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SI PC104 Performance Test Report

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National Ignition Facility Testing Procedure

SI PC104 Performance Test Report

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	NWBS-4.9	**NIFOPS-TGB-OPR**	**NIF-0112966-AA**

Form 001138-0A

This document describes the procedures carried out during the actual tests. This document is an official record of the actual testing procedures carried out and the subsequent results of those tests. This document will be registered in ECMS.

1.0 Purpose and Scope of Testing

1.1 The Spectral Instruments (SI) PC104 systems associated with the SI-1000 CCD camera exhibited intermittent power problems during setup, test and operations which called for further evaluation and testing. The SI PC104 System is the interface between the SI-1000 CCD camera and its associated Diagnostic Controller (DC). As such, the SI PC104 must be a reliable, robust system capable of providing consistent performance in various configurations and operating conditions. This SI PC104 system consists of a stackable set of modules designed to meet the PC104+ Industry Standard. The SI PC104 System consists of a CPU module, SI Camera card, Media converter card, Video card and a I/O module.

1.2 The root cause of power problems was identified as failing solder joints at the LEMO power connector attached to the SI Camera Card. The recommended solution was to provide power to the PC104 system via a PC104+ power supply module configured into the PC104 stack instead of thru the LEMO power connector.

1.3 Test plans (2) were developed to test SI PC104 performance and identify any outstanding issues noted during extended operations. Test Plan 1 included performance and image acquisition tests. Test Plan 2 verified performance after implementing recommendations. Test Plan 2 also included verifying integrity of system files and driver installation after bootup.

1.4 Each test plan was implemented to fully test against each set of problems noted. Test Plan presentations and Test Plan results are attached as appendices.

1.5 Anticipated test results will show successful operation and reliable performance of the SI PC104 system receiving its power via a PC104 power supply module. A SI PC104 Usage

Recommendation Memo will be sent out to the SI PC104 User Community. Recommendation memo(s) are attached as appendices.

1.6 SI PC104 test plans, results, and recommendations were a result of the PC104 Working Group Team established to address PC104 issues found during design, test, and implementation.

The team consisted of

Sam Montelongo,
Ken Piston,
James Moody,
Jarom Nelson.
With input from: Dennis O'Brien, Joe Kimbrough, and Joe Holder.

- Test Plan 1: Date Testing Begun: ___June 27, 2005
- Test Plan 2: Date Testing Begun: ___September 12, 2005

2.0 Materials and Equipment Required

2.1 List std. tools and equipment used during tests

Test or Diagnostic Equipment	Part/Model #	Qty.
Laptop (runs UEC Test code and interacts with the DANTE SI PC104)	Dell	1
KONTRON PC104 System (monitors and records PC104 temperature and buss voltages)	Horizon	1
Video Monitor (shows debug and system information associated with the DANTE SI PC104)	N/A	1
SI-1000 CCD camera #1 (used for testing camera performance)	SN 1000-109	1
SI-1000 CCD camera#2 (used for comparing camera performance with camera #1)	SN 1000-106	1
SI 1000 Simulator (in place of a SI-1000 CCD camera)	N/A	1
Tektronix Scope (record PC104 buss voltage waveforms)	Tek-684B	1
Polyscience Chiller	5005	1

2.2 Special Test Equipment

List any nonstandard NIF test equipment and tools needed to perform the test. For each item, include model and part numbers and the quantity needed. Equipment requiring calibration and/or certification should be so indicated.

Test or Diagnostic Equipment	Part/Model #	Qty.	Calibration/ Certification (Y/N)
DANTE PC104 System with high voltage capability disabled	N/A	1	N
SI PC104 Camera Card #1 (available to modify per SI PC104 User Recommendation)	#107	1	N
SI PC104 Camera Card #2 (available to modify per SI PC104 User Recommendation for comparison tests)	#104	1	N

3.0 Test Plans

3.1 Test plans (two total) were developed to test SI PC104 performance and identify any outstanding issues noted during extended operations. Test Plan 1 (One) included performance and image acquisition tests. Test Plan 2 (Two) verified performance after implementing recommendations. Test Plan 2 also included verifying integrity of system files and driver installation after bootup.

3.2 The SI PC104 test system was provided by the DANTE diagnostic. This diagnostic is the most extreme configuration of the PC104 system currently available. The DANTE diagnostic system consists of SI PC104 System stack with additional components added to the PC104 stack support DANTE specific functions.

- SI PC104 System Stack
- DANTE Timing I/O Board
- CCD Buffer Card

3.3 Test Plan 1 (**ONE**) system configuration, setup and specific set of tests is defined in **Appendix A** “Test Plan 1 for the SI-1000 PC104 Camera Card”.

- *The test goals include:*
- Implement a continuous cycle image acquisition test on a SI PC104 Camera card configured to receive its power from a PC104+ (Tri- M Engineering HE104+DX) power supply module.
- Identify and fix failure modes of the modified SI PC104 Camera Card when operated over an extended period of time.
- Provide guidelines for using the SI PC104 Camera card in diagnostic configurations

3.4 Test Plan 2 (**TWO**) system configuration, setup and specific set of tests is defined in **Appendix C** "Test Plan 2 for the SI-1000 PC104 Camera Card". SI PC104. System performance test goals include:

- *The test goals include:*
- Validate performance of a fully modified (per recommendation) PC104 SI camera card. This test to include testing with the SITASJNIInterface.DLL dated August 9,2005. This code fixes the Exposure/Read issue causing abort of image acquisition.
- Verify operation of Enhanced Write Filter (EWF) on UEC PC104 system. Confirm that power cycling issues are not causing file corruption (i.e. file corruption should be impossible with EWF turned ON)
- Diagnose power cycle and initialization problems on SI PC104 system and provide recommendation for proper procedure.

4.0 Testing Operations

4.1 Test Plan 1 (**ONE**): SI PC104 System configuration changes

- Add PC104+ Power Supply module into SI PC104 stack
- Install modified SI PC104 camera card (SI-1000-107)

    1) Remove LEMO power connector
    2) Detach input and output legs of the +3.3vdc on-board regulator.

4.2 Test Plan 2 (**TWO**): SI PC104 configuration changes

- Install PC104 Power Supply module into SI PC104 stack
- Install modified SI PC104 camera card (SI-1000-107)

    1) Remove LEMO power connector
    2) Fully attach all pins of the +3.3vdc on-board regulator

Any operator action(s) required can be listed in the table below

Step	Operator Action Required	Expected Results/Comments

1	Run tests per Test Plan 1 using modified SI PC104 camera card #1 (LEMO connector removed, +3.3vdc regulator detached) and PC104+ Power Supply module.	Identify performance issues and run comparison tests as needed with SI PC104 camera card #2 and camera # SI-1000-106
2	Run tests per Test Plan 2 using modified SI PC104 camera card #1 (LEMO connector removed, +3.3vdc regulator attached) and PC104 Power Supply module.	Identify performance issues and run comparison tests as needed with SI PC104 camera card #2 and camera # SI-1000-106

5.0 Test results

5.1 Two Test Plans were implemented over the course of testing. Each test plan was implemented to fully test against each set of problems noted. Test plan results presentations are attached as:

- Appendix B “Test Plan 1 Results for the SI-1000 PC104 Camera Card”
- Appendix D “Test Plan 2 Results for the SI-1000 PC104 Camera Card.”

5.2 Test Plan 1 Results Summary:

- Data log files associated with these tests are identified in ***Section 6.3*** Data File Locations.
- Continuous cycles of image acquisition showed no image acquisition failures due to power failure or CPU performance.
- Image acquisition failures were noted due to camera Exposure Time query during data read out but did not happen consistently (average about 1 in 10). UEC test logs showed “CANCEL” message during extended image acquisition cycles.

  If exposure time is queried during readout, camera may (usually) abort image acquisition. Confirmed by vendor and fixed in newer releases of vendor supplied camera firmware.

  LLNL UEC software will be fixed such that Exposure Time queries will not happen during data readout.
- Monitored SI PC104 camera card buss voltages (+3.3vdc, +5vdc, +12vdc) stayed within specs.
- Monitored PC104 power supply current draw stayed within specs.

- SI PC104 camera card visual inspection pre/post test showed

  All solder joints intact

  No damaged trace paths
- No crashes of SI PC104 computer or camera card were noted. Software, hardware and operating system were stable throughout test phase.
- There were no power failure or communication problems with the camera card during image acquisition cycling.
- Camera communication failures were noted on power up but were not pursued at this time.

  Improper shutdown (power cycle) of SI PC104 system sometimes caused communication issues with camera card and simulator.

  Recommendation is to do further testing to isolate problem. See Test Plan 2.

5.3 Test Plan 1 Recommendations

A "SI PC104 Usage Recommendation Memo" (Appendix E) was developed to provide guidelines to the SI PC104 User community. Spectral Instruments was informed of camera card modifications, test results and usage recommendations implemented at LLNL. Issues with the SI PC104 system were mostly attributed to SI Camera card power connector.

The recommendations included:

- Remove the LEMO power connector from the SI camera card.
- Include the Tri-M Engineering HE104+ p/s board (or comparable replacement)
- De-solder and insulate the input/output legs of the 3.3V regulator on the SI camera card
- Tap off the +28V input power to supply the fans.
- Ensure all PC-104 and PC-104+ cards conform to the PC-104 or PC104+ specification.

5.4 Recommended additional performance tests include:

- Run image acquisition tests with a fully modified SI PC104 Camera Card.
- Validate file protection performance of the SI PC104 Disk-on-Chip (DOC) Enhanced Write Filter (EWF) function during power down.
- Perform additional tests with power down/up and initialization of the SI PC104 to identify proper power cycling procedure

5.5 Additional Performance Stress Tests Recommended:

- Raise ambient temperature of SI PC104 System to 40° + 20%
- Vary SI PC104 System Input Power (28V) to SI specification boundaries
- Vary SI-1000 Camera Power Supply (28V) to vendor specification boundaries
- Perform a SI PC104 System Vibration test

5.6 Test Plan 2 Results Summary:

- Data log files associated with these tests are identified in Section 7.3 Data File Locations.
- Performance test of a fully modified camera card with continuous image acquisition cycles.

  No crashes of PC104 computer

  Successful performance of modified camera card during extended image acquisition cycles. No image acquisition failures due to power fail.

  Successful validation of software fixes correcting Exposure/Read issue. All image acquisitions were successful using the new version of SITASJNIInterface.DLL (dated 8/9/2005). This showed no problems during Exposure/Read phase. UEC test logs showed no “CANCEL” message indicating image acquisition abort.

  All SI PC104 camera card buss voltages stayed within specs

- *Problem reports noted:*

  SI driver installation problems after power cycle. Used combination of RESTART and reboot of SI simulator to establish good state of operation.

- EWF Function Verification

  Numerous power cycles (28v cutoff, Shutdown, Restart) under various conditions of PC104 System (Idle, Image Acquisition READ) did not cause file corruption.

  SI PC104 System files were compared against a set of files copied to the Laptop test system prior to starting the tests. System file integrity was successfully verified after each test.

- *Problem report noted:*

  SI driver installation problems after power cycle. Used combination of

RESTART and reboot of SI simulator to establish good state of operation.

- Diagnosis of power cycle and initialization problems on SI PC104 system

  SI Driver Installation was always unsuccessful after full power down sequence. Further testing showed that the SI driver will not install with the Camera Card +3.3vdc regulator removed or pins detached. Spectral Instruments states a 50 msec minimum rise time for the +3.3vdc buss. With the +3.3vdc regulator detached, the PC104+ power supply +3.3vdc buss rise time is inadequate (~125msec). See Appendix G for PC104 power supply waveforms showing both adequate and inadequate rise times.

  With the SI camera card +3.3vdc regulator fully attached, the SI driver successfully installed 100% of the time. This showed an adequate rise time (~25msec) to meet SI specs. Spectral Instruments stated that having the +3.3vdc regulator fully attached while using the HE104+DX power supply to also provide +3.3vdc will cause early component failure. This is not a long-term solution.

- PC104Working Group Recommendation

  Fully attach the +3.3vdc regulator onto the SI PC104 camera card.

  Install and test with a PC104 format Power Supply that provides only +5vdc and +12vdc. This allows the SI PC104 camera card to provide the +3.3vdc required.

- Follow-up tests were done after implementing the PC104 Working Group Recommendations

  An extended performance test (continuous image acquisition cycles) using a PC104 format power supply (Tri- M Engineering HE104-75W) providing only +5vdc and +12vdc showed successful results.

- SI driver installation was successful after every full power cycle.

  During tests using the HE104+DX and SI camera card with the +3.3vdc regulator pins lifted, SI driver installation failed everytime.

  During tests with the HE104-75W and SI camera card +3.3vdc regulator pins attached, SI driver installation was successful everytime (>5 times in sequence).

With every power cycle (1) SI driver installation was verified, camera initialization was verified, (3) and an image acquisition test was completed successfully.

- Camera card +3.3vdc/+5vdc rise time measured to be adequate per SI requirement (≤50msec).
- Continuous cycles of image acquisition showed no image acquisition failures due to power failure or CPU performance.
- No crashes of SI PC104 computer or camera card were noted. Software, hardware and operating system were stable throughout test phase.
- There were no power failure or communication problems with the camera card during image acquisition cycling.
- All SI PC104 camera card buss voltages stayed within specs

5.7 TEST PLAN 2 RECOMMENDATIONS

- A "SI PC104 Usage Recommendation Update Memo" (Appendix F) was developed to provide updated guidelines based on final testing. This memo is to be sent to Spectral Instruments and the SI PC104 user community.

  Do not use the Lemo power connector from the SI Gigabit I/O card. If required in tight designs, this connector can be removed. However, it is not recommended, if avoidable.

  Design diagnostics using the SI PC-104+ system to include the Tri-M HE104-75W power supply board. This board supplies power to the +5vdc and +/- 12vdc PC-104+ busses only. The +3.3vdc buss is supplied by the SI camera card on-board +3.3vdc regulator.

- PC104 Working Group Recommendations

  Send all SI 1000 cameras and PC104 systems to SI for update to latest revision levels (hardware and software).

  Update existing SI PC104 systems with latest SITASJNIInterface.dll.

  Run SI PC104 performance tests with latest hardware and software available from both SI and LLNL.

  Include an image acquisition performance loop test as part of LLNL system verification prior to release of newly purchased or updated SI PC104 systems.

6.0 Summary

- Test Plan 1 results showed successful CPU and camera card performance with the PC104+ power supply. Occasional failures were noted with image acquisition and power up initialization of the SI PC104 with the SI camera. The image acquisition issue was well understood and fixed via software. The power up initialization required further testing implemented in Test Plan 2. A SI PC104 Usage Recommendation memo was sent out to the SI PC104 user community.
- Final Test Plan 2 results showed successful performance of a modified camera card (only LEMO power connector removed) during continuous image acquisition cycles. The updated SITASJNIInterface.dll (dated 8/9/2005) provided successful image acquisition during continuous Exposure/Read cycles with no “CANCEL” messages noted. The EWF function was verified to maintain system file integrity after multiple and various methods of power down. Camera power up initialization issues (SI driver installation) were solved by installing a PC104 format power supply module supplying only +5vdc and +12vdc allowing the SI camera card on-board regulator to supply the +3.3vdc buss.
- Test results were followed up with SI PC104 Usage Recommendation memos to the SI PC104 user community. Two recommendation memos are attached. Memo #1, Appendix E “SI PC104 Usage Recommendation Memo”, developed after Test Plan 1 and Memo #2, Appendix F “SI PC104 Usage Recommendation Memo Update”, developed after Test Plan 2.
- Overall test results showed successful implementation of solutions to SI PC104 issues encountered during initial tests and operations. The SI PC104 system is now a reliable, robust system capable of extended operations in the NIF facility.
- Additional performance stress tests are recommended to more fully address possible operational issues in NIF. These include raising the ambient temperature of SI PC104 System to 40° + 20%, varying the SI PC104 System Input Power (28V) to SI specification boundaries, varying the SI-1000 Camera Power Supply (28V) to vendor specification boundaries, and performing a SI PC104 System vibration test.

6.1 Test Participants

List, by position, the personnel required to perform the test.

Name	Position
Sam Montelongo	**PC104 Working Group Lead**
Jarom Nelson	**PC104 Software Developer**
James Moody	**SI Camera Expert**
Ken Piston	**Electronics Support**
Joe Holder	**Test Plan Reviewer**

Joe Kimbrough	**Test Plan Reviewer**

6.2 Location of Tests

List, Location of tests

Building/Room	Test carried out at this location
Building 391, Room B350	**Test Plan 1**
Building 391, Room B350	**Test Plan 2**

6.3 Test Data Locations

The following table should list data files (e.g., spreadsheets, tables, images) associated with the executed CTP. Ideally, such data files are uploaded to the corresponding CTR record in ECMS. In any event, list each file's location (e.g., "ECMS," or "John Smith's hard drive") in the table below. Include a brief description of each file's content.

File Name or Label	File Location	Brief Description of Data in the File
33RegConfigComparison.xls	TDServer\PC104TestDataLogFiles\BussWaveforms	Data and chart showing comparison of +3.3vdc buss signal at startup measured with SI camera card regulator pins attached and detached.
HE104+DX_Only5and3.xls	TDServer\PC104TestDataLogFiles\BussWaveforms	Data and chart showing +3.3vdc and +5vdc signals measure at power up coming directly out of the HE104+DX power supply.
HE104-75W_System_3&5_Chart.xls	TDServer\PC104TestDataLogFiles\BussWaveforms	Data and chart showing +3.3vdc and +5vdc signals measure at power up coming directly out of the HE104-75W power supply.
SITASJNIINterface062204_HE104+DX_UecTestLog-Wed-Jul-13-13-15-33-587.txt	TDServer\PC104TestDataLogFiles\CameraCardPerformance	UEC test log with "ACQ CANCELED" messages indicating image acquisition failure while using SITASJNIInterfac.dll dated 6/22/04.
HE104+DX_UecTestLog-Thu-Sep-15-10-38-55-280.txt	TDServer\PC104TestDataLogFiles\CameraCardPerformance	UEC test log showing no "ACQ CANCELED" messages while using SITASJNIInterfac.dll dated 8/9/05 and HE104+DX power supply.
BussV_HE104+DX_LogFile_09-15-05_10-57-55.txt	TDServer\PC104TestDataLogFiles\CameraCardPerformance	IO log file monitoring PC104 buss voltages and temperature while using HE104+DX power supply.
HE104-75W_UecTestLog-Thu-Nov-10-09-28-00-177.txt	TDServer\PC104TestDataLogFiles\CameraCardPerformance	UEC test log showing no "ACQ CANCELED" messages while using SITASJNIInterfac.dll dated 8/9/05 and HE104-75W power supply.
BussV_HE104-75W_LogFile_11-10-05_09-46-09.txt	TDServer\PC104TestDataLogFiles\CameraCardPerformance	IO log file monitoring PC104 buss voltages and temperature while using HE104-75W power supply.
SITASJNIInterface080905_HE104+DX_UecTestLog-Mon-Nov-07-09-58-47-092.txt	TDServer\PC104TestDataLogFiles\CameraCardPerformance\ExposureReadTest	UEC test log showing no "ACQ CANCELED" messages while using SITASJNIInterfac.dll dated 8/9/05 and HE104+DX power supply.

SITASJNIInterface062204_HE104-75W_UecTestLog-Thu-Nov-10-09-28-00-177.txt	TDServer\PC104TestDataLogFiles\CameraCardPerformance\ExposureReadTest	UEC test log showing no “ACQ CANCELED” messages while using SITASJNIInterfac.dll dated 6/22/04 and HE104-75W power supply.
SITASJNIInterface080905_HE104-75W_UecTestLog-Fri-Nov-11-10-29-06-502.txt	TDServer\PC104TestDataLogFiles\CameraCardPerformance\ExposureReadTest	UEC test log showing no “ACQ CANCELED” messages while using SITASJNIInterfac.dll dated 8/9/05 and HE104-75W power supply.
PC104 DOC System Files Folder	TDServer\PC104TestDataLogFiles\EWFPerformance\files_to_compare	This folder contains files copied from the PC104 Disk-On-Chip prior to beginning EWF tests.
file_compare_repeat.cmd	TDServer\PC104TestDataLogFiles\EWFPerformance	DOS command file comparing PC104 DOC system files with the “files_to_compare” folder and creating a log file with comparison result.
fc_output_092305.txt fc_output_092605.txt fc_output_092605a.txt fc_output_092805.txt fc_output_092905.txt fc_output_093005.txt	TDServer\PC104TestDataLogFiles\EWFPerformance	Comparison results from issuing “file_compare_repeat.cmd” after power cycling the PC104 system using various methods.
PC104_HE104-75W_PowerCycle_UecTestLog-Thu-Nov-10-09-28-00-177.txt	TDServer\PC104TestDataLogFiles\PowerCyclePerformance	UEC test log showing no “ACQ CANCELED” messages while using HE104-75W power supply. This file also logged messages captured after power cycle tests showing no problems occurring with camera initialization or image acquisition.

7.0 Terminology

List all abbreviations, initialisms, and acronyms used in the test procedure. Define special or nonstandard terms used where understanding of such terms is important to successful execution of the test.

Term	Definition or Full Spelling
SI	Spectral Instruments
PC104	Industry standard for PC104 systems
DC	Diagnostic Controller
EWF	Enhanced Write Filter
UEC	Universal Embedded Code

8.0 Listing of Applicable Reference Documents

List operations or other procedures and documents that were used to perform the test procedures or analyze data

during the testing procedure (for example, installation or interconnect drawings and/or standard operating procedures).

Document #	Title
Appendix A	Test Plan 1 for the SI-1000 PC104 Camera Card
Appendix C	Test Plan 2 for the SI-1000 PC104 Camera Card
Appendix E	SI PC104 Usage Recommendation Memo

9.0 Appendix

The following appendices include test plans, test plan results, recommendation memos, and various PC104 buss waveforms.

Test Plan 1, Test Plan 2, Test Plan 1 Results, and Test Plan 2 Results were presented to the PC104 Working Group team as indicated.

The SI PC104 Recommendation Usage Memo was sent out to the SI PC104 User Community. The SI PC104 Recommendation Update Memo will be sent out to the user community when complete.

PC104 buss waveforms show the various waveforms captured to help isolate the SI driver installation problem.

9.1 Appendix A: Test Plan 1 for the SI-1000 PC104 Camera Card

- Test Plan 1 was presented to the PC104 Working Group Team on June 10, 2005 prior to the beginning of testing. The presentation included
- Test Overview

  Test Goals
  Test Approach
  Test System
  Hardware Components
  Software Components
  UEC Test Program
  Diamond I/O Vendor Software
  Test Area Configuration
  Stress Test Plan
  Stress Test Expectations
  Secondary Tests
  Personnel
  Test Schedule

SI PC104 Working Group
June 10, 2005

Stress Test Plan for the
SI-1000 PC104 Camera Card

Test Plan Review Topics

- Test Overview
- Test Goals
- Test Approach
- Test System
- Hardware Components
- Software Components
- UEC Test Program
- Diamond I/O Vendor Software
- Test Area Configuration
- Stress Test Plan
- Stress Test Expectations
- Secondary Tests
- Personnel
- Test Schedule

Test Overview

- Test encompasses:
  - Monitor and verify SI PC104 system operation (in particular the SI camera card) over an extended period of time using a PC104 power supply module to provide power.
  - Monitor/record SI PC104 camera card busses (voltages) and current draw.
  - Monitor/record SI PC104 camera card temperature at selected areas.
  - Monitor/record PC104 power supply card temperature at selected areas.
  - Monitor/document SI PC104 system failures.
  - Use Test Program to continuously cycle the SI PC104 system thru image acquisition cycles.

Test Goals

- Implement a continuous cycle image acquisition stress test on a SI PC104 Camera card configured to receive its power from a PC104 power supply module.
- Identify and fix failure modes of the SI PC104 Camera Card when stressed over an extended period of time.
- Provide guidelines for using the SI PC104 Camera card in diagnostic configurations
- Develop CM process for testing new PC104 system components (HW/SW) prior to release for use.

Test Approach

- Use current NIF tested
  - UEC code for SI PC104 System
  - DSP file for SI-1000
  - Windows driver for SI-1000
- Use UEC Test program to drive system through continuous non-triggered image acquisition cycles (using loop and delay functions) for a period of 5 days.
- Test PC, SI PC-104 Embedded Controller and PC104 Test Stand will communicate over network link.
- Use Diamond I/O card and vendor software to monitor/record buss voltage and temp parameters
  - PC104 Power Supply (TEMP)
  - SI PC104 Camera Card (Buss Voltages, TEMP, Current)
- Use DANTE CCI as basis for test system
  - System available
  - Extreme config known to have had problem with SI PC104 system

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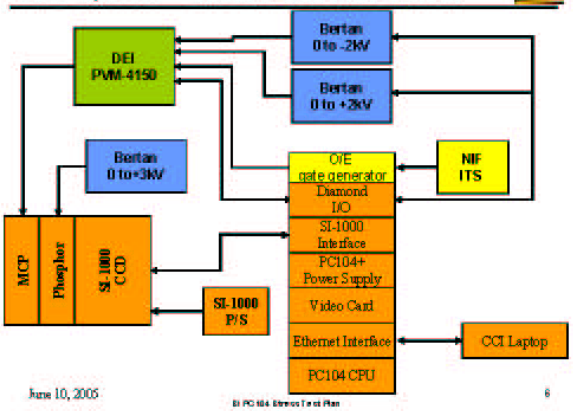
Test System - DANTE CCI MCP Driver



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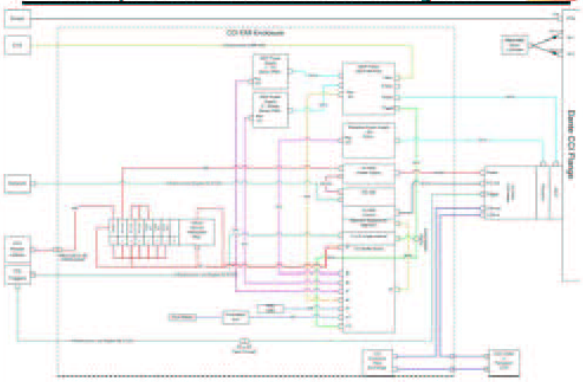
Test System - CCI One-Line Diagram



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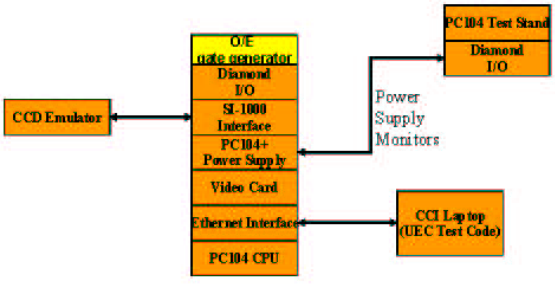
Test System – PC104 Test Setup



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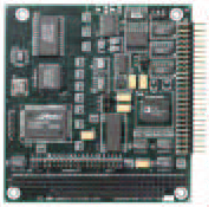
Test System - Diamond Systems I/O Card



Analog Input
- 16 single-ended / 8 differential inputs
- 16-bit A/D resolution
- Programmable input ranges with maximum range of +/-10V

Analog Output
- 4 optional analog outputs
- Fixed and user-programmable output ranges
- Simultaneous update

Digital I/O
- 8 dedicated digital outputs, TTL compatible
- 8 dedicated digital inputs, TTL compatible

Counter/Timers
- 1 32-bit counter/timer for A/D sampling rate control
- 1 16-bit counter/timer for user counting and timing functions
- Programmable clock source for user counter/timer

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Hardware Components

- SI PC104 Camera Card
  - Lift/insulate pins on 3v regulator
  - Do not remove power connector/components
  - Temp Sensors (Qty TBD) at selected locations
  - Buss Voltage monitor (3.3v, 5v, 12v)
  - Current draw monitor (input only)
- PC104 Power Supply
  - Include PC104 P/S module in stack (DONE)
  - Route 28v power to PC104 P/S (DONE)
  - TEMP Sensor (1)
- SI-1000
  - SI-1000 Emulator with Optical interface cable
    - Power load not required, power not supplied via SI PC104
  - Triggers not required
- PC104 Test Stand
  - Diamond I/O board interfaced to monitor parameters

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Software Components

- Test Station PC
  - DANTE CCI Laptop
  - UEC Test Program
    - 1 week development (loop/delay function)
    - Configuration setup
- PC104 Test Stand
  - Diamond I/O vendor code
    - 1 week develop/configure
- SI PC104 Embedded Controller
  - UEC Version 1.1.6 (on-hand)
  - DSP Version D (on-hand)
  - No PC104 firmware updates required

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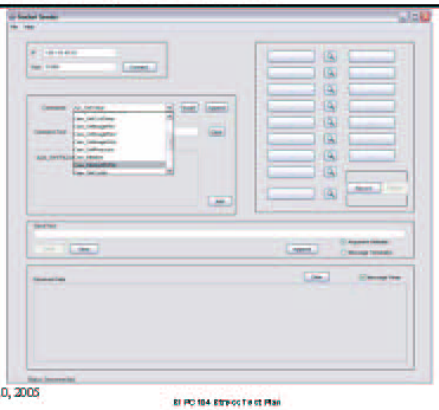
UEC Test Program – J.Nelson



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Diamond I/O Vendor Software – K.Piston

Test Area Configuration

- B391 Rm B350
  - DWTL: K.Piston
  - IWS: T.Thomas
- Dante CCI System
  - J.Holder/K.Piston
- PC Test Station
  - K.Piston
- PC104 Test Stand
  - J.Nelson
- Network Communication
  - K.Piston, J.Nelson

Stress Test Plan

- Run continuous cycles of image acquisition
  - Use same configuration during all testing
  - Acquired image files are not saved
  - Continuous test over a period of 5 days minimum
- Monitor/record SI PC104 camera card buss voltages
- Monitor/record SI PC104 camera card temperature at selected locations
- Monitor/record PC104 power supply current draw
- Record failures
- Inspect PC104 camera card pre/post test
  - Solder joints
  - Trace paths
- Evaluate results and write guidelines

Stress Test Expectations

- Run continuous cycles of image acquisition
  - No image acquisition failures
- Monitor/record SI PC104 camera card buss voltages
  - Buss voltages stay within specs
- Monitor/record SI PC104 camera card temperature at selected locations
  - Temperature stays within specs
- Monitor/record PC104 power supply current draw
  - Current draw stays within specs
- Record failures
  - No unexplainable failures
- Inspect PC104 camera card pre/post test
  - Solder joints: All solder joints solid
  - Trace paths: No damaged trace paths

Secondary Tests

- Power cycling SI PC104 system
- Cable 'rattling', vibration, shock, temperature changes
- Install and test SI PC104 with KONTRON motherboard
- Test with modified SI PC104 Camera Card
  - Remove power connector/components
- Monitor DMA buss signals with analyzer over extended stress test

Personnel Involved with Testing

- Jarom Nelson, Software support
- Ken Piston, Electronics support
- Jim Moody, SI-1000 support
- Sam Montelongo, Test Plan Manager

Equipment Resources

- PC Designated as Test Computer
- DANTE Diagnostic Instrumentation
- PC104 Test Stand
- SI-1000 Emulator and Optical Interface Cable

Test Schedule

- B391 Test System Configuration and Setup
  - June 13–17 K.Piston, J.Nelson
    - UEC Test Program develop/setup: J.Nelson
    - SI PC104 Camera Card Mods/Prep: J.Moody
    - SI PC104 Power Supply Prep: K.Piston
    - Diamond I/O setup/SW config: K.Piston
- Stress Test testing
  - June 20–30 J.Nelson, K.Piston
- Evaluate Test Results
  - July 1–8 J.Moody, S.Montelongo, J.Nelson, K.Piston
- Write SI PC104 Camera Card Usage Guideline
  - July 11-22 S.Montelongo
- Develop SI PC104 Component (HW/SW) CM Process
  - July 11-22 J.Moody

9.2 Appendix B: Test Plan 1 (Results for the SI-1000 PC104 Camera Card)

Test Plan 1 Results were presented to the PC104 Working Group Team on August 11, 2005. The presentation included

Test Overview

Test Goals

Test Implementation

Modified Hardware

Test System Configuration

Test Plan

Test Results

UEC Test Program Implementation and Results

I/O Test Implementation and Results

SI-PC104 Camera Card Inspection

SI PC104 Usage Recommendation

Additional Performance Tests

Recommended Stress Tests

Personnel Involved

Test Schedule

SI PC104 Working Group
August 11, 2005

Endurance Test Results
SI-1000 PC104 Camera Card & PC104 Power Supply Module

Test Plan Review Topics

- Test Overview
- Test Goals
- Test Implementation
- Modified Hardware
- Test System Configuration
- Test Plan
- Test Results
- UEC Test Program Implementation and Results
- I/O Test Implementation and Results
- SI-PC104 Camera Card Inspection
- SI PC104 Usage Recommendation
- Additional Performance Tests
- Recommended Stress Tests
- Personnel Involved
- Test Schedule

Test Overview

- Monitor and verify SI PC104 system operation (in particular the SI camera card) over an extended period of time using a PC104 power supply module to provide power.
- Monitor/record SI PC104 camera card buss voltages and current draw.
- Monitor/record PC104 power supply module temperature.
- Monitor/document SI PC104 failures.
- Use Test Program to continuously cycle the SI PC104 system thru image acquisition cycles.

Test Goals

- Implement an endurance test of a SI PC104 Camera card configured to receive its power from a PC104 power supply module.
- Identify and fix failure modes of the SI PC104 Camera Card when used over an extended period of time.
- Provide recommendation for using the SI PC104 Camera card in diagnostic configurations
- Develop CM process for testing new PC104 system components (HW/SW) prior to release for use.

Test Implementation

- Test Dates: 6/27/05 – 7/6/05, 8/1/05 – 8/5/05
- Test Location:B391 Rm B350
- Test System: DANTE CCI with SI-1000 Simulator, PC104 Test Stand, modified SI Camera card, PC104 P/S
- UEC code for SI PC104 System, Ver. 1.1.6
- DSP file for SI-1000, Rev.D
- Used UEC Test program to drive system through continuous non-triggered image acquisition cycles.
- Used Diamond I/O card to monitor/record buss voltage and temp parameters
  - PC104 Power Supply (TEMP)
  - SI PC104 Camera Card (Buss Voltages, Current)
- Used DANTE CCI as basis for test system
  - Configuration known to have had problem with SI PC104 system

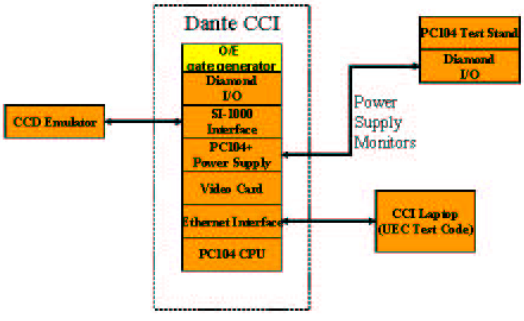
August 11, 2005 SI PC104 Endurance Test Results 5

Modified Hardware Components

- SI PC104 Camera Card
  - Lifted pins on 3v regulator
  - Did not remove power connector/components
  - Buss Voltage monitors (3.3v, 5v, 12v)
  - Current draw monitor (input only)
- PC104 Power Supply
  - TEMP Sensor (1 ea)

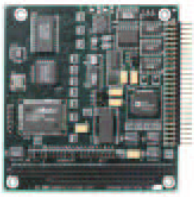
August 11, 2005 SI PC104 Endurance Test Results 6

Test System – PC104 Test Setup



August 11, 2005 SI PC104 Endurance Test Results 7

Test System - Diamond Systems I/O Card



Analog Input
- 16 single-ended / 8 differential inputs
- 16-bit A/D resolution
- Programmable input ranges with maximum range of +/-10V

Analog Output
- 4 optional analog outputs
- Fixed and user-programmable output ranges
- Simultaneous update

Digital I/O
- 8 dedicated digital outputs, TTL compatible
- 8 dedicated digital inputs, TTL compatible

Counter/Timers
- 1 32-bit counter/timer for A/D sampling rate control
- 1 16-bit counter/timer for user counting and timing functions
- Programmable clock source for user counter/timer

August 11, 2005 SI PC104 Endurance Test Results 8

TRI-M HE104+DX Power Supply

Power Supply Specifications	
Model	HE104+DX
5V output*	12 A
12V output	2.5 A
3.3V output	8 A
-12V output	0.5 A
Input Voltage Range	6 to 40V
Load Regulation**	< 60mV
Line Regulation	40mV
Output temp. drift**	< 40mV
Switching Freq.	75kHz
Max. Input Transient	125V for 100msec
Output Ripple**	< 20mV
Conducted Susceptibility**	> 57db
Efficiency	Up to 90%
Temp. Range	-40 to 85C
Size, PC/104 size & mounting holes with PCI-104 bus	3.55"W. x 3.75"L. x 0.6"H.

August 11, 2005 SI PC104 Endurance Test Results 9

Endurance Test Plan

- Run continuous cycles of image acquisition
  - Use same configuration during all testing
  - Acquired image files not saved
  - Test over a period of ~10 days
- Monitor/record SI PC104 camera card buss voltages
- Monitor/record PC104 power supply current draw
- Record failures
- Inspect PC104 camera card post test
  - Solder joints
  - Trace paths
- Evaluate results and write recommendation

August 11, 2005 SI PC104 Endurance Test Results 10

Endurance Test Results

- Run continuous cycles of image acquisition
  - No image acquisition failures due to power failure
- Monitor/record SI PC104 camera card buss voltages
  - Buss voltages stayed within specs
- Monitor/record PC104 power supply current draw
  - Current draw stayed within specs
- Record failures
  - No unexplainable failures
- Inspect PC104 camera card pre/post test
  - Solder joints: All solder joints solid
  - Trace paths: No damaged trace paths

August 11, 2005 SI PC104 Endurance Test Results 11

UEC Test Program Implementation

- Test Loop
  - Enable Digital and Analog outputs, wait 60 Sec
  - Acquire image (takes about 20 sec.), wait 50 Sec
  - Abort image (in case of failure), wait 10 Sec
  - Wait 60 Sec
  - Disable Analog outputs, wait 60 Sec
  - Disable Digital outputs, wait 60 Sec
- One image every 5 minutes

August 11, 2005 SI PC104 Endurance Test Results 12

UEC Test Program Results

- No crashes of computer or camera card
  - Software, hardware and operating system were stable throughout test phase.
  - No power failure or communication problems with camera card.
- Image acquisition failure noted
  - Did not happen consistently (average about 1 in 10)
  - Due to Exposure Time query issue
    - If exposure time queried during readout, camera may abort image acquisition. Confirmed by vendor.
    - LLNL UEC software to be fixed.
- Communication failure on startup
  - Improper shutdown (power cycle) of SI PC104 system sometimes caused communication issues with camera card and simulator.
    - Can be avoided by using proper restart/shutdown.
    - Further testing required to isolate problem.

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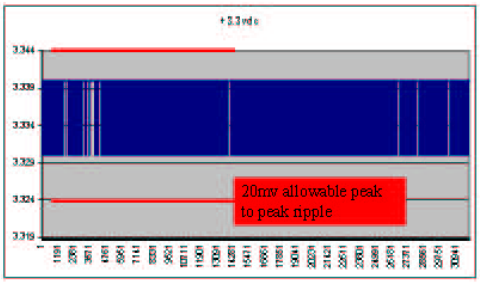
I/O Test Implementation

- Record I/O data once per minute
  - SI PC104 Camera Card
    - Buss voltages 3.3v, 5v, 12v
    - Input side current draw
  - PC104 HE104-DX+ Power Supply
    - Temperature

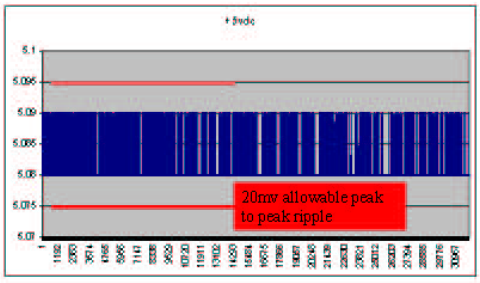
August 11, 2005 14

Power Supply Output +3.3vdc

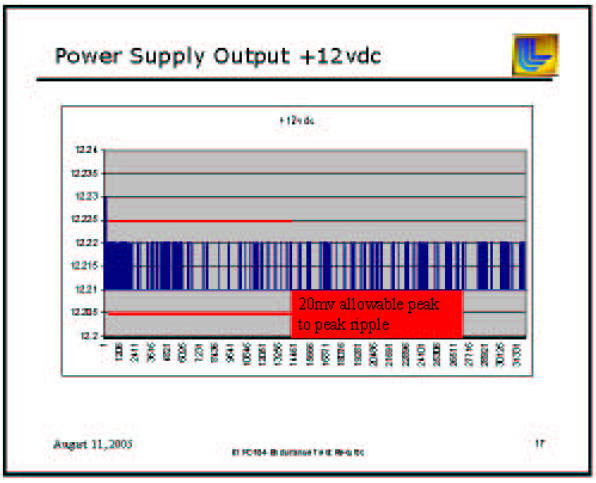


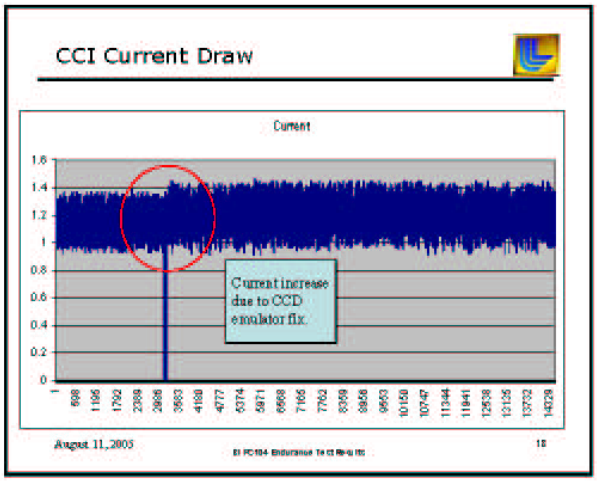
August 11, 2005 15

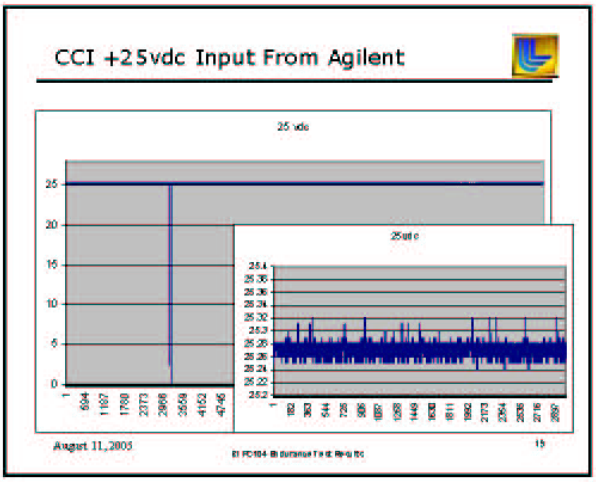
Power Supply Output +5vdc

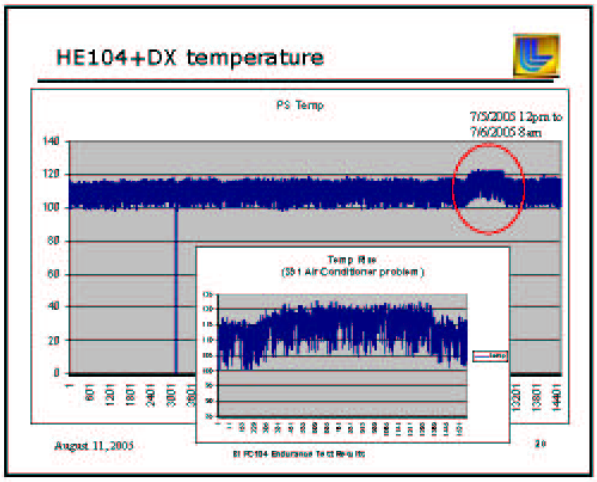


August 11, 2005 16


Power Supply Output +12vdc
+12vdc
20mv allowable peak to peak ripple
August 11, 2005

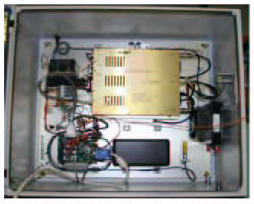

CCI Current Draw
Current
Current increase due to CCD emulator fix.
August 11, 2005


CCI +25vdc Input From Agilent
25 vdc
25vdc
August 11, 2005


HE104+DX temperature
PS Temp
7/5/2005 12pm to 7/6/2005 8am
Temp Rise
(351 Air Conditioner problem)
August 11, 2005

PC104 I/O Test System – Results

- SI PC104 Camera Card buss voltages and current draw performed within specifications.
- HE104+DX power supply performed within specifications.
- Throughout testing the PC104 under test was power cycled several times to fix issues with the CCD emulator.
- During testing the building air conditioning system failed raising the room temperature slightly with no noticeable effects on the PC104.



The PC104 test system was run 2 days with a 1 second log sample. Data showed no differences from previous tests at 1 minute sample rate.

SI-PC104 Camera Card Inspection

- No Failures Identified
  - Camera card inspected post-test
    - No obvious problems found
    - Solder joints intact
    - Trace paths intact

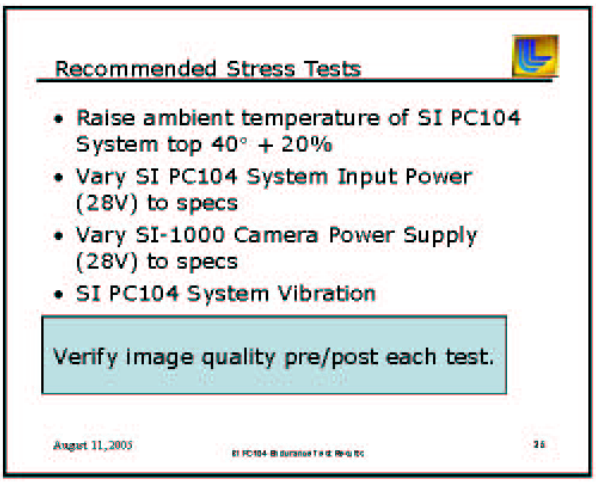
SI PC104 Usage Recommendation

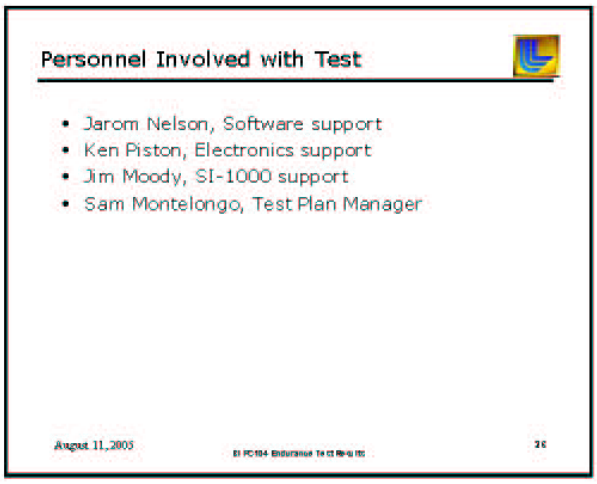
- Issues with the SI PC104 system mostly attributed to SI Camera card power connector.
  - Recommendation
    - Remove the Lemo power connector from the SI camera card.
    - Include the Tri-M Engineering HE104+ p/s board.
    - De-solder and insulate the input/output legs of the 3.3V regulator on the SI camera card
    - Tap off the +28V input power to supply the fans.
    - Ensure all PC-104 and PC-104+ cards conform to the PC-104 or PC104+ specification.

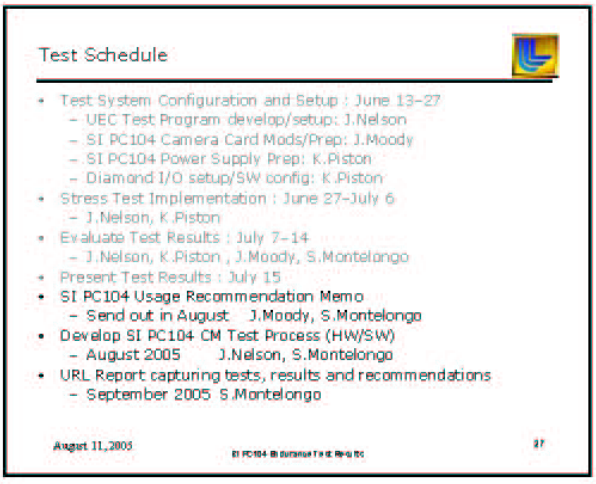
Spectral Instruments informed of camera card modifications, test results and Usage Recommendation implemented at LLNL.

Additional Performance Tests

- Fully modified SI PC104 Camera Card
- KONTRON motherboard as part of SI PC104 stack
- Power down/up initialization of the SI PC104 to identify proper power cycling procedure
- Performance of SI PC104 Disk-on-Chip (DOC) Enhanced Write Filter (EWF)


Recommended Stress Tests
• Raise ambient temperature of SI PC104 System top 40° + 20%
• Vary SI PC104 System Input Power (28V) to specs
• Vary SI-1000 Camera Power Supply (28V) to specs
• SI PC104 System Vibration
Verify image quality pre/post each test.
August 11, 2005
26


Personnel Involved with Test
• Jarom Nelson, Software support
• Ken Piston, Electronics support
• Jim Moody, SI-1000 support
• Sam Montelongo, Test Plan Manager
August 11, 2005
26


Test Schedule
• Test System Configuration and Setup : June 13-27
– UEC Test Program develop/setup: J.Nelson
– SI PC104 Camera Card Mods/Prep: J.Moody
– SI PC104 Power Supply Prep: K.Piston
– Diamond I/O setup/SW config: K.Piston
• Stress Test Implementation : June 27-July 6
– J.Nelson, K.Piston
• Evaluate Test Results : July 7-14
– J.Nelson, K.Piston , J.Moody, S.Montelongo
• Present Test Results : July 15
• SI PC104 Usage Recommendation Memo
– Send out in August J.Moody, S.Montelongo
• Develop SI PC104 CM Test Process (HW/SW)
– August 2005 J.Nelson, S.Montelongo
• URL Report capturing tests, results and recommendations
– September 2005 S.Montelongo
August 11, 2005
27

9.3 Appendix C: Test Plan 2 (The SI-1000 PC104 Camera Card)

Test Plan 2 was presented to the PC104 Working Group Team on September 13, 2005 prior to the beginning of testing. The presentation included

Test Overview and Goals

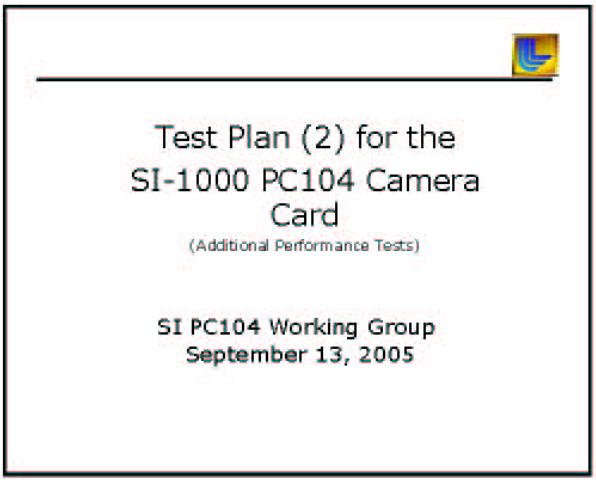
Test Approach and System Configuration

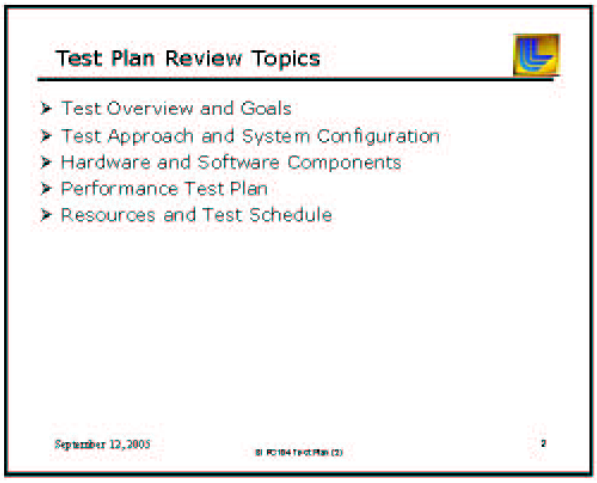
Hardware and Software Components

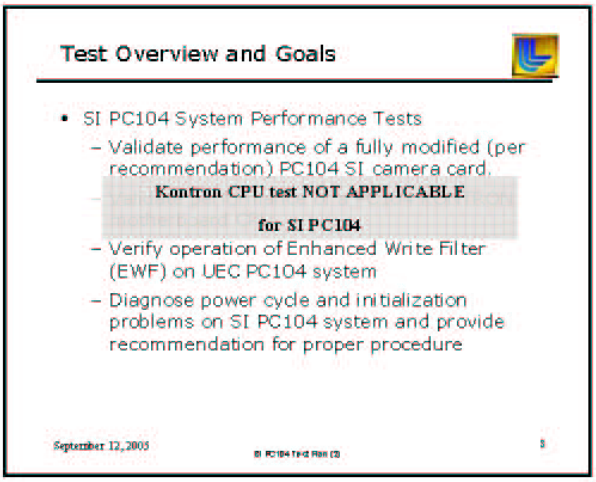
Performance Test Plan

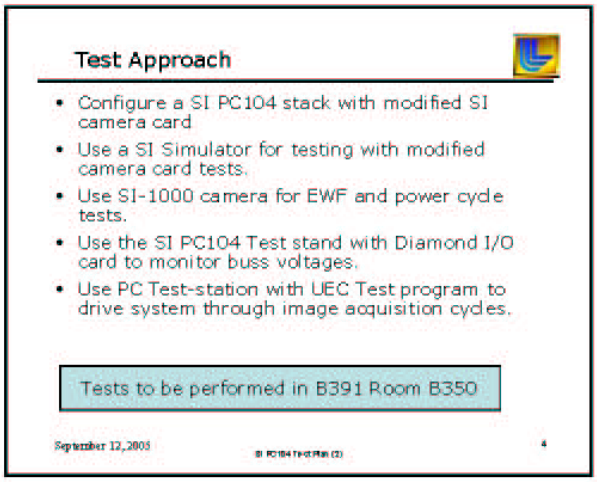
Resources and Test Schedule

The test to "Validate performance of a PC104 KONTRON motherboard CPU" was deemed as NOT APPLICABLE for this type of testing. The KONTRON motherboard does not support a Disk-On-Chip architecture as does the Tillamook PPM-TX PC104 CPU module delivered with the SI PC104. This would have called for a design change to the SI PC104 configuration and would require additional time to test. The KONTRON motherboard shall be tested at a later date as part of the Instrument Based Controller design.

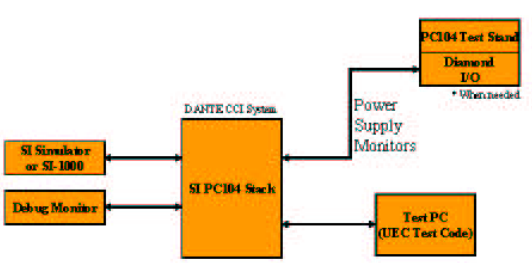

Test Plan (2) for the
SI-1000 PC104 Camera Card
(Additional Performance Tests)
SI PC104 Working Group
September 13, 2005


Test Plan Review Topics
Test Overview and Goals
Test Approach and System Configuration
Hardware and Software Components
Performance Test Plan
Resources and Test Schedule
September 12, 2005
2


Test Overview and Goals
SI PC104 System Performance Tests
Validate performance of a fully modified (per recommendation) PC104 SI camera card.
Kontron CPU test NOT APPLICABLE
for SI PC104
Verify operation of Enhanced Write Filter (EWF) on UEC PC104 system
Diagnose power cycle and initialization problems on SI PC104 system and provide recommendation for proper procedure
September 12, 2005
3


Test Approach
Configure a SI PC104 stack with modified SI camera card
Use a SI Simulator for testing with modified camera card tests.
Use SI-1000 camera for EWF and power cycle tests.
Use the SI PC104 Test stand with Diamond I/O card to monitor buss voltages.
Use PC Test-station with UEC Test program to drive system through image acquisition cycles.
Tests to be performed in B391 Room B350
September 12, 2005
4

Test System Configuration



September 12, 2005

Hardware Components

- SI PC104 Camera Card with recommended modifications (provided by J.Moody)
  - Lift/insulate pins on 3.3v regulator
  - Remove LEMO power connector
- PC Test Station
- SI PC104 System (DANTE CCI)
- SI-1000 Simulator
- SI-1000 Camera
- PC104 Test Stand with Diamond I/O board

September 12, 2005

Software Components

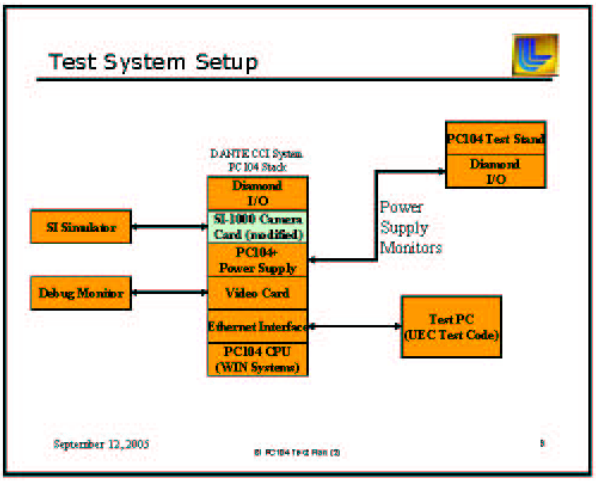
- UEC Test Program
- Diamond I/O data capture software
- DOC with current released UEC code (V1.1.6)
  - Configured with Enhanced Write Filter in ON state
  - Read Exposure issue will cause image acquisition failure ~10 cycles.
    - To be fixed in next release
- Modified UEC Java Driver for SI Simulator
  - Driver takes into account SI Simulator timeout due to not having real CCD.
  - Reload driver after every reboot of SI PC104

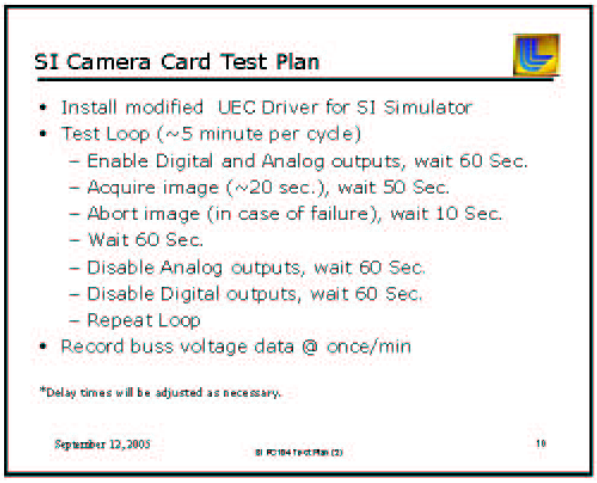
September 12, 2005

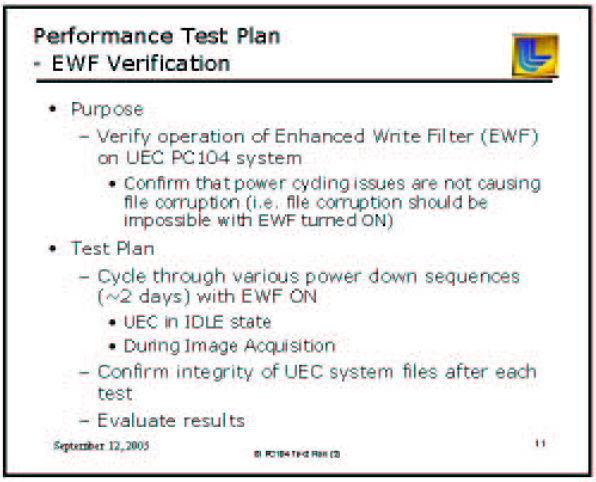
Performance Test Plan - SI Camera Card

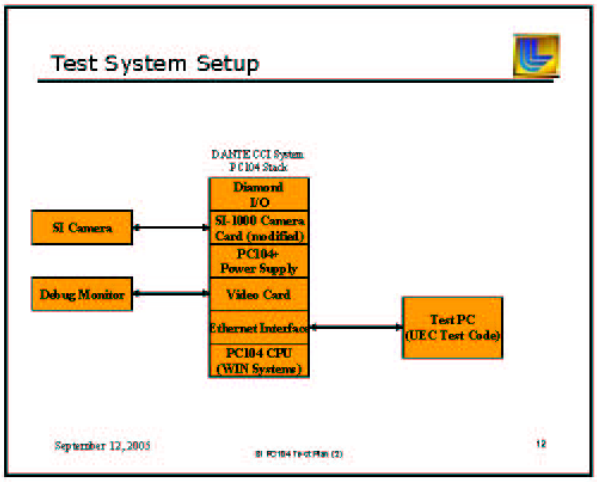
- Purpose
  - Validate performance of a fully modified PC104 SI camera card.
- Test Plan
  - Run continuous image acquisition cycles over a ~2 day period
  - Monitor SI PC104 system performance
  - Monitor/record SI PC104 system buss voltages (+3.3V, + 5V, +12V)
  - Record failures/issues
  - Evaluate results

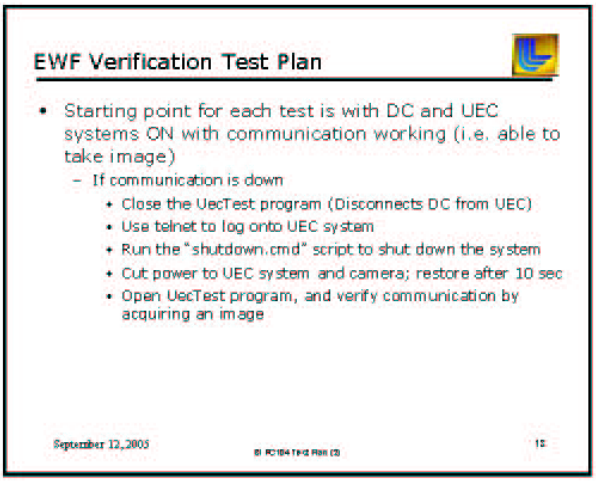
September 12, 2005

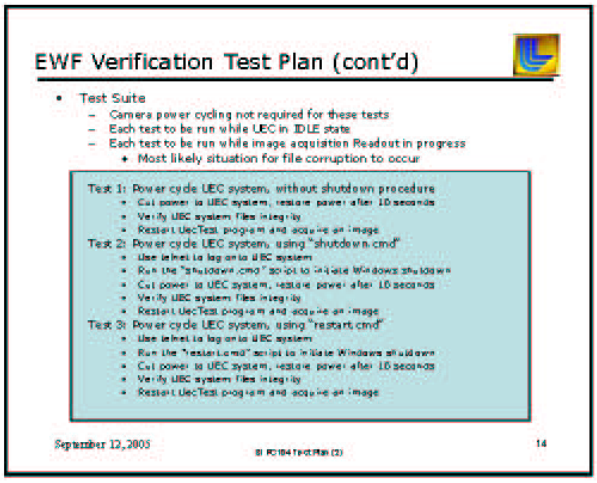

Test System Setup
DANTE CCI System
PC104 Stack
Diamond I/O
SI-1000 Camera Card (modified)
PC104+ Power Supply
Video Card
Ethernet Interface
PC104 CPU (WIN Systems)
SI Simulator
Debug Monitor
PC104 Test Stand
Diamond I/O
Power Supply Monitors
Test PC (UEC Test Code)
September 12, 2005
9

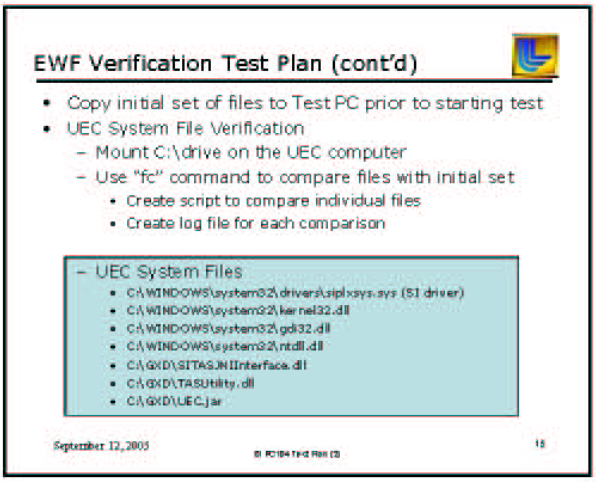

SI Camera Card Test Plan
• Install modified UEC Driver for SI Simulator
• Test Loop (~5 minute per cycle)
– Enable Digital and Analog outputs, wait 60 Sec.
– Acquire image (~20 sec.), wait 50 Sec.
– Abort image (in case of failure), wait 10 Sec.
– Wait 60 Sec.
– Disable Analog outputs, wait 60 Sec.
– Disable Digital outputs, wait 60 Sec.
– Repeat Loop
• Record buss voltage data @ once/min
*Delay times will be adjusted as necessary.
September 12, 2005
10

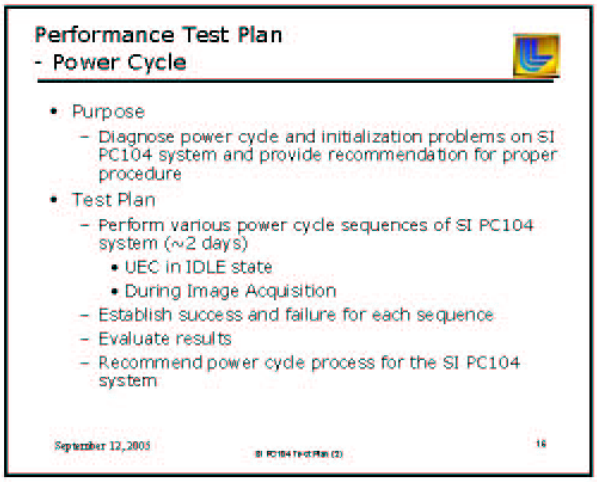

Performance Test Plan
- EWF Verification
• Purpose
– Verify operation of Enhanced Write Filter (EWF) on UEC PC104 system
• Confirm that power cycling issues are not causing file corruption (i.e. file corruption should be impossible with EWF turned ON)
• Test Plan
– Cycle through various power down sequences (~2 days) with EWF ON
• UEC in IDLE state
• During Image Acquisition
– Confirm integrity of UEC system files after each test
– Evaluate results
September 12, 2005
11


Test System Setup
DANTE CCI System
PC104 Stack
Diamond I/O
SI-1000 Camera Card (modified)
PC104+ Power Supply
Video Card
Ethernet Interface
PC104 CPU (WIN Systems)
SI Camera
Debug Monitor
Test PC (UEC Test Code)
September 12, 2005
12

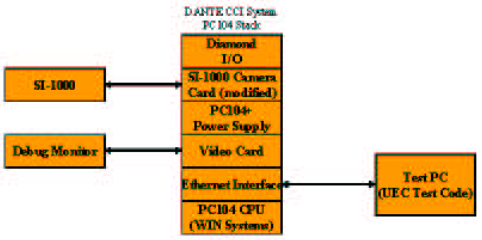

EWF Verification Test Plan
• Starting point for each test is with DC and UEC systems ON with communication working (i.e. able to take image)
– If communication is down
• Close the UecTest program (Disconnects DC from UEC)
• Use telnet to log onto UEC system
• Run the "shutdown.cmd" script to shut down the system
• Cut power to UEC system and camera; restore after 10 sec
• Open UecTest program, and verify communication by acquiring an image
September 12, 2005
15


EWF Verification Test Plan (cont'd)
• Test Suite
– Camera power cycling not required for these tests
– Each test to be run while UEC in IDLE state
– Each test to be run while image acquisition Readout in progress
• Most likely situation for file corruption to occur
Test 1: Power cycle UEC system, without shutdown procedure
• Cut power to UEC system, restore power after 10 seconds
• Verify UEC system files integrity
• Restart UecTest program and acquire an image
Test 2: Power cycle UEC system, using "shutdown.cmd"
• Use telnet to log on to UEC system
• Run the "shutdown.cmd" script to initiate Windows shutdown
• Cut power to UEC system, restore power after 10 seconds
• Verify UEC system files integrity
• Restart UecTest program and acquire an image
Test 3: Power cycle UEC system, using "restart.cmd"
• Use telnet to log on to UEC system
• Run the "restart.cmd" script to initiate Windows shutdown
• Cut power to UEC system, restore power after 10 seconds
• Verify UEC system files integrity
• Restart UecTest program and acquire an image
September 12, 2005
14


EWF Verification Test Plan (cont'd)
• Copy initial set of files to Test PC prior to starting test
• UEC System File Verification
– Mount C:\drive on the UEC computer
– Use "fc" command to compare files with initial set
• Create script to compare individual files
• Create log file for each comparison
– UEC System Files
• C:\WINDOWS\system32\drivers\siplxsys.sys (SI driver)
• C:\WINDOWS\system32\kernel32.dll
• C:\WINDOWS\system32\gdi32.dll
• C:\WINDOWS\system32\ntdll.dll
• C:\GXD\SITASJNIInterface.dll
• C:\GXD\TASUtility.dll
• C:\GXD\UEC.jar
September 12, 2005
13


Performance Test Plan
- Power Cycle
• Purpose
– Diagnose power cycle and initialization problems on SI PC104 system and provide recommendation for proper procedure
• Test Plan
– Perform various power cycle sequences of SI PC104 system (~2 days)
• UEC in IDLE state
• During Image Acquisition
– Establish success and failure for each sequence
– Evaluate results
– Recommend power cycle process for the SI PC104 system
September 12, 2005
16

Test System Setup



September 12, 2005 | SI PC104 Test Plan (3) | 17

Power Cycle Test Plan

- Starting point for each test is with DC and UEC systems ON with communication working (i.e. able to take image)
  - If communication is down
    - Close the UecTest program (Disconnects DC from UEC)
    - Use telnet to log onto UEC system
    - Run the "shutdown.cmd" script to shut down the system
    - Cut power to UEC system and camera; restore after 10 sec
    - Open UecTest program, and verify communication by acquiring an image
- DC System will not be power cycled
  - Coupling to UEC test system is via network communications
  - Restarting the UecTest program should be sufficient
    - Disconnects DC from UEC
  - Would add significant time and complexity to overall test

September 12, 2005 | SI PC104 Test Plan (3) | 18

Power Cycle Test Plan (cont'd)

- Test Suite
  - Each test to be run with and without power cycling the camera
  - Each test to be run while UEC in IDLE state
  - Each test to be run while image acquisition Readout in progress

Test 1: Power cycle UEC system, without shutdown procedure
- Cut power to UEC system, restore power after 10 seconds
- Verify restart initialization successful
- Restart UecTest program and acquire an image

Test 2: Power cycle UEC system, using "shutdown.cmd"
- Use telnet to log on to UEC system
- Run the "shutdown.cmd" script to initiate Windows shutdown
- Cut power to UEC system, restore power after 10 seconds
- Verify restart initialization successful
- Restart UecTest program and acquire an image

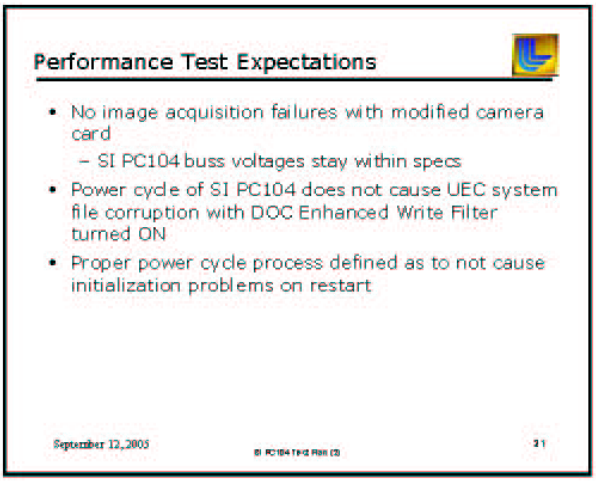
Test 3: Power cycle UEC system, using "restart.cmd"
- Use telnet to log on to UEC system
- Run the "restart.cmd" script to initiate Windows shutdown
- Cut power to UEC system, restore power after 10 seconds
- Verify restart initialization successful
- Restart UecTest program and acquire an image

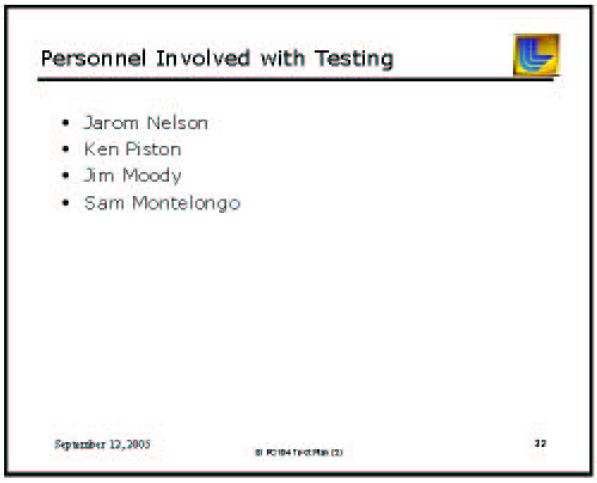
September 12, 2005 | SI PC104 Test Plan (3) | 19

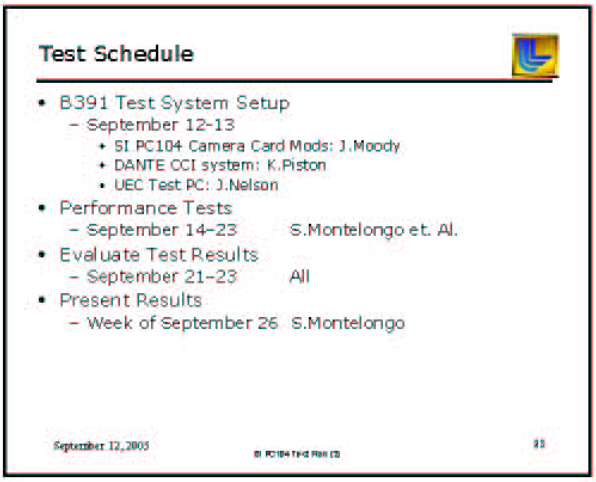
Power Cycle Test Plan (cont'd)

- SI PC104 UEC Restart Initialization Verification
  - Watch UEC monitor for "UEC Started Successfully" message
    - This only signals that the UEC code started successfully.
  - Camera initialization occurs with UecTest INITIALIZE command.
    - Watch for "Camera initialization successful" message from UEC

September 12, 2005 | SI PC104 Test Plan (3) | 20


Performance Test Expectations
• No image acquisition failures with modified camera card
– SI PC104 buss voltages stay within specs
• Power cycle of SI PC104 does not cause UEC system file corruption with DOC Enhanced Write Filter turned ON
• Proper power cycle process defined as to not cause initialization problems on restart
September 12, 2005
21


Personnel Involved with Testing
• Jarom Nelson
• Ken Piston
• Jim Moody
• Sam Montelongo
September 12, 2005
22


Test Schedule
• B391 Test System Setup
– September 12-13
• SI PC104 Camera Card Mods: J.Moody
• DANTE CCI system: K.Piston
• UEC Test PC: J.Nelson
• Performance Tests
– September 14-23 S.Montelongo et. Al.
• Evaluate Test Results
– September 21-23 All
• Present Results
– Week of September 26 S.Montelongo
September 12, 2005
23

9.4 Appendix D: Test Plan 2 (Results for the SI-1000 PC104 Camera Card)

Test Plan 2 Results were presented to the PC104 Working Group Team on November 17, 2005. The presentation included

Test Overview/Goals

Test Implementation and System Configuration

Hardware and Software Components

Test Results

Test Plan 2 culminated with a second round of testing.

The first round of testing showed that the PC104+ power supply was inappropriate for the SI PC104 system as it supplied +3.3vdc to the PC104 buss as did the SI PC104 camera card which also has an on-board +3.3vdc regulator. Spectral Instruments does not recommend having both a PC104+ power supply and the SI camera card regulator both provide the +3.3vdc as a long term solution. It was also found that the PC104+ power supply +3.3vdc rise time was inadequate stand-alone to meet the SI PC104 system timing requirements for SI driver installation.

A PC104 format power supply providing only +5vdc and +12 vdc was recommended and installed in the SI PC104 system. This allowed the SI camera card to provide the +3.3vdc buss voltage. Round 2 of testing validated the performance (+3.3vdc rise time, SI driver installation) of the PC104 power supply configured into the SI PC104 system.

SI-1000 PC104 System
Performance Test Results

SI PC104 Working Group
November 17, 2005

Personnel Involved with Test

- **Jim Moody**
- **Sam Montelongo**
- **Jarom Nelson**
- **Ken Piston**

- **Joe Holder**
- **Joe Kimbrough**

Test Plan Review Topics

- Test Overview/Goals
- Test Implementation and System Configuration
- Hardware and Software Components
- Test Results

Test Overview and Goals

- SI PC104 System Performance Tests
  - Validate performance of a fully modified (per recommendation) PC104 SI camera card.
    - Test SITASJNIInterface.DLL dated August 9,2005.
    - Fixes the Exposure/Read issue causing abort of image acquisition.

    NOT APPLICABLE for SI PC104
  - Verify operation of Enhanced Write Filter (EWF) on UEC PC104 system
  - Diagnose power cycle and initialization problems on SI PC104 system and provide recommendation for proper procedure

Test Approach

- Configure a SI PC104 stack with modified SI camera card
  - Monitor PC104 buss voltages via PC104 Test station
    - +3.3v, +5v, +/-12v
- Use a SI Simulator for testing with modified camera card tests.
- Use SI-1000 camera for EWF and power cycle tests.
- Use PC Test-station with UEC Test program to drive system through image acquisition cycles.
- Use DANTE CCI as the test system
  - Most extreme configuration for PC104 diagnostic stack

November 17, 2005 SI PC104 Performance Test Results 5

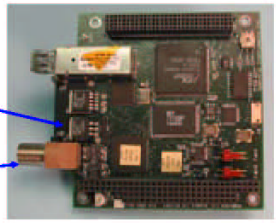
Test Implementation

- Test Dates: 9/12/05 – 11/11/05
- Test Location:B391 Rm B350
- Test System
  - DANTE CCI with SI-1000 Simulator
  - SI CCD Camera 1000-109, 1000-106
  - PC104 Test Stand
  - Modified SI Camera cards: -107, -104
  - PC104 Power Supply HE104+DX
- SI PC104/DOC running UEC Ver. 1.1.6
- SI PC104/DOC SI Driver: SIPLXSYS.SYS Rev. A
- SITASJNIInterface.DLL (versions dated 6/22/04 & 8/9/05)
- DSP initialization file for SI-1000, 3628D.bin
- UECTestC code
  - Camera initialization
  - Image acquisition cycle: single or continuous

November 17, 2005 SI PC104 Performance Test Results 6

Modified Hardware Components

- SI PC104 Camera Card
  - Several cards used: -107, -104
  - Several configs tested
    - +3.3v Regulator
      - 1: Pins lifted
      - 2: Pins fully attached
      - 3: Fully removed
    - LEMO Power Connector
      - 1: Fully removed
      - 2: Fully attached



November 17, 2005 SI PC104 Performance Test Results 7

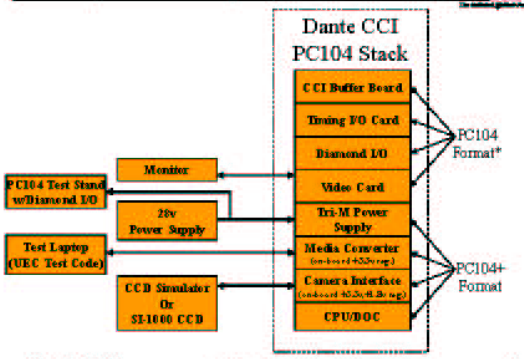
TRI-M HE104+DX Power Supply

TRI-M ENGINEERING

Power Supply Specifications	
Model	HE104+DX
5V output*	12 A
12V output	2.5 A
3.3V output	8 A
-12V output	0.5 A
Input Voltage Range	6 to 40V
Load Regulation**	< 60mV
Line Regulation	40mV
Output temp. drift**	< 40mV
Switching Freq.	75kHz
Max. Input Transient	125V for 100msec
Output Ripple**	< 20mV
Conducted Susceptibility**	> 57db
Efficiency	Up to 90%
Temp. Range	-40 to 85C
Size, PC/104 size & mounting holes with PCI-104 bus	3.55"W. x 3.75"L. x 0.6"H.

November 17, 2005 SI PC104 Performance Test Results 8

Test System Configuration



November 17, 2005

Performance Test - SI Camera Card

- Purpose
  - Validate performance of a fully modified PC104 SI camera card.
- Test Plan
  - Run continuous image acquisition cycles over a several day period
  - Use SI Simulator for tests
  - Monitor SI PC104 system performance
  - Monitor/record SI PC104 system buss voltages (+3.3V, + 5V, +12V)
  - Record failures/issues
  - Evaluate results

November 17, 2005

Performance Test Results - SI Camera Card

- Continuous image acquisition cycles over 4 days
  - No crashes of PC104 computer
  - No image acquisition failures
  - Tested new version of SITASJNIInterface.DLL
    - No problems noted during Exposure/Read phase
- SI PC104 camera card buss voltages
  - All buss voltages stayed within specs
- Problem Reports
  - Noted SI driver installation problems after power cycle. Used combination of RESTART and reboot of SI simulator to establish good state of operation.
- Test Outcome
  - Successful performance of modified camera card during extended image acquisition cycles.
  - Successful validation of software fix correcting Exposure/Read issue.

November 17, 2005

Performance Test - EWF Verification

- Purpose
  - Verify operation of Enhanced Write Filter (EWF) on UEC PC104 system
    - Confirm that power cycling issues are not causing file corruption (i.e. file corruption should be impossible with EWF turned ON)
- Test Plan
  - Cycle through various power down sequences with EWF ON
    - UEC in IDLE state
    - During Image Acquisition
  - Confirm integrity of UEC system files after each test
  - Evaluate results

November 17, 2005

Performance Test Results - EWF Verification

- Problem Reports
  - Noted SI driver installation problems after power cycle. Used combination of RESTART and reboot of SI simulator to establish good state of operation.
- Test Outcome
  - Numerous power cycles (28v cutoff, Shutdown, Restart) under various conditions of PC104 System (Idle, Image Acquisition READ) did not cause file corruption.
  - System file integrity successfully verified after each test.

November 17, 2005 | SI PC104 Performance Test Results | 13

Performance Test - Power Cycle

- Purpose
  - Diagnose power cycle and initialization problems on SI PC104 system and provide recommendation for proper procedure
- Test Plan
  - Perform various power cycle sequences of SI PC104 system
    - UEC in IDLE state
    - During Image Acquisition
  - Establish success and failure for each sequence
  - Evaluate results
  - Recommend power cycle process for the SI PC104 system

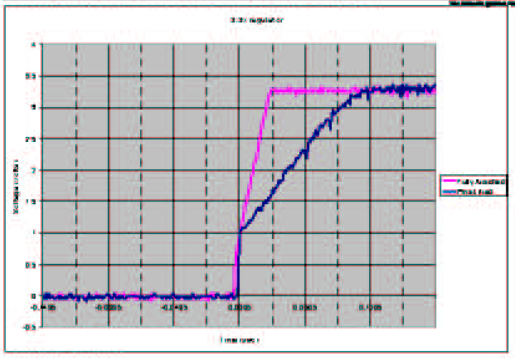
November 17, 2005 | SI PC104 Performance Test Results | 14

Performance Test Results - Power Cycle

- Problem Reports
  - SI Driver Installation
    - SI driver will not install with Camera Card +3.3vdc regulator removed or pins detached . Rise time inadequate (~125msec).
      - SI states 50msec minimum.
    - SI driver successful installation with Camera Card +3.3vdc regulator fully attached. Rise time adequate (~25msec).
    - Soft RESTART successful but...SI camera PWR LED failure indication upon initial communication.
- Recommendations
  - SI: Having the +3.3vdc regulator fully attached while using the HE104+DX power supply to also provide +3.3vdc will cause early component failure.
  - PC104WG: Install a PC104 format Power Supply that provides only +5vdc and +12vdc. Full attach +3.3v regulator.
- Test Outcome
  - Pursue PC104 format Power Supply – Tri-M HE104-75W

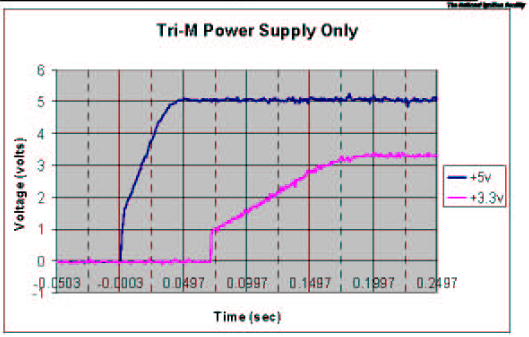
November 17, 2005 | SI PC104 Performance Test Results | 15

PC104 +3.3vdc signal measured at power up using HE104+DX Power Supply



November 17, 2005 | SI PC104 Performance Test Results | 16

HE104+DX (only) +5vdc & +3.3vdc measured at power up



November 17, 2005 SI PC104 Performance Test Results 17

Performance Test - Power Cycle Test : Round 2

- Purpose
  - Test power up performance of SI PC104 system with a PC104 format power supply providing only +5vdc and +12vdc.
    - Tri- M Engineering HE104-75W
- Test Plan
  - Perform various power cycle sequences
    - 28v cutoff and PC104 "restart"
  - SI camera card configuration
    - LEMO connector removed, +3.3vdc regulator attached
  - Establish success and failure for each sequence
  - Evaluate results
  - Recommend power cycle process for the SI PC104 system

November 17, 2005 SI PC104 Performance Test Results 18

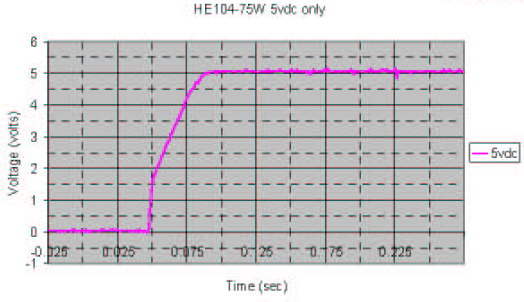
Tri-M HE104-75W Power Supply

TRI-M ENGINEERING

Power Supply Specifications	
Model	HE104-75W
5V output	15A
12V output	3A
-12V output	0.5A
Input Voltage Range	8 to 40V
Load Regulation (5V output)	< 60mV
Line Regulation (5V output)	40mV
Output temp. drift (5V output)	< 40mV
Switching Freq.	300kHz
Max. Input Transient	125V for 250msec
Output Ripple (5V output)	< 20mV
Conducted Susceptibility (5V output)	> 57db
Efficiency (5V output)	Up to 90%
Temp. Range	-40 to 85C
Size: PC/104 size & mounting holes with PC/104 bus	3.55"W. x 3.78"L. x 0.6"H.

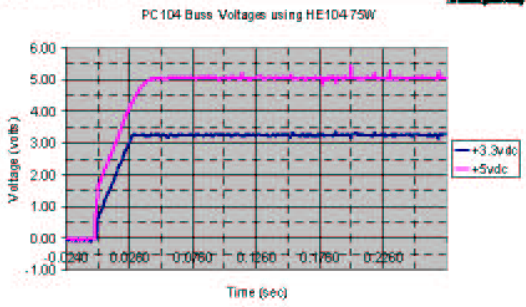
November 17, 2005 SI PC104 Performance Test Results 19

HE104-75W (only) +5vdc signal shows adequate timing



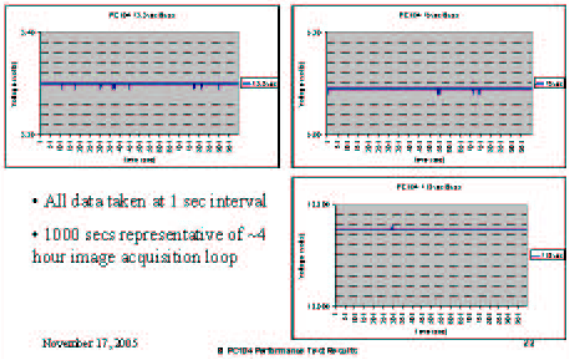
November 17, 2005 SI PC104 Performance Test Results 20

PC104/HE104-75W +3.3v and +5v signals measured at power up



November 17, 2005

PC104/HE104-75W: Buss voltages within specs during image acquisition loop test.



- All data taken at 1 sec interval
- 1000 secs representative of ~4 hour image acquisition loop

November 17, 2005

Performance Test Results - Power Cycle Test : Round 2

- Problem Reports
  - PC104 operating system "restart" although successful in reboot caused camera communications to fail (inconsistent) upon initial communication to CCD.
    - SI response: Update SI PC104 components to latest rev levels.
- Test Outcome
  - SI driver install successful after every full 28v power cycle.
  - LEMO connector detached did not change performance.
  - Camera card +3.3vdc/+5vdc rise time measured to be adequate per SI requirement (≤50msec).
- Recommendation
  - Use "restart" command only for test and debug. Not recommended for use during operations.
  - Always use a full 28vdc power cycle to cleanly reboot PC104.

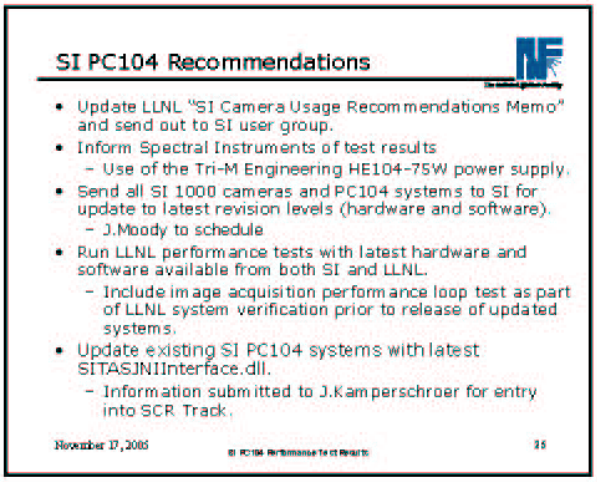
November 17, 2005

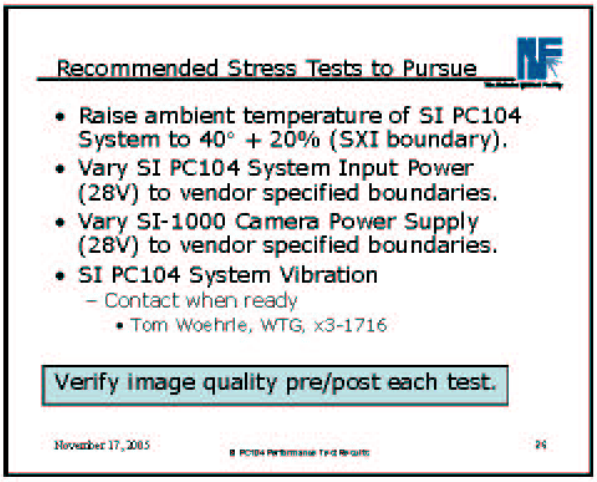
SI PC104 Performance Test Results Summary

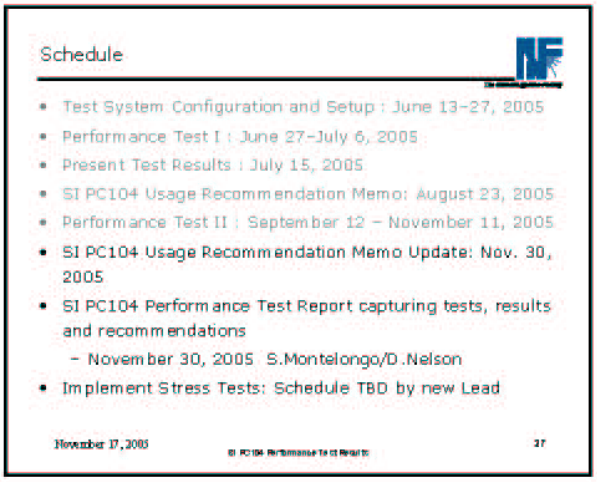
- SI Camera Card
  - Successful performance of modified camera card during continuous image acquisition cycles.
  - Successful data acquisition during Exposure/Read phase. No ABORTs noted.
    - SITASJNIInterface.dll dated 8/9/05
- DOC EWF File Verification
  - Successful system file integrity verification after multiple and various methods of power down.
- Power Cycle Reliability
  - Consistent successful system power up (SI driver installation) after every full 28vdc power cycle.

We now have a SI PC104 system that reliably powers up every time upon a full 28v power down.

November 17, 2005


SI PC104 Recommendations
• Update LLNL "SI Camera Usage Recommendations Memo" and send out to SI user group.
• Inform Spectral Instruments of test results
– Use of the Tri-M Engineering HE104-75W power supply.
• Send all SI 1000 cameras and PC104 systems to SI for update to latest revision levels (hardware and software).
– J.Moody to schedule
• Run LLNL performance tests with latest hardware and software available from both SI and LLNL.
– Include image acquisition performance loop test as part of LLNL system verification prior to release of updated systems.
• Update existing SI PC104 systems with latest SITASJNIInterface.dll.
– Information submitted to J.Kamperschroer for entry into SCR Track.
November 17, 2005
15


Recommended Stress Tests to Pursue
• Raise ambient temperature of SI PC104 System to 40° + 20% (SXI boundary).
• Vary SI PC104 System Input Power (28V) to vendor specified boundaries.
• Vary SI-1000 Camera Power Supply (28V) to vendor specified boundaries.
• SI PC104 System Vibration
– Contact when ready
• Tom Woehrle, WTG, x3-1716
Verify image quality pre/post each test.
November 17, 2005
16


Schedule
• Test System Configuration and Setup : June 13-27, 2005
• Performance Test I : June 27-July 6, 2005
• Present Test Results : July 15, 2005
• SI PC104 Usage Recommendation Memo: August 23, 2005
• Performance Test II : September 12 – November 11, 2005
• SI PC104 Usage Recommendation Memo Update: Nov. 30, 2005
• SI PC104 Performance Test Report capturing tests, results and recommendations
– November 30, 2005 S.Montelongo/D.Nelson
• Implement Stress Tests: Schedule TBD by new Lead
November 17, 2005
17

9.5 Appendix E: Memo #1 (SI PC104 Usage Recommendation Memo)

The SI PC104 Usage Recommendation memo was reviewed with the PC104 Working Group Team prior to sending out to the SI PC104 user community. Recommendations were discussed and reviewed with Spectral Instruments prior to completion.

Interdepartmental

Mail Station L – 459

Ext: 4-9824

NATIONAL IGNITION FACILITY
PROGRAMS DIRECTORATE

December 13, 2005

TO: Spectral Instruments PC104 Users

FROM: Jim M[illegible], Sam Montelongo, Joe Kimbrough

SUBJECT: Upda[illegible]
Spect[illegible]

Spectral Instruments[illegible]
SI-1000 CCD came[illegible]
specifications provi[illegible]
in a housing and wa[illegible]
this system was desi[illegible]
brought onto the PC[illegible]
of testing and diagn[illegible]
this PC-104+ based [illegible]
the SI-designed Gig[illegible]
problems are itemiz[illegible]

1. Input pow[illegible]
were marg[illegible]
to burned [illegible]
specified;
2. Cracked s[illegible]
connector.[illegible]
input pow[illegible]
surface m[illegible]
Gigabit I/[illegible]
power to t[illegible]
of two fac[illegible]
mechanica[illegible]
applicatio[illegible]
during dev[illegible]
altered the[illegible]
mechanica[illegible]
3. Voltage d[illegible]
voltage le[illegible]
problem w[illegible]
current ca[illegible]
appears SI[illegible]

This draft [illegible]
edits with red pen and remit your marked-up cop[illegible]

The solution for these problems was to add a Tri-M Engineering HE104-75W Power Supply module into the SI PC-104 stack. This board requires the NIF standard +28V input and provides the +5V and ±12V supplies for the PC-104 systems. There is a +3.3V regulator on the SI Gigabit I/O card that provides the +3.3V to the SI cards. This voltage is tied to the PC-104+ bus and could possibly provide +3.3V for future card upgrades. However, if that is to be done, it is recommended that a power analysis of the +3.3V for the system and the proposed card be completed. There is also an additional +1.8V regulator on the SI Gigabit I/O card that provides power only to an FPGA; this regulator has not had any problems and will remain. The advantages of using this board are:

1. Eliminates power input through connector on SI Gigabit I/O card.
2. Eliminates requirement of the SMT filters (the components that have had problems with cracked solder joints).
3. Eliminates concerns with undersized input power traces on SI Gigabit I/O card.
4. Provides increased current capacity for all voltages required by the system.

This implementation was tested in November 2005 for an extended period of time. No power related failures were recorded.

The recommendations of the test team for all SI PC-104+ configurations (especially those implementing the SI PC-104+ outside its originally intended configuration) are:

1. Do not use the Lemo power connector from the SI Gigabit I/O card. If required in tight designs, this connector can be removed. However, it is not recommended, if avoidable.
2. Design diagnostics using the SI PC-104+ system to include the Tri-M Engineering HE104-75W Power Supply module. This board supplies power to all PC-104 busses.
   a. Alternate method: Provide an external power supply capable of producing adequate power to busses via the PC-104+ buss connectors. Do not use the LEMO connector. Include a power requirements discussion as part of the diagnostics design review.
3. The SI power supply will no longer provide +24V to the two fans used to cool the PC-104+ module. Fans will need to be implemented in one of the following ways:
   a. Preferred method: Implement +12V fans.
   b. Alternate method: Connect the +12 and -12V supplies differentially to the fans.
   c. Alternate method: The diagnostic designer can provide their own fan system.
4. Ensure all PC-104 and PC-104+ cards intended for use conform to the PC-104 or PC104+ specification.

cc. Dennis O'Brien
Brian MacGowan

9.6 Appendix F: Memo #2 (SI PC104 Usage Recommendation Update Memo)

The SI PC104 Usage Recommendation Update memo is based on results obtained from Test Plan 2. When complete it will be forwarded to the SI PC104 User community and Spectral Instruments. The document will be located on the NIF Server under the PC104 folder.

The update to initial recommendations will be based on the following:

Issues found during further tests showed problems with the SI driver installation upon bootup. It would not consistently install after power up. This problem was noted in prior tests and further evaluation was required to trace down the root of the problem.

The root of the problem was due to the SI PC104 CPU buss voltage timing requirements not being met with the selected PC104+ power supply module (HE104+DX) for the +3.3vdc line. The power supply +3.3vdc signal rise time was too slow (~125 msec). Spectral Instruments requires a rise time of 50 msec or less for proper driver installation.

The SI driver installation problem did not exist if the SI PC104 camera card +3.3vdc regulator was fully attached and the PC104+ power supply was used. In this case both the PC104+ power supply and the +3.3vdc on-board regulator (SI PC104 camera card) were generating +3.3vdc. Spectral Instruments did not recommend this as a long term solution.

The solution was to replace the PC104+ power supply with a PC104 power supply (HE104-75W) and to leave the SI camera card +3.3vdc regulator fully attached. The PC104 power supply only generates +5vdc and +/- 12 vdc allowing the SI camera card to provide the +3.3vdc signal required by the SI PC104 system.

9.7 Appendix G: PC104 Buss Voltage Waveforms

As stated by Spectral Instruments in the (edited) email below, the +3.3vdc signal must have a rise time of 50 msec or less.

From: "Roger W. Cover" <rcover@specinst.com>
To: "Jim Moody" <moody8@llnl.gov>
Cc: "Sam Montelongo" <montelongo1@llnl.gov>,
"Hannes Meyer" <hmeyer@specinst.com>, "Gary Sims" <gsims@specinst.com>
Subject: PC-104+ Power Supply Startup Timing
Date: Wed, 26 Oct 2005 08:57:11 -0700

Howdy Jim,

I have looked into the configuration timing I mentioned in my last email. Here are my results.
<snip…>
While I was looking at the configuration timing, I discovered that the XC18V01 configuration PROM on the PC-104+ camera interface board has a rise time requirement for its power supply. I have attached a snapshot of a portion of the datasheet for that part (XC18V01RiseTime.gif). It states that the 3.3V supply needs to come up in 50ms or less. This makes the power supply you are using unacceptable.

Recommended Operating Conditions

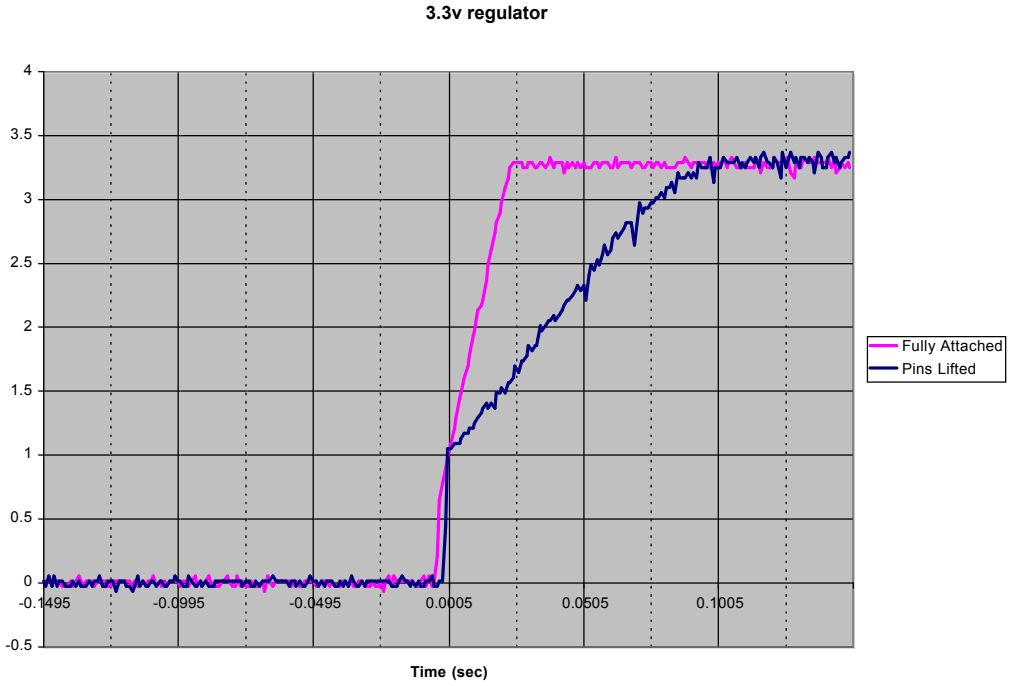
Symbol	Parameter		Min	Max	Units
V_{CCINT}	Internal voltage supply (T_A = 0°C to +70°C)	Commercial	3.0	3.6	V
	Internal voltage supply (T_A = –40°C to +85°C)	Industrial	3.0	3.6	V
V_{CCO}	Supply voltage for output drivers for 3.3V operation		3.0	3.6	V
	Supply voltage for output drivers for 2.5V operation		2.3	2.7	V
V_{IL}	Low-level input voltage		0	0.8	V
V_{IH}	High-level input voltage		2.0	5.5	V
V_O	Output voltage		0	V_{CCO}	V
T_{VCC}	V_{CC} rise time from 0V to nominal voltage(1)		1	50	ms

Notes:
1. At power up, the device requires the V_{CC} power supply to monotonically rise from 0V to nominal voltage within the specified V_{CC} rise time. If the power supply cannot meet this requirement, then the device might not perform power-on-reset properly.

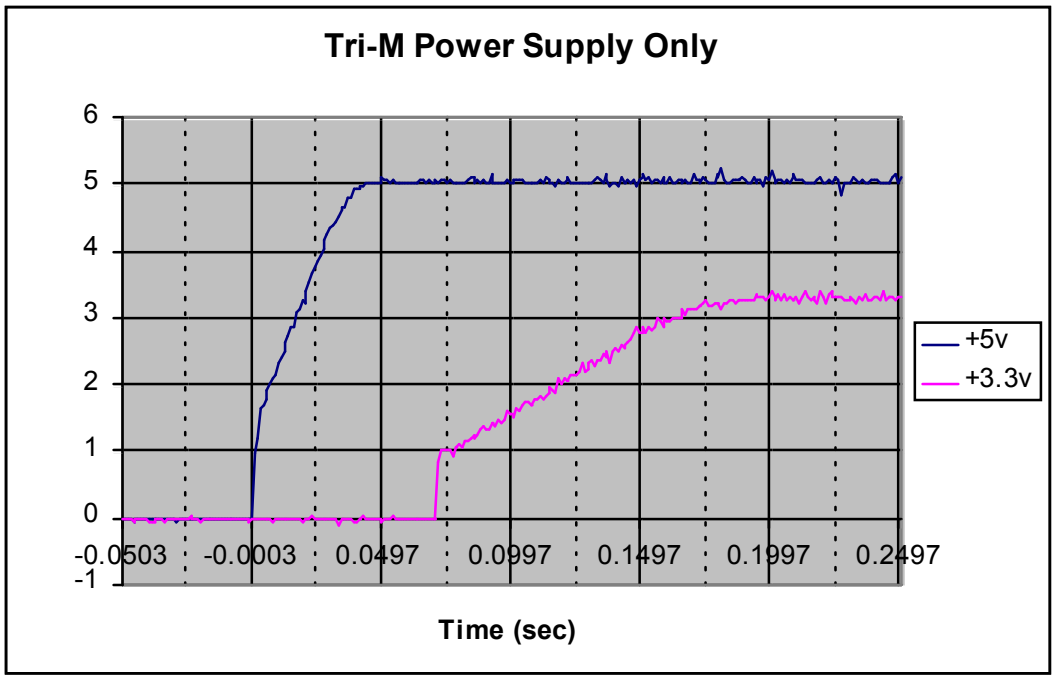
Typically the configuration time is not an issue. In this case it may become a non-issue with a different power supply. Let me know if there is any further information I need to provide.

Regards,
Roger W. Cover
Spectral Instruments, Inc.
420 N. Bonita Ave.
Tucson, AZ 85745
Voice: 520-884-8821 ext. 144
FAX: 520-884-8803

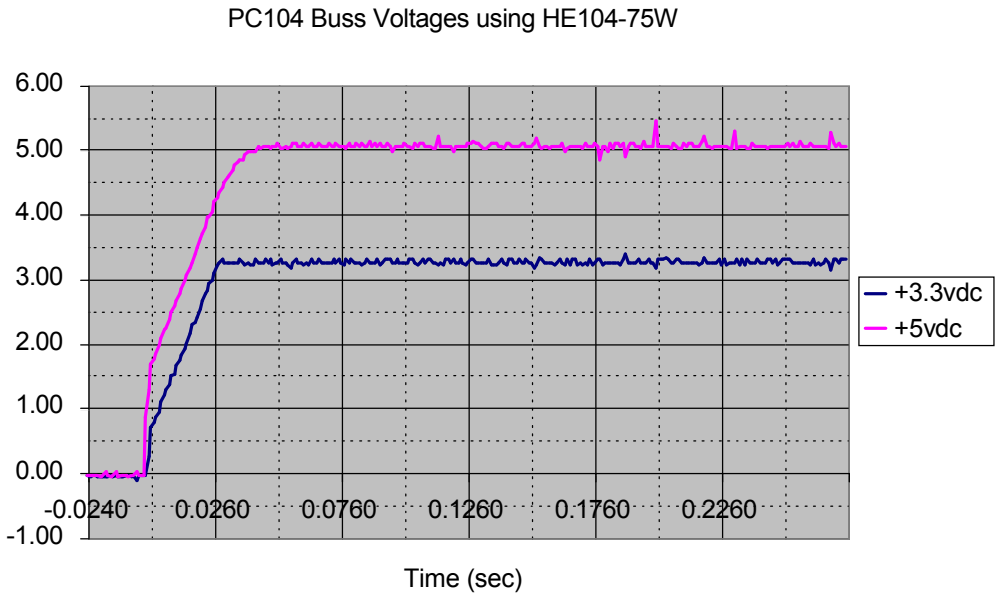
The following waveform shows the SI PC104 +3.3vdc buss measured at power on as a function of the SI camera card on-board regulator with pins lifted and pins fully attached. As can be seen by the waveform, with pins lifted the +3.3vdc rise time is ~125 msec, with pins fully attached the rise time is ~50msec.



The following waveform shows the output of the (PC104+) HE104+DX +3.3vdc and +5vdc signals measured at power on. As can be seen by the waveform, the HE104+DX +3.3vdc rise time is ~125 msec. This is too slow to meet SI power up requirements of 50 msec or less.



The following waveform shows the SI PC104 +3.3vdc and +5vdc buss voltages using the HE104-75W measured at power on. As can be seen by the waveform, the +3.3vdc rise time is ~25 msec. This meets the SI power up requirements of 50 msec or less.



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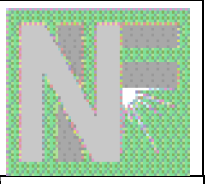

Prepared by	**Sam Montelongo** SI PC104 Tester	**Edited By:**	**Don Nelson** Technical Writer
Reviewed by	**Jim Kamperschroer** Controls/Integration/Testing RI		
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