Extron® Electronics
INTERFACING, SWITCHING AND DISTRIBUTION

User's Manual

VTG 400D/400 DVI

Programmable Video and Audio Test Generator

68-786-01 **Rev. C**
04 09

Precautions

Safety Instructions • English

This symbol is intended to alert the user of important operating and maintenance (servicing) instructions in the literature provided with the equipment.

This symbol is intended to alert the user of the presence of uninsulated dangerous voltage within the product's enclosure that may present a risk of electric shock.

Caution

Read Instructions • Read and understand all safety and operating instructions before using the equipment.

Retain Instructions • The safety instructions should be kept for future reference.

Follow Warnings • Follow all warnings and instructions marked on the equipment or in the user information.

Avoid Attachments • Do not use tools or attachments that are not recommended by the equipment manufacturer because they may be hazardous.

Warning

Power sources • This equipment should be operated only from the power source indicated on the product. This equipment is intended to be used with a main power system with a grounded (neutral) conductor. The third (grounding) pin is a safety feature, do not attempt to bypass or disable it.

Power disconnection • To remove power from the equipment safely, remove all power cords from the rear of the equipment, or the desktop power module (if detachable), or from the power source receptacle (wall plug).

Power cord protection • Power cords should be routed so that they are not likely to be stepped on or pinched by items placed upon or against them.

Servicing • Refer all servicing to qualified service personnel. There are no user-serviceable parts inside. To prevent the risk of shock, do not attempt to service this equipment yourself because opening or removing covers may expose you to dangerous voltage or other hazards.

Slots and openings • If the equipment has slots or holes in the enclosure, these are provided to prevent overheating of sensitive components inside. These openings must never be blocked by other objects.

Lithium battery • There is a danger of explosion if battery is incorrectly replaced. Replace it only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions.

Consignes de Sécurité • Français

Ce symbole sert à avertir l'utilisateur que la documentation fournie avec le matériel contient des instructions importantes concernant l'exploitation et la maintenance (réparation).

Ce symbole sert à avertir l'utilisateur de la présence dans le boîtier de l'appareil de tensions dangereuses non isolées posant des risques d'électrocution.

Attention

Lire les instructions• Prendre connaissance de toutes les consignes de sécurité et d'exploitation avant d'utiliser le matériel.

Conserver les instructions• Ranger les consignes de sécurité afin de pouvoir les consulter à l'avenir.

Respecter les avertissements • Observer tous les avertissements et consignes marqués sur le matériel ou présentés dans la documentation utilisateur.

Eviter les pièces de fixation • Ne pas utiliser de pièces de fixation ni d'outils non recommandés par le fabricant du matériel car cela risquerait de poser certains dangers.

Avertissement

Alimentations• Ne faire fonctionner ce matériel qu'avec la source d'alimentation indiquée sur l'appareil. Ce matériel doit être utilisé avec une alimentation principale comportant un fil de terre (neutre). Le troisième contact (de mise à la terre) constitue un dispositif de sécurité : n'essayez pas de la contourner ni de la désactiver.

Déconnexion de l'alimentation• Pour mettre le matériel hors tension sans danger, déconnectez tous les cordons d'alimentation de l'arrière de l'appareil ou du module d'alimentation de bureau (s'il est amovible) ou encore de la prise secteur.

Protection du cordon d'alimentation • Acheminer les cordons d'alimentation de manière à ce que personne ne risque de marcher dessus et à ce qu'ils ne soient pas écrasés ou pincés par des objets.

Réparation-maintenance • Faire exécuter toutes les interventions de réparation-maintenance par un technicien qualifié. Aucun des éléments internes ne peut être réparé par l'utilisateur. Afin d'éviter tout danger d'électrocution, l'utilisateur ne doit pas essayer de procéder lui-même à ces opérations car l'ouverture ou le retrait des couvercles risquent de l'exposer à de hautes tensions et autres dangers.

Fentes et orifices • Si le boîtier de l'appareil comporte des fentes ou des orifices, ceux-ci servent à empêcher les composants internes sensibles de surchauffer. Ces ouvertures ne doivent jamais être bloquées par des objets.

Lithium Batterie • Il a danger d'explosion s'll y a remplacment incorrect de la batterie. Remplacer uniquement avec une batterie du meme type ou d'un ype equivalent recommande par le constructeur. Mettre au reut les batteries usagees conformement aux instructions du fabricant.

Sicherheitsanleitungen • Deutsch

Dieses Symbol soll dem Benutzer in der im Lieferumfang enthaltenen Dokumentation besonders wichtige Hinweise zur Bedienung und Wartung (Instandhaltung) geben.

Dieses Symbol soll den Benutzer darauf aufmerksam machen, daß im Inneren des Gehäuses dieses Produktes gefährliche Spannungen, die nicht isoliert sind und die einen elektrischen Schock verursachen können, herrschen.

Achtung

Lesen der Anleitungen • Bevor Sie das Gerät zum ersten Mal verwenden, sollten Sie alle Sicherheits-und Bedienungsanleitungen genau durchlesen und verstehen.

Aufbewahren der Anleitungen • Die Hinweise zur elektrischen Sicherheit des Produktes sollten Sie aufbewahren, damit Sie im Bedarfsfall darauf zurückgreifen können.

Befolgen der Warnhinweise • Befolgen Sie alle Warnhinweise und Anleitungen auf dem Gerät oder in der Benutzerdokumentation.

Keine Zusatzgeräte • Verwenden Sie keine Werkzeuge oder Zusatzgeräte, die nicht ausdrücklich vom Hersteller empfohlen wurden, da diese eine Gefahrenquelle darstellen können.

Vorsicht

Stromquellen • Dieses Gerät sollte nur über die auf dem Produkt angegebene Stromquelle betrieben werden. Dieses Gerät wurde für eine Verwendung mit einer Hauptstromleitung mit einem geerdeten (neutralen) Leiter konzipiert. Der dritte Kontakt ist für einen Erdanschluß, und stellt eine Sicherheitsfunktion dar. Diese sollte nicht umgangen oder außer Betrieb gesetzt werden.

Stromunterbrechung • Um das Gerät auf sichere Weise vom Netz zu trennen, sollten Sie alle Netzkabel aus der Rückseite des Gerätes, aus der externen Stomversorgung (falls dies möglich ist) oder aus der Wandsteckdose ziehen.

Schutz des Netzkabels • Netzkabel sollten stets so verlegt werden, daß sie nicht im Weg liegen und niemand darauf treten kann oder Objekte darauf- oder unmittelbar dagegengestellt werden können.

Wartung • Alle Wartungsmaßnahmen sollten nur von qualifiziertem Servicepersonal durchgeführt werden. Die internen Komponenten des Gerätes sind wartungsfrei. Zur Vermeidung eines elektrischen Schocks versuchen Sie in keinem Fall, dieses Gerät selbst öffnen, da beim Entfernen der Abdeckungen die Gefahr eines elektrischen Schlags und/oder andere Gefahren bestehen.

Schlitze und Öffnungen • Wenn das Gerät Schlitze oder Löcher im Gehäuse aufweist, dienen diese zur Vermeidung einer Überhitzung der empfindlichen Teile im Inneren. Diese Öffnungen dürfen niemals von anderen Objekten blockiert werden.

Litium-Batterie • Explosionsgefahr, falls die Batterie nicht richtig ersetzt wird. Ersetzen Sie verbrauchte Batterien nur durch den gleichen oder einen vergleichbaren Batterietyp, der auch vom Hersteller empfohlen wird. Entsorgen Sie verbrauchte Batterien bitte gemäß den Herstelleranweisungen.

Instrucciones de seguridad • Español

Este símbolo se utiliza para advertir al usuario sobre instrucciones importantes de operación y mantenimiento (o cambio de partes) que se desean destacar en el contenido de la documentación suministrada con los equipos.

Este símbolo se utiliza para advertir al usuario sobre la presencia de elementos con voltaje peligroso sin protección aislante, que puedan encontrarse dentro de la caja o alojamiento del producto, y que puedan representar riesgo de electrocución.

Precaucion

Leer las instrucciones • Leer y analizar todas las instrucciones de operación y seguridad, antes de usar el equipo.

Conservar las instrucciones • Conservar las instrucciones de seguridad para futura consulta.

Obedecer las advertencias • Todas las advertencias e instrucciones marcadas en el equipo o en la documentación del usuario, deben ser obedecidas.

Evitar el uso de accesorios • No usar herramientas o accesorios que no sean especificamente recomendados por el fabricante, ya que podrian implicar riesgos.

Advertencia

Alimentación eléctrica • Este equipo debe conectarse únicamente a la fuente/tipo de alimentación eléctrica indicada en el mismo. La alimentación eléctrica de este equipo debe provenir de un sistema de distribución general con conductor neutro a tierra. La tercera pata (puesta a tierra) es una medida de seguridad, no puentearia ni eliminaria.

Desconexión de alimentación eléctrica • Para desconectar con seguridad la acometida de alimentación eléctrica al equipo, desenchufar todos los cables de alimentación en el panel trasero del equipo, o desenchufar el módulo de alimentación (si fuera independiente), o desenchufar el cable del receptáculo de la pared.

Protección del cables de alimentación • Los cables de alimentación eléctrica se deben instalar en lugares donde no sean pisados ni apretados por objetos que se puedan apoyar sobre ellos.

Reparaciones/mantenimiento • Solicitar siempre los servicios técnicos de personal calificado. En el interior no hay partes a las que el usuario deba acceder. Para evitar riesgo de electrocución, no intentar personalmente la reparación/mantenimiento de este equipo, ya que al abrir o extraer las tapas puede quedar expuesto a voltajes peligrosos u otros riesgos.

Ranuras y aberturas • Si el equipo posee ranuras o orificios en su caja/alojamiento, es para evitar el sobrecalientamiento de componentes internos sensibles. Estas aberturas nunca se deben obstruir con otros objetos.

Batería de litio • Existe riesgo de explosión si esta batería se coloca en la posición incorrecta. Cambiar esta batería únicamente con el mismo tipo (o su equivalente) recomendado por el fabricante. Desachar las baterías usadas siguiendo las instrucciones del fabricante.

安全须知 • 中文

这个符号提示用户该设备用户手册中有重要的操作和维护说明。

这个符号警告用户该设备机壳内有暴露的危险电压，有触电危险。

注意

阅读说明书 • 用户使用该设备前必须阅读并理解所有安全和使用说明。

保存说明书 • 用户应保存安全说明书以备将来使用。

遵守警告 • 用户应遵守产品和用户指南上的所有安全和操作说明。

避免追加 • 不要使用该产品厂商没有推荐的工具或追加设备，以避免危险。

警告

电源 • 该设备只能使用产品上标明的电源。 设备必须使用有地线的供电系统供电。 第三条线（地线）是安全设施，不能不用或跳过 。

拔掉电源 • 为安全地从设备拔掉电源，请拔掉所有设备后或桌面电源的电源线，或任何接到市电系统的电源线。

电源线保护 • 妥善布线， 避免被踩踏，或重物挤压。

维护 • 所有维修必须由认证的维修人员进行。 设备内部没有用户可以更换的零件。为避免出现触电危险不要自己试图打开设备盖子维修该设备。

通风孔 • 有些设备机壳上有通风槽或孔，它们是用来防止机内敏感元件过热。 不要用任何东西挡住通风孔。

锂电池 • 不正确的更换电池会有爆炸的危险。必须使用与厂家推荐的相同或相近型号的电池。按照生产厂的建议处理废弃电池。

FCC Class A Notice

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. The Class A limits provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause interference. This interference must be corrected at the expense of the user.

This unit was tested with shielded cables on the peripheral devices. Shielded cables must be used with the unit to ensure compliance.

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.

NOTE: For more information on safety guidelines, regulatory compliances, EMI/EMF compatibility, accessibility, and related topics, see the "**Extron Safety and Regulatory Compliance Guide**" on the Extron website.

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Chapter One

Introduction

About this Manual

About the VTG 400D/400 DVI

Other Features

Introduction

About this Manual

This manual discusses how to set up and operate the Extron VTG 400D/400 DVI programmable video test generator.

Throughout this manual the terms “VTG”, “video test generator”, and “VTG 400D/400 DVI” are used interchangeably to refer to the same products.

About the VTG 400D/400 DVI

The Extron VTG 400D and VTG 400 DVI are advanced, programmable, and upgradeable video and audio test generators that deliver accurate, wide bandwidth video signals and high performance audio test signals. These test generators are professional quality reference tools for setup, performance evaluation, calibration, and troubleshooting audio and video systems.

The VTG 400D/400 DVI offers a comprehensive array of video test patterns, as well as a suite of audio reference signals. Video is output simultaneously as RGB, component video, S-video, and composite video. An SDI and HDSDI output is included with the VTG 400D. A DVI-D output is included with the VTG 400 DVI.

The VTG is designed to provide a wide variety of reference signal types. A total of 113 output scan rates are available for high resolution computer video, as well as HDTV, NTSC, and PAL. Up to 183 additional rates can be programmed into the VTG.

A powerful and innovative feature is the Scope-Trigger™ output (patent pending), which enables analysis of a selected area within the video image using an oscilloscope. Scope-Trigger greatly simplifies and speeds up oscilloscope setup for video signals by using a specially generated trigger signal precisely timed to a user-defined target location on the image.

Other Features

Video output connectors — RGB, composite, and component video are output via BNC connectors or a 15-pin HD connector (RGB). S-video is output from a 4-pin mini DIN connector. SDI/HDSDI (VTG 400D) is output via a BNC connector. DVI-D (VTG 400 DVI) is output via a DVI-I connector.

Audio output connectors — Audio outputs are via a 3-pin XLR connector for balanced audio, a 3.5 mm phone jack for unbalanced left and right audio, and an RCA jack (except the VTG 400 DVI) for unbalanced audio.

Scope-Trigger cursor — The Scope-Trigger cursor may be visible or invisible. If visible, the cursor may be either a crosshair or single pixel and can be positioned anywhere within the video signal using the directional cursor buttons.

RS-232 remote control — The VTG can be remotely controlled by a host computer via an RS-232 control port utilizing Extron’s Simple Instruction Set (SIS™) of basic ASCII commands or through the Windows®-based control software.

Flash-upgradeable firmware — The VTG’s firmware can be updated using the Windows-based Control program via the RS-232 port.

Nonvolatile memory — The VTG retains its configuration settings after the video test generator has been powered off.

Chapter Two

Installation and Operation

Application Example

Tabletop or Desktop Placement

Rear Panel Connectors and Cabling

Connecting Audio Outputs

Top Panel Features

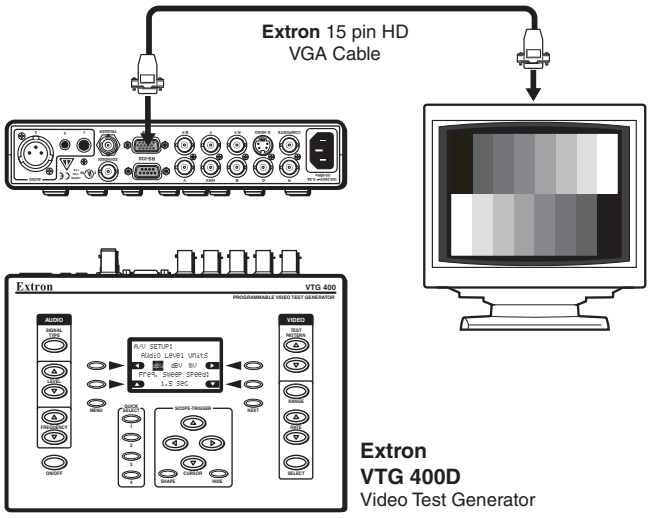
Audio Testing Features

Menus, Configuration, and Adjustments

Additional Functions

Application Example

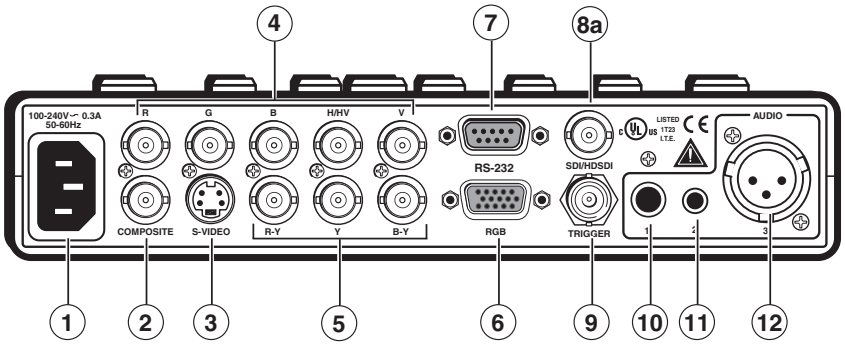
The illustration below is one example of implementing the VTG 400D.



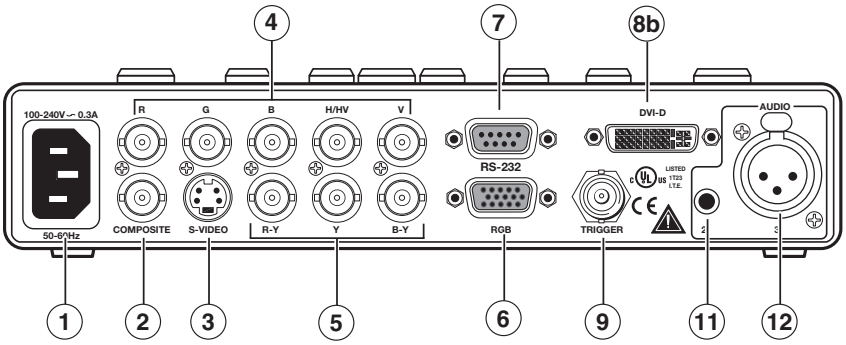
Tabletop or Desktop Placement

For tabletop or desktop placement, install the self-adhesive rubber feet/pads (provided) onto the four corners of the bottom of the enclosure

Rear Panel Connectors and Cabling



VTG 400D rear panel connectors



VTG 400 DVI rear panel connectors

NOTE *RGB video, component video, composite video, S-video, SDI/HDSDI (VTG 400D only), and DVI-D (VTG 400 DVI only) video are output simultaneously.*

(1) **AC power connector —** Plug a standard IEC power cord into the connector to connect the VTG to a 100 to 240 VAC, 50-60 Hz power source.

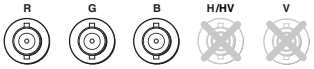
(2) **Composite video output connector —** Composite video is output through this BNC connector.

(3) **S-video output connector —** S-video is output through this 4-pin mini DIN connector.

(4) **RGB computer video output connectors —** Connect a display device to the five female BNC connectors for RGBHV, RGBS, RGsB, or RsGsBs video output, as follows:

RGBHV output

RGBS output



RGsB, RsGsBs output

⑤ **R-Y, Y, B-Y component video output connectors —** Connect a display device to the three female BNC connectors for component video output:

Component video output (R-Y, Y, B-Y)

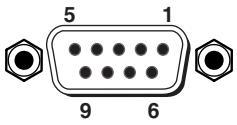
⑥ **15-pin RGB output connector —** RGBHV, RGBS, RGsB, and RsGsBs are output through this 15-pin HD connector.

⑦ **RS-232 port —** This 9-pin female D connector provides for two-way RS-232 communication. See chapter three, "Serial Communication", for information on how to install and use the control software and SIS commands.

The default protocol is 9600 baud, 1 stop bit, no parity, and no flow control.

The rear panel RS-232, 9-pin connector has the following pin assignments:

Pin	RS-232 function	Description
1	–	No connection
2	Tx	Transmit data
3	Rx	Receive data
4	–	No connection
5	Gnd	Signal ground
6	–	No connection
7	–	No connection
8	–	No connection
9	–	No connection



DB9 Pin Locations Female

⑧a **SDI/HDSDI serial digital interface output connector (VTG 400D only) —** Connect an output device to the SDI/HDSDI component output female BNC.

⑧b **DVI-I output connector (VTG 400 DVI only) —** Connect an output device to receive the DVI-D signal from the female DVI-I output connector.

⑨ **Trigger output connector —** Connect an oscilloscope to this female BNC connector when using an oscilloscope to align its display to a specific point in the video waveform.

NOTE *The oscilloscope's external trigger needs to be configured to accept a TTL level (0 to 5 V) signal.*

⑩ **RCA jack (Audio output 1) —** Unbalanced mono audio is output from this female jack. See the note below.

⑪ **3.5 mm mini stereo phone jack (Audio output 2) —** Unbalanced mono audio on both left and right channels is output from this female mini phone jack. See the note below.

⑫ **XLR audio output connector (Audio output 3) —** Balanced mono audio is output from this 3-pin male connector.

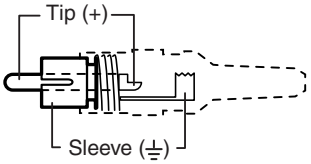
NOTE *See* Connecting Audio Outputs *later in this chapter for audio wiring instructions.*

Connecting Audio Outputs

The VTG has three types of audio output connectors: an RCA jack (VTG 400D only), a 3-pin XLR connector, and a 3.5 mm mini stereo phone jack.

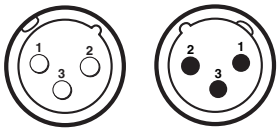
RCA connector

Unbalanced mono audio is output from this connector. Wire the RCA connector as shown here.



XLR connector

Balanced mono audio is output from this connector. Wire the female XLR connector as shown here.

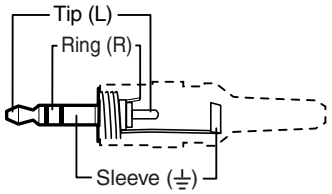


3-pin Male 3 **3-pin Female 3**

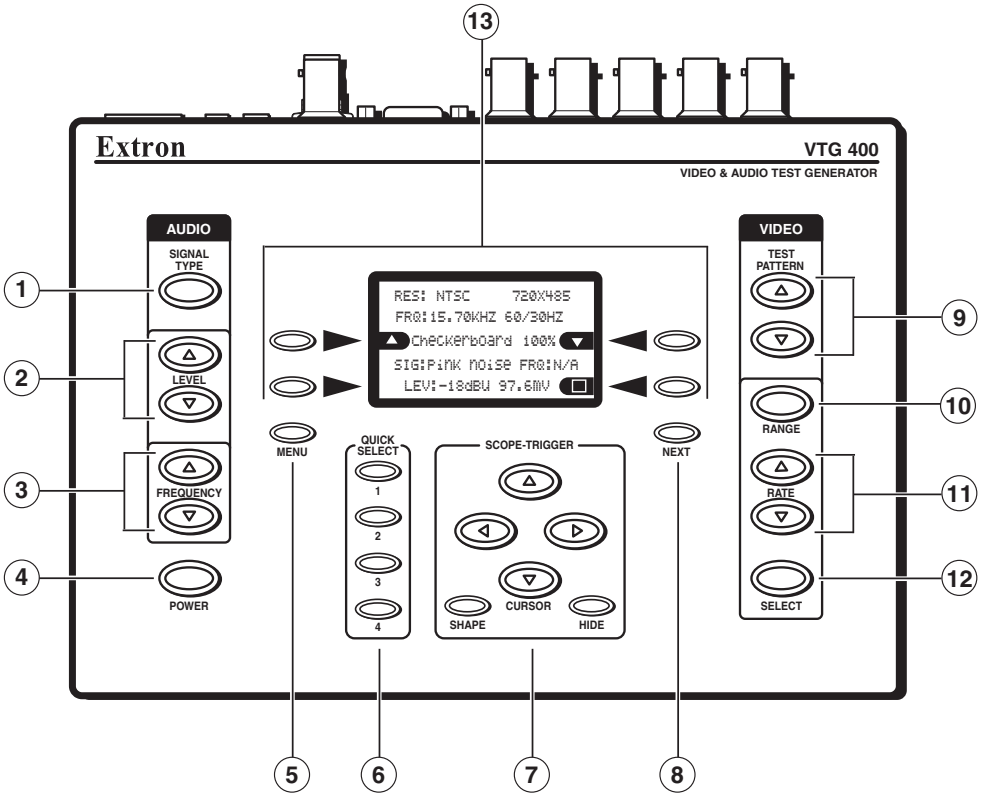
3-pin XLR Pin Configuration			
Application	**Pin 1**	**Pin 2**	**Pin 3**
Balanced audio (std.)	ground (shield) (on sending/female connector)	positive (+) (hot/live)	negative (-) (cold/return)

Mini stereo plug

Unbalanced mono audio on both left and right channels is output from this connector. Wire the mini phone plug as shown here.



Top Panel Features



VTG 400D/400 DVI top panel features

(1) **Audio signal type (Signal Type) —** Press this button to select from among seven different audio test signals: pink noise, white noise, sine wave, square wave, frequency sweep, polarity test, and sine burst. The signal type is indicated on the LCD display. See *Selecting audio signals* later in this chapter.

(2) **Audio output signal level adjustment (Level)** — Press the ▲ button to increase the RMS signal level and the ▼ button to decrease the RMS signal level. See the *Audio Setup menu* section in this chapter to specify either dBu or dBV as the signal level unit. The level setting is indicated on the LCD display.

The audio output level settings for all audio signal types (see (1) above) are retained after the VTG is powered off. The default setting is -28 dBu for polarity test and -10 dBu for all other signal types.

NOTE *If the Level buttons are held down for more than one second, the VTG automatically advances through the level adjustment in the direction indicated by the button.*

(3) **Audio frequency adjustment (Frequency) —** When the audio signal type is either sine wave, square wave, or sine burst (see (1) above), the audio frequency can be adjusted from 20 Hz to 20 kHz (sine) or 20 Hz to 5 kHz (square). Press the ▲ button to increase the frequency and the ▼ button to decrease the frequency. The adjustment is in 1/12 octave steps. See *Setting the audio frequency* later in this chapter. The audio frequency is indicated on the LCD display.

NOTE *If the Frequency buttons are held down for more than one second, the VTG automatically advances through the frequency adjustment in the direction indicated by the button.*

④ **Power —** Power up or power down the VTG by holding down the Power button for one second.

⑤ **Menu —** Press this button to enter the main menus and to move from menu to menu.

⑥ **Quick Select —** Press these buttons to save and recall up to four user-defined presets of current audio settings, video settings, or all settings. See *Quick select buttons* later in this chapter.

⑦ **Scope Trigger adjustment —** Press the cursor buttons to position the oscillosope's trigger point, press the Shape button to toggle between a crosshair or single pixel on-screen cursor, and press the Hide button to make the cursor visible or invisible. See *Scope trigger buttons* in this chapter.

⑧ **Next —** Press this button to enter a specific submenu of a selected main menu.

⑨ **Video test pattern (Test Pattern) —** Press the ▲ or ▼ button to select from among 28 different test patterns. See *Selecting a Video Test Pattern* later in this chapter.

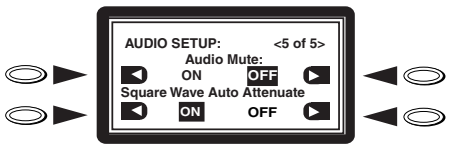
⑩ **Video output range (Range) —** Pressing this button will display the video output range menu. See *Video output range menu* later in this chapter.

⑪ **Video output rate (Rate) —** Press the ▲ or ▼ button to select from among 113 different output rates. See *Video output range and rate buttons* in this chapter.

NOTE *If the Rate buttons are held down for more than one second, the VTG automatically advances through the video output rate adjustment in the direction indicated by the button.*

⑫ **Select video settings (Select) —** Press this button to accept the specified video settings for the signal range (⑩) and output rate (⑪).

⑬ **LCD display and four arrow selection (⬭► , ◄⬭) buttons —** View this five-row liquid crystal display to read the VTG status, menus, and options. Use the four arrow selection buttons on either side of the LCD to select function option icons, as shown in the example below.



Press arrow selection buttons adjacent to the function option icons. See the table of Function Option Icons on the right.

Each arrow selection button is assigned to the adjacent function on the LCD display. The following table identifies the different function option icons.

NOTE *The VTG's backlight times out after 10 seconds of button inactivity. Pressing any button except the power button turns the backlight back on.*

Function Option Icons

Cursor movement and option selection

◄ — Press the button next to this icon to **move the cursor left** or select an option at the left of the LCD.

► — Press the button next to this icon to **move the cursor right** or select an option at the right of the LCD.

▲ — Press the button next to this icon to **increment or scroll up** to the next selection.

▼ — Press the button next to this icon to **decrement or scroll down** to the previous selection.

State indication and option selection

ON or ON — This icon indicates the function is on/active. Press the button next to this icon to toggle the "on" state to "off".

OFF or OFF — This icon indicates the function is off/not selected. Press the button next to this icon to toggle the "off" state to "on".

Option selection

YES or NO — Press the button next to this icon to select "yes" or "no".

SAVE — Press the button next to this icon to save the current settings.

CANCEL — Press the button next to this icon to cancel (*not* save) the current settings.

— Press the button next to this icon to invert the test pattern.

— Press the button next to this icon to return the test pattern from the inverted state to the original state.

Audio Testing Features

The VTG can selectively output seven different audio signal formats. The audio level can also be selected from a range of levels available for each audio format.

Depending on the audio signal format, the audio frequency may be selected from a range of values.

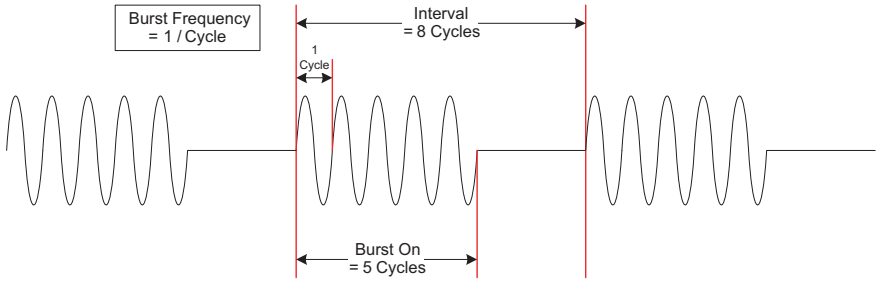
See the *Top Panel Features* section earlier in this chapter for button descriptions.

Selecting audio signals

The following table summarizes the seven audio signal formats available through the VTG. Pressing the Signal Type button repeatedly scrolls through the signals and displays the signal type on the LCD.

AUDIO SIGNAL FORMAT	DESCRIPTION
Pink Noise	Random noise that has constant energy per octave. Used in loudspeaker testing and calibration.
White Noise	Random noise that has an equal energy distribution across all frequencies between 20 Hz and 20 kHz.
Sine Wave	Used in detecting distortion. The frequency can be set from 20 Hz to 20 kHz (in 1/12 octave steps).
Square Wave	Square wave signal with 50% duty cycle and no DC offset. The frequency can be set from 20 Hz to 5 kHz.
Frequency Sweep	Varies the frequency of a sine wave signal continuously over the specified frequencies. Used to detect driver defects and mechanical sources of distortion.
Polarity test	Pulsed waveform (1 Hz pulse, positive-going, pulse width = 1ms, duty cycle = 0.1%) used in verifying the polarity of audio wiring.
Sine Burst	Generates a sine wave of a specified frequency that is gated on and off for fixed intervals. Used in testing the transient response of audio systems. • The burst *interval* is defined by the total number of cycles (on and off) in each repeating period. • The *burst on* duration is defined by the number of cycles in the interval where the sine wave is turned on. See the burst signal example below.

An example of the sine burst signal is shown in the following illustration:



Setting the audio level

The audio level for each audio signal type is selected from a range of values using the ▲ or ▼ Level buttons. The following table lists the range of values.

Audio Signal Format	Audio Level Range (in dBu increments)	Audio Level Range (in dBV increments)
Pink Noise	-4 dBu to -72 dBu	-6 dBV to -74 dBV
White Noise	+6 dBu to -72 dBu	+4 dBV to -74 dBV
Sine Wave	+6 dBu to -72 dBu	+4 dBV to -74 dBV
Square Wave	+6 dBu to -72 dBu	+4 dBV to -74 dBV
Frequency Sweep	+6 dBu to -72 dBu	+4 dBV to -74 dBV
Polarity Test	-14 dBu to -72 dBu	-16 dBV to -74 dBV
Sine Burst	+6 dBu to -72 dBu	+4 dBV to -74 dBV

NOTE *Displayed levels are for high impedance loads. For 600 ohm loads, there is a -0.7 dB (unbalanced) / -1.3 dB (balanced) difference between the displayed and actual levels.*

Setting the audio frequency

The audio frequency for each audio signal type is selected from a range of values using the ▲ or ▼ Audio Frequency buttons and observing the LCD. The following tables list the available frequencies.

Audio Signal Format	Audio Frequencies
Pink Noise	N/A
White Noise	N/A
Sine Wave	20 Hz through 20 kHz (see the following Audio Range chart)
Square Wave	20 Hz through 5 kHz (see the following Audio Range chart)
Frequency Sweep	Sweep speed (in seconds): 120, 90, 60, 30, 20, 10, 9.0, 8.0, 7.0, 6.0, 5.0, 4.0, 3.0, 2.0, 1.0
Polarity Test	1 Hz
Sine Burst	20 Hz through 20 kHz (see the following Audio Range chart)

Audio Range				
20 Hz	80 Hz	315 Hz	1.25 kHz	5.00 kHz
21.2 Hz	85 Hz	335 Hz	1.32 kHz	5.30 kHz
22.4 Hz	90 Hz	355 Hz	1.40 kHz	5.60 kHz
23.6 Hz	95 Hz	375 Hz	1.50 kHz	6.00 kHz
25 Hz	100 Hz	400 Hz	1.60 kHz	6.30 kHz
26.5 Hz	106 Hz	425 Hz	1.70 kHz	6.70 kHz
28 Hz	112 Hz	450 Hz	1.80 kHz	7.10 kHz
30 Hz	118 Hz	475 Hz	1.90 kHz	7.50 kHz
31.5 Hz	125 Hz	500 Hz	2.00 kHz	8.00 kHz
33.5 Hz	132 Hz	530 Hz	2.12 kHz	8.50 kHz
35.5 Hz	140 Hz	560 Hz	2.24 kHz	9.00 kHz
37.5 Hz	150 Hz	600 Hz	2.36 kHz	9.50 kHz
40 Hz	160 Hz	630 Hz	2.50 kHz	10.00 kHz
42.5 Hz	170 Hz	670 Hz	2.65 kHz	10.60 kHz
45 Hz	180 Hz	710 Hz	2.80 kHz	11.20 kHz
47.5 Hz	190 Hz	750 Hz	3.00 kHz	11.80 kHz
50 Hz	200 Hz	800 Hz	3.15 kHz	12.50 kHz
53 Hz	212 Hz	850 Hz	3.35 kHz	13.20 kHz
56 Hz	224 Hz	900 Hz	3.55 kHz	14.00 kHz
60 Hz	236 Hz	950 Hz	3.75 kHz	15.00 kHz
63 Hz	250 Hz	1.0 kHz	4.00 kHz	16.00 kHz
67 Hz	265 Hz	1.06 kHz	4.25 kHz	17.00 kHz
71 Hz	280 Hz	1.12 kHz	4.50 kHz	18.00 kHz
75 Hz	300 Hz	1.18 kHz	4.75 kHz	19.00 kHz
				20.00 kHz

Menus, Configuration, and Adjustments

VTG configuration and adjustments are performed by using top panel controls and the menus that are displayed on the VTG's LCD screen. The VTG can also be controlled via either the Extron Simple Instruction Set (SIS™) commands or the Windows-based control program (see chapter three for details).

Moving through menus by using front panel controls

Menu button — Press the Menu button to activate menus and to scroll to the main menus. After 15 seconds of inactivity, the VTG times out and returns to the default menu cycle.

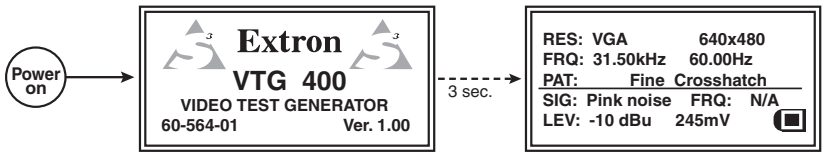
Next button — Press the Next button to move between the submenus of a selected main menu.

NOTE *If a submenu is exited by pressing an audio or video adjustment button, the NEXT button can be pressed from the default screen to return to that same submenu.*

Arrow selection (⬭► , ◄⬭) buttons — Use these buttons to scroll through the submenu options and to make selections. Refer to the flowcharts in this chapter and to specific sections for explanations of cursor button selections.

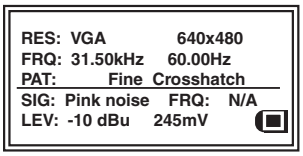
Menu overview

The default screen appears on the LCD when the unit is first powered on, as shown here.



Default menus during initial power up

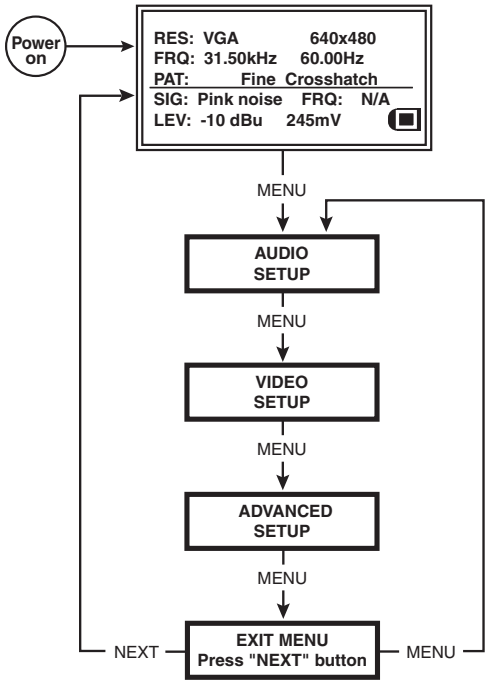
If no top panel buttons are pressed within a 15-second timeout period, the following menu is displayed. Both audio and video information are displayed.



Default menu after 15-second timeout

The main menus are shown in the following flowchart. The main menus for the VTG 400D and VTG 400 DVI are identical. Use the Menu button to scroll between main menus.

NOTE *From any menu or submenu, after 15 seconds of inactivity the VTG saves all adjustment settings, and times out to the default screen.*

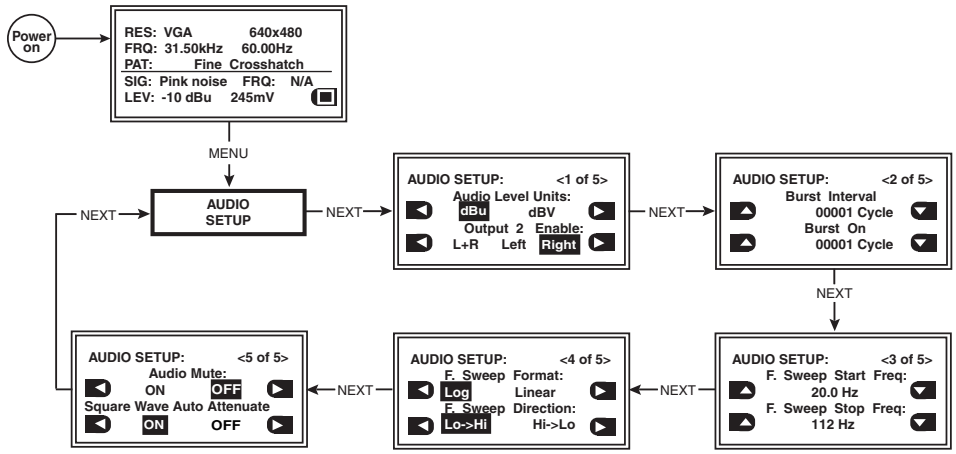


Main menus for the VTG

NOTE *If you press the Menu button while a submenu is active, the next main menu becomes active. For example, the menu changes from an Audio Setup submenu (see the following menu) to the Video Setup main menu.*

Audio Setup menu

The following flowchart illustrates the Audio Setup menu system. Pressing the Next button displays the audio setup submenus.



Audio setup menu

Audio Setup submenu (1 of 5)

Audio level units are specified from this submenu. The output channel(s) of Audio output 2 is (are) also specified.

Audio level units

Specify the audio level unit for the VTG to display. Choose from among the following unit types:

- dBu (default)
- dBV

Output 2 enable

Specify the audio channel(s) to be output from Audio output 2 (3.5 mm mini stereo phone jack). Specify from among the following channels:

- L+R [left and right] (default)
- Left
- Right

Audio Setup submenu (2 of 5)

The interval of the burst cycles and the amount of cycles in each burst are specified from this submenu.

Burst interval

Specify the number of cycles per burst interval (0 through 65,535 cycles).

Burst on

Specify the number of active cycles in each burst (0 through 65,535 cycles).

NOTE *The number of active cycles in a burst must always be less than or equal to the total number of cycles in an interval.*

Audio Setup submenu (3 of 5)

The starting and ending frequencies of the frequency sweep audio test signal are specified from this submenu.

F. Sweep Start Freq

Specify the frequency sweep start frequency (20.0 Hz through 19.0 kHz).

NOTE *The start frequency can never be set greater than the stop frequency.*

F. Sweep Stop Freq

Specify the frequency sweep stop frequency (21.2 Hz through 20.0 kHz).

NOTE *The stop frequency can never be set lower than the start frequency.*

Audio Setup submenu (4 of 5)

The format and direction of the frequency sweep audio test signal are specified from this submenu.

F. Sweep Format

- Log (default) – sweep logarithmically (more time spent in the lower frequencies)
- Linear – sweep linearly (equal time spent in each frequency)

F. Sweep Direction

- Lo->Hi – sweep from the start frequency to the stop frequency
- Hi->Lo – sweep from the stop frequency to the start frequency

NOTE *See the* Audio Setup submenu (3 of 5) *earlier in this chapter.*

Audio Setup submenu (5 of 5)

To prevent damage to connected audio equipment, audio muting and the automatic attenuation of the square wave signal can be specified from this submenu.

Audio Mute

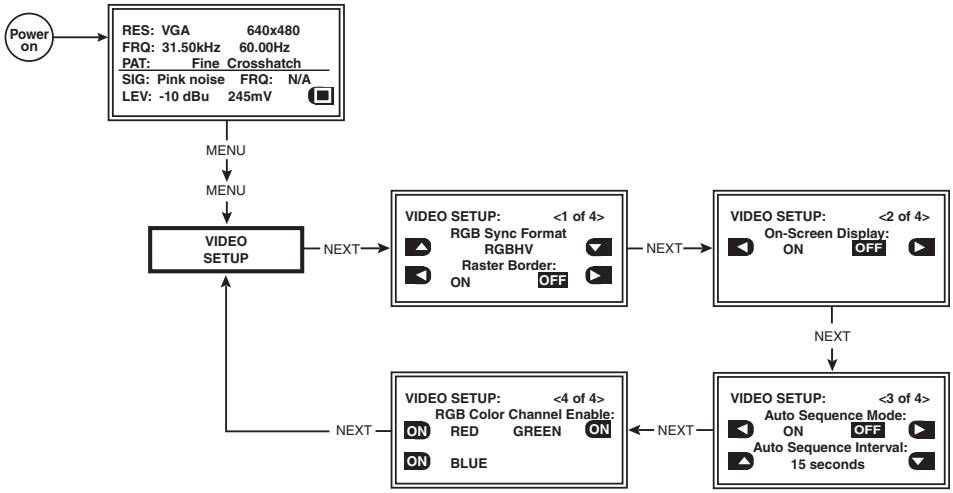
- ON – enable audio muting
- OFF (default) – disable audio muting

Square Wave Auto Attenuate

- ON – automatically attenuate the square wave signal to -40 dBu when toggling through the audio signals
- OFF (default) – disable automatic attenuation of the square wave signal

Video Setup menu

The following flowchart describes the Video Setup menu.



Video Setup menu

Video Setup submenu (1 of 4)

The RGB sync format and a raster border are specified from this submenu.

RGB sync format

Specify the RGB sync format.

- RGBHV (default)
- RsGsBs
- RGsB
- RGBS

Raster border

A one-pixel-wide white border around the edge of the active area can be enabled (on) or disabled (off).

- ON
- OFF (default)

Video Setup submenu (2 of 4)

The test pattern's on-screen display can be enabled (on) or disabled (off) from this submenu.

On-Screen Display

- ON
- OFF (default)

NOTE *When set ON and a new output rate is activated, the VTG displays the rate type, rate frequency, and resolution for 4 seconds. The text is identical to what is displayed on the VTG's LCD display and appears as white text in a black box centered on the test pattern. See the following example illustration.*

Video Setup submenu (3 of 4)

Test pattern autosequence mode and autosequence interval are selected from this submenu. Test pattern autosequence mode specifies whether to step through the test patterns in a predetermined sequence. Test pattern autosequence interval specifies how long each test pattern in the autosequence mode will be displayed.

NOTE *The predetermined sequence of test patterns is specified via RS-232 commands or the Windows-based control program. By default, all test patterns are selected for autosequence. See chapter 3,* Serial Communication.

Autosequence Mode

The mode can be enabled (on) or disabled (off).

- ON
- OFF (default)

Autosequence Interval

There are 3 options for the interval:

- 15 seconds (default)
- 30 seconds
- 60 seconds

Video Setup submenu (4 of 4)

To specify particular colors in the test patterns, the individual color channels can be toggled on or off from this submenu. See the following table of possible color combinations.

RGB Color Channel Enable

Specify each color as enabled (on) or disabled (off).

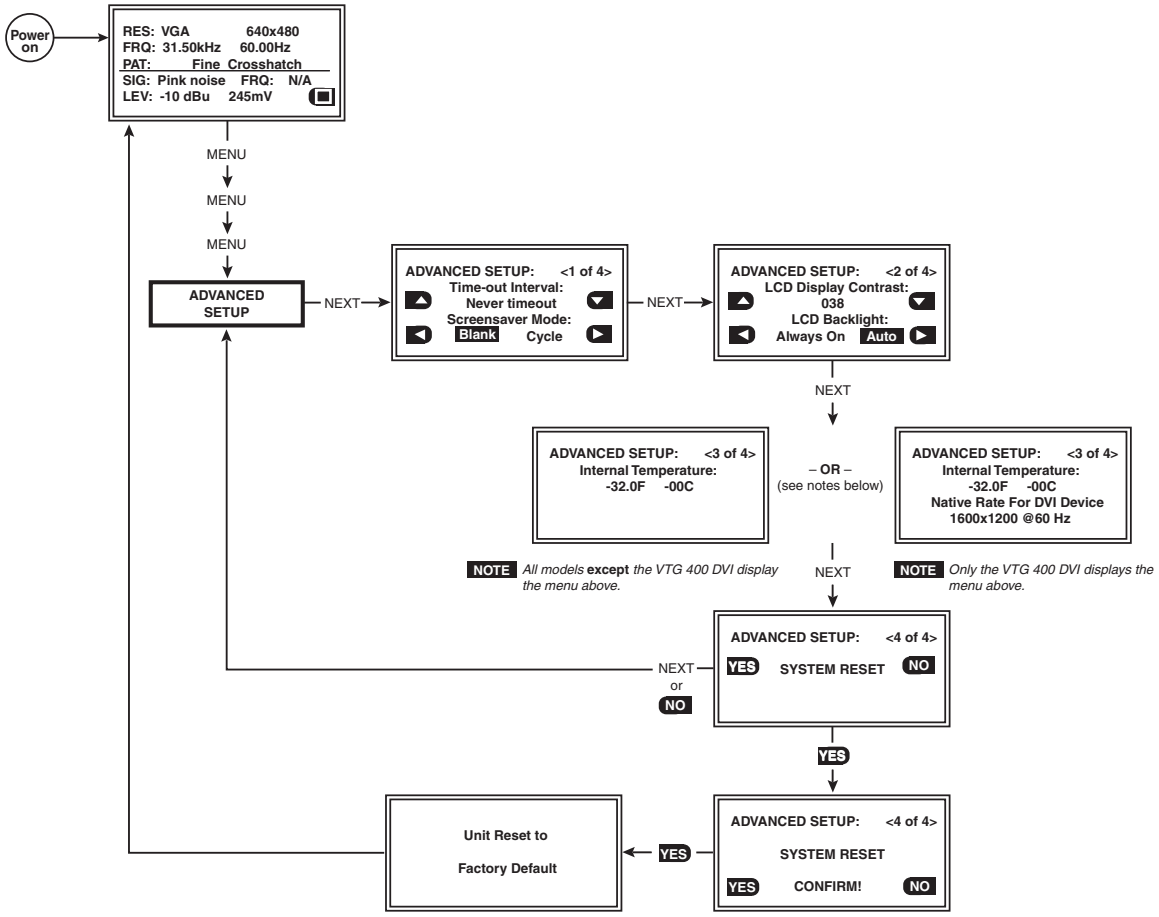
- RED (default = ON)
- GREEN (default = ON)
- BLUE (default = ON)

NOTE *This adjustment affects only the RGB outputs (BNCs and HD15 connector).*

Color Combinations	R	G	B
Black	off	off	off
Blue	off	off	on
Green	off	on	off
Cyan	off	on	on
Red	on	off	off
Magenta	on	off	on
Yellow	on	on	off
White	on	on	on

Advanced Setup menu

The following flowchart describes the Advanced Setup menu.



Advanced Setup menu

Advanced Setup submenu (1 of 4)

The screensaver timeout interval can be specified and the screensaver mode can be set to either a blank (black)/muted screen or a cycle of test patterns from this submenu.

Time-out Interval

Specify the screensaver timeout interval:

- 5 minutes
- 10 minutes
- 15 minutes
- 30 minutes
- Never time out (default — screensaver is not activated)

The following LCD display message is updated approximately every 38 seconds starting with the timeout interval selected.

After the timeout interval has has elapsed, the following LCD message is displayed.

NOTE *The timeout timer is reset whenever any VTG button is pressed.*

Screensaver Mode

The screensaver mode can be set to a blank (black) screen or the mode can be set to cycle through all valid test patterns in 4-second intervals for the video type.

- Blank (default)
- Cycle

NOTE *In blank screen mode, the sync remains active even while the video is muted. Refer to the Test Pattern Chart in* appendix A *for the table of available test patterns and their features.*

Advanced Setup submenu (2 of 4)

The VTG's LCD display features an adjustable contrast setting and a backlight.

LCD Display Contrast

- 000 through 063, select a setting while observing the LCD

LCD Backlight

The LCD backlight on the VTG can be set to remain on or to automatically turn off after 10 seconds of inactivity.

- Always On
- Auto (default)

Advanced Setup submenu (3 of 4)

The VTG's LCD displays the internal board temperature of the VTG in degrees Celsius and degrees Fahrenheit.

The native rate for a DVI device connected to the VTG 400 DVI is displayed on the LCD. This information is detected from the EDID generated by the attached DVI device.

Internal Temperature

- -67° to +257°F (-55° to +125°C)

Native Rate for DVI Device

- The preferred resolution of the device connected to the DVI connector (VTG 400 DVI only).

Advanced Setup submenu (4 of 4)

The VTG can be reset to default settings from this submenu.

System Reset

- YES
- NO

Selecting "YES" displays a confirmation menu.

System Reset Confirm

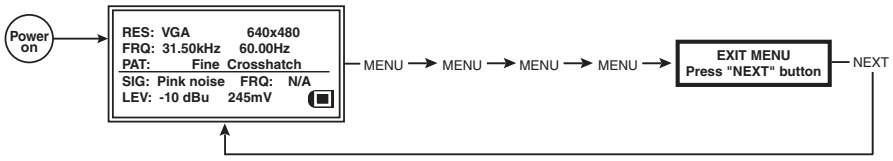
- YES
- NO

Selecting "YES" resets the VTG to factory default settings.

NOTE *A system reset does not affect any stored custom rates. Those rates are not overwritten.*

Exit menu

The following flowchart describes the Exit menu. Pressing the Next button from this menu causes the VTG to return to the default screen.



Exit menu

Additional Functions

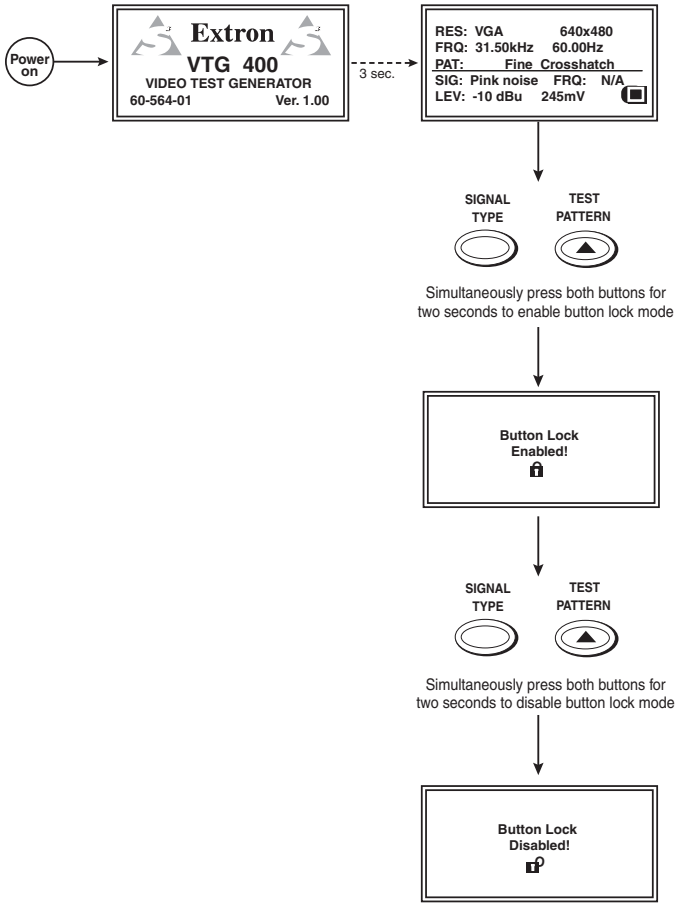
The VTG 400 has several functions that are not accessible through the Menu and Next buttons.

Top panel security lockout (button lock mode)

To prevent accidental changes to settings, simultaneously press and hold the Audio Signal Type button and the Video Test Pattern up cursor (▲) button for about two seconds to enable the VTG's button lock mode. See the following illustration.

Button lock mode locks all top panel functions. When button lock mode is active, all functions and adjustments can still be made through RS-232 control. For details on RS-232 control, see chapter 3.

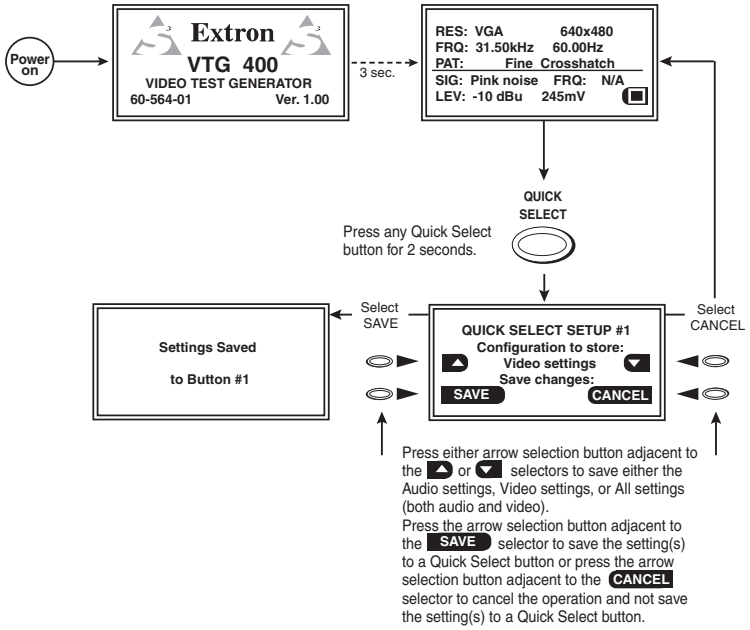
To disable button lock mode, simultaneously press and hold the Audio Signal Type button and the Video Test Pattern up cursor (▲) button for about two seconds.



Button lock mode

Quick select buttons

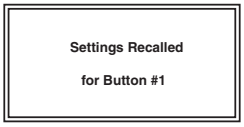
Up to four video and/or audio settings can be saved by pressing one of the four top panel Quick Select buttons for two seconds until the Quick Select Setup menu appears. The following menu flowchart illustrates this process.



Quick Select Setup menu

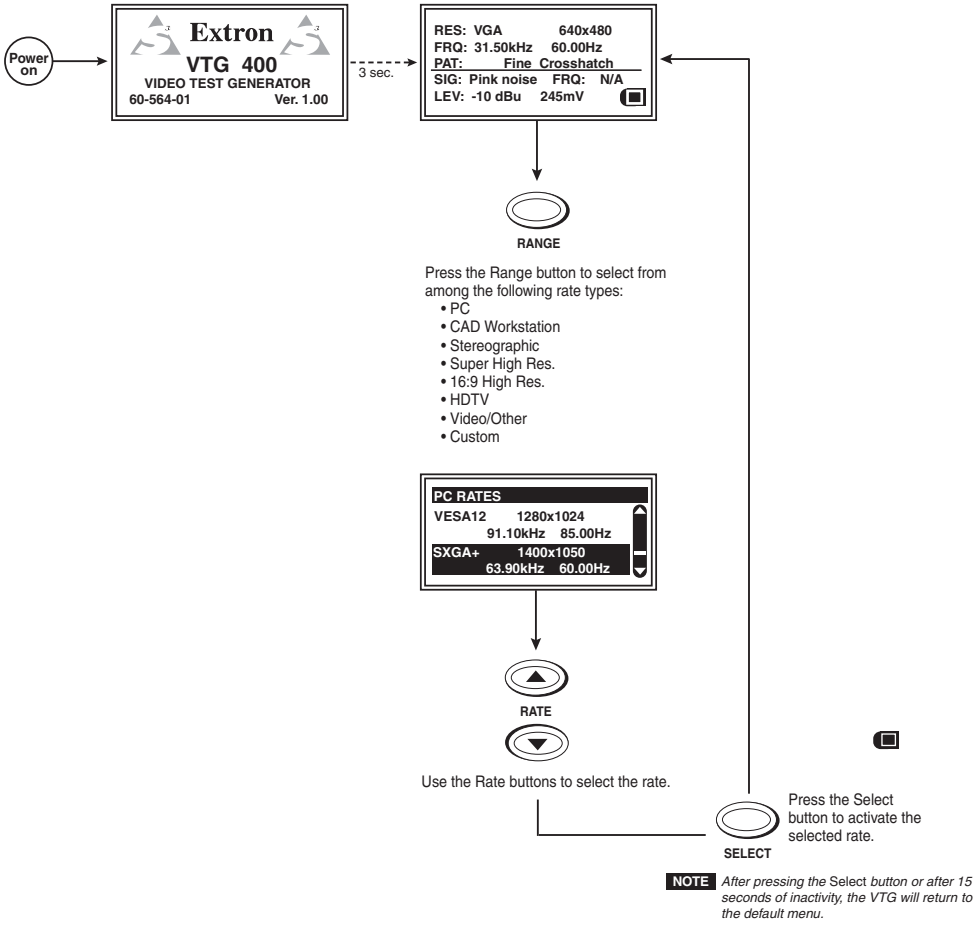
NOTE *The audio and/or video settings are saved when the Save selector (SAVE) is chosen. Nothing is saved if the menu times out after approximately 15 seconds or if the Cancel selector (CANCEL) is chosen.*

To recall a previously saved configuration, press the associated Quick Select button that was used to save the configuration. The recalled configuration overwrites only the corresponding current settings. The following illustration is an example of the LCD screen response after recalling Quick Select button 1:



Video output range and rate buttons

Pressing the Video Range button selects from among eight output range categories. Pressing the ▲ and ▼ Video Rate buttons selects an output rate for the chosen output range. The output rates are displayed two at a time on the LCD. See the following illustration.



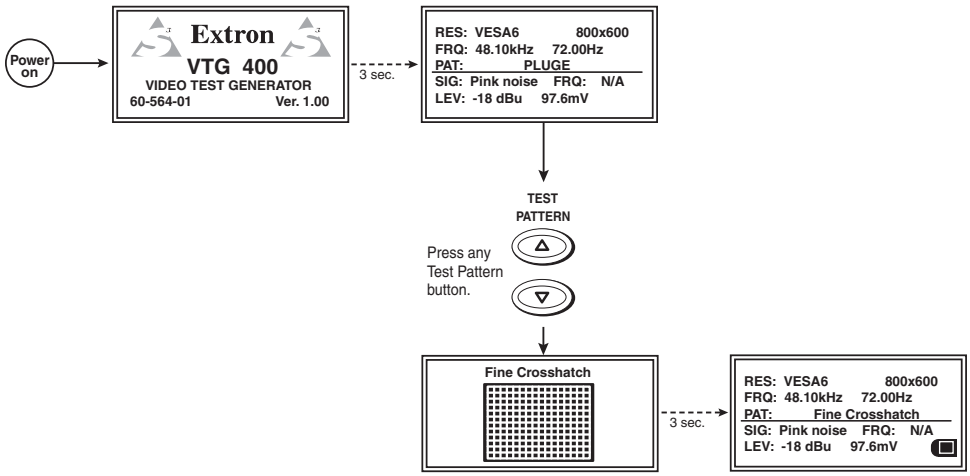
Video output range and rate selection buttons

After selecting the desired rate, press the Select button to activate the selected rate.

NOTE *The VTG returns to the default menu after pressing the Select button or after 15 seconds of inactivity.*

Test pattern selection buttons

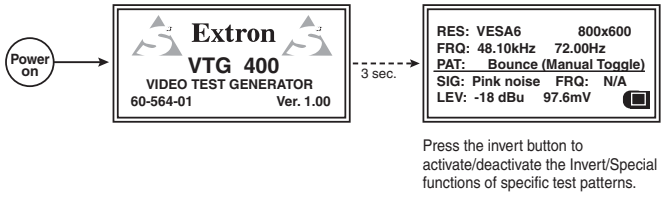
Depending on the currently selected video rate, pressing the ▲ and ▼ Video Test Pattern selection buttons selects from up to 28 different video test patterns. The newly selected test pattern displays for three seconds before returning to the previous menu. See the following menu. Refer to the Test Patterns Chart in appendix A for the table of available test patterns and their features.



Test pattern selection buttons

Invert/special features functions

Certain test patterns, as indicated in the "Invert/Special" column of the Test Patterns Chart, can be inverted, i.e., black becomes white and white becomes black, by pressing the arrow selection button adjacent to the invert symbol ◘ on the LCD screen. See the following diagram.



The following test patterns feature the invert function:

- Circles
- Safe area
- 16:9 crop
- 4:3 crop
- Rectangle/square crosshairs
- 4x4 crosshatch
- Coarse crosshatch
- Fine crosshatch
- Ramp
- Checkerboard
- H pattern

The following test patterns have a special feature function using the invert button:

- SMPTE Bars — This pattern toggles blue mode on and off.
- Bounce (manual toggle) — Toggles the center window on and off. This pattern does not invert the entire pattern.
- Contrast transfer function — This test pattern toggles the vertical lines between always on and blinking.

NOTE *Refer to the* Test Patterns in Detail *section in appendix A of this manual.*

Adjusting the video level of test patterns

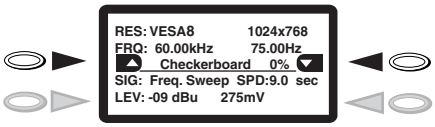
From the default cycle menu, the video level of specific test patterns can be adjusted in 1% increments (1 IRE) from 0 through 100% (0 to 100 IRE). Currently, there are six test patterns that support this adjustable level feature.

- Window (variable level)*
- Flat field*
- Flat field with targets*
- Checkerboard*
- Contrast transfer function
- Hum bar detect

* These test patterns have globally adjustable video levels, i.e., a change to one results in an identical change to all of the others.

NOTE *Adjusting the level of the contrast transfer function test pattern results in changes to the contrast ratio percentage rather than the video level. The hum bar detect and contrast transfer function levels are saved independently, so changes to other patterns' video levels do not affect these two patterns.*

Use the adjacent arrow selection buttons to adjust the video level, as shown here in the example display.



NOTE *Refer to the* Test Pattern Chart *in appendix A for the table of available test patterns and their features.*

Scope-Trigger buttons

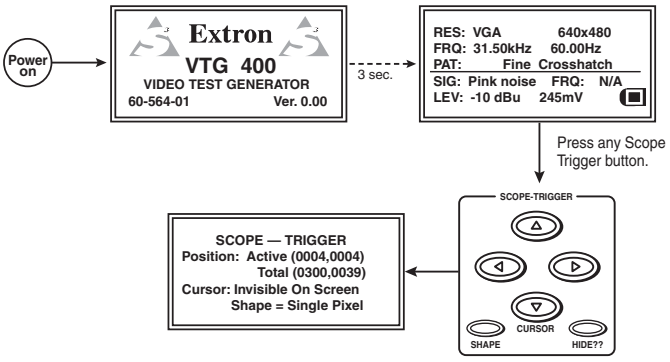
A unique feature of the VTG 400 is the ability to locate a trigger point at a specific pixel location on an oscilloscope's signal display.

NOTE *When a Scope Trigger button is pressed, the LCD displays the Scope-Trigger menu, as shown in the following figure. The cursor's location is given in coordinates (x, y) relative to the active area, as well as the total area of the screen display. The range of the coordinates is dependent on the scan rates.*

Connect the VTG 400's trigger output to the external trigger input on the oscilloscope. The trigger on the scope should be set for rising edge (⎍) slope.

Press the Scope Trigger Cursor buttons (▲, ▼, ◄, ►) to position the oscilloscope's cursor on a line (y-axis) of video and on a specific pixel (x-axis) of that line. This x-y coodinate location is the trigger point. Use the ◄ and ► buttons to position the cursor along the x-axis, and use the ▲ and ▼ buttons to position the cursor along the y-axis.

NOTE *Positioning the cursor outside of the scan rate limits for the active area results in an "N/A" display for the coordinate value and the cursor is no longer visible in the display, but the scope trigger is still active.*



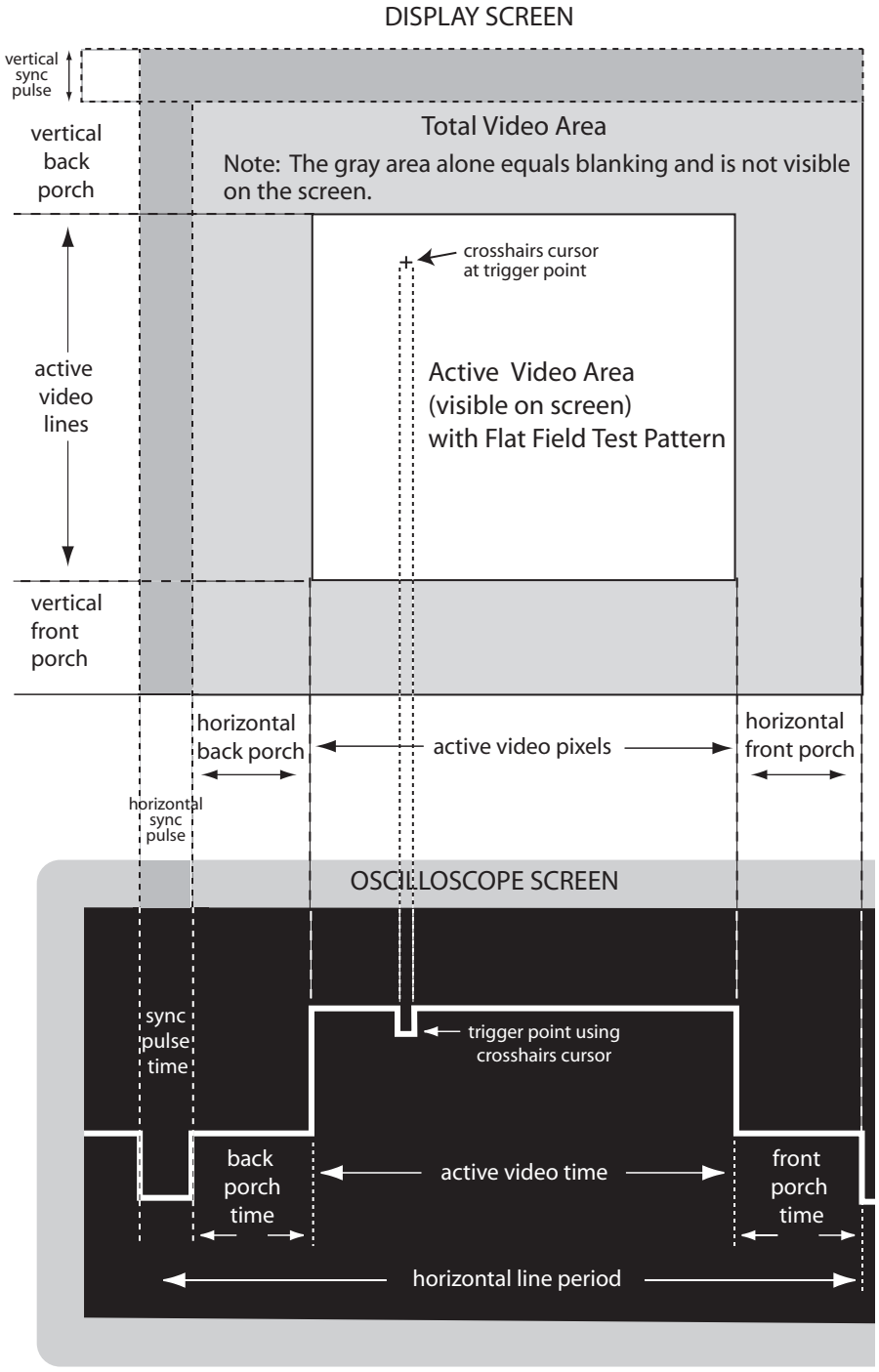
Scope trigger menu

Press the Scope Trigger Shape button to toggle the on-screen cursor between a crosshair (useful for locating the cursor on the display screen) and single pixel (useful for locating the cursor on the oscilloscope screen).

Press the Scope Trigger Hide button to turn the cursor on or off.

An example of a crosshair trigger point on a flat field test pattern is shown in the following figure.

NOTE *When doing a screen capture, hiding the cursor is recommended. A hidden cursor can still be used to change the position of the trigger point.*



Note *The combination of front porch, back porch, and sync times equals blanking*

Oscilloscope trigger point example

3

Chapter Three

Serial Communication

RS-232 Programmer's Guide

Control Software for Windows®

Using the Emulation Mode

Firmware Upgrade Through the Extron Web Site

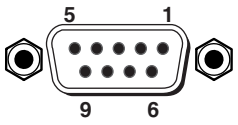
Serial Communication

The VTG can be remotely controlled via a host computer or other device (such as a control system) attached to the rear panel RS-232 connector. The control device (host) can use either the Extron Simple Instruction Set (SIS™) commands or the graphical control program for Windows®.

The VTG uses a protocol of 9600 baud, 1 stop bit, no parity, and no flow control.

The rear panel RS-232 9-pin D connector has the following pin assignments:

Pin	RS-232 function	Description
1	–	No connection
2	Tx	Transmit data
3	Rx	Receive data
4	–	No connection
5	Gnd	Signal ground
6	–	No connection
7	–	No connection
8	–	No connection
9	–	No connection



DB9 Pin Locations
Female

RS-232 Programmer's Guide

Host-to-VTG communications

SIS commands consist of one or more characters per field. No special characters are required to begin or end a command sequence. When the VTG determines that a command is valid, it executes the command and sends a response to the host device. All responses from the video test generator to the host end with a carriage return and a line feed (CR/LF = ↵), which signals the end of the response character string. A string is one or more characters.

It is also possible to send several SIS commands back-to-back in sequence.

Video test generator-initiated messages

When a local event such as a top panel selection or adjustment takes place, the VTG responds by sending a message to the host. No response is required from the host. An example of a video test generator-initiated message is listed here (underlined).

(C) Copyright 2004, Extron Electronics, VTG 400, Vx.xx ↵
The VTG sends the copyright message when it first powers on. Vx.xx is the firmware version number.

Error responses

When the video test generator receives a valid SIS command, it executes the command and sends a response to the host device. If the VTG is unable to execute the command because the command is invalid or it contains invalid parameters, it returns an error response to the host.

The error response codes and their descriptions are as follows:

E05 – VTG 400 power is off and an attempt has been made to send it a command.
E07 – An attempt to select a nonexistent test pattern number has been made.
E08 – An attempt to select a nonexistent scan rate number has been made.
E10 – Invalid command
E11 – Invalid preset #
E13 – Invalid value (out of range)
E23 – Checksum error

Using the command/response tables

The command/response tables in this chapter list valid command ASCII codes, the video test generator's responses to the host, and a description of the command's function or the results of executing the command.

The ASCII to HEX conversion table below is for use with the command/response tables.

ASCII to HEX Conversion Table										Esc	1B	CR	ØD	LF	ØA
	2Ø	!	21	"	22	#	23	$	24	%	25	&	26	'	27
(	28	)	29	*	2A	+	2B	,	2C	-	2D	.	2E	/	2F
Ø	3Ø	1	31	2	32	3	33	4	34	5	35	6	36	7	37
8	38	9	39	:	3A	;	3B	<	3C	=	3D	>	3E	?	3F
@	4Ø	A	41	B	42	C	43	D	44	E	45	F	46	G	47
H	48	I	49	J	4A	K	4B	L	4C	M	4D	N	4E	O	4F
P	5Ø	Q	51	R	52	S	53	T	54	U	55	V	56	W	57
X	58	Y	59	Z	5A	[	5B	\	5C	]	5D	^	5E	_	5F
`	6Ø	a	61	b	62	c	63	d	64	e	65	f	66	g	67
h	68	i	69	j	6A	k	6B	l	6C	m	6D	n	6E	o	6F
p	7Ø	q	71	r	72	s	73	t	74	u	75	v	76	w	77
x	78	y	79	z	7A	{	7B	l	7C	}	7D	~	7E	DEL	7F

The command/response tables use symbols (defined below) to represent variables.

Symbol definitions

↵ = CR/LF (carriage return/line feed) (hex 0D 0A)

← = CR (carriage return)

• = Space

[Esc] = Escape key

[X1] = Controller firmware version (listed to two decimal places, i.e. x.xx)

?.?? = Invalid firmware / firmware not loaded

x.xx* = Currently active firmware

[X2] = Test pattern number (1 or 2 digits)

[X3] = Scan rate number (1 to 3 digits)

[X4] = Scan rate description (32 characters)

[X5] = Timeout interval (0 – 4)
- 0 = Never time out
- 1 = 5 minutes
- 2 = 10 minutes
- 3 = 15 minutes
- 4 = 30 minutes

[X6] = Test pattern auto-sequence interval (1 – 3)
- 1 = 15 seconds
- 2 = 30 seconds
- 3 = 1 minute

[X7] = Audio test signal type
- 1 = Pink noise
- 2 = White noise
- 3 = Sine wave
- 4 = Square wave
- 5 = Frequency sweep
- 6 = Polarity test
- 7 = Sine burst

[X8] = Audio level units
- 1 = dBu
- 2 = dBV

[X9] = Audio level (positive)
Pink noise: N/A
Polarity test: N/A
All other signal types: 0 to +6 dBu
(0 dBV to +4 dBV)

[X10] = Audio level (negative)
Pink noise: -72 dBu to -4 dBu
(-74 dBV to -6 dBV)
Polarity test: -72 dBu to -14 dBu
(-74 dBV to -16 dBV)
All other signal types: -72 dBu to 0 dBu
(-74 dBV to 0 dBV)

[X11] = Audio level (positive/negative) (status only)
Pink noise: -72 dBu to -4 dBu
(-74 dBV to -6 dBV)
Polarity test: -72 dBu to -14 dBu
(-74 dBV to -16 dBV)
All other signal types: -72 dBu to +6 dBu
(-74 dBV to +4 dBV)

X14 = Audio tone frequency (1 - 121) [20 Hz to 20 kHz in 1/12 octave steps]

Audio Range				
1 = 20 Hz	25 = 80 Hz	49 = 315 Hz	73 = 1.25 kHz	97 = 5.00 kHz
2 = 21.2 Hz	26 = 85 Hz	50 = 335 Hz	74 = 1.32 kHz	98 = 5.30 kHz
3 = 22.4 Hz	27 = 90 Hz	51 = 355 Hz	75 = 1.40 kHz	99 = 5.60 kHz
4 = 23.6 Hz	28 = 95 Hz	52 = 375 Hz	76 = 1.50 kHz	100 = 6.00 kHz
5 = 25 Hz	29 = 100 Hz	53 = 400 Hz	77 = 1.60 kHz	101 = 6.30 kHz
6 = 26.5 Hz	30 = 106 Hz	54 = 425 Hz	78 = 1.70 kHz	102 = 6.70 kHz
7 = 28 Hz	31 = 112 Hz	55 = 450 Hz	79 = 1.80 kHz	103 = 7.10 kHz
8 = 30 Hz	32 = 118 Hz	56 = 475 Hz	80 = 1.90 kHz	104 = 7.50 kHz
9 = 31.5 Hz	33 = 125 Hz	57 = 500 Hz	81 = 2.00 kHz	105 = 8.00 kHz
10 = 33.5 Hz	34 = 132 Hz	58 = 530 Hz	82 = 2.12 kHz	106 = 8.50 kHz
11 = 35.5 Hz	35 = 140 Hz	59 = 560 Hz	83 = 2.24 kHz	107 = 9.00 kHz
12 = 37.5 Hz	36 = 150 Hz	60 = 600 Hz	84 = 2.36 kHz	108 = 9.50 kHz
13 = 40 Hz	37 = 160 Hz	61 = 630 Hz	85 = 2.50 kHz	109 = 10.00 kHz
14 = 42.5 Hz	38 = 170 Hz	62 = 670 Hz	86 = 2.65 kHz	110 = 10.60 kHz
15 = 45 Hz	39 = 180 Hz	63 = 710 Hz	87 = 2.80 kHz	111 = 11.20 kHz
16 = 47.5 Hz	40 = 190 Hz	64 = 750 Hz	88 = 3.00 kHz	112 = 11.80 kHz
17 = 50 Hz	41 = 200 Hz	65 = 800 Hz	89 = 3.15 kHz	113 = 12.50 kHz
18 = 53 Hz	42 = 212 Hz	66 = 850 Hz	90 = 3.35 kHz	114 = 13.20 kHz
19 = 56 Hz	43 = 224 Hz	67 = 900 Hz	91 = 3.55 kHz	115 = 14.00 kHz
20 = 60 Hz	44 = 236 Hz	68 = 950 Hz	92 = 3.75 kHz	116 = 15.00 kHz
21 = 63 Hz	45 = 250 Hz	69 = 1.0 kHz	93 = 4.00 kHz	117 = 16.00 kHz
22 = 67 Hz	46 = 265 Hz	70 = 1.06 kHz	94 = 4.25 kHz	118 = 17.00 kHz
23 = 71 Hz	47 = 280 Hz	71 = 1.12 kHz	95 = 4.50 kHz	119 = 18.00 kHz
24 = 75 Hz	48 = 300 Hz	72 = 1.18 kHz	96 = 4.75 kHz	120 = 19.00 kHz
				121 = 20.00 kHz

NOTE *Square wave test signal uses frequencies 1 through 97 only.*

X15 = Audio sweep speed (1 through 15)

1 = 1 sec	6 = 6 sec	11 = 20 sec
2 = 2 sec	7 = 7 sec	12 = 30 sec
3 = 3 sec	8 = 8 sec	13 = 60 sec
4 = 4 sec	9 = 9 sec	14 = 90 sec
5 = 5 sec	10 = 10 sec	15 = 120 sec

X16 = Scope Trigger cursor horizontal position (relative to active area)
Measured from first active video pixel in one-pixel increments.

X17 = Scope Trigger cursor vertical position (relative to active area)
Measured from first line of active video in one-line increments.

X18 = Scope Trigger cursor horizontal position (relative to total area)
Measured from beginning of the horizontal sync pulse in one-pixel increments.

X19 = Scope Trigger cursor vertical position (relative to total area)
Measured from the first line of the vertical sync pulse in one-line increments.

X20 = Scope Trigger cursor shape (1 through 2)
1 = Crosshair (default)
2 = Single pixel

X21 = Quick Select Preset number (1 through 4)

X22 = Quick Select Preset type (1 through 3)
1 = video settings
2 = audio settings
3 = all settings

X23 = Color enable type (0 - 7)

0 = black	R = off	G = off	B = off
1 = blue	R = off	G = off	B = on
2 = green	R = off	G = on	B = off
3 = cyan	R = off	G = on	B = on
4 = red	R = on	G = off	B = off
5 = magenta	R = on	G = off	B = on
6 = yellow	R = on	G = on	B = off
7 = white	R = on	G = on	B = on

X24 = Video scan rate group (1 - 7, 99)

1 = PC (default)	6 = HDTV
2 = CAD workstations	7 = video
3 = stereographics	99 = custom
4 = super high resolution	
5 = 16:9 high resolution	

X25 = Scan rate group count (1 through 99)

X26 = Scan rate group name (21 characters)

X27 = Test pattern count (1 through 99)

X28 = Test pattern name (20 characters)

X29 = RGB sync format

1 = RGBHV (default)
2 = RGBS
3 = RGsB
4 = RsGsBs

X30 = Firmware partition

1 = factory microcontroller firmware
2 = factory FPGA firmware
3 = updated microcontroller firmware
4 = updated FPGA firmware

X32 = 3.5 mm audio connector output channels

1 = both left and right (default)
2 = left only
3 = right only

X33 = Test pattern video level (0 through 100) (in 1% /1 IRE increments)

X34 = Screen saver mode

0 = blank screen (default)
1 = test pattern cycle

X35 = Firmware build number (four digits, 0001 through 9999)

X36 = Burst interval/burst on duration (1 through 65535 cycles)

X37 = Frequency sweep mode

0 = logarithmic sweep (default)
1 = linear sweep

X38 = Frequency sweep direction

0 = low to high (default)
1 = high to low

X75 = Internal temperature in degrees Fahrenheit

X76 = Internal temperature in degrees Celsius

Command/response table for SIS commands

Command	ASCII Command (host to VTG)	Response (VTG to host)	Additional description
Power			
Turn power on	1P/1p	Pwr 1 ↵	Turn VTG power on.
Turn power off	0P/0p	Pwr 0 ↵	Turn VTG power off.
View power status	P/p	1↵/0↵ = on/off	Show power status.
Front panel security lockout (executive mode)			
Enable executive mode	1X/1x	Exe 1 ↵	Enable executive mode.
Disable executive mode	0X/0x	Exe 0 ↵	Disable executive mode.
View executive mode status	X/x	1↵/0↵ = on/off	View executive mode status.
Example:	X	0 ↵	Executive mode is disabled.
Query firmware version			
General query	Q/q	X1 ↵	Show the controller firmware version.
Query all firmware	0Q/0q	X1,X1,X1,X1 ↵	Show the firmware versions for all partitions.
Query specific firmware	X30 Q/X30 q	X1 ↵	Show the firmware version for partition X30.
View build number	*Q/*q	X1 . X35 ↵	Show the firmware build number.
Request part number			
Request VTG 400 part number	N/n	60-564-01 ↵	Show the VTG 400's part #.
Request VTG 400D part number	N/n	60-564-02 ↵	Show the VTG 400D's part #.
Request VTG 400 DVI part #	N/n	60-564-03 ↵	Show the VTG 400 DVI's part #.
Request information			
Display information	I/i↵	Pat X2 • Rte X3 • Grp X24 • Tmo X5 • Asq X6 ↵	Show test pattern, output rate, scan rate group, timeout interval, auto-sequence interval.
View variable pattern video levels	1i/1I	X2 * X33 ... X2 * X33 ↵	View the list of video levels for all variable-level test patterns (excludes fixed-level patterns).
View all audio signal levels	2i/2I	+/- X11 dBu (dBV) •... +/- X11 dBu (dBV) ↵	View the list of audio levels for all signal types ("dBu" or "dBV" expressed based on X8 setting).
View "invertable" pattern list	3i/3I	X2 •... X2 ↵	View the list of test patterns that support "invert" or special purpose functions.
View internal temperature			
View internal temperature	20S	X75 F•• X76 C ↵	Show the temperature in degrees Fahrenheit & Celsius.
Quick select preset			
Recall configuration	X21 .	Rpr X21 ↵	Recall preset X21.
Save configuration	X22 * X21 ,	Spr X22 * X21 ↵	Save settings specified for X22 to preset X21.
View preset type	X21 * .	X22 ↵	Show Quick Select Preset type for preset X21.

Command/response table for SIS commands (continued)

Command	ASCII Command (host to VTG)	Response (VTG to host)	Additional description
List rates			
All rates	L/l	X4 ↵ ... X4 ↵ ↵	List VTG scan rates (all rates returned).
By range	X24 L/X24 l	X4 ↵ ... X4 ↵ ↵	List scan rates for range X24.
Set test pattern			
Specific pattern	X2 J/X2 j	Tst X2 ↵	Select pattern X2.
Increment up	+J/+j	Tst X2 ↵	Select next higher pattern.
Increment down	-J/-j	Tst X2 ↵	Select next lower pattern.
View	J/j	X2 ↵	View current setting.
Invert test pattern / Special function (blue mode for SMPTE color bars and pause for CTF)			
Invert current test pattern	1*21#	Inv1 ↵	Invert or activate the special function for the current test pattern.
Return to normal test pattern	0*21#	Inv0 ↵	Disables special function for selected pattern.
View status	21#	1↵ /0↵ = on/off	View current setting.
Set output rate			
Specific value	X3 * X24 =	Rte X3 * X24 ↵	Select rate X3 from range X24.
Increment up	+=	Rte X3 * X24 ↵	Select next higher rate in current range.
Increment down	-=	Rte X3 * X24 ↵	Select next lower rate in current range.
View	=	X3 * X24 ↵	View current setting.
Set screensaver timeout interval			
Specific value	X5 *1#	Tmo X5 ↵	Set timeout interval.
Increment up	+1#	Tmo X5 ↵	Select next higher interval.
Increment down	-1#	Tmo X5 ↵	Select next lower interval.
View	1#	X5 ↵	View current setting.
Set test pattern autosequence			
Specific value	X6 *2#	Asq X6 ↵	Set autosequence interval.
Increment up	+2#	Asq X6 ↵	Select next higher interval.
Increment down	-2#	Asq X6 ↵	Select next lower interval.
View	2#	X6 ↵	View current setting.
Set audio signal type			
Set signal type	X7 *3#	Ast X7 ↵	Select audio signal type X7.
View	3#	X7 ↵	View current setting.
Set audio tone frequency (applies to sine, square wave, and burst signals only)			
Specific value	X14 *4#	Afq X14 ↵	Set tone frequency to X14.
Increment up	+4#	Afq X14 ↵	Select next higher frequency.
Increment down	-4#	Afq X14 ↵	Select next lower frequency.
View	4#	X14 ↵	View current setting.
Set audio sweep speed (applies to audio sweep signal only)			
Set sweep speed	X15 *5#	Sws X15 ↵	Set audio sweep speed to X15.

(Continued)

Command/response table for SIS commands (continued)

Command	ASCII Command (host to VTG)	Response (VTG to host)	Additional description
View	5#	X15 ↵	View current setting.
Set audio level scale			
Set audio level scale	X8 *16#	Scl X8 ↵	Set the VTG's level scale to X8.
View	16#	X8 ↵	View current setting.
Set audio output level			
Set audio level to + value	X9 G	Lev = + X9 ↵	Set audio level to +X9.
Set audio level to - value	X10 g	Lev = - X10 ↵	Set audio level to -X10.
Increment up	+G/+g	Lev = ± X11 ↵	Increase audio level 1 dB.
Increment down	-G/-g	Lev = ± X11 ↵	Decrease audio level 1 dB.
View	G/g	X11 ↵	View current setting.
Mute audio outputs			
Enable mute	1Z	Amt1 ↵	Mute audio for all outputs.
Disable mute	0Z	Amt0 ↵	Unmute audio for all outputs.
View status	Z	1 ↵ /0 ↵ = on/off	Show audio mute status.
Set start and stop frequencies (frequency sweep)			
Frequency sweep	X14 * X14 *12#	Sfq X14 * X14 ↵	Set the start and stop frequencies for the frequency sweep to be between these two frequencies. The first value must be lower than (never equal to) the second value. Default is 100 Hz to 10 kHz (29 * 109).
View	12#	X14 * X14 ↵	View the start and stop frequencies.
Select 3.5 mm audio output channels			
Select channels	X32 *14#	Och X32 ↵	Select the 3.5 mm stereo output connector channels to enable (L + R, L, R).
View	14#	X32 ↵	Show which 3.5 mm audio channels are enabled.
Set burst signal interval (cycles)			
Set	X36 *22#	Bin X36 ↵	Set the burst signal interval to X36 cycles.
View	22#	X36 ↵	View the burst signal interval.
Set burst on duration (cycles)			
Set	X36 *23#	Bon X36 ↵	Set the burst on duration to X36 cycles.
View	23#	X36 ↵	View the burst on duration.
Set frequency sweep mode			
Set	X37 *24#	Smd X37 ↵	Set the frequency sweep mode.
View	24#	X37 ↵	View the frequency sweep mode.

Command/response table for SIS commands (continued)

Command	ASCII Command (host to VTG)	Response (VTG to host)	Additional description
Set frequency sweep direction			
Set	X38*25#	Sdr X38 ↵	Set the frequency sweep direction.
View	25#	X38 ↵	View the frequency sweep direction.
Set Scope Trigger cursor position			
Set cursor to specific coordinates (relative to active area)	X16 * X17 *6#	Cpa X16 * X17 ↵	Set cursor position to pixel X16 on line X17 (relative to active area of the screen).
Set cursor to specific coordinates (relative to total area)	X18 * X19 *7#	Cpt X18 * X19 ↵	Set cursor position to pixel X18 on line X19 (relative to total area of the screen).
View position	6#	X16 • X17 ↵	View cursor position (relative to active area).
View position	7#	X18 • X19 ↵	View cursor position (relative to total area).
Set Scope Trigger cursor type			
Set cursor type	X20*8#	Cty X20 ↵	Set cursor type.
View current type	8#	X20 ↵	View cursor type.
Hide/reveal Scope Trigger cursor			
Hide cursor	0*9#	Cur00 ↵	Hide cursor.
Reveal cursor	1*9#	Cur01 ↵	Reveal cursor.
View status	9#	00 ↵ *(hidden)* 01 ↵ *(visible)*	View status.
Set color channel enable			
Set color type	X23 *10#	Col X23 ↵	Set color type to X23.
View current type	10#	X23 ↵	View current color type.
Set RGB sync format			
Set sync format	X29 *13#	Syf X29 ↵	Set the RGB sync format.
View	13#	X29 ↵	View current setting.
Adjust test pattern video level (applies to flat field, targets, checkerboard, window, CTF, and hum bar patterns only)			
Specific value	X33 *15#	Vlv X33 ↵	Set the video level of the currently selected test pattern to a specific level.
Increment	+15#	Vlv X33 ↵	Select next higher level.
Decrement	-15#	Vlv X33 ↵	Select next lower level.
View	15#	X33 ↵	View current setting.
Test pattern auto sequence mode			
Enable	1*11#	Tas01 ↵	Turn auto sequence mode on.
Disable	0*11#	Tas00 ↵	Turn auto sequence mode off.
View status	11#	01 ↵ /00 ↵ = on/off	View current mode status.

Command/response table for SIS commands (continued)

Command	ASCII Command (host to VTG)	Response (VTG to host)	Additional description
Enable/disable patterns for test pattern autosequence mode			
Enable pattern	1* X2 *17#	Pas01* X2 ↵	Enable test pattern for autosequence mode.
Disable pattern	0* X2 *17#	Pas00* X2 ↵	Disable test pattern for autosequence mode.
View pattern list	17#	X2 • X2 •... X2 • X2 ↵	List all test patterns that have been enabled for autosequence mode.
On-screen display			
Enable	1*18#	Osd1 ↵	Enable the on-screen display.
Disable	0*18#	Osd0 ↵	Disable the on-screen display.
View status	18#	1 ↵ /0 ↵ = on/off	View the current status.
Raster border			
Enable	1*19#	Ras1 ↵	Enable the raster border.
Disable	0*19#	Ras0 ↵	Disable the raster border.
View status	19#	1 ↵ /0 ↵ = on/off	View the current status.
Set screen saver type			
Set	X34*20#	Sst X34 ↵	Set the screen saver type.
View	20#	X34 ↵	View the screen saver type.
Scan rate group count			
View group count	50#	X25 ↵	View the total number of scan rate groups.
Scan rate group name			
Get scan rate group name	X24 *51#	X26 ↵	View the name of scan rate group X24.
Test pattern count			
View test pattern count	52#	X27 ↵	View the total number of test patterns.
Test pattern name			
Get test pattern name	X2 *53#	X28 ↵	View the name of test pattern X28.
Get test pattern name list	53#	X28 ↵ ...X28 ↵ ↵	View the list of all test pattern names for the currently selected scan rate.
Zap (reset to default settings)			
Total reset	Esc zXXX ←	Zpx ↵	Reset everything: all settings and adjustments are reset to the factory default (rate memory is left intact).
Reset audio	Esc zA ←	Zpa ↵	Reset audio settings to factory defaults.

Control Software for Windows

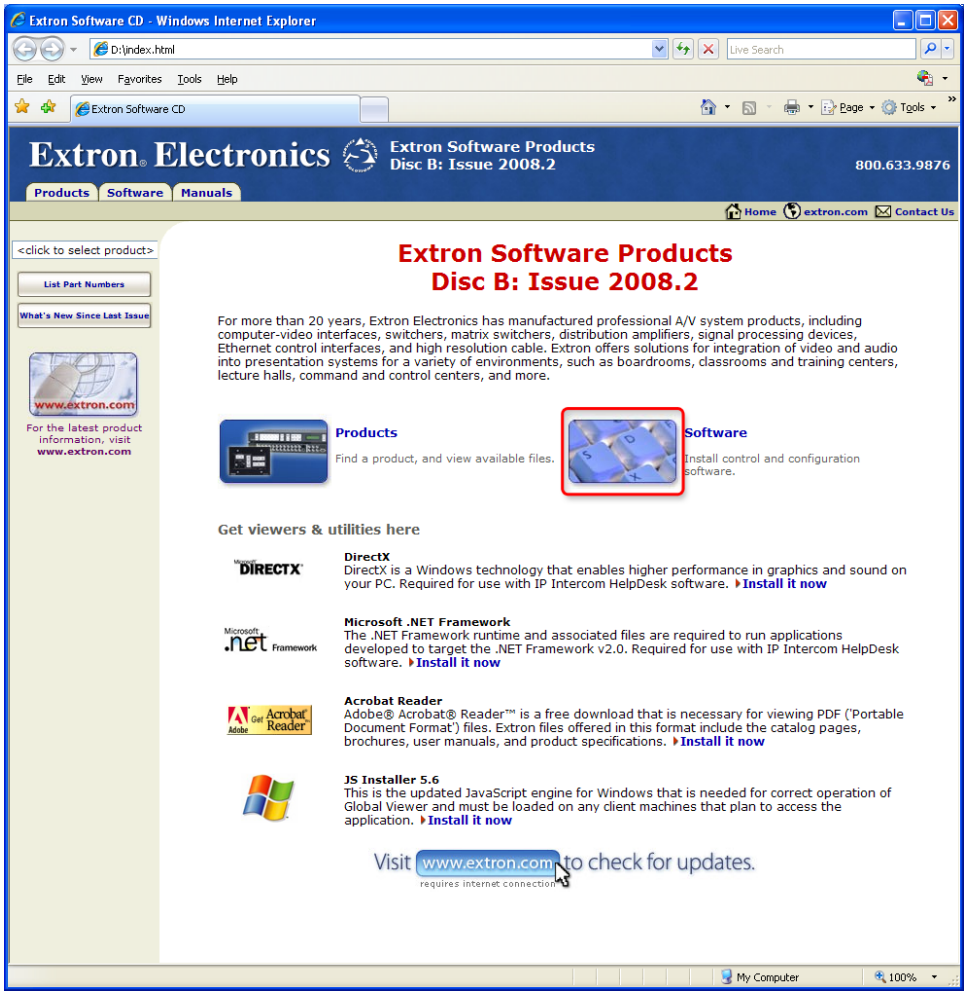
The included Extron VTG 400/400D/400 DVI Control Program for Windows offers another way to control the VTG via RS-232 connection in addition to the Simple Instruction Set commands. The control program's graphical interface includes the same functions as those on the video test generator's top panel and some additional features that are only available through the Windows-based software.

The control software is compatible with Windows 98, Windows NT, Windows 2000, and Windows XP. VTG 400/400D/400 DVI Control Program updates can be downloaded from the Extron Web site:
http://www.extron.com.

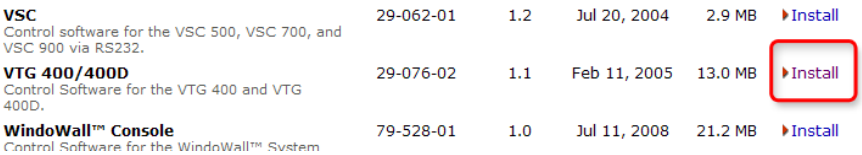
Installing the software

The control program is contained on a disk that is delivered with your VTG. To use the software, you must install the program on your PC. Follow these steps:

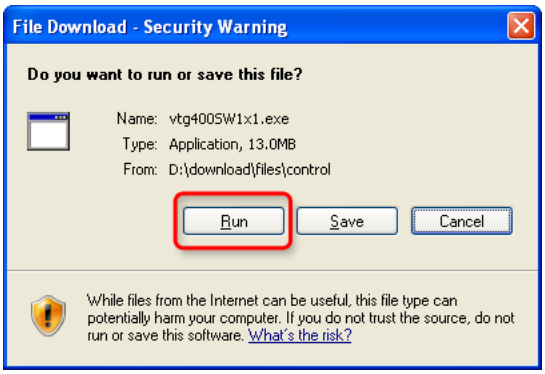
1. Insert the disk into your disk drive. The disk should start automatically. If it does not, open your Windows Explorer and double-click LAUNCH.EXE on the disk drive to start it.
2. On the Software Products Disk screen (see below), click the **Software** button.



3. In the table on the Control Software screen, scroll to locate the VTG 400/400D, and click the **Install** link in the far right column.

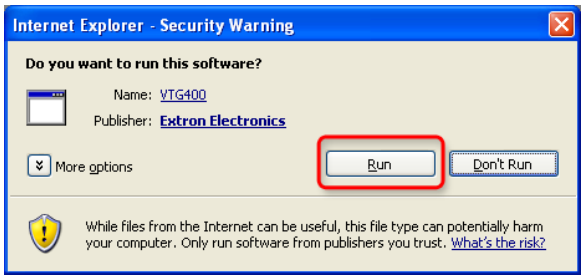


4. On the File Download window that appears, click **Run** to begin installing the program.



If you want to save the installation file (VTG400SW1x*n*.exe) to your desktop to run later, click **Save** instead of **Run**. On the Save As window, save the setup file to the desired location on your PC. When you are ready to install the software, double-click on the **VTG400SW1x*n*.exe** icon, click **Run** on the Security prompt, and restart the procedure at step 4.

5. Another Security prompt appears. Click **Run** on this window to continue with the installation.

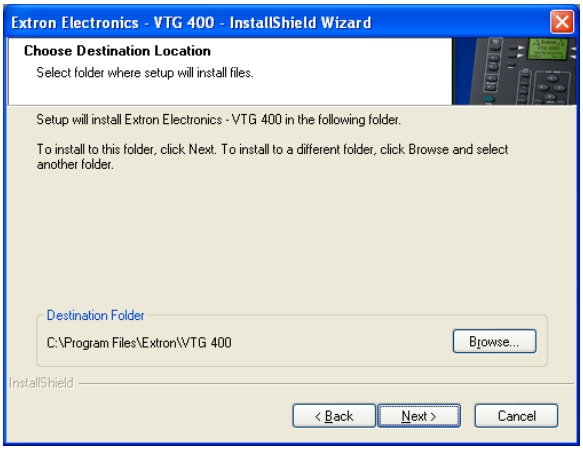


6. Follow the instructions on the InstallShield Wizard screens to complete the program installation.

   By default the installation creates a folder called "VTG400" in the following location on your computer:

   c:\Program Files\Extron\VTG400

   If there is no Extron folder in your Program Files folder, the installation program creates it.



7. When the installation is complete, close the Software products screen. You can now start the Windows-based control program.

Downloading the VTG 400 software from the Web

The VTG 400 Windows-based control program is also available on the Extron Web site at **www.extron.com**. From this site, you can also download updates to the VTG 400 software as they become available.

To access the software on the Web,

1. Open the Extron Web page, and select the Download tab.
2. On the Download Center screen, click the **Control Software** button (shown at right). A Control Software screen is displayed, containing a list of control software products.

3. In one of the linked alphabets displayed across the top and bottom of the screen, click **V**.
4. On the "V" software products page, scroll to locate the VTG 400/400D, and click the **Download** link at the far right.
5. On the next screen, fill in the required information.
6. Click the **Download VTG400SW1x*n*.exe** button.
7. On the File Download - Security Warning window that appears, click Run to begin downloading the installer file.

   If you want to save the installation file (VTG400SW1x*n*.exe) to your computer hard drive to run later, click **Save**. On the Save As window that opens, save the setup file to the desired location. When you are ready to install the software, double-click on the **VTG400SW1xn.exe** icon, and follow the instructions.
8. On the second security prompt window that opens, click **Run** again to start the installation process.
9. Follow the instructions on the InstallShield Wizard screens to complete the software program installation. By default the installation creates a folder called "VTG400" in the following location on the computer:

   c:\Program Files\Extron\VTG400

   If there is no Extron folder in your program Files folder, the installation program creates it.

Starting the control program

Many items found in the VTG 400 Control Program are also accessible via top panel controls and the LCD menus described in chapter 2. Refer to chapter 2 for details on features and settings. The VTG 400 Help Program provides information on settings and on how to use the control program itself.

Some features, including the miscellaneous options, are only available via this control program. These features are described in the sections of this chapter that correspond to the parts of the control program where the features are found.

1. To run the control program, double-click on the VTG 400 Control Program icon in the Extron Electronics group or folder. The Comm Port Selection dialog box appears on the screen. From the "Connect Using" drop-down list box, select *RS-232 serial port*.

NOTE *The VTG Control Program may also be run using previously saved configuration files generated by the Control Program by selecting* Emulation Mode. *See* Using the emulation mode, *later in this chapter.*

2. Click on the COMM port that is connected to the VTG's RS-232 port. The Extron VTG Control Program window appears, as shown in the following illustration. The top menu bar consists of five drop-down menus:

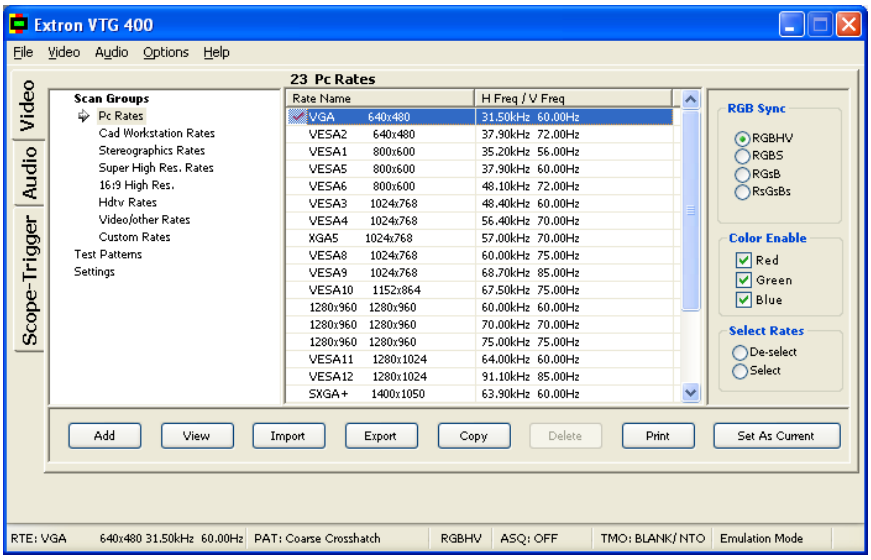
   - **File** menu
   - **Video** menu
   - **Audio** menu
   - **Options** menu
   - **Help** menu

NOTE *The Video menu appears only when the vertical Video tab is selected.*

There are three vertical tabs available:

- **Video** tab
- **Audio** tab
- **Scope-Trigger** tab

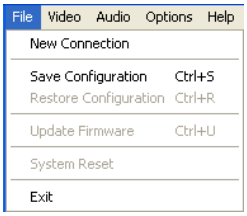
The Video screen, shown below, is the default window when the Control Program opens.



Drop-down menus

File menu

The File menu features six functions: **New Connection**, Save **Configuration**, **Restore Configuration**, **Update Firmware**, **System Reset**, and **Exit**. See the illustration below.



- Reselect a COMM port using New Connection.
- Save Configuration saves the current configuration settings to a *.vtg file.
- Restore Configuration retrieves configuration information from a previously saved *.vtg file.
- System Reset resets the VTG to factory default configuration settings.
- Update Firmware loads the VTG with firmware from a *.bin file.
- Exit terminates the Windows control program.

NOTE *A system reset does not affect any stored Custom Rates.*

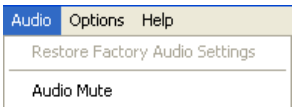
Video menu

The Video menu features seven functions: **Set As Current**, **Add**, **View**, **Copy**, **Delete**, **Import**, and **Export**. See the following illustration.

- Set As Current sets the selected scan rate as the current scan rate.
- The Add command presents a configuration window to create a new custom scan rate.
- The View command displays the current scan rate's configuration profile.
- The Copy command copies the selected scan rate to the Custom rates folder.
- The Delete command deletes the selected custom scan rate from the Custom rates folder.
- The Import command imports (retrieves) scan rates from a file to the Custom rates folder.
- The Export command exports (saves) scan rates to a file.

Audio menu

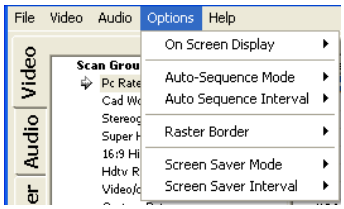
The Audio menu features the **Restore Factory Audio Settings** command and the **Audio Mute** command. See the illustration below.



- The Restore Factory Audio Settings command sets all the audio settings to factory default.
- The Audio Mute command mutes all audio outputs.

Options menu

The Options menu features six functions: **On Screen Display**, **Auto-Sequence Mode**, **Auto Sequence Interval**, **Raster Border**, **Screen Saver Mode**, and **Screen Saver Interval**. See the illustration below.



- On Screen Display sets the output display on or off.
- The Auto Sequence Mode command allows test patterns to be displayed in a predetermined sequence and can be set on or off.
- The Auto Sequence Interval command specifies the duration each test pattern is displayed.
- The Raster Border command sets the raster border around a display's active area as either on or off.
- The Screen Saver Mode can set the screen saver to blank (black screen) or cycle. The cycle option cycles through all valid test test patterns for a given scan rate.
- The Screen Saver Interval command sets the screen saver timeout interval to 5 minutes, 10 minutes, 15 minutes, 30 minutes, or never time out.

Help menu

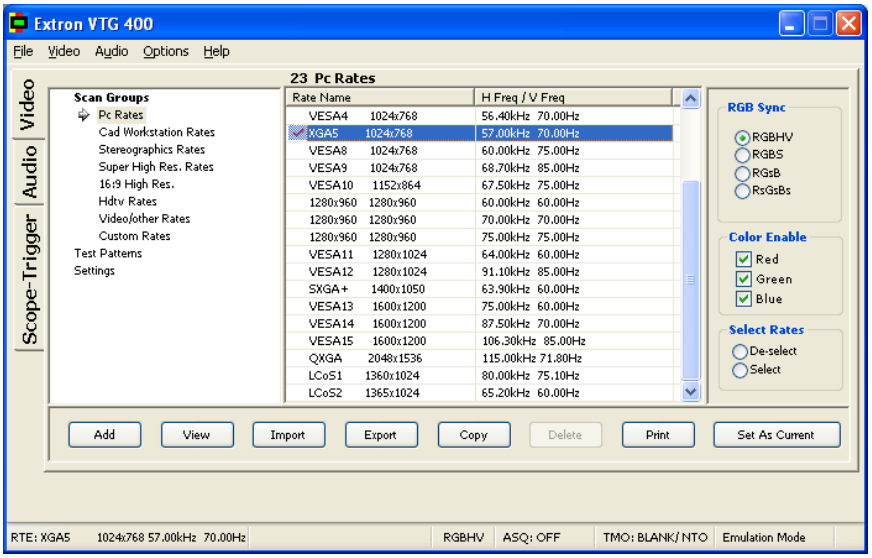
The Help menu allows you to access a help file.

Video tab

The Video tab screen features three main categories: **Scan Groups**, **Test Patterns**, and **Settings**.

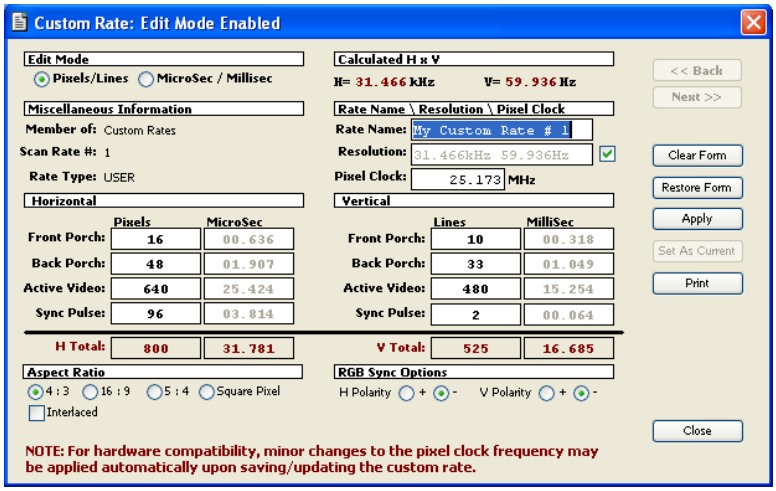
Scan Groups screen

Select the desired video format group from the Scan Groups screen, then choose the scan rate. Activate the chosen rate by double-clicking on the rate or by clicking the Set As Current button.



Add button — Clicking this button allows you to add a new scan rate to the Custom Rates scan group. See the following screen illustration.

NOTE *The Custom Rates scan group is the only group in which scan rates can be added, deleted, or modified. All other scan rate groups remain static, although they can be copied (see the* Copy button *description later in this chapter.*

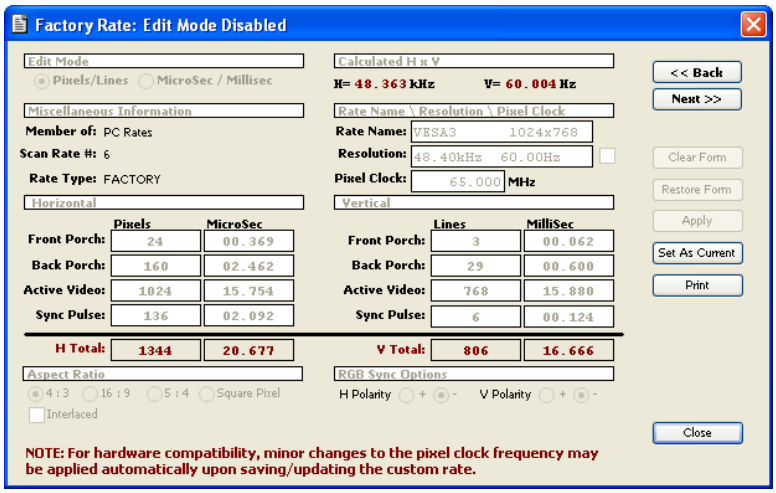


Enter the appropriate information in the above screen, including the horizontal and vertical active video information, rate name and resolution. Select the Apply button to add the new rate.

NOTE *The VTG 400 DVI only outputs custom rates with a pixel clock of less than 165 MHz*

NOTE *Click the* Print *button to print the screen image. The information is sent to Internet Explorer where it can be viewed and printed.*

View button — Selecting this button allows you to view the selected rate's details. If the selected rate is from the Custom Rates group, the values can be edited and applied. See the following screen example.



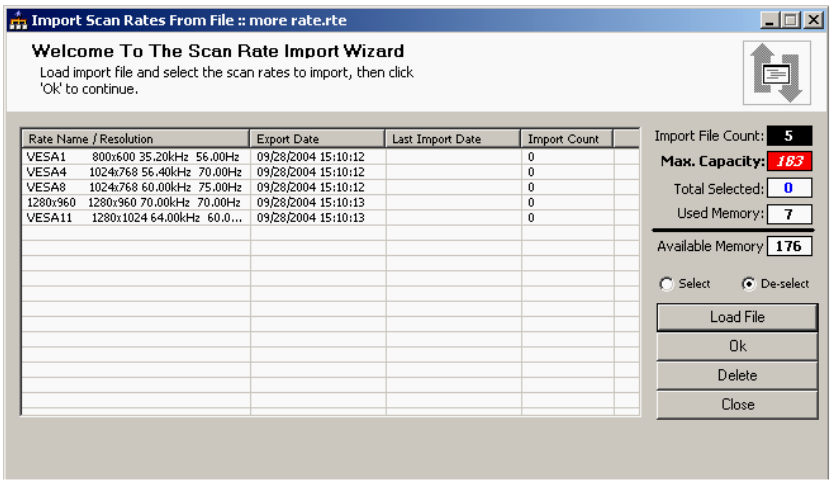
Edit the appropriate information in the above screen. Click the Apply button to save the changes made.

NOTE *Select the* Print *button to print the screen.*

Import button — Selecting this button allows you to import scan rates to the Custom Rates scan group. See the following screen display. A previously saved file of defined scan rates must first be opened via the Load File button (see the following *Export button* description), and a scan rate selected.

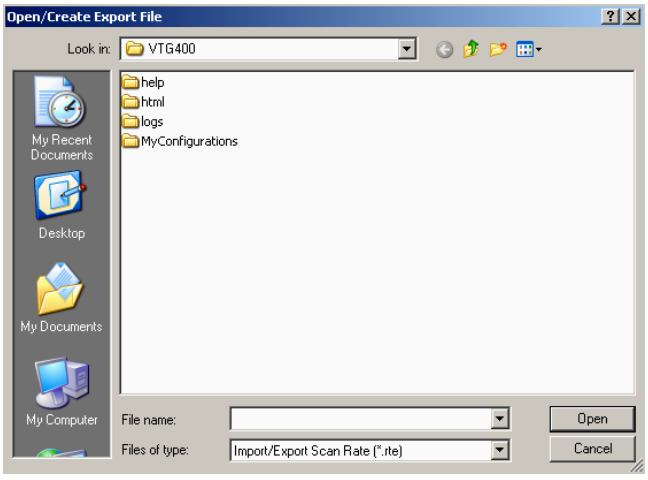
After selecting the previously saved *.rte file, open that file and click on the desired rate(s).

NOTE *The Select radio button selects all the rates in the file, and the De-select radio button deselects all the rates.*



- The Import File Count is the number of rates in the imported file.
- The Max. Capacity is the maximum number of Custom rates that theVTG can store.
- The Total Selected is the number of rates selected in the imported file.
- Used Memory is the number of rates in the Custom Rates folder.
- Available Memory is the number of rates that can still be imported to the Custom Rates folder.
- Select Load File to select another *.rte file.
- Select Ok to import the selected scan rate(s).
- Select Delete to delete the selected scan rate(s) from the *.rte file.
- Select Close to close the current window.

Export button — Selecting this button allows you to export or save a scan rate to an export scan rate file. See the following screen example. The export file of saved rates can later be used to add rates to the Custom Rates folder via the previously mentioned *Import button*.



Copy button — Click this button to copy an existing scan rate(s) to the Custom Rates folder.

Delete button — Click this button to delete an existing scan rate(s) from the Custom Rates folder.

Set As Current button — Click this button to set the selected scan rate as the current scan rate.

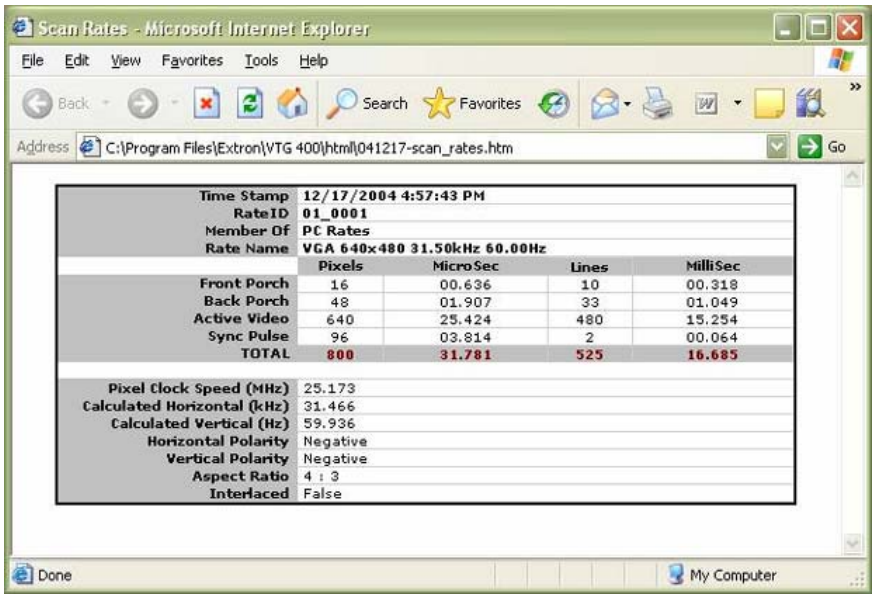
RGB Sync radio buttons — Click one of these radio buttons to select the desired RGB sync: RGBHV, RGBS, RGsB, or RsGsBs.

RGB Color Enable check boxes — Click these to enable the desired color(s): Red, Green, or Blue.

NOTE *This affects the RGB outputs only.*

Select Rates radio buttons — Click De-select or Select to deselect or select all rates in the current group.

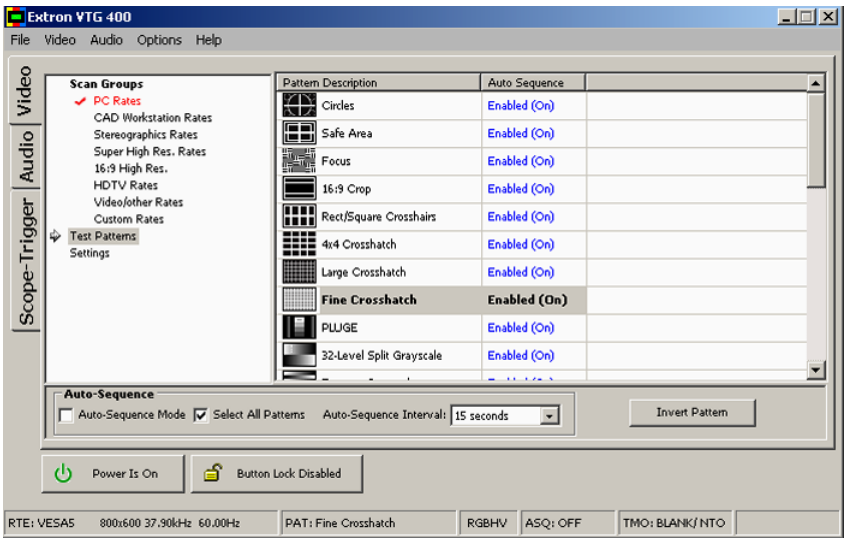
Print button — Click this button to print the selected scan rate(s) using Internet Explorer. See the following screen sample.



Test Patterns screen

The Test Patterns screen, shown in the following illustration, allows you to select and activate a test pattern. A test pattern can also be inverted (black becomes white and vice versa) from this screen.

Test patterns can also be automatically displayed sequentially at set intervals by selecting the Auto-Sequence mode. A test pattern may be removed from (disabled) or added to (enabled) the auto sequence list by right-clicking on the test pattern and choosing the desired option.



Auto-Sequence Mode check box — Enables/disables the Auto-sequence mode.

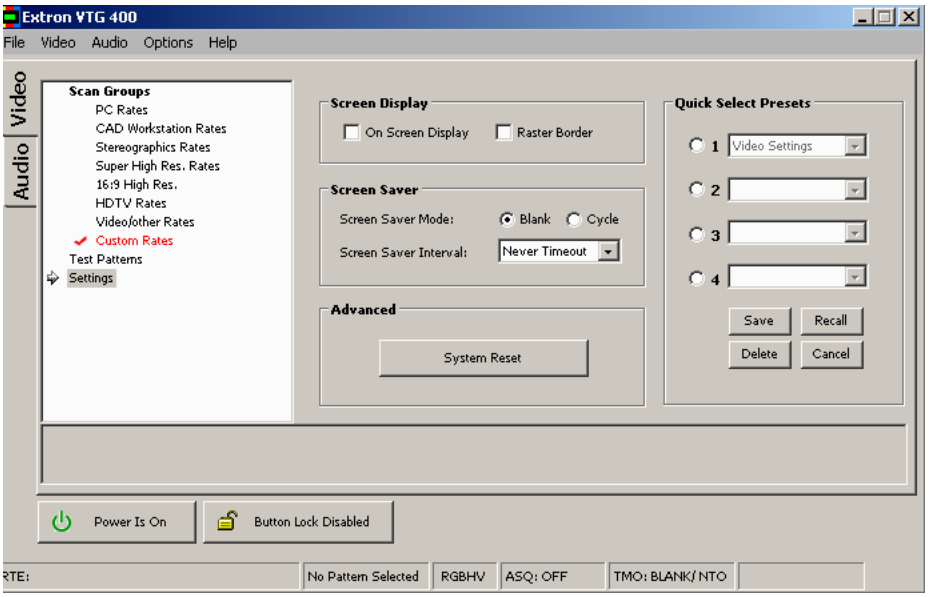
Select All Patterns check box — Enables/disables all available test patterns for use in display or Auto-sequence mode.

Auto-Sequence Interval drop-down box — Sets the Auto-sequence interval to 15 seconds, 30 seconds, or 1 minute.

Invert Pattern button — Inverts (black-to-white/white-to-black) the selected test pattern, if the invert pattern is supported for that pattern.

Settings screen

The Settings screen, shown below, features several options:



Screen Display check boxes — Select the On Screen Display check box to display the rate type, rate frequency and resolution on screen for four seconds. Select the Raster Border check box to display a black border around the display image. The border is useful when centering and sizing the image.

Screen Saver — Select the Blank radio button to display a black screen.

NOTE *While the screen is blank, the horizontal and vertical sync are still active.*

Select the Cycle radio button to cycle through valid test patterns for a specific video output (see the *Test Patterns Chart* in Appendix A. Select the Screen Saver Interval drop down box to set the screen saver timeout interval: 5 minutes, 10 minutes, 15 minutes, 30 minutes, or never time out.

Advanced — Reset the VTG to factory default settings by clicking the System Reset button.

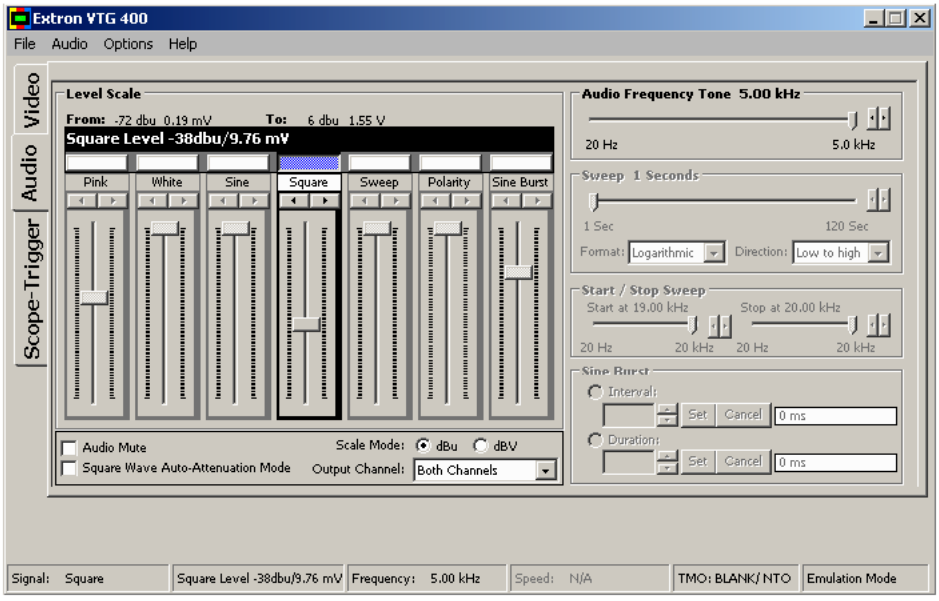
NOTE *A system reset does not affect any stored custom rates.*

Quick Select Presets — Up to four sets of configuration settings – video, audio, or all (video and audio) – can be saved (Save Preset) and later recalled (Recall Preset). Before the save process is completed, the process may be cancelled (Cancel Preset).

Audio tab

The Audio tab screen features seven audio signal types:

- pink noise
- white noise
- sine wave
- square wave
- frequency sweep
- polarity
- sine burst



You can configure the audio signal via the following adjustment tools:

Audio Frequency Tone slider bar — Adjust the slider bar to specify the audio frequency for the sine wave, square wave, or sine burst signals. It is adjusted by moving the slider bar left or right or by selecting the left (◀) or right (▶) arrow buttons to make incremental adjustments to the audio frequency.

Frequency Sweep (Sweep) slider bar — Adjust the slider bar to specify duration of the sweep signal. It is adjusted by moving the slider bar left or right or by selecting the left (◀) or right (▶) arrow buttons to make incremental adjustments to the sweep duration. The frequency sweep format can be logarithmic (more time spent in the lower frequencies) or linear (equal time being spent in the low and high frequencies). The direction of the sweep can be from high to low frequencies or from low to high frequencies.

Start/Stop Sweep slider bar — Adjust the slider bars to specify the start and stop frequencies for the sweep signal. It is adjusted by moving the slider bar left or right or by selecting the left (◀) or right (▶) arrow buttons to make incremental adjustments to the start and stop sweep frequencies.

Sine Burst adjustments box — Set interval and duration in cycles for the sine burst signal. The sine burst duration is always less than the interval.

Level Scale slider bar — Adjust the audio level range for each signal type by moving the slider bar up or down or by selecting the left (◀) or right (▶) arrow buttons to make incremental adjustments to the audio level.

Audio Mute check box — Select this box if audio is to be muted.

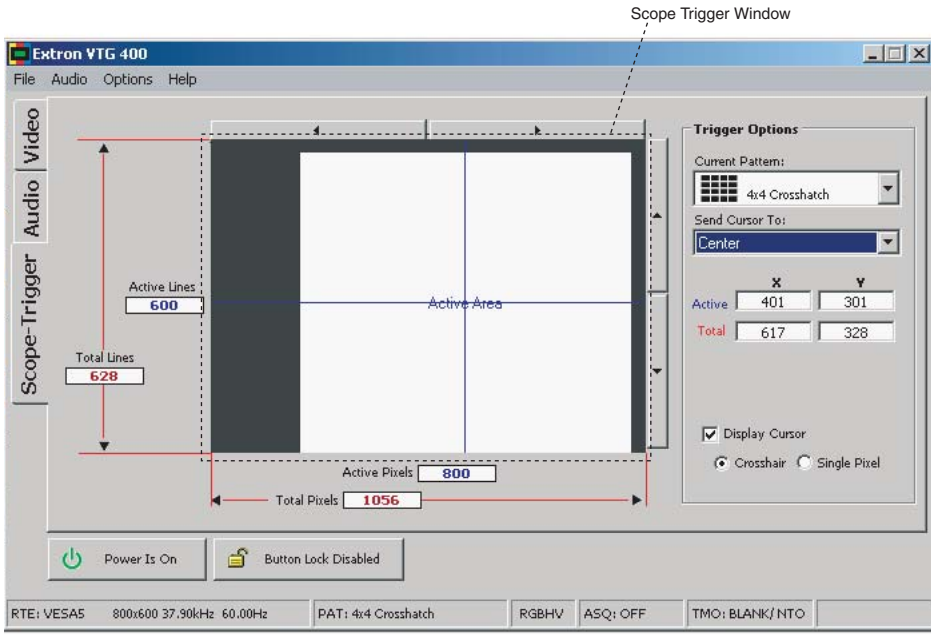
Square Wave Auto-Attenuation Mode check box — Select this box when a square wave signal should be automatically attenuated to -40 dBu (-42 dBV) when toggling through the audio signals.

Scale Mode radio buttons — Select dBu or dBV.

Output Channel drop down box — Select the audio output channel(s): left, right, or both channels.

Scope-Trigger tab

The Scope Trigger tab screen, shown below, features the *Current Pattern* test pattern drop-down box from which an available test pattern for the current video rate may be selected. The trigger point's display cursor can then be activated as either a crosshair or single pixel, and the cursor can be placed using the *Send Cursor To* drop-down box. A specific trigger point can be reached by typing into the appropriate text boxes its X and Y coordinates relative to the active area or total area. The cursor can also be placed by clicking in the *Scope Trigger Window* display or by clicking the directional arrows (◀ , ▶ , ▲ , ▼) that are located above and to the right of the *Scope Trigger Window* display.



Power/Status button

The VTG can be powered on and off by clicking this button. When the button's status indicates "Power is On", it can be clicked to toggle the power off and the status then indicates "Power is Off". When the button's status indicates "Power is Off", it can be clicked to toggle the power on, and the status then indicates "Power is On".

Button Lock/Status button

The VTG can be placed in top panel security lockout mode by clicking this button. When the button's status indicates "Button Lock Enabled", it can be clicked to disable the button lock, and the status then indicates "Button Lock Disabled". When the button's status indicates "Button Lock Disabled", it can be clicked to enable the button lock, and the status then indicates "Button Lock Enabled".

See *Top Panel security lockout* in chapter 2.

Using the help program

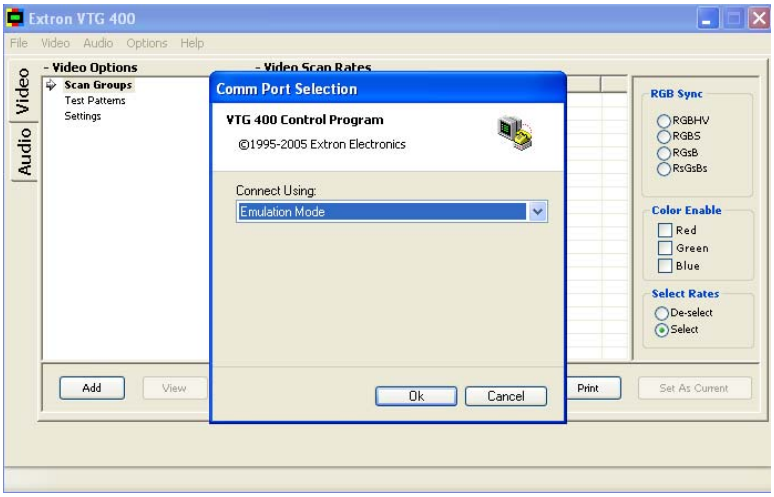
For information on program features:

- Press the F1 computer key.
- Click on the Help menu from within the VTG 400 Control Program.
- Double-click on the VTG 400 Help icon in the Extron Electronics group or folder.

Using the Emulation Mode

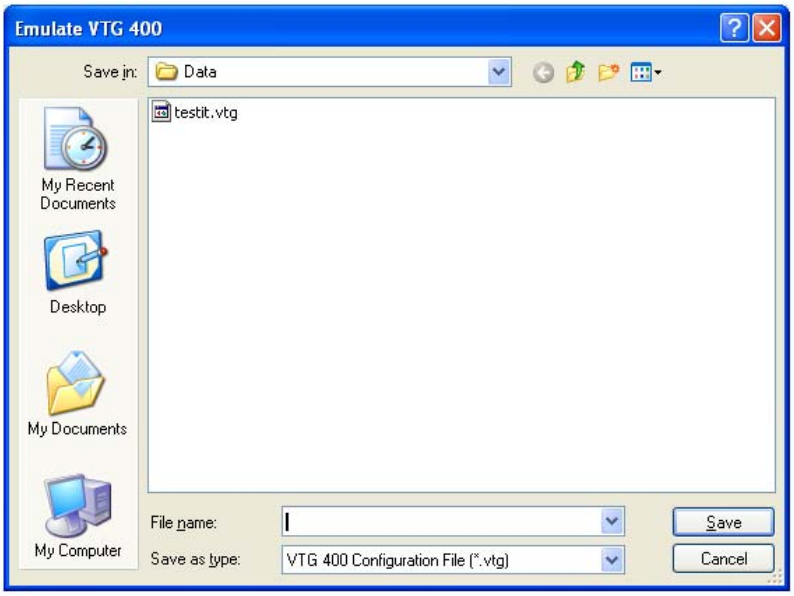
The VTG 400/400D/400 DVI Control Program features an emulation mode so that you can configure the VTG before actually using it on site. In emulation mode, you can save the emulated settings to a configuration file, then load that configuration file to the VTG.

1. Start the control program. In the Comm Port Selection screen, select Emulation Mode, then click OK.

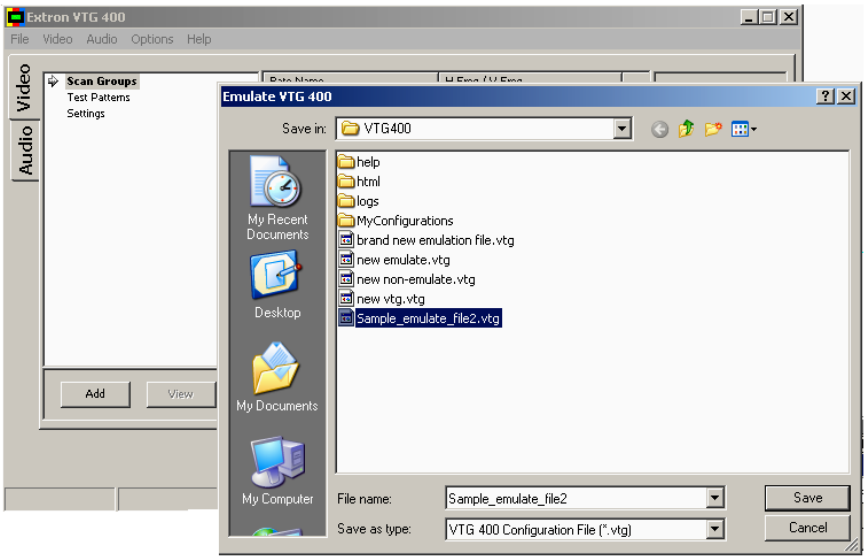


2. You can create a new configuration starting from the default settings (see 2a), or you can base the configuration on an existing setup (see 2b).

   2a. If you will be creating a brand new configuration, enter a new file name and select Save (as shown below) instead of following step 2b.



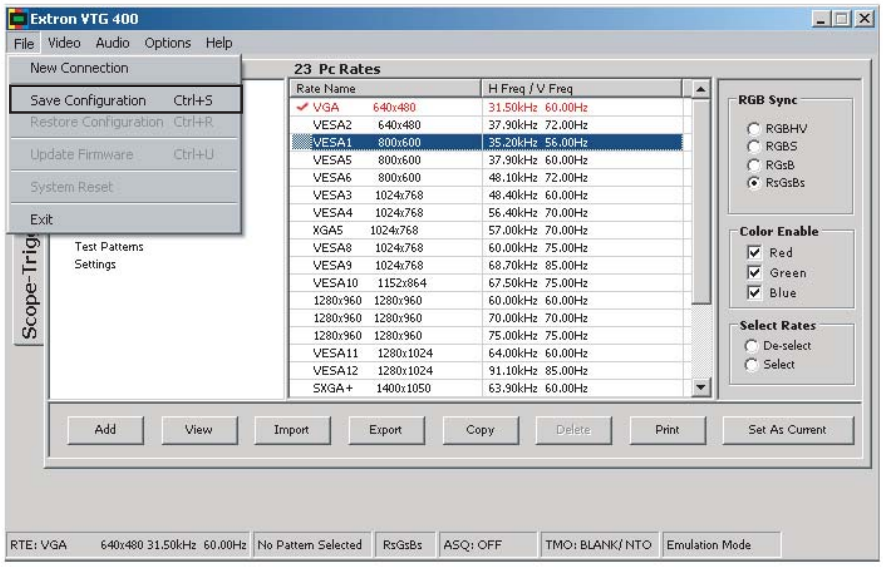
2b. Alternatively, to edit an existing (previously saved) configuration file, select the appropriate configuration (___.vtg) file.



3. Configure the VTG, as explained earlier in this chapter.

4. Save the configuration by selecting Save Configuration from the File drop-down menu.

If the program is closed while in emulation mode, all settings are saved to the current configuration file



Firmware Upgrade Through the Extron Web Site

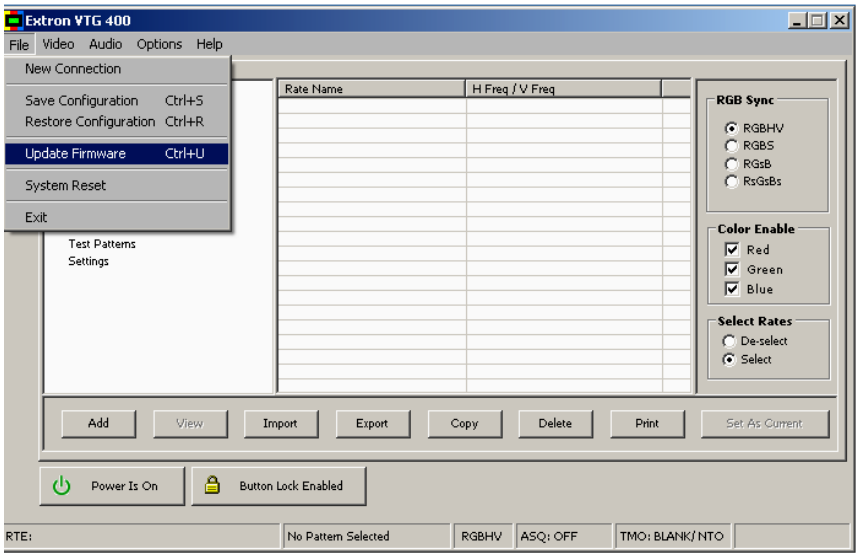
The VTG's firmware is upgraded by going to the Extron Web site, downloading the latest firmware to the PC, then uploading and installing the new firmware from the PC to the VTG via the video test generator's RS-232 port.

Downloading the latest firmware to the PC

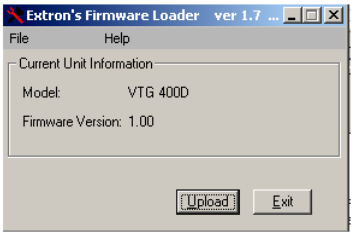
1. Go to the Extron Web site (www.extron.com) and select the product category (VTG 400/400D/400 DVI).
2. Select the Support files tab and click on the Firmware link.
3. Download the firmware install package to your PC. It will have a filename ending in .exe, such as **VTG400_FW1x01.exe**.
4. Save the file to your PC, and run the executable file. By default, the program will extract the firmware file and its release notes to **C:\Program Files\Extron\Firmware\VTG400**.

Uploading the firmware from the PC to the VTG

1. Connect the PC to the VTG via the video test generator's RS-232 port.
2. Start the control program (see *Using the control program* earlier in this chapter).
3. Select Update Firmware from the Control Program window and follow the on-screen instructions.



4. Select Upload from the Firmware Loader window, as shown at right.
5. Select the desired firmware file. The uploading of the firmware to the VTG will take a few minutes.



NOTE *The original factory-installed firmware is permanently available on the VTG. If an attempted upload of new firmware fails for any reason, the VTG reverts to the factory-installed firmware.*

Appendix A

Reference Materials

Specifications

Included Parts

Test Patterns Chart

Test Patterns in Detail

Video Output Scan Rate Table

Appendix

Specifications

Video signal characteristics

Dot clock	200 MHz (max.)
Pixel clock accuracy	100 ppm
Horizontal frequency range (factory defaults)	15 kHz to 131 kHz
Vertical frequency range (factory defaults)	30 Hz to 120 Hz
Rise/fall time	
NTSC, PAL	140 ns
All other signal rates	<4 ns

Video output

Number/signal type	2 RGBHV, RGBS, RGsB, RsGsBs 1 component video 1 S-video 1 composite video (NTSC/PAL) 1 HD-SDI (SMPTE 292M), SDI (SMPTE 259M-C) – VTG 400D only 1 DVI-D (single link) – VTG 400 DVI only
Connectors	1 x 5 female BNC (RGB) 1 female 15-pin HD (RGB) 1 x 3 female BNC (component video) 1 female 4-pin mini DIN (S-video) 1 female BNC (composite video) 1 female BNC (SDI/HD-SDI) – VTG 400D only 1 female DVI-I (DVI-D) – VTG 400 DVI only
Nominal level	1 Vp-p for RsGsBs, Y of component video and S-video, and for composite video 0.7 Vp-p for RGB and for R-Y and B-Y of component video 0.286 Vp-p (burst) for C of NTSC S-video, 0.300 Vp-p (burst) for C of PAL S-video
Minimum/maximum levels	0.0 V to 1.0 Vp-p
Impedance	75 ohms
Resolutions	Computer (VGA–WQXGA), video (NTSC, PAL), HDTV, 16:9 high resolutions, and custom resolutions (user-defined)
Return loss	-30 dB @ 5 MHz
DC offset	0 ±5 mV for RGB and component video, 0 ±5 mV for NTSC S-video and composite video 14 mV ±5 mV for PAL S-video and composite video

Sync

Output type	RGBHV, RGBS, RGsB, RsGsBs (for RGB signals) Tri-level on Y, R-Y, B-Y channels (component video 720p, 1080i, 1080p) Bi-level on Y channel (for all other component video rates)
Standards	NTSC, PAL, SMPTE 170M, SMPTE 274M, SMPTE 293M, SMPTE 295M, SMPTE 296M
Output level	0.3 Vp-p for RGsB, RsGsBs, component video (bi-level sync) 0.6 Vp-p for RGsB, RsGsBs, component video (tri-level sync) TTL: 5.0 Vp-p, unterminated for RGBHV, RGBS
Output impedance	75 ohms
Max. rise/fall time	5 ns (TTL sync)
Polarity	Positive or negative (scan rate/signal dependent)

Scope trigger connectors	1 BNC female (scope trigger)

Audio

THD + Noise	<0.008% typical @ +6 dBu (1.55 V), 1 kHz 0.18% @ -38 dBu (9.75 mV), 20 Hz to 20 kHz
Flatness	±0.05 dB @ 20 Hz to 20 kHz
Accuracy	±0.4 dB

NOTE *0 dBu = 0.775 Vrms, 0 dBV = 1 Vrms, 0 dBV ≈ 2 dBu*

Audio output

Number/signal type	
VTG 400D	1 mono, balanced; 2 mono, unbalanced
VTG 400 DVI	1 mono, balanced; 1 mono, unbalanced
Connectors	
VTG 400D	(1) 3.5 mm mini stereo jack (unbalanced mono left and right, tip-ring-sleeve) 1 female RCA jack (unbalanced, tip-ring) 1 male 3-pin XLR (balanced) (pin 1 = GND, pin 2 = +, pin 3 = -)
VTG 400 DVI	(1) 3.5 mm mini stereo jack (unbalanced mono left and right, tip-ring-sleeve) 1 male 3-pin XLR (balanced) (pin 1 = GND, pin 2 = +, pin 3 = -)

NOTE *The XLR output is immune to phantom power.*

Impedance	50 ohms unbalanced, 100 ohms balanced
Waveforms	Pink noise, white noise, sine wave (fixed/swept burst), square wave, polarity test
Level ranges	Pink noise: -72 dBu to -4 dBu (-74 dBV to -6 dBV) (0.20 mV to 500 mVrms) Polarity test: -72 dBu to -14 dBu (-74 dBV to -16 dBV) (0.20 mV to 158 mVrms) All other signal types: -72 dBu to +6 dBu (-74 dBV to +4 dBV) (0.20 mVrms to 1.58 Vrms)
Maximum level (Hi-Z)	>+6 dBu, balanced or unbalanced at 1% THD+N
Maximum level (600 ohm)	>+4.66 dBu, balanced or unbalanced at 1% THD+N
Crest factor (pink noise)	3.25 (10.24 dB)
Crest factor (white noise)	1.98 (5.95 dB)
Rise time (square wave)	1.5 ms at 20 Hz to 7 µs at 5 kHz
Rise time (polarity test)	5 µs
Frequency accuracy (sine wave)	50 ppm

Control/remote — test generator

Serial control port	RS-232, 9-pin female D connector
Baud rate and protocol	9600 baud, 8 data bits, 1 stop bit, no parity
Serial control pin configurations	2 = TX, 3 = RX, 5 = GND
Program control	Extron's control/configuration program for Windows®Extron's Simple Instruction Set (SIS™)

General

Power	100 VAC to 240 VAC, 50-60 Hz, 15 watts, internal
Temperature/humidity	Storage: -40 to +158 °F (-40 to +70 °C) / 10% to 90%, noncondensing Operating: +32 to +122 °F (0 to +50 °C) / 10% to 90%, noncondensing
Cooling	Convection, vents on sides
Rack mount	No

Appendix

Enclosure type	Metal
Enclosure dimensions	6.75" H x 9.0" W x 1.75" D 17.1 cm H x 22.9 cm W x 4.4 cm D (7.5" [19.1 cm] H including connectors.)
Product weight	3.3 lbs (1.5 kg)
Shipping weight	7 lbs (4 kg)
Vibration	ISTA 1A in carton (International Safe Transit Association)
Regulatory compliance	
Safety	CE, CUL, UL
EMI/EMC	CE, C-tick, FCC Class A, ICES, VCCI
MTBF	30,000 hours
Warranty	3 years parts and labor

NOTE *All nominal levels are at ±5%.*

NOTE *Specifications are subject to change without notice.*

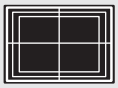
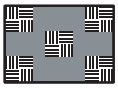
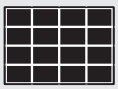
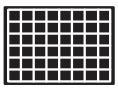
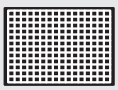
Included Parts

These items are included in each order for a VTG 400D/400 DVI:

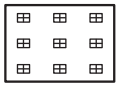
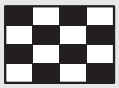
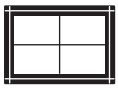
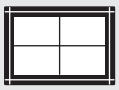
Included parts	Part number
VTG 400D (1)	60-564-02
or VTG 400 DVI (1)	60-564-03
Nylon carrying case	
IEC power cord	
VTG 400D/400 DVI Setup Guide	
Extron software disk	

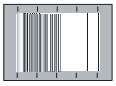
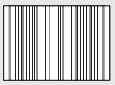
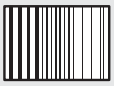
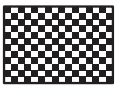
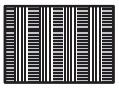
Test Patterns Chart

The following chart lists the VTG test patterns and any special features.

Test Pattern			Range								Special Features	
No.	Name	Icon	PC	Work-station	Stereo-graphics	Super Hi Res	16:9 HR	HDTV	Video NTSC	Video PAL	Adjustable Levels	Invert/ Special
1	Circles		X	X	X	X	X	X	X	X		X
2	Safe Area (5%/10%)		X	X	X	X	X	X	X	X		X
3	Focus		X	X	X	X	X	X	X	X		
4	16:9 Crop (4:3 Rates)		X	X	X	X		X	X	X		X
	4:3 Crop (16:9 Rates)			X			X	X				X
5	Rectangle/ Square Crosshairs		X	X	X	X	X	X	X	X		X
6	4x4 Crosshatch		X	X	X	X	X	X	X	X		X
7	Coarse Crosshatch		X	X	X	X	X	X	X	X		X
8	Fine Crosshatch		X	X	X	X	X	X	X	X		X
9	PLUGE		X	X	X	X	X	X	X	X		
10	32–Level Split Grayscale		X	X	X	X	X	X	X	X		
11	Extreme Grayscale		X	X	X	X	X	X	X	X		

Appendix, cont'd

Test Pattern			Range								Special Features	
No.	Name	Icon	PC	Work-station	Stereo-graphics	Super Hi Res	16:9 HR	HDTV	Video NTSC	Video PAL	Adjustable Levels	Invert/ Special
12	Ramp		X	X	X	X	X	X	X	X		X
13	Color Bars (8-color split)		X	X	X	X	X	X				
	SMPTE Bars (with PLUGE pattern)								X			Blue Mode
	EBU Color Bars (8-color full bars)									X		
14	Window 80%		X	X	X	X	X	X	X	X		
15	Window 20%		X	X	X	X	X	X	X	X		
16	Window (variable level)		X	X	X	X	X	X	X	X	X	
17	Flat Field		X	X	X	X	X	X	X	X	X	
18	Flat Field with Targets		X	X	X	X	X	X	X	X	X	
19	Checker-board		X	X	X	X	X	X	X	X	X	X
20	Bounce (auto-matic)		X	X	X	X	X	X	X	X		
21	Bounce (manual toggle)		X	X	X	X	X	X	X	X		Toggle On/Off

Test Pattern			Range								Special Features	
No.	Name	Icon	PC	Work-station	Stereo-graphics	Super Hi Res	16:9 HR	HDTV	Video NTSC	Video PAL	Adjustable Levels	Invert/ Special
22	Alternating Pixels (1 on, 1 off)		X	X	X	X	X	X				
	Frequency Sweep								X	X		
23	Graphics Multiburst		X	X	X	X	X	X				
	Multiburst								X	X		
24	Alternating Pixels (2-dimen-sional)		X	X	X	X	X	X				
	Multipulse								X	X		
25	Transient Response		X	X	X	X	X	X	X	X		
26	Contrast Transfer Function (CTF)		X	X	X	X	X	X	X	X	X	Vert. Line Flashing On/ Off
27	H Pattern		X	X	X	X	X	X	X	X		X
28	Hum Bar Detect		X	X	X	X	X	X	X	X	X	

Test Patterns in Detail

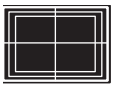
The following test patterns descriptions are helpful in determining how and when the VTG's array of test patterns can be used. The numbers correspond to the test patterns in the previously described Test Patterns Chart.

1. Circles

White circles on a black background are useful for checking overall image geometry and linearity. The invert feature converts the pattern to predominantly white, which may also be used to evaluate white field uniformity as well as geometry across the screen. Projectors having low quality optics may show chromatic aberrations of the test pattern, especially in the corners. Chromatic aberrations manifest when the projection lens functions as a prism and separates light into its component colors. Utilizing this pattern, chromatic aberration is seen as a separation of red, green, and blue typically toward the corners of the image area.

When used in the 16:9 format, the pattern shows the small circles in the extreme corners of the test pattern. The 4:3 format version, if displayed on a 16:9 display in the widescreen mode, shows the circles as being more egg-shaped. The centered vertical line and horizontal line form a crosshair target indicating the exact center of the image.

2. Safe Area (5%/10%)

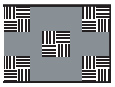


Television receivers (typically CRT-based types) commonly extend the image raster beyond the edges of the display, which is a practice called *overscanning*. Overscanning hides image nonlinearities and raster scan artifacts as well as production test patterns typically hidden within the last few lines of the vertical blanking interval.

The safe area pattern thus becomes a guide for the technicians in the television production environment to show the likely amount of cropped display area on a typical consumer television receiver. The outer rectangle indicates a 5% crop area, which is the minimum amount of overscan for picture information. The inner rectangle represents a 10% crop area and is referred to as the "safe title area".

By maintaining all key action within the rectangle representing the 5% crop area, the producer can guarantee that the viewer will be able to see all of the intended information. By maintaining all titles inside the area bounded by the 10% safe area marker, all text and titling will be seen by the viewer. The centered vertical line and horizontal line form a crosshair target indicating the exact center of the image.

3. Focus



The focus test pattern tests the depth of field of the projector lens. Low quality lenses do not display the corners of the test pattern with equal sharpness to the center; or, the corners do not appear the same as the center. The focus patches represent a combination of high frequency detail (vertical lines) as compared to low frequency information (horizontal lines). These patches should be equal in brightness and color hue when a video system has an overall flat frequency response.

When high frequency response suffers significantly, the patches of vertical alternating pixels blend toward a 50% gray level. Since the background is 50% gray, the patches tend to disappear within the background. Comparing the patches to the background assists in making this evaluation.

4. 16:9 Crop (4:3 rates)

This test pattern is used to display the resulting letterbox effect of a widescreen (16:9) image within a standard 4:3 display system. The outer border corresponds to the maximum dimensions of a 4:3 image for the given line rate. The two horizontal lines within the pattern show the area and boundaries of a 16:9 image within a 4:3 space. Use this pattern for setting or creating screen masking systems.

4:3 Crop (16:9 rates)

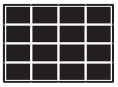
This test pattern is used to display the resulting side-boxing effect of a standard 4:3 image within a 16:9 widescreen display system. The outer border corresponds to the maximum dimensions of a 16:9 image for the given line rate. The two vertical lines within the pattern show the area and boundaries of a 4:3 image within a 16:9 image space. Use this pattern for setting or creating screen masking systems.

5. Rectangle/Square Crosshairs

This pattern can be used to properly center the image and set geometry. For CRT-based projectors, this pattern is used to check and adjust gross linearity and static convergence. Regardless of whether the VTG is set for a 4:3 or 16:9 aspect ratio, this pattern provides a perfectly centered square, which is useful for basic geometric alignment of the projector and the projector-to-screen relationship.

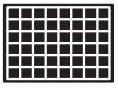
Orthogonal alignment of the projector to the screen is critical for best overall focus and image geometry. Utilizing a simple square allows the installation technician to easily measure from the projector's lens axis location to each corner of the test square for determination of orthogonal alignment. In addition, the outer line provides a border indicating the extreme boundary of the image. It is important that the border line be just visible inside the screen boundaries. The crosshair lines through the center of the pattern provide an easy target for static convergence adjustment of a CRT projector or evaluation of video delay skew.

6. 4x4 Crosshatch



Crosshatch patterns are traditionally used for linearity and convergence adjustment (both static and dynamic) of CRT-based displays. Additionally, this particular 4 x 4 pattern is useful for calibrating the position of picture-in-picture display boxes. It may also be used to calibrate the division of the screen for multiplexed images such as in video wall applications or video multiplexing processors handling several images simultaneously.

7. Coarse Crosshatch

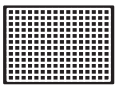


Crosshatch patterns are traditionally used for linearity and convergence adjustment (both static and dynamic) of CRT-based displays. The coarse crosshatch pattern may be appropriate for adjustment where more points of interest are required for optimum adjustment of large projected images. It may also be used for critical skew alignment of the red, blue, and green signals within a twisted-pair video transmission system.

Crosshatch patterns are typically generated using one-pixel wide vertical lines (highest frequency in a given scan rate) and one-line wide horizontal lines in the vertical scanning domain. This feature makes the pattern useful for measuring high

and low frequency response where the perceived brightness of both horizontal and vertical lines should be the same for a system with good frequency response.

8. Fine Crosshatch



Crosshatch patterns are traditionally used for linearity and convergence adjustment (both static and dynamic) of CRT-based displays. The fine crosshatch pattern consists of finely spaced lines to create many more intersection regions for finer convergence adjustment, skew adjustment, lens evaluation, and so forth. All three crosshatch patterns (4x4, large, and fine) include a border which indicates the maximum extension of the active image area for any given signal line rate.

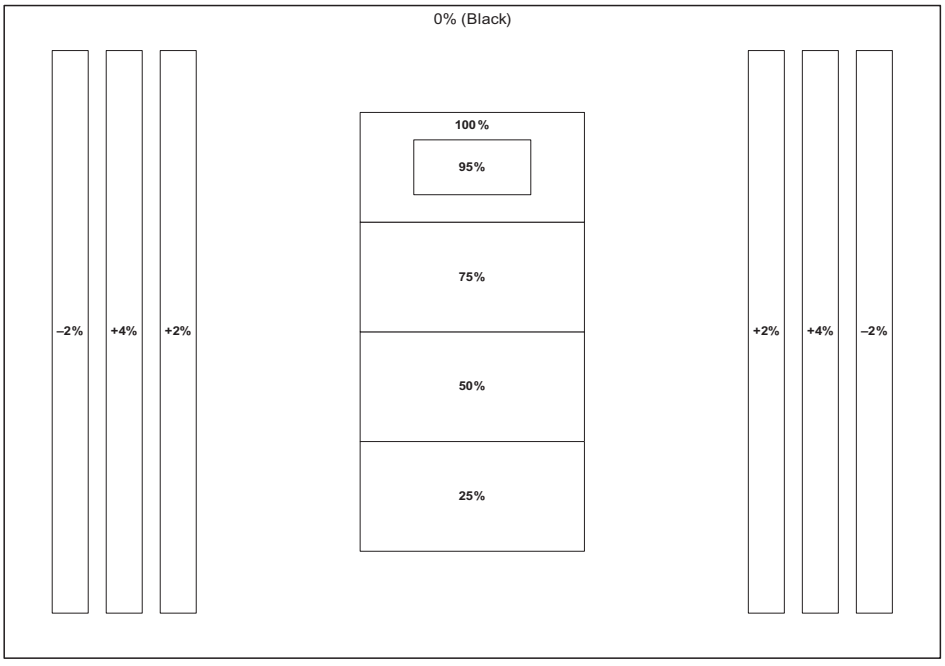
9. PLUGE

The PLUGE (Picture Line-Up Generating Equipment) test pattern is used for proper setup of black level (brightness control) and display gain (contrast).

Setting Black Level

Proper setup of black level, or brightness, is important for establishing the correct threshold where the display begins to emit light as the video signal moves away from black (or cutoff). Setting black level too low results in the crushing of details within the shadow regions of the image. Setting black level too high results in washed out shadow areas. Utilize the vertical bars on each side of the pattern for adjustment of black level.

PLUGE Pattern Video Levels



The overall dark surround of the pattern should be as black as the "blacker-than-black" vertical bar (-2%) when the brightness control is properly adjusted. When the brightness control is correctly set, the remaining two vertical bars on each side

are visible. The dimmer of the two is +2%, and the brighter is +4% above black. If either or both of the brighter bars are not visible, the black level is set too low. When the test pattern background is illuminated such that the "blacker-than-black" bar is discernible against the black surround, the black level is set too high.

Contrast Gain

The group of four illuminated boxes in the center region of the test pattern are used solely for contrast control adjustment. The intensities of the boxes are 25%, 50%, 75%, and 100% from bottom to top. Included within the 100% white box is a 95% box. The contrast control (or system gain) should be adjusted using this pattern until no further increase in contrast produces additional light output from the 100% box. With traditional CRT displays, the white box would "bloom" out of focus, lose all line definition, and tend to distort. It typically would also shift toward yellow (indicating a lack of blue light output) when the threshold of nonlinearity is achieved. The correct setting is just prior to any or all of these described conditions.

For fixed pixel displays, such as LCD, DLP, or LCoS, where the imaging element is merely controlling the amount of light transmitted or reflected, the display system attains maximum light output, and any further adjustment results in no visible change of brightness. Adjusting past the threshold of maximum light output results in the clipping of highlight details close to white by "pushing" them into the full white output region of the display.

This point of maximum light output is difficult to visually gauge. Use the 95% box within the 100% box as an indicator for the correct gain setting. Just when the 95% box begins to climb in brightness and approaches the 100% setting, the point of maximum is reached. If the gain setting is too high, the 95% box merges into the full white presentation of the 100% box. Furthermore, the luminance of the three lower boxes rises to a point where they become white and merge with the 100% box. This condition represents an adverse setting of the system gain.

10. 32-Level Split Grayscale

This pattern is used to assess grayscale tracking, or consistent color of gray, from black to white. The ability of a display to render an accurate image rests with its ability to faithfully reproduce a linear grayscale. There should be no perceived color shift across the presentation of gray levels. Any color shift seen within this pattern manifests as a change in color hue or rendition within all imagery as intensities change from dark to light.

11. Extreme Grayscale

This pattern reveals the display's ability to produce subtle grayscale near the extreme white and black portion of the display's dynamic range. As the display system approaches full white or black, slight changes in luminance output convey shadow and detail near these extremes.

Displays must be capable of fully linear reproduction in order to exhibit good control near the extreme ends of the image range. Incorrectly adjusted contrast (gain) and brightness (black level) controls cause loss of important details near white and black. The extreme grayscale pattern allows easy evaluation of display setup for this important parameter.

The shallow ramps near white at the top of the pattern show performance near white. The center level is 100% white. The shallow ramp extends downward below 100% white by eight steps to 94.5% and upward above reference white to 105.5% in eight steps. Each step represents a 0.685% change. Adjusting contrast (gain) so that

each step above 100% is just visible ensures that peak video changes and details near white are preserved.

Conversely, the shallow ramps near black at the bottom of the pattern show performance near black. The shallow ramp extends downward below black (0%) by eight steps to -5.5% and upward to +5.5% in eight steps. Each step represents a 0.685% change. Adjusting brightness (black level) so that each of the steps below 0% is just visible ensures that peak video changes and details in the shadows are preserved.

The center of the pattern includes a regular 15 step split grayscale for convenience and serves the same function as the split grayscale pattern described earlier.

12. Ramp

The ramp pattern is commonly used to evaluate display performance in the area of pixel depth capability. Since the creation of image test patterns using digital technology, the industry acknowledges that a minimum pixel depth of 8 bits per pixel (256 levels) is the minimum pixel depth requirement for perception of continuous tones in colors and grayscale for each of the primary colors (i.e. red, green, and blue). The VTG utilizes 10-bit pixel depth for creation of all its test patterns. This provides four times more resolution for shades of colors or levels of gray than 8-bit systems.

The gradual change in light output across the ramp should appear smooth without any noise, banding, or other inconsistencies. Displays and processors having less than 8 bits per pixel per color may exhibit periodic vertical bands along the ramp pattern, commonly called *contouring*. The ramp pattern, due to its gradual level change, can be used to highlight specific points where image processing noise may become visible.

13. Color Bars (8-color split)

For graphics line rates, this color bar pattern is helpful in verifying correct cable connections for red, green, and blue signals. It may be used to facilitate setting of video levels and check for low frequency crosstalk between the color channels. General uses include verification of relative color timing, saturation, and level adjustment.

SMPTE Color Bars (with PLUGE pattern)

Designed for NTSC video systems, this pattern was standardized by the Society of Motion Picture and Television Engineers for proper alignment of the NTSC color transmission system. This color bar pattern is used to evaluate NTSC color decoding systems and assist in proper setup of the color and tint (hue) controls in an NTSC television monitor or receiver. The PLUGE pattern contained in the lower right section of the pattern is used to set proper black level as described for the dedicated PLUGE pattern available from the VTG 400.

The small complimentary color rectangles at the bottom of the larger color bars are used to facilitate color and tint calibration. In order to properly calibrate the color and tint controls, some method of suppressing the red and green channels is necessary so that only the blue content of the color bar signal is in use. This may be done by viewing the test pattern through a blue filter, by switching to the "blue only" mode available on some monitors, or by removing the red and green cables from the display input if the decoding process is being handled in an external video processor.

The small blue rectangle under the white bar and the small white rectangle under the blue bar are used to indicate proper threshold of the color control level. While viewing the blue bars, adjust the color level control until the perceived brightness of the small rectangles merges with the larger bars to yield one consistent intensity.

Now, adjust the tint control by viewing the small rectangles under the cyan and magenta bars. Adjust the tint control until those bars merge into one long bar of consistent intensity. There may be interaction between color and tint, so, alternately adjust each control using this procedure until the blue bars across the screen are all of consistent intensity. This ensures proper adjustment of the color decoder. The inability to achieve an even intensity indicates the presence of color decoder errors.

Note that composite NTSC video utilizes a 7.5 IRE setup pedestal for the black level. The S-video format is likely to include the setup pedestal depending on the source system and the methodology for signal creation. The VTG 400 includes the setup on the S-video luminance signal output and on the component Y channel output. Digitally-produced component NTSC or decoded NTSC (into the RGB domain) does not utilize the setup pedestal. This difference can account for a significant shift of black level when calibrating displays for multiple signal sources and formats.

EBU Color Bars (8-color full bars)

The EBU color bars are used by European television personnel transmitting PAL (Phase Alternating Line) television signals. Its function is identical to the NTSC color bars except that it is made up of eight single bars with no provision for color saturation setup or PLUGE. The PAL system, by design, does not require a tint control on the receiver's decoder. Therefore, tint calibration is not required. Note that the PAL transmission standard does not utilize a setup pedestal. Therefore, black level reference in the signal is consistent regardless of format.

14. Window 80%

Window patterns provide a low duty cycle white, or near white, reference at screen center for performing grayscale setup without driving the display into a nonlinear operating condition. In particular, driving CRT-based projectors with high duty cycle signals causes an overdrive condition. Therefore, the 80% gray level of this pattern is a good choice for setup of highlight values when performing grayscale setup of a display where light output efficiency may not rival that of a direct-view display.

Using the 80% window as the highlight value for performing color of white measurement with a colorimeter typically does not overdrive the projection system. When using a colorimeter, or other suitable light measurement device, the gain or highlight controls are adjusted to provide the correct color of white during grayscale calibration. The 80% window pattern is located "next door" to the 20% level window pattern to facilitate quick switching between high and low duty cycle window patterns in order to streamline the grayscale calibration procedure.

15. Window 20%

Window patterns provide a low duty cycle white, or near white, reference at screen center for performing grayscale setup without driving the display into a nonlinear operating condition. The 20% gray level of this pattern is a good choice for setup of lowlight values (those gray levels near black) when performing grayscale setup of a display.

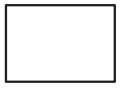
When using a colorimeter, or other suitable light measurement device, the bias or lowlight controls are adjusted to provide the correct color of gray near black during grayscale calibration. This pattern is located "next door" to the 80% level window to facilitate quick switching between high and low duty cycle window patterns in order to streamline the grayscale calibration procedure. In addition, the 20% level window is located next to the variable window pattern which may be set to any value from zero to 100% output level. The default level for the variable window pattern is 100%.

16. Window (variable level)

Window patterns provide a low duty cycle white, or near white, reference at screen center for performing grayscale setup without driving the display into a nonlinear operating condition. The variable window pattern level defaults to 100% output level, or full white. Using the Up/Down soft keys on the VTG 400, the level of this pattern may be set in 1% increments to any value required.

For direct-view displays, the 100% window level is normally used to set the highlight or gain controls when performing grayscale calibration. With this pattern located next to the 20% window, rapid pattern switching is possible between highlight and lowlight adjustments when performing the grayscale calibration procedure.

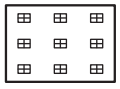
17. Flat Field



This pattern is used to evaluate white field uniformity. The default level of this white field is 100%, but may be adjusted using the VTG 400 soft keys to any value from zero to 100% in 1% increments. This pattern is also used for the measurement of display light output. For example, with the ANSI methods of measurement for display light output, an appropriate light meter may be placed at each of the prescribed nine screen locations in order to obtain readings for entry into the ANSI calculations. See the Flat Field with Targets test pattern for additional support with this task.

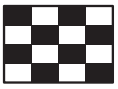
For situations requiring display of any one of the primary or secondary colors as a flat field, the user may enter into the VTG 400 video setup menu and turn On or Off combinations of the primary output channels. Also note that this feature is available to modify the color of most all the test patterns.

18. Flat Field with Targets



Switching to the Flat Field with Targets pattern results in nine box targets being overlaid upon the flat field pattern. These targets guide the user with proper location placement of the appropriate light metering device for collection of light output levels used in calculation of the ANSI lumen value of the display. The targets facilitate location of the light meter only and should be switched Off (returning to the regular flat field pattern) while taking the light measurement reading.

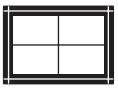
19. Checkerboard



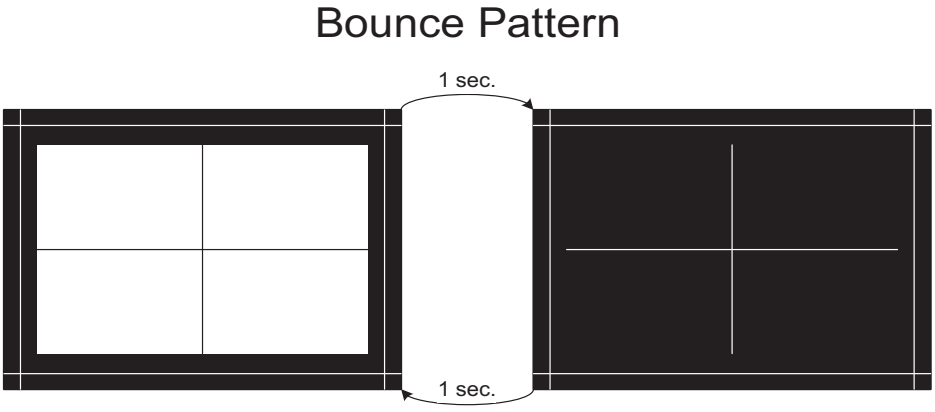
The checkerboard consists of sixteen rectangles with half being black (0%) and half being white (100%). This pattern is commonly used to measure contrast ratio of the display system and is the prescribed pattern for performing contrast ratio measurement within the ANSI procedure.

Fundamentally, contrast ratio is the ratio of the peak white luminance value divided by the minimum luminance value near black. By mathematical definition, as the black level approaches true zero light output, contrast ratio approaches infinity. This pattern may be used to perform the ANSI contrast ratio measurement regimen or other methods as well. The user may "invert" the pattern which will change the luminance of the starting rectangle and subsequent rectangles from the original luminance level to the opposite level. Distortion of the 100% white rectangles on a CRT-based or plasma type display indicate a condition of overdrive.

20. Bounce (automatic)



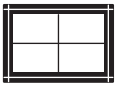
Some operating conditions of displays may only be evaluated or perceived with moving images or images that change in average duty cycle (picture content) over time. The APL (Average Picture Level) bounce pattern provides just such a test. The central area is comprised of a large white rectangle with a black crosshair pattern. The pattern automatically changes between full white and full black continuously at one-second intervals.



The white box in the center of the pattern toggles between black and white once every second. The border on the outside of the pattern does not change .

This duty cycle shift assists evaluation of black level shift. For CRT-based displays, high voltage regulation performance may be evaluated. High voltage variations with image duty cycle changes cause one or more combinations of distortion among the components of the pattern such as the white rectangle, the lines within the white rectangle, or the lines surrounding the pattern.

21. Bounce (manual toggle)



This version of the APL (Average Picture Level) bounce is static and may be exercised by the user at will. Use the Invert function on the VTG's soft keys to cause the pattern to invert, or shift, at any moment desired. This capability is used when evaluation under conditions of random performance is desired. See the automatic version of the APL bounce pattern for more information.

22. Alternating Pixels (1 on, 1 off)

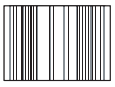
For computer graphics displays, alternating pixels represent the highest frequency operation at a given line rate, or resolution. These one-On, one-Off transitions tax the speed of a graphics system and the display's performance as well. Use this pattern to assess the high frequency performance of the display or a graphics system in total. It may also be used to align or evaluate pixel timing and phase on fixed pixel displays. As a source for EMI testing, the alternating pixel pattern represents a worst case scenario for products that may radiate energy in relation to FCC regulations. Typically, an oscilloscope is used to measure the true performance of the display system using this pattern.

Frequency Sweep

Within the NTSC or PAL environment, the frequency sweep pattern provides a sine wave sweep from near DC to the specified system bandwidth for the affected broadcast standard. This pattern is used to evaluate system bandwidth performance and is also used to evaluate color decoder performance in the region of the chroma subcarrier frequency.

The sweep limit for NTSC is 4.2 MHz and the sweep limit for PAL is 5 MHz. While some visual information can be derived from viewing this pattern on a display, bandwidth evaluation is most accurately accomplished using an oscilloscope or waveform monitor.

23. Graphics Multiburst



The graphics multiburst provides groups of digital bursts consisting of 1/1 (meaning one-On, one-Off) alternating pixels at screen center flanked by 2/2 alternations, then 4/4 alternations, 8/8 alternations, and a white reference. Perception of grayscale should remain consistent throughout; otherwise, frequency response differences will cause color shifts, particularly in the 1/1 burst as compared to the other bursts.

Utilizing an oscilloscope, this pattern may be used to evaluate high frequency versus low frequency performance of a graphics system. The border area between bursts is 50% gray. Anomalies of high frequency performance resulting in severe attenuation of the center burst of 1/1 pixels blend into the middle gray border. In addition, color shifts are most easily identified against the low frequency nature of the middle gray level.

Multiburst

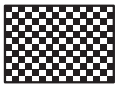
The television multiburst is intended to provide rapid evaluation of system bandwidth over the television channel using a waveform monitor or oscilloscope. A full bandwidth system reproduces the multiburst with all bursts having equal amplitude from low frequency to high frequency. Visually, the pattern may be used to see the relative quality or effect on bandwidth of the color decoder system and luminance channel.

Each version of the multiburst includes one burst at the system subcarrier frequency so that luminance channel attenuation due to the quality of the color decoding system may be observed. Each burst is symmetrical about a 50% (middle gray) pedestal. Following are the basic specifications for the two multiburst formats in the VTG 400:

NTSC – White reference bar followed by 0.5, 1, 2, 3, 3.58, and 4.2 MHz bursts

PAL – White reference bar followed by 0.5, 1, 2, 4, 4.43, and 5 MHz bursts.

24. Alternating Pixels (2-dimensional)



This pattern is similar to the alternating pixel pattern discussed earlier; however, while it consists of one-On, one-Off alternating pixels on each horizontal line, the phase is shifted 180 degrees for every other line thereby creating a minute checkerboard effect. Because of the line-to-line phase shift, this pattern is useful for critically evaluating pixel timing and phase in a graphics display system. The pattern is produced at the highest clock rate required for the selected image resolution. Incorrect pixel digitization within a display manifests on the screen as regions of "dancing pixels", instability, or noise in the test pattern. Pixel timing and phase may be adjusted in most fixed pixel displays until any abnormal noise effects are nullified.

Multipulse

The multipulse pattern is uniquely applied to evaluation of group delay in television signal distribution systems. Individual frequencies propagate along cables, such as coaxial cables, at different speeds. High frequencies are affected more than lower frequencies relative to one another. The rate at which signals of differing frequencies propagate manifests as time of one signal component to the other. This phenomenon is referred to as group delay.

In the case of NTSC or PAL television signals which contain many frequency components that must maintain strict timing relationships, the chroma signal typically becomes misaligned in time (delayed) compared to the luminance transitions. This results in poor edge quality and fidelity for areas containing color information since the color information is not only delayed, but suffers amplitude loss as well.

The multipulse consists of a low frequency level or "white bar" which indicates maximum video signal level. This bar is followed by a series of pulses. The first pulse is a 2T pulse without any modulation. The 2T pulse represents the highest frequency component in the television luminance channel. When its amplitude is maintained at the same level with the bar throughout the system distribution, the low to high frequency response is considered satisfactory.

NTSC Multipulse

The 2T pulse is followed by a series of modulated pulses: First, a 20T pulse encompassing a 1 MHz sine wave burst, followed by a 12.5T pulse containing a 2 MHz sine wave burst, followed by a 12.5T pulse containing a 3 MHz sine wave burst, followed by a 12.5T pulse containing a 3.58 MHz sine wave burst, followed by a 12.5T pulse containing a 4.2 MHz sine wave burst. Much like the multiburst signal discussed earlier, each of these frequencies provides an intermediate bandwidth point for consideration, including the color subcarrier and a frequency burst at the bandwidth limit of the system.

The frequency burst inside each pulse is generated to fit within the pulse symmetrically and have an amplitude that matches the pulse height and duration without extending past its areal limits. Group delay in a television distribution system causes relative time shift between the imposed burst and the encompassing pulse. Amplitude disturbance of the burst within each pulse manifests as an upward or downward level shift, which appears as concaved upward above black level for low level to convexed downward beyond black for excessive level.

Phase anomalies of the burst manifest as a wavy appearance at the base of the pulse region. Transmission line quality and length have more proportional effect on the higher frequency pulse/burst combinations. Group delay effects may be combated using a video processing amplifier or an equalizing network at the termination end of the line.

PAL Multipulse

The 2T pulse is followed by a series of modulated pulses. (1) a 20T pulse encompassing a 1 MHz sine wave burst, (2) a 12.5T pulse containing a 2 MHz sine wave burst, (3) a 12.5T pulse containing a 4 MHz sine wave burst, (4) a 12.5T pulse containing a 4.43 MHz sine wave burst, and (5) a 12.5T pulse containing a 5 MHz sine wave burst. Much like the multiburst signal discussed earlier, each of these frequencies provides an intermediate bandwidth point for consideration, including the color subcarrier and a frequency burst at the bandwidth limit of the system.

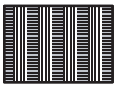
The frequency burst inside each pulse is generated to fit within the pulse symmetrically and have an amplitude which matches the pulse height and duration without extending past its areal limits. Group delay in a television distribution system will cause relative time shift between the imposed burst and the encompassing pulse. Amplitude disturbance of the burst within each pulse manifests as an upward or downward level shift, which appears as concaved upward above black level (for low level) to convexed downward beyond black (for excessive level). Phase anomalies of the burst manifest as a wavy appearance at the base of the pulse region. Transmission line quality and length will have more of a proportional effect on the higher frequency pulse/burst combinations. Group delay effects may be combated using a video processing amplifier or an equalizing network at the termination end of the line.

25. Transient Response

This pattern supports analysis of system transient response both from black to white and white to black. Signal level transitions from the extremes to middle gray require that the display system response be carefully designed so that transition artifacts are not visible on the gray background. Signal overshoot, undershoot, line distortion (streaking), and ringing (trailing ghosts) manifest on the gray surround region when system response is less than ideal.

The horizontal white and black bars emphasize lower frequency response issues. Look for streaks trailing each of the horizontal bars. The short term vertical lines represent high frequency transitions of time durations which will tend to show up ringing problems within the high frequency response of the imaging system. Ringing manifests as dark and light "ghosts" following the vertical lines and bars in the test pattern.

26. Contrast Transfer Function (CTF)



The Contrast Transfer Function (patent pending), or CTF, provides an indication of overall system high frequency response including the display's optical path. While most high frequency test patterns provide electrical bandwidth performance information when used with appropriate test instruments, evaluation of overall system response, including the optical pathway, is virtually nonexistent. Good high frequency performance translates to the perception of contrast and detail in the image. As high frequency performance degrades, contrast ratio between high and low image transitions approach middle gray and appear muddy or non-distinct. Should high frequency transitions become fully attenuated, the contrast falls to zero.

The CTF pattern contains bursts of high frequency alternating pixels and bursts of low frequency lines. Both appear as vertical bands on the screen. In the default mode, the alternating pixel bursts flash On and Off at a rate of 0.5 second, or 2 Hz. Pushing the soft key on the VTG's display screen defeats the flashing effect, if desired.

The low frequency line bursts will pass through a display system with less relative attenuation than the high frequency bursts. Since the high frequency bursts will appear to approach middle gray and lose detail when system response is degraded, the user may adjust the level of the low frequency bursts up or down via the soft keys on the VTG control display to match the perceived brightness of the high frequency bursts. When the point is reached where the perceived brightness of all the bursts is equal, the VTG provides a percentage number on its display. This percentage number is the approximate percentage of contrast performance in the system, including electrical and optical pathways. It may be used as a relative index of performance for the system's bandwidth.

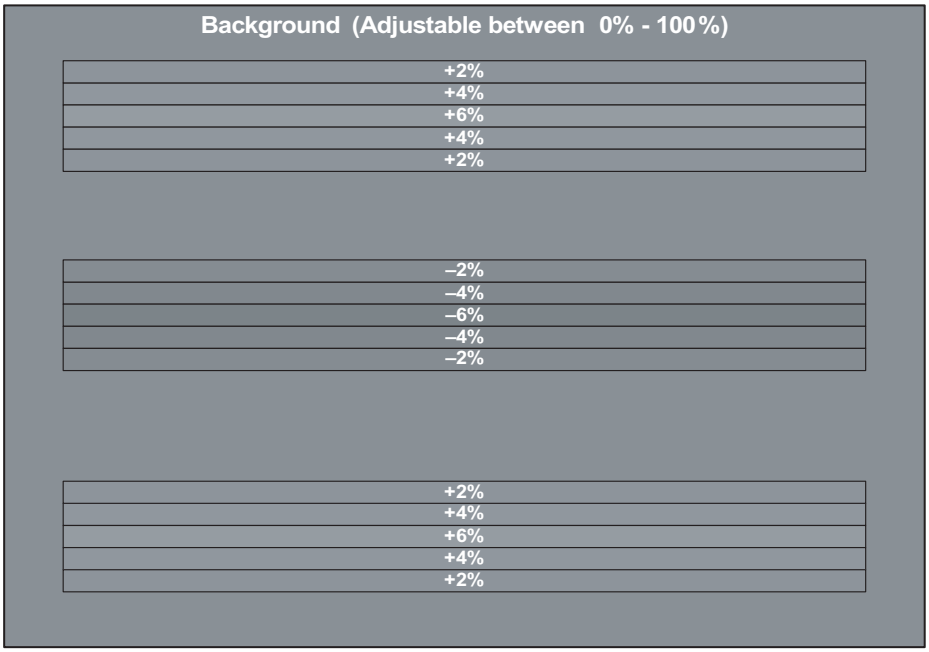
27. H Pattern

The H pattern represents simple text that can be used to evaluate image sharpness or overall response quality using symbology that anyone can understand. The invert soft key on the VTG 400 reverses the text from white text on a black background to black text on a white background. Use the H pattern for high frequency response evaluation where text legibility is the most critical application. This pattern may also be used to evaluate transient response, focus, lens distortions, video clamping stability, and image sharpness.

28. Hum Bar Detect

The Hum Bar Detect pattern assists the user with the location and evaluation of low level ground loop type signal interference. Visual results of induced or conducted low-level AC currents can be difficult to see, depending on image material. This pattern consists of a flat field with three groups of shallow horizontal steps. Each group contains five steps in increments of 2%.

Hum Bar Detect Pattern Video Levels



Note: All bar levels are given relative to the background video level.

The upper and lower groups ascend/descend in value (+2%, +4%, +6%, +4%, +2%) and the middle group descends/ascends in value (-2%, -4%, -6%, -4%, -2%).

VTG 400D/400 DVI Video Output Scan Rate Table

Output Type	Pixel x Line	Horiz Rate (kHz)	Vert Rate (Hz)	Supported Formats
PC Rates				
VGA	640 x 480	31.5	60	RGB, DVI
VESA 2 (VGA)	640 x 480	37.9	72	RGB, DVI
VESA1 (SVGA)	800 x 600	35.2	56	RGB, DVI
VESA5 (SVGA)	800 x 600	37.9	60	RGB, DVI
VESA6 (SVGA)	800 x 600	48.1	72	RGB, DVI
VESA3 (XGA)	1024 x 768	48.4	60	RGB, DVI
VESA4 (XGA)	1024 x 768	56.4	70	RGB, DVI
XGA5	1024 x 768	57	70	RGB, DVI
VESA8 (XGA)	1024 x 768	60	75	RGB, DVI
VESA9 (XGA)	1024 x 768	68.7	85	RGB, DVI
VESA10 (XGA+)	1152 x 864	67.5	75	RGB, DVI
1280 x 960	1280 x 960	60	60	RGB, DVI
1280 x 960	1280 x 960	70	70	RGB, DVI
1280 x 960	1280 x 960	75	75	RGB, DVI
VESA11 (SXGA)	1280 x 1024	64	60	RGB, DVI
VESA12 (SXGA)	1280 x 1024	91.1	85	RGB, DVI
SXGA+1	1400 x 1050	63.9	60	RGB, DVI
SXGA+2	1400 x 1050	65.32	60	RGB, DVI
VESA13 (UXGA)	1600 x 1200	75	60	RGB, DVI
VESA14 (UXGA)	1600 x 1200	87.5	70	RGB
VESA15 (UXGA)	1600 x 1200	106.3	85	RGB
QXGA1	2048 x 1536	99.46	60	RGB
QXGA2	2048 x 1536	115	71.8	RGB
LCoS1	1360 x 1024	80	75.1	RGB, DVI
LCoS2	1365 x 1024	65.2	60	RGB, DVI
Workstation Rates				
SGI	640 x 480	31.5	60	RGB, DVI
SGI	640 x 512	32.22	60	RGB, DVI
SGI	800 x 600	37.8	60	RGB, DVI
SGI	960 x 680	42.84	60	RGB, DVI
SGI	960 x 620	39.06	60	RGB, DVI
SGI	1024 x 768	48.36	60	RGB, DVI
SGI	1024 x 768	40.3	50	RGB, DVI
SGI	1200 x 900	68.04	72	RGB, DVI
SGI	1280 x 1024	53.25	50	RGB, DVI
SGI	1280 x 1024	63.9	60	RGB, DVI
SGI	1280 x 1024	76.68	72	RGB, DVI
SGI	1500 x 1200	75.6	60	RGB, DVI
SGI	1600 x 1024	63.38	60	RGB, DVI
SGI	1600 x 1200	75	60	RGB, DVI
SGI	1760 x 1100	71.04	60	RGB
SGI	1920 x 1035	33.75	60/30	RGB, DVI
SGI	1920 x 1080	33.72	60/30	RGB, DVI
SGI	1920 x 1080	70.31	60	RGB
SGI	1920 x 1080	84.37	72	RGB
SGI	1920 x 1200	77.52	60	RGB
SGI	1920 x 1200	85.27	66	RGB
SGI	2048 x 1120	83.45	72	RGB
Sun	1152 x 900	61.8	66	RGB, DVI
Sun	1152 x 900	71.7	76	RGB, DVI
Sun	1280 x 1024	81	76	RGB, DVI
Sun	1600 x 1280	89.3	67	RGB
Sun	1920 x 1080	84.4	72	RGB
Sun	1920 x 1200	87.2	70	RGB
Sun	1920 x 1200	93.6	75	RGB
Super Hi Res Rates				
Cornerstone	1600 x 1800	105	76	RGB
Extron	1280 x 1024	92	86.8	RGB, DVI
Extron	1600 x 1280	95	70.9	RGB
Extron	1800 x 1440	105	70	RGB

Output Type	Pixel x Line	Horiz Rate (kHz)	Vert Rate (Hz)	Supported Formats
Stereographics Rates				
Stereographics VGA	640 x 222	31.5	120	RGB, DVI
SGI stereo	640 x 480	60.84	120	RGB, DVI
SGI stereo	640 x 512	65.28	120	RGB, DVI
SGI stereo	1024 x 768	96.84	120	RGB, DVI
SGI stereo	1024 x 768	77.47	96	RGB, DVI
SGI stereo	1120 x 840	84.38	96	RGB, DVI
SGI stereo	1280 x 1024	124.60	114	RGB
SGI stereo	1280 x 1024	131.16	120	RGB
SGI stereo	1280 x 492	63.96	120	RGB, DVI
16:9 Hi Res Rates				
16:9	848 x 480	31.02	60	RGB, DVI
16:9	852 x 480	31.8	60	RGB, DVI
16:9	960 x 540	33.78	60	RGB, DVI
16:9	1024 x 576	44.04	60	RGB, DVI
16:9	1024 x 576	52.85	72	RGB, DVI
WXGA1	1280 x 768	45.11	56	RGB, DVI
WXGA2	1280 x 768	48.0	60	RGB, DVI
WXGA3	1280 x 768	47.77	60	RGB, DVI
WXGA4	1280 x 800	49.7	60	RGB, DVI
WXGA5	1360 x 765	47.7	60	RGB, DVI
WXGA6	1360 x 768	47.72	60	RGB, DVI
WXGA7	1365 x 768	47.7	60	RGB, DVI
WXGA8	1366 x 768	47.8	60	RGB, DVI
WSXGA	1440 x 900	55.94	60	RGB, DVI
WSXGA+1	1680 x 1050	64.67	60	RGB, DVI
WSXGA+2	1680 x 1050	65.29	60	RGB, DVI
1080p PC	1920 x 1080	67.2	60	RGB
WUXGA1	1920 x 1200	74.52	60	RGB, DVI
WUXGA2	1920 x 1200	74.6	60	RGB
WQXGA	2560 x 1600	99.46	60	RGB
HDTV Rates				
480p	720 x 483	31.42	59.94	YUV, RGB, DVI
576p	720 x 576	31.25	50	YUV, RGB, DVI
720p	1280 x 720	44.96	59.94	YUV, RGB, HDSDI, DVI
720p	1280 x 720	45	60	YUV, RGB, HDSDI, DVI
720p	1280 x 720	37.5	50	YUV, RGB, HDSDI, DVI
720p	1280 x 720	22.5	29.97	YUV, RGB, HDSDI, DVI
720p	1280 x 720	22.48	30	YUV, RGB, HDSDI, DVI
720p	1280 x 720	18.75	25	YUV, RGB, HDSDI, DVI
1080i	1920 x 1080	33.72	29.97	YUV, RGB, HDSDI, DVI
1080i	1920 x 1080	33.75	30	YUV, RGB, HDSDI, DVI
1080i	1920 x 1080	28.13	25	YUV, RGB, HDSDI, DVI
1080p	1920 x 1080	67.5	60	YUV, RGB, DVI
1080p	1920 x 1080	33.75	30	YUV, RGB, HDSDI, DVI
1080p	1920 x 1080	33.72	29.97	YUV, RGB, HDSDI, DVI
1080p	1920 x 1080	56.25	50	YUV, RGB, DVI
1080p	1920 x 1080	28.13	25	YUV, RGB, HDSDI, DVI
1080p	1920 x 1080	27	24	YUV, RGB, HDSDI, DVI
1080p (24PsF)	1920 x 1080	27	24	YUV, RGB, HDSDI, DVI
1080p (24PsF)	1920 x 1080	26.97	23.98	YUV, RGB, HDSDI, DVI
1035i	1920 x 1035	33.75	30	YUV, RGB, HDSDI, DVI
1035i	1920 x 1035	33.72	29.97	YUV, RGB, HDSDI, DVI
Video Rates				
NTSC	720 x 485	15.7	60/30	VID, Y/C, YUV, RGB, SDI
NTSC 0 IRE (JPN)	720 x 485	15.7	60/30	VID, Y/C, YUV, RGB, SDI
PAL I	720 x 575	15.6	50/25	VID, Y/C, YUV, RGB, SDI
PAL B, G, H	720 x 575	15.6	50/25	VID, Y/C, YUV, RGB, SDI
PAL N	720 x 575	15.6	50/25	VID, Y/C, YUV, RGB, SDI

Extron's Warranty

Extron Electronics warrants this product against defects in materials and workmanship for a period of three years from the date of purchase. In the event of malfunction during the warranty period attributable directly to faulty workmanship and/or materials, Extron Electronics will, at its option, repair or replace said products or components, to whatever extent it shall deem necessary to restore said product to proper operating condition, provided that it is returned within the warranty period, with proof of purchase and description of malfunction to:

USA, Canada, South America, and Central America:
Extron Electronics
1001 East Ball Road
Anaheim, CA 92805
U.S.A.

Japan: Extron Electronics, Japan
Kyodo Building, 16 Ichibancho
Chiyoda-ku, Tokyo 102-0082
Japan

Europe, Africa, and the Middle East:
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Hanzeboulevard 10
3825 PH Amersfoort
The Netherlands

China:
Extron China
686 Ronghua Road, Songjiang District
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Asia:
Extron Asia
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Singapore 368363
Singapore

Middle East:
Extron Middle East
Dubai Airport Free Zone
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United Arab Emirates, Dubai

This Limited Warranty does not apply if the fault has been caused by misuse, improper handling care, electrical or mechanical abuse, abnormal operating conditions or non-Extron authorized modification to the product.

If it has been determined that the product is defective, please call Extron and ask for an Applications Engineer at (714) 491-1500 (USA), 31.33.453.4040 (Europe), 65.383.4400 (Asia), or 81.3.3511.7655 (Japan) to receive an RA# (Return Authorization number). This will begin the repair process as quickly as possible.

Units must be returned insured, with shipping charges prepaid. If not insured, you assume the risk of loss or damage during shipment. Returned units must include the serial number and a description of the problem, as well as the name of the person to contact in case there are any questions.

Extron Electronics makes no further warranties either expressed or implied with respect to the product and its quality, performance, merchantability, or fitness for any particular use. In no event will Extron Electronics be liable for direct, indirect, or consequential damages resulting from any defect in this product even if Extron Electronics has been advised of such damage.

Please note that laws vary from state to state and country to country, and that some provisions of this warranty may not apply to you.

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