

# MURIDEO

**Murideo  
Fresco SIX-G**

**HDMI 2.0 Test Pattern Generator  
HDCP 2.2 Tester**



**User's Manual**

Version 1.00

Call the AVPro Team at –North America 877-886-5112 International +1-605-274-6055

### Important Safety Information

- Follow all instructions
- Use only a dry cloth to clean
- Use caution not to block side vents on unit
- Indoor use only: To reduce the risk of electric shock, do not use near water or expose to rain or moisture. Keep away from excess moisture
- Do not use near heat sources such as room heaters, hot A/V equipment
- Read all warnings
- Use only accessories provided by Murideo
- Unplug the device during lightning storms or when unused for long periods of time
- Keep away from open flames
- Protect all connected cords including power cords from being pinched, compressed, and stepped on
- Do not open the case. All servicing should be done only by qualified and approved service personnel and will void the warranty.
- Electrical Input Rating: Power over 5V/DC 700mA. Caution: Use only the supplied AC/DC Adapter
- Operating temperature range: e.g. 0 to 40C.
- For charging use the provided 5V/ DC 3A supply only
- To disconnect power sources, remove the AC/DC adapters from the wall outlets.

#### Attention:

1. In order to protect your SIX-G and complete system under test from possible damages, please don't turn on the SIX-G power switch before generator Output is attached to tested device (repeater, video processor or display) input.  
Please make sure that system under test is completely powered off before you insert or extract HDMI cable to any of involved devices.
2. Please insert and extract HDMI cables from your SIX-G gently and with high level of care.
3. During Hot-Plug between HDMI connector and receptacle (when tested device is On) ESD discharge can occur due to the potential differences (possible ground -loop) between powered equipments. These potential differences can be on extremely high level. Our Fresco SIX-G HDMI output is protected against ESD discharge till 7KV on all active HDMI lines, but in case if massive discharge will be over that value, will cause serious damage to SIX-G internal circuitry and can make SIX-G HDMI output completely inoperable. We have sophisticated methods to measure directly on High voltage protection chips evidences of such unwanted ESD event, but unfortunately, that will automatically void SIX-G warranty. In your own interest please pay full attention and prevent your workplace from occurrence of ESD by trying to create Static-safe working environment.

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## Overview

Thanks for purchasing the Murideo SIX-G – an ISF Pro Tool!

The Murideo SIX-G is intended for the AV integration market to confirm HDMI 2.0(a) and HDCP 2.2 operation at the 18 GBPS level. Additionally, the SIX-G is an excellent troubleshooting tool for distributed HDMI systems and a reference source for video calibration. SIX-G beside many other sophisticated features is also compatible and certified by SpectraCals, CalMAN.

One of the biggest challenges for integrators today is determining what infrastructure to put in the systems they design and further verifying, that all of the components will work together. Over the past few years UHD TVs have been a mix of HDCP 2.2 and 1.4, 300MHz and 600Mcsc – even to the point of varying by port.

The SIX-G takes the guess work out of troubleshooting, and provides absolute information about HDMI components that will work and IDs ones that won't work – all in a hand-held, ruggedized, portable field tool.

The SIX-G is designed to be extremely accessible, shipping with free control software, plus front panel controls that allow access to 99% of the features.

The SIX-G is the only unit to carry the complete suite of ISF test patterns, select-able color output level, RGB Triplets and Constant APL (Average Picture Level) all in one place, making it a calibrators dream.

Note: The SIX-G ships with a protective cover on the screen that you may remove, although this is not required for operation.

### Key Features:

- HDMI 2.0(a) Support. 600 Mcsc - 2160P @60 4:4:4 Maximum Resolution
- HDR (High Dynamic Range) Support
- HDCP Pass/Fail - HDCP 2.2, 1.4 or None Indicator Light >Some of the 4K UHDs on the market today support HDCP 2.2 - The SIX-G will tell you what the TV will and won't support.
- Hot Plug Detect Indicator Light > On the fly indicator for troubleshooting issues especially when switching, splitting and extending HDMI
- CalMAN Supported > Advanced features available to CalMAN like APL, ISF Test Patterns and more. No driver required & Simple setup.
- EDID Read and Save functionality >did you know most 4K TVs still have 2K preferred timings? Know what your TV is telling you.

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- 48 Bit per pixel color depth > Today's TVs are still 24 bits per pixel, but the new Blu-Ray may be 30, so lots of headroom is available.
- USB Control and WebOS Support
- Portable - Battery Operated > Rechargeable batteries included make field troubleshooting much easier.
- Optimized Ergonomics – 3" LCD display and simple menu system makes SIX-G very user friendly.
- ISF Certified and includes ISF Test Patterns > Specialty Black, White, Multi-burst, and more. People patterns for checking flesh tones and color decoding after calibration.
- Plenty of specialty patterns > Everything you need to setup, calibrate, and troubleshoot HDMI/DVI video systems
- Includes audio confidence test tones > to make sure audio is active on the HDMI line

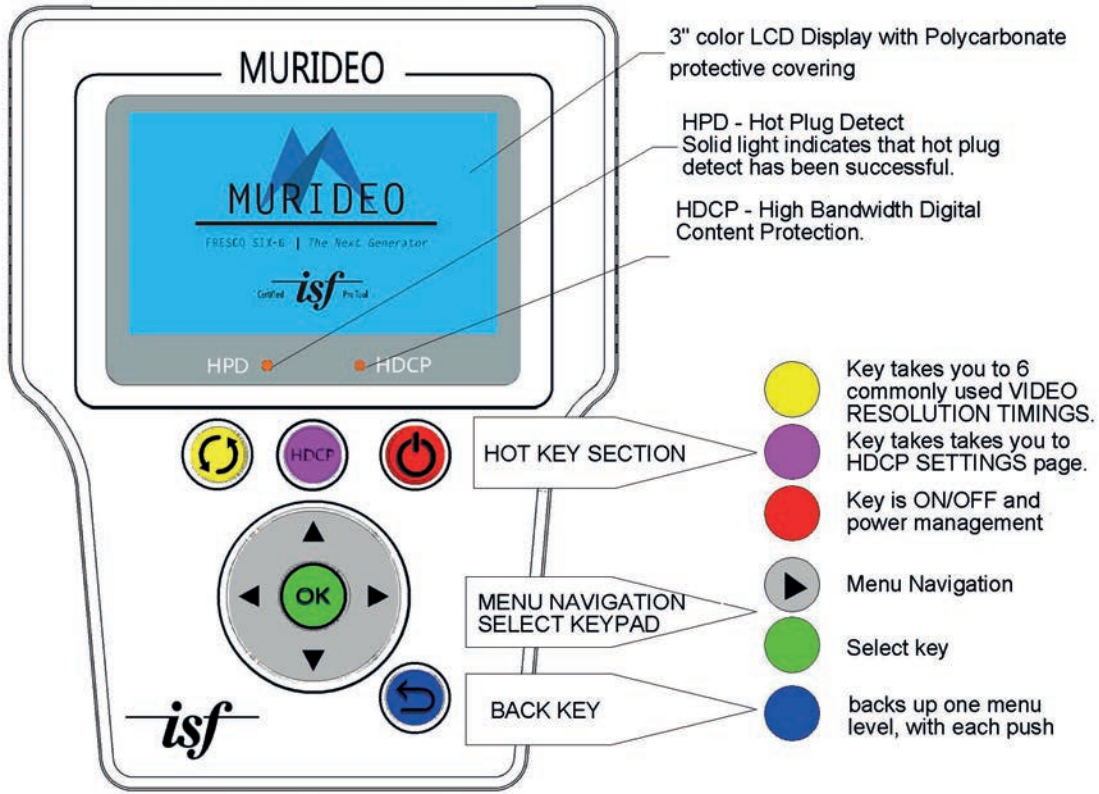
#### **What's in the Box**

- SIX-G Generator
- 5 V DC/AC Power Supply / Charger (110-240 VAC) with set of International plugs (US, UK, AU, EU).
- Rechargeable Battery Pack (installed)
- Hard Case
- 3' Micro USB to USB cable
- 1' 3.5mm to DB9 (F) serial cable adapter

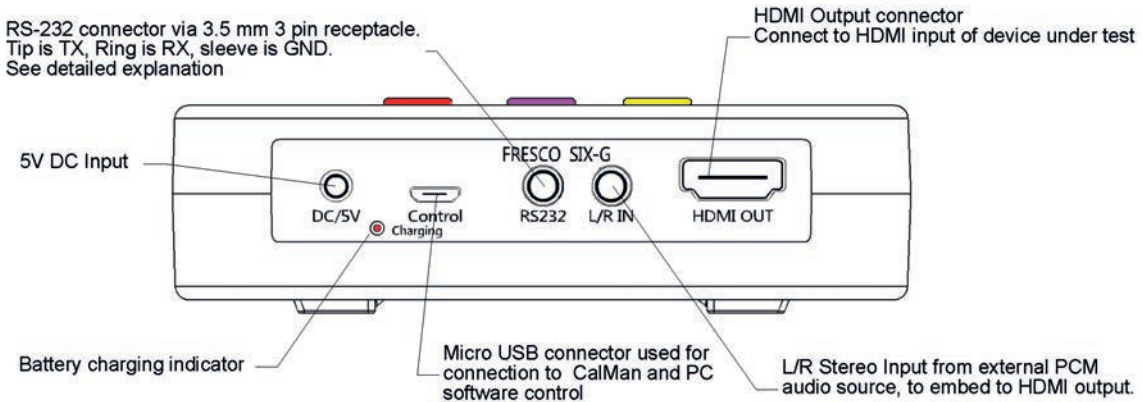
Please read the entire manual before turning on your new Murideo Six-G for helpful tips on charging and battery life extension.

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**Front Panel Functional Description**



**Rear Connector Panel**



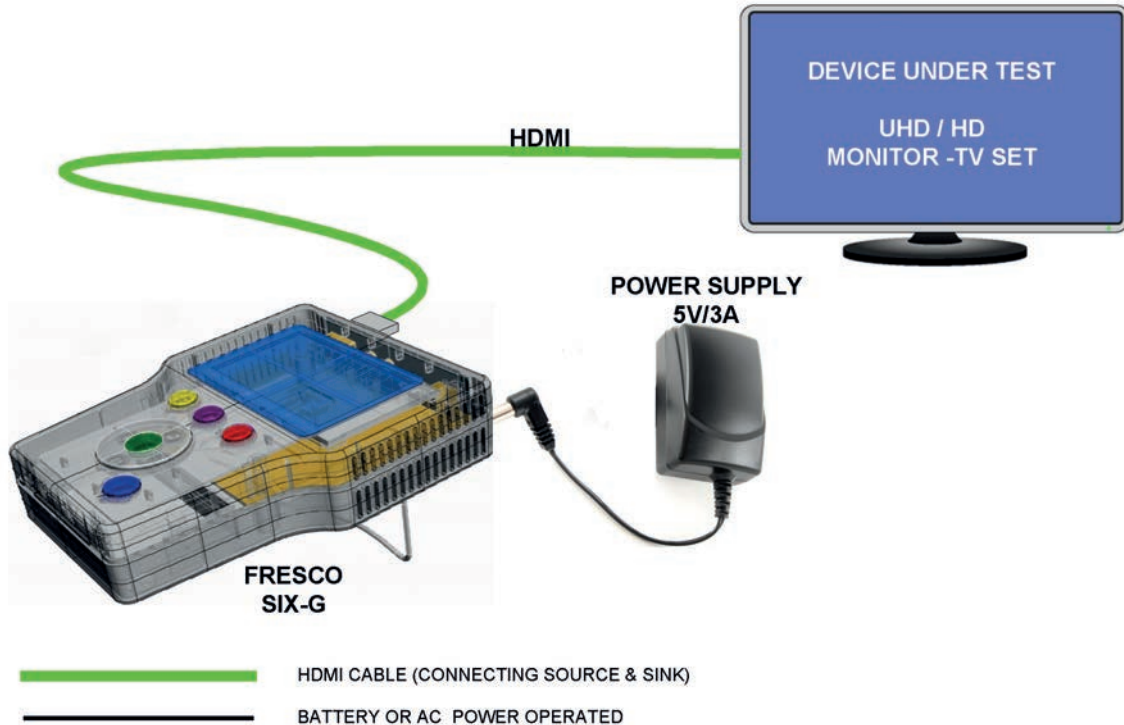
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## Connecting the MURIDEO SIX-G

The SIX-G generator can be operated manually, PC interfaced with Spectralcal's CalMan version 5.6 or greater (in automated mode), or the supplied application software.

### Manual Operation Connection

1. Connect the AC power adapter to the generator and plug it into AC power or power the generator using the internal battery.
2. Connect the HDMI cable between the generator and the unit under test.
3. You are now ready to power up the generator and unit under test and proceed with your performance verification.
  - a. The display will show the last pattern and resolution used. The HPD light will be ON and the HDCP light will be ON if HDCP is enabled.



4. To change the output resolution - Push the OK button to recall the TIMING RES menu or push the **YELLOW** hot key to bring up a list of commonly used timings. Use the UP/DOWN keys to step to the timing you want and then push the OK button.

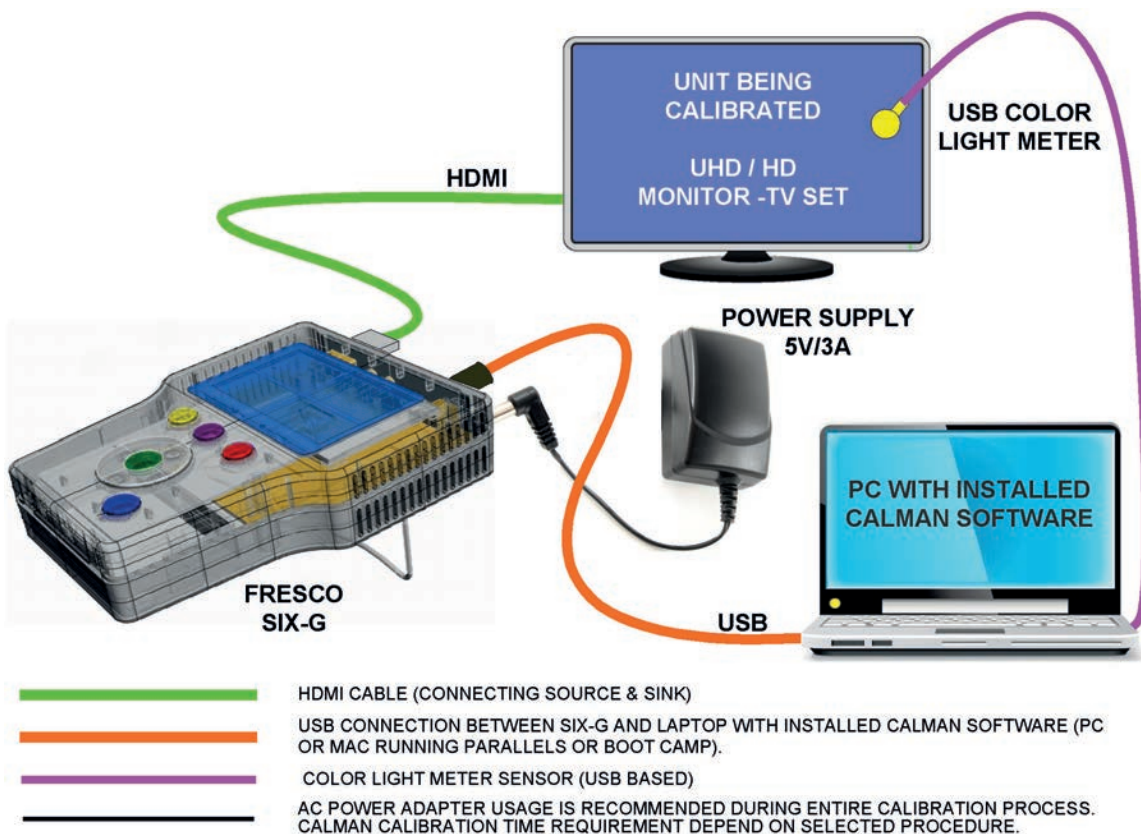
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5. To change the test pattern use the UP/DOWN keys to step to the desired test pattern. The test pattern is shown on the front panel display.
6. The **Purple** hot key will take you to the HDCP Setting menu. Use the UP/DOWN keys to step to the desired HDCP mode and the OK key to make the selection

### Spectracal's CalMan 5 Connections:

You will need a SIX-G, a PC with a licensed copy of CalMan installed, a light measurement meter, and cables. (Contact AVPro if you need a current License or details when other calibration software will be SIX-G supported.)

1. Connect the supplied AC power adapter to the SIX-G. Due to the time required it is recommended to use the AC power adapter during the calibration procedure.
2. Connect the Control port of the SIX-G and the light meter to the PC USB ports.
3. Connect the SIX-G output to the monitor using an HDMI cable.



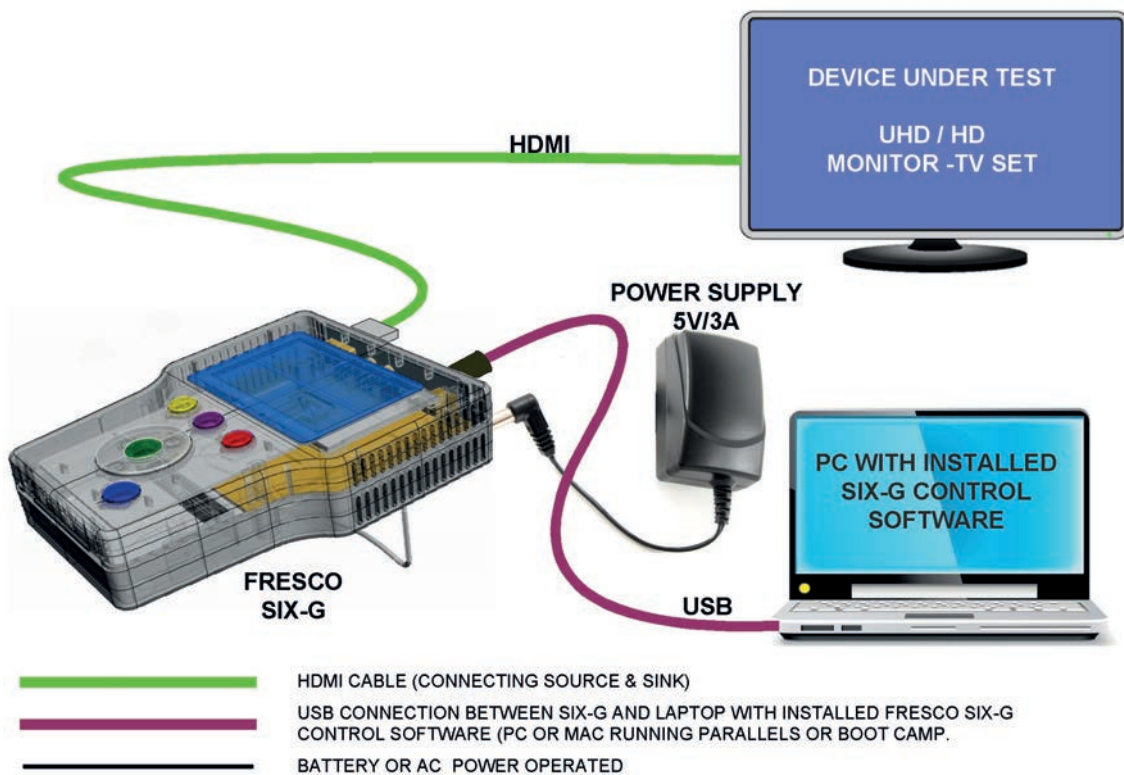
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### PC w/included Software Application Connections:

You will need a SIX-G, a PC with the application installed, supplied HDMI cable, supplied RS-232 cable, and supplied AC power adapter.

1. Connect the SIX-G to it AC power adapter.
2. Connect the SIX-G to the PC using the supplied USB cable or alternatively supplied RS-232 cable terminated with DB 9 female receptacle (in case if your host PC does have physical Serial COM Port).
3. Connect the SIX-G output to the unit under test using an HDMI cable.



### Manual Operation & System Testing

Manual operation is well suited for testing video distribution system components prior to installation or for step-by-step diagnostics and to isolate faulty component within an installed system.

Typical manual operation steps:

1. Connect the SIX-G generator to the unit under test using an HDMI cable.

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2. Power ON the SIX-G generator using the internal battery or the supplied AC power adapter.
3. Power ON the unit under test.
4. Use the navigation keys of the SIX-G to select the resolution, pattern and HDMI setting desired for testing.
5. The unit under test will display the selected test pattern if it is compatible with the test signal timing and signal parameters.
6. If the test pattern is not displayed check the following: HDP front panel light is ON, check that the HDCP SETTINGS mode is compatible with the unit under test, verify the input you are using is compatible with the test signal format – Note that NOT all HDMI inputs on monitors are the same, verify the sink EDID by going to the SINK EDID INFO menu on the SIX-G.

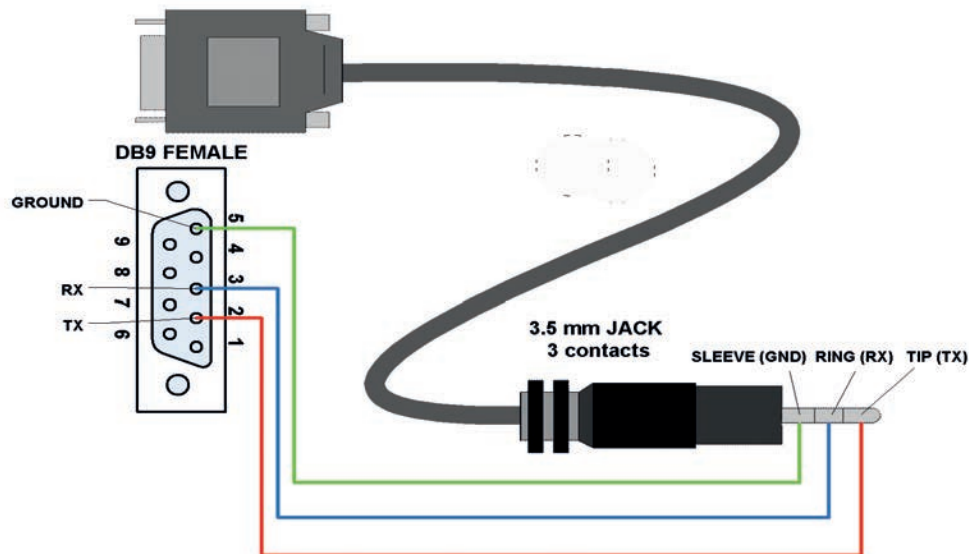
If you are testing or servicing a system you can connect the SIX-G to any HDMI input connection along the signal path. You can work step by step from the Sink back to the Source or from the Source to the Sink.

### Creating test system with multiple SIX-G and allowing 3<sup>rd</sup> party system integration.

For purpose setting up large test system with multiple SIX-G, we provided Serial port via 3.5 mm, 3 pin receptacle and in supplied Control software, mechanism for Serial identification for each connected SIX-G device.

We also added in accessories proprietary serial cable, terminated on one side with DB9 (9 pin connector) and on the other side with 3.5mm (aka: Mini Stereo Jack) with 3 contacts.

Serial Connection diagram:



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**Six-G Input & Output connections:**

1. **Power in:** 5VDC @ 3A adapter
2. **Batteries Included** - Unit runs off internal batteries and is recharged via supplied power adapter. You can also leave the power source connected during use.
3. **Charging Indicator** – on unit rear opanel:
  - a. Red – Unit is charging
  - b. Red LED off – Unit is charged
  - c. Front button – OK then Left Arrow – shows charge level bars.
4. **Control** – connect USB micro cable from *Control Port* to PC for use of SIX-G PC Software or for use with CalMAN or other 3<sup>rd</sup> party software.
5. **RS232** – Use to connect the supplied 3.5mm to 9-pin serial adapter to a PC or 3<sup>rd</sup> party controller for RS232 operations – not normally used for standalone operation.
- 6.
7. **L/R In** – 3.5mm Source audio input stereo L/R – Not normally used for standalone operation.
8. **HDMI Out** – For connecting to an HDMI input on a display, projector or AVR. Can also be connected to any sink or repeater for troubleshooting distributed systems – baluns, matrixes, distribution amps, etc.

**Buttons & Indicators (page 6 for picture).**

1. 3” LCD Display:
  - a. **Firmware Revision** – top right-hand corner (Rev1.00 in example)
  - b. **Active Pattern** – shows the pattern that is currently selected.
  - c. **Active Resolution and Frame Rate**
2. **Hot Plug Detect (HPD)** – is green when hot plug is detected. The HPD (**Hot-Plug-Detect**) feature is a communication mechanism between a source and a sink device that makes the source device aware that it has been connected/disconnected to/from the sink device. When an HDMI cable is inserted between the two devices, the resulting hot-plug detection instantiates a start-up communication sequence. The EDID information stored in the sink device gets read by the source device through the DDC bus, when EDID data exchange is correct HPD LED will lit continually, in case of EDID malfunction HPD LED will blink.
3. **HDCP Locked** – Indicates if HDCP is detected. Green when detected. You must first select either 1.4 or 2.2 HDCP in the menu. Light will turn green when any version of HDCP is detected. HDCP stands for High-Bandwidth Digital Content Protection, a copy protection scheme to eliminate the possibility of intercepting digital data midstream between the source & display. The format designed by Intel and licensed by Digital Content Protection, LLC using an authentication and key exchange procedure before video and audio is presented. Products compatible with the HDCP scheme such as DVD players, satellite and cable HDTV set-top-boxes, as well as few entertainment PCs requires a secure connection to a compliant display, the process often described as the handshake. Due to the increase

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in manufacturers employing HDCP in their equipment, it is highly recommended that any HDTV you purchase is compatible. Current versions of HDCP are 1.4 and 2.2. The Murideo SIX-G handles both.

4. **Format Quick Select (Res Quick Select on photo)** – This button is used to quickly change between 8 common video resolutions and frame rates.
5. **HDCP** – Used to Select HDCP 1.4, HDCP 2.2 or None (no HDCP).
6. **Power** – Hold down for a few seconds to power on or power off the unit.
7. **OK Button** – Press to enter the menu and then use left and right arrows to navigate through the menu pages and up and down arrows to select specific items in menu. Pressing OK again selects the menu item.
8. **Up/Down Arrows** – during normal operation use up and down arrows to navigate through test patterns.
9. **Exit Menu** – Use to go back or exit menus.



Button Labels Indicators




**Menu System** – When the SIX-G initially boots up you will see a splash screen followed by the last pattern used and the resolution and timing plus firmware information.

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**Menu Timeout** – The on screen menu will exit after 20 seconds. After 1 minute of device inactivity display goes black to conserve battery charge – pressing any button will wake it up immediately.

**Unit Sleep/Shutdown** – The unit will completely shut down after 10 minutes of no activity. This is to conserve battery charge and to avoid overheating if you put it back in the case without powering down.



**Navigation** – To navigate the SIX-G menu system start by pressing the  button. From there use the left and right arrows to navigate through the various menu pages. Use the up and down arrows to navigate selected pages and  again to select. Use the  button to return to test pattern selections.

**Menu Pages**– for the purpose keeping with the order below once in the menu use the right arrow to navigate.

1. **Timing Resolution** – Select from 42 preset resolutions and timings from 640x480 60 Hz to 3840x2160 60 Hz. Also includes 3D patterns. You can also select AUTO – this will cause the generator to output the preferred timing from the displays EDID. Additionally, there are 10 placeholders for user-defined patterns. A list of all patterns is included on page 41 of this manual.
2. **Color Space** – Select Color Space for the particular display under test. Selections include:

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- a. RGB (0-255) – RGB Full is generally reserved for PC monitors since PCs use full range RGB.
  - b. RGB (16-235) – RGB Limited - HDTV SMPTE Range – Movies are viewed and produced within this range. This allows you to set absolute black at 16 and white at 235.
  - c. YC444 (16-235)- YCbCr 4:4:4 - full horizontal & vertical resolution – no chroma-subsampling is used.
  - d. YC422 (16-235) – YCbCr 4:2:2 – ½ horizontal resolution, full vertical resolution.
  - e. Human Eye is less sensitive on color data compared to luminance; color data for that reason is ½ horizontal and vertical resolution. Generally YC 4:2:2 is the setting for most consumer electronics sources like Blu-ray players and cable and satellite set top boxes. HDMI specifics is related to new feature of HDMI 2.0 where resolution of 4K/60 fps is standardized with color space YUV 4:2:0.
  - f. AUTO – This will put the generator in the color space setting based on the displays EDID.
3. **Deep Color Depth** – Video Bit Depth – allows selection of bit depth between 8 and 16 bits per pixel – 8-bit, 10-bit, 12-bit, and 16-bit plus AUTO. AUTO will use the bit depth based on the displays EDID.

Note: Resolution, Color Space and Bit Depth are interrelated and effect bandwidth. Here are the new (for 2015) HDMI 2.0 timings (**bold**):

	8bit	10bit	12bit	16bit
4K@24			<b>RGB</b>	
4K@25	RGB 4:4:4	<b>RGB</b> <b>4:4:4</b>	<b>RGB</b> <b>4:4:4</b> 4:2:2	<b>RGB</b> <b>4:4:4</b>
4K@30				
4K@50	<b>RGB</b> <b>4:4:4</b>	<b>4:2:0</b>	<b>4:2:2</b> <b>4:2:0</b>	<b>4:2:0</b>
4K@60	<b>4:2:0</b>			

Source: HDMI.org

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Now – let’s look at a bandwidth calculator for some common timings and familiar content:

Video basics:

The needs for compression: **MPEG compresses about 100:1**

Format	H pixels	V pixels	R refresh rate (fps)	B bit depth	MPEG-2 compression							
					No		Yes		No		Yes	
					D data rate (Gbps)	D data rate (Mbps)	T length (hr)	Sv file size (TB)	Sv file size (GB)			
YouTube HQ	480	360	30	24	0.2	2	2	0.2	2			
720p	1,280	720	60	24	1.8	18	2	1.8	18			
1080p 24 Hz	1,920	1,080	24	24	1.6	16	2	1.5	15			
1080p 60 Hz	1,920	1,080	60	24	4.1	41	2	3.7	37			
4k 30 Hz	4,096	2,160	30	24	8.7	87	2	7.9	79			
4k 60 Hz	4,096	2,160	60	24	17.5	175	2	15.7	157			

Media	Bandwidth (Mbps)
DSL internet	5 Mbps
4G LTE	15 Mbps
ATSC broadcast	19 Mbps
Blu-ray	36 Mbps
Fiber internet	100 Mbps

All calculations above are RGB or YCbCr 4:4:4 8-bit (24-bit column above – 8 bit per RGB pixel = 24-Bit). What you can see is that at 4K 60 Hz 4096x2160 @ 60 frames per second (FPS) and 8-bit we max out at 17.5 GBP/sec which is the top of the HDMI 2.0 specification (18 GBP/sec) - this is the uncompressed figure. In the example above we also show data rates using MPEG compression – this is what allows us to have high bandwidth content delivered to us through the various media in our homes and businesses without visual artifacts.

That being said – certain timings, bit depths and color space combinations cannot be selected as they exceed the maximum bandwidth requirement for HDMI 2.0 of 18 GBP/sec. The SIX-G will not allow you to select an invalid combination of values.

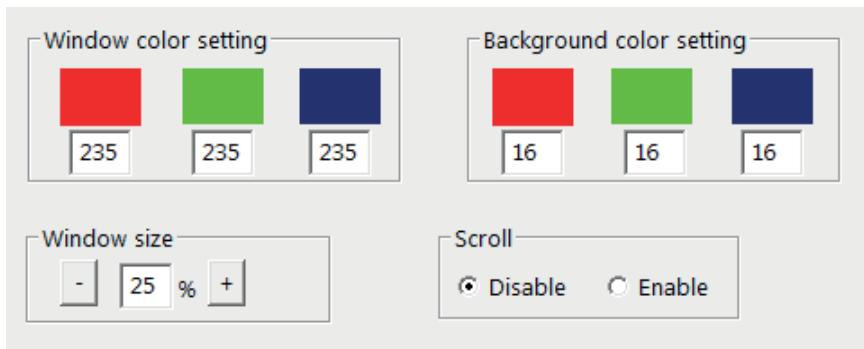
4. **HDCP Setting** – This screen allows you to select (turn on) HDCP 1.4, HDCP 2.2 or NO HDCP. This feature is useful for troubleshooting. HDCP settings. The ability to choose HDCP 1.4, HDCP 2.2 and HDCP OFF. Even though you have an HDCP 2.2 compatible source, sometimes displays and HDMI distribution equipment claim implementation but only provide actual support on one or some of the inputs or even without supporting 18GBP/sec (2160P60 4:4:4 8-bit). The only way to verify what is happening is to use the SIX-G. EXAMPLE: We have discovered some displays will accept HDCP 2.2 but only in 4K30, 4K60 is only accepted in HDCP OFF for PC signals.
5. **HDMI/DVI Setting** – Select DVI or HDMI or AUTO. AUTO reads the EDID for this setting.
6. **Audio Sampling** – Allows audio sampling rates between 32K and 192K. AUTO may also be selected in which case the sampling rate listed in the EDID preferred rate will be used.
7. **Audio Sampling Size** – 16-bit, 20-bit and 24-bit selections are available as is AUTO (EDID).
8. **Audio Source:**
  - a. INT – Internal 1K Test Tone – for confidence testing – does the audio pass through the distribution system? (HDMI, HDBaseT HDIP, etc.) With 32 combinations of speaker configuration you can test connectivity for every speaker in the system.

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- b. External – via 3.5mm stereo jack in top of unit. This can be used to generate test signals such as sinewaves at various frequencies, pink noise, white noise, etc. for system testing.
9. **Audio Channels** – Allows you to select 32 speaker configurations from 2.0 to 7.1. Regardless of your configuration you will likely be able to use one of our 32 combinations to address all of your speakers and Subs. Currently SIX-G supports 8 channels of audio embedded into HDMI with highest resolution of 192 KHz / 24 bit.
10. **Audio Volume** – Use to control internal sinewave generator volume level.

Note: We use Studio Six tools from an IOS device (iPhone) to get pink & white noise and sinewave and square wave signals into the HDMI stream for testing.

11. **RGB Triplet** – Use this menu with the window pattern to create any window size color swatch for advanced measurement. Additionally, you can set the background color using the same method. You have the possibility of creating over 16K colors. To use press OK and then up or down arrow to change – press OK again to make the change. RGB triplets and APL (background color or average picture level (API) - In video systems, the average level of the picture signal during active scanning time integrated over a frame period; defined as a percentage of the range between blanking and reference white level. CalMAN and other calibration software call on specific triplets for more precise calibration and in the creation of LUTs (lookup tables).



12. **Standby Setting** – Standby Off and Standby On – Allows you to select when SIX-G going into sleep mode – generally, with no activity (HPD) the unit will shut down after 10 minutes to conserve power.
13. **Save EDID** – On the unit this feature allows you to save up to 6 EDIDs in the field from any sink (TV/AVR) device. The PC Interface software allows you to do more in depth EDID functions like moving the EDID you captured in the field to another device or to save the EDID on the PC for sending to a manufacturer.
14. **Sink EDID Info** – Gives you basic EDID data including preferred timing on the connected display. PC Interface gives you complete EDID data.
15. **Battery Status** – provides a bar graph of battery charge level.

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**PC Software included:**

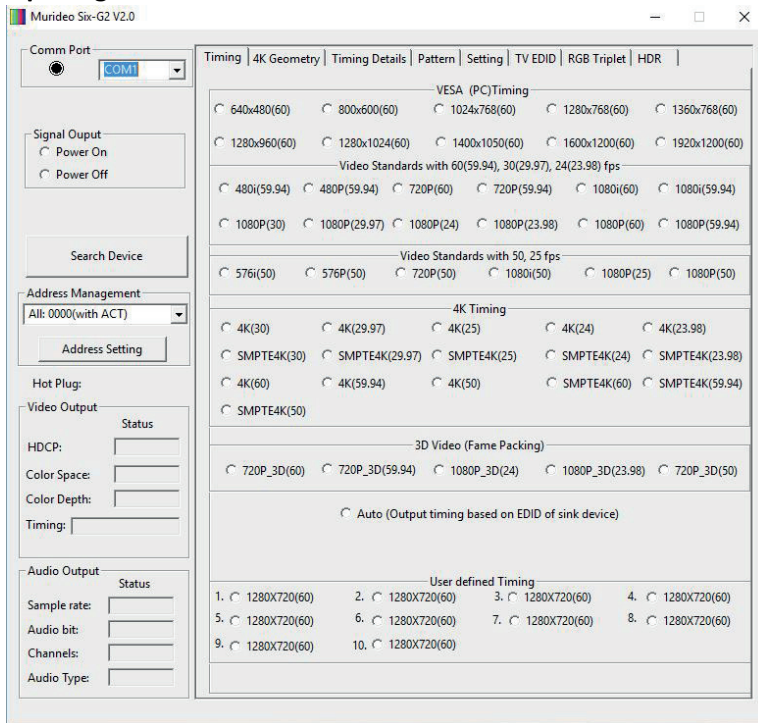
**PC Interface** – This is a program that ships with the Murideo SIX-G free and lets you control the unit from your PC (Mac – use Parallels, Bootcamp or other PC emulator).

**Connection** – Connect from your PC USB port to the SIX-Gs USB Micro port with the supplied cable. No driver installation is required. USB is serial under the hood and the SIX-G will show up as a COM port in Device Manager.

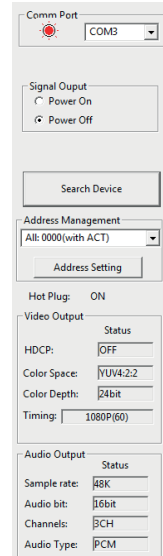


**Run**–The program by double-clicking on this icon. The program will either be on a USB stick that comes with the unit or can be downloaded from the Murideo.com website.

**Opening Screen:**



Opening Screen



Status Panel

Use:

1. To connect click on SEARCH DEVICE – this will find the COM port & change the COM Port light to RED as seen above. The status panel is viewable from all pages.
2. Timing – Click on the Timing you want the generator to output.

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3. Timing Details – This will give you detailed information about the signal you are generating. You can also use this page to define new user defined timings.

The screenshot displays the 'Timing Details' configuration screen. At the top, there are tabs for 'Timing', 'Timing Details', 'Pattern', 'Setting', 'TV EDID', and 'RGB Triplet'. The 'Timing Details' tab is active.

Parameters are organized into several sections:

- Video clk:** 594 MHz
- H freq:** 135 KHz
- Scan type:** Progressive (selected), Interface
- H active:** 3840
- V freq:** 60 Hz
- Sync polarity:** Hsync: + (selected), -; Vsync: + (selected), -
- V active:** 2160
- Vs width:** 10
- H total:** 4400
- Hs width:** 44
- V total:** 2250
- Hs offset:** 368
- H blank:** 560
- Vs offset:** 8
- V blank:** 90

Buttons include 'Update Status', 'Save to Userdefine Timing', and a 'No.' dropdown menu.

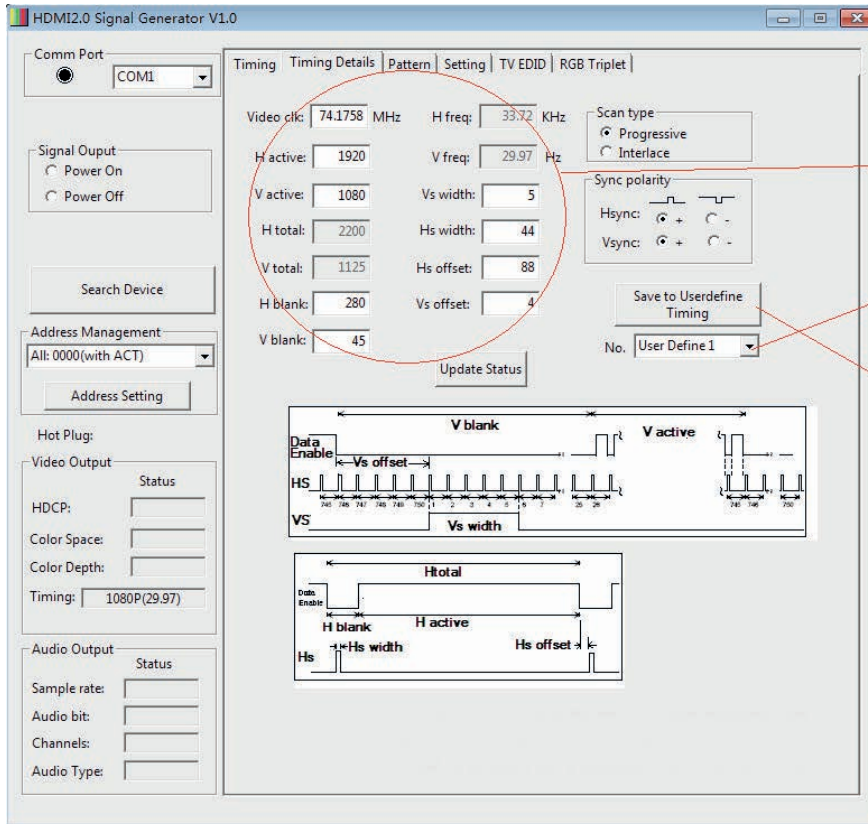
Two waveforms are shown below the parameters:

- Vertical Timing Diagram:** Shows 'V blank' and 'V active' periods. It includes sub-diagrams for 'Vs offset' and 'Vs width'.
- Horizontal Timing Diagram:** Shows 'H total', 'H blank', and 'H active' periods. It includes sub-diagrams for 'Hs width' and 'Hs offset'.

Timing Details Screen

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4. You can also set some USER DEFINED FORMATS



How to add as preset user defined Timing:

1. Please enter into fields desired (valid) video parameters. Note that maximum allowed resolution for User Defined presets is 1920 x 1200 (WUXGA).
2. Select from list User Defined Preset number
3. Save newly created Timing data of User defined Preset to chosen User Defined memory slot number.

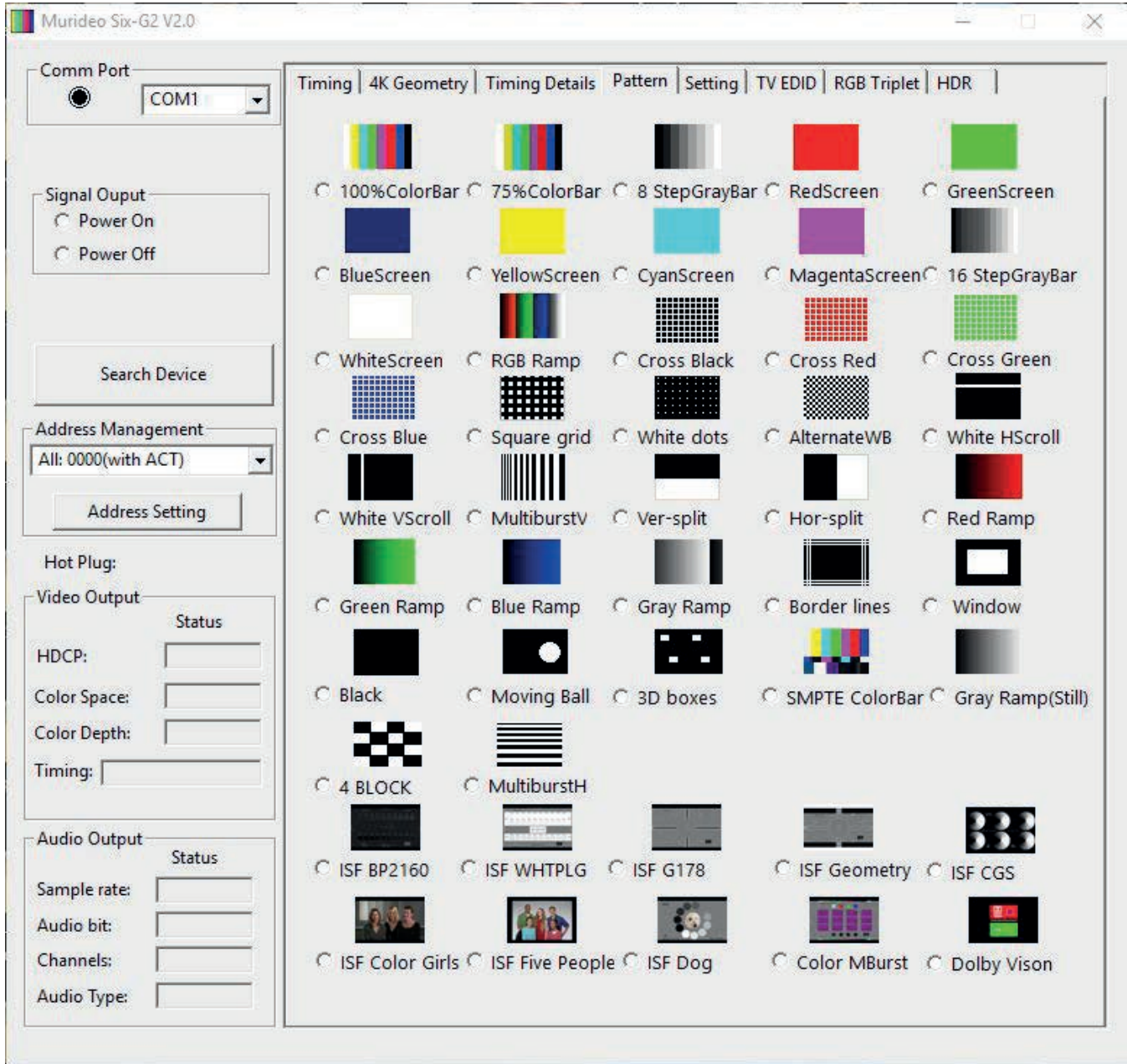
Procedure of creating User Defined Timing

Task of creating non-standard video resolutions / timings (mostly related to VESA domain) is very simple with SIX-G.

Please follow above 3 steps listed on illustration and you can generate wide variety of Specific video resolutions practically for any resolution till VESA 1920 x 1200 (WUXGA).

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5. Patterns – select the pattern you need here.



Pattern Selection Screen

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- 6. Settings – This lets you select various audio and video settings including:
  - a. HDMI/DVI
  - b. HDCP Mode
  - c. Color Space
  - d. Color Depth
  - e. Audio Source
  - f. Audio Sample Rate
  - g. Audio Bit
  - h. Audio Channel & Speaker Settings
  - i. Reset Button – reset to default (preferred EDID timing).

The screenshot shows a settings interface with the following sections:

- Timing** | Timing Details | Pattern | **Setting** | TV EDID | RGB Triplet
- HDMI/DVI**:  DVI,  HDMI,  AUTO
- HDCP**:  HDCP OFF,  HDCP 1.4,  HDCP 2.2
- Color Space**:  RGB Full,  RGB Limit,  YUV4:4:4,  YUV4:2:2,  YUV4:2:0,  AUTO
- Color Depth**:  24bit,  30bit,  36bit,  48bit,  AUTO
- Audio Source Selection**:  Internal generated,  External Stereo Input
- Audio Sample Rate**:  32K,  44K,  48K,  88K,  96K,  176K,  192K,  AUTO
- Audio Bit**:  16bit,  20bit,  24bit,  AUTO
- Audio channel and speaker setting:** 12: 5.1CH RR\_RL\_FC\_LFE\_FR\_FL
- Reset to Default Setting** button

Settings Screen

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7. EDID Settings. Use this to read and save EDIDs from the TV.
  - a. While connected to the display press the READ EDID button. The screen below will appear.

The screenshot displays the EDID Management interface with the following sections:

- Timing Details:** A hex dump of EDID data from 00 to f0.
- EDID read From:** A dropdown menu set to 'TV EDID' with buttons for 'Read EDID', 'Write EDID', 'Save EDID', and 'Open EDID'.
- General Info:**
  - Manufacture's Name: PHL
  - Product Code: 37382
  - Video Signal Interface: Digital
  - Color Bit Depth: Reserved
  - Display Product Name: Philips FTV
  - Vertical Rate: 48Hz-62Hz
  - Horizontal Rate: 15KHz-70KHz
  - Maximum Pixel Clock: 170MHz
  - Extension Device Support:
- HDMI EDID:** check sum Ok !
- Video Information:**
  - Preferred Timing: 1920x1080@60Hz
  - Detailed Timing: 1920x1080@50Hz
  - Extension Detailed Timing1: 1920x1080@24Hz
  - Extension Detailed Timing2: 1920x1080i@50Hz
  - Extension Detailed Timing3: 1280x720@50Hz
  - Short Video Descriptor:
    - 1920x1080p@60Hz 16:9
    - 1920x1080p@50Hz 16:9
    - 1920x1080p@24Hz 16:9
    - 1920x1080p@30Hz 16:9
    - 1920x1080p@25Hz 16:9
    - 1920x1080i@60Hz 16:9
    - 1920x1080i@50Hz 16:9
    - 1280x720p@60Hz 16:9
- Audio Information:**
  - Audio Format: LPCM.
  - Audio Channel(s): 2
  - Sample Frequency:
    - 96KHz
    - 88KHz
    - 48KHz
    - 44.1KHz
    - 32KHz
  - Sample Bit:
    - 24Bit
    - 20Bit
    - 16Bit
  - Audio Format: AC-3.

EDID Management Screen

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8. **RGB Triplet.** Allows you to set the following:
- Window color – enter Red, Green & Blue value.
  - Background color - enter Red, Green & Blue value.
  - Window Size – from 1% to 100%
  - Scroll – Use this to make the window scroll across the display under test.
  - Update to Machine – used to execute the values entered.

RGB Triplet Screen

### Test Patterns and Usage

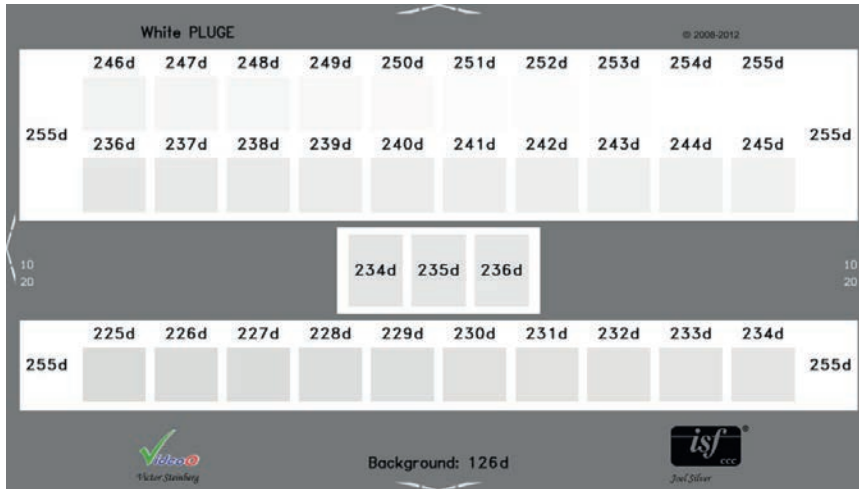
The Murideo SIX-G has three types of test patterns:

1. Visual test patterns which can be used to roughly set display parameters and check performance and calibration by eye. Ex. White PLUGE, Black PLUGE, Geometry, Color Girls, etc.
2. Metering patterns that can be used with a simple meter to read and adjust colorimetry ex. Solid primary, secondary and grey colors – usually accessed directly from 3<sup>rd</sup> party software like CalMAN. Also available via “triplets” menu.
3. Dynamically generated patterns –ex. The SIX-G can create any color and window size and any APL via generator or PC program.

This is an explanation and how to use the visual patterns.

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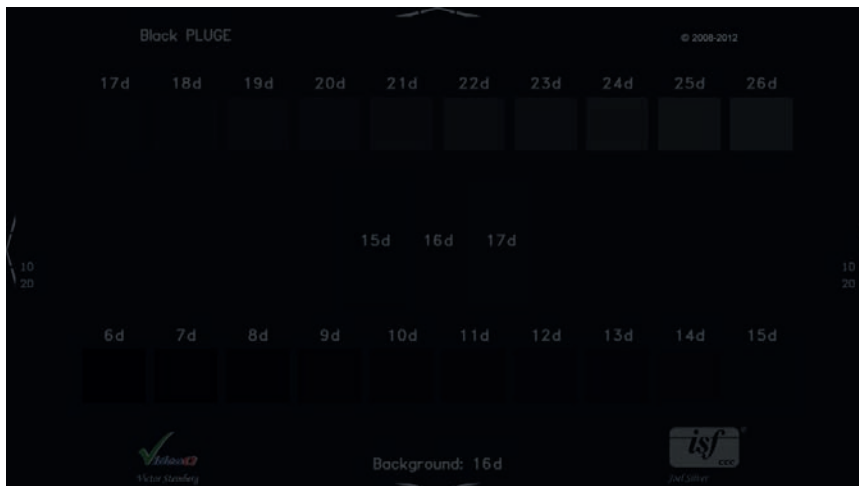
**Contrast – ISF White PLUGE**



This pattern is designed for setting peak white level using the **Contrast control**.

The goal is to get Contrast set as high as possible without clipping the brightest whites and colors. All of the numbered white boxes should be visible and distinct from the surrounding background up to at least 250d, the top two or three boxes may be difficult to distinguish from the background unless you are in a dark room with your eyes fully adjusted to the ambient level. To use this pattern, turn up Contrast until the boxes start to disappear. Once they disappear back the contrast level up a few clicks. The intent is to have as many boxes visible without clipping or color shift. Note: Do not turn contrast down to try and hit 235 (as in 16-235 SMPTE Range) – it is better to clip white slightly than to reduce light output.

**Brightness – ISF Black PLUGE**



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This pattern is designed for setting black level using the **Brightness control**.

First turn up Brightness black level is clearly elevated and boxes below 16 are visible. Then turn Brightness down until box 16 matches the background. Once 16 blends into the background box 17 and above will be visible.

After setting Brightness, you should return to Contrast to make sure that it is set properly, because on many displays the Brightness and Contrast controls affect each other. Move back and forth between the Brightness and Contrast patterns and readjust until both patterns look correct. Then move on to Color and Tint.

Note: If you just can't get black level set correctly check the display for an HDMI setting like HDMI full or limited range or HDMI high or low and change this setting and go back and try to adjust black level.

#### Color and Tint – SMPTE Color Bars

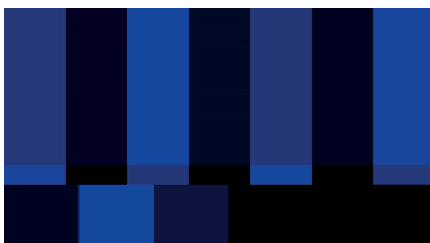


This pattern is designed for setting the Color and Tint controls. (Note that Color might be called “Saturation” and Tint might be called “Hue” on some displays.)

If your display has a “blue only” mode, use that. Otherwise use the Color Girls or Portrait Display patterns to verify flesh tones and colors. Most displays today have a blue-only mode – if they don't – don't use filters – they don't work with the new displays. Put the TV in blue-only mode.

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Adjust Color so the blue and white boxes match. Adjust Tint so the magenta and cyan boxes match. You may need to go back and forth between the two controls to get both sets of boxes to match.



Incorrectly adjusted - outside bar: (color) don't match and inside bars (tint) don't match. Adjust color and tint until the bars



Adjusted Correctly

ISF Color Girls



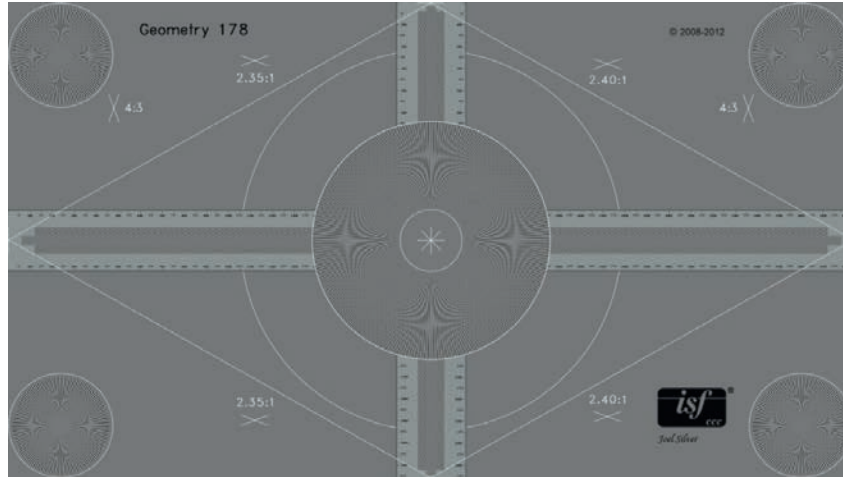
If there is no blue only mode on display use the above pattern as follows:

- Girl on left – pale
- Girl on right – sun burned
- Girl in center – perfect

If you color decoder adjustments are incorrect the girl on the left for instance could look good (color too high) – if the girl on the right look good – color too low...etc. try it out.

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### Sharpness& Geometry – ISF Geometry Pattern

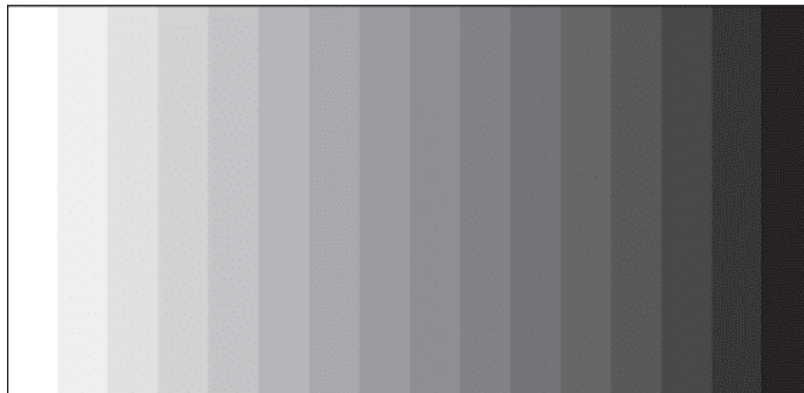


This pattern is used to set the Sharpness control.

This control should be set while seated in the normal viewing location. In general, you would like Sharpness to be set to the highest level that doesn't produce distracting visual artifacts. When Sharpness is correct, you should not see ripples near any of the lines in the image. The vertical and horizontal lines should have clean, sharp edges with no ghost lines or bright halos next to them. The circles and diagonal lines should be smooth and free of stair-stepping. The fine patterns on the top, bottom, left, and right edges of the screen should largely blend in with the background.

Start by turning up the Sharpness control until you start to see one or more of the artifacts listed above, then turn it down until the artifacts just barely disappear.

### Color Temp – 16-Step Gray Bars



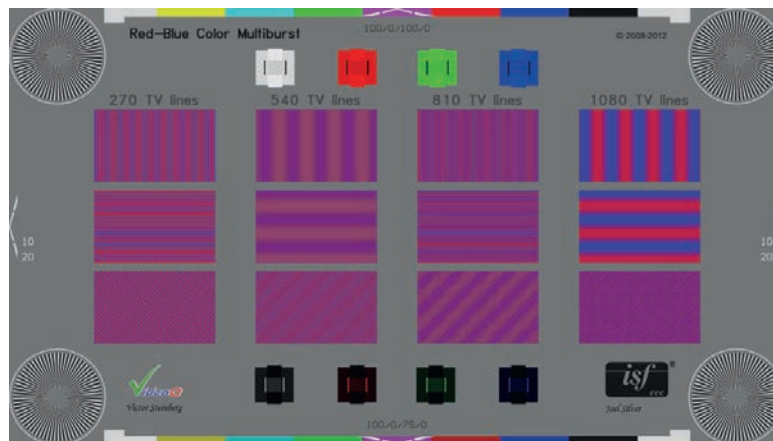
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This pattern is used to choose a basic Color Temperature mode, for displays that have selectable color temperature.

Without special test equipment, it is impossible to set this perfectly, but it is possible to avoid obviously incorrect settings. The goal is to get the pattern to look like neutral white and gray with no obvious color tint. Color temperatures that are too low will look yellow or orange tinted, and color temperatures that are too high will look blue tinted. If your display has a “D65” or “6500K” setting, that’s likely to be the best choice. This may also be warm 1 or warm 2 modes.

If you have a 6500 degree “natural light” lamp and an 18% gray card, you can light the card with the lamp in an otherwise dark room and choose a color temperature that matches it as closely as you can. Otherwise just choose the most neutral white available.

### Color Space Evaluation – ISF Color Multiburst



This pattern is used to choose the most appropriate output color space from your Blu-ray Disc player and/or video processor.

*Spears & Munsil explanation of pattern: Because chroma is upsampled when converting 4:2:0 YCbCr to RGB, in a sense every display scales this pattern, even a native 1080p display. In some cases the player scales the chroma vertically to produce 4:2:2 YCbCr, and then the display scales it horizontally while converting to RGB. Or the player may output RGB, in which case the player is doing the chroma scaling. For players that have different output options over HDMI, you can change them while viewing this pattern and see the differences in how the player and the display handle the chroma channel. The individual sine waves in the center of each burst should look even, with no color shifts or intensity shifts on either side of the peaks. The waves should look smooth and not posterized. If the last burst turns gray, it tells you that the display is scaling the*

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*image down in YCbCr, which produces a slightly lower quality image than converting the 1080p signal to RGB and then scaling it to the display resolution.*

Color spaces can include 4:2:2 YCbCr, 4:4:4 YCbCr, 4:4:4 RGB, and possibly others. While viewing this pattern, select in turn the different color spaces, watching for problems.

Check for loss of line structure, scaling, ringing, smearing and sharp resolution.

Choose the color space that has fewest problems. If all spaces are equivalent choose 4:2:2 YCbCr.

## **HDMI Troubleshooting**

### **General**

This section covers basic troubleshooting guidance for HDMI devices and systems using the SIX-G. This is a practical field service guide and not a lab guide or debugging tool for manufacturers. We use the divide and conquer process of elimination by being able to inject known signals into an HDMI system, and it works quite well in identifying about 99% of issues that are commonly encountered in the field. At this writing (Sept 2015) the industry is in the middle of change - again - 4K UHD is upon us - and we just got done switching everybody to 1080P!

### **Features of the SIX-G that expedite the troubleshooting process include:**

- High-Bandwidth reference test patterns - 2160P60 @ 4:4:4/RGB - inject to verify system compliance and operation.
- HDCP Switch - OFF, 1.4, 2.2 - Verify system and device compatibility.
- Motion Test Patterns - Verify video quality and check for and eliminate video artifacts.
- Portability - Battery operation expedites component-to-component testing in complex distribution systems - no more fumbling for an AC outlet – especially at a POE device connection.

Caution - When troubleshooting and in general don't connect and disconnect HDMI cables and equipment while your devices are powered on (Hot Plug Event). HDMI carries a low DC voltage while connected and disconnected "hot" components can in some cases cause damage.

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## Terminology

We are going to using some terms I wanted to explain before delving into troubleshooting:

- Sink - A device that receives an HDMI signal - like an HDTV
- Source - A device that sends an HDMI signal - like a set top box or Blu-ray player
- Repeater - A device that both sends AND receives an HDMI signal - like an AVR, Processor or Switch.

## Common Problems & Solutions

### No Picture

- Color space mismatch
- HDMI Cable is too long
- Extender problem - CAT 5e too long for spec
- No power on extender
- Display or distribution system (extenders, DA, matrix, switch, AVR, etc.) does not support resolution
- Improper copy guard (HDCP)
- Outdated firmware in TV, AVR or distribution component.
- Clock stretching issue (HDMI early versions don't support)

To troubleshoot with the SIX-G inject known high-resolution signal into TV - verify static patterns and motion patterns; if the pattern does not display change to a lower resolution format.

Example: 2160P60 4:4:4 or RGB - NO PICTURE, change to: 2160P60 4:2:0 - PICTURE - in this scenario anything going though HDBaseT system should not pass (limited to 10.2 Gbps) - see below:

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Bandwidth Required for Video Signals						
Resolution	Frame rate	Chroma Sub	Pixel Clock	8-bit color	10-bit color	Remark
720p / 1080i	60 Hz	4:4:4	74.25 MHz	2.23 Gbps	2.78 Gbps	HDBaseT OK
1080p / 2K	60 Hz	4:4:4	148.5 MHz	4.46 Gbps	5.57 Gbps	HDBaseT OK
4K / UHD	30 Hz	4:4:4	297.00 MHz	8.91 Gbps	11.14 Gbps	HDBaseT 8-bit only
4K / UHD	60 Hz	4:2:0	594.00 MHz	8.91 Gbps <sup>1</sup>	11.14 Gbps	HDBaseT 8-bit only
4K / UHD	60 Hz	4:4:4	594.00 MHz	17.82 Gbps	22.28 Gbps	HDBaseT No - HDMI 8-bit only

If directly connected to the display it depends on the display specification. In some cases it could also be port specific - some ports support the higher resolution signal and some don't - you can test ports directly with the SIX-G.

### HDBaseT Refresher

Notes on category cables:

#### 70-Meter Chipset

230ft @ 1080p over CAT6a  
 197ft @ 1080p over CAT5e/6  
 130ft @ 4Kx2K 4:2:0 8-bit

#### 100-Meter Chipset

330ft @ 4Kx2K 4:2:0 8-bit

4Kx2K 60fps 4:2:0 8-bit is maximum resolution for HDBaseT

Other HDBaseT factors to consider

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Feature	HDBaseT-100	HDBaseT-70
Max Distance @ 1080P60 CAT5e/6	100m/328f	70m/230f
Uncompressed Audio & Video	Yes	Yes
Ethernet 100BaseT	Yes	No
IR & RS232	Yes	Yes
Low Power Mode	Yes	Yes
PoCC Support	Yes	Yes

Connection Diagram  
Fresco SIX-G

**TYPICAL SYSTEM DIAGRAM**



Use the SIX-G to test for resolution mismatch, color space error and HDCP error by injecting known good reference pattern into signal path.

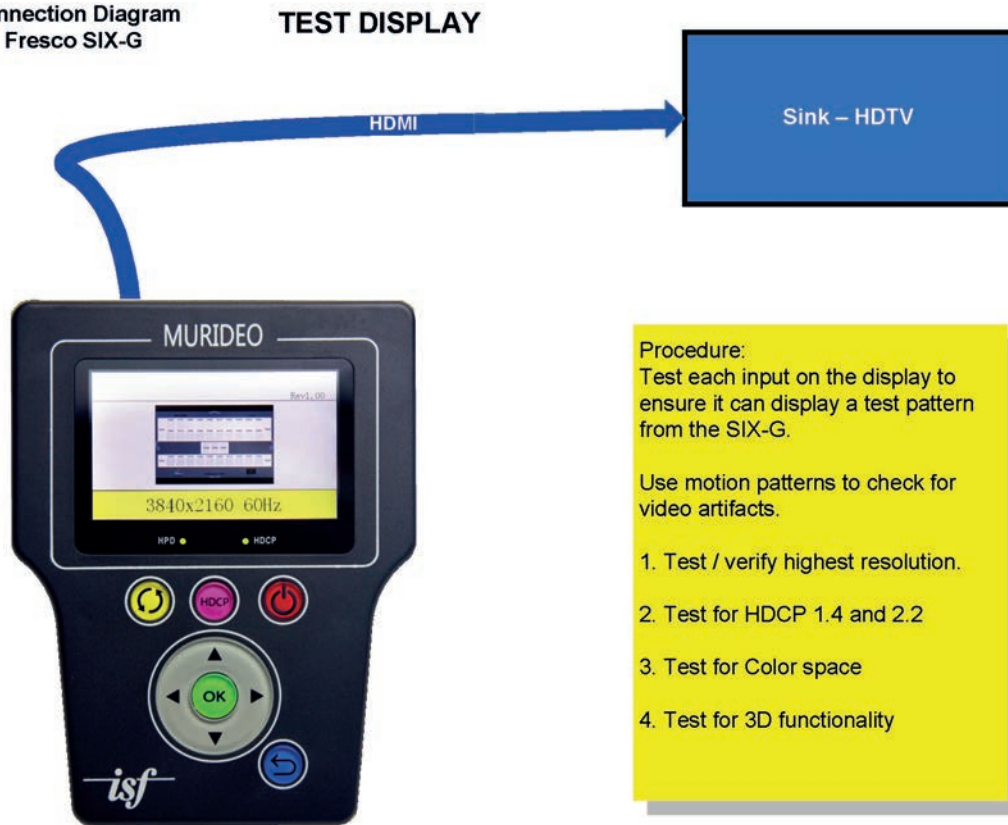
**Can't Pass High Resolution**

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- Check setting on source if available in the menu - see if a lower resolution will pass video.
- Make sure the SYSTEM is compatible with the resolution you are trying to send.
- Now that we have moved to 4K there are a lot of mixed systems out there - make sure sink, source and repeater are rated for the resolution you are trying to send.
- Make sure HDCP compatibility with all devices.

Connection Diagram  
Fresco SIX-G



Troubleshooting with the SIX-G - Inject known resolutions and timings into the suspect system. Lower the resolution until you can get a test pattern to appear. Test sink and repeater separately to determine while component is not passing the higher resolution and replace that component.

### Sparkles in Picture

- Set source to a lower resolution
- In a distributed system - same thing - set source to lower resolution.
- This is usually a bad HDMI cable or a poorly terminated CAT cable or inferior CAT cable.
- The higher the bandwidth the signal the more critical cable selection becomes.

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Troubleshooting with SIX-G - inject lower resolution signal until sparkles go away. In distributed system test all source-sink-repeater test points for defective CAT run or HDMI cable.

#### **Picture but no Sound**

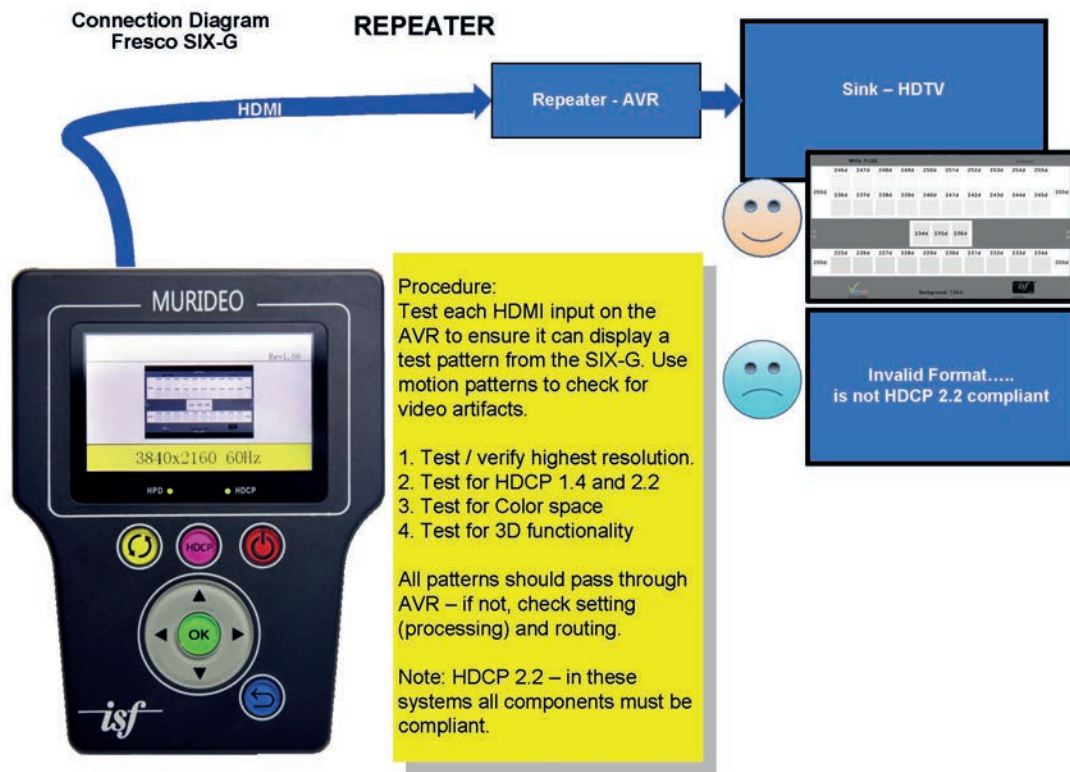
- Mismatch between source or repeater and sink for audio CODEC
- Occurs when HDCP handshake not completed
- Try forcing 2 channel audio if possible
- Make sure AVR and Display have latest firmware

Troubleshooting with SIX-G - inject various audio formats until sound returns - this will verify that connectivity is there. Use SIX-G to verify that the EDID in the display has the correct audio format listed. Usually this symptom is caused by outdated firmware - make sure and update all devices.

#### **Matrix Switch in Mixed Signal Environment - Some displays have video, others do not**

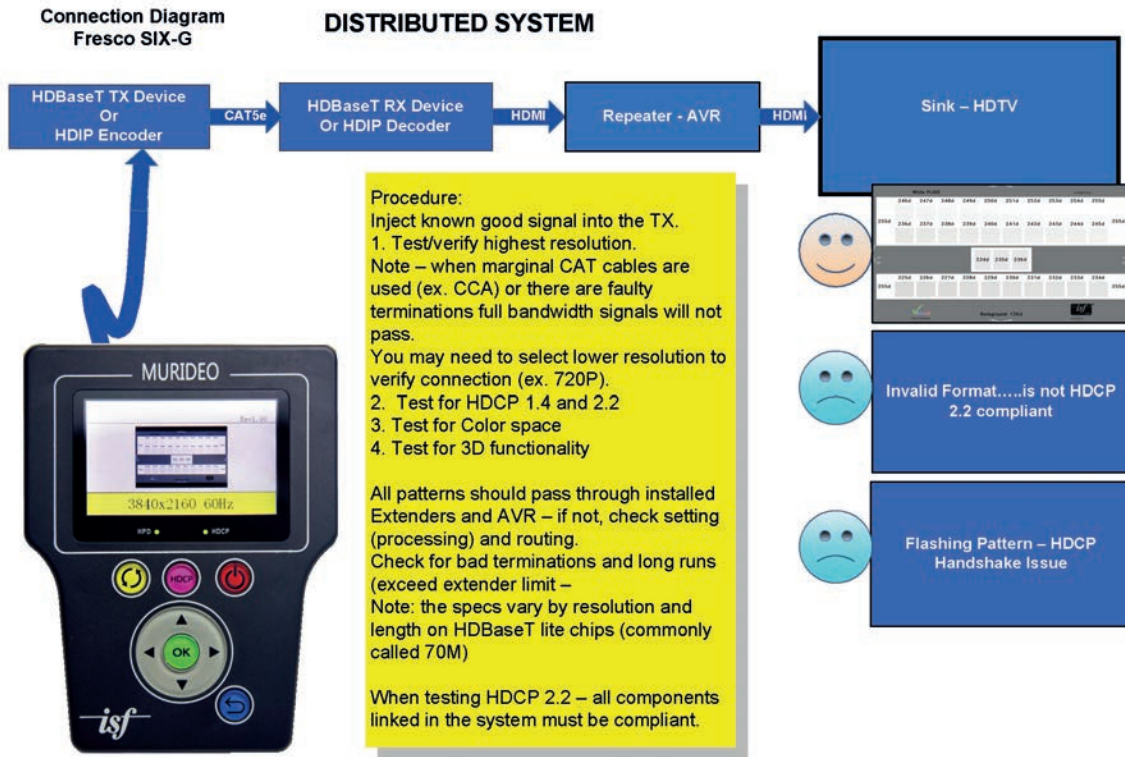
- By their very nature - without a scaler in line - mixed signal distribution systems will lock on to the lowest common resolution based on EDID. A source device can only output one signal through the HDMI cable at a time. If you force a higher resolution than the display can handle you won't get a picture on capable displays.
- Set all displays to lower resolution is an option.
- With 4K UHD and HDMI 2.0 and HDCP 2.2 must be careful - evaluate all components for compatibility - both resolution & timing plus HDCP compliance.
- Program control system so 4K UHD sources with HDCP 2.2 are only routed to compliant displays.

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Troubleshooting with the SIX-G - Test all displays for maximum resolution and HDCP compliance.

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**HDMI Tips for Installers**

- Use Active equipment over Passive wherever possible
- Insure all devices are on the most recent firmware
- Insure all devices are on the same AC circuit if possible
- Keep solid HDMI runs under 25ft (use 24AWG) and go to HDBaseT extenders for runs over 25'.
- Use best cabling possible, the higher bandwidth the better.
- CAT5e or better - use shielded (STP) when you are not absolutely sure what is behind the wall.
- Use only solid copper CAT cables - no CCA.
- Don't over complicate the system with too many devices in series. Too many handshakes cause unexpected and unwanted results.
- Try to buy all the HDMI devices and HDMI cables from one vendor as they have been tested with each other assuring system interoperability.
- Cycle power on all devices in the system - this will cause a hot plug event and will cause the source to read the sink EDID again and possibly return the system to normal operation
- Make sure everything in the system is HDCP 2.2 compliant in a UHD distribution system.

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- Clock stretching issues are common in some STB with older HDMI chipsets (although they look new). This will cause a no picture situation. You can use EDID minder to fix this, and some connectivity companies' even list a fix for clock stretching as a feature in extenders and matrix switches.
- When using POE extenders - make sure they are IEEE 802.11af - this ensures that you don't damage downstream or upstream components.

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**Specifications**

Parameter	Specification
HDMI Version	HDMI 2.0
HDCP Version	HDCP 2.2 and 1.4
HDCP ON/OFF	Yes
Maximum Clock Rate	600 Mcsc (594 MHz)
Maximum Throughput per Channel	6.0 Gbits/sec (18 GBP/sec Total)
Resolution Timings	VESA; Video Standard with 60, 59.94, 30, 29.97, 24, 23.98 fps; Video Standard with 50, 25 fps; 4k timings; AUTO and 10 USER Defined
Video Encoding	RGB, YCbCr
Video Sampling Modes	RGB4:4:4, YUV4:4:4, YUV4:2:2, YUV4:2:0 HDMI2.0
Color Bit Depth	8, 10, 12, 16, and AUTO EDID read
Patterns	Over 80 built in including ISF geometry, ISF resolution, ISF Pluge, Colors, Focus, Resolution, Bars, Ramps, Multibust, Black/White and Moving bars
Audio	LPCM
Audio Source	INT 1KHz test tone or EXT L/R IN
Audio Sampling Rate	32k, 44.1k, 48k, 88k, 96k, 176k
Audio Sampling Bit Size	16, 20 24, AUTO
Audio Channels	2
Audio Volume	Yes
Control	RS-232 and USB
Firmware	Field Upgradable
Power	5V DC Li-Ion Internal Battery or Wall Adapter
Battery Charger	Input 100-240VAC - 50/60Hz @.5A Output 5VDC @2A
Case	ABS
Size	5.4H x 4.2W x 1.2D
Weight	< 1 pound
Interface Connectors	
HDMI OUT	HDMI Type A
L/R Audio IN	
RS232	
Control	Micro USB
DC	

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**List of Supported Resolutions (this can change from time to time via FW updates)**

Maximum 4K UHD resolution is: 2160P60 4:4:4 8-bit (almost 18 GBP/sec)

640x480@60	4096x2160@24
800x600@60	3840x2160@60
1024x768@60	3840x2160@59.94
1280x768@60	3840x2160@50
1360x768@60	720P@60 3D FP
1280x960@60	720P@59.9 3D FP
1280x1024@60	1080P@24 3D FP
1400x1050@60	1080P@23.9 3D FP
1600x1200@60	720P@50 3D FP
1920x1200@60	
480i@59.94	
480P@59.94	
720P@60	
720P@59.94	
1080i@60	
1080i@59.94	
1080P@30	
1080P@29.97	
1080P@24	
1080P@23.976	
1080P@60	
1080P@59.94	
576i@50	USER 1
576P@50	USER 2
720P@50	USER 3
1080i@50	USER 4
1080P@25	USED 5
1080P@50	USER 6
4Kx2K@30	USER 7
4Kx2K@29.97	USER 8
4Kx2K@25	USER 9
4Kx2k@24	USER 10
4Kx2K@23.98	

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### **Murideo Fresco SIX-G API**

A comprehensive API document is available upon request for software developers.

### **Updating Firmware**

Field firmware updates are available via USB port. Firmware updates, when available will be posted on the Murideo.com web site, along with instructions.

### **FCC Interference and Compliance Statement**

This device complies with part 15 of the FCC Rules.

Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

### **FCC WARNING**

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

### **Caution**

To comply with the limits for an FCC Class B computing device, always use the shielded signal cord supplied with this unit. The Federal Communications Commission warns that changes or modifications of the unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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CE mark for Class B ITE (Following European standard EN55022/1998; EN61000-3-2/1995; EN61000-3-3/1995, EN55024/1998, EN60950-1/2001)

Radio Frequency Interference Statement Warning: This is a Class B product. In a domestic environment, this product may cause radio interference in which case the user may be required to take adequate measures.

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## Warranty and Getting Help

### General Warranty Terms

AVPro Global Holdings (DBA MURIDEO) offers a limited warranty for its MURIDEO products. Any product first sold to you is guaranteed to be free from defects in both components and workmanship under regular uses. The warranty period commences on the date the item ships. Attention: Your invoice with the date of purchase, model number and serial number of the product is your proof of the date of purchase. The International Limited Warranty is applicable and shall be honored in every country where MURIDEO or its Authorized Service Providers offer warranty service subject to the terms and conditions provided in this International Limited Warranty Statement.

### MURIDEO Products Warranty Period

The warranty terms for MURIDEO products are: Domestic & Asia EU & UK

MURIDEO – Fresco Six-G HDMI 2.0, 4K Test Pattern Generator & 1 Year & 2 Year

MURIDEO – Prisma Networked Video Processor 1 Year & 2 Year

### System Warranty

During the warranty period, the defective hardware of MURIDEO products will be either repaired or replaced, with new or like new products, at the discretion of MURIDEO except in the cases listed in the Limitation of Liability Clause of this document. This International Limited Warranty covers the costs of service parts and labor required to restore your product to fully functional condition. MURIDEO will, at its discretion, repair or replace any defective products or parts thereof covered by this International Limited warranty with refurbished parts of the product that are equivalent to new or like new products in both functionality and performance. A product or part that is repaired or replaced under this International Limited Warranty shall be covered for the remainder of the original warranty period applying to the product or part, or for 90-days, whichever expires last. All exchanged parts and products under this International Limited Warranty will become the property of MURIDEO.

### Obtaining the Warranty Service

Warranty service or Returned Merchandise Authorization (RMA) under this International Limited Warranty will be honored only if claims are made within the warranty period. For notifications to MURIDEO or products outside the warranty period, the process will be the same, but charges may apply. Contact details may be obtained on MURIDEO website <http://http://avpro.rnmaportal.com/> Customers are requested to perform the following actions before claiming MURIDEO product as defective:

(a) Owner must notify MURIDEO, during the warranty period, in writing of alleged defect, and allow MURIDEO a reasonable opportunity to inspect the allegedly defective product;

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(b) No Product may be returned without MURIDEO's consent, The MURIDEO RMA# must accompany all returns, and all returns must be delivered to MURIDEO within the warranty period;  
(c) Owner may, then at its own expense, return the allegedly defective Product, freight pre-paid and in the original packaging, accompanied by a brief statement explaining the alleged defect to MURIDEO;

(d) If MURIDEO determines that any returned Product is not defective, or if MURIDEO determines that the defect is not covered by the warranty, MURIDEO will return the Product to the Owner at Owner's expense, freight collect, and Owner agrees to pay MURIDEO's reasonable cost of handling and testing;

(e) Upon determining that a returned product is defective, to receive warranty service Owner will need to present the invoice showing the original purchase transaction. If shipping the product, Owner will need to package it carefully and send it, transportation prepaid by a traceable, insured method, to the MURIDEO Service Center. Package the product using adequate padding material to prevent damage in transit. The original container is ideal for this purpose. Include the RMA #, your name, return shipping address, email address and telephone number where you may be reached during business hours, inside the shipping package with the unit. Any replacement unit will be warranted under these Terms and Conditions for the remainder of the original warranty period or ninety (90) days whichever is longer.

Refer to user manual enclosed within the product package and/or information on <http://www.murideo.com/generators.html> for important tips on how to operate and troubleshoot the product.

#### **International Warranty**

Warranty may be valid when a MURIDEO product is purchased in one country and transferred to another country, without voiding the warranty. Please be advised that service availability and response time may vary from country to country. Warranty is transferrable within the warranty period.

MURIDEO is not responsible for any export and import control issues, handling fees, tariffs, import duties, and all other related fees where owner is responsible for shipping its products. This International Limited warranty does not affect your statutory rights.

#### **Limitation of Liability**

MURIDEO reserves the right to refuse warranty service of products under disputable conditions. MURIDEO also holds the rights to declare final decision whether products are within warranty conditions. The following actions and damages will result in voiding the limited warranty:

- Damage caused by act of nature, such as fire, flood, wind, earthquake, lightning, etc.
- Damage or incompatibility caused by failure to perform a proper installation or to provide an appropriate operational environment for the product, including but not limited to unstable

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wired/ wireless network connection and phone lines, bad grounding, external electro-magnetic fields, direct sunlight, high humidity and vibration.

- Damage caused by impact with other objects, dropping, falls, spilled liquids, or submersion in liquids.
- Damage caused by unauthorized repair or disassembling of the product.
- Damage caused by any other abuse, misuse, mishandling, or misapplication.
- Damage caused by third party peripherals (including but not limited to visible damages on motherboard or other electronic parts of the product such as burn spots after electric discharge, melting, fusing, splitting, etc.)
- Any unauthorized software or modification of built-in software not approved by MURIDEO.
- The serial number of the product (or serial number stickers of its parts) has been modified, removed, blurred or damaged.
- Defects caused by transportation, handling or customer abuse.

#### **Disclaimer of Warranty**

THIS WARRANTY IS EXPRESSED IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING THE IMPLIED WARRANTY OF MERCHANTABILITY, THE IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE AND OF ALL OTHER OBLIGATIONS OR LIABILITIES ON MURIDEO'S PART, AND IT NEITHER ASSUMES NOR AUTHORIZES ANY OTHER PARTY TO ASSUME FOR MURIDEO ANY OTHER LIABILITIES. THE FOREGOING CONSTITUTES THE BUYER'S SOLE AND EXCLUSIVE REMEDY FOR THE FURNISHING OF DEFECTIVE OR NONCONFORMING PRODUCTS AND MURIDEO WILL NOT IN ANY EVENT BE LIABLE FOR COST OF SUBSTITUTE OR REPLACEMENT, COST OF FACILITIES OR SERVICE, DOWNTIME COSTS, LOSS OF PROFITS, REVENUES OR GOODWILL, RELIANCE DAMAGES, LOSS OF DATA, LOSS OF USE OR DAMAGE TO ANY ASSOCIATED EQUIPMENT, OR ANY OTHER INDIRECT, INCIDENTAL, SPECIAL, OR CONSEQUENTIAL DAMAGES BY REASON OF THE FACT THAT SUCH PRODUCTS WILL HAVE BEEN DETERMINED TO BE DEFECTIVE OR NONCONFORMING. THE RIGHTS AND OBLIGATIONS OF THE PARTIES UNDER THIS AGREEMENT SHALL NOT BE GOVERNED BY THE PROVISIONS OF THE 1980 U.S. CONVENTION ON CONTRACTS FOR THE INTERNATIONAL SALE OF GOODS OR THE UNITED NATIONS CONVENTION ON THE LIMITATION PERIOD IN THE INTERNATIONAL SALE OF GOODS, AS AMENDED (COLLECTIVELY, THE "CONVENTIONS"); RATHER, THE RIGHTS AND OBLIGATIONS OF THE PARTIES SHALL BE GOVERNED BY THE LAWS OF THE STATE OF SOUTH DAKOTA, INCLUDING ITS PROVISIONS OF THE UNIFORM COMMERCIAL CODE, AS APPLICABLE. FOR THE AVOIDANCE OF DOUBT, THE CONVENTIONS ARE HEREBY EXCLUDED.

This Limited Warranty gives you specific legal rights. You may also have other rights that may vary from state to state or from country to country. You are advised to consult applicable state or country laws for full determination of your rights. Some jurisdictions do not allow the exclusion or limitation of special, incidental or consequential damages, or limitations on how long a warranty lasts, so the above exclusion and limitations may not apply to everyone.

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### **Getting Help**

For service and support, contact your local dealer.

To find your dealer or to contact MURIDEO support, go to:

<http://www.murideo.com/>

or call

+1-605-782-2462 for worldwide technical support

MURIDEO Inc.  
3518 N Casco Ave  
Sioux Falls, SD 57104

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