System 7700
Automated Focal Plane Array Test System

System Administrator's Manual

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REFERENCES

Operation Manuals:

PI-3105, Acquisition System
PI-11000, Instrument Mainframe
PI-2005, Pattern Generator

WARRANTY AND SAFETY INFORMATION

PULSE INSTRUMENTS LIMITED WARRANTY

Pulse Instruments warrants this product to be free of defects in materials and workmanship for a period of one year from the date of purchase.

During the warranty period, Pulse Instruments will, at its own discretion, repair or replace any products or materials returned, freight prepaid, which prove to be defective through normal use.

This warranty does not apply to defects resulting from unauthorized modification, misuse, or neglect. This warranty is in lieu of all other warranties expressed or implied, and Pulse Instruments shall not be liable for any consequential damages resulting from the use or inability to use this product.

USER SAFETY INFORMATION

The System 7700 uses twist-lock 3-prong power cords for connections to both the power source and to earth ground. This unit is to be connected only to power outlets that have provisions to properly grounding the plugs. Do not attempt to defeat this safety feature or connect the unit to ungrounded plugs, as this could result in a shock hazard.

Do not operate any unit in the system with its covers removed.

Service on this system should only be performed by authorized Pulse Instruments personnel. Unless permission to service is granted by Pulse Instruments, any service performed on this system could void all warranty claims.

1. PRODUCT DESCRIPTION AND FEATURES

The System 7700 Automated Focal Plane Array (FPA) Test System is designed to meet all of your IR and CCD FPA test needs. The system includes all the equipment bays, and power conditioning equipment integrated for maximum low noise performance. The PI-DATS software easily configures any test sequence and controls the bias supplies, clock supplies, and data acquisition to facilitate your specific application.

The unique modular design of the System 7700 means you can configure your system to meet your present requirements at minimal price while maintaining the capability for future expansion. The System 7700 also includes numerous safety features to protect your personnel and your product.

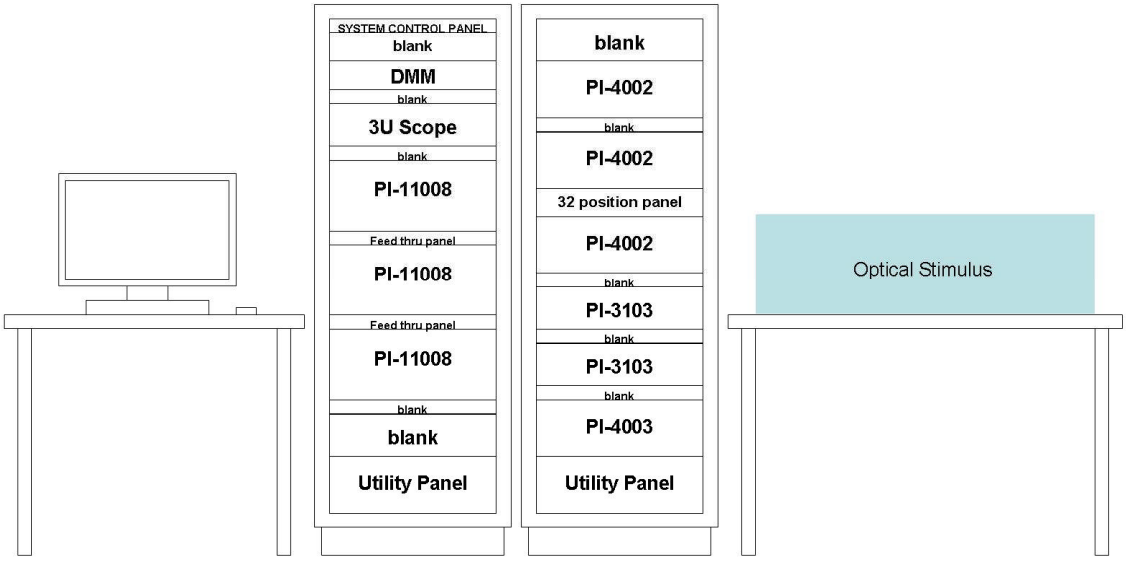

Figure 1 Typical System 7700 Rack Layout (not to scale)

1.1. SAFETY FEATURES

Safety has been aggressively engineered into the System 7700.

AC power to the System 7700 cannot be applied accidentally. Two positive actions are required in the proper sequence to power on the system. System power on can only be accomplished from the System Control Panel.

Each rack has its own circuit breaker and power switch so an individual rack can be powered off and on after system power is applied.

1.2. CABLING

All cabling has been coded to help you identify each individual cable. The prefix identifies the type of cable and the number indicates the specific cable within a type. Each cable is coded as follows:

Code	Cable Type	Code	Cable Type
CX	Coaxial cable	RCX	Ribbon coaxial cable
IEE	IEEE 488 bus	TRX	Triaxial cable
MCX	Multi-coaxial signal cable	VME	VME bus
PAC	AC power cable	W	Wire
PIB	Pulse Instruments bus	WTP	Wire, twisted pair
PRL	Centronix Interface cable	WTPS	Wire, twisted pair, shielded

Your system will have some or all of the types listed above.

1.3. RACK DESIGN

The system racks are designed with power conditioning to reduce system noise as much as possible. Each rack has its own isolation transformer and line filter to provide the cleanest power possible to the instruments within the system. All instruments in the rack are powered with 110V within the system. A utility outlet with facility power is available at the bottom of each rack on the Utility panel.

For better cooling and ventilation, the analog and digital racks are designed deeper than necessary to leave space for air to circulate away from the system components. An additional fan is built into the top of each rack to facilitate air circulation.

1.4. SOFTWARE ARCHITECTURE

An integral part of the System 7700 is PI-DATS, the systems control software package. PI-DATS manages your test plans by orchestrating the operation of each component subsystem into a coordinated test system. Provisions have been made to control some GPIB controlled peripherals with PI-DATS.

2. INSTALLATION

2.1. INTRODUCTION

This system administrator's manual is intended to give a comprehensive overview of the System 7700's features, design philosophy, and capabilities. For more detailed information, see the operator's manual for the specific piece of equipment in question.

2.2. PACKING AND UNPACKING

The System 7700 was shipped to you in several foam filled wood containers designed to withstand normal shipping requirements. Please report any damage to the carrier as soon as possible.

2.3. POWER REQUIREMENTS

The System 7700 is designed to operate from either 105/130VAC 50-60Hz or 210/250VAC power sources. The subsystems that require external power sources are:

Digital Rack
Analog Rack

2.4. COOLING AND VENTILATION

To prevent damage or over-heating of your System 7700, please make certain that there are no obstructions near the unit that would tend to defeat the operation of the rear air intake or exhaust on top of the rack. Adequate circulation and ventilation are necessary for proper unit operation and instrument life.

2.5. CONNECTIONS

When the System 7700 is delivered, a Pulse Instruments technical support team or factory approved representative will make all the necessary connections to place your unit into operation. A set of schematics has been provided as a source of reference.

The System 7700 is installed with internal cabling designed for specific path connections and system timing considerations. After installation this internal cabling should not be reconfigured. If reconfiguration of the signal lines does become necessary, this can typically be accomplished at the signal lines connecting the system to the device under test (DUT). Past users of our equipment have made modifications and forgotten to reassign channels or take other compensatory measures, thereby causing their systems to fail.

3. HARDWARE

3.1. INTRODUCTION

Many of Pulse Instrument's products are designed to be customized by the user. The following instruments are based on option cards that can be installed in many combinations to meet your specific needs:

PI-11008 Instrument Mainframe
PI-4002 Instrument Mainframe
PI-4002A Instrument Mainframe
PI-2005 Pattern Generator

These instruments can be tailored for the speed, noise, accuracy, and number of channels you require. The various card options are further detailed below.

Caution! If cards are installed in or removed from any Pulse Instruments equipment, please ensure that those changes are reflected in your test plan. While the system software automatically detects card types and locations, it cannot compensate for incorrect cabling or incorrect test plans.

3.2. PI-11000 INSTRUMENT MAINFRAME

PI-11000 is the general model number for the Pulse Instruments line of CompactPCI instrument mainframes. There are models with different slot-counts available, such as the PI-11006 with six slots and the PI-11008 with eight slots.

Each PI-11000 is designed around an x86-based single-board-computer and includes a hard drive, network interface, and an optional IEEE-488 (GPIB) interface. These features enable the PI-11000 to be used as the system controller in your test setup.

See the Operators Manual for the PI-11000 Instrument Mainframe for more information.

3.2.1 CPU BOARD

The CPU card is a 6U, CompactPCI x86-based SBC with the following features:

- Single- or Dual-CPUs from 800MHz to 2.0GHz with multimedia extensions
- 256MB – 2GB RAM
- On-board video controller
- Interrupt and Reset buttons
- On-board 10/100BASE-T Fast Ethernet port(s) or Gigabit Ethernet port(s) with status LEDs
- One or more Universal Serial Bus (USB) ports
- Mouse and keyboard port(s)
- One or more serial ports (external or internal)
- Parallel port (optional)
- CD-ROM, CD-RW, or DVD-RW drive (optional)

3.2.2 PI-41401 CLOCK DRIVER CARD

- Four Independent Channels
- Output Levels -5 V to + 8V
- Output Amplitude 0 V to 9 V
- Variable Slew Rate
- Tri-State Operation

3.2.3 PI-41702 BIAS CARD

- Four Output Channels
- ± 8 Volt Output
- ± 100 mA Output Current
- Low Noise Circuitry
- V/I Sense

3.2.4 PI-31000 GPIB INTERFACE

This is the optional GPIB interface from National Instruments, and it is used to communicate with external instruments over the IEEE-488 bus when the PI-11000 is being used as the system controller. There are three supported models: PXI-GPIB (PI-31000), PMC- GPIB (PI-31000A) and USB- GPIB (PI-31000B).

3.2.5 PI-31002 CPCI BRIDGE SET

This is the optional PI-31002 CompactPCI Bridge set. Two of these cards, a Master and a Slave, are required to bridge two PI-11000 Instrument Mainframes.

3.2.6 PI-31001 PI-BUS CARD

The PI-Bus Card controls up to seven PI-4002/PI-4002A Instrument Mainframes. This ensures that the system can easily expand as your testing needs grow. The PI-Bus Card controls the instrument mainframes via a Pulse Instruments designed bus. Software control of the instruments housed on the PI-4002's within the system is provided by PI-CONTROLLER and PI-DATS.

3.3. PI-4002 INSTRUMENT MAINFRAME

Each PI-4002 has slots for eight clock driver or DC bias cards. These cards can be mixed and matched in any order, letting you configure the PI-4002 to meet your specific requirements for low noise, speed, or accuracy.

3.4. PI-4002A INSTRUMENT MAINFRAME

Each PI-4002A like the PI-4002 has slots for up to eight clock driver or DC bias cards. The PI-4002A provides better cooling for newer, higher-power cards. Older boards will not fit in this mainframe because of their size. Newer cards can be mixed and matched in any order, letting you configure the PI-4002A to meet your specific requirements for low noise, speed, or accuracy.

3.5. PI-4003 POWER SUPPLY

The PI-4003 provides power for up to four Instrument Mainframes.

3.6. PI-3105 DATA ACQUISITION SUBSYSTEM

The PI-3105 can acquire data at rates up to 10 MHz with 14 bits of accuracy, in parallel, making it ideal for research and development, characterization, and production testing. The acquisition subsystem is CompactPCI based and consists of Timing and Control Card(s), Acquisition Interface Module(s) configured with up to four A/D Modules each, Digital Multiplexer Card(s) and Digital Acquisition Card(s). A sixteen channel acquisition subsystem can be configured within one eight slot cPCI chassis as long as Frame, Line and Pixel clocks are generated by another source.

3.6.1 PI-41100 TIMING AND CONTROL CARD

This card provides the timing signals and controls for up to 16 channels of A/D conversion (or 8 with the optional CDS feature). Cards are factory configured with 4, 8, 12, or 16 timing signals, designated as PI-41100-4, PI-41100-8, etc.

3.6.2 PI-3100 ACQUISITION INTERFACE MODULE

The PI-3100 houses up to four Gain/Filter stages, A/D converters, and optional CDS converters. It also provides the controls and power for the associated PI-3150 preamplifier modules.

3.6.3 PI-41110 DIGITAL MULTIPLEXER CARD

The PI-41110 Multiplexer card accepts LVDS clocks and data at a maximum total incoming data rate of 80 MHz. Any of the four inputs (**CH1 – CH4 In**) may be switched to the output port (**Data Out**), or the card may be placed in one of 3 multiplexing modes. If switched to a single port, the incoming data rate may be up to 80 MHz. If set to multiplex all active channels must have the same data rate, and the total data rate may be up to 80 MHz.

The Mux card outputs LVDS clocks and data. The output of the **PI-41110 Digital Multiplexer Card** should be cabled to an input port of the PI-41000 Digital Acquisition Card.

3.6.4 PI-41000 DIGITAL ACQUISITION CARD

The PI-41000 Digital Acquisition Card accepts LVDS clocks and data at a maximum total incoming data rate of 160 MHz (80 MHz per port). The PI-41000 can also accept TTL-level clocks on the SMA connectors. Each card has 256 or 512 MB of on-board SDRAM, indicated by the model number (PI-41000-256 or PI-41000-512).

3.7. PI-2005 DATA GENERATOR

Pulse Instruments PI-2005 Pattern Generator can be used to generate a wide range of simple to complex digital patterns for any test application that requires a serial or parallel digital data stream. With almost infinite looping capability and 64K bits per channel, the PI-2005 can create digital data patterns at speeds and complexities that fulfill the most demanding requirements.

The PI-2005 is a specific configuration of the six slot CompactPCI instrument mainframe. It is designed around an x86-based single-board-computer and includes a hard drive, network interface, and an optional IEEE-488 (GPIB) interface. The pattern generation function is provided by a PI-21000 Clock Generator card and up to four PI-2110X sixteen channel Pattern Cards. If slots are available the PI-2005 can support the digital cards described in section 3.2 of this manual

Any Pulse Instruments cPCI mainframe containing a PI-21000 Clock Generator Card and one or more PI-2110X Patterns Cards will appear in software as a “PI-2005” and provides equivalent functionality

The PI-2005 can be used as the system controller and is programmed using Pulse Instruments’ PI-PAT software.

See the Operators Manual for the PI-2005 Pattern Generator for more information.

4. SOFTWARE

4.1. OVERVIEW

Source code is written in Microsoft Visual C++ version 6.0. All Pulse Instruments software is Windows based and requires Microsoft Windows 2000 or later to run properly. Each software package is self-configuring, meaning that it automatically senses what hardware options are installed on your equipment. Every software package can communicate with PI-DATS, the integrated systems control software for true system integration.

4.2. PI-DATS

PI-DATS is the systems control package that coordinates the operation of all the individual programs. It configures any test sequence and controls bias supply, clock supply, and data acquisition for all applications.

4.3. PI-PAT

PI-PAT is the pattern generating software that controls the PI-2005 or equivalent instrument cards. All features are available through PI-PAT. Mouse-driven pattern editing and waveform display speed test setup.

4.4. PI-CONTROLLER

PI-CONTROLLER controls the clock drivers and bias supplies in the PI 4000 Series Stimulus System.

4.5. PI-PLOT

PI-PLOT is a companion application to PI-Controller that provides a variety of ways to view your acquired image data graphically. If you have captured multiple data sets via multiple Master groups, PI-PLOT can display data from all acquired data sets. PI-PLOT also is capable of reading in data from a previously saved file (binary format only).

5. OPERATION

5.1. SYSTEM POWER ON AND OFF

The total system can be powered on from the System Control Panel. As mentioned in the Product Description and Features section, the system is designed to power on only when Power On requirements and sequence are satisfied.

5.1.1. System Power On

First, the system arm power must be turned on. This is accomplished by setting the far left switch on the System Control Panel labeled "ARM POWER" to the ON position. When the Arm Power is on, the light in the rocker switch should light up.

To turn the system power on push the white switch labeled "POWER ON" on the System Control Panel. All equipment racks will be powered. The red lamp on the right side of the System Control Panel will be illuminated indicating power is on.

If the either rack in the system does not power up, check the rack circuit breaker on the Utility Panel at the bottom of each rack.

5.1.2. System Power Off

There are two methods of turning the system power off.

1. If it is desired to shut down the system completely, just set the System Control Panel "ARM POWER" switch to the OFF position.

2. If you want to shut down system power but still have the system in an armed state, push the red "POWER OFF" switch on the System Control Panel.

Note: Even though system power is turned off the utility outlet on the Utility Panel will be powered as long as the system is connected to Facility power and the Outlet Breaker in the on position

5.1.3. Individual System Rack AC Power Control

When the system power is on, indicated by the red lamp on the System Control Panel, each equipment rack can be powered off and on individually. This is a matter of setting the Rack (or System in a single rack system) AC Power Switch on the Utility Panel to either the On or Off position.

5.2. SYSTEM RACK DESCRIPTIONS

5.2.1. System Control Panel

The System Control Panel is mounted at the top of the rack. In a multi-rack system there is only one System Control Panel and it resides on the Digital rack. This panel is connected to each rack's Utility Panel to provide complete system control of the power.

The panel consists of the ARM POWER rocker switch, POWER ON switch, POWER OFF switch and Power On indicator lamp. The function of each of these components is describes in the previous sections covering system power on and off.

5.2.2. Utility Panel

The Utility Panel is located at the bottom of each rack in the system. The panel is connected to the isolation transformer in the rack and includes a 110V line filter providing clean power to the instruments mounted on the rack.

The Rack (or System in a single rack system) AC Power Switch provides the means to power individual racks on and off after system power has been achieved.

The Rack (or System in a single rack system) Breaker is the circuit breaker for the rack's internal power.

The Outlet Breaker is the circuit breaker for the Utility outlet on the right side of the Utility Panel.

The Utility Outlet provides facility power at the front of each rack

Note: Even if system power is turned off the utility outlet on the Utility Panel will be powered as long as the system is connected to Facility power and the Outlet Breaker in the on position

5.2.3. Digital Rack

The Digital Rack is a full height, single-bay equipment rack. Located within this rack is all the instrumentation considered to be primarily digital in nature. This rack contains the System Control Panel, DVM (if purchased with the system), Oscilloscope (if purchased with the system), cPCI chassis including the system CPU, pattern generation and data acquisition cards, Utility Panel and the AC Power Isolation Transformer for the digital instrumentation.

More information on these instruments can be found in the PI-2005 Pattern Generator, PI-11000 Instrument Mainframe and PI-3105 Data Acquisition System Operators Manuals

5.2.4. Analog Rack

The Analog Rack is a full height, single bay equipment rack. Located in this rack are the analog stimulus and analog power supplies for the analog portion of the system. For the typical System 7700 this rack has two (2) PI-4002 Instrument Mainframes or PI-11000 Instrument Mainframes in some combination to separate Drivers and Biases where possible, the PI-4003 Analog Power Supply and the PI-3103A AIM Power Supplies. This rack typically has a Bulkhead Interconnect Panel. The Analog Rack, like the Digital Rack has an AC Power Isolation Transformer and a Utility Panel including AC line filtering.

More information on these instruments can be found in the PI-11000 Instrument Mainframe and PI-3105 Data Acquisition System Operators Manuals

6. MAINTENANCE AND CLEANING

6.1. MAINTENANCE

The following is a short description of general preventive maintenance that should be performed periodically. The following paragraphs are only guidelines and not necessarily all-inclusive. The frequency of some maintenance, such as cleaning fan filters, is dictated by the cleanliness of the lab or test facility. We recommend that fan filters should checked and cleaned, if required, on a monthly basis.

6.1.1. Fan Filter Locations

There are fans in most equipment racks. When checking the filter for cleanliness one should check the fan's operation. Fans turning slower than normal or fans that are non-operative require replacement.

6.1.1.1. Digital rack

There is an air intake filter located on the back of the rack below the door. A dirty filter will restrict the airflow into the rack. Two screws hold the filter in place.

Examine the fan mounted in the top of the rack and clean if necessary.

The cPCI chassis have a fan tray that can be removed for cleaning. It is accessible from the front left side of the chassis by loosening the two flat head screws.

6.1.1.2. Analog rack

There is an air intake filter located on the back of the rack below the door. A dirty filter will restrict the airflow into the rack. Two screws hold the filter in place.

Examine the fan mounted in the top of the rack and clean if necessary.

The cPCI chassis have a fan tray that can be removed for cleaning. It is accessible from the front left side of the chassis by loosening the two flat head screws.

Fan filters are located on the rear of the PI-4002 instruments. Instrument filters can be removed by unsnapping the grille. The rack fan filter can be removed from the outside of the rack. The grille has two (2) spring loaded pins located at the second grille bar. To remove the grille, slide the pins toward the center of the grille.

6.1.2. Other General Maintenance

Power cables should be checked periodically for cuts, fraying or hazardous conditions.

Internal system cables should be checked periodically for cuts, broken connections, etc. Some of the instruments within the system are on slides and others are on shelf angles. Damage may occur to the system cables if care is not taken when extending an instrument from the rack.

6.1.3. Removal of Hardware

All instruments except the cPCI chassis and AIM Power Supply are on slides. To remove an instrument from the rack, remove the panel screws, typically four (4) and carefully pull the instrument to the full slide extension. Full extension will allow removal of the instrument top cover. If the instrument is to be removed from the system rack make sure rack power is off before disconnecting the cables and removing cards. Depress the slide latches on each side and pull the instrument forward.

6.1.4. Equipment Electrical Repair

Repair of the electrical power circuits or electronic circuits should only be done by authorized field engineers or technicians.

6.1.5. Ordering New Parts

When ordering new parts, please specify the name of the component, the subsystem it came from, and a description of the problem, and what remedial action(s) you have tried.

6.2. CLEANING

Racks should be kept closed at all times and filters should be changed on a periodic basis.

SYSTEM WIRING

BIAS SUPPLY PATHS

Bias Supplies are available in the system at two possible locations depending on the configuration of the system. Bias Supplies located in the cPCI chassis are available on the front of the rack with an SMA connector. Bias Supplies located in PI-4002 and PI-4002A Instrument Mainframes are internally cabled to a front panel with BNC connectors. Standard coax cable with either SMA or BNC connectors can be used to connect to the device under test.

PATTERN GENERATOR CHANNELS

The PI-2005 Pattern Generator provides signal timing for various functions within the System 7700. The functions controlled by the Pattern Generator are the clock driver input signals and timing signals (line sync, pixel clock and frame sync) required by the Data Acquisition Subsystem.

Below is the typical PI-2005 Data Channel assignments.

DATA CHANNEL	ASSIGNED FUNCTION	DATA CHANNEL*	ASSIGNED FUNCTION*
1	LINE	17	CLK13
2	PIXEL CLOCK	18	CLK14
3	FRAME	19	CLK15
4	-	20	CLK16
5	CLK1	21	CLK17
6	CLK2	22	CLK18
7	CLK3	23	CLK19
8	CLK4	24	CLK20
9	CLK5	25	CLK21
10	CLK6	26	CLK22
11	CLK7	27	CLK23
12	CLK8	28	CLK24
13	CLK9	29	CLK25
14	CLK10	30	CLK26
15	CLK11	31	CLK27
16	CLK12	32	CLK28

* These Data Channels are not available on the standard 16 Channel Pattern Generator

DRIVER SIGNAL PATHS

The driver signals originate from the test pattern loaded into the PI-2005 memory. The general path of the clock data is; data generated in the pattern generator channel drives the input of a driver card. The driver circuitry modifies the data signal by setting high/low levels, rise/fall times and provides increased signal drive capability. The driver output is cabled to the DUT via either the front panel of the cPCI chassis or a bulkhead interconnection panel depending on the location of the Clock Driver cards.

A complete wiring list has been included with your system documentation for your specification configuration. The details and labeling of all cabling provided with the system is included in that document.

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