VXI Programmable Video Generator and Analyzer

US Patented
Other Patents Pending

Advanced Testing Technologies, Inc.
Overview

The Programmable Video Generator and Analyzer (PVGA) provides the user with a highly flexible video test instrument. The PVGA can simultaneously generate multiple video signals in a full complement of formats - composite (interlaced or progressive scan), stroke (XYZ), mixed video (composite and stroke interleaved), and modulated or rectilinear scan video (e.g. radar and sonar displays). The PVGA also provides a video capture function with the same wide range of formats. The captured video can either be immediately redisplayed on the system’s monitor or ported directly to the ATTI Virtual Spectrum Analyzer (a powerful, user friendly, software tool for the efficient analysis of the video images and formats).

All of these attributes are offered on a C size, VXI card. The capabilities within this C size card have not been duplicated by other manufacturers of video or automatic test equipment to date. The PVGA is a state of the art instrument providing an excellent solution set for many video generating and analysis requirements dictated by today’s advanced avionics and video markets.

Features

Some of the features of the Programmable Video Generator and Analyzer are as follows:

- Four video functions integrated into a single slot, 'C' sized, register-based VXI instrument
- All functions completely autonomous
- Compatible with both analog and digital video systems
- Sophisticated control structure provides the ability to simulate dynamic and interactive displays
- Automatic run time alignment of all analog parameters
- Separate programmable clocks (0.25% resolution) for each function
- User programmable timing pulses for internal/external synchronization
- Comprehensive API interfaces directly with high level languages
- Plug & Play compatible
- Standard video programming simplified with predefined macros
- Satisfies RS170, RS343, and STANAG 3350 class video standards
- Video acquisition mode interfaces directly to the ATTI Virtual Spectrum Analyzer software package for visual image analysis
- In-system upgradeable as functional testing needs are increased
- Built-in test
- All I/O via standard connectors - MCX 75Ω coax (analog) and D-sub 62 pin (digital)
- Turnkey operation

Description

The ATTI Programmable Video Generator and Analyzer (PVGA) is a true VXI instrument integrating multiple function, multiple output video generation, and video-specific digitizer/analyzer capabilities into a complete general purpose test platform for military or commercial applications. The PVGA is produced at several levels of functional capability and may be fully configured with up to three video generator elements and one video capture element. All four video elements are capable of fully independent and simultaneous operation, making the PVGA a complete video test system on a card. When combined with the in-system upgradeability feature, the PVGA is truly a flexible and cost-effective alternative to multiple slot video test configurations. The generator elements can be used separately to test single format video displays, or in combination to test either mixed format video displays or video switching systems. The video capture element can be used alone to test video generators or can be used with one or more of the generator elements to support video processors. Since all outputs are automatically aligned at run time, the PVGA delivers high accuracy signals with no periodic maintenance.
Primary Composite Video (PCV)

The PCV generates high-resolution bit-mapped images for cathode ray tube (analog) and flat panel (digital) displays. Standard and non-standard scan formats - both synchronized and deflection driven - are directly supported by the PCV. An internal dedicated drawing engine greatly accelerates the loading of the image into the bit map. A dynamic overlay image may be superimposed on the main image. The dynamic overlay can be updated from frame to frame as to content, position, or foreground/background status. For units under test that require direct analog raster scan deflection waveforms, the PCV provides these in multiple formats.

Primary Composite Mode

- **Timing**
  - Image resolution: up to active 2048 lines by 2048 active pixels
  - Pixel rate: 80 MHz maximum
  - Horizontal scan rate: 0.001 Hz to 200 kHz (programmable with 0.025% resolution)
  - Vertical scan range: 10 to 4096 lines per frame
  - Sync and blanking: any arbitrary pattern with timing from 0 to full line time
  - Timing resolution for all parameters: 2 pixel times

- **Analog Outputs**
  - Maximum range: +/- 3 volts into 75 Ohms
  - All levels (R, G, B, sync, blanking): individually programmable to any level within maximum range
  - Analog accuracy: +/- 0.5% (local sense) or +/- 0.2% (remote sense)
  - Scan modes: interlaced, non-interlaced, reverse, alternate, repeat

- **Digital Outputs**
  - Composite sync
  - Blanking
  - Horizontal marker
  - Vertical marker
  - User specified pulses (2)
  - Pixel clock
  - Video data (24 bits - 8 bits each for R, G, and B)

- **Multilevel Output**
  - A unique, user configurable signal with 4 independent voltage levels (range: +3 volts to -3 volts) that can be arbitrarily assigned to logic states from:
    - Sync and blanking
    - Horizontal and vertical markers
    - One of two sets of user specified pulses

Raster Scan Deflection

- **Modes**
  - Rectilinear
  - Polar
  - Arbitrary

- **Timing**
  - Line rate: any from 0.001 to 100 kHz
  - Field rate: any from 1e-5 to 1 kHz

- **Analog Outputs**
  - Line and field: +/- 10 volts into 75 Ohms with 12 bit resolution and 0.5% accuracy (local sense) and 0.2% (remote sense)
  - Filters: 2 kHz, 20 kHz, 2 MHz (assigned as a function of mode and rate)

Dynamic Overlay

- **Overlay storage**: 1 Meg by 16 bits
- **Overlay size and number available**: Ranging from (1) 2048 x 2048 overlay to (256) 128 x 128 overlays
- **Overlay position storage**: 26214 programmable blocks (sufficient for over 14 minutes of continuous overlay movement at 30 Hz frame rate)
- **Position control modes**
  - Continuous
  - Externally gated
  - Externally triggered
- **Intensity control - externally gated on/off**
- **Position sequence modes**
  - Repeat
  - Non-repeat
- **Overlay priority - programmable frame by frame**
  - Overlay image in front of primary image
  - Overlay image behind primary image
**Secondary Video Source (SVS)**
The SVS generates medium resolution bit-mapped images in any synchronized scan format. The purpose of the SVS is to produce a second video signal of either identical or different format than that of the PCV. The two video signals - PCV and SVS - can be used together to test multi-scan monitors, video switching systems, channel isolation et al., or separately to simultaneously test multiple displays.

**Secondary Composite Mode**
- **Timing**
  - Image resolution: 1024 active lines by 1024 active pixels
  - Output resolution: 2048 lines by means of line doubling
  - Pixel rate: 40 MHz maximum
  - Sync and blanking: any arbitrary pattern with timing from 0 to full line time
  - Timing resolution: 1 pixel time
- **Analog outputs - same as for Primary Composite**
- **Digital output**
  - Horizontal sync
  - Vertical sync
  - Field marker

**Stroke Generator (SG)**
The SG produces stroke, or X-Y-Z video in which the image is drawn on the screen by directly deflecting the beam along the lines of the image being drawn. Complex, interactive images can be produced by the SG by means of its programmable sequence control structure that controls the order, duration, and position of image elements. Image control can be a mix of internal, external, or real time software.

**Stroke**
- **Analog outputs**
  - X and Y: +/- 10 volts into 75 Ohms with 12 bit resolution and 0.5% accuracy (local sense) and 0.2% (remote sense)
  - Z: +/- 10 volts into 75 Ohms with 19 bit resolution and 0.5% accuracy (local sense) and 0.2% (remote sense)
- **Digital image storage:** an arbitrary series of images contained in a 256K by 32 bit memory
- **Digital sequence control structure storage:** a sequence list of 16K sequence control blocks
- **Stroke clock:** 80 MHz maximum with resolution of 0.25%
- **Image content:** any image that can be comprised of an arbitrary series of lines and arcs
- **Programmable Sequence Control block content**
  - Display continuous
  - Display - loop for
  - Display - wait for external trigger
  - Program stop
  - Jump to another block (goto)
  - Jump to a subroutine (gosub)
  - Jump - return from subroutine (return)
  - Loop back for programmed number of loops
  - Real time branch (software driven)
  - Output_adjust - offset (X,Y)
  - Output_adjust - offset increment (X,Y)
  - Offset select (63 independent offsets)

**Video Redisplay Tool**
The Video Redisplay Tool software allows all video formats captured with the RTC (Real Time Capture mode) to be continuously streamed to the host PC and displayed on the host monitor for visual operator verification. Options such as frame averaging, threshold clipping, and display adjustments are available to aid in the visual presentation.

**Real Time Capture (RTC)**
The RTC performs one-shot or continuous full frame video image capture on both analog and digital video in either synchronized or deflection driven format. For synchronized video, the RTC has an adaptive sync lock that locks on the input synchronization signal even if the signal is marginal.
Capture Resolution
- Capture storage: 3 - 1 Meg by 16 bit memories
- 12 bits per sample to 20 MegaSamples per second (three inputs)
- 12 bits per sample to 40 MegaSamples per second (single input)
- 8 bits per sample to 40 MegaSamples per second (three inputs)
- 8 bits per sample to 80 MegaSamples per second (single input)

Capture Redisplay
- Self contained - image redisplayed on station monitor, no external equipment required
- Compatible with all format and capture modes
- Redisplay rate up to 1/2 of input frame rate
- User definable (size and location) region of interest for optimal speed and accuracy
- Captured video images can be archived in still image format (JPEG or bit mapped) or motion image format (MPEG or AVI)

Analog Input Channels
- Full scale range: +/- 0.5 volts minimum to +/- 10 volts maximum
- Bandwidth: greater than 40 MHz
- Input impedance: 75 Ohms
- Analog accuracy: execution time aligned to +/- 0.2% (card input pin to analog-to-digital converter)

Digital Input
- TTL levels from either 5 volt or 3.3 volt sources
- Input impedance: 100 Ohms

Capture Modes
- Composite video
- Analog video with separate syncs
- Digital video with separate syncs
- Deflection scan (raster) video
- Stroke (XYZ) video

Control Modes
- Internal
- External - gated
- External - triggered

Available Performance Levels
The PVGA is available in multiple levels of functional capability.
- Base Generation
  - Primary composite video
  - Stroke video
  - Mixed video (stroke over composite)
- Enhanced Generation option
  - Secondary composite video generation
  - Raster video generation (rectilinear, sector, and radial formats)
  - Mixed video (raster over composite)
- Video Acquisition Functions option
  - Composite video acquisition (single frame capture)
  - Raster and stroke video acquisition (single frame capture)
  - Digital video acquisition (32K color)
- Video Redisplay Application option
  - Upgrades all video acquisition modes to continuous capture
  - Near real-time display of video capture on host computer’s monitor
  - Archive capability to JPEG, BMP, and MPEG file formats

Summary
The ATTI Programmable Video Generator and Analyzer was designed from the bottom up to be part of a modern ATE System. It provides multiple functions on a single VXI card, its signals are highly accurate, and it requires no periodic maintenance. All functions are completely autonomous and the PVGA is compatible with both analog and digital video systems. This state-of-the-art instrument has its own built-in test and is capable of turn-key operation. All of these features make the PVGA a cost-effective addition to any ATE system.

Mode Summary
- ✓ Primary Composite Mode
- ✓ Secondary Composite Mode
- ✓ Raster Video
- ✓ Modulated Raster Video
- ✓ Stroke Video
- ✓ Mixed Video
- ✓ Video Frame Capture
- ✓ Continuous Capture Redisplay

Full Spectrum Video Testing
**ATTI Company Profile**

The corporation:
- has designed, developed and manufactured ATE since 1987
- has delivered and supported many test systems in both the commercial and military sectors
- is an innovator in developing and implementing VXI technology solutions
- has developed over one thousand test program sets, covering the test spectrum from simple to extremely complex
- has numerous satisfied customers, including:
  - Agusta, Italy
  - Boeing
  - Esdas, Turkey
  - Havelsan, Turkey
  - Hellenic Air Force
  - Japanese Air Force
  - KLM Royal Dutch Airlines
  - M&T Corporation
  - Modern Technologies Corporation
  - NASA
  - NATO
  - Palomar Products, Inc.
  - Royal Saudi Air Force
  - US Air Force
  - US Navy

**ATTI Worldwide Support**

The corporation:
- has delivered numerous test systems worldwide
- offers one of the most experienced service, training and support teams in the world
- has worked with our customers solving diverse test challenges in digital, analog, and RF applications
- is committed to total hardware and software support including service, spares, upgrades, documentation, training, and configuration control
- offers modem links to experienced professionals in our home office in Hauppauge, NY
- is committed to future updating of both hardware and software to enhance our customers' products while protecting their investment in test programs
- has the financial efficacy to guarantee long-term commitments

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