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Marvin Test Systems, Inc.

Using PXI Digital Test Instrumentation for Video Test Applications

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PXI Systems Alliance

Presented By

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PXI Systems Alliance

- Non-profit consortium responsible for promoting, maintaining and developing the PXI standard
- 65 members and over 1400 products
- 3 levels of membership:
  - Sponsor
  - Executive
  - Associate
- www.pxisa.org

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Dale Johnson

Geotest
Marvin Test Systems, Inc.

- Customer Technical Support Manager for Geotest
- Over 20 years in the test and measurement industry
- Previous positions included marketing and product support for Interface Technology's line of VXI digital instrumentation products
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  - Geotest web site: www.geotestinc.com

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Geotest – Marvin Test Systems

Geotest
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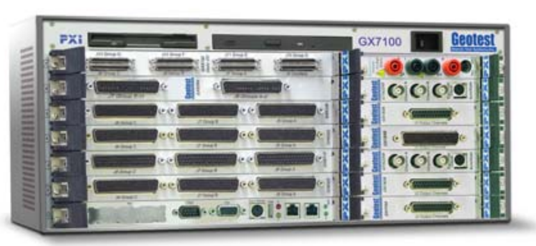
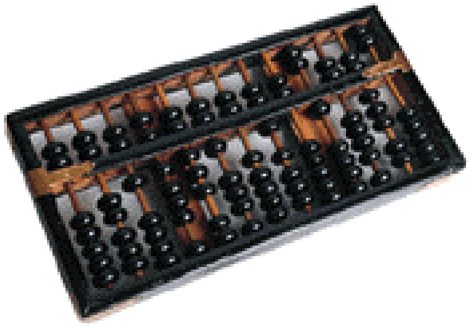
- A provider of test-and-measurement hardware and services for the electronics industry.
- Products and services:
  - Broad line of PXI *Smart* chassis, instrumentation, and switching
  - ATEasy – Test executive and test development software environment
  - Legacy instrumentation replacement solutions
  - System integration and turnkey applications
- One of 5 PXISA sponsor members
- Established in 1988, Geotest is a division of the Marvin Group, a US corporation and is based in Irvine, CA.



Agenda

- Defining Digital Test
- Attributes of Digital Testers
- Requirements and Considerations for Digital Test for Video Test Applications
- Video Test Application

What Is Digital Test?



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Digital Test Defined

- Loosely defined, digital test is the application of and/or the monitoring of sequential logic states across one or more channels for the purpose of:
  - Functionally testing a device
  - Controlling a device
  - Synchronizing multiple devices
  - Exercising a device so that it may be characterized
  - Simulating or emulating an interface to a device
  - Communicating with a device (custom protocols)

Digital Test Means
Different Things to Different People

- Functional Test
  - Wafer, Component, Board, LRU, System
- Bus or Processor Emulation
  - Microprocessor, Microcontroller, Backplane, Custom
- Record & Playback of Real-World Signals
  - Audio, Video, RF, Pressure, Temperature
- Event Timing & Synchronization
  - Instrument Triggering, Radar/Sonar Timing, Multi-Phase Clocking

Digital Test Attributes

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- Static or Dynamic pattern application
- Stimulus, Acquisition or Stimulus/Response
- Parallel I/O or Serial I/O
- Number of Pins
- Test Rate (Data Rate, Clock Rate, Frequency)
- Pattern Depth (Vector Depth, State Depth)
- Pattern Sequencing (Looping, Branching, Handshaking)
- Logic Levels (Fixed, Variable, Optical)
- Tristate Control for Bi-directional I/O
- Real-Time Compare
- Data Formatting & Edge Timing
- Algorithmic Pattern Generation

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Block Diagram

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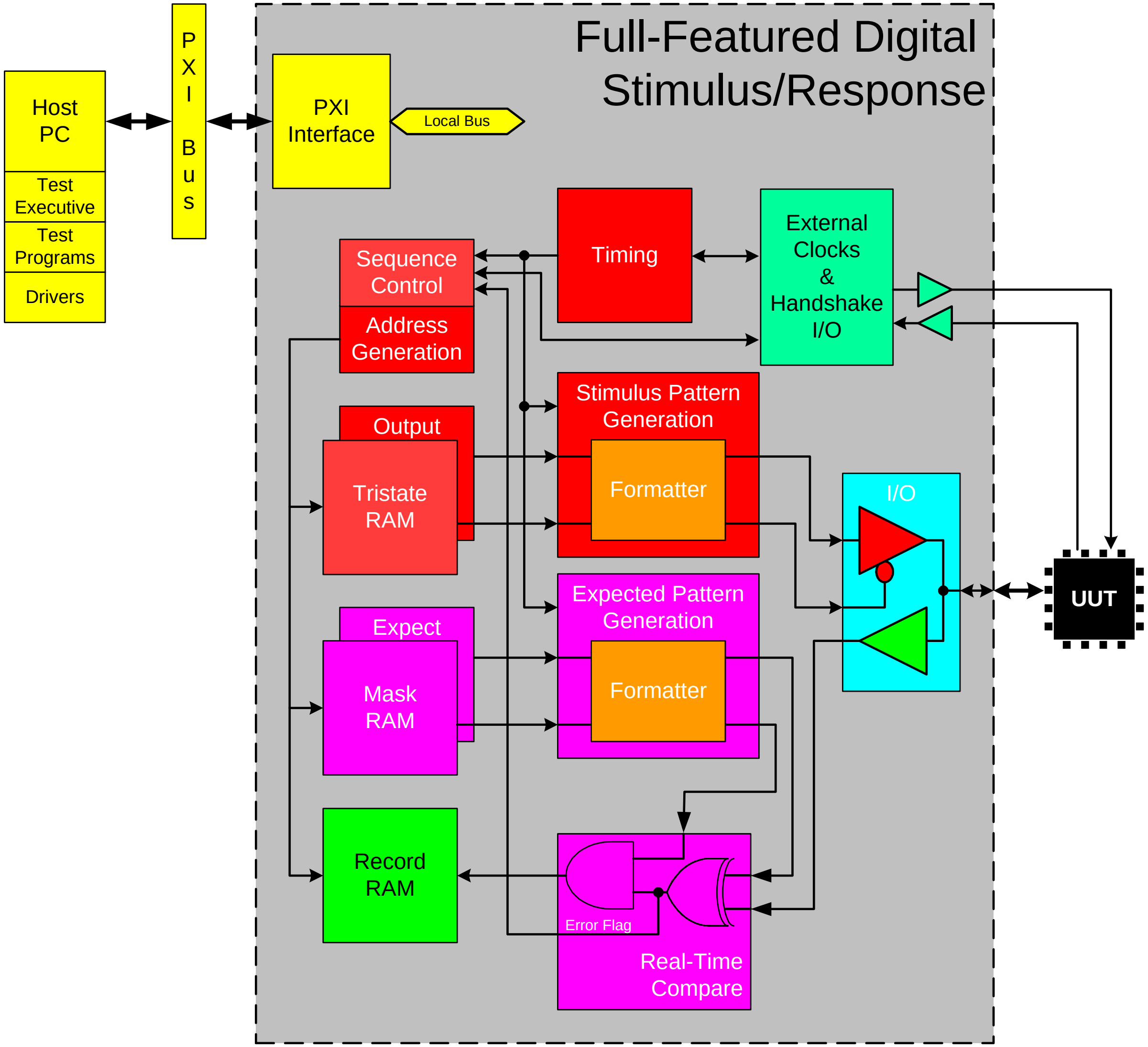

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Digital Test Requirements for Video Test Applications

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- Image sensor testing
- Radar Target Simulation
- Testing video processors
- Display testing / pattern generation

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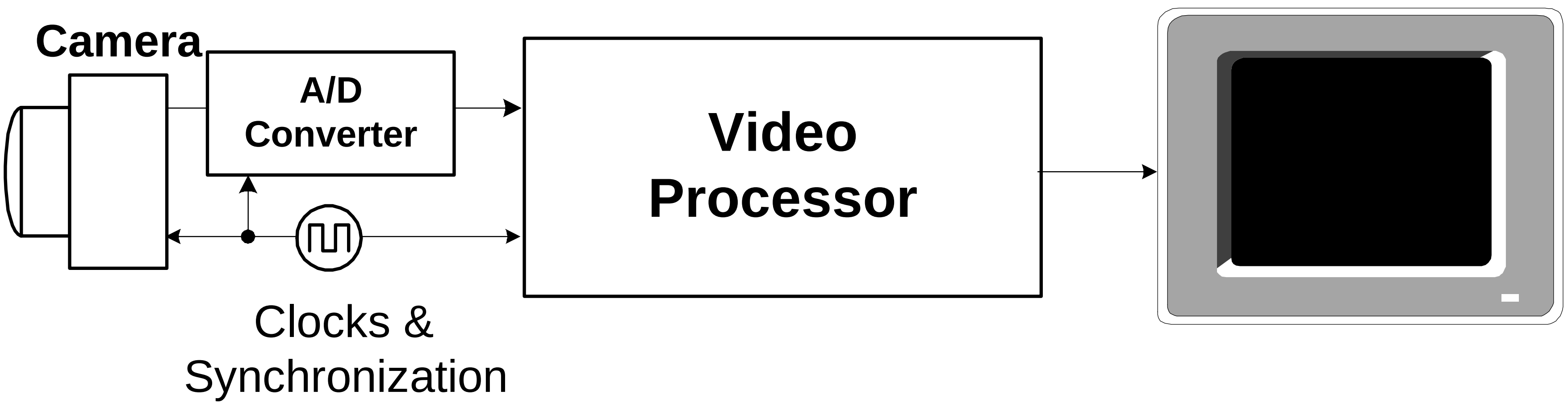
Video Display Example



Video Display Testing

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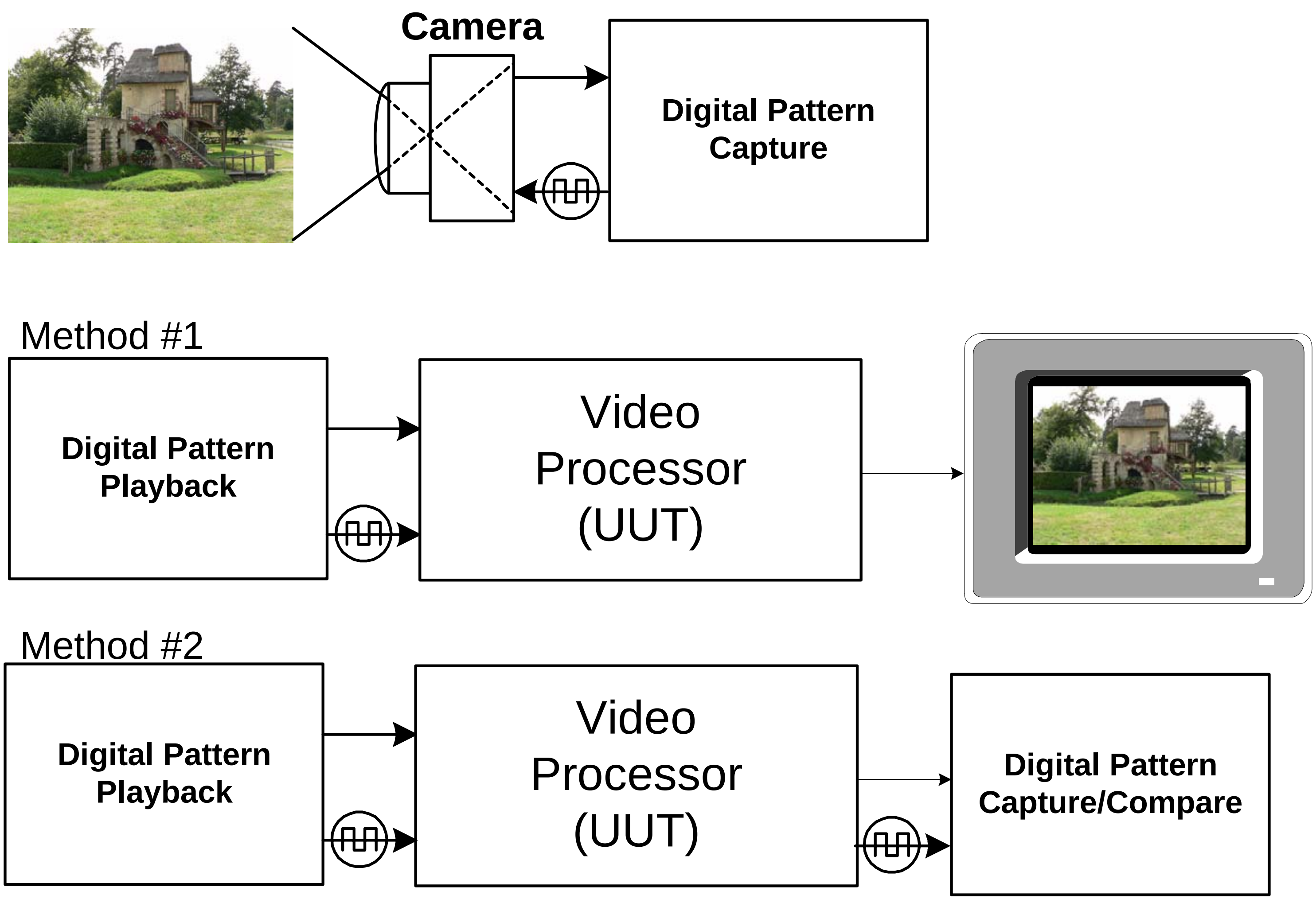

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Radar Receiver/Processing Example

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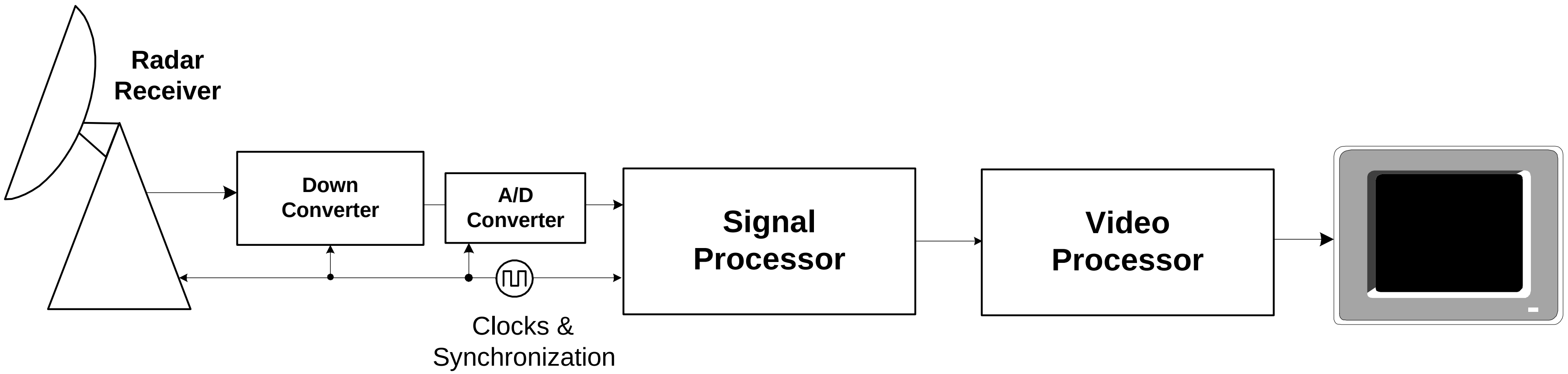

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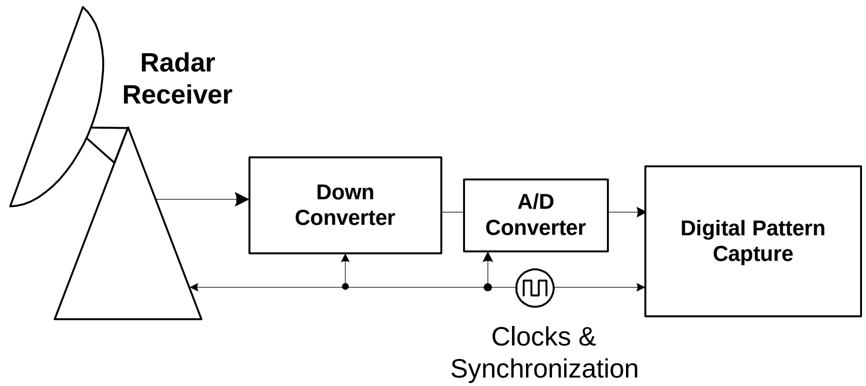
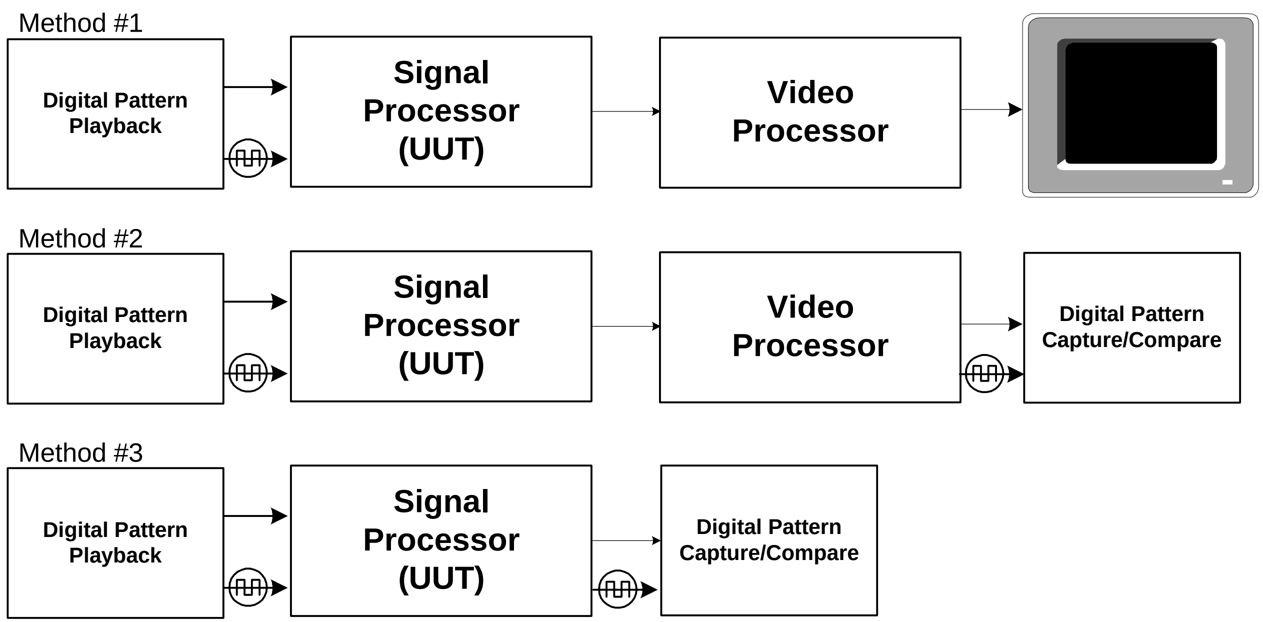
Radar Receiver/Processing Test Example #1





Digital Testing Requirements for Video (1)

- Deep pattern memory
  - How much is enough?
  - One frame of B&W HD video (1280 x 720) requires almost 1 MS of data, with a data rate of 30 MS/s. RGB would require three times the number of samples and three times the data rates.
  - Deep memory digital instruments with configurable width / depth features can provide > 1 G of 16 bit data allowing capture/playback of more than 30 seconds of B&W video data

Digital Testing Requirements for Video (2)

- Number of channels for digitizing resolution and number of channels to support arrays
  - How many bits of resolution are required (8-16/channel) for each analog channel?
  - How many analog channels are required?
  - May require multiple digital instruments synchronized to one-another

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Digital Testing Requirements for Video (3)

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- Data rate
  - How fast do you need to output / acquire data (Frequency or MSamples/Sec)?
    - 30 MHz for 1280 x 720 B&W
    - 100 MHz for 1280 x 720 RGB
    - Faster for higher resolution
- Interface logic levels
  - LVDS is typical
  - Programmable levels may be required to support custom interfaces

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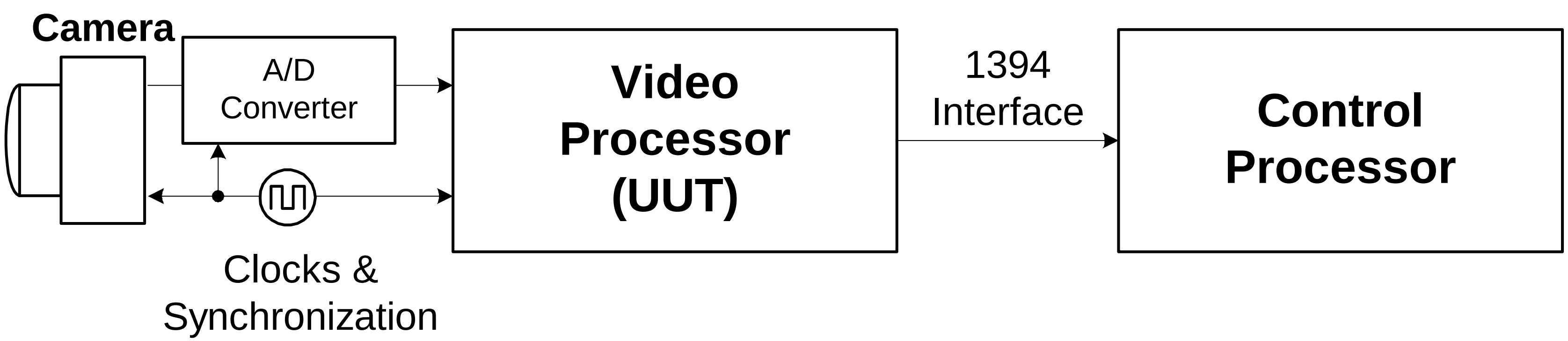
Digital Testing Requirements for Video (5)

- Flexible Clocking Options
  - May need to synchronize the UUT to the instrument, or the instrument to the UUT
- Upload / download time for patterns
  - Instrument bus needs to load / read large pattern files to /from the digital instrument
  - Deep pattern memory may allow storing multiple test patterns in the instrument at one time, off-loading some of the pattern transfers
- Software tools / drivers
  - Procedures to load / read pattern files
  - Instrument Control
  - Compare captured patterns to known good results

Video Test Application



- Requirements
  - Test a Video Processor
  - Digital video interface input
    - 12-bit, 100 MHz
  - Firewire 1394 output
  - Evaluate output using a known input and a known good response

Test Methodology

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1. Create a library of video test patterns by capturing real-world digital video signals
2. Create a library of Known-Good outputs for each video test pattern using a Known-Good-Board (KGB)
3. Test unknown processors, comparing Unit Under Test (UUT) output to Known-Good output

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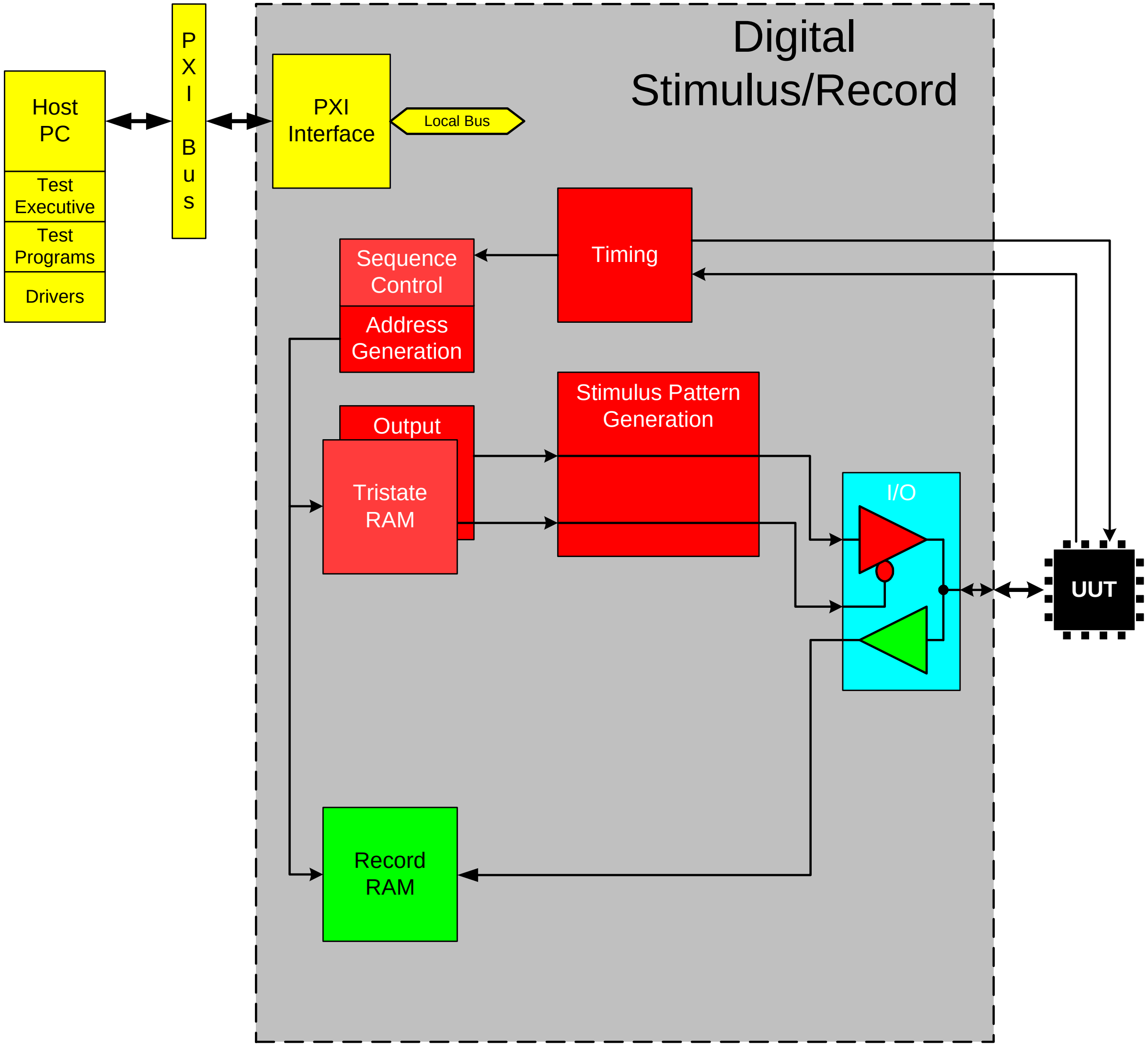
Digital Test Instrument Block Diagram



Step 1 – Capture Real-World Patterns

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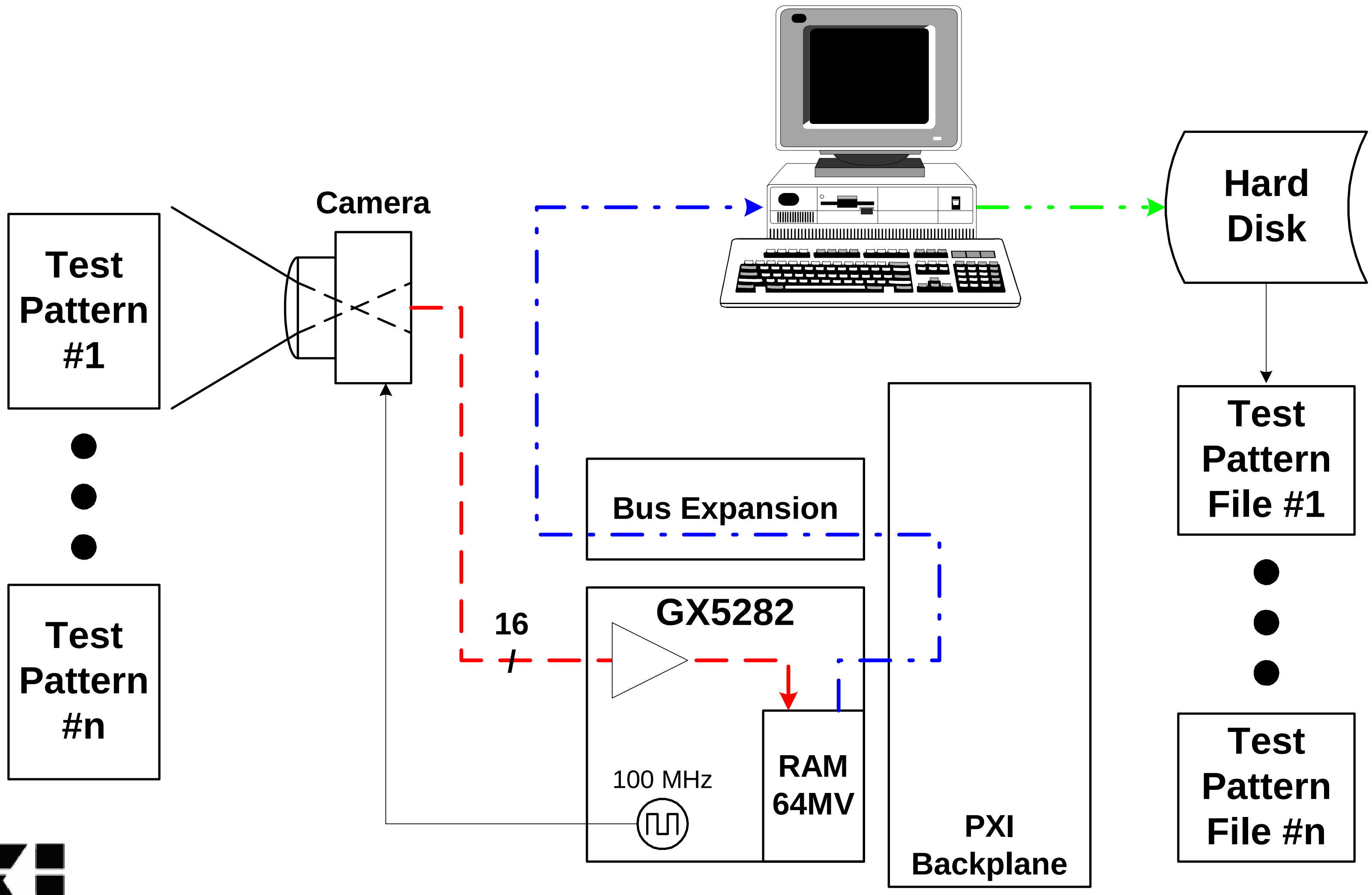

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Digital Video Data Capture Configuration

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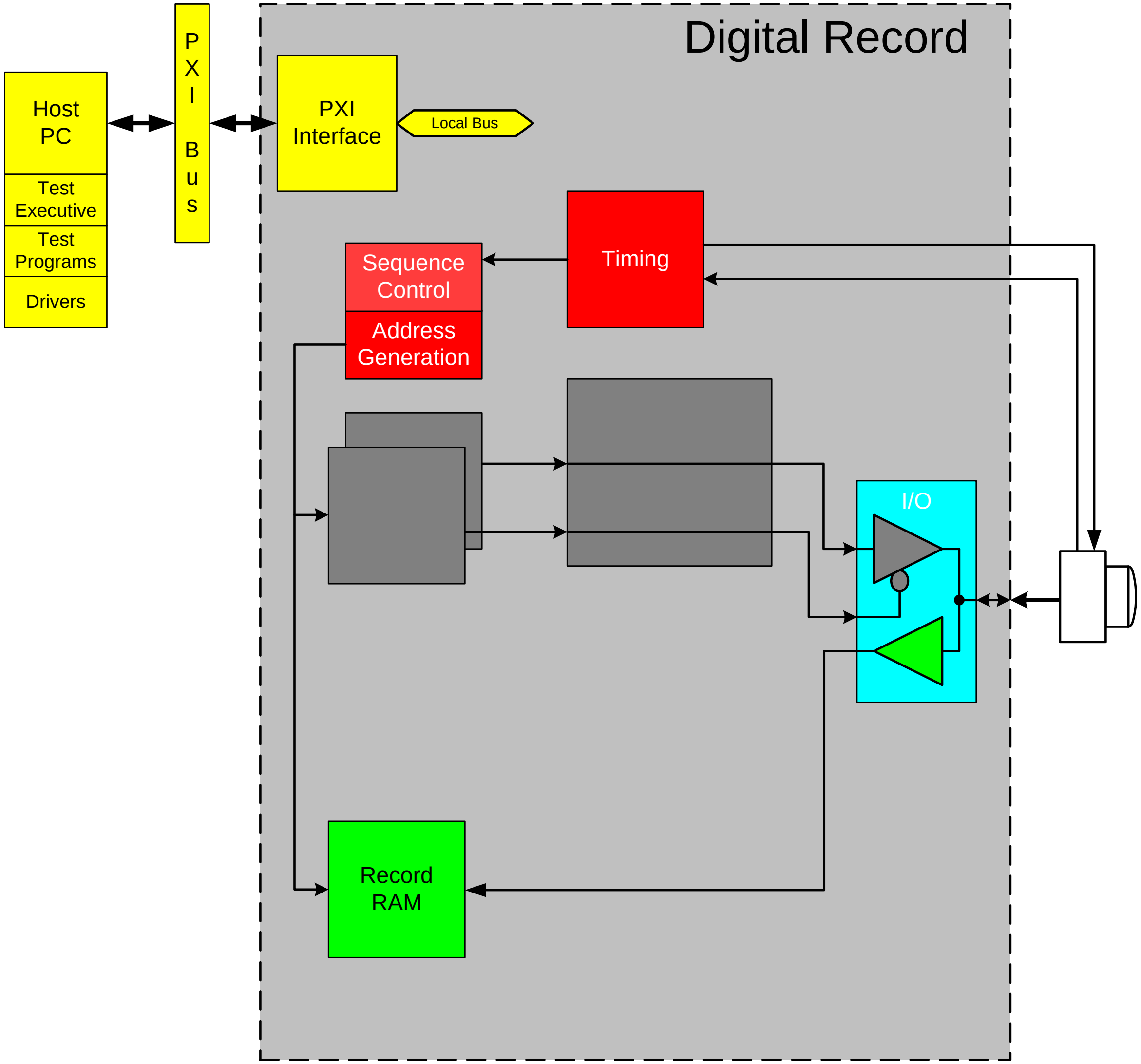

Step 2 – Generate Known-Good UUT Results

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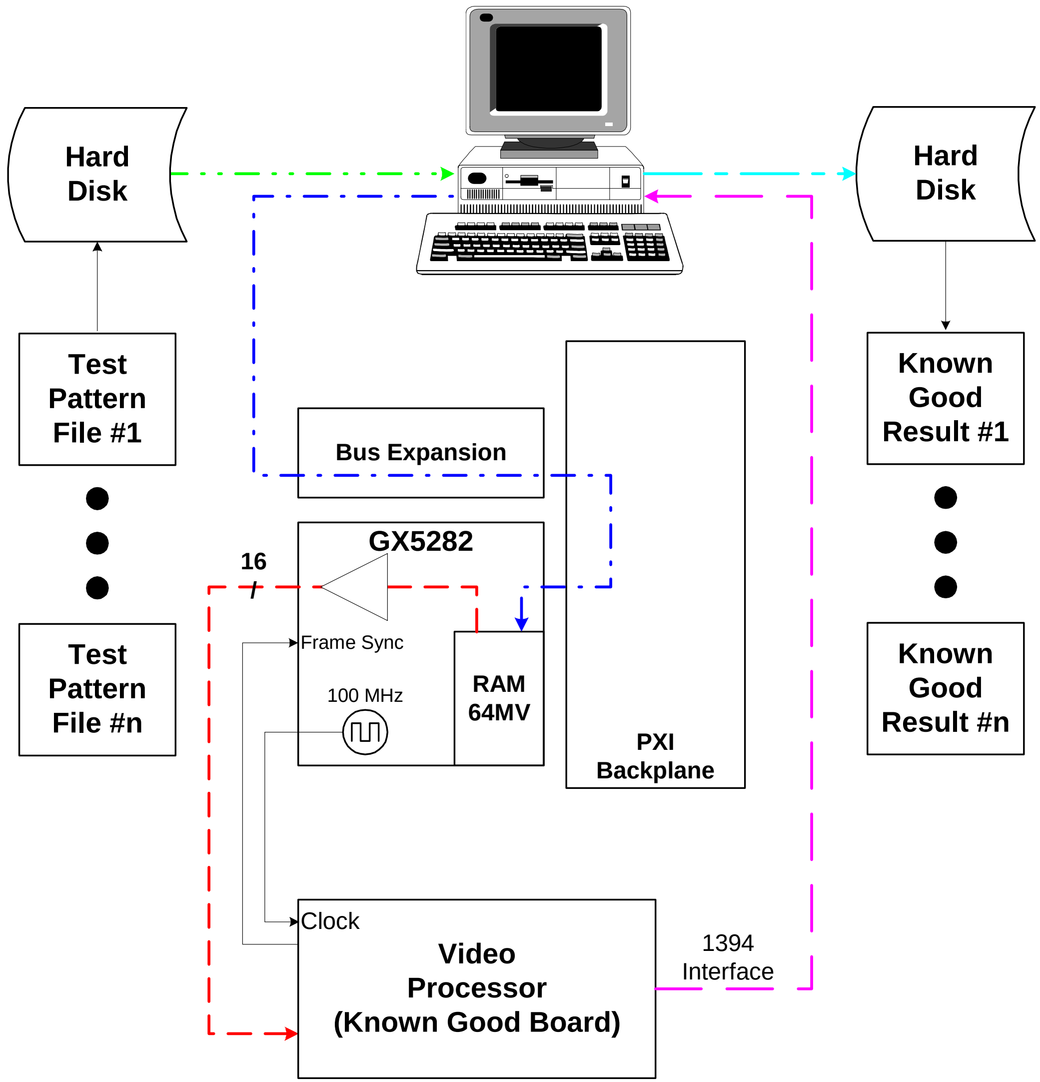

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Digital Video Generation Configuration

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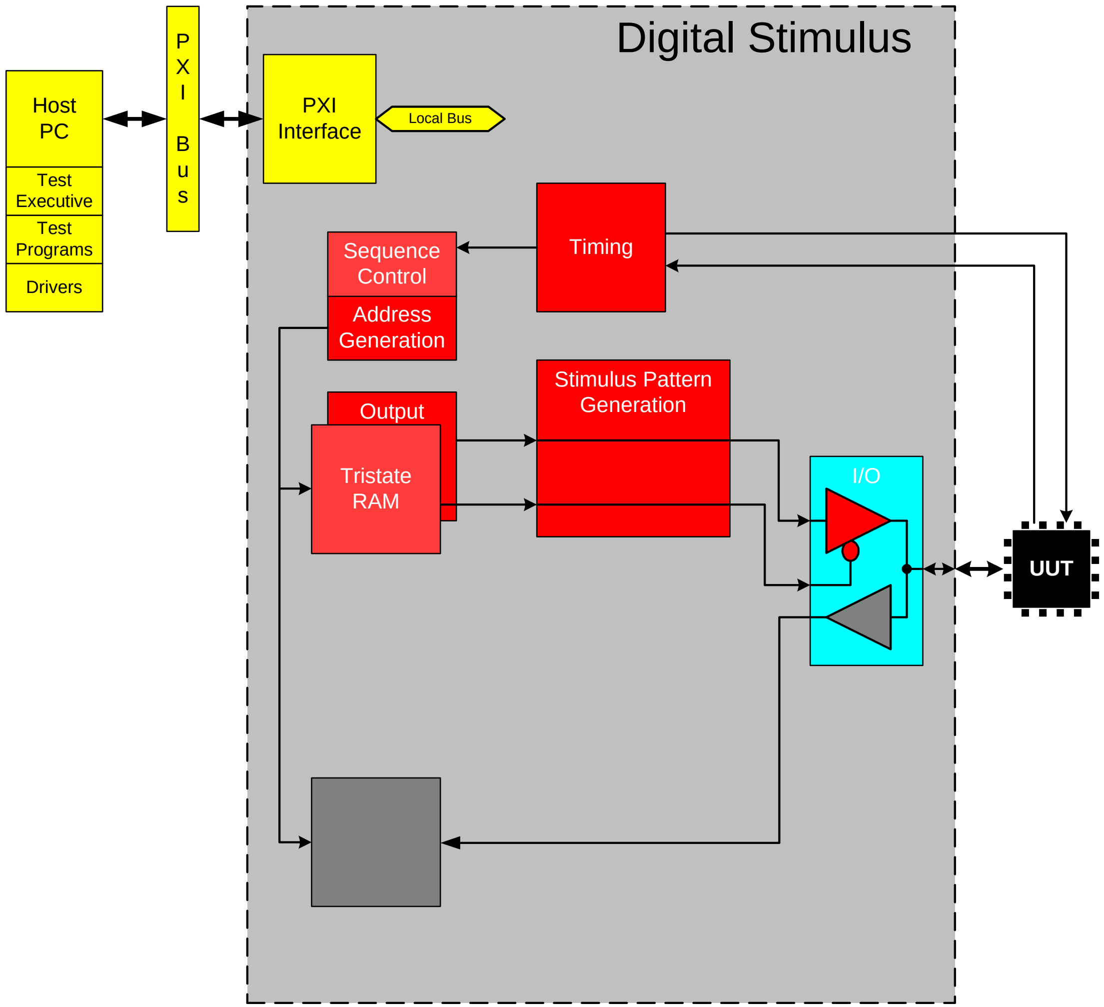

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Step 3 – Test the UUT, Compare Results

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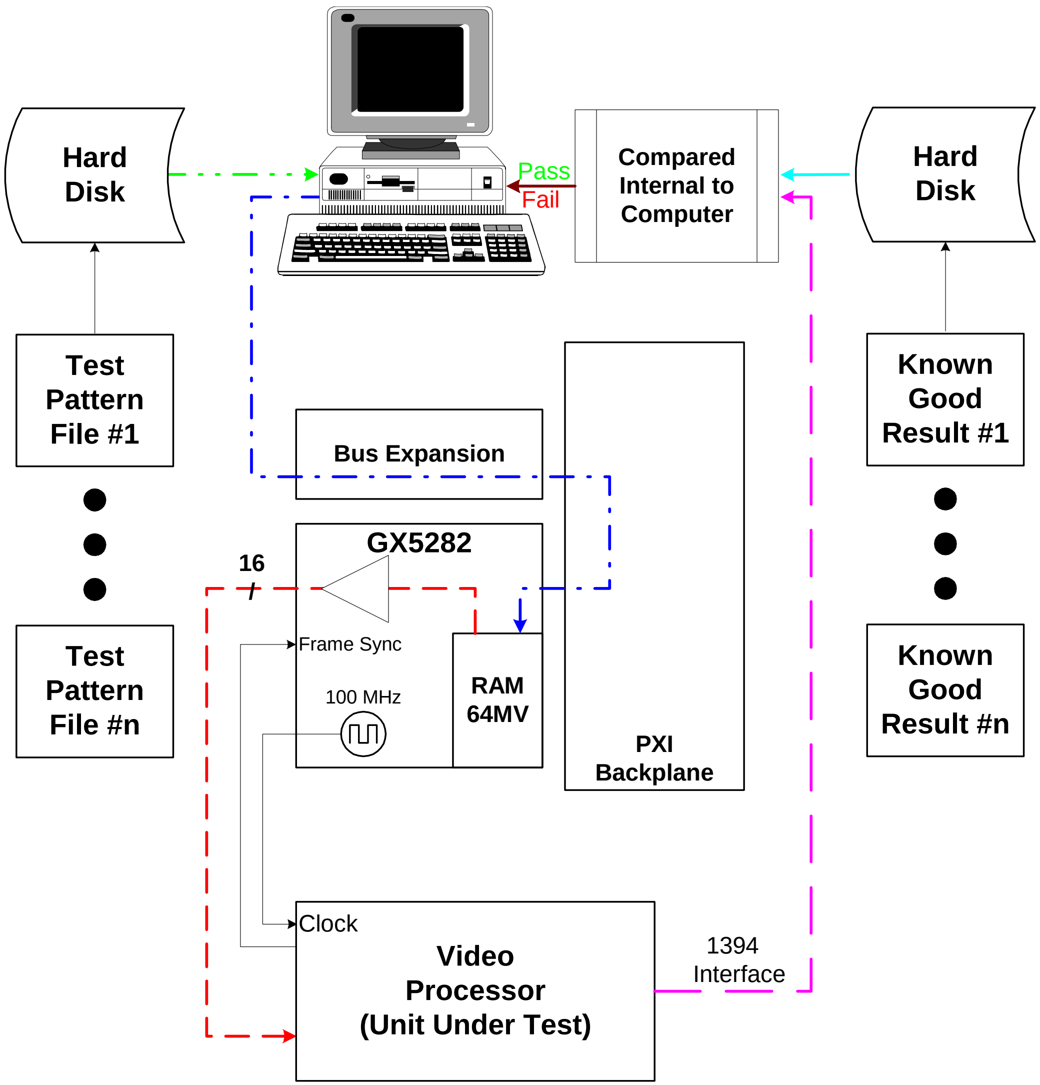

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Digital Video Generation Configuration

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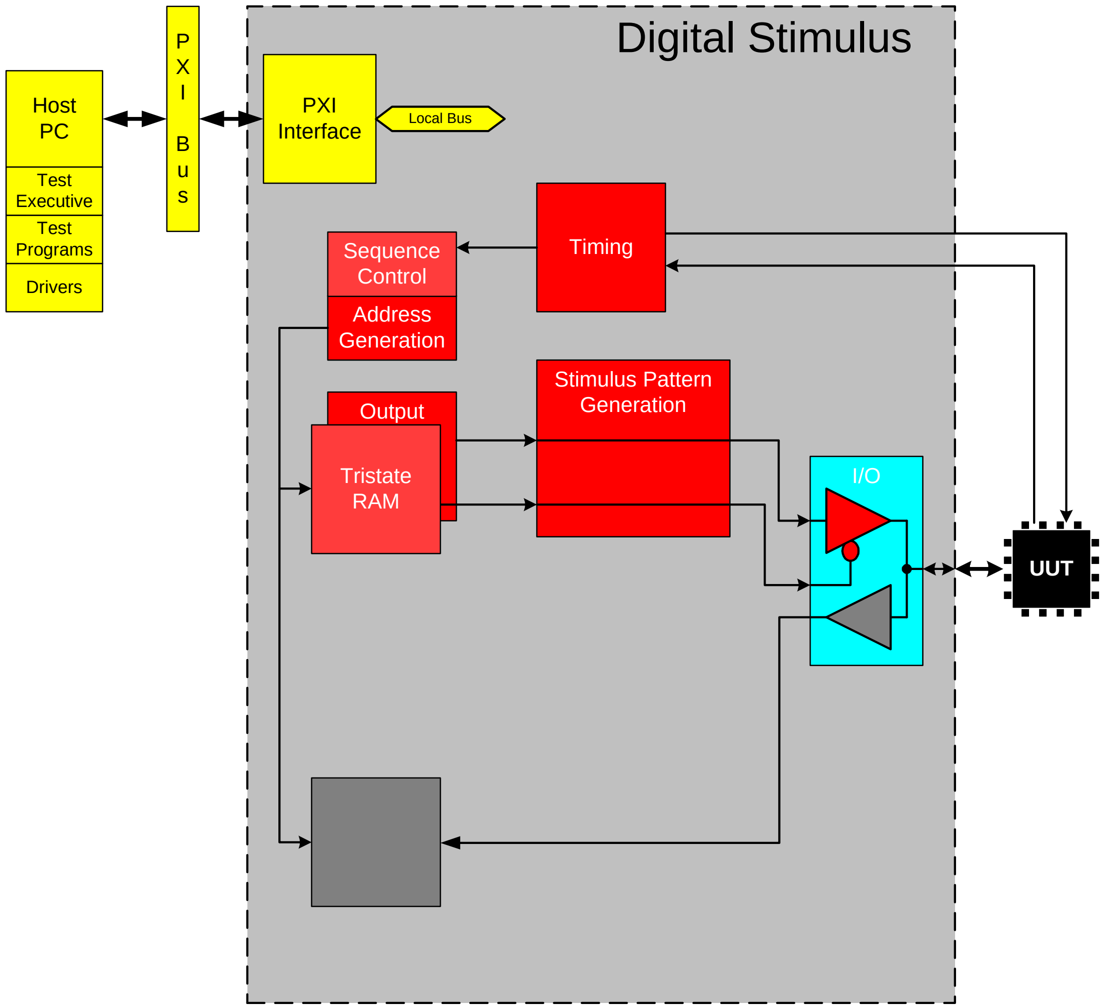

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Summary – Digital Test for Video Test Applications

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- Reliable and repeatable methodology for testing / emulating video components and systems
- Capturing real time video offers an easy way to create real-world digital video stimuli
- Sufficient memory is needed to effectively deploy a digital capture / playback methodology
- Combining deep memory digital instrumentation with a memory compare methodology (post processing) offers a fast and simple way to verify operation of complex video components and overall system performance

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