HD output standard or a lock error will occur.



The **Timing** menu screen shown below allows you to set the timing of the test and black signal outputs relative to the reference signal:

- **Vertical** – adjust the vertical timing of the test signal and black output relative to the selected reference.
- **Horizontal** – adjust the horizontal timing of the test signal and black outputs relative to the selected reference.



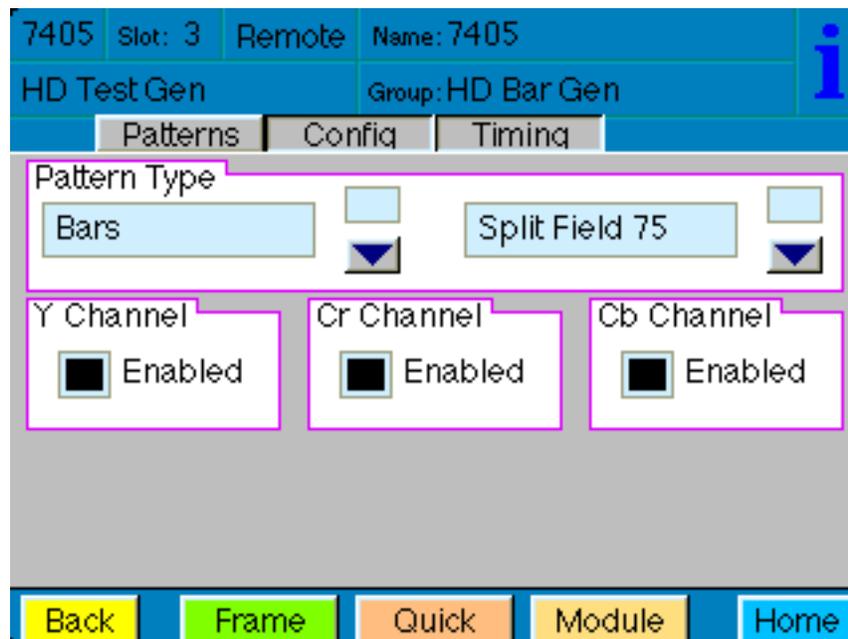
Avenue Touch Screen Remote Configuration

The Avenue Touch Screen remote control status menu for this module is illustrated and explained below. Refer to the **7405 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.

7405 Avenue Touch Screen Menus

The **Patterns** menu shown below allows you to set the type of test pattern desired for the TSG outputs with the following controls:

- **Pattern Type** – select the HD test signal type in the first window and the test signal parameters in the second window. Refer to the **7405 Parameter Table** shown earlier for a complete listing of the available test signals and their parameters. Refer to Appendix A for a complete description of each test pattern.
- **Y, Cr, Cb Enabled** – deselect to turn off the **Y**, **Cr** and/or **Cb** Channels of the selected pattern type 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.



The **Config** menu screen shown below allows you to select the module reference, the reference type, and the HD output standard for the test signal with the following controls:

- **Ref Select** – select the source of the reference from **Master Ref** from the Avenue frame or the **Ext Video** reference connected to the **Ref In BNC** on the rear of the 7405 module.
- **Ref Type** – select the reference type from **SD Composite** (525 – NTSC or 625/PAL) or **HD Tri-Level**.
- **Output Std** – select the output standard for the test signal. Refer to the **7405 Parameter Table** shown earlier for a complete listing of the available test signal standards.

Refer to the locking rules outlined below for setting the reference remotely:

- When the reference type selected is **SD Composite**, you may use either 525/NTSC or 625/PAL with any HD output standard and the generator will always lock to the reference. The signals however may not be vertically coincident. To guarantee the HD output will be vertically coincident with the reference, use the following guidelines:

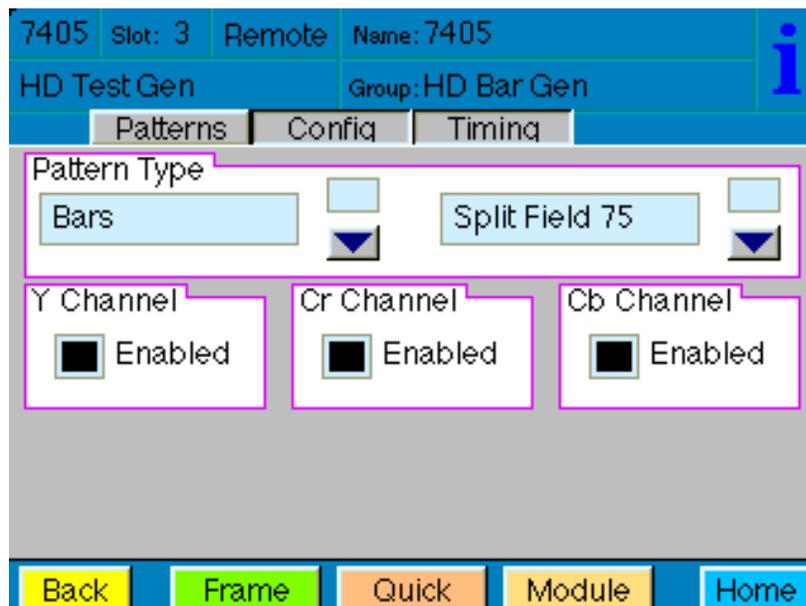
For 525/NTSC reference – set the HD output standard to one of the following:

720p/59.94 Hz
1080i/59.94 Hz
1080p/23.98 Hz
1080sF/23.98 Hz

For 625/PAL reference – set the HD output standard to one of the following:

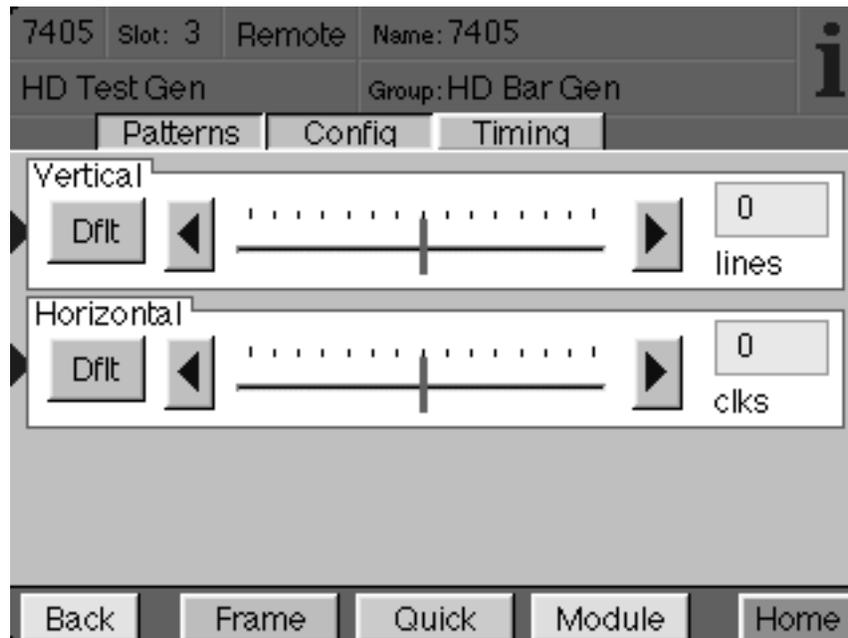
720p/50 Hz
1080i/50 Hz
1080p/50 Hz
1080sF/25 Hz

- When the reference type selected is **HD Tri-level**, the incoming HD Tri-level reference (either **Master Ref** or **Ext Video**) must be the same as the selected HD output standard or a lock error will occur.



The **Timing** menu screen shown below allows you to set the timing of the test and black signal outputs relative to the reference signal:

- **Vertical** – adjust the vertical timing of the test signal and black output relative to the selected reference.
- **Horizontal** – adjust the horizontal timing of the test signal and black outputs relative to the selected reference.



TROUBLESHOOTING

As a troubleshooting aid, the reference signal status and presence, any locking errors, 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 module:

Ref LED is not lit on front panel:

- Reference is not present on Master Ref input to frame or Ref In external video BNC.

Lock Error LED is lit on front panel:

- Tri-level reference input does not match the selected HD output standard.

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.

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

7405 HD Test Signal Generator

Output:

Number: Six (4 test signal, 2 black)
Signal Type: HD Serial Digital
Impedance: 75 ohm
Return Loss: >15 dB DC to 1.5 GHz
Standards Supported: 1080i (SMPTE 274M-4, 5, 6) 50, 59.94, or 60 Hz
720p (SMPTE 296M-1, 2, 3) 59.94 or 60 Hz
1080p (SMPTE 274M-9, 10, 11) 23.98, 24, 25 Hz
1080sF (RP211-14, 15, 16) 23.98, 24, 25 Hz

Reference Input:

Number: One external (Ref In BNC on module)
One internal (Frame's Master Reference BNC)
Signal Type: PAL or NTSC composite video or HD Tri-level Sync
Return Loss: >40 dB (applies to external reference input)

Test Signals:

Bars: Split Field 75
Split Field 100
Mon Align
Full Field 75
Full Field 100
Black: Black
Flat Field 50
Ramp: Data Ramp
5 Step
Pulse & Bar: Window
Timing: Blanking
Cosite
Misc: Black
Crosshatch
Aspect
Safe Title
Checkfield

General Specifications:

Power Consumption: < 7 Watts
Temperature Range: 0 to 40 degrees C ambient (all specs met)
Relative Humidity: 0 to 95%, noncondensing
Altitude: 0 to 10,000 ft.

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 7405 module. Section A.1 lists the test patterns provided and Section A.2 provides a description of the 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 ten patterns that are available in Local mode are identified with the corresponding rotary switch position for selecting them.

Color Bars

Split Field 75%

Split Field 100%

Mon Align (SMPTE Bars) (Rotary Switch Setting 3)

Full Field 75%

Full Field 100% (Rotary Switch Setting 2)

Black

Black (Rotary Switch Setting 1)

Flat Field 50

Ramp

Data Ramp (Rotary Switch Setting 9)

5 Step

Pulse & Bar

Window (Rotary Switch Setting 4)

Timing

Blanking

Cosite (Rotary Switch Setting 8)

Miscellaneous

Black

CrossHatch (Rotary Switch Setting 5)

Aspect Ratio (Rotary Switch Setting 7)

SafeTitle (Rotary Switch Setting 6)

Checkfield (Rotary Switch Setting 10)

A.2 TEST PATTERN DESCRIPTIONS

Bars Test Patterns

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%.

Split Field Bars

Pluge and 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.

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.

Mon Align (SMPTE Color Bars)

SMPTE Color Bars has a reverse sequence of bars to help 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. It also includes pluge.

Mon Align

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 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 HD black test pattern is a full-field black signal.

Flat Black 50

A 50 percent black signal creating a gray signal for applications requiring a neutral background.

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.

Data Ramp

The data ramp test pattern goes from minimum to maximum legal digital values 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.

5 Step Ramp

The five step ramp test pattern has five steps used for aligning display systems such as a projector.

Pulse and Bar Test Patterns

This test pattern is 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 K_{2T}, and transient response such as K_{PB}.

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}.

Timing Test Patterns

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

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.

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.

Miscellaneous Test Patterns

The following test patterns have special purposes.

Black

A standard black signal.

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.

Aspect Ratio

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.

Checkfield

The checkfield or 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. This test signal is very useful for testing transmission paths.

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